# Handbook on Supply and Use Tables and Input Output-Tables with Extensions and Applications

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# Handbook on Supply and Use Tables and Input-Output Tables with Extensions and Applications

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# Preface and acknowledgements

The present *Handbook on Supply and Use Tables and Input-Output Tables with Extensions and Applications* has been prepared as part of a series of handbooks on national accounting in support of the implementation of the System of National Accounts 2008 (2008 SNA). The objective of this Handbook is to provide step-by-step guidance for the compilation of supply and use tables (SUTs) and input-output tables (IOTs) and an overview of the possible extensions of SUTs and IOTs which increase their usefulness as analytical tools.

Preparation of the Handbook started as an update of the 1999 United Nations publication entitled *Handbook of National Accounting: Input-Output Table Compilation and Analysis*,[1] with the aim of incorporating changes in the underlying international economic accounting standards, most notably the 2008 SNA, and classifications; extending the scope of the Handbook to provide fuller coverage of SUTs; and providing practical compilation guidance for countries with advanced and less advanced statistical systems. In this process, however, the Handbook has also evolved to include an innovative approach to the compilation of SUTs and IOTs in the following three main areas: first, the underlying use of an integrated approach to statistics; second, the use of a business model for the compilation of SUTs and IOTs linking the various parts through the compilation scheme known as the "H-Approach"; and, third, the mainstreaming of environmental considerations.

The Handbook builds on the experience, practices and guidance available at national and regional level, including the Eurostat *Manual of Supply, Use and Input-Output Tables* (Eurostat, 2008). It provides a consistent worked example of SUTs and IOTs, which runs throughout the chapters (as far as practically possible) in order to facilitate understanding of the various compilation steps. It also provides examples of best practices to illustrate certain aspects of the compilation of SUTs, along with clear recommendations, principles and guidelines in order to ensure best practice.

For the preparation and drafting of the Handbook, an editorial board was established in May 2013, comprising 12 members and the United Nations Statistics Division. The editorial board members were leading international experts, including members of the International Input-Output Association, with decades of accumulated knowledge and experience from different regions and from different institutions, such as national statistical offices, central banks, international organizations and the academic community.

An editor (Sanjiv Mahajan, Office for National Statistics, United Kingdom) was appointed to lead the work of the editorial board and coordinate the contributions of experts for the various

[1] ST/ESA/STAT/SER.F/74, Sales No. E.99.XVII.9.

chapters. Initial drafts of the chapters were prepared by members of the editorial board, including the editor. These were further refined and aligned by the editor in liaison with respective members of the board and the United Nations Statistics Division into a coherent set of chapters. This was achieved through many bilateral electronic communications between the editor and chapter authors, a face-to-face meeting of all board members in New York in May 2014, and a final editorial board review prior to a global consultation.

The Handbook is therefore the outcome of a collaborative team effort led by the editor in liaison with the United Nations Statistics Division and the editorial board. This team comprises the following:

- Sanjiv Mahajan, editor — Office for National Statistics, United Kingdom
- Joerg Beutel — Konstanz University of Applied Sciences, Germany
- Simon Guerrero — Central Bank of Chile
- Satoshi Inomata — Institute of Developing Economies, Japan External Trade Organization
- Soren Larsen — Statistics Denmark
- Brian Moyer — Bureau of Economic Analysis, United States of America
- Isabelle Remond-Tiedrez — European Commission, Eurostat
- José M. Rueda-Cantuche — European Commission, Joint Research Centre
- Liv Hobbelstad Simpson — Norway
- Bent Thage — Denmark
- Catherine Van Rompaey — Statistics Canada
- Piet Verbiest — Statistics Netherlands
- Ilaria Di Matteo — United Nations Statistics Division

The editorial board members contributed initial draft chapters and a detail review of all the chapters in the various rounds of consultation. Substantive contributions on specific topics, including initial draft chapters, were provided by the editorial board members as follows: Joerg Beutel (transforming SUTs into IOTs, compiling physical SUTs (PSUTs) and environmentally extended IOTs (EE-IOTs), extension of SUTs and IOTs and modelling applications of IOTs); Simon Guerrero (examples of country practices); Satoshi Inomata (multi-country SUTs and IOTs); Soren Larsen (compiling the use table); Brian Moyer (compiling the import use table and domestic use table); José M. Rueda-Cantuche (transforming SUTs into IOTs and projecting SUTs and IOTs); Liv Hobbelstad Simpson (guidance for countries with limited statistical resources and examples of country practices); Bent Thage (classification of industries and products, compiling the supply table, use table, valuation matrices, import use table and domestic use table, and transforming SUTs into IOTs); Catherine Van Rompaey (regional SUTs); and Piet Verbiest (compiling SUTs in volume terms and balancing). The editor also provided substantive contributions to these topics, initial draft chapters and all other topics in the Handbook, and brought

all the material together through numerous iterations with editorial board members reflecting many changes and improvements.

The contributions by the editor and the members of the editorial board and their commitment to the Handbook are very much acknowledged and appreciated. The following specific contributions are also acknowledged: Joerg Beutel, in formatting and standardizing tables, charts, boxes and figures throughout the Handbook; Ilaria Di Matteo, in reorganizing the chapters and ensuring overall coherence and consistency of the Handbook; and Erwin Kolleritsch (Statistics Austria), in kindly providing and checking much of the empirical data supporting the SUTs and IOTs in parts two and three of the Handbook.

The Handbook also benefited from specific inputs provided by Issam Alsammak (Statistics Canada), Gary Brown (Office for National Statistics, United Kingdom), Andrew Cadogan (Australian Bureau of Statistics), Duncan Elliot (Office for National Statistics, United Kingdom), Antonio F. Amores (European Commission Joint Research Centre), Ziad Ghanem (Statistics Canada), Manfred Lenzen (University of Sydney, Australia), Bo Meng (Institute of Developing Economies, Japan External Trade Organization), Louis de Mesnard (University of Bourgogne, France), Carol Moylan and Tom Howells (Bureau of Economic Analysis, United States), Jan Oosterhaven (University of Groningen, Netherlands), Ole Gravgard Pedersen (Statistics Denmark), Xesús Pereira (University of Santiago de Compostela, Spain), Joao Rodrigues (Technical University of Lisbon, Portugal), Jaroslav Sixta (Czech Statistical Office), Silke Stapel-Weber (European Commission, Eurostat), Umed Temursho (European Commission Joint Research Centre), Norihiko Yamano and Nadim Ahmad (OECD), and Herman Smith, Julian Chow, Gulab Singh, Benson Sim and Alessandra Alfieri (United Nations Statistics Division).

Feedback was also received from participants at various meetings and conferences, most notably the annual International Input-Output Association (2014, 2015 and 2016) and various regional national accounts meetings. The Handbook has benefited greatly from the numerous useful comments and suggestions made by national statistical offices, central banks, regional commissions, academic associations and international organizations, and also by the Intersecretariat Working Group on National Accounts during the global consultation in the period August to October 2017.

The Handbook was prepared under the supervision of Herman Smith and the overall responsibility of Ivo Havinga, both of the United Nations Statistics Division.

# Contents

# Abbreviations

| | |
|---|---|
| AIIOT | Asian International Input-Output Tables |
| ANZSIC | Australian and New Zealand Standard Industrial Classification |
| ARIMA | autoregressive integrated moving average |
| BEC | classification by broad economic categories |
| BPM | Balance of Payments and International Investment Position Manual |
| BTDIxE | Bilateral Trade Database by Industry and End-Use |
| $CH_4$ | methane |
| CIF | cost, insurance and freight |
| $CO_2$ | carbon dioxide |
| COFOG | Classification of the Functions of Government |
| COICOP | Classification of the Purposes of Non-profit Institutions Serving Households |
| COPNI | Classification of the Purposes of Non-profit Institutions Serving Households |
| COPP | Classification of the Outlays of Producers According to Purpose |
| CPA | Classification of Products by Activity |
| CPC | Central Product Classification |
| CPI | consumer price index |
| CRAS | cell-corrected RAS method |
| CREEA | compiling and refining of economic and environmental accounts |
| CSPI | corporate services price index |
| EBOPS | Extended Balance of Payments Services Classification |
| ECE | Economic Commission for Europe |

| | |
|---|---|
| EE-IOT | environmentally extended input-output tables |
| EPI | export price index |
| ERETES | equilibre ressources-emplois et tableau entrées-sorties |
| ESA | European system of accounts |
| EU | European Union |
| FAO | Food and Agriculture Organization of the United Nations |
| FBS | finance and business services |
| FI | fixed industry |
| FIGARO | full international and global accounts for research in input-output analysis |
| FISIM | financial intermediation services indirectly measured |
| FOB | free on board |
| FP | fixed product |
| GDP | gross domestic product |
| GENESIS | online databank of the Federal Statistical Office of Germany |
| GNI | gross national income |
| GRAS | generalized RAS |
| GSBPM | Generic Statistical Business Process Model |
| GTAP | global trade analysis project |
| GTAP-MRIO | multi-region input–output table based on the global trade analysis project database |
| GVA | gross value added |
| HS | Harmonized Commodity Description and Coding System |
| ICIO | inter-country input-output |
| ICPIs | intermediate consumption price indices |

| | |
|---|---|
| ICT | information and communications technology |
| ILO | International Labour Organization |
| IMF | International Monetary Fund |
| IMTS | International Merchandise Trade Statistics: Concepts and Definitions |
| INSEE | Institut national de la statistique et des études économiques |
| IOTs | input-output tables |
| IPCC | Intergovernmental Panel on Climate Change |
| IPIs | import price indices |
| ISIC | International Standard Industrial Classification of All Economic Activities |
| KLEMS | Integrated Industry-Level Production Account |
| KRAS | Konfliktfreies RAS |
| MPS | Material Product System |
| MRIO | multi-region input-output |
| $N_2O$ | nitrous oxide |
| NACE | Statistical Classification of Economic Activities in the European Community |
| NAICS | North American Industry Classification System |
| NMVOC | non-methane volatile organic compounds |
| NOx | mono-nitrogen oxides |
| NPISH | non-profit institution serving households |
| OECD | Organization for Economic Cooperation and Development |
| PIOT | physical input-output tables |
| PPP | purchasing power parities |
| PSUT | physical supply and use table |
| PYPs | previous years' prices |
| R&D | research and development |

| | |
|---|---|
| RAS | ranking and scaling data reconciliation method |
| RPI | retail prices index |
| SAM | social accounting matrix |
| SDMX | Statistical Data and Metadata Exchange |
| SEEA | System of Environmental and Economic Accounts |
| SESAME | system of economic and social accounting matrices and extensions |
| SITC | Standard International Trade Classification |
| SNA | System of National Accounts |
| SO2 | sulphur dioxide |
| SUT-Euro | Euro method for SUTs |
| SUTs | supply and use tables |
| TEC | trade by enterprise characteristics data |
| TiVA | trade in value added |
| TLS | taxes less subsidies on products |
| TRAS | three-stage RAS |
| TTM | trade and transport margins |
| UNSD | United Nations Statistics Division |
| UNWTO | World Tourism Organization |
| VAT | value added taxes |
| WCO | World Customs Organization |
| WIOD | World Input-Output Database |
| WPI | wholesale price index |
| WTO | World Trade Organization |

# Part one

# Chapter 1. Introduction

## A. Background

1.1. The supply and use tables (SUTs) are an integral part of the System of National Accounts 2008 (2008 SNA) forming the central framework for the compilation of a single and coherent estimate of gross domestic product (GDP) integrating all the components of production, income and expenditure approaches, and providing key links to other parts of the SNA framework.

1.2. In their simplest form, the SUTs describe how products (goods and services) are brought into an economy (either as a result of domestic production or imports from other countries) in the supply table, and how those same products (intermediate consumption; final consumption by household, non-profit institutions serving households, and general government; gross capital formation; and exports) are used in the use table.

1.3. The SUTs also provide the link between components of gross value added (GVA), industry inputs and outputs. Although typically they show only the industry dimension, SUTs can also be formulated to show the role of different institutional sectors (for example, non-financial corporations, government, and others) providing an important linking mechanism to the different accounts of the SNA framework (the goods and services account, production account, generation of income account and the capital account).

1.4. Importantly, and by design, these interlinkages facilitate data confrontation and the examination of the consistency of data on goods and services obtained from different statistical sources, such as business surveys, household surveys and administrative data within a single detailed framework. As such, they provide a powerful mechanism for feedback on the quality and coherency of primary data sources.

1.5. The SUTs do not just provide a framework to ensure the best quality estimates of GDP and its components: they are also an important analytical resource in their own right, showing the interaction between producers and consumers. When measured in volume terms, the SUTs provide the basis for a rich stream of analyses, notably in the field of structural analysis, and in particular productivity, where in recent years SUTs have been widely accepted as an important tool for

KLEMS-type[2] productivity measures. Just as important is their growing use as the basis for deriving the input-output tables (IOTs).

1.6. In many respects, the IOTs, which show the links between final uses and intermediate uses of goods and services defined according to industry outputs (industry-by-industry tables) or according to product outputs (product-by-product tables) predate the SUTs. The IOTs also show separately the consumption of domestically produced and imported goods and services. The widespread availability of SUTs has meant, however, that the SUTs form the starting point for constructing IOTs and, in turn, an entire swathe of related analytical products and indicators, such as the Leontief inverse and other type of analyses, including output multipliers, employment multipliers, and others.

1.7. The SUTs and IOTs are compiled by many countries in the course of producing their core national accounts, thereby improving the coherency and consistency of their national account estimates. The ability to readily create IOTs from SUTs (as shown in chapter 12) has helped to reinforce the momentum behind the evolution, role and use of SUTs.

1.8. SUTs and IOTs have received much attention in recent years. This is because their analytical properties allow for a much wider set of analyses, not only of the national economy and the regions within a nation but also of the interlinkages between economies at the global level and also of environmental impacts.

1.9. Further momentum has been generated for the role of SUTs and IOTs in step with the rapidly growing impact of globalization and the international fragmentation of production. For a full understanding of international interdependencies and their impact on important policy areas, such as trade, competitiveness and sustainable development, there is increasing need to view production and consumption through a global value chain lens. In other words, multi-country and regional SUTs and IOTs have become essential tools to inform policy and policymakers. Over the past five years, a number of efforts have been made by the international statistics community to meet these needs, such as the trade in value added database prepared by the Organization for Economic Cooperation and Development (OECD) and the World Trade Organization (WTO), and other comparable databases such as the World Input-Output Database (WIOD) and the Handbook on Accounting for Global Value Chains prepared by the Expert Group on International Trade and Economic Globalization Statistics.

1.10. Given these developments and, in particular, the heightened importance of SUTs and IOTs, the timing of the present Handbook is important and highly relevant. The present chapter provides a general introduction to the various issues considered in greater detail in the various chapters that follow. Section B of this introductory chapter provides a general overview of the roles and uses of

[2] KLEMS is an industry-level growth and productivity research project, based on the analysis of capital (K), labour (L), energy (E), materials (M) and service (S) inputs.

SUTs and IOTs. Section C covers the SNA and its links to SUTs and IOTs. Section D covers the objectives of the Handbook and its new features compared to previous manuals on the subject. Lastly, section E briefly outlines the structure and content of the Handbook.

## B. Uses of SUTs and IOTs

1.11. The uses of SUTs and IOTs are multiple and their statistical and analytical importance has increased with time and in response to new and emerging issues, such as globalization and sustainable development, with its three pillars of social, economic and environmental development. Where possible, the analytical uses of SUTs and IOTs are presented below in parallel. As SUTs form the basis for the compilation of IOTs, the uses of the two types of tables are treated in the same way in this section.

1.12. As mentioned above, the SUTs combine in a single framework the three approaches to measuring GDP, namely, the production approach, the income approach and the expenditure approach. All three approaches are based on sets of data with various levels of detail and a range of different sources. Combining the data in a single statistical framework compels compilers to use harmonized and unique classifications of producers, users and income receivers, together with harmonized and unique classifications and definitions of products and income categories. Under these conditions, corresponding data can be related and compared in an organized manner. Combining the three data sets provides an opportunity to analyse the causes of discrepancies, make necessary adjustments and fill data gaps when necessary.

1.13. An important objective of national accounts is to estimate year-to-year and quarter-to-quarter changes in a number of macroeconomic variables. When dealing with production, use and the generation of value added, it is important to divide the current price changes into volume changes (representing what is termed “real” growth) and price changes. When SUTs are compiled simultaneously in current prices and in volume measures (as recommended in this Handbook, using what is known as the “H-Approach”), there are considerable advantages in the overall quality and consistency of the information provided. During the entire statistical process – from the processing and analysis of the source data through to, and including, the balancing of the SUTs – data in current prices and deflated data are obtained simultaneously and consistently with each other.

1.14. In addition to annual national accounts, SUTs can be used in the compilation of quarterly national accounts. This may range from the compilation and balancing of quarterly SUTs to the mere use of the SUTs framework to highlight possible discrepancies between quarterly product supply and use. The annual estimates of GVA can, for example, be used as weights in the quarterly estimate of GDP in volume terms to reflect the most recent period. In addition, SUTs can provide weighting schemes for price and volume indices.

1.15. The SUTs and IOTs serve also as the basis for compiling a range of accounts –regional, environmental, labour, tourism, etc. The clear links of these satellite systems with both the SUTs and the IOTs ensure the consistency of the satellite systems with the concepts and methods of the core national accounts and allow for feedback loops with the SUTs during the compilation and balancing process of the frameworks involved. For instance, the SUTs can support the compilation of regional accounts by including clear links to variables like regional GVA. When physical environmental flows are linked to the SUTs and IOTs in the environmental accounts, they provide feedback loops to the compilation of SUTs by contrasting physical and monetary measures of the supply and use of products. When SUTs are linked to labour and capital, they can be used for productivity analyses that link economic growth to the use of intermediate inputs. Lastly, social accounting matrices elaborate the linkages between SUTs and sector accounts. They capture transactions and transfers between all economic agents in the accounting system and measures effects of macroeconomic policies on distribution.

1.16. The SUTs and IOTs also provide the basis for different types of analytical uses at micro and macro levels (see, for example, United Nations, 2002; Mahajan, 2004a; and Mahajan, 2006). Various examples are included in the list of additional reading at the end of this Handbook. Examples include the following:

- Economic analyses: export shares, import penetration, concentration ratios, links between prices and costs, links between energy production, consumption and emissions, etc.
- Impact and policy analyses: sensitivity analyses, analyses of the impacts of taxation changes, price changes, introduction of a minimum wage, specific economic crisis, earthquakes, etc., analyses of consumption and demand-based accounting and analyses of air emissions, material flows, energy, water, etc.
- Industrial and sectoral analyses: changes over time to specific sectors, such as information and communications technology (ICT), oil and gas, food, sport, creative arts, tourism, health, etc., and, more recently, analyses covering the digital economy, sharing economy, collaborative economy and also product-specific global value chains.
- Local government type investment planning: construction projects, shopping centres, new motorways, rural planning, etc.
- Base structures for modelling: computable general equilibrium models, environmental analyses, supply-side-based models, etc.

1.17. The role of SUTs and IOTs in understanding global value chains is of particular importance, given the interconnected nature of today's global economy. SUTs constitute the centrepiece of the internationally compatible accounting framework for a systematic and detailed description of the economy, its various components on the supply and use side and its relations to other economies. The construction of international SUTs and IOTs makes it possible, in combination with trade statistics, to follow the trade in value added and to understand who ultimately benefits from the trade of finished goods in terms of value added, employment, and other factors. The compilation of international or global SUTs and IOTs tables poses a number of compilation challenges (including, for example, the recording of goods sent abroad for processing and the recording of the production abroad and merchanting operations affecting SUTs and IOTs) and relies on the availability of national SUTs and IOTs on a comparable basis.

1.18. In addition, the inclusion of the environmental dimension in the SUTs and IOTs further enhances the usefulness of these tables by allowing the integration and consistency of the economic and environmental information and an understanding of the interlinkages between the economy and the environment. Incorporating environmental considerations as part of the regular compilation of SUTs improves the quality, coherence and consistency of the related outputs and the process provides powerful feedback loops for identifying improvements.

## C. System of National Accounts

1.19. The SNA provides an internationally compatible framework for a systematic and detailed description of a total economy (namely, that of a region, country or group of countries), its components and its relations with other total economies. The 2008 SNA (United Nations, European Commission, IMF, OECD and World Bank, 2009) is the latest version of the SNA, which was adopted by the United Nations Statistical Commission in 2008.

1.20. The SNA describes the basic features of the accounting system in terms of concepts, principles, statistical units and their groupings, etc. The SNA gives an overview of the sequence of accounts, the balancing items associated with each account, a brief description of key aggregates and the role of SUTs and the input-output framework. The key accounting sequence includes the following stages: production of goods and services, transactions relating to products (goods and services) and also to non-produced assets, transactions which distribute and redistribute income and wealth, financial transactions and balance sheets.

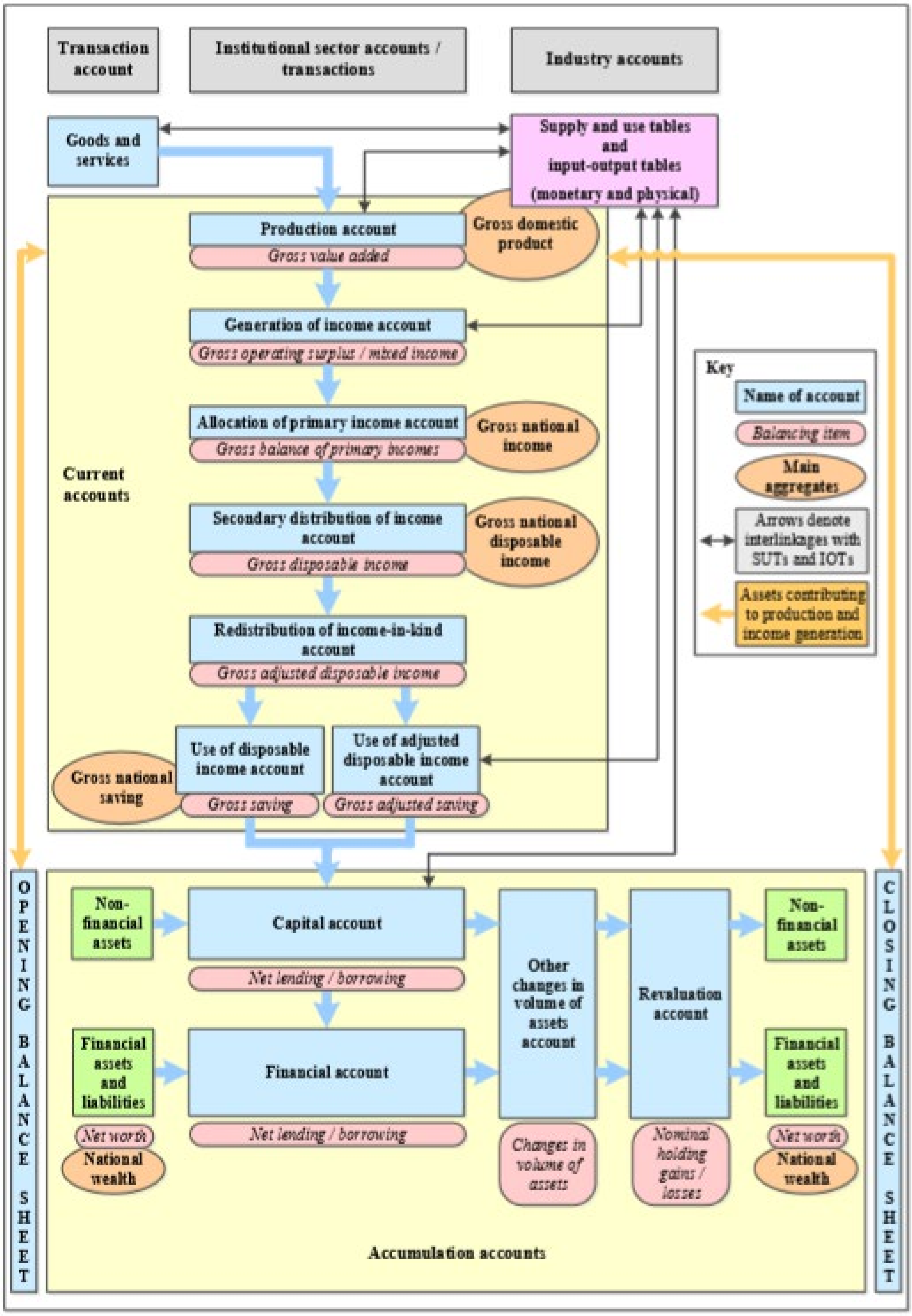
1.21. The SNA framework also draws in other aspects, such as price and volume measurement, population, labour market measures, regional accounts and various specific conceptual issues. Figure 1.1 provides an overview of how SUTs and IOTs fit within the SNA framework. In particular, it shows which accounts in the SNA sequence of accounts are more directly linked with SUTs and IOTs, namely, production accounts, generation of income accounts, use of disposable income accounts and capital accounts.

1.22. Producing annual SUTs simultaneously both in current prices and in volume terms, not only ensures consistency for price volume measures, it also allows for the estimation of the volume of GVA through what is termed “double deflation”, which is recommended in the 2008 SNA.

1.23. As noted above, the SUTs are an integral part of the SNA, determining a single estimate of GDP both in current prices and in volume terms and linked to the institutional sector accounts. For example, the goods and services account for the total economy can be directly compiled from the SUTs through appropriate aggregation. In addition, by using the breakdown of GVA by components in the use table, the production account and the generation of income account can easily be compiled from the SUTs and linked to the institutional sectors.

1.24. Another important aspect linking the SUTs and the institutional sector accounts is the statistical unit. The SNA uses two types of units and two corresponding ways of subdividing the economy, which are quite different and serve separate analytical purposes. The units can be classified to an industry for use in the SUTs and to an institutional sector for use in the institutional sector accounts.

**Figure 1.1 Overview of the links between SUTs and the SNA framework**




Compiled by Sanjiv Mahajan, May 2014

1.25. The first purpose of describing production, income, expenditure and financial flows, and balance sheets, is served by grouping institutional units into institutional sectors on the basis of their principal functions, behaviour and objectives. The SNA enables a complete set of flow accounts and balance sheets to be compiled for each sector and subsector, and also for the total economy. The five institutional sectors distinguished in the SNA are the following:

- Non-financial corporations
- Financial corporations
- General government
- Households
- Non-profit institutions serving households

1.26. The SNA also describes the transactions between these five institutional sectors and the rest of the world. These institutional sectors can be further split into subsectors, for example, general government can be split into central government and local government.

1.27. The second purpose of describing processes of production and for input-output analysis is served by the grouping of local kind-of-activity units (or establishments) into industries, on the basis of their type of activity. An activity is characterized by an input of products, a production process and an output of products.

1.28. In order to ensure consistency between SUTs and the institutional sector accounts, a link table is compiled as an integrated part of the system. In this link table, a cross-classification of output, intermediate consumption, components of value added (and other possible variables of industries) between the industries and the institutional sectors is shown. Thus, this table links the main macroeconomic variables from the SUTs to the institutional sector accounts, providing a picture of local kind-of-activity units and one based on institutional units. As both types of units are classified differently, the link table also provides a picture of the relations of output, intermediate consumption, value added, and other variables, originating in the different industries and institutional sectors.

1.29. The SUTs – consistent with the national accounts – are normally produced in connection with the final or benchmarked versions of the macroeconomic data some two or three years after first preliminary results of the national accounts are published. The SUTs, however, should play a more vital role at the heart of national accounts in the production of preliminary annual or even quarterly accounts. Once the SUTs compilation system is in place on an annual basis, the statistical benefits are significant.

1.30. SUTs can play various roles in the national accounts. One, for example, is to update SUTs – often in a more aggregated version – from the previous year with information available for the preliminary estimates in order to have a complete set of SUTs available that are consistent with the national accounts. This procedure is a good method for revealing inconsistencies in the aggregated preliminary national accounts. Another role of SUTs could arise from new information in a situation in which new, and more, detailed information on total supply and exports is available at an early stage, the structure and relationships in the SUTs of the previous year could be used to project SUTs for domestic output and imports.

1.31. The compilation of SUTs was in the past associated solely with the construction of IOTs. The SUTs were therefore seen as an intermediate step in the compilation of IOTs. This meant, effectively, that the SUTs were only compiled out after the compilation of the national accounts had been completed. This approach, in fact, has significant limitations because the independently calculated national accounts aggregates had to be kept unchanged despite inconsistencies identified through the SUTs system.

1.32. SUTs are now seen as more than just as a step in the construction of IOTs: it is the SUTs that provide the ideal framework guaranteeing the coherency and consistency of supply and use of products in the system in current prices, and in volume terms, thereby improving the quality of the national accounts, and in turn the key economic aggregates.

1.33. The compilation of SUTs is thus recommended as part of the regular annual compilation of national accounts. The annual compilation of SUTs is also one of the recommended data sets used in assessing the scope of implementation of the 2008 SNA.[3] The compilation of SUTs on a quarterly basis can also play a role in improving the quality and coherence of quarterly national accounts (the role played by SUTs in quarterly national accounts is further elaborated in chapter 14).

1.34. The approach to the compilation of SUTs as an integral component of the production of national accounts may be formulated in general terms as follows:

- SUTs are produced as a central element of the compilation of national accounts with a view to providing a key link to various parts of the SNA framework.
- SUTs provide a statistical framework representing the most efficient means of incorporating all basic data – aggregated or detailed – covering the components of the three approaches to measuring GDP, and linking to the institutional sector accounts in a systematic way.
- SUTs effectively ensure the consistency and reconciliation of results at a detailed level and thereby improve the overall quality of the national accounts.
- SUTs are compiled and balanced in both current prices and in volume terms.
- SUTs are produced annually or even, if possible, on a quarterly basis, the ideal option.

[3] See table 2 of the 2011 report of the Intersecretariat Working Group on National Accounts to the United Nations Statistical Commission at its forty-second session (E/CN.3/2011/6), available at: http://unstats.un.org/unsd/statcom/doc11/2011-6-NationalAccounts-E.pdf.

- SUTs can provide a powerful feedback mechanism on the coherency and consistency of source data, such as business surveys, and on the classification of units on the business register.

1.35. When balanced, SUTs provide a coherent, consistent and wholly integrated suite of statistics for a single period (for example, a year), which include:

- A single estimate of GDP in current prices and in volume terms, which is underpinned with components of the production, income (only in current prices) and expenditure approaches to measuring GDP
- Detailed goods and services account in current prices and in volume terms (not by institutional sector)
- Production accounts by industry and by institutional sector in current prices and in volume terms.
- Generation of income accounts by industry and by institutional sector (both in current prices only)
- Link to the use of disposable income account through the flows of final consumption expenditures and capital account through gross capital formation (and its components) balanced via SUTs.

1.36. These guidelines should form part of the strategic tools used to improve the quality of the national accounts.

## D. Objectives of this Handbook

1.37. The theoretical development of IOTs has a long history. Box 1.1 provides a description of the evolution of both IOTs and SUTs within the context of national accounts. The United Nations Statistics Division has followed the theoretical development and the practical work of national statistics offices on IOTs and SUTs from the outset. Starting in 1996, it has prepared a number of publications, under the guidance of the United Nations Statistical Commission, such as those listed among the references under United Nations, 1966, 1973 and 1999, to share practices, update the methodology in line with the updates of the SNA, and provide guidance on the compilation of IOTs.

1.38. This Handbook continues those efforts in cooperation with other international organizations and experts, providing practical and step-by-step guidance for the compilation of SUTs and IOTs based on the latest international statistical standards set out in the 2008 SNA and the sixth edition of the International Monetary Fund (IMF) *Balance of Payments and International Investment Position Manual* (BPM 6) (IMF, 2009).

**Box 1.1 Evolution of the SUTs and IOTs within the national accounts**

The national accounting system is continuously evolving across the various domains to reflect developments in and improvements to the quality of economic statistics and the evolution of economies, with a view to providing a relevant measurement of the economy. Over the past four centuries many significant contributions have been provided by people from various disciplines and countries, resulting in the system as it stands today and how it relates to SUTs and IOTs. Below is a short description of this evolution.

Wassily Leontief (1905–1999), who is often referred to as the pioneer of input-output-based economics, made the first of many key contributions with the publication of his article “Quantitative input and output relations in the economic system of the United States”. This article discussed the construction of an economic transactions table that Leontief had based on the *tableau économique*, proposed by François Quesnay in 1758.

The framework was developed and applied as an economic tool with the construction of the first IOTs for the United States covering the years 1919 and 1929 published in 1936. Later, Leontief developed the first input-output-based model, which was based on theories developed by Leon Walras published in 1874 and 1877. Leontief‘s pioneering work was recognized by the award to him of the Nobel Prize in Economics in 1973. As a result, input-output analysis has become a major tool in developing quantitative economics as a science.

The role of SUTs and IOTs has evolved within national accounts. The 1953 SNA (United Nations, 1953) included no reference to SUTs or IOTs. The 1968 SNA (United Nations, 1968), however, presented the integration of an input-output framework into the integrated economic accounts of the SNA. The conceptual development of the integrated economic accounts of the SNA earned Richard Stone the Nobel Prize in Economic Science in 1984, for having made fundamental contributions to the development of the SNA and having thereby greatly improved the basis for empirical economic analysis.

Alongside Leontief and Stone, other Noble laureates include Ragnar Frisch and Jan Tinbergen in 1969, Paul Samuelson in 1970, Simon Kuznets in 1971, John Hicks in 1972 and James Meade in 1977, who have all contributed to the foundations of the measurements used in today’s SNA and the interlinkages between various sectors and activities in an economy.

The latest evolution of SUTs was recognized in the 1993 SNA (United Nations, CEC, IMF, OECD and World Bank, 1993), chapter XV of which covered both SUTs and IOTs. With the latest version of the SNA, the 2008 SNA, the role and applications of SUTs have been further enhanced, and this in turn will help to meet many analytical needs, as reflected in chapters 14 and 28 of the 2008 SNA.

1.39. This Handbook may, therefore, be viewed as an update of the United Nations *Handbook of Input-Output Table Compilation and Analysis* (United Nations, 1999). In response, however, to the ever-increasing importance of SUTs in their own right, this Handbook extends the scope of the previous publication by providing a more detailed description and compilation guidance for SUTs. As stated in the 2008 SNA, “only supply and use tables provide a sufficiently rigorous framework to eliminate discrepancies in the measured flows of goods and services throughout the economy to ensure the alternative measures of GDP converge to the same value” (2008 SNA, para. 14.15).

1.40. The Handbook builds on the experience, practices and guidance available at national and regional level, such as the *Eurostat Manual of Supply, Use and Input-Output Tables* (Eurostat, 2008). At the same time, however, it provides an innovative approach to the compilations of SUTs and IOTs in the following three main areas:

- Underlying use of an integrated approach to statistics

- Use of a business model for the compilation of SUTs and IOTs linking the various parts through an H-Approach compilation scheme
- Mainstreaming of environmental considerations, through the inclusion of the environmental focus of chapter 13 at the core of part three of the Handbook

1.41. The compilation guidance provided in this Handbook relies on an integrated statistics approach whereby the production of statistics in the various domains is not seen in isolation but as part of an integrated process using common concepts, definitions, business registers and frames, statistical units, estimation methods and data sources to improve the consistency of the statistics compiled, to reduce the respondent burden, and potentially to reduce the statistical agency costs. In particular, the consistency of the basic economic information that feeds into the national accounts and the SUTs with the classifications, concepts and definitions of the 2008 SNA greatly reduces the discrepancies across data from different sources, thus facilitating their reconciliation as part of the integration process. The integrated statistics approach is described in the *Guidelines on Integrated Economic Statistics* (United Nations, 2013).

1.42. This Handbook follows the Generic Statistical Business Process Model (GSBPM) (UNECE, 2013) to describe the production of statistics in a general and process-oriented manner. The underlying concepts and principles of the GSBPM have been followed in describing the business process and stages of the statistical production processes underpinning the compilation of SUTs and IOTs. Chapter 3 of this Handbook describes these links in more detail in the context of SUTs and IOTs. In addition, the chapters in parts two and three of the Handbook are linked to the different parts of these stages of the statistical production process.

1.43. With the adoption of the *System of Environmental-Economic Accounting* (SEEA) (United Nations, European Commission, FAO, IMF, OECD and World Bank, 2014) by the United Nations Statistical Commission, the extension of SUTs and IOTs to include environmental flows in monetary and physical terms has become an internationally agreed standard. Including environmental consideration from the outset in the compilation of SUTs brings a number of advantages. It facilitates the integration and reconciliation of the information, it enhances the quality of the information, and it significantly increases the uses to which the tabulations may be put.

1.44. In line with the United Nations Statistical Commission,[4] this Handbook recommends the annual compilation of SUTs. In addition, the Handbook promotes the compilation of these tables as an integral part of the compilation of national accounts in order to ensure full consistency of the basic data and also of the macroeconomic estimates that are derived from the accounts.

[4] See the 2011 report of the Intersecretariat Working Group on National Accounts to the United Nations Statistical Commission at its forty-second session (E/CN.3/2011/6), available online at: http://unstats.un.org/unsd/statcom/doc11/2011-6-NationalAccounts-E.pdf

1.45. The Handbook provides a consistent numerical example of SUTs and IOTs that runs throughout the chapters (as far as practically possible), in order to facilitate understanding of the various compilation steps. It also provides examples of best practices to illustrate certain aspects of the compilation of SUTs. It should be noted that, in the numerical examples provided in the Handbook, the numbers may not add up exactly to the totals because of rounding.

1.46. The target audience for this Handbook mainly includes compilers of SUTs and IOTs with a basic knowledge and understanding of the SNA. Since, however, the Handbook provides an overview of the whole statistical production process, managers or staff in charge of the programme of national accounts and of economic and environmental accounts would also benefit from the Handbook in gaining an overall understanding of the requirements for the compilation of SUTs and IOTs. Lastly, analytical users may also benefit from perusing the Handbook, as it would provide them with a better understanding of the compilation steps, thus increasing the analytical applications of SUTs and IOTs.

## E. Structure of the Handbook

1.47. The Handbook consists of the following four main parts:

- Part one, providing an introduction to the Handbook, set out in chapter 1.
- Part two, describing the overview of SUTs and IOTs, the fundamental building blocks required, cross-cutting issues and the main stages of the GSBPM – namely, the design, building and collection phases. Part two comprises chapters 2–4.
- Part three, describing the compilation, balancing and dissemination phases of SUTs and IOTs. This also includes the physical SUTs (PSUTs), environmentally extended IOTs (EE-IOTs) and the SUTs links to the quarterly national accounts. Part three comprises chapters 5–15.
- Part four, providing examples of the extensions and applications of SUTs and IOTs. Part four comprises chapters 16–21.

***Part one***

1.48. As indicated above, chapter 1 provides an introduction to the Handbook; it describes the importance of SUTs and IOTs for statistical purposes (for example, compilation of annual and quarterly national accounts, etc.), for policymaking and for analytical purposes (for example, economic forecasting, assessing the impact of globalization). It also provides a general description of the SNA and where the SUTs fit within the SNA framework. This chapter also describes the overall approach of the Handbook (including in comparison to previous handbooks) to the compilation of SUTs and IOTs and provides a general outline of its contents.

***Part two***

1.49. Chapter 2 provides a conceptual overview of SUTs and IOTs and describes the basic elements determining their structure and compilation. These include the accounting principles of the SNA, the classifications of economic activities and products, the choice of the statistical units and how they affect SUTs and IOTs, and the valuation in SUTs and IOTs. The chapter identifies the advantages of compiling SUTs as an integral part of the national accounts and how the SUTs are used to obtain consistent estimates of GDP. It also describes in more detail the extended perspective adopted in this Handbook to SUTs and IOTs, incorporating an environmental dimension which makes possible an integrated overview of the framework from the very outset.

1.50. Chapter 3 provides an overview of the different phases that constitute the statistical production process of SUTs and IOTs, based on the stages of the GSBPM and in line with the United Nations Guidelines on Integrated Economic Statistics (United Nations, 2013). This chapter also provides an overview of the different institutional set-ups in countries which may have an impact on the compilation process. The compilation phases specific to SUTs and IOTs are presented in this chapter together with a link to the relevant chapters of the Handbook.

1.51. Chapter 4 covers specific phases of the GSBPM, namely the specify needs, design, build and collect phases. It provides a description of the elements that should be considered and carefully evaluated at the beginning of the compilation process, such as the level of detail of the industry and products in the tables, the compilation schedule, the revision policy, resources, typical data sources, and others. These and other issues are covered in this chapter, thus providing a foundation for the compilation of SUTs and IOTs.

***Part three***

1.52. Chapter 5 describes the conceptual and practical aspects of the compilation of the supply table and how the so-called "unbalanced" supply table is put together from the typical data sources for SUTs, such as business surveys, administrative data and others.

1.53. Chapter 6 describes the conceptual and practical aspects of the compilation of the use table. As in chapter 5, this chapter shows how an unbalanced use table is constructed on the basis of typical data sources.

1.54. Chapter 7 describes how to compile the valuation matrices necessary to bridge the different valuation concepts of the product flows. This chapter covers the main concepts and methodologies of compiling matrices for trade margins, transport margins, taxes on products and subsidies on products.

1.55. Chapter 8 describes the structure of the imports use table and the domestic use table and the steps necessary to disaggregate the use table into an imports use table and a domestic use table. Historically, the compilation of these tables was largely viewed as an intermediate – though not essential – step in the compilation of IOTs. That said, however, the imports use table and the domestic use table are becoming increasingly important in their own right for analytical purposes.

1.56. Chapter 9 covers the compilation of SUTs in volume terms. It follows the recommendation that SUTs should simultaneously be compiled in current prices and in volume terms. The compilation of SUTs in volume terms can start after the SUTs have been compiled in current prices (although the current price tables do not need to be balanced) but there is need for a simultaneous presentation of volume and price indices.

1.57. Chapter 10 describes the importance of linking SUTs and the institutional sector accounts, which involve data by industry that are to be subdivided according to the institutional sectors to which the units within each industry are assigned. The chapter provides guidance on how to compile the cross-tabulation between industries and institutional sectors and presents various approaches that may be followed in establishing the link between the SUTs and the institutional accounts. It also identified certain issues that may arise in the compilation of the linking table.

1.58. Chapter 11 describes the manual and automated balancing procedures of SUTs in both current prices and in volume terms. This is important for full consistency of the detailed information. The various checks related to product, industry and macro identities, benchmarking with national accounts, and comparison with previous SUTs, if available, are explained. It is recommended that SUTs should be produced and balanced simultaneously at basic and purchasers' prices and also for domestic and imported products, all of which should be both in current prices and in volume terms. A further dimension, and challenge to be surmounted, is the need to cover both annual SUTs and, if possible, quarterly SUTs.

1.59. The sequence of chapters represents the preferred scenario for the compilation of SUTs. Different approaches may be followed, however. An increasing number of countries have achieved the preferred scenario. This scenario for the compilation of SUTs and IOTs may be seen as ambitious but it can be realized through gradual improvements in source data, production processes and the information technology environment.

1.60. Chapter 12 provides an overview of the IOTs (product by product and industry by industry) and describes the methods and the underlying assumptions for transforming SUTs into IOTs. The compilation of IOTs is quite different in nature from that of SUTs and relies on the availability of SUTs. The compilation of IOTs is considered more as an analytical step than a compilation process and, for this purpose, is viewed as a transition from statistics to modelling.

1.61. Chapter 13 describes the structure of the SUTs in physical units where additional rows and columns are added to show flows from the environment to the economy and vice versa. This chapter also describes typical data sources for the compilation of these tables and examples of specific issues in which the SEEA and the SNA differ (for example, the treatment of international flows and the treatment of goods for processing), and shows how standard economic IOTs in monetary units may be extended to include information on the environment in physical units in the environmentally extended IOTs. Physical IOTs are also an extension of the SUTs framework, extended to take into account environmental considerations. They consist of a transformation of the PSUTs. Given certain conceptual and practical issues in the compilation of physical IOTs, however, the focus of the 2012 SEEA – and thus of this chapter – has shifted towards the compilation of environmentally extended IOTs rather than physical IOTs. Examples of two country practices are also presented in this chapter.

1.62. Chapter 14 provides an overview of how SUTs may be used to improve the quarterly national accounts. Since there are various scenarios that can be used in practice, this chapter focuses only on three main situations which illustrate the use of SUTs to various degrees in the compilation of the quarterly national accounts.

1.63. Data dissemination is an important activity for any statistical production process, as it provides users with a range of statistics produced to internationally agreed guidelines. Presenting SUTs and IOTs to users in a clear, transparent and user-friendly manner is thus an important task for the statisticians. Chapter 15 provides an overview of the elements that should be considered when disseminating SUTs and IOTs, such as the identification of users' needs in order to tailor dissemination to the main types of users of SUTs and IOTs, the importance of having a dissemination strategy and the elements that should be covered in the strategy. Reference to the Statistical Data and Metadata Exchange (SDMX) for SUTs and IOTs is also provided in this chapter.

***Part four***

1.64. Chapter 16 describes the methods for compiling regional (subnational) SUTs and the main compilation issues, such as the disaggregation of the information at subnational level, among others. Different issues and challenges are covered through a bottom-up and top-down compilation approach.

1.65. Although the focus of this Handbook is mainly on the compilation of national SUTs and national IOTs, there is a growing demand for these instruments to capture the structure and mechanism of the cross-border fragmentation of production activities. Chapter 17 provides an overview of multi-country SUTs and IOTs, the main compilation issues, and a simplified compilation procedure. This chapter also reviews current international initiatives in this area.

1.66. Chapter 18 deals with the projections of SUTs and IOTs. Many users also require comparable input-output products that are comparable in terms of frequencies and timeliness. For example, some countries produce quarterly SUTs, some countries produce annual SUTs and some countries produce SUTs on a less regular basis. Consequently, a variety of methods, techniques and approaches exist for the projection of SUTs and IOTs and for dealing with data gaps. These techniques also can help producers, for example, to deal with periods between benchmarked years. This chapter examines various methods and techniques used, along with a range of literature available on how to surmount the problem of incomplete data, thus allowing the estimation and projection of IOTs. The chapter also presents a numerical example for three methods: the generalized RAS, the SUT-RAS and the Euro methods.

1.67. Chapter 19 describes the main extensions of supply, use and input-output tables as part of a satellite system which is routinely used for economic analysis. Several examples of the disaggregation of the use table and various satellite accounts are reviewed, including such extensions as social accounting matrices, extended IOTs and other satellite systems.

1.68. Chapter 20 describes the different types of input-output models and provides a broad overview illustrating the benefits and the approaches used. The traditional quantity model and price model of input-output analysis are presented for monetary IOTs and physical IOTs. Input and output coefficients, the Leontief inverse, price and quantity models, indicators, multipliers and inter-industrial linkages were developed for an empirical extended IOT, with extensions for gross fixed capital formation, capital stock, employment, energy, air emissions, waste, sewage and water.

1.69. Chapter 21 provides examples of compilation practices from various countries with different statistical systems. In general, the compilation practices can vary greatly depending on the resources available, the statistical infrastructure, registers, surveys, methodologies and other factors. This chapter provides guidance for countries with limited statistical resources and illustrates differences and challenges in the compilation of SUTs and IOTs.

# Part two

# Chapter 2. Overview of the supply and use tables and input-output tables

## A. Introduction

2.1. Before providing step-by-step guidance on the compilation of SUTs and IOTs, it is important to ensure a general understanding of the two sets of tables. The main objective of this chapter is, therefore, to provide an overview of SUTs and IOTs, which may be found in sections B and C, respectively. Section D introduces the fundamental elements of the SUTs and IOTs, such as the underlying classifications, the statistical units and the valuation methods. Some of these elements are discussed in more detail in subsequent chapters. Lastly, section E elaborates on the importance of compiling SUTs as an integral part of the national accounts.

2.2. Although this chapter covers a wide range of challenges and issues that must be tackled when planning and building a new system of SUTs and IOTs, all aspects may not be achievable in countries with limited resources. It is worth recognizing that a system may be established with a moderate level of ambition using available data, even if these are incomplete. Nonetheless, it is preferable to have a SUTs-type environment for reconciliation of the various statistical sources, rather than only an unbalanced series of national accounts aggregates.

## B. Overview of SUTs

2.3. The SUTs describe the whole economy by industry (for example, the motor vehicle industry) and by product (for example, sports goods). The tables show links between components of GVA, industry inputs and outputs, and product supply and use. The SUTs link different institutional sectors of the economy (for example, non-financial corporations) together with details of imports and exports of goods and services, final consumption expenditure of government, household and non-profit institutions serving households (referred to as NPISHs), and capital formation.

2.4. As their name suggests, SUTs consist of two interlinked tables: the supply table and the use table. The supply table shows the supply of goods and services by type of product and by type of industry, distinguishing between supply by domestic industries and imports of goods and services. In other words, the supply table provides information on the output (by product) generated by economic activities and the imports (by product) from abroad. The totals in the last column represent the total supply by products and the totals in the bottom row represent the total output by economic activity and total imports. A simplified supply table is presented in Table 2.1 below.

**Table 2.1: Simplified structure of the supply table**

| Products \ Industries | Industries | | | | Imports | Total |
|---|---|---|---|---|---|---|
| | Agriculture, forestry, etc. | Mining and quarrying | … | Services | | |
| Agriculture, forestry, etc.<br>Ores and minerals, etc.<br>…<br>Services | Output by product by industry | | | | Imports by product | Total supply by product |
| Total | Total output by industry | | | | Total imports | Total supply |

2.5. The second table is the use table, which provides information on the uses of the different products. The use table shows the use of goods and services by type of product and by type of use, in other words, as intermediate consumption by industry, final consumption, gross capital formation or exports. Furthermore, the table shows the components of gross value added by industry – namely, compensation of employees, other taxes less subsidies on production, consumption of fixed capital and net operating surplus. While the totals by row represent the total uses by product, the total by column represent the total output by economic activity, total final consumption, total gross fixed capital formation and total exports. Table 2.2 below shows the simplified structure of the use table.

**Table 2.2: Simplified structure of the use table**

| Products \ Industries | Industries | | | | Final uses | | | Total |
|---|---|---|---|---|---|---|---|---|
| | Agriculture, forestry, etc. | Mining and quarrying | … | Services | Final consumption | Gross capital formation | Exports | |
| Agriculture, forestry, etc.<br>Ores and minerals, etc.<br>…<br>Services | Intermediate consumption by product and by industry | | | | Final uses by product and by category | | | Total use by product |
| Value added | Value added by component and by industry | | | | | | | Value added |
| Total | Total output by industry | | | | Total final uses by category | | | |

Empty cells by definition

2.6. The classification of products, in practice, is often more detailed than the classification of industries, thus generating rectangular SUTs. For example, the output of the dairy industry is separately shown in the SUTs for the products of processed milk, butter, yoghurt, cheese and so forth, and not as only one aggregate product for all dairy products.

2.7. There are three basic identities that hold between the supply table and the use table. The first identity corresponds to the fundamental identity in national accounts, whereby for each economic activity the following holds:

Identity (1) Output = Intermediate consumption + GVA

2.8. The second identity is that the total supply by product is equal to the total use by product. This means that the amount of products available for use in an economy must have been supplied either by domestic production or by imports, and the same amount of products entering an economy in an accounting period must be used for intermediate consumption, final consumption, capital formation or exports. This means that, for each product (or group of products):

Identity (2) Output + Imports = Intermediate consumption + Final consumption + Capital formation + Exports

2.9. Another important identity which is also key when linking the production and income approaches to calculating GDP and the industry and institutional sector dimension through the SUTs is the following:

Identity (3) For each industry, the GVA using the production approach equals the GVA estimate using the income approach.

2.10. These identities are fundamental in the balancing process that is carried out when compiling SUTs both in current prices and in volume terms, all through a time series dimension.

2.11. Once balanced, the supply table and the use table can be integrated into a single matrix – often referred to as the SUTs framework, which is shown in Table 2.3 below. This table clearly shows the two basic identities linking the SUTs. The total supply by product (left part of the bottom row of Table 2.3) equals the total use by product (top part of the last column of Table 2.3) and the total outputs by industry are identical in both SUTs (the middle part of the bottom row equals the middle part of the last column). The schematic view of SUTs in Table 2.3 also serves as the underlying matrix for projection methods (see chapter 18).

**Table 2.3: Supply and use tables framework**

| | | Products | | | | Industries | | | | Final uses | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agriculture, forestry, etc. | Ores and minerals, etc. | … | Services | Agriculture, forestry, etc. | Mining and quarrying | … | Services | Final consumption | Gross capital formation | Exports | |
| Products | Agriculture, forestry, etc.<br>Ores and minerals, etc.<br>…<br>Services | | | | | Intermediate consumption by product and by industry | | | | Final uses by product and by category | | | Total use by product |
| Industries | Agriculture, forestry, etc.<br>Mining and quarrying<br>…<br>Services | Output by product by industry | | | | | | | | | | | Total output by industry |
| Value added | | | | | | Value added by component and by industry | | | | | | | Value added |
| Imports | | Total imports by product | | | | | | | | | | | Total imports |
| Total | | Total supply by product | | | | Total output by industry | | | | Total final uses by category | | | |

Empty cells by definition

2.12. SUTs thus bring together the components of each of the three approaches to measuring GDP– namely, the production, income and expenditure approaches:

(a) Production approach:

GDP = Output (at basic prices) - Intermediate consumption + Taxes less subsidies on products

(b) Income approach:

GDP = Compensation of employees + Gross operating surplus + Other taxes less subsidies on production + Taxes less subsidies on products

(c) Expenditure approach:

GDP = Final consumption + Gross capital formation + Exports - Imports

2.13. When balanced, SUTs show, by definition, a single estimate of GDP both in current prices and in volume terms. This underlines the importance of the recommendation that SUTs be compiled as part of the annual regular compilation of the national accounts, as they ensure the consistency and coherence of the national accounts components, namely, goods and services account, production account (by industry and by institutional sector) and generation of income account (by industry and by institutional sector), and make it possible to derive a single estimate of GDP. The institutional sector links are covered in more detail in chapter 10.

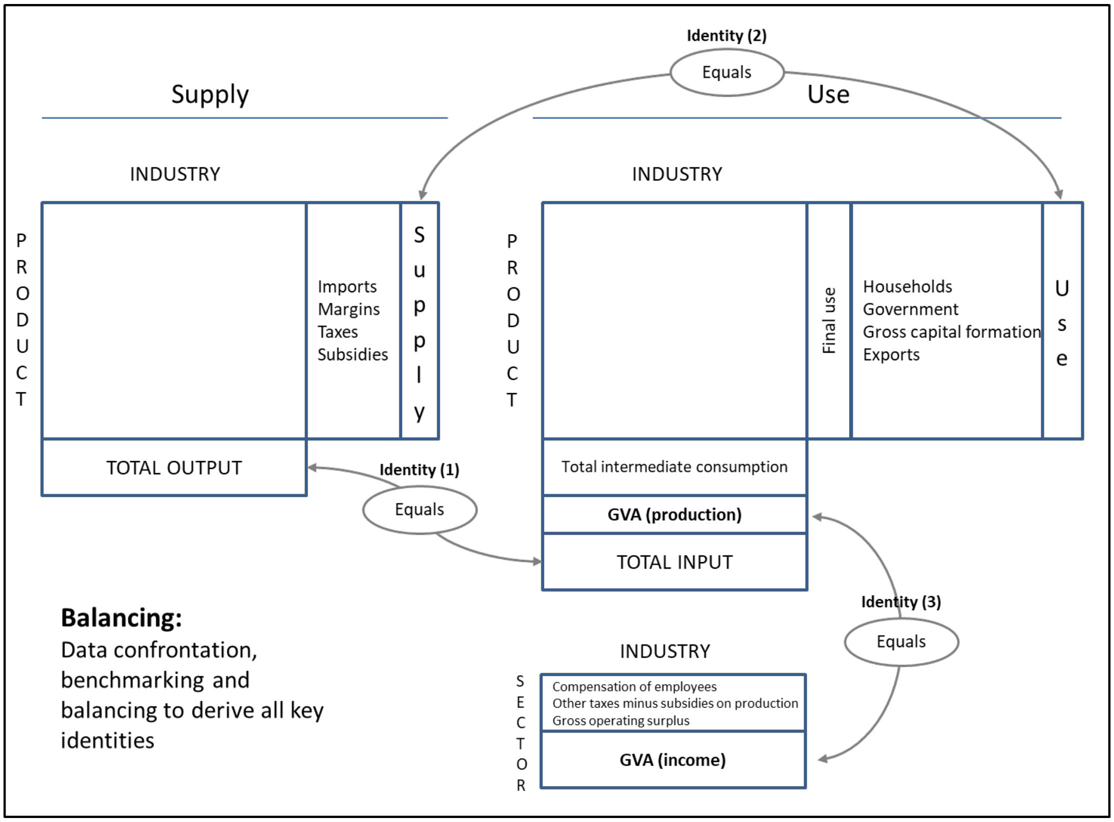
2.14. The SUTs also have links to other accounts, such as disposable income accounts (covering variables like household final consumption expenditure) and accumulation accounts (covering variables like gross fixed capital formation as part of the capital account).

2.15. Producing annual SUTs simultaneously both in current prices and in volume terms (preferably, when two successive years of current price SUTs are available) ensures coherence and consistency for both price and volume measures. In addition, this approach allows for the estimation of the volume of GVA through what may be termed “double deflation”, where GVA is derived by deducting intermediate consumption in volume terms from total output in volume terms. This can be achieved on the basis of an individual unit, industry, institutional sector, and for the whole economy.

2.16. SUTs can also be compiled on a quarterly basis to derive official estimates of quarterly GDP. Developing quarterly SUTs may be highly demanding in terms of resources, time and data availability but have the advantage of significantly improving the quality of the estimate of quarterly GDP.

2.17. Figure 2.1 provides a graphical overview of the SUTs, explicitly identifying the main identities that are ensured in balanced SUTs. Box 2.1 presents a numerical example of balanced SUTs.

**Figure 2.1: Graphical overview of supply and use tables**




2.18. The use table records the intermediate consumption and final uses by type of product but it does not distinguish between the consumption of domestically produced goods and services and that of imported goods and services. Although such a split is not a necessary condition for the creation of balanced SUTs in current prices, it is a key step linking SUTs and IOTs. The disaggregation of the use table into two tables, the domestic use table and the imports use table, is shown in Box 2.2, with a numerical example.

2.19. The compilation of the imports use table is necessary to ensure good quality volume estimates (in particular, GVA by industry) and these tables are becoming increasingly important owing to the growing impact of globalization and the need to measure global value chains and trade in value added.

## Box 2.1 Numerical example of the SUTs system

**Supply table**

| | | Industries: Agriculture | Industries: Manufacturing and construction | Industries: Services | Imports | Total supply |
|---|---|---|---|---|---|---|
| Products | Agriculture | 270 | 30 | 50 | 20 | 370 |
| Products | Manufacturing | 6 | 380 | 87 | 42 | 515 |
| Products | Construction | 4 | 50 | 13 | 8 | 75 |
| Products | Trade, transport and communication | 10 | 15 | 210 | 7 | 242 |
| Products | Finance and business services | 6 | 17 | 240 | 11 | 274 |
| Products | Other services | 4 | 8 | 100 | 12 | 124 |
| | Total | 300 | 500 | 700 | 100 | 1 600 |

**Use table**

| | | Industries: Agriculture | Industries: Manufacturing and construction | Industries: Services | Final use: Final consumption expenditure | Final use: Gross capital formation | Final use: Exports | Total use |
|---|---|---|---|---|---|---|---|---|
| Products | Agriculture | 34 | 59 | 93 | 131 | 21 | 32 | 370 |
| Products | Manufacturing | 97 | 107 | 57 | 122 | 73 | 59 | 515 |
| Products | Construction | 9 | 12 | 4 | 17 | 30 | 3 | 75 |
| Products | Trade, transport and communication | 42 | 24 | 11 | 140 | 20 | 5 | 242 |
| Products | Finance and business services | 14 | 53 | 42 | 116 | 31 | 18 | 274 |
| Products | Other services | 14 | 35 | 22 | 35 | 10 | 8 | 124 |
| | Taxes *less* subsidies on products | 4 | 5 | 12 | 52 | 6 | 1 | 80 |
| | GVA | 86 | 205 | 459 | | | | 750 |
| | Total | 300 | 500 | 700 | 613 | 191 | 126 | 2 430 |

**Supply and use tables framework**

| | | Products: Agriculture | Products: Manufacturing | Products: Construction | Products: Trade, transport and communication | Products: Finance and business services | Products: Other services | Industries: Agriculture | Industries: Manufacturing and construction | Industries: Services | Final use: Final consumption expenditure | Final use: Gross capital formation | Final use: Exports | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Products | Agriculture | | | | | | | 34 | 59 | 93 | 131 | 21 | 32 | 370 |
| Products | Manufacturing | | | | | | | 97 | 107 | 57 | 122 | 73 | 59 | 515 |
| Products | Construction | | | | | | | 9 | 12 | 4 | 17 | 30 | 3 | 75 |
| Products | Trade, transport and communication | | | | | | | 42 | 24 | 11 | 140 | 20 | 5 | 242 |
| Products | Finance and business services | | | | | | | 14 | 53 | 42 | 116 | 31 | 18 | 274 |
| Products | Other services | | | | | | | 14 | 35 | 22 | 35 | 10 | 8 | 124 |
| Industries | Agriculture | 270 | 6 | 4 | 10 | 6 | 4 | | | | | | | 300 |
| Industries | Manufacturing and construction | 30 | 380 | 50 | 15 | 17 | 8 | | | | | | | 500 |
| Industries | Services | 50 | 87 | 13 | 210 | 240 | 100 | | | | | | | 700 |
| | Taxes *less* subsidies on products | | | | | | | 4 | 5 | 12 | 52 | 6 | 1 | 80 |
| | GVA | | | | | | | 86 | 205 | 459 | | | | 750 |
| | Imports | 20 | 42 | 8 | 7 | 11 | 12 | | | | | | | 100 |
| | Total | 370 | 515 | 75 | 242 | 274 | 124 | 300 | 500 | 700 | 613 | 191 | 126 | 4 030 |

= Zero by definition

The **supply table** shows the supply of goods and services by product and by type of supplier, distinguishing supply by domestic industries and imports of goods and services. The domestic output of industries is shown by products. The vector of imports comprises the nation's total imports of goods and services by product.

The **use table** shows the use of goods and services by product and by type of use, i.e. as intermediate consumption by industry, final consumption expenditure, gross capital formation and exports of goods and services. The intermediate uses and final uses reflect the consumption of domestically produced goods and services and also of imported goods and services. Furthermore, although the table is shown in summary form, it should be noted that there are components underlying the headings, for example, GVA can be split between compensation of employees, other taxes less subsidies on production, consumption of fixed capital and net operating surplus.

Note that, for illustrative purposes, it is assumed that the SUTs presented here are compiled on a consistent valuation basis.

2.20. Once the imports use table is constructed, the domestic use table can be estimated by subtracting the imports use table from the use table. The imports use table and the domestic use table form the basis for the construction of input imports tables and domestic IOTs, respectively. More detail may be found in chapters 8 and 12.

## Box 2.2 Numerical example showing a use table split between consumption of domestic production and imports

**Supply table**

| | | Industries | | | Output | Imports | Total supply |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufact. and construction | Services | | | |
| Products | Agriculture | 270 | 30 | 50 | 350 | 20 | 370 |
| | Manufacturing | 6 | 380 | 87 | 473 | 42 | 515 |
| | Construction | 4 | 50 | 13 | 67 | 8 | 75 |
| | Trade, transport and communication | 10 | 15 | 210 | 235 | 7 | 242 |
| | Finance and business services | 6 | 17 | 240 | 263 | 11 | 274 |
| | Other services | 4 | 8 | 100 | 112 | 12 | 124 |
| Total | | 300 | 500 | 700 | 1 500 | 100 | 1 600 |

**Use table**

| | | Industries | | | Final use | | | Total use |
|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufact. and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 34 | 59 | 93 | 131 | 21 | 32 | 370 |
| | Manufacturing | 97 | 107 | 57 | 122 | 73 | 59 | 515 |
| | Construction | 9 | 12 | 4 | 17 | 30 | 3 | 75 |
| | Trade, transport and communication | 42 | 24 | 11 | 140 | 20 | 5 | 242 |
| | Finance and business services | 14 | 53 | 42 | 116 | 31 | 18 | 274 |
| | Other services | 14 | 35 | 22 | 35 | 10 | 8 | 124 |
| | Taxes *less* subsidies on products | 4 | 5 | 12 | 52 | 6 | 1 | 80 |
| | GVA | 86 | 205 | 459 | | | | 750 |
| Total | | 300 | 500 | 700 | 613 | 191 | 126 | 2 430 |

**Domestic use table**

| | | Industries | | | Final use | | | Total use |
|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufact. and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 30 | 50 | 90 | 130 | 20 | 30 | 350 |
| | Manufacturing | 85 | 90 | 51 | 120 | 70 | 57 | 473 |
| | Construction | 5 | 10 | 3 | 16 | 30 | 3 | 67 |
| | Trade, transport and communication | 40 | 20 | 10 | 140 | 20 | 5 | 235 |
| | Finance and business services | 10 | 50 | 40 | 115 | 30 | 18 | 263 |
| | Other services | 10 | 30 | 20 | 35 | 10 | 7 | 112 |
| | Imports | 30 | 40 | 15 | 5 | 5 | 5 | 100 |
| | Taxes *less* subsidies on products | 4 | 5 | 12 | 52 | 6 | 1 | 80 |
| | GVA | 86 | 205 | 459 | | | | 750 |
| | Output | 300 | 500 | 700 | 613 | 191 | 126 | 2 430 |

**Imports use table**

| | | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufact. and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 4 | 9 | 3 | 1 | 1 | 2 | 20 |
| | Manufacturing | 12 | 17 | 6 | 2 | 3 | 2 | 42 |
| | Construction | 4 | 2 | 1 | 1 | | | 8 |
| | Trade, transport and communication | 2 | 4 | 1 | | | | 7 |
| | Finance and business services | 4 | 3 | 2 | 1 | 1 | | 11 |
| | Other services | 4 | 5 | 2 | | | 1 | 12 |
| Total | | 30 | 40 | 15 | 5 | 5 | 5 | 100 |

Empty cells by definition

The **domestic use table** is derived by subtracting the imports use table from the total use table shown in box 2.1.

The imports of goods and services are then shown separately as a new row denoted as “Imports” in the domestic use table. The domestic use table shows the input requirements of industries in terms of domestic intermediates, imported intermediates and primary inputs (GVA). It also shows the use of domestic output of products for intermediate uses and final uses.

The **imports use table** includes information on the use of imported products for intermediate consumption and final uses and the column totals, which match the estimates shown in the “Imports” row.

### 1. Supply and use tables in current prices and in volume terms: H-Approach

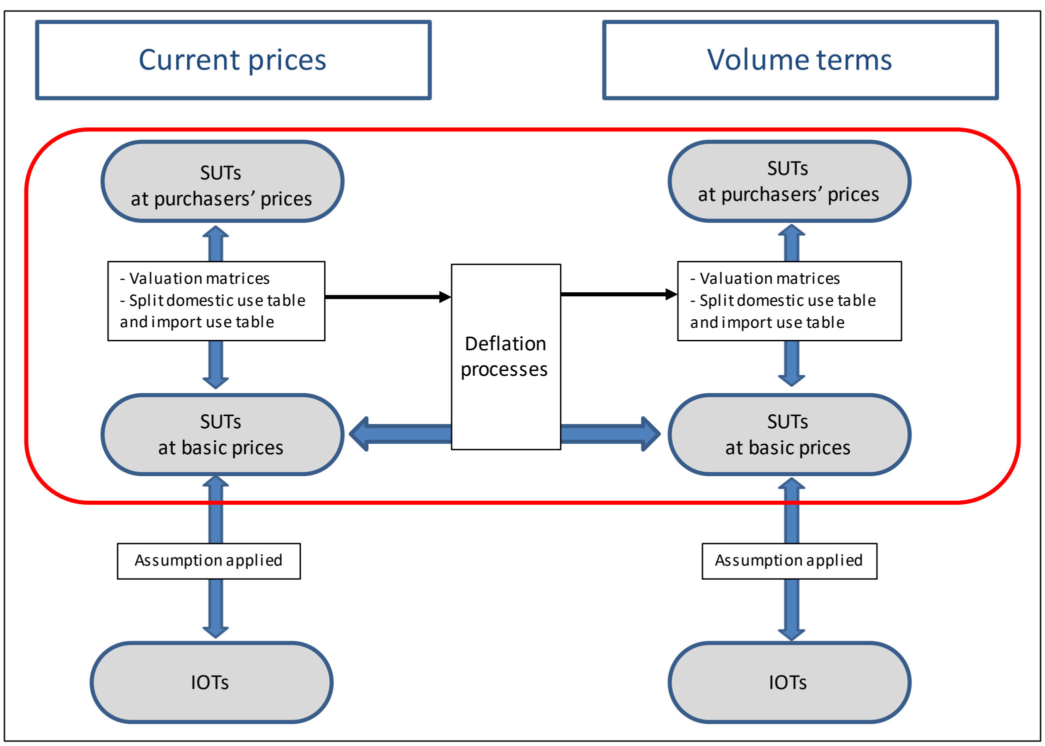
2.21. The SUTs framework not only constrains the current value estimates of supply and use of products to balance exactly, it also provides a means of ensuring that the corresponding volume estimates in previous years’ prices are balanced and that the series of prices implied by the existence of one table in current prices and one in volume terms are strictly consistent. In general, the best way to ensure mutual consistency is to prepare the SUTs in current values and in volume terms at the same time (2008 SNA, para. 14.136).

2.22. The compilation and balancing of SUTs in current prices and in volume terms for a sequence of years also helps to balance the changes in volumes, values and prices in the best possible way (the key condition for the attainment of this outcome is that SUTs are available in current prices both for the current year and for the previous year). This approach ensures a high degree of quality in terms of coherence and consistency over time – and recommended as the best approach for the production of SUTs. Producing annual SUTs simultaneously both in current prices and in volume terms also allows estimation of the volume of GVA through double deflation, whereby GVA in previous years' prices is derived by deducting intermediate consumption in previous years' prices from total output in previous years' prices. Then, the change in volume of GVA between each pair of consecutive years is given by the change of GVA in previous years' prices compared to GVA of the previous year at current prices of that year.

2.23. The SUTs at purchasers' prices and at basic prices in current prices and in volume terms can be compiled and balanced sequentially or simultaneously. In both cases, powerful feedback loops covering quality in terms of consistency and coherence are available. More details are provided in chapters 9 and 11.

2.24. Figure 2.2 shows an overview of the H-Approach for an integrated compilation of SUTs (and IOTs) in current prices and volume terms. The H-Approach is the recommended compilation approach, which brings together the compilation of SUTs in current prices and volume terms, the valuation at basic prices, producers' prices and purchasers' prices, and the links with the compilation of IOTs. The matrices covering other taxes on production, other subsidies on production, trade margins and transport margins are the valuation matrices which link between basic prices, producers' prices and purchasers' prices.

**Figure 2.2 Schematic overview of the compilation of SUTs and IOTs: H-Approach**



2.25. The diagram in Figure 2.2 may be visualized as the letter "H" with the left vertical arm representing SUTs and IOTs in current prices and the right vertical arm representing the SUTs and IOTs in previous years' prices. The horizontal transition represents the deflation process using, for example, a combination of prices, volume indicators and rates of the previous year applied to the volumes.

2.26. The SUTs in current prices are decomposed into the component parts (imports and the valuation matrices on the left-hand side of the H-Approach), each of which is deflated separately as appropriate (the join in the middle), and then added back to get to a purchasers' prices valuation in previous years' prices (the right-hand side). This means that basic prices play the dominant role in the process, and the initial compilation flow is from top left to middle left and that of deflation to middle right, and then to top right.

2.27. When final use deflators are deemed to be better for final use components at purchasers' prices, then the H-Approach allows for the use of higher quality deflators, which are perhaps more appropriate. In these types of examples, it is possible to work with purchasers' prices where the data are believed to be more reliable, making appropriate adjustments, working from top right to middle right, then onto middle left and to top left, and still ensuring a balance at each stage. Similarly, if high quality volume indicators are available, then this can better inform, for example, the step between the middle left and middle right with adjustments as appropriate.

2.28. For balancing purposes, areas such as value added tax (VAT) on products and changes in inventories may be separated out as balanced matrices (whereby the impact on production, income and expenditure is equal and the matrices are in balance) to avoid any balancing adjustments, but this may overcomplicate the system.

2.29. It is important to note that the scheme presented in Figure 2.2 should not be taken as one to be implemented as a whole. In practice, for example, if a country wants to focus exclusively on the compilation of annual SUTs, the focus should be on the compilation steps of the SUTs within the bold line box in Figure 2.2 which are recommended in order to achieve balanced SUTs in current and in volume terms. If, however, a country wants to compile SUTs and IOTs, all the steps in Figure 2.2 should be completed in order to guarantee important feedback loops and enhance the quality of the tabulations.

2.30. When planning for the compilation of SUTs, it is useful to keep in mind the compilation approach in Figure 2.2, since it is naturally linked to the production of time series of SUTs (and IOTs) both in current prices and in previous years' prices using chain-linked volumes. More detail of this may be found in chapter 9. Although SUTs in volume terms for one period can be compiled using SUTs in current prices for one period and deflators, the preferred approach contains a time-series dimension and the following principles:

- To compile SUTs in volume terms, the following are needed:

- Balanced set of SUTs at purchasers' prices in current prices for the present year and the previous year
- Deflators for each flow

- Previous year's SUTs in current prices of that year are needed to derive volume estimates. The SUTs in figure 2.2 are balanced for illustrative purposes. In reality, however, they may be unbalanced and an iterative balancing process may be necessary. This allows for the first SUTs in previous years' prices to be compiled.
- Each transition stage is created in a balanced format which provides a much easier systematic process and build. This means that each of the transition matrices covering taxes, subsidies, trade and transport margins and import of goods and services will be balanced, in other words, the supply-side row total will equal the use-side row total.
- For some of the variables, like household final consumption expenditure, there are already present deflation approaches using consumer price indices to generate the corresponding estimates in previous years' prices. These estimates are likely to differ from those generated with the H-Approach but would also feature in the reconciliation and balancing process of the estimates, and form an example of working from right to left through balanced adjustments.

2.31. The H-Approach provides a transparent, coherent and consistent approach for the compilation and balancing of SUTs. For example, balancing adjustments to one part of the SUTs can be assessed in terms of their impact on other areas of the SUTs, and also in terms of time series.

**2. PSUTs**

2.32. The SUTs described in the previous sections are part of the 2008 SNA framework. As such, they reflect the production boundary of the SNA and they are compiled in monetary units. The tables can, however, be extended to include the environment as providers of natural inputs into the economy and as absorbers of residuals from the economy. The extension of these tables and, more generally, of the accounting framework of the SNA to include environmental considerations is carried out in the 2012 SEEA. The SEEA enables the analyses of the interaction between the environment and the economy, such as an assessment of the use of natural resources, the generation of waste by the economy and waste flows into the environment.

2.33. The SEEA central framework comprises a sequence of accounts – namely, the SUTs in monetary and physical units, the asset accounts in physical and monetary units, and environmental activity accounts and related flows. The present Handbook covers the SUTs of the SEEA and, in particular, since the monetary SUTs of the SEEA are the same as the SNA, the Handbook focuses on the PSUTs of the SEEA. For additional information on the complete set of accounts of the

SEEA, the reader is directed to the publication United Nations, European Commission, FAO, IMF, OECD and World Bank (2014).

2.34. PSUTs are used to assess how an economy supplies and uses energy, water, materials, and also their changes in production and consumption patterns over time, and therefore, in combination with data from monetary SUTs, changes in productivity and intensity in the use of natural inputs and the release of residuals can be examined. The structure of PSUTs is based on the monetary SUTs with extensions to incorporate a column for the environment and rows for natural inputs and residuals.

2.35. Table 2.4 and Table 2.5 provide the simplified structure of the physical supply table and use table, respectively. In order to address specific environmental domains (for example, accounting for water, energy, timber and other resources), these tables are compiled for a disaggregation of products and industries which is relevant for the particular environmental domain of interest. In the case of energy, for example, the products of interest that can be explicitly shown in the table include coal, peat and peat products, natural gas and others. The industries of interest include the main suppliers of energy products (for example, electricity generation, manufacture of gas and other products) and the main users of energy products (for example, manufacturing, transportation and others). These tables are compiled in monetary units – within the SNA context – and in physical units as shown in Table 2.4 and Table 2.5.

2.36. In the PSUTs, the SUTs of the SNA are augmented to include a block of rows for “natural inputs” and a block of rows for “residuals”. The block for natural inputs is used to describe the flows from the environment to the economy; in other words, this block describes the extraction of natural inputs (for example, water, energy resources and others) from their location in the environment as a part of economic production processes or that are directly used in production. Natural inputs may be, first, natural resource inputs, such as mineral and energy resources or timber resources; second, inputs from renewable energy sources, such as solar energy captured by economic units; or, third, other natural inputs such as inputs from soil (for example, soil nutrients) and inputs from air (for example, oxygen absorbed in combustion processes) (2012 SEEA, para. 2.89). When an industry, for example, extracts water as part of the economic production process, this is recorded in the block of natural inputs in the use table in Table 2.5. It is assumed that the environment provides (that is, supplies) all the natural inputs that are used into the economic production process.

2.37. The blocks for “residuals” represent the flows of solid, liquid and gaseous materials, and energy, that are discarded, discharged or emitted to the environment (for example, emission to air) by establishments and households through processes of production, consumption or accumulation but that may also flow within the economy, as is the case when, for example, solid waste is collected as part of a waste collection scheme (2012 SEEA, para. 2.92).

2.38. The block for residuals in the supply table (Table 2.4) represents the flows of waste from the economy to the environment and thus it includes the generation and disposal of waste during economic production activities (generation of waste by industries) and generated during final consumption (mainly by households). While the block of residuals in the use table (Table 2.5) shows, for example, the collection and treatment of waste and other residuals by economic activities, the accumulation of waste in controlled landfills and the residuals flows direct to the environment.

**Table 2.4 Schematic view of the physical supply table**

| | Industries | Industries | | | | Imports | Final consumtpion | Gross capital formation/ Accumulation | Environment | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Agriculture, forestry, etc. | Mining and quarrying | … | Services | | | | | |
| Natural inputs | Mineral and energy resource | | | | | | | | Flows from the environment | Total supply by natural inputs |
| | Water | | | | | | | | | |
| | … | | | | | | | | | |
| Products | Agriculture, forestry, etc. | Output by product by industry | | | | Imports by product | | | | Total supply by product |
| | Ores and minerals; etc. | | | | | | | | | |
| | … | | | | | | | | | |
| | Services | | | | | | | | | |
| Residuals | Solid waste | Residuals generated by industry | | | | | Residuals generated by final consumtpion | Residuals from scrapping and demolition of produced assets | | Total supply by residuals |
| | Wastewater | | | | | | | | | |
| | … | | | | | | | | | |

Empty cells by definition

Cells may contain relevant flows

**Table 2.5 Schematic view of the physical use table**

| | Industries | Industries | | | | Exports | Final consumtpion | Gross capital formation/Accu mulation | Environment | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Agriculture, forestry, etc. | Mining and quarrying | … | Services | | | | | |
| Natural inputs | Mineral and energy resource | Extraction of Natural inputs | | | | | | | | Total use by natural inputs |
| | Water | | | | | | | | | |
| | … | | | | | | | | | |
| Products | Agriculture, forestry, etc. | Intermediate consumption by product and by industry | | | | Final uses by product and by category | | | | Total use by product |
| | Ores and minerals; etc. | | | | | | | | | |
| | … | | | | | | | | | |
| | Services | | | | | | | | | |
| Residuals | Solid waste | Collection and treatment of waste and other residuals | | | | | | Accumulation of waste in controlled landfilled | Residual flows direct to the enviornment | Total use by residuals |
| | Wastewater | | | | | | | | | |
| | … | | | | | | | | | |

Empty cells by definition

Cells may contain relevant flows

2.39. The supply and use identity applies to both physical and monetary flows. For each product measured in physical terms (for example, cubic metres of timber), the quantity of output and imports (total supply of products) must equal the quantity of intermediate consumption, household final consumption, gross capital formation and exports (total use of products). The equality between supply and use also applies to the total supply and use of natural inputs and the total supply and use of residuals. In addition to the supply and use identity, the PSUTs incorporate the input-output identity, implying that the total flows into the economy either are returned to the environment or accumulate in the economy.

## C. Overview of IOTs

2.40. For many analytical purposes, a transformation from a pair of SUTs into a single IOT where total input (row totals) and total output (column totals) are equal brings considerable advantages. IOTs have algebraic properties that make them particularly suitable for analyses that enable estimates of the effects of changing relative prices, labour and capital requirements in the face of changing output levels, the consequences of changing patterns of demand and so on. They may also be used as the basis for an expanded version that may be used to estimate the demands made by the economy on the environment (2008 SNA, para. 28.35).

2.41. An IOT is essentially derived from the use table, where either the columns representing industries are replaced by products or where the rows representing the products are replaced by industries through a transformation process which involves a range of assumptions. The resulting intermediate consumption matrix is then square, showing products in both rows and columns or industries in both. In both cases, the row totals for the complete matrix match the column totals for the complete matrix, product-by-product matrix or industry-by-industry matrix as the case may be (2008 SNA, para. 28.32). Of course, the classifications in the IOTs coincide with those in the SUTs, as the former is a transformation of the latter.

2.42. It is recommended that the IOTs be derived from SUTs. The IOTs derived from the SUTs further describe the interrelationships between industries and products, along with the sale and purchase relationships between producers and consumers within an economy. They can be produced to illustrate flows between the sales and purchases (final and intermediate) of industry outputs (referred to as industry-by-industry tables) or to illustrate the sales and purchases (final and intermediate) of product outputs (referred to as product-by-product tables).

2.43. The derivation of IOTs from the system of SUTs may also reveal inconsistencies and weaknesses in the SUTs. This is made possible by the powerful quality-related feedback loop from the IOTs to the SUTs and vice versa.

2.44. Table 2.6 provides a simplified IOT where the columns of the original use table referring to industry-based structures are transformed into product-based structures. The relations between output and input are now relations between products and primary inputs necessary to produce outputs in similar production units. Primary inputs are inputs that are not outputs of other industries. They include the imports of goods and services and the components of GVA, such as compensation of employees, and others. They are necessary to the production process but are not produced anywhere in the domestic economy.

**Table 2.6 Simplified IOT (product by product)**

| Products (rows) / Products (columns) | Products | | | | Final uses | | | Total |
|---|---|---|---|---|---|---|---|---|
| | Agriculture, forestry, etc. | Ores and minerals; etc. | … | Services | Final consumption | Gross capital formation | Exports | |
| Agriculture, forestry, etc.<br>Ores and minerals; etc.<br>…<br>Services | Intermediate consumption by product | | | | Final uses by product and by category | | | Total use by product |
| Imports | Intermediate consumption of imported products | | | | Final use of imported products | | | |
| Value added | Value added by component | | | | | | | Value added |
| Total | Total supply | | | | Total final uses by category | | | |

Empty cells by definition

2.45. For the transformation of SUTs into IOTs, various assumptions have to be made or adjustments are required based on industry-by-industry or product-by-product assumptions:

- *Product-by-product IOTs*: these may be compiled using either the product technology assumption (whereby each product is produced in its own specific way, irrespective of the industry where it is produced) or the industry technology assumption (whereby each industry has its own specific means of production, irrespective of its product mix).

- *Industry-by-industry IOTs*: these may be compiled using either the fixed industry sales structure assumption (whereby each industry has its own specific sales structure, irrespective of its product mix) or the fixed product sales structure assumption (whereby each product has its own specific sales structure, irrespective of the industry where it is produced).

A mixture of both assumptions can also be applied by implementing a hybrid technology assumption. The correct use and understanding of the terminology, transformation process and assumptions applied are covered in more detail in chapter 12 of this Handbook.

2.46. The selection of the appropriate type of IOT – product-by-product or industry-by-industry – depends on a number of statistical and practical considerations. For example, industry-by-industry IOTs are closer to statistical sources and actual market transactions. Product-by-product IOTs are believed to be more similar in terms of cost structure and production activities. This view has been somewhat weakened, however, by changes introduced in the 2008 SNA, such as the strict implementation of changes in economic ownership.

2.47. In the IOTs, two identities of the SUTs system are reduced to a single type of identity. It is typical for IOTs that, for each product or industry, the input equals output and total input equal total output.

2.48. The figures of total output and total input by product are the same as total supply and total use by product of the SUTs – this holds for product-by-product IOTs. The industry-based structures are transformed into product-based structures. In this transformation, the final use data are left unchanged. The transformation only rearranges the data on the basis of the production matrix of the intermediate use table by applying certain analytical assumptions to the relations between primary and secondary outputs.

2.49. In general, and for analytical purposes, it is recommended to separate the use table into the use table for domestic output and the imports use table. More detail on the compilation of the domestic use table and the imports use table may be found in chapter 8.

2.50. Box 2.3 and Box 2.4 show a simplified numerical example of a sequence of tables – based on the SUTs shown in Box 2.1 and Box 2.2 – necessary for compiling product-by-product IOTs and industry-by-industry IOTs, respectively.

## Box 2.3 SUTs and product-by-product IOTs

**Supply table**

| | | Industries | | | | | |
|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Domestic supply | Imports | Total supply |
| Products | Agriculture | 270 | 30 | 50 | 350 | 20 | 370 |
| | Manufacturing and construction | 10 | 430 | 100 | 540 | 50 | 590 |
| | Services | 20 | 40 | 550 | 610 | 30 | 640 |
| | Total | 300 | 500 | 700 | 1500 | 100 | 1600 |

**Use table**

| | | Industries | | | Final use | | | |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | Total use |
| Products | Agriculture | 34 | 59 | 93 | 131 | 21 | 32 | 370 |
| | Manufacturing and construction | 106 | 119 | 61 | 139 | 103 | 62 | 590 |
| | Services | 70 | 112 | 75 | 291 | 61 | 31 | 640 |
| | Taxes *less* subsidies on products | 4 | 5 | 12 | 52 | 6 | 1 | 80 |
| | GVA | 86 | 205 | 459 | | | | 750 |
| | Total | 300 | 500 | 700 | 613 | 191 | 126 | |

Empty cells by definition

**Use table for domestic output**

| | | Industries | | | Final use | | | |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | Total |
| Products | Agriculture | 30 | 50 | 90 | 130 | 20 | 30 | 350 |
| | Manufacturing and construction | 90 | 100 | 54 | 136 | 100 | 60 | 540 |
| | Services | 60 | 100 | 70 | 290 | 60 | 30 | 610 |
| | Imports | 30 | 40 | 15 | 5 | 5 | 5 | 100 |
| | Taxes *less* subsidies on products | 4 | 5 | 12 | 52 | 6 | 1 | 80 |
| | GVA | 86 | 205 | 459 | | | | 750 |
| | Total | 300 | 500 | 700 | 613 | 191 | 126 | |

**Imports use table**

| | | Industries | | | Final use | | | |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | Total |
| Products | Agriculture | 4 | 9 | 3 | 1 | 1 | 2 | 20 |
| | Manufacturing and construction | 16 | 19 | 7 | 3 | 3 | 2 | 50 |
| | Services | 10 | 12 | 5 | 1 | 1 | 1 | 30 |
| | Total | 30 | 40 | 15 | 5 | 5 | 5 | 100 |

**Input-output table for domestic output (product by product)**

| | | Products | | | Final use | | | |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | Output |
| Products | Agriculture | 34.08 | 52.23 | 83.69 | 130.00 | 20.00 | 30.00 | 350.00 |
| | Manufacturing and construction | 113.17 | 111.84 | 18.99 | 136.00 | 100.00 | 60.00 | 540.00 |
| | Services | 73.23 | 114.19 | 42.58 | 290.00 | 60.00 | 30.00 | 610.00 |
| | Imports | 37.73 | 46.07 | 1.20 | 5.00 | 5.00 | 5.00 | 100.00 |
| | Taxes *less* subsidies on products | 4.58 | 4.83 | 11.59 | 52.00 | 6.00 | 1.00 | 80.00 |
| | GVA | 87.21 | 210.84 | 451.95 | | | | 750.00 |
| | Total | 350.00 | 540.00 | 610.00 | 613.00 | 191.00 | 126.00 | |

**Input table for imports (product by product)**

| | | Products | | | Final use | | | |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | Total |
| Products | Agriculture | 4.91 | 10.75 | 0.34 | 1.00 | 1.00 | 2.00 | 20.00 |
| | Manufacturing and construction | 20.22 | 21.68 | 0.11 | 3.00 | 3.00 | 2.00 | 50.00 |
| | Services | 12.60 | 13.65 | 0.74 | 1.00 | 1.00 | 1.00 | 30.00 |
| | Total | 37.73 | 46.07 | 1.20 | 5.00 | 5.00 | 5.00 | 100.00 |

In product-by-product IOTs, all inputs are allocated to similar production units. They are derived from the SUTs system on the basis of analytical assumptions (see chapter 12 for further detail on the derivation of IOTs).

Product-by-product IOTs are further away from statistical sources than industry-by-industry IOTs.

## Box 2.4 SUTs and industry-by-industry IOTs

**Supply table**

| | | Industries | | | Domestic supply | Imports | Total supply |
|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | | | |
| Products | Agriculture | 270 | 30 | 50 | 350 | 20 | 370 |
| | Manufacturing and construction | 10 | 430 | 100 | 540 | 50 | 590 |
| | Services | 20 | 40 | 550 | 610 | 30 | 640 |
| Total | | 300 | 500 | 700 | 1500 | 100 | 1600 |

**Use table**

| | | Industries | | | Final use | | | Total use |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 34 | 59 | 93 | 131 | 21 | 32 | 370 |
| | Manufacturing and construction | 106 | 119 | 61 | 139 | 103 | 62 | 590 |
| | Services | 70 | 112 | 75 | 291 | 61 | 31 | 640 |
| | Taxes *less* subsidies on products | 4 | 5 | 12 | 52 | 6 | 1 | 80 |
| | GVA | 86 | 205 | 459 | | | | 750 |
| Total | | 300 | 500 | 700 | 613 | 191 | 126 | |

= Zero by definition

**Use table for domestic output**

| | | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 30 | 50 | 90 | 130 | 20 | 30 | 350 |
| | Manufacturing and construction | 90 | 100 | 54 | 136 | 100 | 60 | 540 |
| | Services | 60 | 100 | 70 | 290 | 60 | 30 | 610 |
| | Imports | 30 | 40 | 15 | 5 | 5 | 5 | 100 |
| | Taxes *less* subsidies on products | 4 | 5 | 12 | 52 | 6 | 1 | 80 |
| | GVA | 86 | 205 | 459 | | | | 750 |
| Total | | 300 | 500 | 700 | 613 | 191 | 126 | |

**Imports use table**

| | | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 4 | 9 | 3 | 1 | 1 | 2 | 20 |
| | Manufacturing and construction | 16 | 19 | 7 | 3 | 3 | 2 | 50 |
| | Services | 10 | 12 | 5 | 1 | 1 | 1 | 30 |
| Total | | 30 | 40 | 15 | 5 | 5 | 5 | 100 |

**Input-output table for domestic output (industry by industry)**

| | | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Industries | Agriculture | 26.78 | 43.70 | 72.72 | 112.31 | 19.25 | 25.24 | 300.00 |
| | Manufacturing and construction | 78.17 | 90.47 | 55.30 | 138.46 | 85.28 | 52.32 | 500.00 |
| | Services | 75.05 | 115.83 | 85.97 | 305.23 | 75.47 | 42.45 | 700.00 |
| | Imports | 30.00 | 40.00 | 15.00 | 5.00 | 5.00 | 5.00 | 100.00 |
| | Taxes *less* subsidies on products | 4.00 | 5.00 | 12.00 | 52.00 | 6.00 | 1.00 | 80.00 |
| | GVA | 86.00 | 205.00 | 459.00 | | | | 750.00 |
| Total | | 300.00 | 500.00 | 700.00 | 613.00 | 191.00 | 126.00 | |

**Input table for imports (industry by industry)**

| | | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Industries | Agriculture | 3.71 | 7.69 | 2.61 | 0.86 | 0.86 | 1.61 | 17.34 |
| | Manufacturing and construction | 13.74 | 16.69 | 6.16 | 2.54 | 2.54 | 1.83 | 43.50 |
| | Services | 12.55 | 15.62 | 6.23 | 1.60 | 1.60 | 1.56 | 39.17 |
| Total | | 30.00 | 40.00 | 15.00 | 5.00 | 5.00 | 5.00 | 100.00 |

In industry-by-industry IOTs, inputs are allocated to industries. They are derived from the SUTs system on the basis of pragmatic assumptions. The intermediate input of industries consists of output of industries rather than products (of industry adjusted products) (see chapter 12 for details on the derivation of IOTs).

Industry-by-industry IOTs are closer to statistical sources and actual observations than product-by-product IOTs.

## D. Structure of SUTs and IOTs: basic elements

2.51. Defining the structure of SUTs and IOTs is a principal first step and depends on a number of basic elements which form the backbone of these tabulations. These elements include:

- Principles of the accounting system underlying the SNA applied to SUTs and IOTs
- Classification of economic activities and its level of detail
- Classification of products and its level of detail

- Choice of the statistical units
- Valuation

2.52. Considerations on these elements reflect the specific context in which the tables are compiled, which include the analytical objectives, the data availability, the economic structure of the country, and others. Each of these elements is described below.

### 1. Principles of the accounting system underlying the SNA applied to SUTs and IOTs

2.53. The accounting system underlying the SNA is derived from broad bookkeeping principles and is applied to the structure and links in the SUTs and IOTs. There are three bookkeeping principles underlying the SNA accounting system:

- Vertical double-entry bookkeeping, also known as double-entry bookkeeping
- Horizontal double-entry bookkeeping
- Quadruple-entry bookkeeping

2.54. The main characteristic of vertical double-entry bookkeeping is that each transaction leads to at least two entries, traditionally referred to as a credit entry and a debit entry. This principle ensures that the total of all credit entries and all debit entries for all transactions are equal, thus permitting a check on consistency of accounts for a single unit. Each transaction requires two entries.

2.55. The concept of horizontal double-entry bookkeeping is useful for compiling accounts that reflect the mutual economic relationships between different institutional units in a consistent manner. It implies that, if unit A provides something to unit B, the accounts of both A and B show the transaction for the same amount: as a payment in A's account and as a receipt in B's account. Horizontal double-entry bookkeeping ensures the consistency of recording for each transaction category by counterparties. For example, dividends payable throughout the economy should be equal to dividends receivable throughout the economy once transactions with the rest of the world are taken into account.

2.56. The simultaneous application of vertical and horizontal double-entry bookkeeping results in quadruple-entry bookkeeping – which forms the accounting system underlying the SNA. It deals in a coherent manner with multiple transactors or groups of transactors, each of which satisfies vertical double-entry bookkeeping requirements. A single transaction between two counterparties thus gives rise to four entries. In contrast to business bookkeeping, national accounts deal with interactions among a multitude of units in parallel, and thus require special care from a consistency point of view.

2.57. An account records and displays all the flows and stocks for a given aspect of economic life. In each account, the sum of resources is equal to the sum of uses with a balancing item to ensure this equality. Normally the balancing item will be an economic measure which is itself of interest.

2.58. The accounts can be built up for different areas of the economy by employing a system of economic accounts which highlight, for example, production, income and financial transactions. In many cases, these accounts can be elaborated and set out for different institutional units and groups of units (or institutional sectors). Usually a balancing item has to be introduced between the total resources and total uses of these units or sectors and, when summed across the whole economy, these balancing items constitute significant aggregates.

2.59. The accounting structure is uniform throughout the system and applies to all units in the economy, whether they are institutional units, subsectors, sectors or the whole economy, although some accounts (or transactions) may not be relevant for some institutional sectors.

2.60. The national accounting system uses two types of units and two corresponding ways of subdividing the economy, which are quite different and serve separate analytical purposes:

- The first purpose, namely that of describing production, income, expenditure and financial flows, and balance sheets, is served by grouping institutional units into institutional sectors on the basis of their principal functions, behaviour and objectives. The national accounting system enables a complete set of flow accounts and balance sheets to be compiled for each sector, and subsector, and also for the total economy.
- The second purpose, namely that of describing processes of production and for input-output analysis, is served by the system grouping establishments into industries on the basis of their type of activity. An activity is characterized by an input of products, a production process and an output of products.

2.61. Figure 2.3 shows in matrix form an overview of the structure of the SNA. The degree of subdivisions of the columns and rows using the relevant classifications determines the degree of detail of the accounts. The shaded rows and columns for goods and services and production by industry indicate those parts of the system relevant for the compilation of SUTs and IOTs, and clearly indicate that SUTs are at the core of the national accounts system.

2.62. The three approaches to measuring GDP (production, income and expenditure) are shown in Box 2.5 and can be derived from the data in Figure 2.3 generating a single estimate of GDP.

2.63. All the aggregate components and detailed components are included in the SUTs and IOTs-related part of the system.

## Figure 2.3 System of national accounts in matrix form

millions of euros

| Receipts / Liabilities \ Expenditures / Assets | | Opening balance | Goods and services | Production by industry | Income and consumption | Accummu-lation | Rest of the world | Closing balance | Total excl. balance |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Opening balance | 1 | | | | | Assets of domestic sectors (real and financial) | Financial assets of the rest of the world | | |
| Goods and services | 2 | | | 303 492 Intermediate consumption | 226 258 Final consumption | 74 612 Gross capital formation | 165 648 Exports of goods and services | | 770 009 |
| Production by industry | 3 | | 578 360 Output at basic prices | | | | | | 578 360 |
| Income and consumption | 4 | | 33 778 Taxes less subsidies on products | 274 868 Value added at basic prices | | | 38 023 Primary incomes and current transfers from rest of the world | | 346 670 |
| Accummulation | 5 | Liabilities of domestic sectors | | | 79 669 Gross savings | | - 5 057 Deficit on the balance of payments | Liabilities of domestic sectors | 74 612 |
| Rest of the world | 6 | Financial liabilities of the rest of the world | 157 871 Imports of goods and services | | 40 743 Primary incomes and current transfers to the rest of the world | | | Financial liabilities of the rest of the world | 198 614 |
| Closing balance | 7 | | | | | Assets of domestic sectors (real and financial ) | Financial assets of the rest of the world | | |
| Total excl. balance | 8 | | 770 009 | 578 360 | 346 670 | 74 612 | 198 614 | | |

Table based on 2011 figures from Austria

## Box 2.5 Three approaches to measuring GDP

Production approach

millions of euros

| Variable | Value |
|---|---|
| Output at basic prices | 578 360 |
| - Intermediate consumption | - 303 492 |
| = Gross value added at basic prices | 274 868 |
| + Taxes less subsidies on products | 33 778 |
| = Gross domestic product | 308 647 |

Income approach

millions of euros

| Variable | Value |
|---|---|
| Compensation of employees | 144 343 |
| + Other taxes less subsidies on production | 4 858 |
| + Consumption of fixed capital | 53 469 |
| + Net operating surplus | 72 198 |
| = Gross value added at basic prices | 274 868 |
| + Taxes less subsidies on products | 33 778 |
| = Gross domestic product | 308 647 |

Expenditure approach

millions of euros

| Variable | Value |
|---|---|
| Final consumptipon | 226 258 |
| + Gross capital formation | 74 612 |
| + Exports of goods and services | 165 648 |
| - Imports of goods and services | - 157 871 |
| = Gross domestic product | 308 647 |

Table based on 2011 figures from Austria

## 2. Classification of economic activities

2.64. The International Standard Industrial Classification of All Economic Activities (ISIC) is the international reference classification of economic activities (also referred to as "industries"). The fourth revision, ISIC Rev. 4, was issued by the United Nations in 2008 (United Nations, 2008). Its main purpose is to provide a set of activity categories that can be used for collecting and presenting internationally comparable statistics by economic activity.

2.65. In general, the scope of ISIC covers productive activity, that is, all economic activities within the production boundary as described in the SNA (with one exception for activities in Class 9820– "Undifferentiated service-producing activities of private households for own use"). The classification is used to classify statistical units such as establishments or enterprises, according to the economic activity in which they mainly engage. All categories at each level of the classification are mutually exclusive. ISIC Rev. 4 is the reference classification of production activities of the 2008 SNA.

2.66. The structure of ISIC consists of 21 sections, 88 divisions, 238 groups and 419 classes. The principles and criteria used to define and delineate the categories are based on the inputs of goods, services and factors of production, the process and technology of production, the characteristics of outputs, and the use to which the outputs are put. At the class level of the classification, preference has been given to the process and technology of production in defining individual ISIC classes, in particular in the classes related to services. The list of products that defines a class is called the principal products of that class. At the division and group levels, characteristics of outputs and the use to which outputs are put become more important for the creation of analytically useful aggregation categories.

2.67. At national and regional levels, there may be need for recourse to a level of detail that reflects specific national and regional circumstances. It is important, however, that these classifications are compatible with ISIC Rev. 4 at an aggregated level of detail. At its thirty-seventh session, the United Nations Statistical Commission recommended that countries adapt their national classifications in a way that allows them to report data at least at the two-digit level of ISIC Rev. 4 without loss of information.[5] Examples of regional classifications include the industrial classification used in the European Union, the second revision of the Statistical Classification of Economic Activities in the European Community (NACE Rev. 2), which is identical with ISIC Rev. 4 up to the two-digit level (divisions) of the classification. At lower levels, NACE has provided more detail suitable for the European users of the classification. The additional detail can always be aggregated to ISIC categories at the three-digit and four-digit levels, within the same structure. The North American Industry Classification System (NAICS), although it has a substantially different structure from ISIC, has been designed in a way that

[5] See *Official Records of the Economic and Social Council, 2002, Supplement No.4* (E/2006/24), chapter I, para. 3, item 37/105 (b).

statistical data collected according to NAICS can be re-aggregated into the two-digit divisions of ISIC Rev. 4. The Australian and New Zealand Standard Industrial Classification (ANZSIC) was revised in 2006. Its structure broadly follows the ISIC structure, so that categories at the division and more detailed levels can be aggregated into the two-digit categories of ISIC.

2.68. An economic unit may engage in a variety of production activities. The classification of the economic unit is made in accordance with the importance of the production activities. In this regard, the activities of an economic unit are subdivided into principal activity, secondary activity and ancillary activities. The principal activity of an economic entity is the activity that contributes most to the value added of the entity, as determined by what is known as the "top-down method". This method follows a hierarchical order, starting with the identification of the relevant category at the highest level (section) and progressing down through the levels of the classification to the lowest level (classes). The effect of this top-down method is such that the principal activity need not account for 50 per cent or more of the total value added of an entity or even that its generated value added exceed that of all other activities carried out by the unit, although, in the majority of cases, it will do so (United Nations, 2008, para. 57).

2.69. In practice, it is often impossible to obtain information on the GVA of the different activities performed and the activity classification has to be determined by using substitute criteria, such as employment and turnover.

2.70. Products resulting from a principal activity are either principal products or by-products. By-products are products that are necessarily produced together with principal products, for example, hides produced when producing meat by slaughtering animals. Since normal patterns of horizontal integration have been taken into account when defining the ISIC classification, such commonly integrated activities are usually included in the same ISIC class, even though the outputs of the activities have quite different characteristics. Thus ISIC class 1010 "processing and preserving of meat" also includes hides, skins, wool and feathers originating from slaughtered animals (United Nations, 2008, paras. 57 and 120).

2.71. A secondary activity is a separate activity the products of which are ultimately intended for third parties and that is not the principal activity of the entity in question. The outputs of secondary activities are called secondary products, including any by-products associated with these outputs. Most economic entities produce at least some secondary products.

2.72. Traditionally, the existence of by-products has been seen as creating problems in input-output analysis as they would disturb supply-and-use relationships. Additional demand for the principal product would therefore also result in more output of the by-product, without there automatically being any additional demand for that increased output. In the case of more complex production processes than meat and hides, for example in the chemical and electronic industries, it will, however, be very difficult or even, in the absence of special technical insight, impossible for the compilers of SUTs to identify by-products separately.

2.73. A distinction is made between principal and secondary activities on the one hand and ancillary activities on the other. All economic units require some basic, routine services to support their production activities. When they are provided in-house, they are called ancillary activities. In general, an ancillary activity is a supporting activity undertaken within an enterprise in order to create the conditions within which the principal and secondary activities can be carried out (2008 SNA, para. 5.36). Ancillary activities typically produce services that are commonly found as inputs into almost any kind of economic activity. These outputs are always services and intended for intermediate consumption within the same entity. They include, for example, the maintenance of records, files or accounts in written form or on computers; the purchase of materials and equipment; the provision of electronic and traditional written communication facilities; the hiring, training, managing and paying of employees; the storing of materials or equipment; warehousing; the provision of security and surveillance, and others.

2.74. Some of these activities are found in every economic entity. The output of an ancillary activity is not explicitly recognized and recorded separately in the SNA. It follows that the use of this output is also not recorded. All the inputs consumed by an ancillary activity – materials, labour, consumption of fixed capital, and so forth – are treated as inputs into the principal or secondary activity that it supports.

2.75. The following activities are not to be considered ancillary: producing goods or services as part of gross fixed capital formation and research and development activities, which are considered to be part of gross fixed capital formation in the 2008 SNA. These items will therefore appear as either principal or secondary output. Goods that become embodied in the output of the principal or secondary activities are not outputs of ancillary activities.

2.76. More details on principal products, secondary products and ancillary products specific to the construction of the supply table may be found in chapter 5.

**(a) Considerations for the compilation of SUTs and IOTs**

2.77. In SUTs and IOTs, industries should be classified according to ISIC Rev. 4. The major advantage of using established international industrial classifications is that comparability with other types of economic statistics and the national accounts is not compromised. The choice is therefore not which industrial classifications should be used in the SUTs and IOTs but rather the level of detail.

2.78. At the working level, it is recommended to use the most detailed level of classification of industry, taking into consideration user needs, the availability of data and the level of detail used in the national accounts. Furthermore, certain compilation aspects also influence the choice of working level, such as the distinction between industries which are allowed to deduct VAT and those that are not, the distinction between market and non-market producers, and the explicit identification of certain industry subdivisions that are relevant for the compilation of the trade and transport margin matrices. In addition, the link between SUTs and the institutional sector accounts should be reflected. These considerations are further elaborated in chapters 4–7. In general, the level of detail in the published and disseminated SUTs differs from that at the working level: SUTs tend to be published at a more aggregated level of detail which takes into account users' needs and confidentiality.

### 3. Classification of products

2.79. The international reference classification of products is the Central Product Classification (CPC). The latest revision, CPC Version 2.1, was issued by the United Nations in 2015 (United Nations, 2015). The primary purpose of CPC is to classify all goods and services that are the result of production in the economy. CPC presents categories for all products that can be the object of domestic or international transactions or that can be entered into stocks. It includes products that are the output of economic activity, including transportable goods, non-transportable goods and services. CPC in general follows the definition of products within the SNA.

2.80. The importance of the industrial origin of goods and services was underscored by the attempt to group into one CPC subclass mainly the products that are the output of a single ISIC class. Through their linkage to the criterion of industrial origin, the input structure, technology and organization of production characteristics of products are also reflected in the structure of CPC. The criterion of industrial origin of products is one of the classification principles applied by ISIC.

2.81. CPC was developed primarily to enhance harmonization among various fields of economic and related statistics and to strengthen the role of national accounts as an instrument for the coordination of economic statistics. It provides a basis for transforming basic statistics from their original classifications into a standard classification for analytical use. As a general purpose classification, CPC provides less detail than other specific classification systems in areas or applications for which such systems are available, for example the Harmonized Commodity Description and Coding System (Harmonized System). The Harmonized System[6] codes provide building blocks for the part dealing with transportable goods and take into account the basic categories of economic supply and use of products as specified in the SNA such as intermediate consumption, final consumption, capital formation, and imports and exports.

2.82. CPC is a system of categories that are both exhaustive and mutually exclusive. This means that if a product does not fit into one CPC category, it must automatically fit into another. In CPC Version 2.1, in total there are 10 sections, 71 divisions, 329 groups, 1,299 classes and 2,887 subclasses. Each subclass in sections 0–4 of CPC is defined as the equivalent of one heading or subheading or the aggregation of several headings or subheadings of the Harmonized System, since the Harmonized System is a detailed classification of transportable goods that is widely accepted for use in international trade statistics by virtually all countries. Other classifications of

[6] The Harmonized Commodity Description and Coding System is the classification used for international trade statistics.

products may be used at country and regional level, however, these classifications are in general broadly consistent with CPC Version 2.1. The Classification of Products by Activity (CPA) is based on NACE – and therefore follows a different aggregation structure than CPC – and detailed categories that are mostly aligned with CPC. Exceptions exist for areas where CPC deviates from the Harmonized System, since CPA maintains a closer link with the Combined Nomenclature, which is the European version of that classification.

2.83. CPC and ISIC are both general purpose classifications, with ISIC representing the activity side. Each subclass of CPC consists of goods or services that are predominantly produced in a specific class of ISIC. The relationship between industries and their products is complex, however, and changes over time, and it should be noted that there has been no intention of establishing a one-to-one correspondence between CPC and ISIC. Such an effort is considered neither practical nor desirable as it might lead to an inadequate description of CPC categories, in particular at the higher levels.

2.84. The classification of a product in the service part of CPC does not automatically imply that the product cannot be a principal output of a goods producing industry. Thus the two CPC divisions: (87) Maintenance, repair and installation (except construction) services; and (88) Manufacturing services on physical inputs owned by others, both appear in the business and production services section of CPC but the units carrying out these activities on a fee or contract basis are classified in the same ISIC category as units producing the same goods or services for their own account. The correspondence table between CPC Version 2.1 and ISIC Rev. 4 (see the United Nations Statistics Division classification website at: http://unstats.un.org/unsd/class/default.asp) shows that 125 subclasses of CPC division 88 are defined to correspond to 125 manufacturing industry classes of ISIC. This implies that these manufacturing services are the principal output (and not as might have been expected, the secondary output) of the corresponding manufacturing activities. In other words, there are no service industries producing these services. This example shows the need to ensure that services of these kinds are correctly entered into the domestic output matrix, requiring a considerable number of products.

2.85. Box 2.6 shows other classification of products, such as the Harmonized System, the Standard International Trade Classification (SITC), the Classification by Broad Economic Categories (BEC) and the Extended Balance of Payments Services Classification (EBOPS) and how they relate to CPC. The basis for grouping products in the SUTs (and IOTs) is thus most commonly an aggregation of CPC sections, divisions or groups (2008 SNA, para. 14.22).

**Box 2.6 Other classifications of products**

The Harmonized Commodity Description and Coding System, generally referred to as the Harmonized System or simply HS, is a multipurpose international product nomenclature developed by the World Customs Organization (WCO). The system is used by more than 200 countries and economies as a basis for their collection of external trade statistics for goods. It is also extensively used by governments, international organizations and the private sector for many other purposes, such as internal taxes, trade policies, monitoring of controlled goods, rules of origin, freight tariffs, transport statistics, price monitoring, quota controls, compilation of national accounts, and economic research and analysis.

As a result of the intensive world-wide use and degree of detail that the Harmonized System provides, it is a fundamental classification system and provides a key link for the definitions of all other classifications of goods (including the goods part of CPC), as well as for the definition of the classes of ISIC. The latest version now available is HS 2012.

The Harmonized System explanatory notes are a part of a commodity database giving the Harmonized System classification of more than 200,000 products actually traded internationally. This high number of background products also makes it evident that, at the level of external trade statistics (usually 5,000–10,000 products, as most countries apply further subdivisions of the 5,000 Harmonized System codes), there will be no homogeneous products, and of course, even less so at the much higher level of aggregation applied in a SUTs system.

SITC and BEC are both classifications of goods defined in terms of the Harmonized System, and also primarily used in relation to external trade data. SITC distinguishes around 3,000 products at its most detailed level. It is primarily used as an alternative to the Harmonized System publication level of external trade statistics, and there will usually be no advantage in applying it in SUTs, rather than using the Harmonized System directly. Following the breakdown of products according to BEC (food, materials, fuel, capital goods, transport equipment, consumer goods), these groupings may be used as a reference when deciding on uses of some products but this breakdown is not applicable as the main product classification in the SUTs system. Furthermore, BEC is not an international standard classification in the same sense as the Harmonized System or SITC.

The relationship between CPC and SITC is similar to that between CPC and the Harmonized System, since SITC also uses the subheadings of the Harmonized System as building blocks to create product groupings that are more suitable for the economic analysis of trade. BEC is related to CPC through its close correlation with SITC and is designed to serve as a means for converting external trade data compiled by use of the SITC into end-use categories that are meaningful within the SNA framework. It is generally possible to rearrange entire CPC subclasses into BEC categories through the correspondences between CPC and SITC, and between SITC and BEC.

EBOPS 2010 (United Nations, European Commission, IMF, OECD and WTO, 2011) is a classification of trade in services that was developed to provide further breakdowns of the BPM 6 classification so as to meet a number of user requirements, including the provision of information required under the General Agreement on Trade in Services. It builds upon the BPM 6 classification of services. In BPM 6, 12 main service categories are identified and broken down into a list of standard and supplementary components. EBOPS 2010 consists of a further breakdown of these components into more detailed sub-items. EBOPS 2010 also includes several supplementary items for the recording of useful additional information regarding services transactions in various sectors such as, travel and tourism or insurance services. Like the BPM 6 services classification, EBOPS 2010 is primarily a product-based classification. Items of these classifications may be described in terms of CPC. Correspondences cannot, however, be established in the areas of travel, construction, and government goods and services, n.i.e., which focus on the mode of consumption of goods and services or the status of the transactor, rather than on the type of product consumed. A detailed correspondence between EBOPS 2010 and CPC Version 2, may be found online at http://unstats.un.org/unsd/tradeserv/TFSITS/msits2010/annexes.htm.

### (a) Considerations for the compilation of products in the SUTs and IOTs

2.86. Based on the description of the product classifications and their level of detail, it is obvious that products in the SUTs, even when a high level of detail is applied, as is the case with 2,000 products, will nonetheless represent aggregated groups of products when compared with the detail applied in basic statistics, and even more so when compared with the real-world variety of products. Accordingly, analogies to the notion of homogeneous products, which are often assumed in standard economic theory, will in general be inappropriate, as there can be no homogeneous products or production processes at the SUTs or IOTs level of aggregation. Many economies usually consist of hundreds of thousands of producing units, of which virtually no two are completely identical, and there are millions of different products and even more production processes. It is therefore important to realize that national accounts and SUTs record economic transactions, and not physically identifiable products or related technical production processes, which will in general be outside the sphere of official statistics.

2.87. Even very detailed basic statistics already represent highly aggregated data when compared to the number of real-world products. As previously mentioned, the HS contains descriptions of 200,000 products. Statistics on products are collected at a maximum detail of, say, 10,000 products, and only in selected areas such as external trade statistics and output from manufacturing industries. Furthermore, products that are identical in a physical sense may be different in an economic sense when they are sold at different prices to different purchasers. This may, for example, happen because of the way transportation costs are invoiced. The concept of basic prices is defined specifically to include this possibility. Statistics on the breakdown of products for intermediate consumption will often give less detail than production statistics and may sometimes be collected from enterprise units rather than establishment units, and in most cases the statistical coverage of purchases is irregular or limited to certain industries, for example, mainly manufacturing industries, but even in this case the compilers of SUTs may be confronted with the task of further aggregation.

2.88. To gain a better understanding of the level of aggregation, it is useful to consider the product definitions required when selecting items and collecting prices for compiling price indices such as consumer price indices and producer price indices. Each item must be defined more precisely than by just referring to even the most detailed product classification. The same applies when collecting prices for use in the International Comparison Programme. Official statistics have in these cases to make selections from a product universe at a much more detailed level than 10,000 product groups, in order to compile a sound price index. This places the notion of “homogeneity”, as often applied in connection with SUTs and IOTs, in perspective (see 2008 SNA, para. 14.144).

2.89. As a result, the term “homogenous” in the context of the SUTs system usually means “mutually exclusive”. As outlined above, international activity and product classifications aim at mutually exclusive classification criteria. Yet within any group of products fulfilling this criterion, there may be considerable “non-homogeneity” depending on the level of aggregation. The classification of products in this (mutually exclusive) sense is statistically possible at any level of aggregation but a product in the SUTs will usually represent a basket of products, and the contents of the basket will, furthermore, vary from one cell to another along the rows of both the supply table and the use table. For the classification of producer units into industries the same "mutually exclusive" conditions basically hold, although the situation is somewhat different as the statistically observed input structures will usually represent a mixture of intermediate consumption structures for many individual products, some of which will also be produced in other industries. As a consequence, industries producing mutually exclusive products can only be derived on certain assumptions which do not in general form part of the compilation of the SUTs. Redefinitions (see chapter 5) may be seen as an exception.

### 4. Other classifications relevant for SUTs and IOTs

2.90. The SUTs system distinguishes a large number of products and industries. Final uses, however, often distinguish only final consumption, gross capital formation and exports at a very aggregate level. The functional classifications help to support the compilation of SUTs and allow for a wide range of other analyses. It is mainly the disaggregated SUTs which allow us to identify the different purposes of expenditure on a product basis.

2.91. The SNA uses special classifications to analyse consumption and other outlays according to the purpose for which the expenditure is undertaken. Such functional classifications and associated detail – the Classifications of Expenditure According to Purpose (United Nations, 2000a) – can be found in chapter 29 of 2008 SNA, on satellite accounts and other extensions. These classifications include, in particular, the classification of the functions of government (COFOG); the classification of individual consumption according to purpose (COICOP), the classification of the purposes of non-profit institutions serving households (COPNI) and the classification of the outlays of producers according to purpose (COPP). The main purpose of these classifications is to provide more detailed statistics for a wide variety of analytical uses. In 2018, the United Nations issued the first revision of COICOP, COICOP 2018 (United Nations, 2018), to reflect users' need for more detail and several other issues that required a revision of the classification.

2.92. For the SUTs, it is recommended that the lower-level detail be produced in the form of disaggregated matrices as subsystems feeding into the central compilation of SUTs in current prices and in volume terms. As a result, the correspondence between categories of these functional classifications and CPC makes it possible to bring the basic data into the use tables.

2.93. The correspondence table between categories of CPC and COICOP has been established and available on the United Nations Statistics Division classification website at http://unstats.un.org/unsd/class/default.asp. When making decisions on the details of the product classification to be applied in SUTs, the possibility of establishing transformation tables to COICOP at group levels or class levels and to make use of the reverse transformation, from the products surveyed in the household budget surveys to the products of the SUTs, should be taken into consideration. These transformation matrices are keys to the use of the consumer price index (CPI) in the volume estimates, as sub-indices of the CPI will usually be based on the COICOP classification. In addition, for the purposes of household budget surveys and purchasing power parities (PPPs), COICOP is applied at a more detailed level, including as many as 300 or more subclasses.

2.94. Table 2.7 shows the types of links and extensions. Some of the key areas are covered in this section but more detail in terms of compilation is provided in chapter 6.

2.95. COPP provides detailed information on outlays of producers for current production, infrastructure research and development, environmental protection, marketing and human resource development. It should be noted that COPP is included here more for completeness of presentation of the functional classifications. COPP is not widely used and does not fit well in the SUTs framework, as its outlays include wages and other types of costs in addition to intermediate consumption. In principle, COPP applies to all producers, whether market or non-market or for own final use.

## Table 2.7 Links between the use table and functional classifications

Use table

| | | INDUSTRIES | | | | FINAL USE | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | .. | Other services | Total | Final consumption expenditure | | | Gross capital formation | Exports | |
| | | | | | | Households | NPISH | General government | | | |
| Products | Agriculture<br>:<br>Other services | | | | | | | | | | |
| | Value added | | | | | | | | | | |
| | Total | | | | | | | | | | |

Final consumption expenditure by households (COICOP 2018)

| | | COICOP | | | | | |
|---|---|---|---|---|---|---|---|
| | | Food and non-alcoholic beverages | Alcoholic beverages, tobacco and narcotics | Clothing and footwear | ... | Personal care, social protection and miscellaneous goods and services | Total |
| Products | Agriculture<br>:<br>Other services | | | | | | |
| | Total | | | | | | |

Final consumption expenditure by NPISH (COPNI)

| | | COPNI | | | | | |
|---|---|---|---|---|---|---|---|
| | | Housing | Health | Recreation and culture | ... | Services n.e.c. | Total |
| Products | Agriculture<br>:<br>Other services | | | | | | |
| | Total | | | | | | |

Final consumption expenditure by government (COFOG)

| | | COFOG | | | | | |
|---|---|---|---|---|---|---|---|
| | | General public services | Defence | Public order and safety | ... | Social protection | Total |
| Products | Agriculture<br>:<br>Other services | | | | | | |
| | Total | | | | | | |

## 5. Statistical units

2.96. In general, the same statistical unit is the basis for compiling the use table and for compiling the supply table. Different choices of statistical units are available for the compiler and it is important to have a clear understanding of the impact of the choice of different statistical units has on the SUTs and on the IOTs.

2.97. Different types of statistical units may be defined (for example, enterprise group, local unit, kind-of-activity unit, and others). For SUTs, however, the focus is on two specific statistical units: enterprises and establishments (local kind-of-activity units).

2.98. An enterprise is defined as the view of an institutional unit as a producer of goods and services (where institutional units are economic entities that have autonomy of decision making and have clear links with the legal units). An establishment is an enterprise or part of an enterprise that is situated in a single location and in which only a single productive activity is carried out or in which the principal productive activity accounts for most of the value added.

2.99. The impact of globalization and the way in which multi-national businesses control and operate their activities pose a number of challenges, including the basis of the statistical unit for measurement of national activity versus global activity. Following the recommendations of the 2008 SNA, however, the establishment is the unit that is more suitable for the analysis of production in which the technology of production plays an important role. The establishment is therefore the recommended unit for the compilation of the production part of the national accounts and therefore the compilation of SUTs. This means, as a rule, that multi-product enterprises must be partitioned into smaller and more uniform units with regard to their kind of production, if possible.

2.100. Trying to collect data on sub-establishment production processes as part of the input-output compilation is an approach that has no natural limitation and that will, apart from the costs, almost invariably become skewed by the specific knowledge and insight that the compilers happen to possess and lead to non-transparent and uneven compilation processes.

2.101. In practice, the extent of partitioning enterprises into establishments varies across countries, depending on whether the creation of establishments is based on a relatively modest breakdown of institutional units or whether, alternatively, the starting point is a register of all local producer units. The latter case follows the formal definitions set out in the 2008 SNA and would lead to a purer activity classification than the former. Recommendations for partitioning vertical and horizontal integrated enterprises are briefly outlined in Box 2.7.

**Box 2.7 SNA recommendations on partitioning of vertically and horizontally integrated enterprises**

A **horizontally integrated enterprise** is one in which several different kinds of activities that produce different kinds of goods or services for sale on the market are carried out simultaneously, using the same factors of production (2008 SNA, para. 5.21).

Horizontal integration occurs when an activity results in end products with different characteristics. This could theoretically be interpreted as activities carried out simultaneously using the same factors of production. In this case, it will not be possible to separate them statistically into different processes, assign them to different units or generally provide separate data for these activities. Another example would be the production of electricity through a waste-incineration process. The activity of waste disposal and the activity of electricity production cannot be separated in this case.

Within the SNA, a separate establishment should be identified for each different kind of activity wherever possible (2008 SNA, para. 5.22).

A **vertically integrated enterprise** is one in which different stages of production, which are usually carried out by different enterprises, are carried out in succession by different parts of the same enterprise (2008 SNA, para. 5.23). Vertical integration of activities occurs wherever the different stages of production are carried out in succession by the same unit and the output of one process serves as the input to the next process. Examples of common vertical integration include tree-felling and subsequent on-site sawmilling, mining of metal ores and manufacture of basic iron and steel, operation of a clay pit combined with a brickworks or production of synthetic fibres in a textile mill.

While the procedure for the treatment of vertically integrated activities could be applied to any unit, it should be noted that the SNA recommends that, when a vertically integrated enterprise spans two or more sections of ISIC, at least one establishment must be distinguished within each section. With such a treatment, activities of units engaged in vertically integrated activities will not cross section boundaries of ISIC (2008 SNA, para. 5.26). If this approach has not already been followed in basic statistics, the compilers of SUTs will exceptionally have to deal with individual producer units.

## 6. Valuation in the SUTs

2.102. More than one set of prices may be used to value outputs and inputs depending on how taxes and subsidies on products, and also transport charges and trade margins, are recorded. The 2008 SNA distinguishes three main valuation concepts of the flows of goods and services: basic prices, producers' prices and purchasers' prices.

2.103. The valuation of the data for the use table (for example, intermediate and final consumption) is different from the valuation of the data for the production side of the supply table. In fact, the valuation of use table is based on the actual price paid by the users for the goods and services (i.e., purchasers' price) while the valuation of the production data in the supply table is based on output at basic prices – this in line with the 2008 SNA.

2.104. In order to balance the SUTs, the same valuation should be used. For this purpose, specific matrices have to be compiled for trade and transport margins and taxes and subsidies on products. The compilation of these valuation matrices is an important component of the compilation of SUTs and IOTs. Chapter 7 provides a detailed description of the compilation steps for the valuation matrices and the compilation issues.

2.105. An overview of the three different valuations – basic prices, producers' prices and purchasers' prices – is provided below. They differ as a result of the treatment of taxes on products less subsidies on products, and trade and transport margins.

### (a) Basic prices

2.106. Basic prices are the preferred method in the 2008 SNA for valuing output in the accounts. This price basis reflects the amount receivable by the producer from the purchaser for a unit of goods or services, minus any taxes payable, and plus any subsidy receivable on that unit as a consequence of production or sale (for instance, the cost of production).

2.107. The value of output at basic prices reflects the sum of intermediate consumption of goods and services at purchasers' prices, compensation of employees, return to capital for market producers' own capital formation, and other taxes less subsidies on production. Other taxes on production include items such as property taxes and business rates, business licences, motor vehicle licenses, mission permits issued by governments under cap-and-trade schemes, and others. Basic prices exclude any transport charges invoiced separately by the producer. When a valuation at basic prices is definitely not feasible, then a proxy as close as possible to basic prices should be used.

2.108. The basic price valuation is the preferred valuation for the construction of IOTs which in turn are used in constructing structural models of the economy or modelling particular features of economic behaviour. When compiling the IOTs, it is therefore necessary also to value the purchases by products at basic prices, a process which is further explained in chapter 7.

### (b) Producers' prices

2.109. Producers' prices may be thought of as the prices of goods and services "at the factory gate", so to speak. This valuation includes all taxes on production and taxes on products, for example excise duties. Producers' prices relate to basic prices as follow:

| | | |
|---|---|---|
| Producers' prices | *equals* | basic prices |
| | *plus* | taxes on products (excluding invoiced VAT) |
| | *less* | subsidies on products. |

2.110. Although the producers' price valuation is valid and noted in the 2008 SNA, it not recommended for use in the 2008 SNA. At the same time, this valuation still forms the basis for some business survey data. Accordingly, if relevant, specific steps are needed to change data based on business survey to basic prices, as appropriate, for use in national accounts and SUTs.

### (c) Purchasers' prices

2.111. Purchasers' prices are those prices payable by the purchaser and include transport costs, trade margins and taxes (unless the taxes are deductible by the purchaser). Purchasers' prices are defined as follows:

Purchasers' prices *equals* producers' prices
*plus* any non-deductible VAT or similar tax payable by the purchaser
*plus* transport costs paid separately by the purchaser and not included in the producers' price.
*plus* trade margins.

2.112. Where taxes and subsidies on products and other taxes and subsidies on production are concerned, some short definitions are provided below:

- Taxes on products include, in particular, value added taxes, taxes and duties on imports, and taxes on products such as stamp taxes on the sale of petrol, diesel, alcoholic beverages and tobacco.

- Subsidies on products include import subsidies and other subsidies on products.

- Other taxes on production consist of all taxes that enterprises incur as a result of engaging in production, independently of the quantity or value of the goods and services produced or sold. These may be payable on the land, fixed assets, business and property rates or labour employed in the production process or on certain activities or transactions.

- Other subsidies on production consist of subsidies which resident producer units may receive as a consequence of engaging in production, including in particular subsidies on payroll or work force, subsidies to reduce pollution and grants for interest relief.

2.113. In the use table, transactions are recorded at purchasers' prices. In the supply table, domestic production is recorded at basic prices and imports by type of product at cost, insurance and freight (CIF) prices. In the SNA and the balance of payments, total imports of goods are valued at free on board (FOB) prices. Further details on these connections and the adjustments required may be found in chapter 5, section D. Accordingly, additional columns are included in the supply table in order to complete the valuation gap between total use and total supply of products. These include information on trade and transport margins, taxes on products and subsidies on products.

### (d) Value added tax

2.114. VAT is a wide-ranging tax usually designed to cover most or all goods and services. In some countries, VAT may replace most other forms of taxes on products but it may also be levied in addition to certain other taxes on products, such as excise duties on tobacco, alcoholic beverages or fuel oils. VAT is a tax on products collected in stages by enterprises. Producers are required to charge certain percentage rates of VAT on the goods or services that they sell. VAT is shown separately on the sellers' invoices so that purchasers know the amounts that they have paid. Producers are generally not required, however, to remit to the government the full amounts of the VAT invoiced to their customers because they are permitted to deduct the VAT that they themselves have paid on goods and services purchased for their own intermediate consumption, resale or gross fixed capital formation.

2.115. Deductible VAT is the VAT payable on purchases of goods or services intended for intermediate consumption, gross fixed capital formation or for resale that producers are permitted to deduct from their own VAT liability to the government in respect of VAT invoiced to their customers. Non-deductible VAT is VAT payable by purchasers that is not deductible from their own VAT liability, if any.

2.116. The SNA requires that the net system of recording VAT should be followed. In the net system, outputs of goods and services are valued excluding invoiced VAT; imports are similarly valued excluding invoiced VAT; and purchases of goods and services are recorded including non-deductible VAT.

### (e) Valuation in SUTs and IOTs

2.117. Box 2.8 presents an overview of the valuation in the compilation of SUTs and IOTs in a simplified numerical example. this overview underlines the different valuation layers: the supply table at basic prices including the transformation into purchasers' prices is considered with the use table at purchasers' prices (total supply equals total use). In a second step, valuation matrices are compiled – one for the trade and transport margins and the other for the taxes less subsidies on products – in order to transform the use table from purchasers' prices to basic prices. In this way, the supply table at basic price can be considered in relation to the use table at basic prices (total supply at basic prices equals total use at basic prices). The use table at basic prices is further split between the domestic use table and imports use table at basic prices. The SUTs at basic prices are the starting point for the compilation of IOTs, which are compiled at basic prices.

## Box 2.8 Overview of the valuation in SUTs and IOTs

**BALANCED SUPPLY AND USE SYSTEM**

Supply table at basic prices including a transformation into purchasers' prices

| Products | Industries | | | Output at basic prices | Imports | Supply at basic prices | Trade and transport margins | Taxes *less* subsidies on | Total supply at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|
| | Agricul-ture | Manuf. and constr. | Services | | | | | | |
| Agriculture | 270 | 30 | 50 | 350 | 20 | 370 | 28 | 20 | 418 |
| Manufacturing | 6 | 380 | 87 | 473 | 42 | 515 | 80 | 21 | 616 |
| Construction | 4 | 50 | 13 | 67 | 8 | 75 | 22 | 4 | 101 |
| Trade, transport and communication | 10 | 15 | 210 | 235 | 7 | 242 | - 130 | 13 | 125 |
| Finance and business services | 6 | 17 | 240 | 263 | 11 | 274 | | 15 | 289 |
| Other services | 4 | 8 | 100 | 112 | 12 | 124 | | 7 | 131 |
| Total | 300 | 500 | 700 | 1 500 | 100 | 1 600 | | 80 | 1 680 |

Use table at purchasers' prices

| Products | Industries | | | Final use | | | Total use at purchasers' prices |
|---|---|---|---|---|---|---|---|
| | Agricul-ture | Manuf. and constr. | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Agriculture | 38 | 65 | 103 | 155 | 24 | 33 | 418 |
| Manufacturing | 115 | 123 | 64 | 167 | 85 | 62 | 616 |
| Construction | 12 | 16 | 6 | 24 | 39 | 4 | 101 |
| Trade, transport and communication | 21 | 2 | 2 | 98 | 1 | 1 | 125 |
| Finance and business services | 14 | 54 | 43 | 128 | 32 | 18 | 289 |
| Other services | 14 | 35 | 23 | 41 | 10 | 8 | 131 |
| GVA | 86 | 205 | 459 | | | | 750 |
| Output at basic prices | 300 | 500 | 700 | 613 | 191 | 126 | |

**COMPILATION OF VALUATION TABLES**

Trade and transport margins

| Products | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|
| | Agricul-ture | Manuf. and constr. | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Agriculture | 3 | 5 | 4 | 13 | 2 | 1 | 28 |
| Manufacturing | 16 | 14 | 5 | 33 | 10 | 2 | 80 |
| Construction | 3 | 4 | 1 | 5 | 8 | 1 | 22 |
| Trade, transport and communication | - 22 | - 23 | - 10 | - 51 | - 20 | - 4 | - 130 |
| Finance and business services | | | | | | | |
| Other services | | | | | | | |
| Total | | | | | | | |

Taxes less subsidies on products

| Products | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|
| | Agricul-ture | Manuf. and constr. | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Agriculture | 1 | 1 | 6 | 11 | 1 | | 20 |
| Manufacturing | 2 | 2 | 2 | 12 | 2 | 1 | 21 |
| Construction | | | 1 | 2 | 1 | | 4 |
| Trade, transport and communication | 1 | 1 | 1 | 9 | 1 | | 13 |
| Finance and business services | | 1 | 1 | 12 | 1 | | 15 |
| Other services | | | 1 | 6 | | | 7 |
| Total | 4 | 5 | 12 | 52 | 6 | 1 | 80 |

**TRANSFORMATION OF SUPPLY AND USE TABLES TO BASIC PRICES**

Supply table at basic prices

| Products | Industries | | | Output at basic prices | Imports | Supply at basic prices |
|---|---|---|---|---|---|---|
| | Agricul-ture | Manuf. and constr. | Services | | | |
| Agriculture | 270 | 30 | 50 | 350 | 20 | 370 |
| Manufacturing | 6 | 380 | 87 | 473 | 42 | 515 |
| Construction | 4 | 50 | 13 | 67 | 8 | 75 |
| Trade, transport and communication | 10 | 15 | 210 | 235 | 7 | 242 |
| Finance and business services | 6 | 17 | 240 | 263 | 11 | 274 |
| Other services | 4 | 8 | 100 | 112 | 12 | 124 |
| Total | 300 | 500 | 700 | 1 500 | 100 | 1 600 |

Use table at basic prices

| Products | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|
| | Agricul-ture | Manuf. and constr. | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Agriculture | 34 | 59 | 93 | 131 | 21 | 32 | 370 |
| Manufacturing | 97 | 107 | 57 | 122 | 73 | 59 | 515 |
| Construction | 9 | 12 | 4 | 17 | 30 | 3 | 75 |
| Trade, transport and communication | 42 | 24 | 11 | 140 | 20 | 5 | 242 |
| Finance and business services | 14 | 53 | 42 | 116 | 31 | 18 | 274 |
| Other services | 14 | 35 | 22 | 35 | 10 | 8 | 124 |
| Taxes less subsidies on products | 4 | 5 | 12 | 52 | 6 | 1 | 80 |
| GVA | 86 | 205 | 459 | | | | 750 |
| Total | 300 | 500 | 700 | 613 | 191 | 126 | |

**COMPILATION OF SEPARATE USE TABLES FOR DOMESTIC OUTPUT AND IMPORTS**

Imports use table at basic prices

| Products | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|
| | Agricul-ture | Manuf. and constr. | Services | Final cons. exp. | Gross capital form. | Exports | |
| Agriculture | 4 | 9 | 3 | 1 | 1 | 2 | 20 |
| Manufacturing | 12 | 17 | 6 | 2 | 3 | 2 | 42 |
| Construction | 4 | 2 | 1 | 1 | | | 8 |
| Trade, transport and communication | 2 | 4 | 1 | | | | 7 |
| Finance and business services | 4 | 3 | 2 | 1 | 1 | | 11 |
| Other services | 4 | 5 | 2 | | | 1 | 12 |
| Total | 30 | 40 | 15 | 5 | 5 | 5 | 100 |

Domestic use table for domestic output at basic prices

| Products | Industries | | | Final use | | | Total use at basic prices |
|---|---|---|---|---|---|---|---|
| | Agricul-ture | Manuf. and constr. | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Agriculture | 30 | 50 | 90 | 130 | 20 | 30 | 350 |
| Manufacturing | 85 | 90 | 51 | 120 | 70 | 57 | 473 |
| Construction | 5 | 10 | 3 | 16 | 30 | 3 | 67 |
| Trade, transport and communication | 40 | 20 | 10 | 140 | 20 | 5 | 235 |
| Finance and business services | 10 | 50 | 40 | 115 | 30 | 18 | 263 |
| Other services | 10 | 30 | 20 | 35 | 10 | 7 | 112 |
| Imports | 30 | 40 | 15 | 5 | 5 | 5 | 100 |
| Taxes less subsidies on products | 4 | 5 | 12 | 52 | 6 | 1 | 80 |
| GVA | 86 | 205 | 459 | | | | 750 |
| Total | 300 | 500 | 700 | 613 | 191 | 126 | |

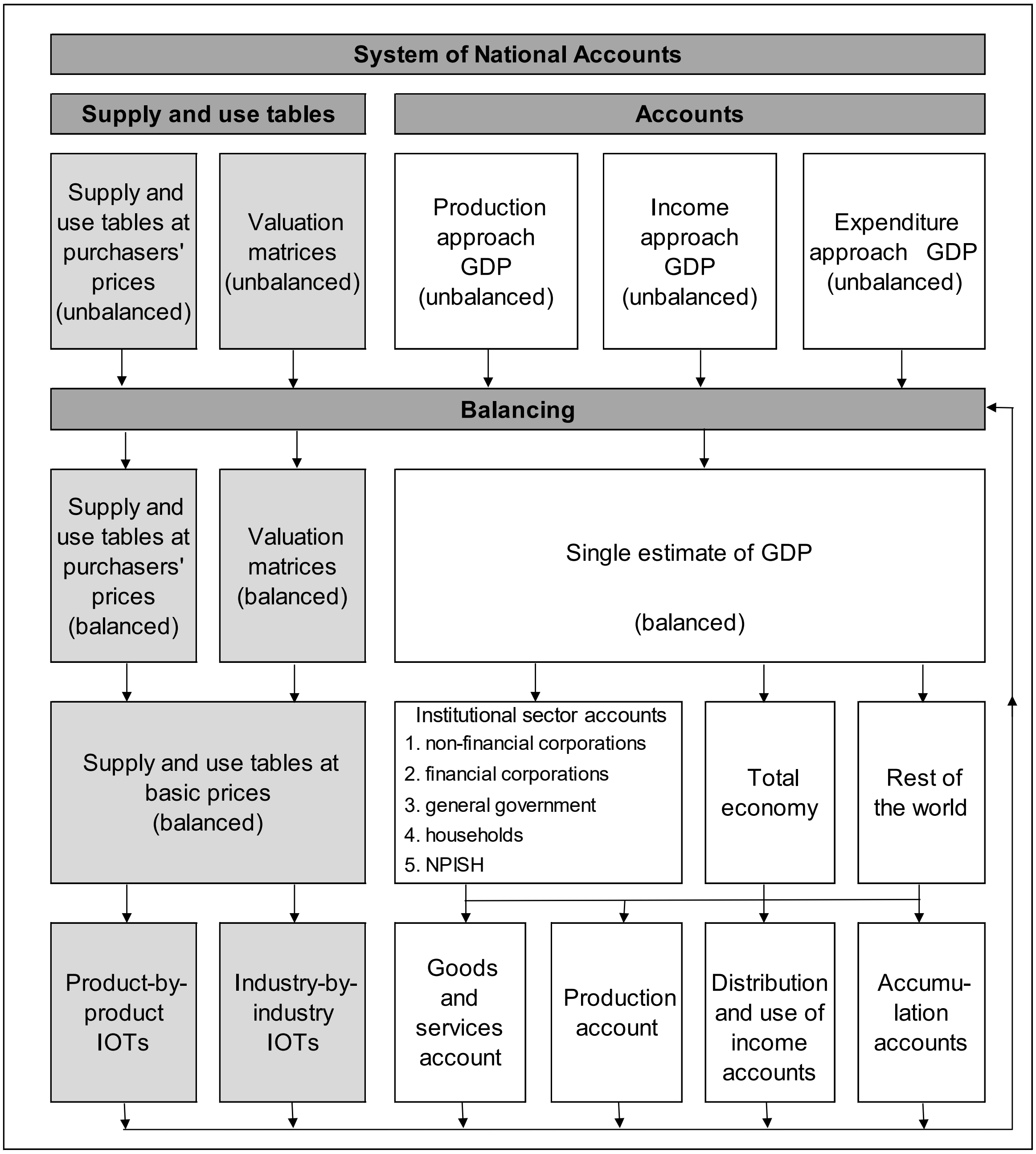
Empty cells by definition

## E. Compiling SUTs as an integral part of the national accounts

2.118. As mentioned before, the compilation of SUTs should be seen as an integral part of the compilation of the national accounts. Figure 2.4 provides a general overview of how the compilation of SUTs and IOTs fits within the compilation of national accounts conforming to the same statistical standards (for example, 2008 SNA, BPM 6, 2012 SEEA, IMF Government Finance Statistics, and others), and using the same basic sources generally used for the compilation of national accounts.

2.119. One important feature of the approach outlined in Figure 2.4 is the level at which the traditional annual and quarterly balancing process of the national accounts and balance of payments system takes place. Balanced macroeconomic data can be derived at a more aggregated level by applying the production, income and expenditure approaches. A recommended, better quality option is that the system be balanced at the same time for the institutional sector accounts and the SUTs at a lower-level disaggregation of products and industries. In many countries, the annual and quarterly estimates of GDP are obtained from the production, income and expenditure approaches and reconciled using SUTs. Some countries have a long tradition and much experience in using detailed production data based on establishments (local kind-of-activity units) as the statistical unit for compiling GDP estimates following the production approach.

**Figure 2.4 Overview of SUTs and IOTs as part of the SNA compilation**




## 1. Different approaches to measuring GDP

2.120. The three approaches to measuring GDP form the basis of estimating GDP both quarterly and annually. The use of three different methods which, as far as possible, use independent sources of information avoids sole reliance on one source and is conducive to greater confidence in the overall estimation process. This in turn also underpins not only the quality of the key aggregates but also of the underlying details. The SUTs combine the three approaches in a consistent manner.

### (a) Production approach

2.121. The production approach looks at the contribution of each economic unit by estimating the value of their output less the value of goods and services used up in the production process to produce their output, this is also known as GVA. Using the production approach:

| | | |
|---|---|---|
| GVA at basic prices | *equals* | output at basic prices |
| | *less* | intermediate consumption at purchasers' prices |

and then,

| | | |
|---|---|---|
| GDP | *equals* | GVA at basic prices |
| | *plus* | taxes on products |
| | *less* | subsidies on products |

GDP is also the balancing item of the production account for the whole economy.

2.122. The distinction between market and non-market producers (see 2008 SNA, para. 6.133, for the definitions) is important for the determinants of both total output and gross value added which is covered in this section. While the output of market producers is determined from the revenue side, the output of non-market producers is calculated as the costs of all inputs including labour cost and consumption of fixed capital. Box 2.9 provides an overview of the calculation of output for market and non-market producers.

2.123. The estimate of output for producing units in the non-market sector is derived by summing their costs, for example, intermediate consumption, compensation of employees, other taxes (less subsidies) on production and consumption of fixed capital. GVA is the sum of compensation of employees, other taxes (less subsidies) on production and consumption of fixed capital.

2.124. The production approach to measuring GDP, and the estimates of GVA, can be implemented by using an industry dimension or by an institutional sector dimension. GVA is the variable used when producing labour productivity estimates and also output per worker uses GVA as the output measure.

**Box 2.9 Calculation of output for market and non-market producers**

**Market producers and producers for own final use**

| | | |
|---|---|---|
| Total output (at basic prices) | *equals* | total sales of goods and services (as invoiced, excluding VAT) |
| | *plus* | changes in inventories of work-in-progress and finished goods |
| | *plus* | output produced for own use, for example research and development (R&D), computer software and construction (also known as own account capital formation) and household production of agriculture products for own use |
| | *less* | purchases of goods or services for resale without further processing (thereby only including the gross margin within output) |
| | *plus* | income earned in kind |
| | *less* | any taxes on products |
| | *plus* | any subsidies on products |

| | | |
|---|---|---|
| Total intermediate consumption (at purchasers' prices) | *equals* | total purchases of goods and services for use as inputs to the production process (excluding employment costs and fixed capital formation) |
| | *less* | changes in inventories of materials and fuels |
| | *less* | any purchased or bought-in R&D, computer software (treated as capital expenditure, assuming this is included in the purchases in the first place) |
| | *plus* | Financial intermediation services indirectly measured (FISIM) |
| | *plus* | any imputed insurance premium supplements |
| | *less* | any payments to employees such as income earned-in-kind |
| Gross value added (at basic prices) | *equals* | total output (at basic prices) |
| | *less* | total intermediate consumption (at purchasers' prices) |
| **Non-market producers** | | |
| Total output (at basic prices) | *equals* | total intermediate consumption (at purchasers' prices) |
| | *plus* | compensation of employees (labour costs) |
| | *plus* | imputed charge for consumption of fixed capital (sometimes called depreciation) |
| | *plus* | other taxes on production and imports |
| | *less* | other subsidies on production |
| Gross value added (at basic prices) | *equals* | compensation of employees (labour costs) |
| | *plus* | imputed charge for consumption of fixed capital (depreciation) |
| | *plus* | other taxes on production and imports |
| | *less* | other subsidies on production |
| Final consumption expenditure (at purchasers' prices) | *equals* | total intermediate consumption at purchasers' prices |
| | *plus* | gross value added at basic prices |
| | *equals* | total output at basic prices |
| | *less* | market output |
| | *less* | payment for non-market output |
| | *less* | output produced for own final use |
| | *equals* | non-market output |

### (b) Income approach

2.125. Using the income approach, GDP is obtained by adding together the income components that make up value added. GDP by income approach covers only the income generated within the domestic economy:

| | | |
|---|---|---|
| GDP | *equals* | compensation of employees |
| | p*lus* | gross operating surplus and gross mixed income |
| | *plus* | other taxes less subsidies on production |
| | *plus* | taxes on products and imports. |
| | *less* | subsidies on products |

The above income approach provides estimates of GDP market prices.

2.126. As its name suggests, the income approach adds up all income earned by resident individuals or corporations in the production of goods and services and is therefore the sum of uses in the generation of income account for the total economy (or alternatively the sum of primary incomes distributed by resident producer units).

2.127. The income approach to measuring GDP can be analysed either by industry, by institutional sector or by type of factor income. The type of factor income approach is often linked to the source data and allows for the incorporation of various administrative data sources. These include, for example, generating direct estimates of mixed income (using labour force data and administrative data) and gross trading profit and loss (using company accounts data) as complementary estimates and not as residuals.

2.128. Based on factor incomes, to estimate gross operating surplus the following categories are added:

- Self-employment income (mixed income and quasi-corporations)
- Gross trading profits of private financial corporations
- Gross trading profits of private non-financial corporations
- Gross trading surplus of public corporations (financial and non-financial)
- Rental income
- Non-market consumption of fixed capital

and the following categories are deducted:

- Holding gains and losses on inventories
- Intermediate consumption of financial intermediation services indirectly measured (referred to as FISIM)

2.129. Producing all three dimensions in a single, integrated SUTs framework provides a natural link between the production account and generation of income account, both by industry and by institutional sector. This approach also ensures a high degree of consistency and coherency across the accounts.

2.130. It should be noted that the income approach to measuring GDP cannot be used to calculate chained linked volume measures directly because it is not possible to separate income components into prices and quantities in the same way as for goods and services. However, a chained linked volume measure of the income based total can be obtained indirectly. The expenditure based GDP deflator at market prices (also known as the index of total home costs) can be used to deflate the current market price income based total estimate to provide a chained linked volume measure of the total income component of GDP for balancing purposes.

### (c) Expenditure approach

2.131. In the expenditure approach, GDP is obtained by adding the final expenditures or uses by consumers and producers of goods and services produced within the domestic economy. The total is obtained from the sum of final consumption expenditure on goods and services by households, NPISHs and government, gross capital formation (gross fixed capital formation on tangible and intangible fixed assets, changes in inventories and acquisitions less disposals of valuables) and net exports of goods and services.

2.132. Using the expenditure approach:

| | | |
|---|---|---|
| GDP | *equals* | Final consumption expenditure (households, NPISHs and government) |
| | *plus* | gross fixed capital formation |
| | *plus* | change in inventories |
| | *plus* | acquisitions less disposals of valuables |
| | *plus* | exports |
| | *less* | imports |

2.133. The data for these categories are estimated from a wide variety of sources, including business surveys, expenditure surveys, the government's internal accounting system, surveys of traders and the administrative documents used in importing and exporting goods.

2.134. To avoid double counting in this approach, it is important to classify consumption expenditures as either final or intermediate. Final consumption expenditure involves the consumption of goods purchased by or for the ultimate consumer or user. These expenditures are final because the goods are no longer part of the economic flow or being traded in the market place. Intermediate consumption, on the other hand, is consumption of goods and services that are used or consumed in the production process. Gross capital formation is treated separately from intermediate consumption as the goods (or services) involved are not used up within the production process in an accounting period, except for depreciating over time.

2.135. Exports include all sales to non-residents, and exports of both goods and services have to be regarded as final consumption expenditure, since they are final as far as the domestic economy is concerned. Imports of goods and services are deducted because they are not part of the production of the domestic economy but produced in another economy.

2.136. The expenditure approach to measuring GDP is also used to estimate chain-linked volume measures of GDP. The chained-linked volume measure shows the change in GDP after the effects of inflation have been removed.

2.137. Box 2.10 shows a numerical example of how a single estimate of GDP can be derived from a balanced SUTs system by extracting the components of the production, income and expenditure approaches to measuring GDP from the supply table and use table.

# Box 2.10 Example of derivation of GDP from balanced SUTs

**Supply table at basic prices, including a transformation into purchasers' prices**

Millions of euros

| | | | INDUSTRIES | | | | | | | | | VALUATION | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Imports | Total supply at basic prices | Wholesale trade margins | Retail trade margins | Transport margins | Taxes on products | Subsidies on products | Total | Total supply at purchasers' prices |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (15) |
| Products | Agriculture | (1) | 8 782 | | | | | | 8 782 | 3 271 | 12 052 | 1 052 | 873 | 274 | 386 | - 107 | 2 479 | 14 532 |
| Products | Manufacturing | (2) | 796 | 182 982 | 643 | 1 808 | 133 | 44 | 186 405 | 124 590 | 310 995 | 29 777 | 19 061 | 2 540 | 21 041 | - 49 | 72 370 | 383 364 |
| Products | Construction | (3) | 83 | 961 | 43 060 | 734 | 255 | 179 | 45 272 | 563 | 45 835 | | | | 1 542 | | 1 542 | 47 377 |
| Products | Trade | (4) | 1 | 4 773 | 311 | 54 204 | 640 | 257 | 60 187 | 600 | 60 787 | - 31 301 | - 21 040 | | 586 | | - 51 755 | 9 032 |
| Products | Transport | (5) | 13 | 465 | 66 | 25 538 | 128 | 125 | 26 335 | 8 150 | 34 485 | | | - 2 800 | 628 | - 448 | - 2 620 | 31 865 |
| Products | Communication | (6) | 160 | 1 781 | 139 | 43 912 | 1 253 | 982 | 48 228 | 6 234 | 54 463 | 472 | 1 021 | 9 | 3 592 | - 34 | 5 059 | 59 522 |
| Products | Finance and business services | (7) | 29 | 8 902 | 698 | 7 588 | 106 909 | 3 381 | 127 508 | 7 061 | 134 569 | | | - 22 | 4 865 | | 4 842 | 139 411 |
| Products | Other services | (8) | 3 | 85 | 13 | 1 053 | 143 | 74 346 | 75 643 | 824 | 76 467 | | 85 | | 1 777 | | 1 861 | 78 329 |
| | Total | (9) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | 151 293 | 729 653 | 0 | 0 | 0 | 34 416 | - 638 | 33 778 | 763 431 |
| Adjustments | CIF/FOB adjustments on imports | (10) | | | | | | | | - 97 | - 97 | | | | | | | - 97 |
| Adjustments | Direct purchases abroad by residents | (11) | | | | | | | | 6 675 | 6 675 | | | | | | | 6 675 |
| | Total | (12) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | 157 871 | 736 230 | | | | 34 416 | - 638 | 33 778 | 770 009 |
| | Total of which: | | | | | | | | | | | | | | | | | |
| | Market output | (13) | 9 763 | 195 916 | 41 462 | 127 401 | 88 330 | 18 116 | 480 989 | | 480 989 | | | | | | | 480 989 |
| | Output for own final use | (14) | 104 | 4 029 | 3 468 | 2 134 | 19 890 | 2 670 | 32 295 | | 32 295 | | | | | | | 32 295 |
| | Non-market output | (15) | 0 | 4 | 0 | 5 302 | 1 241 | 58 528 | 65 075 | | 65 075 | | | | | | | 65 075 |

**Use table at purchasers' prices**

Millions of euros

| | | | INDUSTRIES | | | | | | | FINAL USE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Final consumption expenditure | | | Gross fixed capital formation | Changes in valuables | Changes in inventorie | Exports | Total | Total use at purchasers' prices |
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Households | NPISH | General government | | | | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| Products | Agriculture | (1) | 2 583 | 6 570 | 16 | 371 | 34 | 49 | 9 623 | 3 595 | | | 180 | | - 27 | 1 161 | 4 909 | 14 532 |
| Products | Manufacturing | (2) | 2 205 | 107 190 | 12 441 | 16 874 | 6 015 | 8 797 | 153 522 | 71 438 | | 3 180 | 26 756 | 2 183 | 3 034 | 123 252 | 229 842 | 383 364 |
| Products | Construction | (3) | 105 | 2 440 | 9 528 | 2 446 | 3 907 | 1 604 | 20 029 | 1 667 | | | 25 155 | | - 38 | 563 | 27 348 | 47 377 |
| Products | Trade | (4) | 33 | 1 883 | 119 | 2 240 | 259 | 308 | 4 842 | 3 325 | | | 67 | 45 | | 753 | 4 189 | 9 032 |
| Products | Transport | (5) | 14 | 4 386 | 267 | 8 399 | 822 | 321 | 14 208 | 5 833 | | 3 370 | | | | 8 453 | 17 656 | 31 865 |
| Products | Communication | (6) | 34 | 2 563 | 299 | 9 359 | 5 919 | 1 833 | 20 008 | 26 444 | | 121 | 5 976 | | 67 | 6 905 | 39 514 | 59 522 |
| Products | Finance and business services | (7) | 457 | 13 578 | 4 736 | 20 359 | 29 166 | 9 134 | 77 430 | 38 838 | | 1 006 | 11 170 | | - 178 | 11 145 | 61 981 | 139 411 |
| Products | Other services | (8) | 8 | 382 | 59 | 1 171 | 415 | 1 794 | 3 829 | 14 923 | 5 416 | 53 373 | 113 | 107 | 1 | 567 | 74 500 | 78 329 |
| | Total at purchasers' prices | (9) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 152 800 | 459 939 | 763 431 |
| Adjustments | CIF/FOB adjustments on exports | (10) | | | | | | | | | | | | | | - 97 | - 97 | - 97 |
| Adjustments | Direct purchases abroad by residents | (11) | | | | | | | | 6 675 | | | | | | | 6 675 | 6 675 |
| Adjustments | Purchases on the domestic territory by non-residents | (12) | | | | | | | | - 12 945 | | | | | | 12 945 | | |
| | Total at purchasers' prices | (13) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 159 792 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 165 648 | 466 517 | 770 009 |
| VALUE ADDED | Compensation of employees | (14) | 551 | 30 679 | 10 239 | 37 906 | 22 997 | 41 971 | 144 343 | | | | | | | | | |
| VALUE ADDED | Other taxes less subsidies on production | (15) | - 1 627 | 1 077 | 546 | 1 755 | 2 004 | 1 103 | 4 858 | | | | | | | | | |
| VALUE ADDED | Consumption of fixed capital | (16) | 1 845 | 12 750 | 1 542 | 10 917 | 18 934 | 7 480 | 53 469 | | | | | | | | | |
| VALUE ADDED | Net operating surplus | (17) | 3 658 | 16 453 | 5 138 | 23 040 | 18 989 | 4 921 | 72 198 | | | | | | | | | |
| VALUE ADDED | Gross operating surplus | (18) | 5 503 | 29 203 | 6 680 | 33 957 | 37 923 | 12 401 | 125 667 | | | | | | | | | |
| VALUE ADDED | GVA | (19) | 4 427 | 60 959 | 17 465 | 73 618 | 62 923 | 55 475 | 274 868 | | | | | | | | | |
| | Total input at basic prices | (20) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | | | | | | | | | |

Table based on 2011 figures from Austria

The box below shows how a single estimate of GDP at market prices can be derived from the above balanced SUTs system by extracting the components of the production, income and expenditure approaches to measuring GDP from either the supply table or the use table.

**Calculation of gross domestic product**

Millions of euros

| Production approach | | Income approach | | Expenditure approach | |
|---|---|---|---|---|---|
| Total output at basic prices | 578 360 | Compensation of employees | 144 343 | Final consumption expenditure by Households | 159 792 |
| - Intermediate consumption at purchasers' prices | - 303 492 | + Other taxes less subsidies on productio | 4 858 | + Final consumption expenditure by NPISH | 5 416 |
| | | + Consumption of fixed capital | 53 469 | + Final consumption expenditure by General government | 61 050 |
| | | + Net operating surplus | 72 198 | + Gross fixed capital formation | 69 418 |
| = GVA | 274 868 | = GVA | 274 868 | + Changes in valuables | 2 335 |
| | | | | + Changes in inventories | 2 859 |
| + Taxes less subsidies on products | 33 778 | + Taxes less subsidies on products | 33 778 | + Exports | 165 648 |
| | | | | - Imports | - 157 871 |
| = GDP | 308 647 | = GDP | 308 647 | = GDP | 308 647 |

Table based on 2011 figures from Austria

## 2. Linking SUTs to the institutional sector accounts

2.138. It is important to link the SUTs to the institutional sector accounts in order to have a complete, consistent and integrated set of accounts, as highlighted in Figure 1.1. The SNA uses two types of units and two ways to subdivide the economy. Both are quite different and serve different analytical purposes. In order to describe production, income, expenditure and financial flows, and balance sheets, the SNA uses institutional units which, on the basis of their principal functions, behaviour and objectives, are grouped into institutional sectors like non-financial corporations and financial corporations. For the institutional units, the full set of accounts is covered in the system.

2.139. A simplified version of a table covering the main institutional sectors is shown in Table 2.8. Further details may be found in chapter 10, on linking the institutional sector accounts to the SUTs.

**Table 2.8 Simplified table linking the SUTs to the institutional sector accounts**

| INSTITUTIONAL SECTORS | INDUSTRIES | | | | Total |
|---|---|---|---|---|---|
| | 1 | 2 | … | n | |
| **1. Non-financial corporations** | | | | | |
| Total output | | | | | |
| Market output | | | | | |
| Output for own final use | | | | | |
| Non-market output | | | | | |
| Intermediate consumption | | | | | |
| GVA at basic prices | | | | | |
| Compensation of employees | | | | | |
| Other net taxes on production and imports | | | | | |
| Consumption of fixed capital | | | | | |
| Operating surplus, net | | | | | |
| Gross fixed capital formation | | | | | |
| **2. Financial corporations** | | | | | |
| Total output | | | | | |
| : | | | | | |
| Gross fixed capital formation | | | | | |
| **3. General government** | | | | | |
| Total output | | | | | |
| : | | | | | |
| Gross fixed capital formation | | | | | |
| **4. Households** | | | | | |
| Total output | | | | | |
| : | | | | | |
| Gross fixed capital formation | | | | | |
| **5. Non-profit institutions serving households** | | | | | |
| Total output | | | | | |
| : | | | | | |
| Gross fixed capital formation | | | | | |
| **6. Total** | | | | | |
| Total output | | | | | |
| : | | | | | |
| Gross fixed capital formation | | | | | |

2.140. When describing the processes of production (and input-output analyses), the system uses the establishment as the statistical unit and groups it into industries on the basis of its principal activity. For the establishment, only a limited set of accounts is feasible, namely those accounts of the SUTs framework.

2.141. In order to show the relationships between the accounts of the production processes and the accounts of the institutional units, a link table can be compiled as an integrated part of the system. In this link table, a cross-classification of output, intermediate consumption, components of GVA (and possible other variables of industries) between the industries and the institutional sectors is shown. This link table should help to ensure consistency of data compiled on the basis of establishment and on the basis of institutional units. As both units are classified differently, the link table also provides a picture of the relationships between output, intermediate consumption, GVA, and other variables, originating in the different industries and institutional sectors.

### 3. Benefits of compiling SUTs as an integral part of the national accounts

2.142. There are a number of advantages of producing SUTs as an integral part of the national accounts and this approach is therefore recommended in this Handbook.

2.143. From a methodological point of view, the following may be identified:

- SUTs provide the ideal framework for integrating the components of the three approaches to measuring GDP both in current prices and in volume terms.
- When statistical discrepancies exist amongst the macroeconomic aggregates, it is less clear where adjustments could be applied. Through their detailed examination of the supply and use of products, however, the SUTs provide a powerful approach to identifying which areas could be adjusted.
- SUTs allow for the data confrontation of different primary sources by bringing them together into a single framework, and facilitate efforts to prioritize how resources could be allocated to seek quality improvements.
- Where statistical information is incomplete or contradictory, as may happen with gross fixed capital formation or household final consumption expenditure, alternative estimates can be made in a transparent way using the SUTs framework, ensuring consistency and coherence.
- SUTs provide a full framework for establishing the connection between the various valuation concepts in national accounts, from basic prices through to purchasers' prices.
- SUTs form the ideal framework for estimating GVA through double deflation and GDP in volume terms, while also ensuring coherence of deflation across the different areas.

2.144. In terms of practical benefits:

- SUTs offer new options to incorporate all existing information, including from primary sources, on a consistent basis. This is also true for information that is only periodically available, as well as a framework for making reliable estimates, including plausible restrictions and identities.
- When SUTs are produced as an integral part of the national accounts, it is relatively easy to compile IOTs. These IOTs derived from SUTs will be fully compatible and consistent with all figures from the national accounts, adding to the credibility and analytical usefulness of both products.

- SUTs that are consistent with the national accounts are normally produced in connection with benchmarked macroeconomic data some two or three years after the initial preliminary results of the national accounts are published. SUTs can also play a vital role in the production of preliminary annual or even quarterly accounts.

2.145. Once the SUTs system is in place on an annual basis, the benefits are significant and can take various forms:

- SUTs from the previous year can be updated with information available for the preliminary year in order to produce a complete set of SUTs (albeit at a more aggregated level) that are consistent with the preliminary figures. This procedure is a good method for revealing inconsistencies in the aggregated preliminary figures at an early stage.
- SUTs can be used to incorporate new information; for example, when new detailed information on total supply and exports is available earlier, then the structure of SUTs of the previous year could be used to project SUTs for domestic output and imports.

# Chapter 3. Business processes and production stages

## A. Introduction

3.1. The compilation of monetary and physical SUTs and thus IOTs is viewed as part of a statistical production process which starts from the identification of the objectives and users' needs to the dissemination of the tabulations and the evaluation of the production process. The various stages of compilation of SUTs (and IOTs) presented in this Handbook follow those of the GSBPM (United Nations Economic Commission for Europe, 2013). The GSBPM explicitly identifies and organizes the compilation steps and the interdependencies between them in a generic statistical business process. Thus it provides a useful flexible framework by which to describe the compilation process for SUTs and IOTs.

3.2. It should be mentioned that country practices in the compilation of SUTs and IOTs vary considerably, since they are specific to the particular context in which they take place. For example, they depend on the specific institutional arrangements of the statistical system, the statistical legal framework, the legal, political, regional and taxation arrangements, the statistical units, the business registers, the range of processes, publication schedules, revision policies, resources, data availability, confidentiality, and also the final outputs. Despite the great variability in country practices, there are common steps in the compilation of SUTs and IOTs. In the description of the compilation stages of the GSBPM in this Handbook, these common steps that are flexible and applicable to all countries are identified.

3.3. There is an overarching framework within which the statistical production process takes place and this should be taken into consideration in the design of the compilation process and also in the actual compilation of SUTs and IOTs. This includes the statistical institutional arrangement in the country and the data and metadata quality framework.

3.4. The objective of this chapter is to provide an overview of the compilation steps for SUTs and IOTs. Section B presents an overview of the different institutional set-ups in various countries. Section C outlines the GSBPM compilation stages that relate to SUTs and IOTs and, lastly, section D provides a schematic summary of the compilation steps and their links with the relevant chapters of the Handbook and a summary of the main recommendations, principles and guidelines for the compilation of SUTs, IOTs, PSUTs and EE-IOTs that are covered by this Handbook. Annex A to chapter 3 provides examples of institutional arrangements for the compilation of economic statistics in countries.

## B. Institutional arrangements

3.5. The institutional arrangements are generally understood as a set of agreements between the agencies involved regarding the division of responsibilities in the collection, processing, compilation and dissemination of data. They are fundamental to an effective statistical system and essential for the management of an integrated economic statistics programme. The functions and responsibilities of the lead statistical agency in the country can be carried out more efficiently if it is supported in its role by institutional arrangements such as advisory committees, relationship meetings, memorandums of understanding, service-level agreements, technical cooperation and a legal framework that protects the confidentiality and integrity of the data while allowing for the sharing of data between partner statistical agencies (United Nations, 2013, para. 3.23).

3.6. Apart from the legal framework and other factors, institutional arrangements depend on the kind of national statistical system that exists in a given country, namely, whether it is centralized or decentralized. A national statistical service is considered centralized if the management and operations of the statistical programmes are predominantly the responsibility of a single autonomous government agency, and decentralized if the statistical programmes are managed and operated under the authority of several government departments. Under this arrangement, a particular agency is usually entrusted with the responsibility of coordinating the statistical activities of the various departments.

3.7. In economic statistics, countries have different institutional arrangements under which such bodies as, for example, the national statistical office and the central bank have different roles and responsibilities. Countries often follow a decentralized approach, under which the collection of economic statistics is split across different institutions within the country, so that, for example, the national accounts (non-financial accounts) are compiled by the national statistics office, the balance of payments and financial accounts are compiled by the central bank, and the government finance statistics covering the public sector are compiled by the finance ministry.

3.8. When countries are considering either building or redesigning their systems or changing the roles and responsibilities of the various institutions involved, the undertaking should be approached with the aim of producing integrated economic accounts throughout the entire statistical production process. The motivation for integrated economic statistics comes from the benefits that such data sets provide for coordinated national and global policy initiatives in an increasingly interconnected world. The integration of economic statistics involves the use of common concepts, definitions, estimation methods and data sources for statistical reconciliation, helping to improve the coherence and consistency of a wide range of economic statistics and to reduce the respondent burden and overall costs. Integration therefore is not specific either to the type of statistical system (centralized versus decentralized) or to the level of development of the statistical system. This approach has the following prerequisites:

- Adoption of the conceptual framework of the SNA and the SEEA as the umbrella framework for organizing economic statistics
- Alignment of the interdependencies of the components of the statistical production process (statistical units, classifications and others)
- Establishment of enabling institutional arrangements for statistical integration (United Nations, 2013, para. 2.5)

3.9. Examples of institutional arrangements in different countries may be found in the annex to this chapter. In general, it could be said that, beyond being conducive to the coherence and consistency of official economic statistics, a centralized arrangement may provide more comparability and harmonization both within the statistical system and with the statistical system of other countries. Although the transition to an integrated system may incur large investment costs, it would generate great benefits in terms of improved quality and reduced costs in both the short term and the long term.

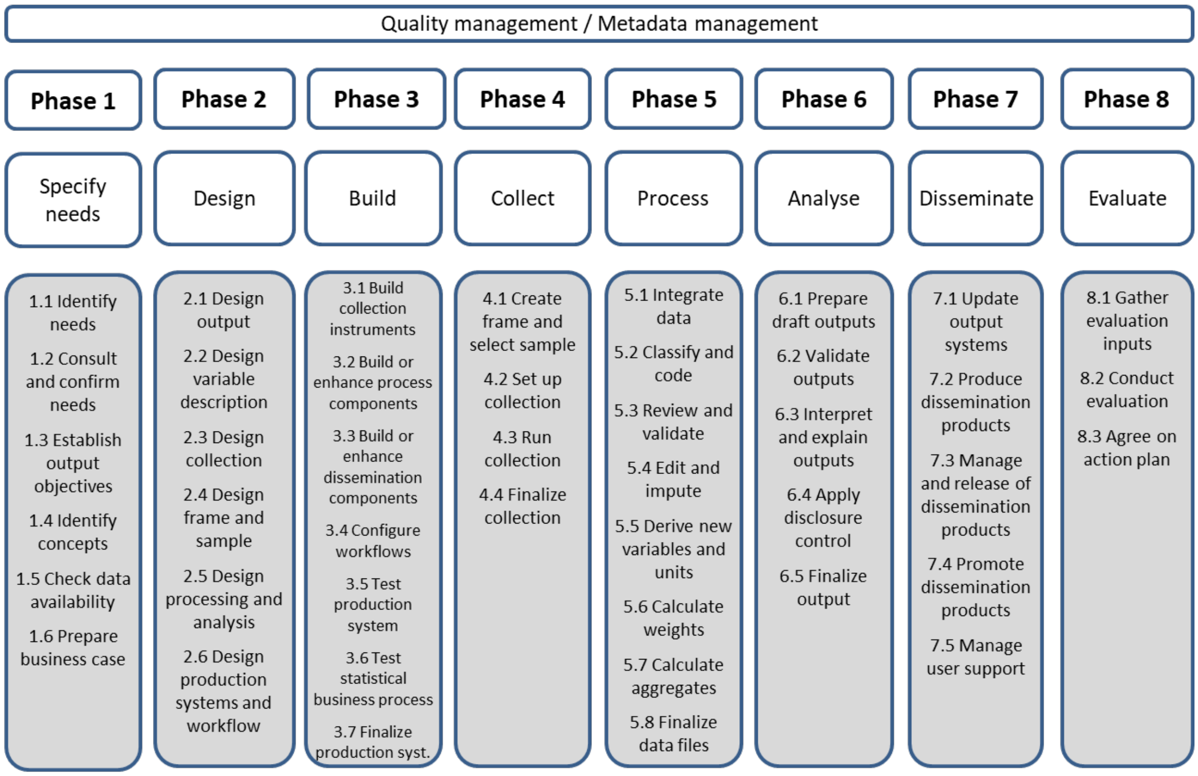
3.10. The roles and responsibilities of the various institutions in countries evolve over time and aspects of the historical evolution of these arrangements are reflected in the country examples covered in this chapter. One such example is that of Finland, where, in 2014, the compilation of the balance of payments was transferred from the country's central bank to its statistics office. Finland now follows the practice of other countries such as Denmark, Ireland, Luxembourg, Malta, Norway and the United Kingdom, where the balance of payments is compiled alongside the national accounts within the statistical office and not in the central bank.

## C. Overview of the Generic Statistical Business Process Model

3.11. The GSBPM describes, and defines, the set of business processes needed to produce official statistics. It provides a standard framework and harmonized terminology to help statistical organizations to modernize their statistical production processes, and to share methods and components. The GSBPM can also be used for integrating data and metadata standards, as a template for process documentation, for harmonizing statistical computing infrastructures, and to provide a framework for process quality assessment and improvement. The GSBPM is a reference model that can be used in a flexible manner to describe, document, organize and communicate the statistical production process in question.

3.12. The GSBPM consists of a sequence of eight phases: (1) Specify needs; (2) Design; (3) Build; (4) Collect; (5) Process; (6) Analyse; (7) Disseminate; and (8) Evaluate. An overview of the phases, together with the sub-elements of each phase, may be seen in Figure 3.1.

**Figure 3.1 Phases of the GSBPM**




3.13. The GSBPM is not a rigid framework in which all steps must be followed in a strict order; rather, it helps to identify the possible steps in the statistical business process, and the interdependencies between them. Although presentation of the GSBPM follows the logical sequence of steps in most statistical business processes (for example, business surveys), in different circumstances the elements of the model may occur in a different order. In addition, in compiling SUTs and IOTs, some sub processes will be revisited a number of times, forming iterative loops, in particular within the "Process" and "Analyse" phases.

3.14. This section focuses on the business processes in national accounts, in particular, the compilation of SUTs, PSUTs and IOTs. The business process and stages of production covered in this chapter therefore reflect the application of the underlying GSBPM. As a result, Figure 3.2 provides an overview of a simplified business processing model specific for the compilation of SUTs, PSUTs and IOTs.

3.15. In the compilation of SUTs and IOTs, the sequential stages in the compilation of the GSBPM may be summarized as follows, and as presented in Figure 3.2:

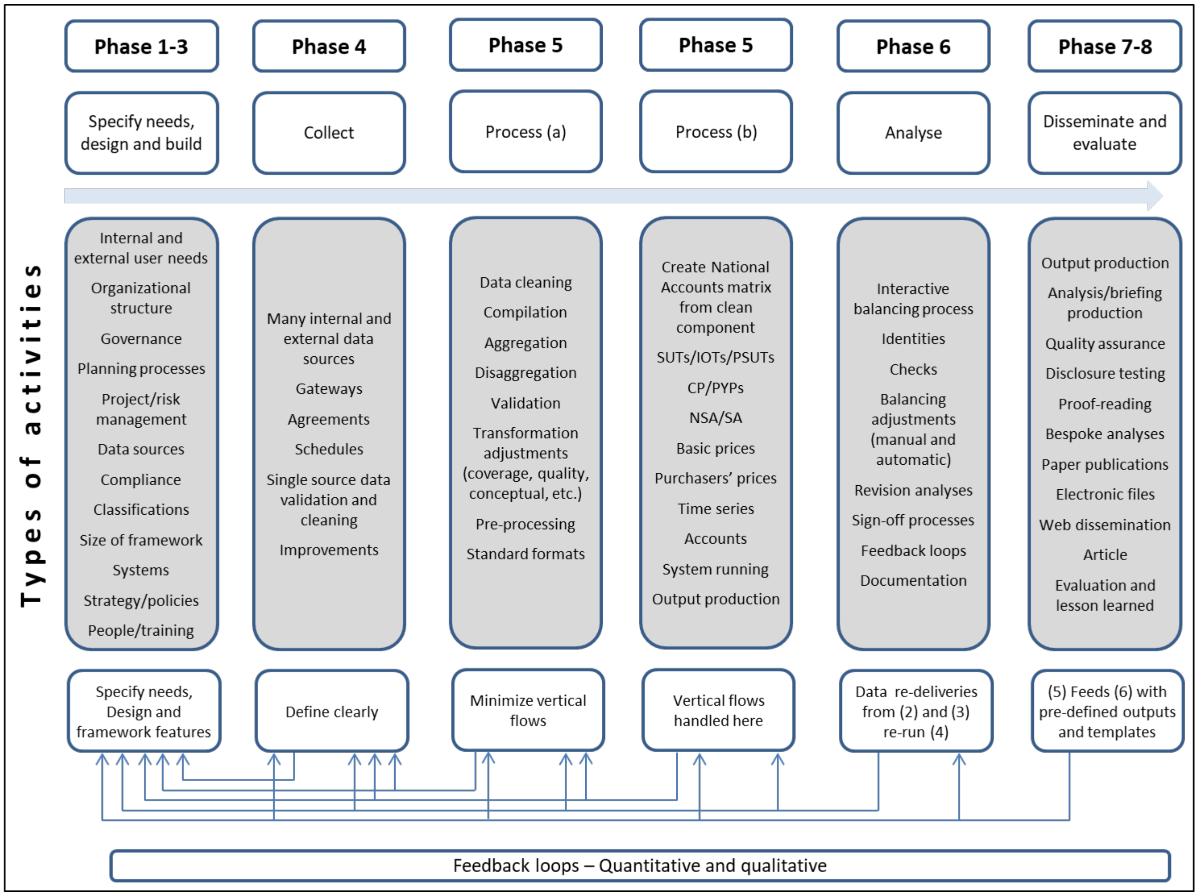
- Phases 1–3: Specify needs, design and build. This stage includes tasks related to the phases: 1 – "Specify needs", 2 – "Design", and 3 – "Build" of the GSBPM set out in Figure 3.1. It covers all the pre-collection activities of setting up the system, including identifying users' needs, designing the system, determining the size of the SUTs and IOTs, and other tasks.

- Phase 4: Collect. This relates to the activities of data gathering from various sources. In general, the compilers of SUTs (and IOTs) rely on data already collected for the purposes of national accounts which have often already been adjusted to fit into the national accounting framework.
- Phase 5: Process. This stage corresponds to a number of activities related to the data cleaning, adjustments and transformation that are needed in order to start putting the data into an unbalanced SUT. This stage is very important in the compilation of SUTs and IOTs and is therefore separated into two steps in Figure 3.2. The first corresponds to all the activities necessary to put the data in the initial unbalanced SUTs. This involves data cleaning, pre-processing, aggregation and disaggregation of the basic data and any other adjustment to the basic data to fit into the national accounts concepts of the SUTs. The second step in this phase corresponds to all the activities of setting up an initial (unbalanced) set of SUTs at purchasers' and basic prices and in current prices and volume terms.
- Phase 6: Analyse. This stage corresponds mainly to the activities of balancing (manual and automated) SUTs and IOTs and the feedback loop to the source data to resolve inconsistencies. As a result, there is a continuous loop between this and the previous phase, making it possible to achieve balanced SUTs and IOTs. In this stage, the final output of the compilation process is prepared, validated and finalized.
- Phases 7 and 8: Disseminate and evaluate. This stage refers to the activities related to the dissemination of the output tables, which include the preparation of printed publications, press releases and websites, the promotion of dissemination products and other tasks, as well as the activities related to the evaluation of the production process and also of the output in the light of internal or external feedback.

3.16. The grey boxes for each stage in Figure 3.2 include examples of the types of functions undertaken. They are listed in no particular order of importance and are linked with one another.

3.17. The broad approach is to move and process data from left to right, with minimal backward loops, even though effective feedback loops are critical at each phase, and the incorporation of new, or improved, data deliveries are unavoidable. Good data version control at each stage is needed, enabling the generation of a wide-range of outputs, articles and analyses such as revision analysis.

**Figure 3.2 Simplified business processing model for compiling SUTs, IOTs, and PSUTs**




3.18. Each phase should be viewed as cumulative, even when allowing for the iterative nature of the balancing process. The incorporation of balancing adjustments should be viewed as a cumulative step and not as creating a loop.

3.19. It is important to prepare proper documentation throughout the various compilation stages and in particular during the stage of balancing and adjustment. The steps and links between the source data through to the balanced data should be recorded and documented separately and reviewed in subsequent balancing exercises to investigate source data incoherence, bias and other factors. For example, moving from the original source data (such as business survey data, administrative-based data, company accounts-based data, and other types of data) to the validated 2008 SNA data, a number of adjustments may need to be made in such areas as the following:

- Coverage (including exhaustiveness) adjustments
- Conceptual adjustments
- Quality adjustments

- Balancing and coherence adjustments

3.20. In general, for all the stages of the compilation process, it is important also to have in place the following:

- Data version control – for example, data storage, conventions allowing easy access and revision analyses, and also pre and post automated balancing analyses
- Clear controls and disciplines – for example, read and write access for each stage, setting out operational standards, change controls and testing, and other measures
- Appropriate staffing – for example, ensuring that all staff are trained and skilled to undertake the different functions and ensuring that sufficient staff are in place for each phase
- Clear organizational structure of the staff involved – for example, clear roles and responsibilities of staff, as staff members can have more than one role in more than one phase

## D. Overall strategy for the compilation of SUTs and IOTs

3.21. Within the stages of the overall production process presented in the previous section, the “Process” and “Analyse” phases (5 and 6) have a particular structure in the compilation of SUTs and IOTs. This section provides an overview of the steps that are generally undertaken to construct SUTs and IOTs after the data have been gathered. In addition, since the compilation of SUTs and IOTs is not seen as a one-time exercise but as part of a continuous programme, this section also provides the strategy for compiling SUTs and IOTs in current prices and in previous years’ prices for the first year of compilation and the subsequent years.

3.22. The first step in compiling SUTs and IOTs is to populate the various separate parts of the supply table and use table (as shown in Figure 3.3) with the available data. This leads to the construction of unbalanced SUTs which are then subjected to a balancing process to reconcile all the entries.

3.23. The steps that are generally used by countries to construct an unbalanced version of the SUTs are presented below:

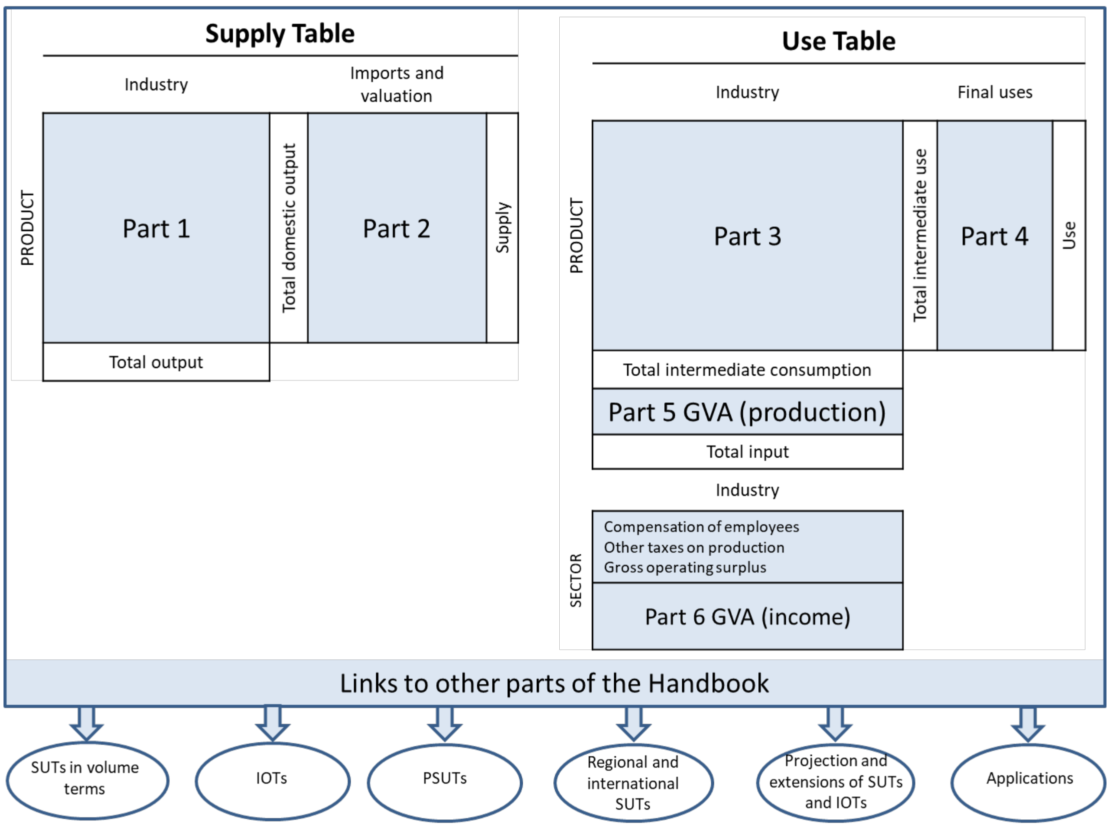
- *Step 1 – construction of the supply table*: This consists of filling the available data into an initial unbalanced supply table, which covers domestic output by product (part 1 in Figure 3.3) and the imports of goods and services and the valuation matrices comprising information on taxes less subsidies on products, trade margins and transport margins (part 2 in Figure 3.3). These valuation matrices allow the transformation of total supply of products at basic prices (formed by summing the domestic output and the imports) to total supply of products at purchasers’ prices. The construction of this initial unbalanced supply table is presented in chapter 5 of this Handbook.

- *Step 2 – construction of the use table*: In a manner similar to step 1, this step consists of filling the use table with the available data, which cover: the intermediate consumption at purchasers' prices (showing the input requirements of goods and services for the production of the domestic output of each industry shown in the supply table – part 3 in Figure 3.3); final uses at purchasers' prices and for each category, such as final consumption and gross fixed capital formation, for which separate compilation steps will be needed (part 4 in Figure 3.3); and production-based GVA at basic prices shown by industry (part 5 in Figure 3.3). This compilation step is covered in chapter 6 of this Handbook.
- *Step 3 – compilation of the valuation matrices*: These matrices are essential to the preparation of SUTs at basic prices. They expand the valuation columns in part 2 of the supply table in Figure 3.3 into corresponding matrices for intermediate consumption and final consumption of the use table. This compilation step is described in chapter 7 of this Handbook.
- *Step 4 – compilation of the imports use table and domestic use table at basic prices*: This step is essential to increasing the analytical uses of SUTs by distinguishing the use of imported and domestic products. This compilation step is presented in chapter 8 of this Handbook.
- *Step 5 – compilation of the SUTs in volume terms (previous years' prices)*: When balanced both in current prices and in volume terms, the SUTs ensure coherent and consistent deflation of the components of the production and expenditure approaches to measuring GDP as well as coherent and consistent estimates of price and volume indices. This requires that SUTs are compiled in volume term at this stage of the compilation process. The compilation of SUTs in volume terms is described in chapter 9 of this Handbook.
- *Step 6 – Linking SUTs with the institutional sector accounts*: Linking SUTs and the institutional sector accounts is an important step in the compilation of SUTs, ensuring the full integration and consistency of SUTs with the national accounts. This link is provided by compiling a linking table between the sectors and industries (part 6 in Figure 3.3). The compilation of the linking tables is presented in chapter 10 of this Handbook.

3.24. These six steps above are generally followed in that order; however, there is a significant level of interdependency in the compilation process. For example, trade and transport margins and taxes less subsidies on products are necessary for the transformation of the use table from purchasers' prices to basic prices and also for conversion of the supply of products at basic prices to purchasers' prices in the supply table, to enable the balancing of products at purchasers' prices. This information may partly be derived from estimates based on the use tables and linked to estimates from the supply table at basic prices.

3.25. On the other hand, estimates of certain final uses may require basic supply side information if, for example, the product flow [7] method is being applied. Nevertheless, allowing for interdependencies in the compilation of these tables, it is vital that the tables are viewed and accepted as primary estimates.

**Figure 3.3 Structure of the SUTs and the links covered in this Handbook**




3.26. Once these six steps are completed, the result is unbalanced SUTs at purchasers' prices and basic prices. This represents the start of a balancing procedure which is an iterative procedure integrating the following aspects:

- Balancing of SUTs at purchasers' prices
- Compilation of valuation matrices
- Transformation of SUTs into basic prices

[7] Following the terminology used in 2008 SNA (para. 14.2), in this Handbook the expressions "product balance" and "product flow" methods are used in preference to "commodity balance" and "commodity flow method", as reflecting the more recent usage of the word "product" in place of "commodity". It is noted, however, that the change in terminology does not indicate a change in methodology.

- Compilation of separate use tables for use of domestic output and use of imports of goods and services
- Balancing of SUTs at purchasers' prices and at basic prices
- Balancing the production-based GVA and income-based GVA, providing the link to the institutional sector accounts

All of the above should be balanced with time series in mind to ensure consistent movements of levels and growth rates.

3.27. One of the key reasons why the SUTs are balanced first at purchasers' prices is to reflect as closely as possible the basis of the survey data that is being fed into the use table. The intermediate uses and final uses, for example, are collected close to the economic reality of the prices paid by purchasers, in other words, the purchasers' prices. In addition, no valuation issues exist with such variables as compensation of employees and other taxes less subsidies on production.

3.28. These aspects should, however, be viewed alongside the domestic output part of the supply table reflecting data collected from producers whereby the output is valued at basic prices. Thus a balance between the two is needed.

3.29. For the SUTs balanced at purchasers' prices, the two key identities are:

- Total supply of products at purchasers' prices equals total uses of products at purchasers' prices.
- Total output of industries at basic prices equals total input of industries at basic prices.

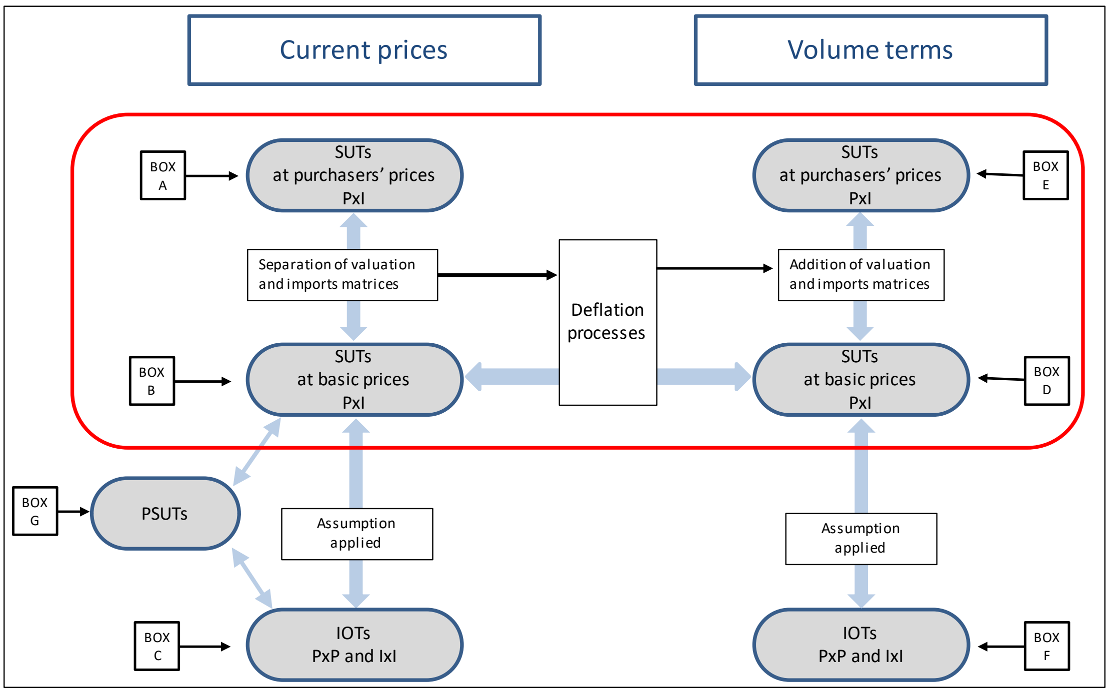
3.30. Balancing is not just necessary in order to achieve the above identities but also makes it possible to trace inconsistencies of basic data and estimation methods. Ideally, the balancing of the SUTs system should be done both in current prices and in volume terms simultaneously. In fact, balancing in this manner means that the process is not complete until the transformation into basic prices and the separation of the use of domestically produced products from the use of imported goods and services have been achieved, as these are key steps in producing the SUTs in volume terms. These steps are in practice interrelated and provide a powerful feedback loop in terms of quality and validity of the various component estimates.

### 1. Compilation of SUTs in current prices and volume terms

3.31. The SUTs framework in Figure 3.3, when treated in summary form, can be combined with the H-Approach to show a simplified version of the compilation schematic configuration when the SUTs are compiled in current prices and in volume terms. Figure 3.4 illustrates the sequence of steps involved in the compilation of SUTs, PSUTs, and IOTs. The inner box outlined in red focuses on the compilation of SUTs. Thus, countries that intend to compile only monetary SUTs can focus on the steps within the red box and follow the compilation sequence indicated by the arrows in the figure. The order of compilation of PSUTs and IOTs in the figure does not imply a compilation sequence for these tabulations. The compilation of these tables reflects the country's priority.

3.32. The simplified illustration provided in Figure 3.4 of the compilation of SUTs, PSUTs and IOTs can be seen in relation, on the one hand, to phase 4, "Process", when it comes to compiling unbalanced SUTs and PSUTs and, on the another hand, to phase 5, "Analyse", when it comes to compiling balanced SUTs, PSUTs, and IOTs.

**Figure 3.4 Compilation of SUTs and IOTs in current prices and in volume terms**




PxP: product-by-product
PxI: product-by-industry
IxI: industry-by-industry

3.33. In compiling the seven boxes, in the sequence from box A to box G, a further dimension of their evolution needs to be reflected. In year 1 of the compilation process, boxes A, B and C representing current prices are produced in that sequence covering the economy for year (T) for SUTs and IOTs, and box G covering PSUTs which are linked to the outputs of boxes B and C.

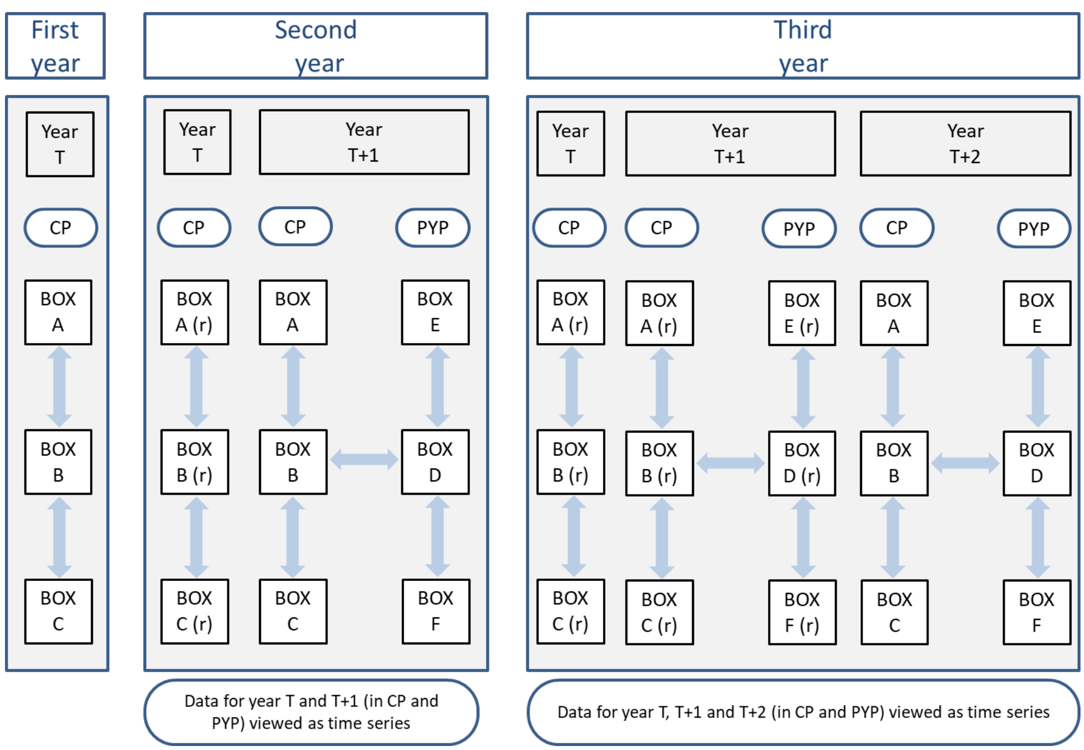
3.34. As mentioned in chapter 2, SUTs in volume terms for one period can be compiled using SUTs in current prices for one period and deflators. The preferred approach, however, includes a time-series dimension and boxes D, E and F representing the previous years' prices should not be compiled in year 1 as there are no SUTs in current prices for the previous year (T-1).

3.35. It is therefore essential to have two consecutive years of SUTs in current prices to enable the production of the first year of SUTs in previous years' prices. If the SUTs are produced less frequently, say, every five years, it is much more difficult to produce SUTs in volume terms.

3.36. In year 2, boxes A, B and C are produced covering the economy for year (T+1) together with any revisions to the data for boxes A, B and C for the year (T). In addition, the first set of SUTs in previous years' prices can be compiled for year (T+1). In each year thereafter, the process will extend the availability of SUTs by an extra year in current prices and previous years' prices, while also incorporating any revisions to SUTs for earlier periods to ensure consistent time series.

3.37. Figure 3.5 provides a summary of the evolution dimension for the first three years. As time passes, different challenges will evolve, such as the need to retain an ever-increasing number of years of SUTs on a consistent basis, the need for a revisions policy, data version and vintage control, managing the production of consistent levels and growth rates, the organizational arrangement of resources which may not increase each year, among others. It is thus important to ensure that this process is properly planned and managed from the start.

**Figure 3.5 Evolution of compiling SUTs and IOTs in the first three years**




Note: CP: current prices; PYP: previous years' prices; (r) revised tables.

3.38. Based on the overall strategy for the compilation of SUTs and IOTs, it is possible to provide step-by-step guidance. This is provided for the first year of compilation, and then subsequent years of compilation, as there are some additional steps that need to be considered in order to ensure a fully consistent time series of SUTs in current prices and in previous years' prices.

### (a) Step-by-step summary for the first year of compilation

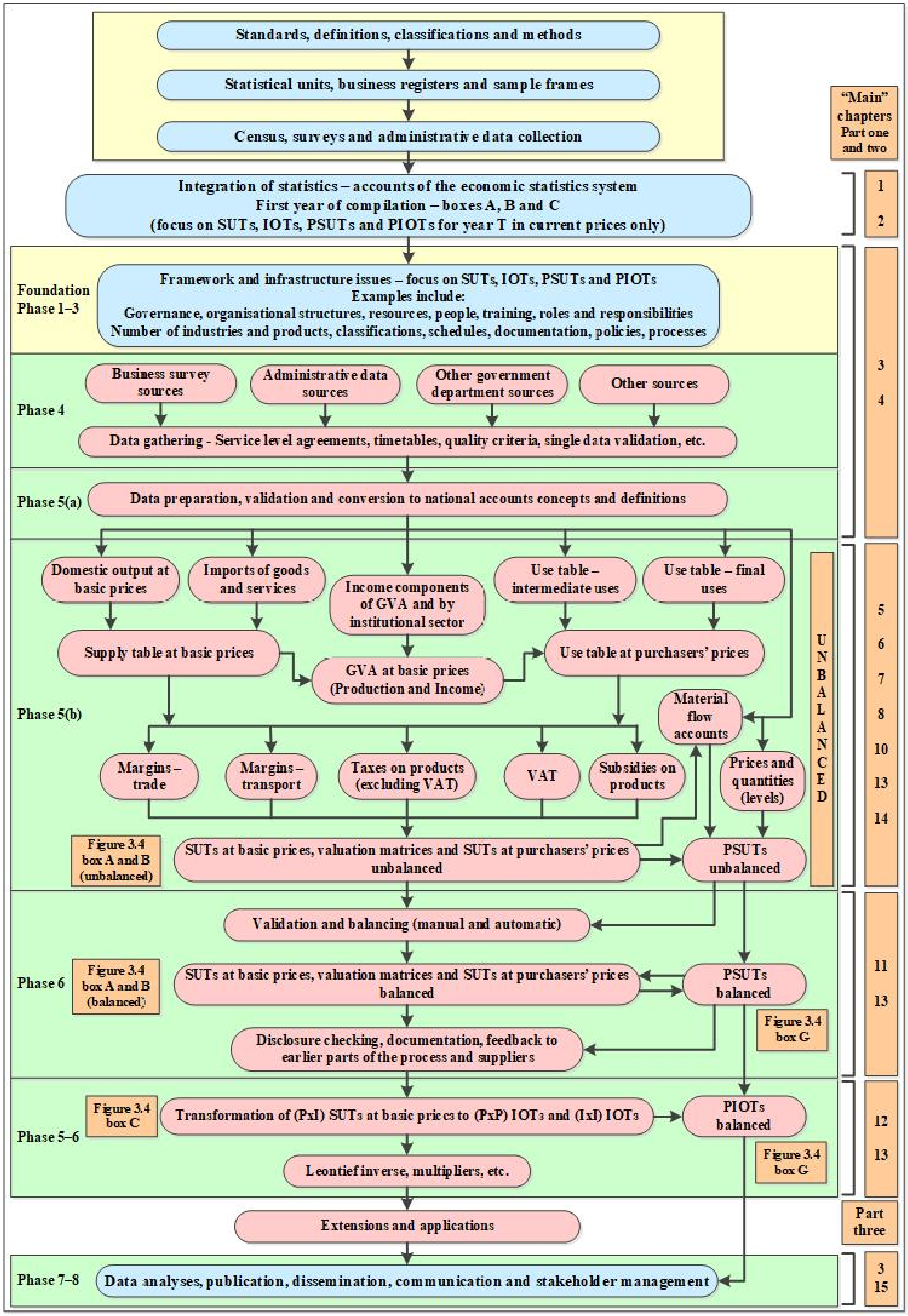
3.39. Figure 3.6 provides a description of the various phases in the compilation of SUTs and IOTs for year 1 of the compilation, together with the reference to the relevant chapters of the Handbook. The figure also contains references to boxes A–G of Figure 3.4 and the compilation stages of Figure 3.2. Although boxes A, B and C form key outputs, there are various intermediate stages and intermediate outputs as denoted in the separate stages in Figure 3.6.

3.40. Before starting the first year of compilation, as illustrated in Figure 3.6, compilers should ensure that the overall framework is well in place, comprising: standards, definitions, classifications and methods, statistical units, business registers and sample frames, census, survey and administrative data collection.

3.41. The following key features of Figure 3.6 should be noted:

- It is consistent with Figure 3.5 and covers the simplified business process model for compiling SUTs and IOTs. Each block of work in Figure 3.6 is split according to the type of work as indicated in the six different stages in Figure 3.2.
- It follows the underlying principles and features of the GSBPM.
- The flow of work is kept as logical and sequential as possible and follows the H-Approach as covered earlier. As mentioned earlier in this chapter, however, the compilation of SUTs and IOTs includes several interrelated processes and dependencies which must be reflected and retained. Furthermore, in some cases, there is more than one approach available, for compiling trade margins using a supply-side approach or use-side approach or both.
- The flows in Figure 3.6 do not present backward loops, although effective feedback loops are critical at each phase and improve the process. For example, the compilation and balancing of PSUTs provides an important feedback loop to the compilation of monetary SUTs, thus enhancing the quality of physical and monetary SUTs.
- Integrated links bring the PSUTs together with such input data as the prices and quantities (levels) and material flow accounts alongside the SUTs and IOTs.
- Each phase of work is also linked to the main chapters in parts A and B of this Handbook, providing much more detail on the compilation – these links provide the key chapters but not all references.
- The same approach has not been applied to part C (Extensions and applications) of the Handbook as there are many variations and options.

## Figure 3.6 First year of compilation



### (b) Step-by-step summary for the subsequent years of compilation

3.42. Having completed the year 1 results, Figure 3.7 provides a detailed stage of production for year 2 with the focus on the SUTs in previous years' prices, which, as mentioned, can only be compiled when SUTs have been compiled for the current year and the previous year.

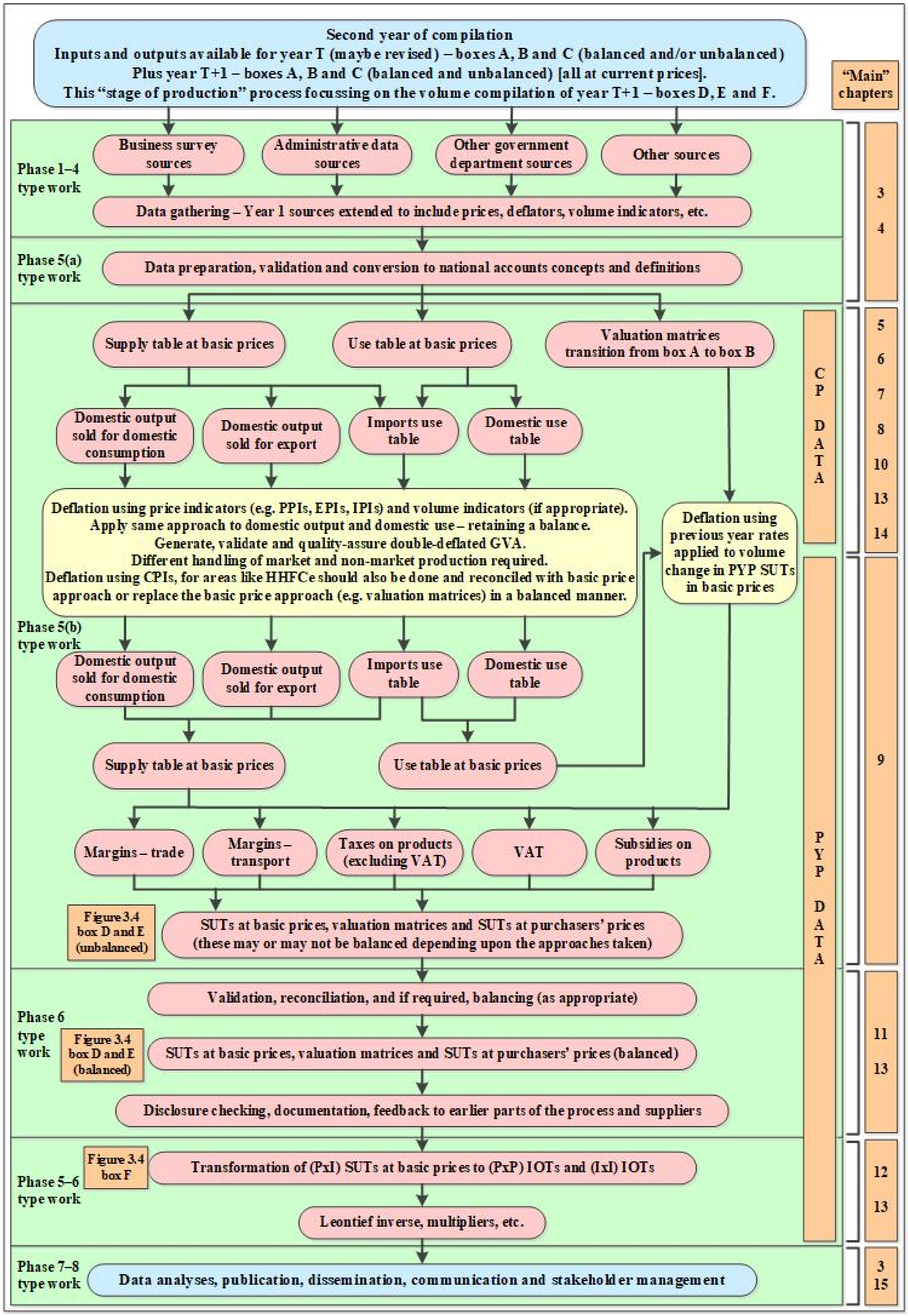
3.43. In compiling SUTs in previous years' prices for the first time, there may be several years of SUTs in current prices already available. If so, then the compilation is just an extended version of the process indicated in Figure 3.7, and it is better in terms of quality and consistency as there is a time series dimension in place immediately.

3.44. Other features to note in Figure 3.7 are the following:

- The focus of the steps in Figure 3.7 is the right-hand side of the H-Approach of Figure 3.4 and builds on the detail available from the left-hand side – assuming the left-hand side products are available.
- The deflation approach follows the underlying H-Approach and is covered in chapter 9, on compiling supply and use tables in volume terms.
- Other approaches are available but this is the recommended approach.
- The compilation of IOTs in volume terms is not essential but is not resource-intensive if all the other parts are available.

3.45. An additional feature is also achieved whereby GVA in volume terms is arrived at using the SNA recommended approach, namely, double deflation. However, the results from this approach need additional quality assurance against other indicators. This is to ensure that the quality of the GVA estimate in volume terms (and, in turn, GDP) is not reduced as a consequence of the errors in either the current price estimates of output and intermediate consumption or inappropriate deflation of these two variables.

**Figure 3.7 Second year of compilation**



## 2. Summary of the main recommendations, principles and guidelines of the Handbook

3.46. Box 3.1 provides a list of the main recommendations, principles and guidelines relevant for the compilation of SUTs, IOTs, PSUTs (and EE-IOTs) and related products presented in this Handbook, covering various aspects such as the organizational or institutional environment, compilation, data strategy and requirements, and balancing.

3.47. The recommendations and guidelines presented in box 3.1 may be viewed as aspirational as they provide the model scenario for the compilation and dissemination of SUTs, IOTs and related products. Countries can gradually implement the recommendations and guidelines in accordance with their specific situation in terms of such factors as data availability, resource constraints, legal framework and others, and in line with their priorities.

**Box 3.1 Examples of the main recommendations, principles and guidelines provided in this Handbook**

**A. Organizational or institutional environment**

1. The organization of the economic statistics system should follow an integrated economic statistics approach. The use of the GSBPM to organize the statistical production process would facilitate the compilation of SUTs, IOTs and related products.

2. National accounts should have very close links with all its suppliers, in particular, the business register, business surveys and administrative sources.

3. The compilation of the various components of the SNA framework should be coordinated and integrated in terms of production processes, such as production schedules, feedback loops, coherence, and other features:

- National accounts (including balance of payments and monetary financial statistics, government finance statistics)
- SUTs and IOTs together with PSUTs and EE-IOTs
- Environmental-economic accounts to be closely linked with the compilation of SUTs
- Regional accounts
- Prices
- Labour market statistics

4. The compilation of SUTs and IOTs should be performed as part of the regular compilation of the national accounts and within the core national accounts. This would have the following effects:

- Leads to better quality, coherence and consistency of national accounts, balance of payments and related statistics
- Creates effective and powerful data quality and coherence feedback loops, which in turn help to address structural issues and biases and to prioritize resources to targeted improvements

5. The final estimates of the national accounts aggregates should be derived from the balanced SUTs framework and not the other way around. For example, the SUTs based estimates should be not confined to predetermined estimates or already published estimates.

6. The compilation of SUTs and IOTs should reflect stakeholder interests. This can be achieved by organizing regular meetings with data suppliers and users together with other regular stakeholders.

7. Appropriate internal governance should be exercised to ensure accountability and guidance, supported by programme, project and process management, including risk management, under a framework reflecting:

- Schedules, timetables and customer-supplier service-level agreements set in place to ensure a regular supply of source data, briefings and evaluation reviews
- Various standards and policies, such as revision policy, confidentiality and disclosure controls, and others
- Staff recruitment, retention and skill development

8. Skill development needs to take into consideration the following types of training requirements:

- National accounts – Technical skill focus covering national accounts concepts, methods, processes and guidance, and also such functions as developments, compilation, coordination, balancing, analyses and dissemination
- Systems – IT systems, programming, data management (standards and principles), data dissemination, also covering website management, and other systems, including the role of dedicated IT professionals supporting economic statistics
- Management – staff management, effective leadership, communication, and other aspects

9. For effective and sustainable production of SUTs and IOTs, it is important to have sufficient computing capacity in place that includes:

- Robust, reliant, structured, quick and well-documented systems
- Database software and hardware, speed, structure, flexibility, statistical functionality, data management and links to web dissemination

10. It is important that the statistical production process is well documented and kept up to date, reflecting:

- Operational, methodological, system, metadata and recording-specific issues, adjustments, etc. for each quarterly or annual exercise

11. The compilation of SUTs and IOTs is to be performed with due consideration for the costs and resources available and also other criteria such as data availability, data quality and time.

**B. Compilation**

1. SUTs (and IOTs) should be compiled annually and, if possible, on a quarterly basis, following the H-Approach for the production of SUTs and IOTs in current prices and in previous years' prices (including valuation and imports matrices). The application of the H-Approach makes it possible for the volume of GVA to be estimated using a double deflation method and also ensures greater coherence, linking SUTs to various other parts of the SNA framework.

2. SUTs should be produced first, then IOTs derived from the SUTs, using additional information and assumptions.

3. Rectangular SUTs should be compiled with more products than those provided for by industries:

- The greater the detail, better the quality – while more detail will increase the burden on business, systems and resources, it can improve the quality of balancing
- Improved matching between prices and values, thereby ensuring better quality of the data in volume terms
- Compilation (and balancing) should be undertaken at the greatest level of detail available – time, quality and resources permitting. Due to confidentiality-type criteria, however, the level of publication may – or will – be aggregated to a higher level

4. Standard international statistical classifications (such as ISIC, CPC, COICOP, and others) should be used at appropriate detailed levels to ensure international comparability. Within these classifications, greater granularity may be desired for specific economies.

5. Consistent statistical units should be used throughout the process, from the business register and business surveys through to the SUTs.

6. Ideally, SUTs and PSUTs (and EE-IOTs, as appropriate) should be based on sound and complete data sources, reflecting:

- Common concepts, definitions and classifications
- Comprehensive and up-to-date statistical business register
- Wide range of (preferably annual) regular business surveys (including structural detail), household surveys, administrative data, prices, and other sources
- Benchmarking and reconciliation – preferably conducted annually, reflecting rapidly changing economies (minimizing the use of fixed factor or stability assumptions)
- Incorporation of labour and capital information ensuring improved coherence for productivity estimates
- Appropriate choice of index number formulae and base year

7. All the data building blocks should be recorded separately, namely, source data, coverage adjustments (including exhaustiveness), conceptual adjustments, quality adjustments, balancing adjustments, and others

8. A table should be compiled linking the SUTs and the institutional sector accounts, including:

- Goods and services
- Production accounts by industry and by institutional sector
- Generation of income accounts by industry and by institutional sector
- Parts of the use of disposable income account (such as household final consumption expenditure) and parts of the capital account – by industry and by institutional sector (such as gross capital formation and its components)

9. Use of the bottom-up approach should be preferred in the compilation of regional SUTs, which should be reconciled with national SUTs.

10. For the derivation of IOTs, the following should be the methods most frequently used:

- Model A (product-by-product) IOTs using the product technology assumption
- Model D (industry-by-industry) IOTs using the fixed product sales structure assumption
- Hybrid – mix of technologies usually chosen to avoid having any negatives

11. Comprehensive documentation should be prepared on operational methods and methodology, including appropriate metadata and revision analysis.

12. Efforts should be made to keep up to date with, and contribute to, internationally evolving and agreed changes to concepts, methods and systems developments.

**C. Data strategy and requirements**

1. SUTs are data-hungry and a range of timely, comprehensive, consistent and coherent data sources are needed. The data strategy should reflect a range of aspects.

2. These should include data-handling aspects such as:

- Data collection (for example, questionnaire design, electronic data capture, receipt of all the data that a company can provide, etc.)
- Data processing, data editing, metadata and data warehousing

- Data quality frameworks
- Data dissemination and use of SDMX standards

3. The following structural and data-collection issues should be reflected:

- Comprehensive and up-to-date statistical business register used as the sampling frame for all business surveys
- Use of as many data sources as possible, censuses, business and household surveys, administrative data, company accounts, regulatory accounts, company websites, and other sources
- An international business unit handling all aspects of multinational enterprise groups, from profiling the business structures to data collection and data reconciliation and feeding coherent data through to the various statistical domains. In addition, the need to develop links and share data with other national statistics offices and national central banks for statistical purposes only.
- Frequency of information – monthly, quarterly, annually or five-yearly. The more regular, the better the information reflects rapidly changing industry structures of sales and inputs, changing patterns of household consumption, impact of globalization on trade flows, and other factors
- Sufficient, appropriate and relevant, price indices matching the current price values for deflation or use of suitable volume only indicators where price information may be unavailable
- Strategy for handling, and reviewing, areas where data may be missing

4. The following more general needs should be included:

- Need to minimize the burden on business
- Need to have confidentiality and disclosure testing processes

**D. Balancing**

1. SUTs should be balanced in current prices and in volume terms, thus leading to:

- A single estimate of GDP incorporating the components of production, income and expenditure approaches to measuring GDP
- Volume estimates of GVA through double deflation
- Balance between supply of products and use of products and between industry inputs and industry outputs

2. The balancing process should simultaneously encompass:

- SUTs at basic prices and at purchasers' prices
- SUTs in current prices and in volume terms (preferably, previous years' prices)
- SUTs links to IOTs, PSUTs and EE-IOTs (as appropriate)
- Link with the institutional sector accounts

3. Balancing should strongly promote integration of the following:

- Goods and services, production account, generation of income account, parts of the capital account and use of disposable income account
- Incorporation of PSUTs and EE-IOTs (as appropriate)
- Productivity estimates (labour, capital and multifactor)

4. Simultaneous balancing should be preferred to sequential balancing. If this is not possible, sequential balancing (first in current prices, then in volume terms), with quick and effective feedback loops, should be considered as an alternative.

5. The organization of the balancing function can be set up in different ways across teams. A centralized balancing approach should, however, be preferred to the decentralized balancing arrangement whereby the balancing of the various elements related to SUTs and IOTs (such as current and constant prices for a single year and for a time series, links with

productivity, regional accounts, among others) is carried out at the same time and within the same unit in order to ensure the full consistency of all SUTs-related products.

6. The production and balancing of SUTs should enable the identification of source data incoherence. Mechanisms should be developed to provide feedback to data suppliers and help prioritize areas for improvement and allocation of resources.

7. An annual review and evaluation of the balancing adjustments should be carried out, to identify and address any evolving biases.

# Annex A to chapter 3: Examples of institutional arrangements in countries

A3.1 This annex presents examples of institutional arrangements in selected countries. The examples cover the cases of centralized and decentralized statistical systems.

## A. Centralized production of economic statistics: Canada

A3.2 As a centralized national statistics office, Statistics Canada is accorded the legal mandate to collect and disseminate a broad range of statistics by a federal act (the Statistics Act). Provisions in the Act also serve to protect data confidentiality and assure political neutrality and an arms-length relationship with policymakers.

A3.3 Users are regularly consulted, and the office, through various channels, ensures that priority requirements are established and met. These channels include national advisory committees, federal-provincial consultations and regular bilateral meetings with key policy partners such as the federal finance department and the Central Bank.

A3.4 Statistics Canada produces a full suite of macroeconomic accounts, including:

- National accounts (including financial and wealth accounts)
- Balance of payments
- Government finance statistics
- Productivity measures
- Environmental accounts (natural resource stocks, along with physical flows of energy use, greenhouse gas emissions and water use)
- Selected satellite accounts covering tourism, culture and pensions

A3.5 The compilation processes are integrated to assure data coherence across components of the Canadian macroeconomic accounts, and regional SUTs serve as the integrating mechanism for the production dimensions. The integration is achieved through annual benchmarking and reconciliation processes with current price measures of GDP income and expenditure, real GDP by industry and labour and multifactor productivity. Data coherence is a requirement for key policy applications, such as the input to fiscal formulas for the sharing of sales tax revenues among the Federal Government and provincial jurisdictions or to formulas for equalizing fiscal capacity among Canadian provinces.

A3.6 Economic surveys, along with labour market data, price statistics and international trade statistics, are produced within Statistics Canada, ensuring the alignment of priority-setting for feeder programmes to the macroeconomic accounts.

A3.7 All business surveys are linked to a central business register maintained through regular updates from administrative files. The survey content is harmonized, as are approaches to collection, processing and estimation within an integrated business statistics programme framework. The use of administrative data is optimized throughout all stages of the process, and continuous access to required files is assured through formalized arrangements with data providers, such as the Canada Revenue Agency and national and provincial regulatory authorities.

A3.8 In recent years, Statistics Canada has made significant progress towards implementing consistent classification standards across all feeder programmes, thereby facilitating the compilation of SUTs. The North American Industry Classification System (NAICS) serves as the basis of industry statistics and North American Product Classification (NAPCS) the basis of statistics on products. Continuing efforts are being made to ensure compliance and to coordinate input from the macroeconomic accounts and feeder programme areas into the development of updated standards.

## B. Centralized production of economic statistics: Norway

A3.9 Statistics Norway has overall responsibility for official statistics in Norway, and also for the conduct of extensive research and analysis activities. Statistics Norway reports to the Ministry of Finance, with the support of the Statistics Act of 1989. Statistics Norway is a professional, autonomous organization with the mandate to determine what it publishes, and when and how the publishing shall take place.

A3.10 Statistics Norway is responsible for the production and maintenance of the business register, along with the business surveys using samples drawn from this register.

A3.11 The Department of National Accounts and Industry Statistics comprises nine divisions, with the following responsibilities:

- National accounts
- Primary industry statistics
- Manufacturing and research and development statistics
- Construction and service statistics
- Transport, tourism and ICT statistics
- Energy statistics
- Natural resources and environmental statistics

- Accounting statistics
- Business register

A3.12 The division for national accounts is responsible for the following:

- Quarterly and annual national accounts (including SUTs, IOTs and regional accounts)
- Quarterly and annual non-financial accounts
- Quarterly balance of payments

The balance of payments has been an integral part of the national accounts since the 1950s. Satellite accounts are also prepared by the division for national accounts but not on a regular basis.

A3.13 The Department of Prices, Financial and External Trade Statistics comprises six divisions, with the following responsibilities:

- Financial market statistics (including financial accounts)
- Public finance statistics
- Financial corporations
- External trade statistics (in liaison with the Customs Department)
- Price statistics
- Development cooperation

Banking statistics were originally under the responsibility of Statistics Norway and were then moved to Bank of Norway before being moved back to Statistics Norway.

## C. Centralized production of economic statistics: United Kingdom

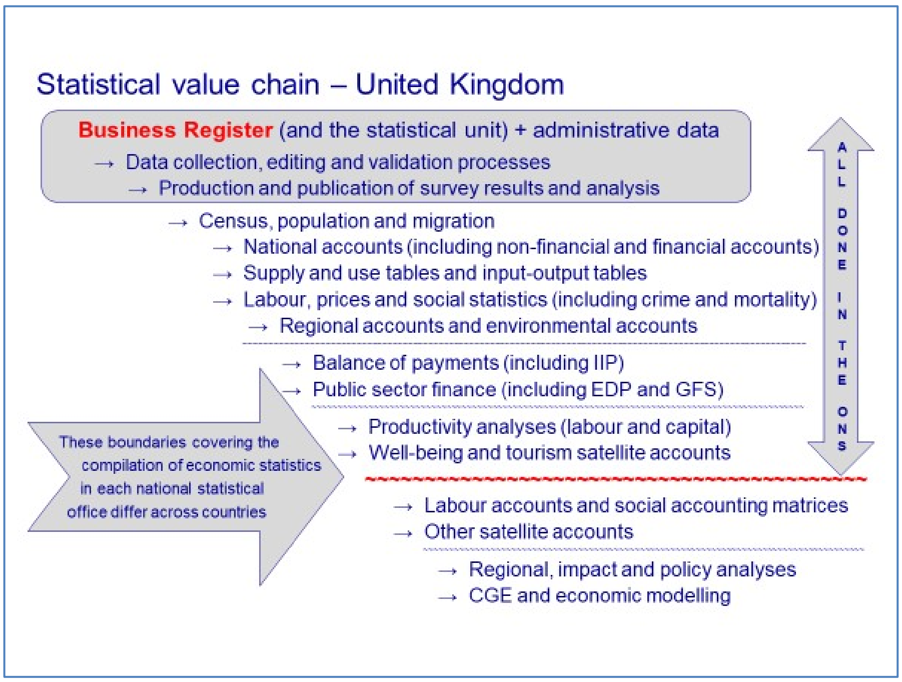
A3.14 The structure of the United Kingdom statistical system has evolved over many decades, helped by several reorganizations of statistical departments and changes in legislation, consolidating the responsibility for almost all economic statistics under the Office for National Statistics and the Government Statistical Service. The United Kingdom system continues to evolve, for example, by developing better links and access to administrative data.

A3.15 Currently, the United Kingdom has in place resources, systems and processes for producing detailed, integrated and timely quarterly and annual economic accounts. The Office for National Statistics, as an independent statistical body with a central role, is wholly responsible for the compilation of the national accounts, balance of payments, public sector finance statistics, labour market statistics and price statistics. The compilation of SUTs is central to the annual national accounts system. The Office also produces regional accounts, environmental accounts and IOTs (Mahajan, 2016).

A3.16 The Office for National Statistics is one of the few national statistics offices with such centralized responsibility and coverage of economic statistics – this has only been the case since the late 1980s. Furthermore, since 2011, all the above economic statistics are being produced at the same location.

A3.17 The independent status of the Office for National Statistics is supported by national legislation, pursuant to which it reports to the United Kingdom Statistics Authority. The Statistics Authority, which was established on 1 April 2008 under the Statistics and Registration Service Act 2007, is a non-ministerial department overseen by Parliament and not by a government minister.

**Figure 3A.1: Integrated process of compiling national accounts and balance of payments United Kingdom**




Compiled by Sanjiv Mahajan March 2014

## D. Decentralized production of economic statistics: Chile

A3.18 Economic statistics in Chile are mainly produced by three institutions:

- Central Bank of Chile, which is responsible for the compilation of most of the macroeconomics statistics, namely, national accounts (non-financial and financial accounts), balance of payments and international investment position
- Finance Ministry, which produces the government finance statistics
- National Statistics Office, which undertakes the data collection covering economic and business surveys and the compilation of price indicators, labour market indicators and socio-demographic data

A3.19 The organizational structure described above allows the Bank to achieve a high level of consistency between external statistics and national accounts in terms of both the statistics themselves and the methodology.

A3.20 In the production of macroeconomics statistics, the Bank uses a significant amount of data, provided mainly by the Tax Revenue Service, the National Customs Service, the General Comptroller's Office and the National Statistics Office, the latter being the main provider of statistics for national accounts compilation. Dependency on the statistics from the National Statistics Office entails a high degree of coordination between both institutions. To this end, a framework agreement is in place to ensure that the requirements and conditions for the provision of statistical products are met. In addition, a committee with members from both institutions regularly meets to coordinate issues related to data collection and the specific needs of national accounts.

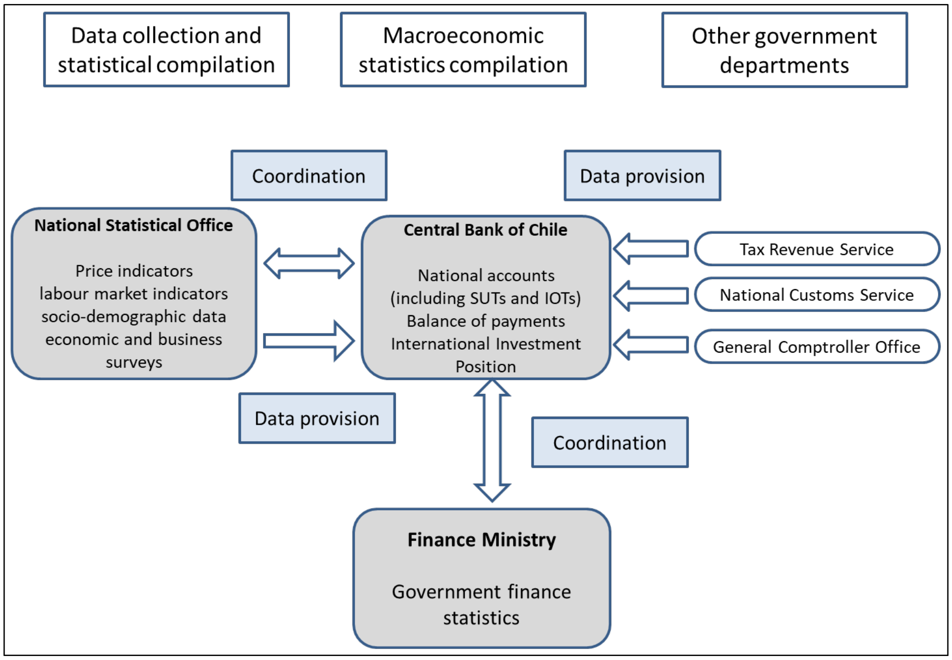
A3.21 There are strong links between the Central Bank of Chile and the National Statistics Office, buttressed by a continuous programme to improve the cooperation and the quality of the links and the data flows between the customer and supplier.

A3.22 Other salient features of the Chilean system include the following:

- The SUTs and IOTs are compiled within the national accounts in the Central Bank of Chile.
- Where the balance of payments is concerned, the Central Bank of Chile collects the data on international trade in services to supplement the data on the international trade in goods collected and provided by the National Customs Service.
- The Central Bank of Chile also produces regional GDP figures on an annual basis.
- The national statistics office produces a business register which, in turn, is employed by the Central Bank of Chile after making improvements and modifications.
- Although the environmental accounts are not produced for Chile, various efforts have been undertaken by the Minister of the Environment to produce a range of environmental indicators.

A3.23 The diagram below shows the components of the statistical system in Chile.

**Figure 3A.2 Statistical system in Chile**




## E. Decentralized production of economic statistics: United States of America

A3.24 The United States of America has a highly decentralized statistical system, under which responsibility for producing a substantial portion of official federal economic statistics is divided among 13 agencies that have statistical work as their principal mission.

A3.25 There are also numerous other entities that are considered part of the statistical system in the United States but statistical work is not their principal mission. Most of the country's primary economic indicators are produced by one of three main federal statistical agencies, while the United States Census Bureau conducts economic censuses and surveys. The three main agencies and their responsibilities are the following:

- Bureau of Economic Analysis: this body relies primarily on data generated by other agencies to compile the national accounts (non-financial accounts) and the balance of payments.
- Federal Reserve Board (the United States central bank): this compiles the financial accounts and government finance statistics.
- Bureau of Labor Statistics: this body prepares the labour market statistics and price statistics.

A3.26 The Bureau of Economic Analysis also undertakes a number of business surveys. At the same time, however, most of the statistics used by the Bureau in preparing GDP and input-output accounts come from non-Bureau sources, including other statistical offices. The Census Bureau provides most of the other expenditure components of GDP and output and intermediate purchases within the input-output framework. For the period 1997–2017, the Bureau of Economic Analysis produced SUTs at basic prices with a transformation to purchasers' prices, make/use tables at purchasers' prices for benchmark years and at producers' prices annually, together with IOTs. Annual make/use tables at producers' prices at a more aggregated level of detail are also available for the period 1947–1996.

A3.27 The agencies each produce and maintain their own business register, often created using different sources, as detailed below:

- The Census Bureau's business establishment list is compiled mainly from federal tax forms and used as the primary sampling frame for the five-year economic censuses and many of the economic surveys.
- The Bureau of Labor Statistics business establishment list is based on information collected in connection with the joint federal and state unemployment insurance programme and used by Bureau establishment surveys, including the producer price index (PPI) survey.

**Figure 3A.3 Overview of the products produced by the main agencies**

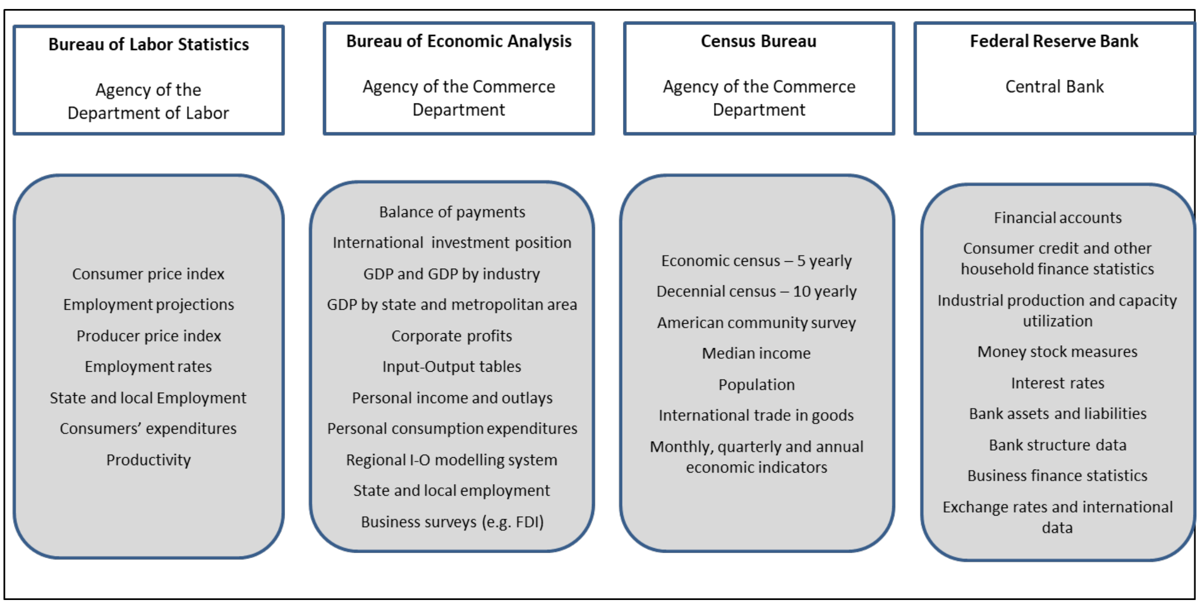
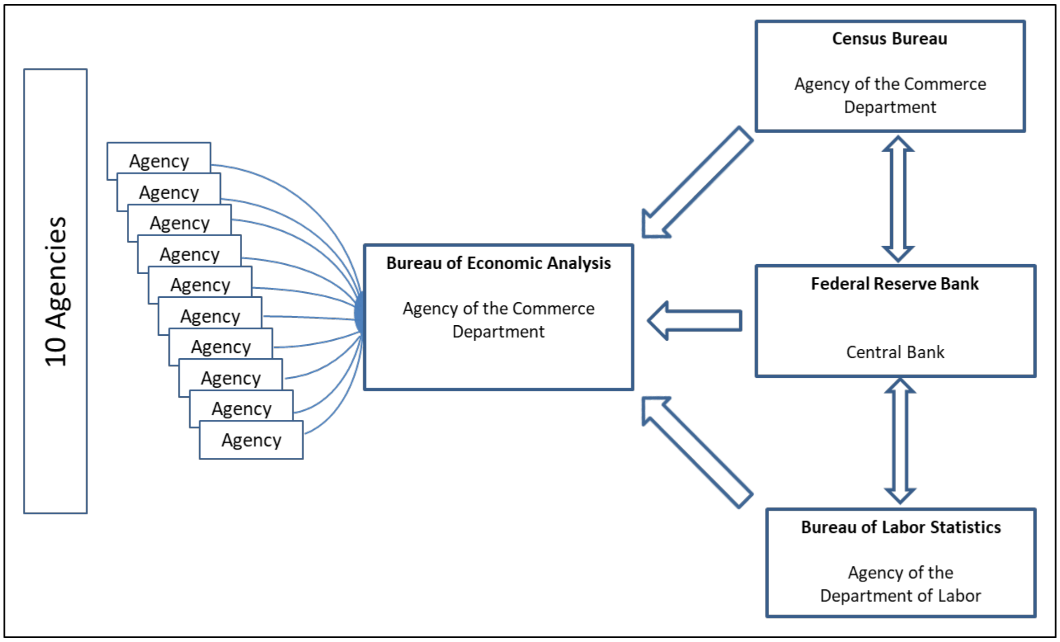


**Figure 3A.4 Overview of the statistical system structure**




A3.28 Data sharing between agencies, as practised in the United States, may significantly improve data harmonization and eventually lead to savings. In recent years, the Bureau of Economic Analysis has signed memorandums of understanding with other agencies and ministries to facilitate the exchange of data, including confidential data.

A3.29 Although there may be differences in the concepts of statistics employed by different agencies and in their statistical coverage (for example, productivity statistics are published in the United States by the Bureau of Labor Statistics and then used by the Bureau of Economic Analysis in its measurement of national accounts), the confrontation of the data themselves or of the data processing steps raises the data validation to another level and enhances the quality of statistics.

# Chapter 4. Specify needs, design, build and collect stage

## A. Introduction

4.1. The objective of this chapter is to describe the activities specific to the compilation of SUTs and IOTs which take place during the phases of the GSBPM relating to the specification of needs, designing, building and collecting, referred to together as the "specify needs, design, build and collect stage". The chapter will also explore specific elements that need to be considered when compiling SUTs and IOTs. These phases of the GSBPM is of particular importance in the compilation process because of its direct implications for all the remaining phases and their elements need to be continuously reviewed and corresponding adjustments made to the process.

4.2. The following section of the chapter focuses on the "specify needs", "design" and "build" phases of this stage. The level of detail of the industry and products in the tables must be carefully evaluated at the beginning of the compilation process, together with other elements such as the compilation schedule, the revision policy and others. Section C moves on to the collect phase and describes the main data sources used for SUTs and IOTs.

## B. Specify needs, design and build phases

### 1. Specify needs

4.3. The identification of user's needs is a fundamental step in the compilation of any statistics, as it aims to identify what statistics need to be compiled, in which format, when and for what purpose. All these elements affect the planning of the compilation process of SUTs and IOTs since they have implications, for example, for the choice of the level of industry and product detail of the SUTs. Thus an assessment of the objectives of these tabulations has to take place during the specify needs phase of the statistical production process and this assessment must be regularly reviewed in the light of feedback from users, to ensure the relevance of the compiled SUTs and IOTs. During this phase, consultation with relevant stakeholders, through meetings, workshops and surveys, is of key importance.

4.4. Other elements of this phase include the identification of the statistical outputs that are required to meet the user needs and checking the data availability to see if existing data sources can meet the user requirements, if there are alternative data sources that would be more suitable for the specific statistics, and if there are data gaps to fill.

4.5. There are many different users – policymakers, analysts, researchers and others – and uses – planning, modelling, monitoring and so forth – of SUTs and IOTs. It is therefore important to maintain links with the users to ensure that their needs are met through a single efficient compilation process. For example, in the context of growing concerns about the environment, if a specific environmental topic, such as water, energy, fish, or forests, is considered as a key user need to be addressed, it is important to develop and design a compilation process which includes these elements from the outset, rather than adjusting ex post facto the statistical output through modelling based on various assumptions.

4.6. The compilation of any statistical output depends to a large extent on the availability of appropriate infrastructure for information technology and human resources. The technology has changed enormously over the last fifty years. Statistics which were once compiled with calculators are now processed in seconds by modern computers, laptops or even smartphones. This rapid development has facilitated the work of statisticians and improved the timeliness of their statistical outputs. When compiling SUTs and IOTs, a variety of software, databases and custom-designed platforms is available and can be adapted to the specific compilation process in any given country.

4.7. It is therefore important to have a clear understanding of the information technology requirements necessary for all the phases of the compilation process. In practice, more than one software package is often required and the ones selected are those which best meet the diverse functional requirements of the specific phase and which are able to communicate with one another in an easy, effective and efficient manner. If the links between the software packages are cumbersome or time-consuming, alternatives should be sought. Many national statistical offices have developed in-house tailored software to meet their needs – this has advantages but may entail greater overhead maintenance and training requirements.

4.8. Box 4.1 and Box 4.2 provide examples of custom-made software produced and maintained by, in the first case, Statistics Netherlands and, in the second, the Institut national de la statistique et des études économiques (INSEE) – the French national statistical office – and Eurostat – the statistical office of the European Union.

**Box 4.1 Example of in-house custom-built software: Statistics Netherlands**

Statistics Netherlands has a long-standing tradition of compiling SUTs both in current prices and in volume terms, and also IOTs, and therefore has extensive experience in tackling the various challenges associated with the use of computer systems to produce and maintain long-run series of SUTs and IOTs.

Statistics Netherlands has been publishing SUTs since 1990 (relating to the benchmark revision for the year 1987) and IOTs since the 1950s (for years starting from 1948).

Statistics Netherlands has always used in-house custom-built software for the compilation of the balanced SUTs and IOTs. There are two separate software tools which are both updated continuously on an SQL database. These are combined with a graphical user interface in Visual Basic for Applications (VBA) code, enabling data to be accessed and adjusted by the national accounts staff. Both systems can handle quarterly and annual data.

The first application includes tools for the transformation of source data to national accounts definitions and standards, both in current prices and in volume terms.

The second application includes tools for simultaneous balancing of the SUTs in current prices and in volume terms, for compiling the valuation matrices and for transforming the SUTs to industry-by-industry IOTs.

The present systems are based on a major overhaul carried out in 1995 and have been continuously updated. A key rebuild took place in 2004/2005, reflecting a new programming language and also including new features.

**Box 4.2 ERETES**

ERETES – the acronym for "équilibre ressources-emplois et tableau entrées-sorties" (supply-use balances and input-output tables) – is a computer system designed to assist national accountants to compile the SUTs and integrated economic accounts (including sector accounts), which complies with the principles and guidelines set out by the SNA. ERETES was developed by INSEE and Eurostat. In 2014, it was being used by several countries in Africa and Latin America and the Caribbean. Further countries are expected to adopt the system. The ERETES system is available in French, Spanish and English.

Although the objective of ERETES is to generate SUTs and the integrated economic accounts, it can also be used by countries that have limited data resources. The minimum data requirements are an enterprise survey and a household budget survey, foreign trade statistics, government accounts, balance of payments and banking statistics. With these data, ERETES can help countries to generate estimates of GDP in current prices. If sufficient price and volume indices are available, then estimates of GDP in volume terms can also be generated. The compilation of SUTs would also require information on intermediate consumption and trade and transport margins.

One key advantage of ERETES over other computer systems is that it is supported by a permanent secretariat that can call on a group of multilingual national accountants and information technology experts with extensive experience of applying the system in a number of developing countries. ERETES is regularly updated and improved. ERETES is available at: http://www.eretes.net/EN/index.htm.

4.9. Another successful example of custom-built software produced by one national statistical office, and then made available for use by other countries under specific terms and conditions, may be seen in the Norwegian software SNA-NT. Here, Statistics Norway provided both the software and the associated human resources for training in the use of the applications by, for example, Malawi, the Czech Republic and Slovakia.

4.10. When choosing the software and hardware to support the compilation of SUTs and IOTs as part of the national accounts, consideration should be given to various criteria such as the database environment, in particular its flexibility and structure, its statistical functionality and diagnostic tools required, the necessary availability of mathematical functions such as matrix calculations, the resources and costs, the training programme, compatibility with data suppliers, data management, and the data dissemination platform envisaged.

4.11. Across the world a range of different products are used to this end, such as Oracle, JAVA programming, MATLAB, SPSS, SQL, SAS, Excel and custom-made software built to meet specific requirements. For example, the use of Excel or input systems such as an Oracle database could provide an effective solution in the “collect” and “process” phases, for preparing and validating the data, while SAS could be used for the further processing of SUTs and IOTs. Tools such as Excel, an output system and web-tools for dissemination may offer the best means of validating and balancing, and also of analysing and disseminating the data.

4.12. Skilled and trained human resources are also a fundamental pillar for the compilation of SUTs and IOTs. It is thus important to recruit and retain skilled and effective staff and develop and use internal and external training opportunities on the theoretical and practical aspects of the compilation of economic statistics.

4.13. An important step in this phase is the preparation of a document summarizing the findings of all the activities mentioned above – namely: needs identification; establishment of output objectives; checking of data availability and information technology requirements, and others – in the form of a business case, with a view to securing approval to implement the new or modified statistical business process. Such a business case would need to conform to the requirements of the approval body but would typically include elements such as a description of the “as-is” business process (if it already exists), with information on how the current statistics are produced, highlighting any inefficiencies and issues to be addressed; the proposed “to-be” solution (with clear improvements and benefits); detailing how the statistical business process will be developed to produce the new or revised statistics; an assessment of costs and benefits, and any external constraints.

## 2. Design and build phases

4.14. The design phase comprises all the activities undertaken to define the statistical output and the concepts, methods, collection instruments and operational processes necessary. Accordingly, this phase includes all the design elements needed to define or refine the statistical output identified in the previous phase, all relevant metadata, ready for use later in the statistical business process, and quality assurance procedures.

4.15. These activities make substantial use of international and national standards, in order to reduce the length and cost of the design process and enhance comparability and usability of outputs. Organizations are also encouraged to reuse or adapt design elements from existing processes. In addition, outputs of design processes may form the basis for future standards at the national and international levels.

4.16. The design of the statistical output for SUTs and IOTs consists of the size and layout of the tables; the breakdown of industries and products; disclosure control methods; processes governing access to any confidential information; and the identification of the statistical variables needed, which is then linked to the data collection phase.

4.17. In the build phase, the production solution is put together and tested to the point where it is ready for use in a live environment. This phase is broken down into several activities, which include a review of data sources; the configuration of the workflow from data collection through to dissemination; and testing of the statistical business process. For statistical outputs produced on a regular basis, the design and build phases usually occur for the first iteration, and following a review or a change in methodology or technology, rather than for every iteration.

4.18. During the design and build phases a number of specific issues in the compilation of SUTs and IOTs should be considered. These include, for example, the choice of the level of detail of industries and products of SUTs and IOTs at working level and in the dissemination phase; how to handle confidentiality throughout the compilation process; the schedule for the compilation and dissemination of SUTs and IOTs; the revision policy and analysis; the resources required to sustain the compilation; the benchmarking; and the choice of the index formula and the base year. In addition, it is important to create and maintain documentation for all phases of the compilation process to serve as a quality control measure of the process. All these activities in the design and build phases are further elaborated in the following sections.

### (a) Level of industry, product detail and size of SUTs and IOTs

4.19. The level of industry and product detail of the published and disseminated SUTs and IOTs greatly depends on the objectives of the tabulations and their uses. The industries and products explicitly identified in the disseminated tables reflect to a great extent the users' needs and the specific policy concern of interest. For example, if a specific environmental domain is of interest, such as energy, specific industries and products are likely to be explicitly identified in the disseminated tables in order to address the specific domain. The ultimate level of aggregation of the disseminated SUTs and IOTs has an impact on – and at the same time is affected by – the data availability and the data collection, compilation and balancing procedures.

4.20. The number of products in the SUTs is usually higher than the number of industries, thus showing more than one primary product for each industry, casing the SUTs to be rectangular. Their size and shape will have appropriate implications for IOTs, the physical tables and other related products analyses (for example, productivity).

4.21. The level of detail of industries and products at the working level is generally very disaggregated and the recommendation is to work with the most detailed level of aggregation taking into consideration the constraints posed by the available data, resources, and burden on business. Various aspects need to be considered, including the user needs, the availability of data, and the level of detail used in national accounts. For example, compilation aspects that influence the level of detail (since they facilitate the compilation and validation of the data at the working level) include:

- Distinction between industries which are allowed to deduct VAT and those that are not allowed to deduct VAT, and different VAT rates per product and categories exempt from

VAT to facilitate the compilation of the valuation matrices in particular for taxes and subsidies.

- Distinction between market and non-market activities to facilitate the understanding of the input structure of GVA.
- Subdivisions of industries according to institutional sectors which have an impact on the linking table between SUTs and the institutional sector accounts.
- Separate identification of certain industry and product subdivisions to facilitate the compilation of the trade and transport margin matrices, such as section G and its divisions of ISIC Rev. 4.
- Links to international industry, product and functional classifications.
- Links between output structures, input structures, price indices and values for deflation, along with the availability of price statistics to generate estimates in volume terms.
- Links between domestic supply and exports, and also intermediate consumption and imports, to study the input structure of the industries.
- Links to the environmental accounts.
- Enterprises that trade internationally and have links to global value chains (see extended SUTs and the OECD trade by enterprise characteristics (TEC) database).
- Availability and quality of source data.
- Size and value of output and value added of the industry: if the industry is too large and heterogeneous then it should be further broken down. The same can apply to products.
- Benchmarking (annual as opposed to five-yearly) using comprehensive sources and censuses, since the level of detail in benchmarking years is much larger than that during regular annual compilation of SUTs and IOTs.
- Annual chain-linking the volume estimates.
- Staff resources, time schedules for production and publication, confidentiality and system infrastructure.

4.22. An appropriate choice of the level of industry and product detail in the SUTs at working level will facilitate the compilation and the search for causes of inconsistencies. For many products, it is possible, by their nature, to identify the industry in which they are used. For example, fertilizers are mainly used in agriculture, crude oil in oil refineries, concrete in construction, and so forth. For some products, it may also be possible to identify whether they are used as intermediate consumption or final consumption. Haircut services, for example, can be assumed to be mainly consumed by households and thus recorded in household final consumption expenditure. The more detailed the classification of products used in SUTs, the easier it is to use expert knowledge to supplement surveys in allocating products to different uses.

4.23. Linking and matching products to valuation-related elements (taxes, subsidies, trade and transport margins) make the composition of transactions more transparent and clear-cut and significantly facilitates their analysis.

4.24. If the products are more detailed, it will also mean that the number of users of a certain product is greatly reduced. Where there is only one producer and one user of a product, the search for the cause of inconsistencies would only require investigating two source statistics. When a product has 20 users, for example, the search becomes more complicated.

4.25. Questions relating to the layout of SUTs tables also arise for the final use part of the SUTs. It may be useful to integrate the functional classifications in the final consumption data, showing final consumption by products and by consumption purpose. On the other hand, it may be better to keep such detail and transformation separate, but this integration will still be needed in some form or other in the compilation of SUTs and the other accounts of the system.

4.26. In the dissemination phase, the size and breakdown between industries and products shown in the SUTs (and thus in the IOTs) mainly reflect the user's needs and the objective of the tabulations, taking into account confidentiality considerations. Other presentational considerations include, for example, the size and relative value of output and value added for the industries and the size and value of supply for the products. Industries or products that are not economically significant or relevant for a particular economy may be aggregated together, while a more detail breakdown may be shown for economic activities that contribute substantially to GDP, in order more effectively to analyse the cost structures and the interdependencies with other economic activities.

4.27. It should be mentioned that, when compiling consistent annual, or quarterly, SUTs, the stability of the level of detail of the applied classifications is also important, as many ratios and proportions will usually be taken as a starting point in the estimates for the following year.

4.28. A higher degree of product detail also supports the use of certain estimation methods, for example the product flow method of compiling national accounts (namely, balancing the supply and use of products) by taking into account the relevant differentiation concerning product tax rates, margin rates and homogeneity in prices. Moreover, it is much easier to distribute disaggregated products and services across industries and final use categories with the product flow method than at a higher aggregate level. Detailed product accounts also help in the balancing procedure, as it is easier to explore and detect the causes of imbalances if the basis is determined by homogeneous single products rather than aggregate groups of products. The work on a detailed product level certainly increases the data quality but has resource and systems implications. At higher levels of aggregation, problems of imbalance might not even be detected at all and therefore not remedied.

4.29. Table 4.1 provides an example of the size of SUTs and IOTs compiled by selected countries. It is worth noting that the internal working level of the industry and product detail used for compilation and balancing is much higher than which is actually published. For example, in the United States, the working level in producing the SUTs is over 800 industries, whereas in Denmark, there are around 2,350 products at the working level but the SUTs are published only at a level of 64 products by 64 industries.

4.30. It is important to distinguish between the detail required for the compilation and balancing work at the working level as opposed to the information required for the publication. The in-house operating detail should be the same or, as in most cases, in greater detail in terms of number of industries and products than that allowed for disclosure by the publication. For example, many countries distinguish hundreds or even thousands of products but do not publish at these levels, as a great deal of confidential information would thereby be released. It should be noted, however, that countries often allow people outside the national statistical office to have access to more detailed data, albeit confidential and under signed agreements, for analytical purposes.

# Table 4.1 Examples of the size of published and internal working level SUTs and IOTs

| Country[1],[2] | National Supply and Use Tables | | | | | National Input-Output Tables | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Current prices | | | | Volume terms or PYPs | Current prices | | | |
| | Internal working / compilation levels | | Published levels | | Do you produce such tables: Y (yes) N (no) or P (plan to) | Internal working / compilation levels | | Published levels | |
| | Number of products | Number of industries | Number of products | Number of industries | | Number of industries / products | | Number of industries / products | |
| | | | | | | P x P Tables | I x I Tables | P x P Tables | I x I Tables |
| Argentina[3] | 271 | 162 | 271 | 162 | N | n/a | 124 | n/a | 124 |
| Australia[4] | 301 | 67 | n/a | n/a | Y | n/a | 114 | n/a | 114 |
| Austria | 573 | 135 | 74 | 74 | P | 74 | n/a | 74 | n/a |
| Belgium[5] | 355 | 135 | 64 | 64 | P | 135 | n/a | 64 | n/a |
| Brunei Darussalam[6] | 324 | 74 | 74 | 74 | N | 74 | 74 | 74 | 74 |
| Canada | 490 | 230 | 490 | 230 | P | n/a | 230 | n/a | 230 |
| Chile | 275 | 160 | 180 | 111 | Y | n/a | 111 | n/a | 111 |
| Columbia | 369 | 61 | 61 | 61 | Y | 61 | 61 | 61 | 61 |
| Costa Rica | 183 | 146 | 183 | 138 | Y | 183 | 136 | 183 | 128 |
| Czech Republic | 252 | 120 | 88 | 88 | Y | 184 | 184 | 82 | 82 |
| Denmark[7] | 2 350 | 117 | 117 | 117 | Y | n/a | 117 | n/a | 117 |
| Estonia | 247 | 98 | 64 | 64 | Y | 64 | n/a | 64 | n/a |
| Finland | 776 | 179 | 64 | 64 | Y | n/a | 179 | n/a | 64 |
| Germany | 86 | 63 | 85 | 63 | P | 73 | n/a | 72 | n/a |
| Hungary[8] | 820 | 242 | 64 | 64 | Y | 88 | 88 | 64 | 64 |
| Iceland[9] | 561 | 142 | n/a | n/a | P | n/a | n/a | n/a | n/a |
| India[10] | 142 | 126 | 140 | 66 | N | 130 | n/a | 130 | n/a |
| Indonesia[11] | 244 | 81 | n/a | n/a | P | 251 | n/a | 185 | n/a |
| Ireland[12] | 82 | 82 | 58 | 58 | Y | 82 | n/a | 58 | n/a |
| Kuwait[13] | 43 | 43 | n/a | n/a | N | 43 | 43 | n/a | n/a |
| Mexico[14] | 819 | 814 | 262 | 262 | P | 814 | 262 | 814 | 262 |
| Netherlands | 614 | 128 | 85 | 76 | Y | n/a | 128 | n/a | 76 |
| New Zealand[15] | 299 | 118 | 201 | 106 | P | n/a | 106 | n/a | 106 |
| Norway | 860 | 156 | 64 | 64 | P | n/a | 156 | n/a | 64 |
| Republic of Korea | 1 851 | 328 | 384 | 328 | N | 1 851 | n/a | 384 | n/a |
| Saudi Arabia[16] | 59 | 59 | 18 | 18 | N | 59 | 59 | n/a | n/a |
| Serbia | 216 | 88 | n/a | n/a | N | n/a | n/a | n/a | n/a |
| Singapore | 71 | 71 | 71 | 71 | N | n/a | 71 | n/a | 71 |
| Slovakia | 290 | 88 | 64 | 64 | Y | 88 | n/a | 64 | n/a |
| Slovenia[17] | 350 | 230 | 64 | 64 | Y | 64 | n/a | 64 | n/a |
| South Africa | 104 | 293 | 104 | 62 | N | n/a | 50 | n/a | 50 |
| Sweden[18] | 403 | 97 | 62 | 64 | P | 62 | n/a | 62 | n/a |
| United Kingdom[19] | 112 | 112 | 112 | 112 | P | 112 | n/a | 112 | n/a |
| United Republic of Tanzania[20] | 250 | 59 | 250 | 59 | P | n/a | n/a | n/a | n/a |
| United States of America[21] | 4 988 | 819 | 73 | 71 | P | 73 | 71 | n/a | n/a |
| Submissions to European Commission reflect EU Member States[22] | 64 | 64 | 64 | 64 | P | 64 | 64 | 64 | 64 |

*Key:* PYP – previous year's prices
P x P – product-by-product
I x I – industry-by-industry

(1) The above table was compiled by Sanjiv Mahajan (Office for National Statistics, United Kingdom) at the time of preparation of this Handbook. The numbers are indicative for the reference year 2014 (as at December 2016) unless denoted otherwise.

(2) Other differences will exist in terms of comparability, given that the tables are compiled on different bases, in terms of the frequency of the tables, classifications used, the SNA version, latest reference year, latest benchmark year, valuation of SUTs (basic prices or producers' prices or purchasers' prices), assumptions underpinning the IOTs, etc.

(3) For Argentina the SUTs reference year is 2004 and the IOTs reference year is 1997.

(4) For Australia the IOTs working level operates at 1268 products and 114 industries.

(5) For Belgium the IOTs reference year is 2010.

(6) For Brunei Darussalam the reference year for SUTs and IOTs is 2005.

(7) For Denmark the number of products can vary from year to year. Detailed data can be made available outside Statistics Denmark for analytical purposes.

(8) For Hungary the IOTs reference year is 2010 (compiled five-yearly).

(9) For Iceland the SUTs are produced but not yet published. The plans are to publish 64 products x 64 industries.

(10) For India the SUTs reference year is 2012/13 and the IOTs reference year is 2007/08. Industry outputs are published in full whereas industry uses are aggregated to higher levels.

(11) For Indonesia the SUTs and IOTs reference year is 2010.

(12) For Ireland the SUTs reference year is 2013 and the IOTs reference year is 2011.

(13) For Kuwait the SUTs and IOTs reference year is 2010.

(14) For Mexico the reference is year 2008, the PxP IOTs reference year is 2008 (814 products), updated version for 2012 (259 products), and the IxI IOTs reference year is 2012.

(15) For New Zealand the production of SUTs in volume terms is being planned but there are no plans for publication.

(16) For Saudi Arabia the SUTs and IOTs internal working levels reference year is 2011 and the published SUTs reference year is 2013.

(17) For Slovenia the SUTs reference year is 2013 and the IOTs reference year is 2010. SUTs and IOTs will be published in 2017, both with a reference year of 2014.

(18) For Sweden the SUTs in PYPs are produced but not yet published. A version is, however, submitted to the Commission (Eurostat) and the plan is to publish at some stage.

(19) In the United Kingdom the IOTs PxP tables use the hybrid assumption approach

(20) For the United Republic of Tanzania the SUTs reference year is 2007. IOTs for the reference year 2007 are being finalized.

(21) For the United States, in benchmark years, the SUTs are published at the 389 product and 389 industry level of detail. While IOTs themselves are not currently published, the IxI Leontief Inverse tables calculated from IOTs are published at the 71 industry level of detail, and PxP tables at the 73 product level of detail.

(22) All EU Member States are expected to provide:

Annual SUTs both in current prices and PYPs as well as five-yearly IOTs under the ESA 2010 Transmission Programme after the expiry of any National Derogations.

The SUTs and IOTs are to be supplied using 64 products and 64 industries.

4.31. Confidentiality is a fundamental principle of official statistics (see United Nations, 2013b). It ensures that individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons, are to be strictly confidential and used exclusively for statistical purposes. It is important therefore that procedures are put in place to ensure the confidentiality of the information disseminated.

4.32. Countries may apply different criteria to decide whether specific data may be disclosed or not. This decision is likely to be driven by the legislation in place underpinning the collection of data from businesses. The decision is normally influenced by the number of enterprises observed in an industry or by whether the data can be disclosed through a process of deduction. One solution would be to choose a higher aggregation level with a sufficient number of enterprises in an industry to overcome any disclosure problems. There may not always be an easy solution for some industries or the products to which they should be allocated. The price is a loss of information due to aggregation, resulting in the increased heterogeneity of the SUTs system. Other methods might therefore be explored or combined, such as creating or redefining products.

4.33. Cases where there are one or two dominant producers in an industry, such as mining, extraction of crude oil, sugar, pharmaceuticals and others, pose a different challenge. In these cases, it is recommended, when necessary, that specific permission is sought from the business when their data are publicly available from other public sources, for example published company annual reports and accounts. If permission is not granted, then suppression of the relevant cells in the SUTs should be considered. The aggregation of industries and products with non-disclosive industries and products should, however, be avoided, as this results in the loss of useful details for non-disclosive industries and products.

**(b) Schedule of the work programme**

4.34. Aligning the monthly, quarterly and annual timetables covering data collection processes, compilation processes, data supply, validation, balancing and publication for all the accounts and outputs is a key step in ensuring coherence and consistency. This should include the compilation of SUTs and other input-output-related products, as appropriate.

4.35. The overall process needs therefore to be split into well-defined blocks of work with clearly defined processes and linkages between the processes, in such a way that they all fit within realistic schedules (including contingency planning and risk management) with clear roles and responsibilities for the staff and management involved. The governance of the programme should be clear, with regular monitoring and meetings scheduled at key junctures, for example, linked to key milestones in the process. The project management of the process should ensure that dedicated resources are attributable to this support function.

4.36. The schedule needs to incorporate deadlines of both data providers and data users, together with various internal intermediate deadlines. For annual business surveys, the time lag from changing the questionnaire to incorporating the new results and publication in SUTs and national accounts could be around three years; thus it is important to retain schedules, which are regularly reviewed and reflect the incorporation of continual data improvements.

4.37. In general, it is useful to put in place service-level agreements with data providers and also with data users. Agreements with data providers would cover the types of data to be provided, the quality criteria, briefings, schedules and the format in which the data will be delivered. Important elements to consider in such service-level agreements include:

- Clear ownership – senior representatives from both the supplier side and the customer side
- Reasons for data requirement
- Publication of results including disclosure requirements
- Process of data delivery by data provider (for example, format)
- What data are required (need to specify the variables needed)
- Timing of data deliveries
- Required briefing to accompany the data
- Handling of customer queries

- Quality (covering such criteria as consistency, credibility, revisions, precision and communication)
- Methodological notes supporting the data (for example, sources, methods, coverage, and others)
- Development, improvements and consultation
- Arrangements for review of the process, among others

4.38. Service-level agreements with data users, on the other side, would cover, for example, users' deadlines (such as those linked to policy agendas, research schedules, and other factors) to be reflected in the statistical production schedule. For example, the finance ministry or the central bank or both may require structural updates on the economy to fit with their policy review. Such user requirements may form part of regular annual schedules for the producers of SUTs.

4.39. In general, there should be a regular review, possibly on an annual basis, of all aspects of the process (including timetables, data quality, implementation of future changes, and other considerations) with both data providers and data users, to ensure continuous improvement and to guide changes as necessary.

4.40. The schedule for the compilation of SUTs naturally depends on the periodicity and frequency of SUTs and IOTs. In general, it is recommended that SUTs be compiled annually, in line with the United Nations Statistical Commission recommendations on the scope of the implementation of the 2008 System of National Accounts.[8] While it is recommended that a benchmark system of SUTs based on specific survey results be compiled every five years, rapid changes in the economy, the external impacts of globalization, the increasing rate of change of technology and its impact, new products, new industries, the impact of digitization and other factors may affect the production process of SUTs and the periodicity of benchmarked tables, with the result that an annual benchmark process may be preferred.

4.41. Schedules setting the frequency of SUTs compilation may be assessed against the revision policy and the uses of intra-annual sources (such as quarterly and monthly short-term indicators), with a view to incorporating if necessary the revision guidelines and indicators policy.

### (c) Revision policy and analysis

4.42. Revisions to time series data are an important part of the production process. Changes to published data can occur for many different reasons. For example, forecast data may be replaced by survey data, the reclassification of industries, methodological changes to the way in which data are estimated or just through the correction of errors. Changes due to the correction of errors should be identified as corrections and distinguished from revisions that are more commonly associated

[8] See the recommended data set in the report of the Intersecretariat Working Group on National Accounts (E/CN.3/2011/6), available at http://unstats.un.org/unsd/statcom/doc11/2011-6-NationalAccounts-E.pdf.

with improving estimates as more information is gathered over time (Mahajan, 2015). There is a conflict between the release of timely estimates and that of accurate estimates. If statistical offices and central banks waited to publish the most accurate data possible, given the nature of data collection, there would be a large time lag between the date to which the data refer and the date of publication.

4.43. Bringing together data for the purposes of compiling SUTs and other input-output-related products integrated within the national accounts involves aligning production timetables (quarterly or annual) and schedules, and also revision policies. Ideally, a highly effective revision policy to ensure that revisions are implemented in a coordinated and coherent fashion across the accounts should cover the national accounts, balance of payments and government finance statistics, should include the SUTs and IOTs, and should also extend to primary source data and other domains, such as regional accounts and environmental accounts.

4.44. The revision policy should reflect appropriate criteria to assess each revision, including when best to implement the changes, for example, in a quarterly exercise (for example, for short-term revisions) or in an annual exercise (for example, for long-period revisions). This will have an impact on how to compile SUTs and IOTs and the revision guidelines should be operated flexibly, reflecting such issues as economic significance and practical aspects such as their impact on resources and systems.

4.45. The usual guidelines applied to all the accounts cover:

- Revisions to the latest quarters for an incomplete year (these can affect annual SUTs)
- Revisions to past recent quarters since the last full benchmark year
- Revisions made through the annual process to recent years, say, between three and five completed years
- Revisions to a longer period, sometimes viewed as a major revision. Many earlier years may be revised depending on whether they meet certain criteria such as those relating to methodological improvements, correction of errors and economic significance

4.46. Any changes to back data will also have an impact on the monthly and quarterly seasonally adjusted estimates.

4.47. In some countries, occasional or major revisions of national accounts are usually carried out every five years and require more resources if the revision is implemented on the basis of a large SUTs system. A revision at a more aggregated level is always easier and less demanding.

4.48. The various revision practices have different pros and cons:

- Regular revisions to SUTs and national accounts help to preserve good quality levels and growth rates. Some users do not welcome regular revisions, however, whereas others do not welcome the "big bang" approach to revisions.
- Five-yearly revision exercises may mean more significant changes for a number of years until the next revision window.
- Revisions only at the aggregated level may provide problems with the detail and provide discontinuities in the long time series of annual SUTs
- Revisions also at the level of IOTs ensures that SUTs and IOTs remain consistent.

4.49. Revisions applied only to part of the accounts and not all the relevant outputs would generate incoherence across different outputs and not help users, for example, in some countries, SUTs may be revised but the IOTs are not revised, thus the links between the two products are out of line. This situation should be avoided.

4.50. Analysis of revisions can provide information about the reliability of estimates and how they change between the first estimate and final estimate as well as a source for the identification of any biases, (Mahajan, 2004b). Note that revision analysis does not give information on the accuracy of an estimate, for example, the final estimate may not be accurate in terms of sampling error or non-sampling error.

4.51. The knowledge of the source and the reasons for the revisions is key and helps producers, and users, to better understand the data. Sometimes with major revisions going back in time, understanding the changes can be quite complicated, such as changes in definitions, classifications and data. For analytical users of SUTs and IOTs, it is important to understand the reasons and impact, especially when there is a mix of revisions, such as, for example, with the introduction of 2008 SNA, necessitating the revision of SUTs and IOTs going back 30–40 years or more. The forthcoming handbook on backcasting methodology (United Nations, forthcoming) will provide more information on this topic.

### (d) Resources

4.52. When considering the resources and human requirements for the full integration of SUTs and IOTs (and also physical SUTs) in the compilation of national accounts and balance of payments, it is essential to distinguish between the first compilation of the SUTs, the recurrent production of SUTs and the process surrounding major backward revisions.

4.53. A substantial amount of resources is required to build up an integrated SUTs framework for the first time. This work involves establishing all the planning, conceptual and methodological work, data collection needs, requirements of all the individual industry and product balances, the development of appropriate techniques for incorporating the primary sources and new software for handling the SUTs system and the necessary training and investment in staff and systems. The investment may lead to considerable changes in working procedures towards a better integration of activities from data collection through to publication, following an integrated statistics approach.

4.54. The resources needed to establish an integrated SUTs framework should, however, be viewed against the way in which the development will evolve, for example, the level of integration and the organization of roles and responsibilities across the statistical domains. The implementation of the recommendations and guidelines provided in this Handbook can be carried out in a gradual manner taking into account countries' specific situation in terms of the resources available and their national priorities. Countries' practices may vary considerably, among such scenarios as the following:

- Only annual SUTs in current prices
- Annual SUTs in both current prices and in volume terms
- Annual SUTs complemented with a quarterly SUTs system
- Annual and quarterly SUTs in current prices and in volume terms
- SUTs at basic prices or at purchasers' prices
- Benchmarking annually or, say, at least every five years
- Links between SUTs and IOTs:
    - SUTs only
    - SUTs and IOTs, both in current prices (possibly also in volume terms)
    - Only IOTs and no SUTs – this is clearly the least favoured scenario but it has a historical legacy in some countries

4.55. Developing a new SUTs and national accounts system poses different challenges involving the change of existing production systems while maintaining business-as-usual activities.

4.56. Where periodicity is concerned, at least every five years a benchmark system of SUTs should be compiled which is based on more exhaustive specific survey and administrative data results. As described earlier in this chapter, however, when considering schedules for SUTs (and IOTs), with rapidly changing and developing economies, the impact of globalization and digitization, and other factors, it is recommended that the development of new SUTs systems should reflect an annual benchmarking and reconciliation process. This will also help to avoid significant revisions and distortions to the levels of data. Together with annual chain-linking, this will mean better quality measurement of the growth rates of GDP in volume terms, in particular for the more recent periods. Appropriate techniques have been developed and the trends of structural change (for example, composition of outputs and intermediate consumption) during the previous years can be used to take forward the structures in SUTs, if no new structural information is available, for example, beyond benchmark years.

4.57. The experience from countries which have integrated the SUTs framework into the compilation of their national accounts suggests that the resources needed are similar to the resources for those countries following a more traditional approach with a separate SUTs compilation. It is therefore recommended that SUTs are compiled as an integrated process and a regular part of the compilation of the national accounts. The fact that IOTs are produced with relatively few additional resources if a SUTs system is in place militates in favour of an integrated and regular approach for the compilation of IOTs.

### (e) Benchmarking, extrapolation using indicators, price and volume information

4.58. Planning a new system of SUTs is generally linked to a benchmark year for which the most important areas of the economy are covered by censuses and surveys. This is especially important when policy decisions are based on the levels of the figures, for example, the level of gross national income (GNI). Some detailed data sources are collected at more or less regular intervals and will not all be available for the benchmark year. Hence, figures that do not relate to the actual year will need to be corrected for the changes that have taken place between the reference period of the data and the period for which they are being used. This can be done using indicators for value or volume and price indicators.

4.59. When a balanced benchmark SUT exists, the compilation of SUTs for following (or previous) years will usually be considerably easier. It is possible to use information on the structures of the benchmark table to fill the gaps between those cells for which no new source data are available or to extrapolate as appropriate. For example, input structures will change over time and information on new input structures can then be used as it becomes available, replacing the extrapolated information. Taking into account that the other estimated structures are subject to uncertainty, it may be sufficient to review them at intervals of a few years, one at a time. Even when such structures are reused from the previous year, they will change over time as a result of balancing the SUTs. This could happen even more rapidly with the impact of globalization and the development of new products.

### (f) Features of GDP in volume terms

4.60. When looking at the change in the economy over time, the main concern is often whether more goods and services are actually being produced now than at some time in the past. With productivity, however, the point of interest is whether this output is increasing relative to the inputs.

4.61. Over time, changes in current price GDP show changes in the monetary value of the components of GDP. These changes in value can reflect changes in both price and volume, making it difficult to establish how much of an increase in the series is due either to increased activity in the economy (volume change) or to an increase in the price level. For productivity measures, only volume changes are used. It is therefore useful to measure GDP in volume terms (preferably in previous years' prices), meaning that price effects are excluded, including in current prices. In most cases, the revaluation of current price data to remove price effects (known as deflation) is carried out by using price indices such as component series of the retail prices index or producer price index, to deflate current price series at a detailed level of disaggregation.

4.62. At the international level, constant price estimates and chain-linked volume measures are two common measures for volume change of GDP. Under the constant price method, a certain year is selected as the base year; constant price volume estimates of GDP for subsequent years are the aggregation of its components computed by multiplying the price of each component in the base year by its volume in the current year, and the real growth is derived from the comparison of constant price volume estimates at different years.

4.63. Under the chain-linked volume measures method, the annually reweighted chain-linking approach is adopted to compile the volume measures of GDP and its components. First, the volume estimates of major components of GDP in the current year are revalued at preceding year prices, which in practice are calculated by deflating the current price values of subcomponents by the relevant price indices. Second, the short-term volume indices for different years, calculated by dividing the volume estimate of GDP from the initial step by the current price GDP in the previous year, are chain-linked to a selected reference year in order to obtain a continuous time series of the chain volume indices of GDP and its components. The chain-linked volume index series can be converted into the chained monetary series by multiplying the chain-linked volume index by the current price value in the reference year.

4.64. For some series, price indices for particular goods and services are used to deflate the current price series, such as components of the following:

- Consumer price index (CPI)
- Retail price index (RPI)
- Producer price index (PPI)
- Corporate services price index (CSPI)
- Import prices
- Export prices

4.65. The process known as "double deflation" is the preferred method for the estimation of GVA in volume terms. This is achieved by deflating the value of output and the value of intermediate inputs separately to get corresponding volume measures, and then subtracting the latter from the former. This double deflation approach means that an industry's total output is deflated by the price of its primary and secondary output, while each intermediate input is deflated by its own price index.

4.66. This is in contrast to the single deflation method, whereby GVA in current prices is deflated directly using an output-based deflator to arrive at GVA estimates in volume terms. The single indicator volume estimates can also be derived in other ways, for example, by deflating output with output price indices, assuming a constant GVA to total output ratios from the base year, or using volume indicators directly. This direct price deflation of GVA is not recommended by the SNA when using a single indicator method.

4.67. The SUTs offer a major advantage and a natural framework that enables double deflation to be applied in a coherent and consistent manner across the national accounts.

4.68. Chain-linked volume measure series are expressed as index numbers in which the series are simply scaled proportionately to a value of 100 in the reference year. These index numbers are volume indices of the so-called "base weighted" or "Laspeyres" form.

4.69. Aggregate price indices are of the "Paasche" or "current-weighted" form. They are generally calculated indirectly by dividing the current price value by the corresponding chained volume measure and multiplying by 100. Examples are the GDP deflator and the households' consumption deflator.

4.70. Value indices are calculated by scaling current price values proportionately to a value of 100 in the reference year. By definition, such a value index, if divided by the corresponding volume index and multiplied by 100, will give the corresponding price index.

4.71. From the point of view of production, GDP at market prices is at best estimated with reference to annually compiled SUTs both in current prices and in previous years' prices. The SUTs are compiled in previous years' prices in order to achieve an accurate breakdown of value changes in subsequent years according to volume and price changes.

4.72. The base-year table provides the specific weights for each industry and product, used in the index formulae by which the price data are aggregated.

4.73. The great statistical benefit of a system based on previous years' prices is the fact that the weights in the index formulae are always up-to-date, thus reflecting the structure of the recent past, and in turn optimizing the quality of the GDP growth rates in volume terms for more recent periods.

### (g) Choice of index number formulae

4.74. In order to calculate price and volume measures, a number of methodological choices have to be made, for example:

- Which index number formulae will be applied
- Whether a fixed base year or an annually changing base year will be applied

4.75. Different index formulae may be applied using different weighting schemes. It is beyond the scope of this manual to discuss in depth the theoretical and practical considerations relating to this choice. Chapter 15 of the 2008 SNA and Eurostat (2016) provide much more detail on the choice of index formulae.

4.76. Economic theory suggests that an index formula that assigns equal weight to the current year and the base year is to be preferred. This is one of the reasons why the SNA has a preference, albeit not a strong one, for the so-called “superlative” indices, like Tornqvist and Fisher.

4.77. Although the superlative indices have a number of attractions, it should be noted they also have notable disadvantages:

- Superlative indices are demanding in their data requirements and will increase the work burden significantly.
- Superlative indices are less intuitive than Laspeyres and Paasche indices.
- Superlative indices are not additively consistent, which is a serious constraint when applied in an accounting framework.
- Values change does not always equal volume change times price change.

4.78. From a practical point of view, a number of requirements can be imposed on the index numbers:

- The applied index formulae should be a good approximation of the changes obtained by the superlative indices.
- A change in value must be divided into a price change and a volume change without a residual.
- Values in volume terms for aggregates should equal the sum of values in volume terms of constituent parts, applying the same index formulae.
- In addition, it is sensible for the index formulae to be relatively straightforward and easy to interpret for users.

4.79. The last three requirements can only be met with the application of the Laspeyres volume index formula and the Paasche price index formula. The formulae underpinning these indices are shown below

Laspeyres volume index

$$L_q = \frac{\sum p_0 q_t}{\sum p_0 q_0} = \frac{\sum p_0 q_0 \frac{q_t}{q_0}}{\sum p_0 q_0}$$

Paasche price index

$$P_p = \frac{\sum p_t q_t}{\sum p_0 q_t} = \frac{\sum p_t q_t}{\sum p_t q_t / \frac{p_t}{p_0}}$$

where $p$ is the price and $q$ is the quantity.

4.80. The characteristic for the Laspeyres volume index is that the volume changes of individual goods are weighted with the value of the transaction concerned in the base year..

4.81. The characteristic for the Paasche price index is that the price changes of individual goods are weighted with their value of the transaction concerned in the current year. The deflated values derived with this index formula combination can easily be explained as values in prices of the base year.

4.82. It can be easily shown that the decomposition of value changes, in terms of volume and price changes, do not have a residual.

$$P_v = \frac{\sum p_t q_t}{\sum p_0 q_0} = L_q \times P_p$$

4.83. The deflation of values in current prices by using a Paasche price index gives:

$$P_v / P_p = \sum p_t q_t \,/ \frac{\sum p_t q_t}{\sum p_0 q_t} = \sum p_0 q_t$$

4.84. This illustrates that the deflated aggregate equals the sum of deflated components, which means that additivity in the SUTs for volume estimates is assured. The use of Laspeyres volume indices and Paasche price indices ensures that the current price identities also hold in volume terms. This also means that, after balancing, for every product, the total supply equals total use, and for every industry, the total output equals total intermediate consumption plus gross value added and, in volume terms, this is:

| | | |
|---|---|---|
| Total supply in volume terms | *equals* | Total use in volume terms |
| Total output in volume terms | *equals* | Total intermediate consumption in volume terms |
| | *plus* | Total value added in volume terms |

### (h) Choice of the base year

4.85. By applying the Laspeyres volume index number formula, the volume changes are weighted with the values of the concerning transaction in a base year. The question arises which year should be chosen as the base year. Generally speaking, there is a choice between a fixed base year and a changing base year.

4.86. With the method of fixed weights for a series of years, the weights are derived from a single year in the past. An advantage of this method is that, with long time series of values at prices of the base year, the deflated components of aggregates add up exactly to the deflated aggregate. A serious disadvantage, however, is that volume changes of aggregates are calculated with outdated weights. This disadvantage is especially severe when relative prices change rapidly and, as a result, economic growth can be significantly misrepresented. In addition, the disappearance of products (such as vinyl records, cathode ray tube televisions, and so forth) or the appearance of new products (such as mobile telephony, pharmaceutical tablets, iPads, and the like) can lead to notable distortion in the estimates of economic growth. Even a fixed base year has to be changed every five years, and then all previously published real growth rates will be revised – this change is often not welcomed by users.

4.87. Applying a changing base year means that the weights are updated every year and are usually derived from the previous year. Since those weights are more up-to-date, a better approximation of the volume changes is obtained than with the method of using fixed weights. The time series can be obtained by multiplying separately estimated year-to-year volume indices – this is called “chaining”.

4.88. An important advantage of the chaining method is that the above-mentioned misrepresentation of growth rates is avoided. In fact, chain-linked volume measures provide a more reliable measure of volume growth, provided individual prices and quantities tend to increase or decrease steadily over time. They also have a key disadvantage, however, in that when the time series are in prices of the previous year, the deflated components of an aggregate then no longer add up exactly to the deflated aggregate. As a result, mathematical discrepancies will appear that cannot be removed without distorting the underlying actual volume and price movements.

### (i) Documentation

4.89. As the compilation of SUTs is a complex process, a thorough documentation of the basic data and the methods used, the problems encountered, the solutions applied, and the results achieved is highly recommended. Such an annual (or quarterly, if appropriate) inventory is not only worthwhile for purposes of publication but also for internal use in the compilation process itself and future exercises. When SUTs have to be balanced, information on, in particular, the sources and methods of estimation for each single supply and use element is needed to evaluate and analyse industry and product imbalances. The documentation helps to evaluate the data quality and outline the strategy for balancing. The balancing steps should also be documented, of course, in order to avoid repeating changes and the destruction of already balanced data.

4.90. Documentation of the various compilation steps can also point to missing data issues and problems of basic data quality. It is important that such findings are used as feedback to primary statistics and to identify priorities in improving the compilation methodology. A documentation system for the SUTs should be seen in the frame of the overall documentation for the system of national accounts data.

4.91. Producing a balanced set of SUTs for several years is like solving a puzzle. At first, all macroeconomic data, survey results, census results and other valid economic data on supply and use of products in the economy have to be collected. In a second step, missing data have to be estimated on the basis of harmonized methodologies and documented procedures. In the third and final stage, the balancing of the SUTs system generates a consistent set of macroeconomic variables in current prices and in previous years' prices. Thus the documentation of all stages of the compilation of hard data in terms of sources and soft data in terms of estimates and adjustments, ideally for each cell of the SUTs system, is key. In turn, a quality assessment using clear criteria for each cell can also be developed over time.

4.92. Links between survey data and final national accounts data should be maintained in the system, in particular separately recording documentation on the survey data, coverage adjustments, conceptual and valuation adjustments, quality adjustments and balancing and coherence adjustments. Analyses of these types of adjustments over time and over successive exercises can also help to highlight any biases, incoherence in data sources, and other shortcomings and, in turn, help in developing priorities and strategies for further improvements and investment.

## C. Collect phase

4.93. The collect phase of the GSBPM (see figure 3.2) consists of all the activities concerning the collection and gathering of all necessary information (data and metadata), using different collection modes (including extractions from statistical, administrative and other non-statistical registers and databases), and their storage in an appropriate structured environment for further processing. While it may include the validation of dataset formats, it does not include any transformations of the data themselves, as these are all effected in the "process" phase. For statistical outputs produced regularly, this phase occurs in each iteration.

4.94. Generally, the compilation of SUTs and IOTs relies on the data sources used for calculating GDP according to the production, income and expenditure approaches. An overview of the range of data sources generally used is provided in Box 4.3.

4.95. It should be noted that this situation is reversed in some countries, such as Chile and Japan, where the requirements of SUTs (and IOTs) are first clearly defined and then the surveys (regular and ad hoc) are undertaken to collect data to meet these requirements. This may be ideal for SUTs (and IOTs), but it may also be more costly.

4.96. The compilation of SUTs is data demanding and in principle could be based on many sources that could help to populate the SUTs. It is strongly recommended, however, for purposes of timeliness, that more data sources should be regularly available, and that these are also based on official statistics, preferably using the same business register sampling frame. It is also worth noting that many sources can provide data feeding into both the supply table and the use table for the respective industries and products, as appropriate. For example, annual structural surveys provide details on both sales and purchases.

**Box 4.3 Data sources generally used**

Monthly, quarterly, annual, regular and ad hoc business surveys based on the business register sampling frame:

- Monthly business surveys covering production, distribution, construction and service industries and financial information such as employment and turnover
- Monthly surveys collecting price-related details such as producer (input and output) prices covering all industries (for example, manufacturing and services), retail and consumer price indices, import prices, export prices, and earnings and wage prices
- Quarterly business surveys covering areas like capital expenditure, inventories and profits
- Annual business surveys covering structural business statistics for each industry:
  - Detailed information covering such variables as turnover, employment, purchases, capital expenditure, inventories, holding gains, taxes and subsidies, and others
  - Detailed sales by type of product
  - Detailed purchase data by type of product, covering intermediate-type products and capital-type product separately
- Range of quarterly and annual surveys covering financial services, in particular financial assets and liabilities, international trade in services and foreign and direct investment
- Economic censuses every three to five years.

Household-based surveys:

- Living costs and food surveys – collecting details on expenditure by households
- International passenger surveys – expenditure by residents abroad and non-residents' expenditure in the domestic economy
- Labour force surveys – collecting details on employment including hours worked

Administrative data:

- Census – population estimates for grossing purposes for use in household-based surveys
- Pay and profits data relating to tax and employment records from collecting government departments, along with data covering self-employed incomes
- VAT payments data and turnover subject to VAT by industry (and by product where differential rates exist) from the tax collecting departments
- Imports and exports of goods data collected by customs

Other government departments:

- Agriculture industry data from the agricultural ministry
- Banking industry data from the central bank
- Data on government incomes and expenditures from the finance ministry – expenditure will need to be split between the individual consumption and collective consumption categories. This source can also provide the full range of taxes receivable and subsidies payable

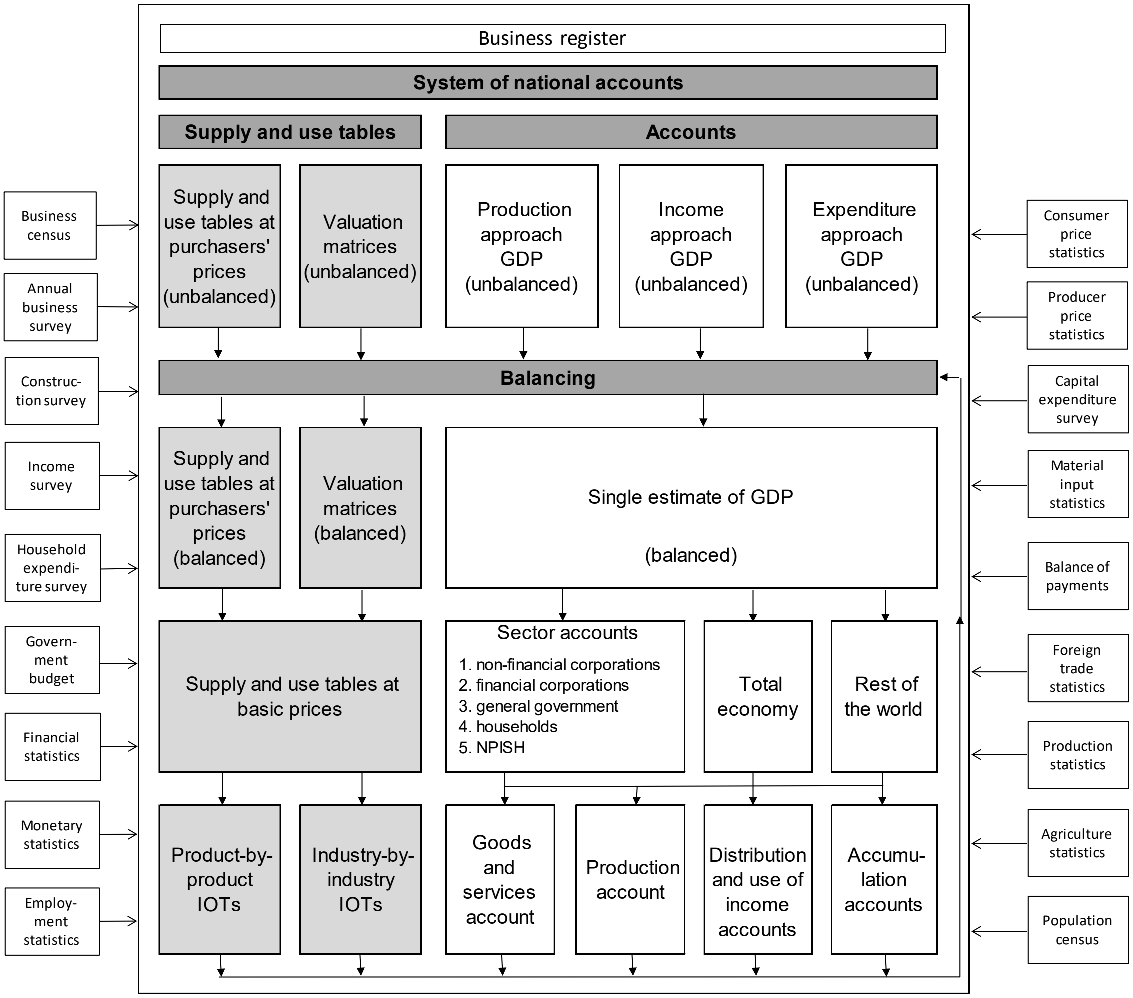
Other sources:

- Company annual report and accounts (in general, the direct use is limited, however these are often used for public utility companies like electricity, gas, water, postal services, telecommunications and others, in many countries)
- Regulatory bodies' accounts
- Insurance data from the insurance industry regulators
- Airline data from the airline industry regulators
- Financial details from company websites which supplement the company annual report and accounts

4.97. The compilation of SUTs, whether carried out as an integral part of the compilation of national accounts (as recommended in this Handbook) or as a separate compilation from that of the national accounts, is based to a large extent on the same data sources as those used for the national accounts. Figure 4.1 expands on figure 2.3 in chapter 2 to show the typical data sources used for the compilation of national accounts, which also feed into the compilation of SUTs and IOTs. Often the same source can provide data feeding into more than one of the approaches to measuring GDP. For example, the agricultural data from agricultural departments often feeds into all three approaches to measuring GDP, thereby ensuring natural consistency and coherence of the data used in SUTs.

4.98. In general, there is a strong correlation with the level of detail used within the SUTs and the quality of the product balances and the aggregates. The more disaggregated the level of industries and products, the higher the degree of matching of individual products in terms of allocation of uses, prices and other characteristics and hence the better the quality. If the product level is too aggregated, the individual products may be too broad and heterogeneous, and therefore of lesser quality.

**Figure 4.1 Overview of SUTs and IOTs as part of the SNA compilation**




## 1. Typical data sources

### (a) Structural surveys

4.99. Many countries rely on annual structural type surveys which fit in naturally to the needs of the SUTs framework. One of the advantages of such a set-up is that it allows the collection of a range of variables from a single source – the statistical unit – thereby ensuring the consistency and coherence of each variable and across variables. Thus, the employment data will be consistent with the turnover data and, in turn, with the derived GVA data.

4.100. Where annual structural surveys exist, data for a number of key variables are collected with more detail supplemented from other surveys (for example, detailed purchases data). These variables can include:

- Sales of goods and services (and an appropriate product breakdown)
- Purchases of goods and services (and an appropriate product breakdown)
- Purchases and sales of goods for resale without any further processing (this helps to produce the trade margins by type of product)
- Changes in inventories (a split between materials and fuels, work-in-progress and finished goods not sold is required, as the first category affects intermediate consumption and the latter two categories affect output)
- Capital expenditure (and an appropriate product breakdown)
- Employment costs (and an appropriate breakdown)
- Taxes on products and production (covering business rates, excise duties and others)
- Subsidies on products and production (covering agriculture, transport and others)
- Areas such as research and development, and international trade in services, which link to other related surveys

4.101. Often data compiled to respond to statistical regulations are used in the compilation of SUTs. For example, in the European Union, statistical regulations for member States cover various business statistics derived from monthly, quarterly and annual surveys providing short-term indictors and structural business statistics. Data from many of these sources also feed into the compilation of SUTs. The Handbook on the Design and Implementation of Business Surveys (Eurostat, 1998), provides extensive detail on the conduct of such surveys.

### (b) Administrative data

4.102. Administrative data constitute a key data source for the compilation of both quarterly and annual national accounts and, in some countries, administrative data may be the main data source. The use of administrative data is growing under the influence of a number of factors, such as good coverage, declining resource impact on national statistical offices and lessening of the response burden.

4.103. Administrative data have statistical strengths and weaknesses vis-à-vis sample surveys. Apart from the low cost of obtaining administrative data, their major strength is that they commonly have complete – or nearly complete – coverage of the fields to which they relate. As a result, there are no sampling errors and any non-sampling errors, such as those arising from an out-of-date business register and inadequate new business provisions, are scarce and minor.

4.104. The weaknesses of administrative data arise from the fact that they are by-products of administrative systems which are not generally designed to meet the needs of the national accounts. Examples of these weaknesses include the following:

- Available data do not meet national accounting definitions (for example, wages rather than compensation of employees, or a measure of depreciation that differs from the national accounting concept of consumption of fixed capital).
- Purchases registered in the VAT system will usually include both purchases for intermediate consumption and for gross capital formation.
- Data are not recorded on an accrual basis (for example, exports and imports from customs are recorded as they cross the customs frontier and not when they change ownership).
- Data are incomplete (for example, movement of oil rigs in and out of territorial waters are excluded from customs data).
- Data may not be disaggregated in a desirable way (for example, government expenditures may not distinguish between wages and intermediate consumption or new motor vehicle registrations may not distinguish between household and business use).
- Administrative data may be untimely (for example, company tax data).
- Administrative data may undergo change as a result of a change in policy.

**(c) Business and company accounts-based statistics**

4.105. The values of outputs, inputs, gross capital formation and other elements have their counterparts in business accounts or government accounts, but the concepts used in business accounting often do not consistently follow national accounts definitions. Further details on this issue may be found in United Nations (2000b) and Mahajan (2013). A few examples are listed below:

- Differences between concepts: financial intermediation services indirectly measured (referred to as FISIM), insurance services, and others.
- Change in inventories: different valuations, correction for holding gains and losses, and others.
- Distinction between intermediate consumption and capital formation: acquisitions of machinery and equipment included in current expenses, and others.
- Distinction between intermediate consumption and compensation of employees: fringe benefits, links to own account production, and others.
- Use in business accounts of a time frame that does not follow the calendar year: often accounts that are closest to the calendar year can be used as an approximation for the annual

values but it may be appropriate to correct figures for some big enterprises that have accounts that cover other periods or may have large seasonal patterns, such as the gas supply industry.

- Use in government accounts of a fiscal year that differs from the calendar year. It can be misleading to use the information for the nearest fiscal year as if it were identical to calendar year data. Annual data can be calculated by weighting together data for the two fiscal years that overlap the actual year. A better method is, however, to use quarterly or monthly information to split the data from each fiscal year into the shares belonging to different calendar years where such information exists.

**(d) VAT-based statistics**

4.106. The VAT system usually provides statistics on those units that are covered by the business register, which will also use VAT-registered businesses as a source. The business register generally includes the units that collect VAT on all or a part of their turnover and those that can deduct VAT on all or part of their purchases (capital or current).

4.107. The VAT-based statistics may exist in published form but, even when not published, they can usually be obtained from the authorities that are responsible for collection of VAT, with appropriate service level and confidentiality agreements in place. Typically, this source will contain information on VAT-liable, zero-rated and VAT-exempt turnover and also on deductible and non-deductible purchases with a classification by industries.

4.108. The VAT-based statistics tend to be available on both a quarterly and an annual basis, and are usually available shortly after the reference period. A correction based on the final dates of payment may be necessary if the statistics show payments instead of accruals.

4.109. There are pitfalls to bear in mind when using VAT-based statistics for national accounts purposes:

- The concepts used in VAT-based statistics are different from those used in national accounts. As VAT-based turnover covers sales of products from own production, sales of traded goods and sales of used capital equipment, the VAT purchases cover purchases of goods and services for use as inputs, goods intended for resale and also purchases of capital equipment. Before these figures can be used in national accounts, the VAT purchases must be split into the different shares based on details payments.
- VAT-based statistics do not show figures for units with activities that are not VAT-liable and they may not include units with turnover below certain thresholds. Such thresholds differ from country to country but will often exclude a significant share of the smaller enterprises. The informal economy can – by its very nature – be assumed not to be included in the VAT-based register sources.

- The industry classification of the VAT-based units may not be the same as the classification used in national accounts.
- For practical reasons, the units accepted in VAT-based statistics may be enterprises, kind-of-activity units, establishments, or even conglomerates of enterprises which are allowed a joint registration for payment of VAT.

4.110. Despite such caveats, the VAT-based statistics may still be the most reliable data source for the size of some industries that are poorly covered by other sources. The figures from VAT-based statistics should, however, be seen as the minimal size of the industries in question. It can be necessary to add values for units below the threshold values and VAT-exempt units, including those operating in the informal and hidden economy.

**(e) Missing data**

4.111. If certain data are not available in the official statistical system, the first option would be to check whether such data are available outside official statistics. One such example is when intermediate data on advertising costs are not available as a separate item in the business surveys. In this case, one possible source could be data from relevant trade associations observing the advertising market. Despite the fact that the data are often not sufficiently comprehensive, or the classifications differ from the official classifications, so that the data do not fully conform to the required concepts, these data certainly give a good indication of the advertising market across the various industries.

4.112. There may be a full set of data observations for a period, and then again for a later period. Various modelling techniques exist for generating estimates for the intervening periods to populate the SUTs, such as the basic Holt-Winters approach (Holt, 1957; Winters, 1960). When balancing SUTs, however, these estimates should be treated as being of much lower quality than the more reliable and up-to-date estimates.

4.113. Furthermore, if no specific data are available, the expert advice of chambers of commerce, trade associations, research institutes or other similar organizations could be useful.

4.114. In certain industries, a single company or a few companies are the big players in that market. Those could also be specifically contacted for expert input or to request some of their internal data on a confidential basis. For example, telecommunication companies may provide their revenue data by type of customer; supermarket chains may be asked to provide data on their sales by products; major railway companies may provide data on the goods transported, and so on.

4.115. Annual company reports and accounts, publications of regulatory bodies and trade associations, and internet company websites are very useful sources of financial data for businesses and households.

4.116. Certain estimates can be based on the identities and coherence of the SUTs framework. This holds true for the application of the product flow method, where detailed supply data are used to estimate certain use data. The product flow method basically applies fixed allocations which will need to be reviewed each year. The method should be applied with great caution in populating SUTs and will depend on the level of product detail. The collection of primary data from various sources with data confrontation provides the best approach to the populating of SUTs and the attainment of good quality results.

### (f) Exhaustiveness: methods of grossing up

4.117. Statistical sources usually exclude units with employment or turnover below certain thresholds, while national accounts data should include estimates for these missing units. The methods used for grossing up will typically be based on an estimate of employment in the excluded units, and assumptions on output, input, capital formation and other factors by employee. These assumptions should as far as possible reflect the conditions in comparable units but when the small units are not covered by source data, the grossing up procedure will necessarily add to the uncertainty of the estimated totals. It can also be expected that the structures of outputs and inputs of small units are somewhat different from those found in the units covered by collected data.

4.118. There is considerable interest in the phenomenon of the non-observed economy. This term is used to describe activities that, for one reason or another, are not captured in regular statistical enquiries, because they are underground, illegal or informal, consist in household production for own final use, or simply because of deficiencies in the basic data collection system. Guidance in this regard is provided in the handbook on measuring the non-observed economy (OECD, ILO and Interstate Statistical Commission, 2002) and in the manual on the informal sector (ILO, 2013).

4.119. In countries where a significant share of total output and input is found in the informal economy, it can be appropriate to conduct specific surveys of this activity. With a view to confronting data on the supply and use of labour, useful information on this subject may actually be found in population censuses, household budget surveys or labour force surveys. In this respect, the SUTs framework, in which available source data are combined and balanced, offers the most promising means of arriving at exhaustive estimates of economic activity.

# Part three

# Chapter 5. Compiling the supply table

## A. Introduction

5.1. The first step in the compilation of SUTs and IOTs is the construction of an initial and unbalanced version of the supply table. The values entered into the tables should reflect, as far as possible, all available knowledge and data on the product structure of each column, although many values may need to be changed when the SUTs system is balanced. This applies to estimated totals and also to the values of supply of specific products.

5.2. Before balancing takes place, the estimates for domestic supply, imports of goods and services should be checked for credibility, and if necessary adjusted as appropriate. These will then form the starting point for the balancing process.

5.3. This chapter focuses on the steps and data sources needed to compile this initial, unbalanced version of the supply table. Section B provides a more detailed overview of the structure of the supply table. Section C focuses on the compilation of the domestic output table and the necessary compilation steps and section D focuses on the compilation of the imports of goods and services. Annex A to chapter 5 provides an example of a questionnaire on the collection of sales of goods and services, inventories of goods and trade-related data.

## B. Structure of the supply table

5.4. The supply table shows the supply of goods and services for a given period of time by type of product of an economy and distinguishes between the output of domestic industries and imports by type of product. The supply table is generally compiled first at basic prices, reflecting the valuation of the data sources. As illustrated in Table 5.1, the supply table at basic prices consists of two main parts: domestic output and imports of goods and services.

5.5. The domestic output matrix contains information on the supply of products by the different industries. The column for the imports of goods and services contains information on the total imports by product. The matrices for domestic output and imports of goods and services have the same row structure, defined by product categories. This structure allows for the horizontal aggregation of all the elements and the transition from total supply of products at basic prices to total supply at purchasers' prices.

## Table 5.1 Numerical example of a supply table at basic prices

Millions of euros

| | | | INDUSTRIES | | | | | | | | Imports | Total supply at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agricul-ture | Manufac-turing | Construc-tion | Trade, transport and communication | Finance and business services | Other services | Output at basic prices | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | | (8) | (9) |
| PRODUCTS | Agriculture | (1) | 8 782 | | | | | | 8 782 | | 3 271 | 12 052 |
| | Manufacturing | (2) | 796 | 182 982 | 643 | 1 808 | 133 | 44 | 186 405 | | 124 590 | 310 995 |
| | Construction | (3) | 83 | 961 | 43 060 | 734 | 255 | 179 | 45 272 | | 563 | 45 835 |
| | Trade | (4) | 1 | 4 773 | 311 | 54 204 | 640 | 257 | 60 187 | | 600 | 60 787 |
| | Transport | (5) | 13 | 465 | 66 | 25 538 | 128 | 125 | 26 335 | | 8 150 | 34 485 |
| | Communication | (6) | 160 | 1 781 | 139 | 43 912 | 1 253 | 982 | 48 228 | | 6 234 | 54 463 |
| | Finance and business services | (7) | 29 | 8 902 | 698 | 7 588 | 106 909 | 3 381 | 127 508 | | 7 061 | 134 569 |
| | Other services | (8) | 3 | 85 | 13 | 1 053 | 143 | 74 346 | 75 643 | | 824 | 76 467 |
| | Total | (9) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | | 151 293 | 729 653 |
| Adjustments | CIF/FOB adjustments on imports | (10) | | | | | | | | | - 97 | - 97 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | 6 675 | 6 675 |
| | Total | (12) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | | 157 871 | 736 230 |
| | Total of which: | | | | | | | | | | | |
| | Market output | (13) | 9 763 | 195 916 | 41 462 | 127 401 | 88 330 | 18 116 | 480 989 | | | |
| | Output for own final use | (14) | 104 | 4 029 | 3 468 | 2 134 | 19 890 | 2 670 | 32 295 | | | |
| | Non-market output | (15) | 0 | 4 | 0 | 5 302 | 1 241 | 58 528 | 65 075 | | | |

Table based on 2011 figures from Austria

5.6. The supply table at basic prices is then transformed into the supply table at purchasers' prices, through the addition of valuation adjustments represented by valuation matrices covering trade margins, transport margins, taxes on products and subsidies on products. Table 5.2 shows the valuation adjustments which are added to the columns of the supply table at basic prices to arrive at the total supply of each product at purchasers' prices.

5.7. The first step in the compilation of an initial version of the supply table therefore involves the compilation of data for total domestic output at basic prices and imports valued at CIF prices aggregated to total supply at basic prices. The second step involves the compilation of trade and transport margins, taxes on products less subsidies on products which are used to convert the total supply of products at basic prices to the total supply of products at purchasers' prices.

5.8. The data in the domestic output matrix are valued at basic prices, which is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, plus any subsidy receivable by the producer as a consequence of its production or sale. The value of output of goods excludes any transport charges invoiced separately by the producer.

5.9. Data on imports by product from foreign trade statistics are usually valued at CIF prices. In the 2008 SNA and BPM 6, however, in which total imports of goods are valued FOB, an extra row has to be added for the CIF/FOB adjustments on imports, in order to reconcile the different valuations. These adjustments are shown in row (10) of Table 5.1 and explained in detail in section

D. In addition, a further adjustment is added in the supply table to account for direct purchases made abroad by residents: this is shown in row (11) in Table 5.1.

5.10. These adjustments in the supply table (rows (10) and (11) in Table 5.1 and Table 5.2) have corresponding entries in the use table (rows (10) and (11) in table 6.1) under the columns for exports and final consumption expenditures by households. It should be noted that some countries do not show these estimates in separate rows but consolidate the values across the product groups in the respective columns, thereby providing a different product balance.

**Table 5.2 Supply table at basic prices, including a transformation into purchasers' prices**

Millions of euros

| | | | INDUSTRIES | | | | | | Output at basic prices | Imports | Total supply at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agricul-ture | Manufac-turing | Construc-tion | Trade, transport and communication | Finance and business services | Other services | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| PRODUCTS | Agriculture | (1) | 8 782 | 0 | 0 | 0 | 0 | 0 | 8 782 | 3 271 | 12 052 |
| | Manufacturing | (2) | 796 | 182 982 | 643 | 1 808 | 133 | 44 | 186 405 | 124 590 | 310 995 |
| | Construction | (3) | 83 | 961 | 43 060 | 734 | 255 | 179 | 45 272 | 563 | 45 835 |
| | Trade | (4) | 1 | 4 773 | 311 | 54 204 | 640 | 257 | 60 187 | 600 | 60 787 |
| | Transport | (5) | 13 | 465 | 66 | 25 538 | 128 | 125 | 26 335 | 8 150 | 34 485 |
| | Communication | (6) | 160 | 1 781 | 139 | 43 912 | 1 253 | 982 | 48 228 | 6 234 | 54 463 |
| | Finance and business services | (7) | 29 | 8 902 | 698 | 7 588 | 106 909 | 3 381 | 127 508 | 7 061 | 134 569 |
| | Other services | (8) | 3 | 85 | 13 | 1 053 | 143 | 74 346 | 75 643 | 824 | 76 467 |
| | Total | (9) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | 151 293 | 729 653 |
| Adjustments | CIF/FOB adjustments on imports | (10) | | | | | | | | - 97 | - 97 |
| | Direct purchases abroad by residents | (11) | | | | | | | | 6 675 | 6 675 |
| | Total | (12) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | 157 871 | 736 230 |
| | Total of which: | | | | | | | | | | |
| | Market output | (13) | 9 763 | 195 916 | 41 462 | 127 401 | 88 330 | 18 116 | 480 989 | | |
| | Output for own final use | (14) | 104 | 4 029 | 3 468 | 2 134 | 19 890 | 2 670 | 32 295 | | |
| | Non-market output | (15) | 0 | 4 | 0 | 5 302 | 1 241 | 58 528 | 65 075 | | |

| | | | Total supply at basic prices | VALUATION MATRICES | | | | | | Total supply at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Trade margins | Transport margins | VAT | Taxes on products | Subsidies on products | Total | |
| | | | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 12 052 | 1 926 | 274 | 329 | 57 | - 107 | 2 479 | 14 532 |
| | Manufacturing | (2) | 310 995 | 48 838 | 2 540 | 13 175 | 7 866 | - 49 | 72 370 | 383 364 |
| | Construction | (3) | 45 835 | 0 | 0 | 1 529 | 13 | 0 | 1 542 | 47 377 |
| | Trade | (4) | 60 787 | - 52 341 | 0 | 575 | 11 | 0 | - 51 755 | 9 032 |
| | Transport | (5) | 34 485 | 0 | - 2 800 | 558 | 71 | - 448 | - 2 620 | 31 865 |
| | Communication | (6) | 54 463 | 1 493 | 9 | 3 375 | 217 | - 34 | 5 059 | 59 522 |
| | Finance and business services | (7) | 134 569 | 0 | - 22 | 2 706 | 2 159 | 0 | 4 842 | 139 411 |
| | Other services | (8) | 76 467 | 85 | 0 | 1 201 | 576 | 0 | 1 861 | 78 329 |
| | Total | (9) | 729 653 | 0 | 0 | 23 447 | 10 969 | - 638 | 33 778 | 763 431 |
| Adjustments | CIF/FOB adjustments on imports | (10) | - 97 | | | | | | - 97 | - 97 |
| | Direct purchases abroad by residents | (11) | 6 675 | | | | | | 6 675 | 6 675 |
| | Total | (12) | 736 230 | 0 | 0 | 23 447 | 10 969 | - 638 | 40 356 | 770 009 |
| | Total of which: | | | | | | | | | |
| | Market output | (13) | | | | | | | | |
| | Output for own final use | (14) | | | | | | | | |
| | Non-market output | (15) | | | | | | | | |

Table based on 2011 figures from Austria

5.11. A distinction may be made in the SUTs between the three types of production: market output; output for own final use; and non-market output. In the domestic output matrix, however, these three categories of production are usually grouped together in the relevant industries and shown in three supplementary rows for each industry. Thus government services are distributed in the system according to the various activities in which the government is engaged: for example, public administration services, education services, health services, recreation services, social welfare services, and others, but are shown together with the corresponding market producers. For example, health services provided by market and non-market producers (within the same industry) are shown as a total. Furthermore, for some industries, the supplementary rows are useful for the link with the institutional sector accounts.

5.12. Although the supplementary rows make it possible to split output by industry into the three categories of output, there is no product dimension. Ideally, each industry should be shown separately (also reflecting different structures and links between the output and the inputs) or additional analyses produced for the user.

5.13. Imports of goods and services are classified by type of product. Since this table is designed to show the total supply by type of products, the valuation of imports of goods should be compatible with the valuation of the domestic production of goods. Imports by type of product are therefore valued at CIF prices which are comparable with the domestic output at basic prices. Although total imports of goods are valued at FOB prices, it is not easy to move the imports of goods by type of product to CIF prices, as this depends upon the source data and the person providing the transportation (see 2008 SNA, para. 14.77).

5.14. The addition of the two components – production and imports – gives the total supply of products at basic prices.

5.15. The supply table at purchasers' prices is obtained by adding various valuation matrices (earned on both domestic output and imports) to the total supply at basic prices, thus enabling movement from one valuation to another. The valuation matrices include:

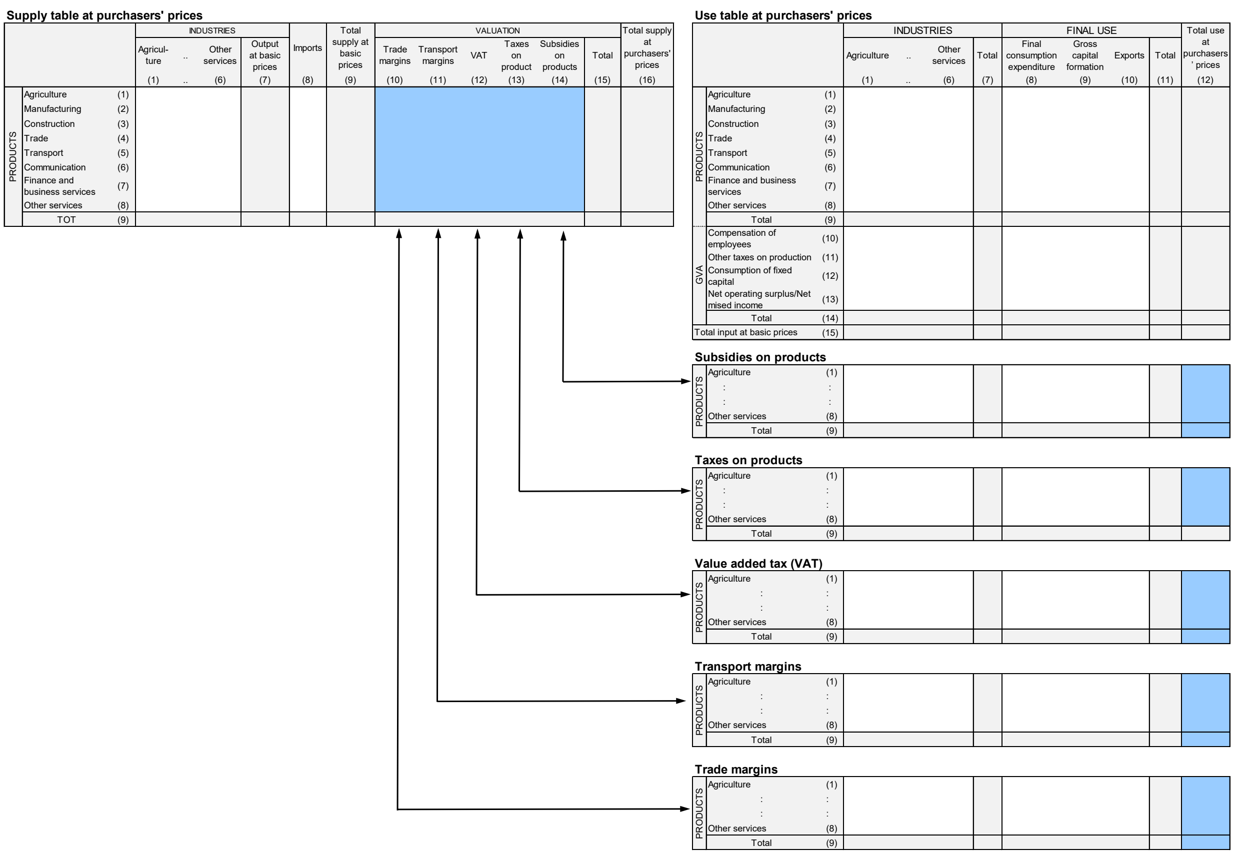
- Trade margins
- Transport margins
- Taxes on products (with non-deductible VAT treated separately from other taxes on products)
- Subsidies on products (which are deducted)

5.16. It should be noted that, when the supply table is shown with the final column summing to purchasers' prices, it is referred to as the supply table at purchasers' prices. This is actually just the supply table at basic prices with the addition of the valuation columns. The production and import sections of the supply table have not been changed and remain valued at basic prices.

5.17. The task of compiling SUTs is a highly integrated process. This is particularly true for the estimation of the valuation vectors and matrices, where it is often necessary to rely also on estimates from the use table side in order to obtain the valuation vectors entered into the supply table. Figure 5.1 provides an overview of how the valuation matrix in the supply table is linked to a sequence of valuation matrices in the use table. This figure also demonstrates the interconnections between the valuation matrices linking the supply table and use table. The estimation of the valuation matrices, considering both the supply table and the use table, is dealt with in chapter 7.

5.18. The rest of this chapter focuses on the compilation of the supply table at basic prices.

**Figure 5.1 Link between valuation matrices in the supply table and the use table**




## C. Domestic output

### 1. Structure of the domestic output table

5.19. The first and most elaborated part of the supply table is the domestic output matrix. This records data on the production of the economy classified along two dimensions: the rows represent the type of products (based on CPC Version 2.1) and the columns represent the different industry groupings (based on ISIC Rev. 4). Thus the rows show the domestic output matrix, a single product by producing industry, and the columns show all the products produced by a single industry.

Although this is consistent with CPC and ISIC, countries may however use different and more detailed classifications, for example, those which reflect country-specific activities.

5.20. The domestic output matrix reflects the principal and secondary products of industries including by-products. It is the principal activity of the statistical unit that determines its classification to a specific industry. In special cases where the domestic output matrix is square (the number of products being equal to the number of industries), and the sequence of products arranged to reflect the sequence of the industries (based on their principal activities), the principal activity of an industry is reported on the diagonal of the matrix, while the secondary activities of an industry are listed as off-diagonal entries.

5.21. In practice, however, it is common to have more products than industries. For this reason, the production part of the supply table is usually a rectangular matrix with more rows than columns, as shown in Table 5.1. This reflects the fact that it may be of more interest to specify, for example, different kinds of agricultural crops, in the case of agriculture, and of less interest or practical use to distinguish farms specializing in each possible type of crop. In this case, all the crops would still form the principal output of agriculture, whereas, for example, the production of wine or the construction of buildings for own use would be treated as secondary outputs of the industry. The greater the level of product detail, the more scattered the entries will be around the principal products. In these cases, it is not possible to observe directly the distinction of principal products versus secondary products or production in the rectangular domestic output matrix.

5.22. Annex A to this chapter provides an extract of a survey questionnaire collecting data on sales of goods and services by type of product, in addition to other variables by product, such as opening stocks (inventories), closing stocks (inventories) and trade margins.

5.23. Even though the industry concept is already being applied in the national accounts, the existing level of detail or precise delimitation should not be viewed as a constraint when compiling SUTs and, in particular, when compiling benchmark tables. On the other hand, the way in which statistical units are defined and classified in the business register and covered in basic statistics represents a real constraint on the possible choices concerning industries in the SUTs. Even though industries may, in the process of compiling SUTs, be redefined to some extent or otherwise modified in terms of their basic statistics, the options are much more limited than the range of choices available when it comes to deciding what product classification should be applied.

5.24. The choice of the level of detail for industries and products to be used in the SUTs must be based on a thorough examination of the available statistics and considerations concerning the advantages of using product details in balancing, in estimating margins and taxes on products by uses, final uses by purpose, in volume estimates and in other applications. The general recommendation, however, is to work with as much detail as possible, as any aggregation of basic statistics will also entail a loss of information that could at some stage have contributed to the overall quality of the balanced SUTs (on this issue, see also chapter 4).

5.25. It is also necessary to clarify any user requirements about the format of the final table, including international reporting. In general, it would be an advantage to work at a more detailed level than that warranted by current uses, in order to extract the maximum information from available data sources and to be prepared for the emergence of new uses and for transformations necessary to comply with future changes to economic activity and product classifications.

## 2. Primary statistics and data sources

5.26. The structure of economic entities varies from small enterprises engaged in one or a few activities that are undertaken either at, or from, a single geographical location to large and complex enterprises engaged in many different activities. These enterprises may be horizontally or vertically integrated, and their activities may be undertaken either at, or from, many geographical locations. The way in which producer units are defined, measured statistically, broken down or aggregated is of fundamental importance when compiling SUTs.

5.27. In practice, compilers of SUTs will not deal with individual economic units but only with the aggregates of units in the form of industries, usually based on current business statistics by economic activity. To arrive at a full understanding of the role of these statistics in the compilation of SUTs, it is necessary to assess the delimitation of units that influence the properties of the industries.

5.28. The most important prerequisite for the collection of basic statistics is the business register and the types of economic units that it holds. Ideally, business registers will contain two types of unit: enterprise units and establishments.

5.29. Usually the enterprises form the core units of the business register, as they are easier to identify and track on a current basis because of their legal status. The number of establishments created depends on the register policy adopted (in other words, how many enterprises are partitioned into establishments). Different geographical locations of the production units will be one of the main criteria for subdividing an enterprise into several establishments.

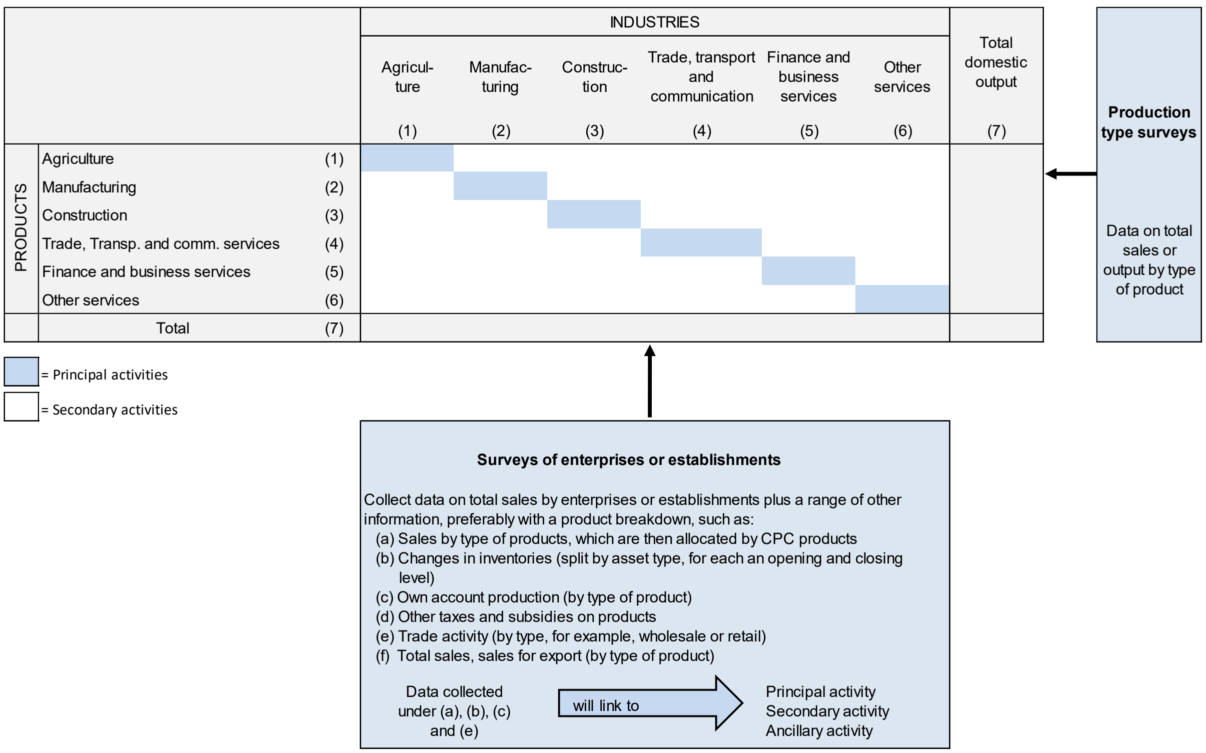
5.30. In the collection of basic statistics, the enterprise will usually serve as the collection entity and, to the extent that the enterprise is made up of several establishments, the enterprise will be requested to report a separate range of statistics for each of those establishments. This has implications for both the supply table and the use table, as some types of costs can only be reported at the enterprise level, whereas it is possible to report all regular production costs for the individual establishments.

5.31. As the large majority of enterprises are small or medium in size, and tend to engage in one kind of activity only, the enterprise and the establishment units may be identical in these cases. Large enterprises, however, which often contribute the bulk of the production of an economy, will often cover different kinds of economic activity and therefore, in formal terms, be made up of several establishment units.

5.32. It is important to note that many primary sources, such as enterprise surveys and production surveys, which are used to collect data feeding into the domestic output matrix, often also collect data at the same time through the same survey questionnaire but feed these into the use table (for example, data on the industries' input structures and gross fixed capital formation). This approach provides the data feeding into the SUTs with a high degree of coherence and consistency.

5.33. The estimates of the domestic output matrix are usually based on two main types of information sources: enterprise surveys and production surveys. Additional information, such as administrative sources, company accounts and others, will also be used. Figure 5.2 provides a simplified view of the different types of information used in compiling the domestic output matrix.

**Figure 5.2 Different types of information used in compiling the production matrix**




5.34. Starting with the enterprise survey, the principal objective is to supply information on the main structural characteristics of the different economic activities. The basic unit of this type of survey tends to be the enterprise. From this source, it is possible to estimate the total production by activity, starting with its private accounting business systems. On the other hand, the production surveys allow the estimation of the total production by type of product.

5.35. Combining both sources of information, enterprise statistics and production statistics, it is possible to combine the data and obtain the production by type of product, by principal activities of the enterprise and by principal activities of the establishment that belongs to this enterprise. Consequently, the principal production and the secondary production of a product can be identified, primarily for industrial products. In many cases, lack of information makes it necessary to use reasonable assumptions about what products are constitute the industries' secondary production.

5.36. Many enterprises may perform some construction work, for example, own-account gross capital formation and minor maintenance and repair work. Enterprises in the manufacturing and service industries are often involved in either wholesale trade or retail trade or even both. Many service industry enterprises may provide retail trade services as a secondary activity. Lastly, activities involving the rental of real estate and leasing of equipment are often secondary activities.

5.37. In basic statistics, output by products will usually be available for goods-producing industries such as agriculture, mining and manufacturing industries – at least for enterprises and establishments above a certain threshold – and similarly imports and exports of goods will be covered in great detail by external trade statistics. For service industries, a breakdown of output by individual kinds of services (as defined in the CPC classification) is less common, although in recent years many countries have developed such statistics. If there is a lack of product statistics for services, the output by the most detailed service activities of ISIC may be used as proxy, assuming that all output consists of the services characteristic for that particular industry. Concerning product breakdowns, construction will be placed between these two extremes.

5.38. For manufacturing units below a certain threshold, output statistics by products will usually be missing, whereas total output will be estimated based on either business surveys or administrative records. Working at the most detailed activity level available, output from these small units can be broken down into the products of the system, for example, by assuming that the composition by product is identical to that which has been observed for the smallest category of those units for which output statistics by product exist. During the balancing process, this assumption may be modified and the output redistributed by product.

5.39. The products recorded in the domestic output part of the supply table should be output valued at basic prices at the time it is completed. For manufacturing industries, it is usually only sales by product that are given in the surveys and adjustments would need to be made for change in inventories of finished goods and work-in-progress, in order to move from sales to output.

5.40. When information exists about opening and closing inventories by industry, it can be assumed that the composition by product is identical to the sales by product. The change in inventories of finished products and work-in-progress by product can be derived by applying relevant price indices and assumptions about inventory valuation principles used by enterprises. As the reliability of these data by product is limited, however, and as, by definition, these data should always be identical on the supply side and the use side, there is no need to adjust the sales figures or enter them into the final use category of changes of inventories at this stage. In the system, it is the actual sales figures that are relevant for the distribution by users, and the estimated data for change in inventories can therefore be simply imposed on the system after the balancing has been completed. This is, however, not the case for change in inventories of materials and fuels (recorded in the intermediate use part of the use table) and in trade. Changes in inventories of agricultural products and mining products will usually have to be included in the system from the outset, as the output data will often refer not to sales but to actual output.

### 3. Principal and secondary products

5.41. The distinction between principal and secondary production has traditionally played a prominent role in I-O literature, as the existence of secondary production requires certain assumptions for IOTs to be compiled. It should be noted, however, that a match between products and industries (determining in which industry a product is the principal output) is really only necessary in those cases where the chosen techniques for deriving IOTs as a starting point requires the SUTs to be aggregated to square tables, cases where the sequence of the aggregated products is made comparable to the sequence of industries. With regard to other techniques for the compilation of IOTs and for the purpose of the SUTs, there is no need to match products and industries. It should thus be noted that, when industry-by-industry IOTs are derived on the assumption of fixed product sales structures, there is no need first to aggregate the rectangular SUTs.

5.42. When necessary, the match between product and principal producer can be derived either theoretically (by identifying for each product the principal producer according to the ISIC definitions of the principal products of each industry – the correspondence keys are available on the United Nations Statistics Division classification website at http://unstats.un.org/unsd/class/default.asp) or empirically (established by observation of the actual domestic output matrix, the industry being the main producer of each product).

5.43. In principle, the empirical match will be the most precise in the sense that it depicts the production relationships as they actually exist in this particular economy. The theoretical match may be the preferred approach when considering time series and international comparisons. These matching methods also demonstrate that the product classification applied when compiling SUTs can be chosen completely independently of whether or not it may subsequently be necessary to derive square SUTs.

5.44. When the domestic output matrix is aggregated to a square matrix and arranged so that the entries for the primary products fall on the diagonal, the off-diagonal elements show the extent of secondary production. This refers to that part of a product which is produced by industries other than the one where it principally belongs either formally according to the industrial classification (theoretical aggregation key), or according to the industry which is actually the main producer (empirical aggregation key).

5.45. As the secondary production observed in the domestic output matrix depends on the level of aggregation both of products and of industries, secondary production does not possess any observable characteristics of its own. The elusive character of the concept of secondary production makes it difficult to justify that a product should be of particular interest statistically just because it is produced in two or more industries at a certain level of industry or product aggregation. When the industry and product classifications to be used in SUTs have been decided (inclusive of possible redefinitions), the principal versus secondary distinction plays no role in the subsequent elaboration and balancing within the SUTs framework.

5.46. For most countries, the domestic output matrix is characterized by showing secondary production almost exclusively for manufacturing industries, whereas for most other industries, practically all the production is found on the diagonal elements (or in the rectangular table – in what is known as the "diagonal field"). There are three main reasons for this:

- Basic statistics for manufacturing industries have traditionally included detailed product statistics and thus make identification of secondary production possible.

- For service industries, the diagonal structure is simply due to the fact that, more often than not, very limited detail has been collected on the type of product breakdown of these service activities. Thus, the total output from establishments (or even enterprises) must be assumed to be the primary output of the industries to which the units are classified in the business register.

- The activities of industries such as agriculture, construction and trade are often defined in a purer form (the industries covering all their principal products, and only those) in the national accounts and SUTs than in the business register. In this case, all secondary agricultural, construction and trade activities in other industries would have been transferred to their main activities. Alternatively, data for some activities may have been constructed in such a way that from the outset no secondary production exists, for example, agricultural activity is measured as the sum of all agricultural products, construction activity as the value of new construction and repairs, and so forth.

5.47. When the rectangular SUTs have been balanced, there may be a need to aggregate them into a square system either for dissemination purposes or for compiling IOTs by methods that require square SUTs. In a square system, the number of product groups must be identical to the number of industries, and furthermore, the products aggregated in such a way that the resulting product groups can be given corresponding industry names, indicating the industry of which they are principal products. If aggregation is made solely for dissemination purposes, the product aggregation could also be carried out to, for example, higher levels of CPC – which, as mentioned above, have no direct correspondence with ISIC defined industries.

### 4. Ancillary activities

5.48. When the production of an enterprise takes place in two or more different establishments, certain ancillary activities may be carried out centrally for the collective benefit of all the establishments. If, in such a case, a producer unit is undertaking purely ancillary activities and is statistically observable, in that separable accounts for the production that it undertakes are readily available, or if it is in a geographically different location from the establishments that it serves, it may be desirable and useful to consider it as a separate unit and to allocate it to the industrial classification corresponding to its principal activity. Another exception is the case when some products are used both for own ancillary use and also supplied to another unit (see 2008 SNA, para. 14.33). In the 2008 SNA, however, it is recommended that statisticians do not make extraordinary efforts to create separate establishments for these activities artificially in cases where suitable basic data are not available.

5.49. The fact that establishments, even at a detailed level, are classified to the same activity, does not mean that they are in all respects identical. Each establishment has its own unique institutional and organizational characteristics, which may influence the composition of its purchases as much as the underlying technical production processes. Two establishments producing identical products may have quite different input structures, depending on the degree of reliance on purchased semi-fabricated products, outsourcing of certain activities (see also chapter 8, section D, on goods sent abroad for processing), whether it owns the capital equipment and buildings it uses rather than leasing or renting them, and so forth, and in general, on the degree of vertical integration of the various stages of the production processes. There is no way that these institutional characteristics inherent in the original source data should be eliminated from the SUTs (or subsequently from the IOTs) nor does the SNA expect the compilers to try to do so.

5.50. Institutional arrangements of production not only differ between establishments classified in the same industry but also across countries and over time. It is obvious that there are serious limitations to the view that the SUTs (and the IOTs) portray the technical characteristics of a production system. From a statistical point of view, the achievable elimination of institutional arrangements is obtained by using establishments as production units (with the possible additional partitioning of vertically integrated enterprises as discussed above), given that the establishments are designed with this purpose in mind and there are no official statistics providing production structures below this level.

5.51. In some countries, the recommended establishment unit approach may not be achievable in practice, since, for legal, practical or historic reasons, statistics are only collected for enterprise units. Even though compilers of the SUTs may in this situation try to break down the most important multi-activity enterprises into their constituent establishment units, there is in general no feasible alternative to working with the existing data. In this case it is still possible to compile SUTs, although the overall picture of the productive system will become less precise and to some extent blurred, which will also have an adverse effect on the resulting SUTs and IOTs.

5.52. It should, however, be recognized that the important objectives of compiling the SUTs may also be achieved when the data are based on enterprise units (see SNA 2008, para. 14.21), although some product-flow and common-sense procedures may be more difficult to apply because of the less stringent definition of industries, as the composition of output from the enterprise units will also be crossing the borderlines between sections of ISIC. For these reasons, an enterprise-based approach will in general require more thorough coverage of statistical source data. It should also be borne in mind that there are no automatic methods available that can disentangle this dataset and transform it into SUTs or IOTs with analytical properties comparable with those resulting from SUTs based on establishment-type units. Depending on the specific circumstances, it may in such cases be decided to compile SUTs alone and not IOTs.

## 5. Redefinitions

5.53. Redefinitions refer to adjustments made to the source data relative to the way in which they are obtained from the primary statistics, in order to obtain "purer" industries, so to speak, for use in the SUTs. This is an exception to the previously mentioned rule that SUTs compilers should not attempt to create their own versions of basic statistics. That would not be cost-effective nor would it be conducive to the comparability of SUTs with other economic statistics or on an international scale. In practice, deviations from the way in which enterprises or establishments are defined in the business register and reflected in primary statistics should be limited in scope.

5.54. Such redefinitions may be seen as implementing the SNA recommendation to partition vertically or horizontally integrated enterprises or establishments that have production in two or more sections of ISIC Rev. 4 (2008 SNA, paras. 5.52–5.54). Redefinitions are generally carried out manually, using product-specific input structures based on specific insight into the activities, leading to results that will come as no surprise nor give rise to negative elements, as might have been the case had more automatic methods been applied. By reducing secondary production, redefinitions facilitate the subsequent compilation of IOTs, and compilers of SUTs should be aware of how the choice of compilation techniques will affect the subsequent calculation of the IOTs.

5.55. Redefinitions (more background is provided in Box 5.1) are usually concentrated on a few major activities, such as agriculture, energy, construction and trade, or a few major enterprises, such as mining operations. Redefinitions affect all those activities from which secondary output is being removed. For some activities, redefinition-type adjustments may have been carried out already in the source data, as in the following cases:

- The European Union System of Agricultural Accounts requires that all agricultural activity is covered by these accounts and there are very limited possibilities for the retention of non-agricultural secondary production within the system definition of agriculture.
- All rented dwellings are usually grouped together in one single industry (together with owner-occupied dwellings) independently of the activity of the actual owner.
- Trade activities outside the trade industries (trade as secondary activity), by definition, have already been separately identified when compiling the national accounts, as only the trade margins, and not the gross turnover of the traded products, should be counted as output, and may have been grouped together with trade as primary activity.

- Construction activities are also frequently redefined to form one single, "pure" construction activity, often because total output has been defined by adding up the values of specific types of construction output rather than output from building establishments, or alternatively inputs have been determined from the supply of construction materials. Any of these approaches will also facilitate the distribution of building materials for intermediate consumption.

**Box 5.1 Redefinitions**

In Miller and Blair (2009), on page 141, redefinitions are defined as: "Factoring out the amount of secondary products produced as well as the inputs used in that production and reassigning both to the industry for which the product is classified as primary".

In addition, a distinction is made between *specific redefinition* and *mechanical redefinition* (page 215), where the former is the "by hand" procedure and the latter refers to the various mathematical procedures that can be applied to eliminate secondary production when producing IOTs from SUTs (covered in chapter 12 of Miller and Blair).

The specific redefinition or two-step process emerges from the practice in several countries. It is explained in detail for the United States in Guo J. and others (2002). The Bureau of Economic Analysis paper was presented at the fourteenth International Conference on Input-Output Techniques, held in Montreal, Canada, in 2002. The article also analyses the differences between the resulting tables when redefinitions are not applied (case 1), and when they are applied (case 2).

The redefinition method is also used in Canada and Denmark, whereas the industry-by-industry IOTs in Norway are more of the case 1 type, in that they retain the micro-macro link to a maximum degree.

The industry-by-industry IOTs of the Netherlands seems to fit somewhere between case 1 and case 2.

In France, the first step (redefinition) is based on enterprise units and is carried out to an extent that the supply table becomes diagonal. The use tables thereby also form the IOTs, and the second step (compiling the IOTs) becomes superfluous.

5.56. Although the redefinitions serve the purpose of creating purer activities and thus facilitate I-O analysis, their main purpose is to arrive at an activity classification that is applicable for use in the national accounts, and thus conducive to the integrated compilation of SUTs and national accounts. Three different situations can be distinguished:

- Case 1: no redefinitions take place in the national accounts, the SUTs and the industry-by-industry IOTs.
- Case 2: redefinitions have been carried out for all national accounts data and in the SUTs prior to the calculation of the industry-by-industry IOTs.
- Case 3: redefinitions are not carried out when the current national accounts are compiled but applied when the SUTs and the industry-by-industry IOTs are compiled.

5.57. In the first two cases, the consistency and comparability of the current national accounts (tables by industry), and of the SUTs and IOTs classifications are upheld, but that is not so in the third case. Ideally, the choice of redefinitions should already be introduced in the general classification of industries used in national accounts. Not only will the manually prepared redefinitions be more precise at these earlier stages, but they will also facilitate the balancing of the system as the need to make a large number of small input entries to many cells of the use table will be obviated.

## D. Imports of goods and services

### 1. General description and definition

5.58. The second part of the supply table covers the total imports of goods and services. In national accounts, imports refer to transactions that occur when there are changes of economic ownership of goods between residents and non-residents, whether or not there are corresponding physical movements of goods across frontiers.

5.59. International merchandise trade statistics represent the main source of data for imports of goods. International standards are specified in International Merchandise Trade Statistics: Concepts and Definitions (IMTS 2010) (United Nations, 2011). For imports of services, the main source of data is either the details available in the balance of payments statistics or specialized statistics on international trade in services (for example, business surveys), according to the international standards given in the 2010 Manual on Statistics of International Trade in Services (United Nations, European Commission, IMF, OECD and WTO, 2011) in connection with product classifications.

5.60. Some differences exist, however, between the concepts used in international trade statistics and the 2008 SNA and BPM 6, and adjustments therefore need to be made to the basic statistics in order that they can be used in the SUTs. The BPM 6 identifies sources of difference between the IMTS and the 2008 SNA and BPM 6 concepts of imports that may occur in countries. In this regard, it recommended that a standard reconciliation table be compiled to assist users in understanding these differences.

5.61. One major difference is the valuation used to record imports of goods. While IMTS 2010 uses a CIF valuation for imports, the 2008 SNA and BPM 6 use a uniform FOB valuation for both exports and imports of goods. The 2008 SNA states, in paragraph 3.149:

> Imports and exports of goods are recorded in the SNA at border values. Total imports and exports of goods are valued free-on-board (FOB, that is, at the exporter's customs frontier). As it may not be possible to obtain FOB values for detailed product breakdowns, the tables containing details on foreign trade show imports of goods valued at the importer's customs frontier (CIF, that is, cost, insurance and freight), supplemented with global adjustments to FOB values. CIF values include the insurance and freight charges incurred between the exporter's frontier and that of the importer. The value on the commercial invoice may of course differ from both of these.

5.62. The adjustments for the FOB and CIF valuation of imports are described in more detail in the next section.

5.63. Another difference is the time of recording. In the 2008 SNA and BPM 6, the time of recording of imports and exports corresponds to the time that ownership of the goods is transferred. By contrast, IMTS follows the timing of customs processing. While this timing is often an acceptable approximation to the change of economic ownership principle, adjustments may be needed in some cases, such as for items with large values or goods sent on consignment (that is, dispatched before they are sold). It should be noted that, in the case of goods sent abroad for processing with no change of economic ownership, the values of goods movements are included in the IMTS-based recording but are to be excluded from the ownership-based recording in the national accounts and balance of payments. It is recommended, however, that the values of goods movements be entered as supplementary items in the balance of payments, to indicate the nature of these arrangements.

5.64. Other adjustments to IMTS may be needed to bring estimates into line with the change of economic ownership of goods, either generally or because of the particular coverage of each country. Possible examples include:

- Merchanting
- Non-monetary gold
- Goods entering or leaving the territory illegally
- Goods procured in ports by carriers
- Goods moving physically but where no change of economic ownership has taken place such as in cases of operating leases

5.65. To maintain consistency with BPM 6, the 2008 SNA introduced new treatment relating to merchanting and goods sent abroad for processing. Merchanting is a process whereby a unit in economy X purchases goods from economy Y for sale in economy Z (sometimes within economy Y itself). The goods legally change ownership but do not physically enter the economy where the owner is resident. By convention, the purchases of the goods intended for resale is shown as negative exports. When the goods are sold, they are shown as positive exports. When the purchase and sale take place in the same period, the difference is shown as an addition to exports. If the purchase takes place in an accounting period, the negative export is offset by an increase in inventories of goods for resale, even though those goods are held abroad.

5.66. The surplus on this item in the foreign trade statistics is by its nature a trade margin and should be included in the output of the industry. In the main, this activity takes place in the trade industry. In exceptional cases, this may lead to an overall deficit on the item in the foreign trade statistics but the trade margin would usually still remain positive (the deficit added to changes in inventories). As indicated, trade margins from merchanting activity primarily occur in the trade industry but can occur in many other industries, unless all trade is redefined to the trade industry. Given that business statistics provide source data as a starting point for the compilation of SUTs, merchanting activity can then appear in various industries, for example, oil companies and pharmaceutical companies.

5.67. The new treatment of goods sent abroad for processing is dealt with in more detail in chapter 8 of this Handbook.

5.68. A special category within imports is the direct purchases abroad by residents. This item covers all purchases of goods and services made by residents while travelling abroad for business or pleasure. Two categories must be distinguished because they require different treatments:

- Expenditure by resident business travellers: this item refers to intermediate consumption of several industries to which the travellers belong (in the use table) and imports of services (in the supply table).
- Expenditure by other resident travellers on personal trips: this expenditure is recorded in final consumption expenditures by households (in the use table) and imports of services (in the supply table).

5.69. Imports broken down by products in the SUTs do not include direct purchases abroad by residents. Consequently, these must be included in an adjustment row to obtain the overall value of imports (row (11) in Table 5.1).

5.70. In tables 5.1 and 5.2, the estimates for CIF/FOB adjustments on imports and the direct purchases abroad by residents are shown separately in the rows. It should be noted, however, that some countries do not show these estimates in separate rows but consolidate the values in the product groups in the respective columns. This situation in turn leads to different product balances but does not change the imports aggregate total. This is often due to the coverage of the data sources and, in these cases, appropriate adjustments should be applied to extract the corresponding entries to generate the separate entries.

5.71. Goods procured in ports by carriers may be included in a similar adjustment row. It should also be noted that imports and exports of ships and aircraft may have to be given special attention, as these transactions may follow special recording procedures in the external trade statistics that are not consistent with the way in which output or gross fixed capital formation should be recorded in the national accounts.

5.72. Imports of goods and services in SUTs are dealt with in more detail in chapter 8.

### 2. Valuation for imports: CIF and FOB valuation

5.73. In the 2008 SNA and BPM 6, the total imports of goods are valued FOB. The data on imports by detailed products from the foreign trade statistics used in the SUTs are usually available at CIF prices, however, following the International Merchandise Trade Statistics (United Nations, 2011). To reconcile the different valuations used for total imports of goods and for the product components of imports, two types of adjustments are needed. These adjustments are presented below.

### (a) Data adjustment

5.74. The first type of adjustment must be made to the data of the balance of payments prior to entering data from this data source into the SUTs system. This adjustment is necessary in order to ensure as a starting point a consistent set of data for imports and exports of goods and services that can be balanced across the SUTs. This adjustment is illustrated in Table 5.3.

5.75. The starting point is the account for the rest of the world, as shown in columns (1) and (2) of Table 5.3 (which mirrors the balance of payments according to BPM 6), where only the entries for goods and services are shown and where imports of goods are valued FOB (372 in column (2) of Table 5.3). This is the value of the goods at the point of exit from the exporter's economy, including transport charges and trade margins up to the border point. The CIF value of imports (382 in column (6) of Table 5.3) of goods measures the value of a good delivered at the point of entry into the importing economy. The difference between the two values (10 in column (4) of Table 5.3) is made up of the costs of transportation, insurance and other expenditures between the point of exit of the exporter's country and the point of entry into the importer's country.

5.76. The services linked to the difference between the FOB and CIF values can be delivered by either resident producers or non-resident producers. To the extent that non-resident producers are involved, the BPM 6 imports of services must be reduced with their services (7 in column (4) of Table 5.3) to avoid double counting, as these services are now included in the CIF value of the imported goods. Adjustment for the services delivered by resident producers (3 in column (3) of Table 5.3) is a bit trickier, as a service that, according to the BPM 6 definition, is a purely domestic transaction will now appear as an import of services included in the CIF value of imported goods. As this import originates from resident producers, it is necessary to introduce a balancing service export of the same value.

**Table 5.3 Data adjustment for external trade of goods and services**

| | SNA/BPM balance of payments | | Introducing imports CIF | | SUTs balance of payments | |
|---|---|---|---|---|---|---|
| | Uses (FOB) (1) | Resources (FOB) (2) | Uses (3) | Resources (4) | Uses (CIF) (5) | Resources (CIF) (6) |
| Imports of goods | | 372 | | 10 | | 382 |
| Exports of goods | 462 | | | | 462 | |
| Imports of services | | 84 | | -7 | | 77 |
| Exports of services | 78 | | 3 | | 81 | |
| **Total** | 540 | 456 | 3 | 3 | 543 | 459 |
| Balance | | 84 | | 0 | | 84 |

*Note*: In practice there will be a further breakdown of both goods and, in particular, services in the balance of payments, and therefore also for the adjustments in columns (3) and (4).

5.77. In Table 5.3, all data adjustments are shown in columns (3) and (4), and the resulting "SUTs Balance of Payments" in columns (5) and (6). It is noted that the balance of the adjustment items is zero, and consequently, the surplus on the transactions in goods and services – 84 in column (2) – is identical in the two alternative ways of presenting the external transactions.

5.78. The "SUTs balance of payments" represents the framework of source data for external trade for SUTs with the appropriate product breakdowns. The composition by specific services making up the CIF and FOB difference will usually be available from the working tables of the balance of payments compilers, as their starting point for the FOB recording of imports will usually have been imports of goods from the external trade statistics valued at CIF Regular surveys may also have been carried out to illuminate the CIF and FOB difference and the related service structure.

5.79. It is important to underline that the above data adjustment is not the CIF and FOB adjustment often seen as a separate row in SUTs or IOTs. The data adjustment must be made before starting compiling SUTs. At the detailed product level, the supply and use of the individual services are adjusted so that they can meaningfully be balanced under the CIF valuation of goods, and these data adjustments will not be separately identifiable in the completed SUTs.

### (b) CIF and FOB adjustment row

5.80. The CIF and FOB adjustment is an ex post facto adjustment made at the macro level to the totals for exports and imports of goods and services to derive the corresponding totals found in the SNA (the goods and services account and the rest of the world account).

5.81. In principle, the purpose of this adjustment is to demonstrate that the data in SUTs are consistent with the rest of the national accounts and to avoid the double-counting of CIF-type services provided by residents. The CIF and FOB adjustment row has no balancing or other methodological functions in the SUTs, and it may be omitted from the SUTs and also the IOTs if there is no special need to maintain the exact conceptual relationship to the national accounts.

5.82. Table 5.4 illustrates the place and content of the CIF and FOB adjustment row in SUTs, albeit limited here to external trade data.

**Table 5.4 CIF and FOB adjustment row**

| | Supply Table Imports | | Use Table Exports | |
|---|---|---|---|---|
| | Goods | Services | Goods | Services |
| SUT total | 382 | 77 | 462 | 81 |
| CIF/FOB adjustment | -10 | 7 | | -3 |
| BOP total | 372 | 84 | 462 | 78 |

5.83. The "SUT total" row includes the totals for imports and exports of goods and services in the balanced SUTs system, consistent with the "SUTs Balance of Payments" in Table 5.3.

5.84. In order to obtain totals for the external transactions identical to those found in the rest of the national accounts (and the balance of payments), the adjustments shown in the "CIF/FOB adjustment" row of Table 5.4 are introduced. These adjustments mirror those that were made as data adjustments in Table 5.3. The two types of adjustments have quite different roles, however:

- Those in Table 5.3 relate in principle to columns of the SUTs and must necessary be carried out prior to the balancing, and there is no way to avoid this adjustment.
- On the other hand, the CIF/FOB adjustment in Table 5.4 is a kind of "memo" row of the SUTs that can be added ex post facto, or even omitted if there is no need to demonstrate consistency with the national accounts.

5.85. It should be noted that, if goods and services are lumped together in SUTs, the CIF/FOB adjustment row will only include the adjustment item, -3, for both imports and exports.

5.86. From a bookkeeping perspective, the data adjustment for exports of services (3 in Table 5.3) could alternatively be recorded as a negative import, even though this action entails a less logical explanation of how the domestic output of services are disposed of and also requires the existing imports of those services to be sufficient to prevent a negative net result.

5.87. With this approach, there would be adjustments in Table 5.3 for imports only, showing identical numerical changes for goods and services, respectively. The CIF/FOB adjustment row in Table 5.4 would in this case have entries only for imports (-10 for goods and +10 for services), and if imports were not shown separately for goods and for services, the CIF/FOB adjustment row would be empty. Further details covering issues of consistency in the SNA are provided in Box 5.2.

**Box 5.2 Consistency issues with the CIF/FOB adjustment**

The CIF/FOB adjustment is dealt with in both the *Eurostat Manual of Supply, Use and Input-Output Tables* (Eurostat, 2008) and in the supply and use table chapters 14 and 28 of the 2008 SNA.

In the numerical example in Eurostat (2008) (pages 60, 70 and 122), external trade in goods and services are lumped together and, as explained above, for this case, the CIF/FOB adjustment row therefore contains identical negative adjustments for imports and exports. In the more extensively elaborated numerical example (pages 113–115), where comparisons are also made to the treatment in the 1993 SNA, ex ante data adjustments are mixed up with the ex post CIF/FOB adjustment in a complicated manner.

The CIF/FOB adjustment table has both a column and a row dimension, and the final outcome is incorrect because the ordinary exports of services linked to exports of goods are included in the adjustment.

The exposition of the CIF/FOB adjustment in the 2008 SNA is unclear because it starts out from the assumption that the SUTs have been balanced using inconsistent data, namely imports of goods valued CIF, and services as defined as in the BPM 6 based on imports being valued FOB. This shortcoming can obviously not be remedied by ex post adjustments to columns and rows, as any new column data would require a new balancing of the SUTs.

The final outcome in the 2008 SNA are SUTs with a CIF/FOB column in the supply table (table 14.12 of the 2008 SNA), in addition to the CIF/FOB adjustment row with adjustments for imports only (the resident producers' delivery of services linked to imports CIF being treated as negative imports).

If the CIF/FOB adjustment column in the supply table (table 14.12 of the 2008 SNA) is added to the column for imports of services, services as defined in the SUTs balance of payments are obtained, so that in principle this could be taken to indicate the ex ante data adjustment. This is not easily understood from the exposition, however, and, to compound the lack of clarity, the CIF/FOB adjustment is being distributed by user (in table 14.15 of the 2008 SNA), a step for which there is no explanation.

# Annex A to chapter 5: Sample questionnaire collecting sales of goods and services, inventories of goods and trade-related data

A5.1 The extract shown in figure A5.1 is from a business survey questionnaire from the Statistical Office of Serbia. Data are collected for each industry and by product covering the following areas:

- Sales of goods produced by the enterprise
- Closing stocks of products and work-in-progress
- Sales of merchandise
- Trade margin
- Closing stocks of goods for resale

A5.2 Additional tables collecting data on the sales of industrial and non-industrial services provide the full coverage of goods and services needed to calculate the industry totals. An extract of these tables may be seen in figure A5.2. These data make it possible to calculate the industry output by product and trade margins required to populate the domestic output part of the supply table and the trade margins column, as shown in Table 5.2. In some countries, opening stock values are also collected.

## Figure A5.1 Extract of questionnaire covering sales of goods, inventories of goods and trade activity

| No. | Code | Product description | Sales of goods produced by the enterprise (group of accounts 61) | Closing stocks of products and work in progress (group of accounts 10 and 11) | Sales of merchandise (group of accounts 60) | Trade margins amount rate % | Closing stocks of goods for resale (group of accounts 13) |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| 1000 | | TOTAL | | | | | |
| | | AGRICULTURAL PRODUCTS, RAW AND UNPROCESSED PRODUCTS OF PLANT AND ANIMAL ORIGIN | | | | | |
| 1001 | 01.11.1–01.11.4 | Cereals, all kinds (except rice), cereal seeds | | | | | |
| 1002 | 01.11.6, 01.11.7 | Green leguminous vegetables (beans, peas, lentils and other) | | | | | |
| 1003 | 01.11.8 | Soya beans, groundnuts (row) and cotton seed | | | | | |
| 1004 | 01.11.9 | Other oil seeds–sunflower, sesame, flax, etc. | | | | | |
| 1005 | 01.11.12 | Rice, not husked | | | | | |
| 1006 | 01.13 except 01.13.7 | Vegetables, raw and seeds | | | | | |
| 1007 | 01.13.7 | Sugar beet and sugar beet seed | | | | | |
| 1008 | 01.13.8 | Mushrooms and truffles | | | | | |
| 1009 | 01.15 | Unprocessed, raw tobacco | | | | | |
| 1010 | 01.16 | Fibre crops (flax, cotton, hemp and other, used in textile industry) | | | | | |
| 1011 | 01.19.1 | Forage crops and vegetative matter for livestock feeding unprocessed form | | | | | |
| 1012 | 01.19.2 | Flower and flower seeds | | | | | |
| 1013 | 01.21 | Grapes | | | | | |
| 1014 | 01.22, 01.23 | Tropical and subtropical fruits, all kinds (including citrus, figs, etc.) | | | | | |
| 1015 | 01.24, 01.25 except 01.25.3 | Other fruits, tree and bush fruits, except nuts (apples, pears, cherries, berries, etc.) | | | | | |
| 1016 | 01.25.3 | Nuts (almonds, hazelnut, walnuts, etc.) | | | | | |
| 1017 | 01.26 | Olives, coconuts (raw, unprocessed) | | | | | |
| 1018 | 01.27 | Coffee beans, tea leaves, cocoa beans, not roasted | | | | | |
| 1019 | 01.28 | Spices, aromatic, drug and pharmaceutical crops | | | | | |
| 1020 | 01.11.5, 01.14, 01.19.3, 01.29, 01.3 | Vegetables and fruit seeds, other seeds; grass, unprocessed straw and other residues of cereals; seeds for trees and seedings; planting materials, sugar cane and other raw, unprocessed and untreated products of plant origin not elsewhere | | | | | |
| 1021 | 01.4. except 01.45.3 & 01.49.3 | Live animals and animal products (unprocessed milk, eggs, natural honey; seeds and embryos of animals, except raw skins, shorn wool and skins, etc.) | | | | | |
| 1022 | 01.45.3, 01.49.3 | Raw fur skins, shorn wool, skins (excluding products of slaughterhouses and industrial meat production, see 1036) | | | | | |
| 1023 | 01.49, part | Other agricultural animal origin products, raw, unprocessed and untreated, not elsewhere classified | | | | | |
| 1024 | 01.7 | Hunting and trapping products, raw, unprocessed | | | | | |
| | | PRODUCTS OF FORESTRY | | | | | |
| 1025 | 02.2 | Wood in the rough–logs, fuel wood and other raw products of forestry, odds and ends included | | | | | |
| 1026 | 02.1, 02.3 | Forest trees and seeds, wild growing edible products; natural cork, varnish, balsams and other naturals gums and resins and other raw products of forestry not elsewhere classified | | | | | |
| | | FISH AND OTHER FISHING PRODUCTS, UNPROCESSED AND UNTREATED | | | | | |
| 1027 | 03 | Fish, sea food and other fishing products; aquaculture products (raw, unprocessed and untreated) | | | | | |
| | | MINING AND QUARRYING PRODUCTS, UNPROCESSED; CRUDE AND NATURAL GAS | | | | | |
| 1028 | 05.1, 05.2 | Coals, hard coal and lignite (coal for heating included) | | | | | |
| 1029 | 06.1 | Crude petroleum, bituminous or oil shale and tar sands. Note, petroleum products entered in row 1082 | | | | | |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| | | MANUFACTURING INDUSTRY PRODUCTS | | | | | |
| | | Food products and other processed products of plant and animal origin; used as reproduced material | | | | | |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| | | Production of electricity and manufactured gas (excluding natural gas extraction and petrol gases in refineries); trade and distribution of electricity and manufactured gas | | | | | |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| | | Construction | | | | | |
| 1162 | 41, part | Development of building projects | | | | | |
| 1163 | 41, part | Construction works of residential and non-residential buildings | | | | | |
| 1164 | 42 | Construction and construction works of civil engineering | | | | | |
| 1165 | 43 | Specialized constructions works | | | | | |

# Figure A5.2 Extract of questionnaire covering sales of industrial and non-industrial services

| No. | CPA code | Code and service description | Sales of services (groups of accounts 61 and 65, part) |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 2000 | | TOTAL | |
| | | Support services directly linked with the production of goods and services | |
| 2001 | 01.6 part | Support agricultural services to crop production | |
| 2002 | 01.6 part | Support services to animal production (animal farming ; veterinary services excluded (row 2059) | |
| 2003 | 02.10.2, 02.4 | Support services to forestry (cultivation and logging of trees, excluded) | |
| 2004 | 09 | Mining support services, services to petroleum and natural gas extraction | |
| 2005 | 13.3 | Textile finishing services–bleaching, dyeing, printing etc. | |
| 2006 | 16.10.9 | Drying, impregnation or chemical treatment services of timber and product of wood; support services in the processing of wood and wood products not elsewhere classified | |
| 2007 | 25.5 | Forging, pressing, stamping and roll-forming services of metal | |
| 2008 | 25.6 | Treatment and coating services of metals; machining | |
| 2009 | 24.5 | Casting services of metal and steel | |
| | | Subcontracted services in industry and construction, trade services and other intermediation commissions. Note: enter only the value of the services, value of materials of goods excluded | |
| 2010 | 14, part | Subcontracted operations in textile industry (excluding value of materials) | |
| 2011 | 15, part | Subcontracted operations in footwear and leather production industry (excluding value of materials) | |
| 2012 | 16, part | Subcontracted operations in production of processed wood and wood products (value of materials, excluded) | |
| 2013 | 25, part | Subcontracted operations as part of machine industry–processing and finishing materials services (value of materials, excluded) | |
| 2014 | – | Other subcontracted operations in production of goods of other enterprises (value of materials, excluded), please specify | |
| 2015 | 46.1 | Trade commissions | |
| 2016 | – | Other intermediation commissions please specify | |
| | | Repair, maintenance, installation services; conversion, reconstruction and fitting out of transport equipment | |
| 2017 | 33.1 | Repair and maintenance services of fabricated metal products, machinery and equipment, except motor vehicles | |
| 2018 | 95.1 | Repair services of computers and communication equipment | |
| 2019 | 95.2 | Repair services of personal and household goods | |
| 2020 | 45.2 | Maintenance and repair services of motor vehicles | |
| 2021 | 33.2 | Installation services of industrial machinery and equipment | |
| 2022 | 29.20.4, 29.20.5 | Reconditioning, assembly, fitting out and bodywork services of motor vehicles, except installation, maintenance and repair services | |
| 2023 | 30.11.9, 30.20.9, 30.30.6 | Conversion, reconstruction and fitting out services of other transport equipment, except installation, maintenance and repair services | |
| | | Transportation services Note include transportation equipment rental services with driver and removal services | |
| 2024 | 49.1 and 49.3 | Land transport services–passengers, taxi include | |
| 2025 | 49.2 and 49.4 | Land transport services–freight | |
| 2026 | 50.1 | Water transport services–passengers | |
| 2027 | 50.2 | Water transport services–freight | |
| 2028 | 51.1 | Air transport services–passengers | |
| 2029 | 51.2 | Air transport services–freight | |
| 2030 | 52.2 | Support services for transportation (loading, unloading, hauling, towing, parking service, etc., transportation excluded) | |
| | | Other services | |
| 2031 | 18 | Printing services and services related to printing (newspaper printing, pre-press, binding and related services, reproduction services of recorded media) | |
| 2032 | 35.30 | Steam, hot water, air conditioning supply services | |
| 2033 | 36 | Natural water, water treatment, supply and distribution services | |
| 2034 | 37 | Sewerage services, removal and treatment services | |
| 2035 | 38 | Waste collection, treatment and disposal services | |
| ⋮ | ⋮ | ⋮ | ⋮ |
| | | Donations and state subsidies (group accounts 64), lease of intangible assets and income from fees and charges. Note: 2089 and 2090 positions are not entered | |
| 2086 | | Donations and other unconditioned transfers in cash or in kind by resident legal and natural persons (account 640 and 641) | |
| 2087 | – | Donations and other unconditioned transfers in cash or in kind by foreign legal and natural persons (account 640 and 641) | |
| 2088 | – | Subsidies, grants, donations and transfers of state and local government bodies (account 640 and 641) | |
| 2089 | – | Income from fees for usage of public non-produced assets (this is filled out only by budgetary units–account 741500) | |
| 2090 | – | Income from administrative and legal fees (this is filled out only by budgetary units–account 742200) | |

# Chapter 6. Compiling the use table

## A. Introduction

6.1. This chapter primarily deals with the construction of an initial, unbalanced version of the use table. The values entered into the tables should, as far as possible, reflect all available knowledge and data on the product structure of each column, although many values may need to be changed when the SUTs system is balanced. This applies to estimated totals and also to the values for specific products. Before balancing takes place, the estimates for intermediate consumption, final uses and GVA, and the components of GVA (if available at this stage of the process), should be checked for credibility and, if necessary, adjusted as appropriate. These will then form the starting point for the balancing process.

6.2. In section B, this chapter provides an overview of the structure of the use table and describes the main blocks of the table. Section C focuses on the intermediate consumption; section D on the GVA part of the table; section E on the final consumption expenditure; section F on the gross capital formation; and section G on the exports of goods and services. The chapter has two annexes: annex A set out an example of a questionnaire for the collection of data on the purchase of goods and services for intermediate consumption and annex B provides a description of the impact of the change in treatment of research and development according to the 2008 SNA.

## B. Structure of the use table

6.3. The use table shows the use of goods and services by product and by type of use for intermediate consumption by industry, final consumption expenditure, gross capital formation and exports. The use table also shows the components of GVA by industry for compensation of employees, other taxes less subsidies on production, consumption of fixed capital, and net operating surplus and net mixed income. Table 6.1 illustrates the structure of the use table.

6.4. The use table has two main objectives:

- The columns show the cost structure of each industry and the product structure of each type of final use.
- The rows show the distribution of each product and primary input (labour and capital) by uses.

6.5. It is customary to compile the use table, at least initially, at purchasers' prices. This valuation relates most closely to the basis of the data collected via business and household surveys and is known by the purchasers of the products.

## Table 6.1 Use table at purchasers' prices

Millions of euros

| | | | INDUSTRIES | | | | | | | FINAL USE | | | | | | | | Total use at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Final consumption expenditure: Households | Final consumption expenditure: NPISH | Final consumption expenditure: General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 2 583 | 6 570 | 16 | 371 | 34 | 49 | 9 623 | 3 595 | | | 180 | | - 27 | 1 161 | 4 909 | 14 532 |
| PRODUCTS | Manufacturing | (2) | 2 205 | 107 190 | 12 441 | 16 874 | 6 015 | 8 797 | 153 522 | 71 438 | | 3 180 | 26 756 | 2 183 | 3 034 | 123 252 | 229 842 | 383 364 |
| PRODUCTS | Construction | (3) | 105 | 2 440 | 9 528 | 2 446 | 3 907 | 1 604 | 20 029 | 1 667 | | | 25 155 | | - 38 | 563 | 27 348 | 47 377 |
| PRODUCTS | Trade | (4) | 33 | 1 883 | 119 | 2 240 | 259 | 308 | 4 842 | 3 325 | | | 67 | 45 | | 753 | 4 189 | 9 032 |
| PRODUCTS | Transport | (5) | 14 | 4 386 | 267 | 8 399 | 822 | 321 | 14 208 | 5 833 | | 3 370 | | | | 8 453 | 17 656 | 31 865 |
| PRODUCTS | Communication | (6) | 34 | 2 563 | 299 | 9 359 | 5 919 | 1 833 | 20 008 | 26 444 | | 121 | 5 976 | | 67 | 6 905 | 39 514 | 59 522 |
| PRODUCTS | Finance and business services | (7) | 457 | 13 578 | 4 736 | 20 359 | 29 166 | 9 134 | 77 430 | 38 838 | | 1 006 | 11 170 | | - 178 | 11 145 | 61 981 | 139 411 |
| PRODUCTS | Other services | (8) | 8 | 382 | 59 | 1 171 | 415 | 1 794 | 3 829 | 14 923 | 5 416 | 53 373 | 113 | 107 | 1 | 567 | 74 500 | 78 329 |
| | Total at purchasers' prices before adjustments | (9) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 152 800 | 459 939 | 763 431 |
| Adjustments | CIF/FOB adjustments on exports | (10) | | | | | | | | | | | | | | - 97 | - 97 | - 97 |
| Adjustments | Direct purchases abroad by residents | (11) | | | | | | | | 6 675 | | | | | | | 6 675 | 6 675 |
| Adjustments | Purchases in the domestic territory by non-residents | (12) | | | | | | | | - 12 945 | | | | | | 12 945 | | |
| | Total at purchasers' prices | (13) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 159 792 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 165 648 | 466 517 | 770 009 |
| GVA | Compensation of employees | (14) | 551 | 30 679 | 10 239 | 37 906 | 22 997 | 41 971 | 144 343 | | | | | | | | | |
| GVA | Other taxes less subsidies on production | (15) | - 1 627 | 1 077 | 546 | 1 755 | 2 004 | 1 103 | 4 858 | | | | | | | | | |
| GVA | Consumption of fixed capital | (16) | 1 845 | 12 750 | 1 542 | 10 917 | 18 934 | 7 480 | 53 469 | | | | | | | | | |
| GVA | Net operating surplus/net mixed income | (17) | 3 658 | 16 453 | 5 138 | 23 040 | 18 989 | 4 921 | 72 198 | | | | | | | | | |
| GVA | Gross operating surplus/gross mixed income | (18) | 5 503 | 29 203 | 6 680 | 33 957 | 37 923 | 12 401 | 125 667 | | | | | | | | | |
| GVA | GVA | (19) | 4 427 | 60 959 | 17 465 | 73 618 | 62 923 | 55 475 | 274 868 | | | | | | | | | |
| | Total input at basic prices | (20) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | | | | | | | | | |

Empty cell by construction

Table based on 2011 figures from Austria

6.6. The upper part of the use table (rows (1)–(9) in Table 6.1) shows how the use of goods and services is distributed as intermediate consumption by industry, final consumption expenditure, gross capital formation and exports. The rows of this part of the table correspond to the same rows of the supply table. Each row in the upper part of the SUTs represents a product balance for each product.

6.7. In the lower left part of the use table (rows (14)–(19) in Table 6.1), the components of GVA are shown below intermediate consumption for each industry. If the industry output is given and the intermediate consumption of products determined in the use table, GVA of an industry can be estimated, in the first instance, as a residual variable. If, however, the income measure components of GVA (compensation of employees, other net taxes on production, consumption of fixed capital) are known, the residual value is net operating surplus and net mixed income. Net operating surplus can also be directly estimated using business accounts providing an alternative for data confrontation with the residual approach – the linking between business accounts and national accounts is covered in chapter 2. For each industry, the sum of intermediate consumption at purchasers' prices and GVA at basic prices will equal the value of output at basic prices shown as column totals in the supply table.

6.8. The columns of the use table cover the following categories:

- Industries (columns (1)–(6) in Table 6.1). Intermediate consumption will be shown with the same breakdown (number of columns) as for the industries' domestic production in the supply table.

- Final consumption expenditure (columns (8)–(10) in Table 6.1), which consists of final consumption of households, NPISHs and general government, The latter is typically broken down into individual and collective consumption.

- Gross capital formation (columns (11)–(13) in Table 6.1), which is broken down in its components of total value of the gross fixed capital formation, changes in inventories and acquisitions less disposals of valuables. This can be further broken down by types of assets or industries.

- Exports of goods and services (column (14) in Table 6.1), which may be shown as a single column or as goods and services in separate columns. These can be further broken down as columns for export of domestically produced products and re-exports. Exports can also be broken down by countries or geographical or market groupings of countries.

6.9. As described in chapter 4, the actual number of rows and columns in the SUTs will depend, among other aspects, on resources and availability of source data.

6.10. The use table also includes a number of rows (in particular, rows (10)–(12) in Table 6.1) which contain adjustments. In particular, these rows contain the adjustment for the valuation of exports (CIF/FOB adjustments on exports), direct purchases abroad by residents, and purchase in the domestic territory by non-residents. In the SUTs, total imports and exports are valued FOB. Data on detailed flows of imports from foreign trade statistics are valued, however, at CIF prices. To reconcile the different valuations used for total imports FOB and the imported products CIF, a total CIF/FOB adjustment row on imports is added to the supply table. The same negative entries are shown in the CIF/FOB adjustment row for exports. More details on the CIF/FOB issues may be found in chapter 5.

6.11. The adjustments for direct purchases abroad by residents and purchases in the domestic territory by non-residents have to be made because the final consumption expenditure of households, as broken down by product, includes direct purchases by non-residents in the domestic territory and these must be treated as exports. Similarly, direct purchases by residents abroad must be treated as imports and thus included in the total final consumption expenditure of households.

6.12. The purchases by residents abroad are treated as both imports and final consumption expenditure of households. Thus an appropriate positive amount has to be entered in the imports column of the supply table and, at the same time, as a positive entry in the column of final consumption expenditure of households in the use table. The purchases in the domestic territory by non-residents are treated as exports and deducted from households' final consumption expenditure. Thus the corresponding amount entered in the exports column with a positive value is deducted in the column of final consumption expenditure of households. The balance of the row is zero.

6.13. The SUTs provide a framework enabling the supply and use of all products to be balanced, and the total outputs and inputs of each industry to be balanced. In this stage of the compilation process, however, it is recommended that the SUTs be populated using data based on the best possible data sources before the balancing process takes place. Preferably, regular (quarterly and annual) business surveys based on a high-quality comprehensive business register, along with household-based surveys and the use of administrative data, should be used.

6.14. A simple method for drawing up product balances – traditionally referred to as the "product flow" method – is to distribute the value available for domestic use based on the characteristics of each product. This may work well for products that have specific uses, for instance, as input in a particular industry or as gross fixed capital formation. Most of the products in the SUTs are, however, broad categories of goods or services that may have several different uses. Estimates of the use side that are solely based on the supply of specific products can, however, be used where information from the use side is not available.

6.15. For compiling the use table, two general options are available: the input approach and the output approach. In the input approach, the cost structures of industries and input structures of final use categories are compiled on the basis of specific survey results, while in the output approach the allocation of goods and services is determined with the product flow method. As the input approach is based on collected data, it is the recommended approach for populating the intermediate use part of the use table. The output approach is an alternative, providing a cross-check and forming the basis of the balancing process.

6.16. There is no absolute rule determining whether to give priority to columns or rows of a use table. This depends on basic surveys and the specific country practices of national accounts, and also on such indicators as quality and coverage of the data. It is, however, recommended that the compilation process be started by column, because data received from basic sources will then be fully reflected. At the same time, this method is consistent with the institutional approach to identifying the input structures for industries by intermediate consumption and GVA, and for the categories of final use (consumption, gross capital formation, exports) by product. A distinction must be made, however, between population of the tables with a tendency by column and the balancing of the tables with a stronger row dimension.

6.17. The prime objective of the use table is to identify the cost structures of industries and the input structure of final uses. The input approach can be implemented if survey results are available which identify the main cost structures – the survey approach to the collection of input data is recommended. The main types of sources for the input approach are the establishment survey, the consumer expenditure survey, the government expenditure survey, and the capital expenditure survey. At the same time, the use table identifies the use of products and primary inputs. The main sources of the output approach are production statistics and foreign trade statistics.

6.18. The output approach (product flow method) is highly dependent on survey results from production statistics and foreign trade statistics.

6.19. Only in the absence of any surveys on the cost structure of industries or any information from input methods should the product flow method be considered. The product flow method can be useful for compiling the rows in a first stage, even if later on they are changed during the balancing process. If product flows are compiled at a very detailed level, it will be possible to break down intermediate consumption between industries even in the absence of complete and direct information on cost structures. Only in the case of specific products, for example, ships, military aircraft, nuclear fuels, and others, should the product flow method be preferred.

6.20. The output approach is often used to compile use tables. It is a valuable complement of the input approach. The product flow method facilitates identifying the output structure of goods and services. The more homogeneous goods and services are, the easier it will be to allocate the use in specific industries or categories of final uses. The product flow method is widely applied for rectangular systems of products and industries in which the number of products is much larger than the number of industries. Provided that survey results are available, the input approach is the best option to identify cost structures. The product flow method is a valuable cross-check for the input approach. It makes possible the identification of a more refined structure of intermediate and final uses in terms of specific products. The product flow method is also a powerful tool when it comes to balancing the system.

6.21. Nevertheless, the first stage is always to compile the totals of industries in terms of output, intermediates and GVA. This takes place in the production accounts of the system. Then the categories of final uses are added which were derived from specific surveys and statistics and product flow accounts.

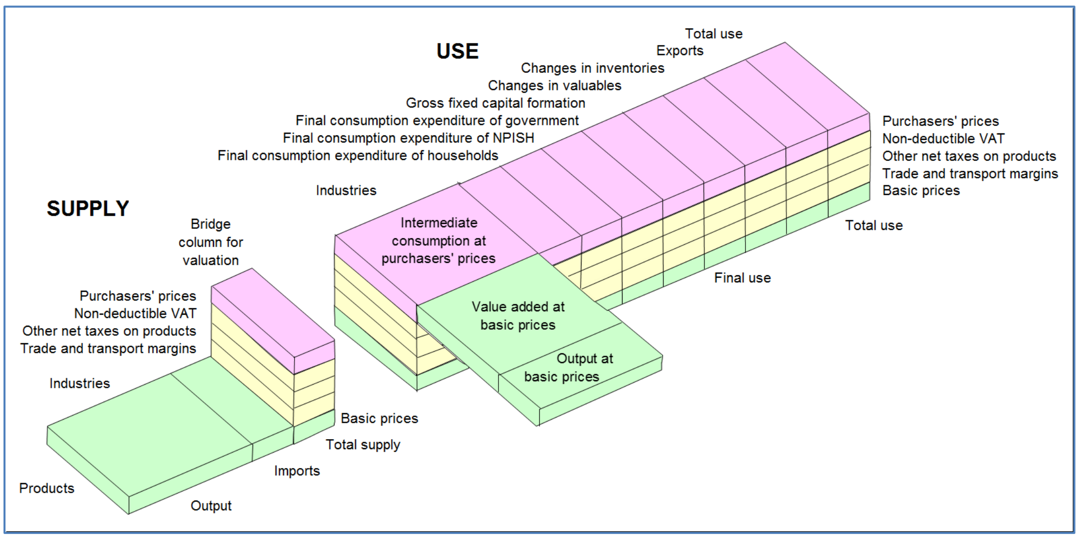
## 1. Three-dimensional presentation of the SUTs

6.22. Trade and transport margins, taxes less subsidies on products (except VAT) and non-deductible VAT must be distributed by products in the valuation table (sometimes referred to as the “bridge column”), shown as part of the supply by products at purchasers’ prices. It is recommended that, where the supply values from the different levels of the valuation table are distributed by uses in “valuation layers”, the matrices should have the same size and format as the upper part of the use table at purchasers’ prices.

6.23. Figure 6.1 shows how the layers can be shown, stacked one above the other, in a three-dimensional representation of the use table. In this way, it will be possible to look at each product balance as a vertical slice, going from left to right, from the SUTs, where the supply is shown at basic prices, while the uses can be seen as a table showing how purchasers’ prices are transformed into basic prices by removal of trade and transport margins, net taxes on products excluding VAT and non-deductible VAT.

6.24. The exact distribution of trade and transport margins and net taxes on products by uses cannot usually be observed in the data sources and need therefore to be estimated on the basis of whatever data are available, and also on common-sense assumptions., Further details of this approach may be found in chapter 7. Hence the establishment of the full three-dimensional system will require some additional resources. It can, however, be very useful as a tool for keeping track of the use of trade and transport margins and net taxes on products by uses, which are also needed for estimation of SUTs in volume terms and IOTs (both in current prices and in volume terms).

**Figure 6.1 Three-dimensional view of SUTs**




## C. Intermediate consumption part of the use table

6.25. This section describes how to put together an initial unbalanced version of the intermediate consumption part of the use table and the data sources that can be used.

6.26. Intermediate consumption consists of the value of the goods and services consumed as inputs by a process of production, excluding fixed assets whose consumption is recorded as consumption of fixed capital (2008 SNA, para. 6.213). It thus includes all non-durable goods and services with an expected life of less than one year which are used up in the process of production by industries, thus excluding any goods purchased for resale without any further processing. The bought and not-consumed goods are entered in changes in inventories. Goods paid for by employers for the benefit of their staff can be regarded as remuneration in kind entered in compensation of employees.

6.27. The compilation methods for intermediate consumption vary across countries, depending on the data sources available. The recommended approach is to have regular (for example, annual) data collection on input structures, an approach that is even more advisable with globalization and new technologies contributing to rapid structural change. The most commonly used approach, however, consists in starting with total intermediate consumption by industry – namely, the "Total" row (row (9) in Table 6.1). Then there is a balancing process with the amounts which are available for intermediate use of the various products (see the following sections). Lastly, an equilibrium is obtained between the sum of the "Total" row and the sum of the "Total" column.

6.28. Nevertheless, in some countries, in particular those in which accounts rely on data sources on enterprises (institutional approach), intermediate consumption may be initially known at a high level. Thus the main problem consists in distributing this total intermediate consumption among industries.

6.29. Intermediate consumption can be broken down by industries according to ISIC and by institutional sectors. As for the supply table, it is also possible to distinguish between market producers, non-market producers and producers for own final use and between producers in the formal and the informal economy. The columns in the use table correspond to the same classifications used in the supply table. When estimating the input structure, however, the number of columns does not necessarily need to be identical, although it is recommended that, where appropriate, the industry columns headings in the supply table and the use table are the same.

6.30. The separated columns of an ISIC category (for example, market and non-market) can have significantly different input structures. Trade margins on their inputs may also differ because of the use of different trading channels and discounts and taxation rules may vary, such as those relating to the deductibility of VAT.

6.31. When a distinction is made between market producers, non-market producers and producers for own final use, the inputs in each of these categories of units could be shown as separate submatrices. This would, however, leave many input columns empty or almost empty. A practical solution could be to separate only market and non-market producers within the same ISIC category into different columns where both have a significant size, for example, in the case of health and education services. Similarly, production on own account or informal activity may be shown in separate columns, if it is of special interest, for instance within agriculture, construction or trade.

### 1. Initial, unbalanced version of the intermediate consumption part of the use table

6.32. The information used for the construction of an initial set of estimates for the intermediate consumption part of the use table will be drawn from various source data.

6.33. For some industries, the source data may consist of a complete picture of outputs and inputs by products. These estimates will typically combine information on physical volumes and prices and may also use information from accounting data. The estimates may be carried out outside the actual SUTs compilation process. A similar situation obtains for the grossing up of survey results to cover the entire industries in question, for example, agriculture, forestry and fishing. From the perspective of the national accounts and SUTs compilation, the values of all inputs are assumed to be already grossed up and ready to be entered into the SUTs framework.

6.34. It is important to ensure consistency between estimated outputs, inputs and change in inventories within each industry. Products delivered between units within the industry should appear with the same value for sales and purchases of the industry, except for the costs of change of ownership.

6.35. If different data sources are used to draw up the output and input sides of an industry, it is important to make sure that the units behind the data are defined in a similar way. Otherwise there is a danger that the industry's GVA could be overestimated or underestimated. It is also important to ensure that all the inputs are covered and that less important inputs are not missing from the input structure.

6.36. As mentioned before, the most common method used in filling the initial and unbalanced version of the intermediate consumption part of the use table is, first, to estimate the values for total intermediate consumption by industry; second, to enter in the table known values of intermediate consumption by product and by industry when available; and, third, to use additional information on cost structures to estimate all other values in this part of the use table.

### (a) Total intermediate consumption by industry

6.37. The data sources used to populate the use table so as to obtain the value of total intermediate consumption by industry (see chapter 4 for more detail on this) include statistical surveys, accounts-based statistics and VAT-based statistics. It should be noted that the same source for the industry providing data feeding into the supply table often also forms the source for the data feeding into the use table.

6.38. For some industries, all inputs are provided by the data supplier and total intermediate consumption is calculated as the sum of these inputs. For most industries, however, total intermediate consumption needs to be estimated from annual and/or quarterly business surveys based on information from business accounts, government accounts and other sources, such as annual reports and financial statements of the economic units themselves.

### (b) Inputs by products for each industry

#### Known values for specific cells, rows or columns

6.39. Some values for cells of the intermediate consumption part of the use table may be known from source data, or they may already have been calculated within the framework of independent subsystems, such as the use of energy, FISIM or insurance services by industries. For some industries, the entire columns of initial inputs can be drawn up in subsystems from which they can be transferred to the SUTs framework. Entire rows and columns may be filled in this way. The source data used to calculate such values may not necessarily be available at purchasers' prices and they may need to be converted using the best possible assumption on trade and transport margins, net taxes on products and non-deductible VAT.

**Input structures**

6.40. Surveys on cost structures and other information on the input structure could be used for estimating the input structure in the intermediate consumption part of the use table.

6.41. Ideally, detailed purchases of goods and services should be collected annually covering all industries through surveys of cost structures. These annual surveys typically capture various aspects such as:

- Year-on-year structural changes
- Technological innovation and change
- Contracting out
- Company restructuring, mergers and takeovers
- Non-consolidation of businesses and industries
- Technological product and import substitution
- Economies of scale
- Inventory control
- Price changes

6.42. The collection of regular purchases details also makes possible the better measurement of sudden economic change, due for example to the swine flu crisis (affecting agricultural and slaughtering industries), storm damage (affecting construction and insurance industries), growth of Internet activity, or other natural disasters which may affect the supply and price of certain intermediate products with an impact on the production chains and other consequences.

6.43. Annual surveys of cost structure would also considerably facilitate the production of good quality SUTs in volume measures, which has a key annual focus. Annex A to this chapter provides an example of the type of costs and inventories questions, by type of product covering all goods and services that could be included in a questionnaire.

6.44. The information from surveys based on business accounts may contain some useful subtotals, for example, purchases of goods or indirect production costs, but it would usually be insufficient to provide a full breakdown by product and by industry. Similarly, government accounts may contain supplementary information on the input of products, but generally not with sufficient detail for full input structures.

6.45. Known totals and subtotals must be supplemented by other information. Surveys on the use of raw-materials and services are typically used to serve the needs of national accounts, specifically the use table. The coverage of such surveys has traditionally been limited to manufacturing and other industries that have a significant input of raw materials. The cost structures of construction, distribution and service industries should also be surveyed, however. The level of detail should preferably make it possible to aggregate the collected data into the products used in the SUTs but, for practical reasons, it may equally be the product categories from surveys that need to be split into more detailed categories used in the SUTs – the latter approach generates lower quality estimates. A survey may only exist for earlier or later years than the year for which the SUTs are being compiled, in which case the revaluation of the values to prices of the year in question should be considered.

6.46. Surveys of cost structures may not have total coverage. They may exclude units below a threshold or they may be based on small samples. When results are grossed up to industry totals, uncertainty is added to the figures. Input structures of small establishments that are not covered by the survey will probably be unlike the structures found in the survey. Furthermore, surveys may collect data for enterprises rather than establishments. Enterprise-based data will include inputs of establishments classified in other industries, and therefore reflect some inputs which should not be included here but in another industry.

6.47. Cost structures typically also include some acquisition of capital equipment originally treated as current expenditure in business accounts.

6.48. If annual surveys are not available, the use of older SUTs, where a more detailed survey may have been conducted, can be used to form an initial structural base for a more recent period. Where such periodic surveys exist, different processes can be applied to generate more recent time series and meaningful data using more recent control totals applied to old structures.

6.49. Lastly, respondents do not always know all their inputs, and categories whose descriptions begin with "Other" or finish with "not elsewhere classified (n.e.c.)" will usually be overstated in such surveys. It may be a good idea to apply some common-sense corrections to the survey data before they are used to create input structures. The grossed-up values of inputs by products calculated from surveys are probably, despite their inaccuracy, often the best possible initial estimates of input structures, but they should be used with some caution.

6.50. The availability of statistics on cost structures can vary greatly among countries. For example, there are countries where surveys on cost structure are conducted yearly for all industries; there are countries where only manufacturing industries are surveyed annually and most other industries are surveyed with regular intervals; and there are countries where such surveys are scarce, outdated or altogether missing.

6.51. It is advisable that the need for new surveys is considered well in advance when new benchmark SUTs are planned, as it may take several years to plan and implement and obtain useable results from such surveys. Where no statistics are available, the possible existence of alternative data sources should also be investigated.

6.52. In some countries, it is common for annual reports and accounts of enterprises to include detailed descriptions of the use of inputs, for example, supporting purchase ledger details. The information is, however, typically shown in a rather unsystematic way. To make this detail useful, the data must be categorized in a way that corresponds to the product classification used in SUTs. A similar approach can be used for inputs in general government, if the accounts for central and local government contain detailed information that can used to create input structures.

6.53. If nothing is known about inputs for some industries, it may be possible to use input structures from other industries that are assumed to be similar, but with some modifications based on expert opinions. As a last resort, input structures from neighbouring countries or similar activities in other countries could be considered, in particular, if those structures are based on actual source data, and account should also be taken of possible differences in the extent of processing and other factors. The initial inputs that are based on these kinds of approaches are uncertain, and they are more likely to be adjusted – within reasonable limits – in the balancing process.

6.54. In countries where the informal economy forms a considerable share of output in specific industries, the structure of inputs used in informal units can be expected to differ from the structure found in surveys of formal businesses. Within agriculture and related activities, the input in informal units may be covered by agricultural statistics. Otherwise it may be appropriate to make a separate estimation of the input structure in the informal economy. Information on the use of inputs in informal activities may be found in household budget surveys or labour force surveys, as mentioned above, if not in special studies of the informal activities. Such data may give an incomplete picture of the outputs and inputs and it may be necessary to add some supplementary assumptions based on expert knowledge before they can be used in SUTs.

### (c) Putting together known values and information on product structure

6.55. Information on what are referred to as the “known” values and information on the input structure can be put together in order to fill an initial version of the values of intermediate consumption by product of an industry. Box 6.1 provides a numerical example of how all the available information can be combined.

## Box 6.1 Example of a calculation of the values of an input column

In this example the total input, 2,500, is supposed to be known. A survey-based input structure sums to 100 per cent.

The values of input of products 2 and 5 are known as 150 and 300 respectively. The known values are treated as predetermined and subtracted from the total value that is going to be distributed by products.

The residual total value of inputs, 2,500 - 450 = 2,050, is now distributed proportionally with the "survey-based input structure" excluding the "known values".

Finally, the known and the calculated input values are added together to form the complete initial column of intermediate consumption for the industry in question.

| Products \ Input in an industry | Survey based input structure | Known (predetermined) values | Survey-based input structure excl. known values | Inputs estimated from survey-based structure | Result: Input column |
|---|---|---|---|---|---|
| | % | Value | % | Value | Value |
| | (1) | (2) | (3) = (1) * 100.0/80.0 | (4) = (3) * (2500-450)/100 | (5) = (2) + (4) |
| Product 1 | 16.0 | 0 | 20.0 | 410 | 410 |
| Product 2 | 6.0 | 150 | 0.0 | 0 | 150 |
| Product 3 | 7.0 | 0 | 8.8 | 179 | 179 |
| Product 4 | 44.0 | 0 | 55.0 | 1 128 | 1 128 |
| Product 5 | 14.0 | 300 | 0.0 | 0 | 300 |
| Product 6 | 8.0 | 0 | 10.0 | 205 | 205 |
| Product 7 | 5.0 | 0 | 6.3 | 128 | 128 |
| **Total** | 100.0 | 450 | 100.0 | 2 050 | 2 500 |

### (d) Grossed-up data versus the data collected by surveys

6.56. Putting together information from different kinds of sources in the SUTs framework generally will result in an unbalanced set of SUTs. The total uses of a product will therefore differ from the total supply for most products. In the final, balanced version of the use table such differences are removed either by manual adjustments or by automatic methods.

6.57. The corrections that are necessary to remove the differences between the first estimates of supply and use should as far as possible retain those values that are considered to be reliable statistics. For this purpose it is useful to be able to distinguish between:

- Inputs by product that have actually been reported as primary statistics by respondents and values that are found in annual reports, government accounts or other reliable sources
- Initial inputs by product that are the result of grossing up to the estimates for total input in each industry

6.58. In most cases, the difference between the two will represent the value that can be removed during the balancing process when total initial use exceeds total initial supply for a product. It can be useful if the reliable parts of the input values are shown together with the grossed-up values in the tables presented to the people working on the manual balancing of SUTs.

6.59. An example, of part of an industry input structure (column) with supplementary reliable values at purchasers' prices in the rightmost column is shown in Table 6.2. Columns (6) and (7) show values from the two approaches, which in turn should be investigated to achieve a plausible industry input structure and, in turn, an agreed estimate for each product. Apart from wood-wool, all the other products show significant differences, which call into question the reliability of the data feeding into the SUTs for the input structure for this industry.

**Table 6.2 Intermediate consumption of selected inputs into "Manufacture of rubber and plastic products"**

| | Transaction (1) | Basic price (2) | Margins (3) | Net taxes on products (excl. VAT) (4) | VAT (5) | Purchasers' price (6) | Reported values (7) |
|---|---|---|---|---|---|---|---|
| | .. | .. | .. | .. | .. | .. | .. |
| Wood-w ool | P.2 | 22 | 0 | 0 | 0 | 22 | 20 |
| Wood in logs or roughly cut | P.2 | 5 625 | 607 | 0 | 0 | 6 232 | 2 340 |
| Plyw ood, laminated w ood | P.2 | 10 286 | 1 024 | 0 | 0 | 11 310 | 10 539 |
| Packaging material, w ood | P.2 | 20 085 | 580 | 0 | 0 | 20 665 | 12 816 |
| Other w ood products | P.2 | 20 352 | 1 854 | 0 | 0 | 22 206 | 20 353 |
| Paper in rolls and sheets | P.2 | 3 027 | 46 | 0 | 0 | 3 073 | 1 329 |
| … | .. | .. | .. | .. | .. | .. | .. |

P.2: Intermediate consumption.

6.60. An example showing part of a product balance (row) with supplementary reliable values in the rightmost column is shown in Table 6.3. Here the reported values on the supply side refer to basic prices, while the reported values on the use side refer to purchasers' prices. Although the basic price estimates are in balance (allowing for rounding differences), columns (6) and (7) show significant differences at purchasers' prices between the estimated value and the reported value.

### Table 6.3 Sample product balance for "Gelatine and gelatine derivatives"

**Supply**

| | Transaction (1) | Basic price (2) | Reported values (3) |
|---|---|---|---|
| Oher food products, n.e.c. | P.1 | 12 | 12 |
| Paints and soap, etc. | P.1 | 230 779 | 230 779 |
| Imports | P.1 | 136 245 | 136 244 |
| Gelatine amd gelatine derivatives | Total | 367 036 | 367 035 |

**Use**

| | Transaction (1) | Basic price (2) | Margins (3) | Net taxes on products (excl. VAT) (4) | VAT (5) | Purchasers' price (6) | Reported values (7) |
|---|---|---|---|---|---|---|---|
| Meat products | P.2 | 14 029 | 4 749 | | | 18 778 | 3 498 |
| Fish products | P.2 | 932 | 31 | | | 963 | |
| Dairy products | P.2 | 9 925 | 7 958 | | | 17 883 | |
| Bakery products | P.2 | 133 | 110 | | | 243 | 134 |
| Other food prod. n.e.c. | P.2 | 109 577 | 22 735 | | | 132 312 | 67 143 |
| Paints and soap, etc. | P.2 | 34 113 | 7 170 | | | 41 283 | 26 765 |
| Pharmaceuticals, medicine | P.2 | 64 658 | 9 516 | | | 74 174 | 7 315 |
| Rubber and plastic products | P.2 | 17 812 | 3 754 | | | 21 566 | 10 436 |
| | .. | .. | .. | .. | .. | .. | .. |
| Change in inventories, materials | P.52 | 736 | 141 | | | 877 | |
| Change in inventories, goods for resale | P.52 | 736 | 141 | | | 877 | |
| Exports of domestic production | P.6 | 98 487 | 357 | | | 98 844 | 97 197 |
| Re-exports | P.6 | 10 287 | 35 | | | 10 322 | 10 150 |
| Gelatine amd gelatine derivatives | Total | 367 035 | 56 697 | | | | 222 638 |

P.1: Output
P.2: Intermediate consumption
P.6: Exports of goods and services
P.52: Changes in inventories

## D. GVA part of the use table

6.61. Once the intermediate consumption part of the use table has been estimated, it is possible to calculate the GVA for each industry. The GVA at basic prices is estimated as total output at basic prices from the supply table minus total intermediate consumption at purchasers' prices from the upper part of the use table. The GVA can be broken down into the following components:

- Compensation of employees
- Other taxes less subsidies on production
- Gross operating surplus and gross mixed income

6.62. Gross operating surplus can be further split into net operating surplus and consumption of fixed capital on gross operating surplus. In addition, gross mixed income can be further split into net mixed income and consumption of fixed capital on gross mixed income. If information is available, these breakdowns could be shown in the Use table as follows:

Gross value added

- Compensation of employees
- Other taxes on production
- Other subsidies on production
- Gross operating surplus
  - Consumption of fixed capital on gross operating surplus
  - Net operating surplus
- Gross mixed income
  - Consumption of fixed capital on mixed income
  - Net mixed income

6.63. Each of the categories of GVA is described below, together with the relevant data sources.

## 1. Compensation of employees

6.64. Compensation of employees is defined as the total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done by the latter during the accounting period (2008 SNA, para. 7.5). Compensation of employees has two main components: wages and salaries payable in cash or in kind; and social insurance contributions payable by employers (actual and imputed) (2008 SNA, para. 7.42). Generally, statistics drawn from business accounts and government accounts show values for wages and salaries and possibly also other costs related to employment. In both cases, there may be conceptual differences from the national accounts concepts, due, for example, to the different treatment of particular issues such as fringe benefits, employers actual and imputed social contributions, and other factors. In addition, the information usually needs to be grossed up to cover the part of each industry that is not covered by the statistics (for example, non-exhaustive business register) and values that are only available for enterprises which would need to be distributed by establishments before use.

6.65. Information from tax-collecting authorities can provide data on compensation of employees that will also cover industries not fully covered by accounts statistics or surveys. This information may contain a distribution by industries that can be more or less consistent with the industry classification used in other statistical sources. If a business register is used to classify data from the various sources, it is likely that the figures from various sources will be classified in the same way. As the structure of many economic units will change over time, the same units may nevertheless be classified differently in different data sources. It should be borne in mind that data collected for administrative purposes may refer to units that are neither enterprises nor establishments, thus for the purposes of national accounts further alignment may be necessary for consistency.

6.66. In some countries, data for compensation of employees in a number of industries is estimated based on labour force surveys, household budget surveys or occasional industrial censuses in combination with population censuses. This is of particular relevance to cases where a considerable share of economic activity takes place in the informal economy.

### 2. Other taxes less subsidies on production

6.67. The other component of GVA at basic prices consists of other taxes less subsidies on production, which may be shown separately. Other taxes on production consist of all taxes except taxes on products that enterprises incur as a result of engaging in production (2008 SNA, para. 7.97). Similarly, other subsidies on production consist of subsidies except subsidies on products that resident enterprises may receive as a consequence of engaging in production. There are different types of taxes and subsidies on production. They may include taxes or subsidies on payroll or workforce, subsidies to reduce pollution, recurrent taxes on land, buildings or other structures, and others.

6.68. Generally, government accounts contain information on the total taxes and subsidy on production for each type of taxes and subsidies as they cover the various taxes and subsidies covered by the legislation.

6.69. The distribution of the taxes and subsidies by industries may be available from source data, but when this is not the case, the total taxes and subsidies on production have to be allocated to relevant industries (proportionally to the items to which they relate). The amounts should be shown at an accrual basis.

### 3. Operating surplus and mixed income

6.70. The value of "gross operating surplus and gross mixed income" is obtained as a residual when compensation of employees and other taxes and subsidies are subtracted from GVA at basic prices by industry. Estimates of these industry totals are usually available early in the process of compilation of the use table and should be checked for credibility before balancing SUTs. As shown in chapter 2, however, direct estimates of mixed income and gross operating surplus can be estimated using administrative sources in addition to company accounts. In doing so, a complementary estimate can provide data confrontation with the residual estimate.

6.71. The consumption of fixed capital on operating surplus and mixed income is usually based on the perpetual inventory model method. The corresponding values for net operating surplus and net mixed income are usually calculated in one of the final steps in the compilation of SUTs as the calculation of consumption of fixed capital requires finalized data on gross fixed capital formation broken down by industries, by institutional sector and by type of asset.

## E. Final consumption expenditure part of the use table

6.72. Final consumption expenditure is the amount of expenditure on consumption goods and services (2008 SNA, para. 9.7). Final consumption expenditure can be disaggregated between individual consumption expenditure and collective consumption expenditures. The first consists of expenditure on individual consumption goods or services that are acquired by a household and used to satisfy the needs or wants of members of that household. The latter consists of the expenditures for collective consumption services which are services provided simultaneously to all members of the community or to all members of a particular section of the community, such as all households living in a particular region.

6.73. Final consumption expenditure is disaggregated in the use table in final consumption expenditure by households, NPISHs or general government. Table 6.4 shows the structure of the final consumption expenditure in the use table.

**Table 6.4 Categories of final consumption expenditure**

| | FINAL CONSUMPTION | | | |
|---|---|---|---|---|
| Products | Households | NPISHs | General government | Total |
| Product 1 | | | | |
| Product 2 | | | | |
| : | | | | |
| Product N | | | | |
| Total | | | | |

6.74. The manner in which the submatrix of the use table is compiled, showing the use of products for final consumption, is similar for each of the three types of final consumer (households, NPISHs and general government) but starts from a different classification for each of them, reflecting the way (and the basic functional classifications) in which the basic data are collected.

### 1. Household final consumption expenditure

6.75. Household final consumption expenditure consists of the expenditure, including expenditure whose value must be estimated indirectly, incurred by resident households on individual consumption goods and services, including those sold at prices that are not economically significant and including consumption goods and services acquired abroad (2008 SNA, para. 9.113).

6.76. Information on consumption by households usually starts from household surveys. In these surveys, household expenditure is classified according to COICOP, as shown in Box 6.2. It is therefore recommended to underpin the compilation of this part of the use table with a table linking data on the final consumption expenditures by purpose and by products. This will greatly improve the quality of the data and will ensure that the different analyses of household final consumption expenditure are consistent and coherent with the balanced SUTs. It will also ensure homogeneity in the deflation process, thus ensuring better quality volume data.

**Box 6.2 Classification of individual consumption according to purpose**

COICOP is an integral part of the SNA, but it is also intended for use in three other statistical areas: household budget surveys, consumer price indices and international comparisons of GDP and its component expenditures. The purposes defined in COICOP are based on the classifications of consumer expenditures which national statistical offices have developed for their own use to serve a variety of analytic applications. Although COICOP is not strictly linked to any particular model of consumer behaviour, the classification is designed to broadly reflect differences in income elasticities. In 2018 the United Nations issued the first revision of COICOP, COICOP 2018 (United Nations, 2018), to reflect users' need for more detail and several other issues that required a revision of the classification. There are 15 divisions in COICOP 2018:

01 - Food and non-alcoholic beverages

02 - Alcoholic beverages, tobacco and narcotics

03 - Clothing and footwear

04 - Housing, water, electricity, gas and other fuels

05 - Furnishings, household equipment and routine household maintenance

06 - Health

07 - Transport

08 - Information and communication

09 - Recreation, sport and culture

10 - Education services

11 - Restaurants and accommodation services

12 - Insurance and financial services

13 - Personal care, social protection and miscellaneous goods and services

14 - Individual consumption expenditure of non-profit institutions serving households (NPISHs)

15 - Individual consumption expenditure of general government

The first 13 divisions add up to total individual consumption expenditure of private households. The last two identify those parts of consumption expenditure by non-profit institutions serving households and general government that are treated as social transfers in kind. Together all 15 items represent actual final consumption by households.

6.77. Table 6.5 shows the table that is used to cross-classify data of final consumption expenditures by purpose (COICOP classes) and by products (CPC classes). The list of products in this table is the same as that used for the supply table and the intermediate consumption part of the use table. Of course, the higher the level of disaggregation, the better the quality and precision of allocation to products and the greater the homogeneity for deflation purposes.

6.78. The compilation of Table 6.5 relies on different data sources and is often based on household budget surveys which directly collect details of expenditure on goods and services by households and also on retail trade surveys (although some adjustments are needed). These data sources are discussed in the following sections.

**Table 6.5 Table linking final expenditures by purpose (COICOP) and product (CPC)**

| Consumption COICOP groups / Products | Household consumption (COICOP) | | | | |
|---|---|---|---|---|---|
| | Food | Non-alcoholic beverages | … | Other services | Total |
| | 01.1 | 01.2 | … | 13.9 | 01.1-13.9 |
| Product 1 | | | | | |
| Product 2 | | | | | |
| : | | | | | |
| Product N | | | | | |
| Total | | | | | |

6.79. Some adjustments may be needed to ensure that the final consumption expenditures by households reflect the final consumption expenditures of resident households. This means that, if the starting point is the final expenditures that took place in the territory by households, adjustments are needed to remove the expenditures in the country by non-resident households and include the final expenditures of resident households abroad. When distributions by COICOP groups of these adjustment items are unknown, they can be placed in one or two supplementary columns with a positive and a negative value as appropriate.

6.80. Very few products are exclusively used for household final consumption expenditure. For example, some domestic supply of typical consumer-related goods (for example, food) is used as intermediate consumption in restaurants, transport services and government institutions, as individual consumption of NPISHs and general government or – in the case of durables – as fixed capital formation. Accordingly, the amounts spent by households (this is considered as final consumption expenditures by households) cannot be determined from the supply of such products without knowledge of the other uses.

6.81. For some products, full information on household final consumption expenditure can be provided by subsystems established outside the SUTs framework. The underlying data may have the form of physical volume and price information, such as energy. Administrative sources can provide a rich source of detail, for example, covering purchases of motor vehicles, school fees and other outlays such as education, prescription medicine, and other expenses on health services.

6.82. Table 6.6 provides a numerical example of the link between household final consumption expenditure of households in the use table and COICOP by product breakdown. In this example, the largest expenditure items are housing, followed by transport, restaurants and food.

## Table 6.6 Final consumption expenditure of households (by COICOP headings)

| COICOP | | CLASSIFICATION OF INDIVIDUAL CONSUMPTION BY PURPOSE (COICOP) | | | | | | | | | | | | Total use at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Food and non-alcoholic beverages COICOP 01 | Alcoholic beverages, tobacco and narcotics COICOP 02 | Clothing and footwear COICOP 03 | Housing, water, electricity, gas and other fuels COICOP 04 | Furnishings, household equipment and routine household maintenance COICOP 05 | Health COICOP 06 | Transport COICOP 07 | Commu-nication COICOP 08 | Recreation and culture COICOP 09 | Education COICOP 10 | Restaurants and hotels COICOP 11 | Miscella-neous goods and services COICOP 12 | |
| PRODUCTS | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| Agricultural products | (1) | 2 240 | 60 | 0 | 434 | 0 | 0 | 0 | 0 | 860 | 0 | 0 | 0 | 3 595 |
| Manufactured products | (2) | 14 016 | 5 537 | 9 749 | 7 090 | 10 198 | 2 254 | 12 809 | 2 548 | 2 767 | 0 | 0 | 4 470 | 71 438 |
| Construction | (3) | 0 | 0 | 0 | 1 667 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 667 |
| Trade, transport, communication | (4) | 0 | 0 | 0 | 0 | 0 | 0 | 7 827 | 3 361 | 4 407 | 0 | 20 008 | 0 | 35 602 |
| Financal and business services | (5) | 0 | 0 | 0 | 26 218 | 747 | 0 | 1 339 | 0 | 2 590 | 0 | 0 | 7 944 | 38 838 |
| Other services | (6) | 0 | 0 | 194 | 77 | 212 | 3 730 | 235 | 133 | 4 204 | 1 221 | 0 | 4 918 | 14 923 |
| Total | (7) | 16 257 | 5 597 | 9 943 | 35 487 | 11 157 | 5 984 | 22 209 | 6 041 | 14 827 | 1 221 | 20 008 | 17 332 | 166 063 |

Table based on 2011 figures from Austria

*Note*: the products “Trade”, “Transport” and “Communication” of table 6.1 are presented together in table 6.6. At the time of drafting, this table was compiled in accordance with COICOP (United Nations, 2000a).

6.83. COICOP also distinguishes household final consumption expenditure according to the following product classes: services (S), non-durables (ND), semi-durables (SD) and durables (D). This supplementary classification provides data for other analytic applications, such as assessing household stocks of goods and the cyclical variation in consumer demand. For example, in dealing with the stock of capital goods held by households, goods in COICOP classes that are identified as durables provide the basic elements for such estimates. Box 6.3 provides a description of durable, semi-durable, non-durable goods and services.

### Box 6.3: Non-durable, semi-durable and durable goods

Non-durable goods are defined as goods that can be used only once, for example: food, non-alcoholic beverages, alcoholic beverages, tobacco, materials for the maintenance and repair of dwellings, pharmaceuticals, fuels, energy, garden plants, flowers, pets, newspapers and stationery.

Semi-durable goods differ from durable goods in that their expected lifetime of use, although more than one year, is significantly shorter, and their purchase price is typically less than that of durable goods. For example: clothing, footwear, household textiles, motor vehicle spare parts, recording media, games, toys, books, and electrical appliances for personal care.

Durable goods are those goods which can be used repeatedly or continuously over a period of more than a year, for example: furniture and furnishings, carpets, major tools, vehicles, telephone equipment, computers, photographic equipment, jewellery, clocks and watches.

Services include cleaning and hire of clothing, actual and imputed housing rental, repair services, domestic services, outpatient and hospital services, transport services, post and telecommunication services, recreational and cultural services, education, catering, accommodation, hairdressing, insurance and financial services.

### (a) Household budget surveys

6.84. Household budget surveys provide a good source for expenses classified by purpose and by product according to internationally agreed standards. Such surveys may also include information on a wider range of household activities and living conditions, and sometimes may be named "living standard surveys". Household budget surveys are generally used to compile or update the weights for the basket of goods used in the CPIs and to collect information on household income, possession of assets, type and equipment of dwellings, outlays for repair and maintenance, production for own use and other informal economic activity. This supplementary information is often useful for national accounts and PPPs and may actually have been collected with this purpose in mind, and also for satellite accounts such as social accounting matrices. Household budget surveys can contain information relating to consumption of goods produced for own consumption and services from owner-occupied dwellings which in some countries may not be available from other data sources.

6.85. Household expenditure surveys frequently use COICOP as the basis for the collection of household expenditure information. The results are reallocated to products classified by CPC and then used to estimate the vector of household final consumption expenditure by product for the SUTs.

6.86. Household budget surveys often provide good initial estimates feeding into household final consumption expenditure. Attention should be paid, however, to the coverage of the survey in order to ensure that the survey results can be used for final consumption expenditures by households. For example, some household budget surveys may not cover the year for which the SUTs are being compiled, in which case the survey data should be referenced to prices of the actual year and, if possible, corrected for the development in volumes from the surveyed period. In addition, since household final consumption expenditure refers to the total resident population, the statistician must ensure that the results of the household budget surveys are grossed up to cover the total population.

6.87. If no household budget survey exists for the SUTs reference year, an alternative approach may be to use the structure of expenditure from the last household budget survey and prorate this structure to the estimate for total expenditure of the reference year. This clearly assumes a fixed basket of spending on goods and services (this does not allow for relative price changes or changes due to new products or products not anymore consumed). The balancing process will, however, generate changes to this structure, for example reflecting changes from the supply side.

### (b) Retail trade surveys

6.88. Household final consumption is linked to turnover of retail trade after adjusting for sales to businesses and non-residents. Consumers buy most of their goods from retail outlets. Retail trade statistics provide data on turnover broken down into product groups. Retail trade statistics, however, do not include imputed transactions, such as imputed rentals of owner-occupied dwellings and FISIM, which are included in household final consumption expenditure. These are compiled using different sources and affect other parts of the national accounts, not just household final consumption expenditure.

6.89. Retail sales statistics that are used to feed into household final consumption expenditure need to undergo appropriate adjustments. For example, although consumers purchase most of their goods and services from retail outlets, they also purchase goods and services from units not classified to the retail industry, for example, directly from manufacturers and service industries. On the other hand, sales by retail outlets are not all consumed by resident household consumers but purchases from these retail outlets are also made by non-residents (for example, visitors) and these are categorized as exports made by businesses and, in turn, treated as intermediate consumption.

6.90. Accordingly, the turnover of retail trade and some services disaggregated by detailed industries can provide valuable information on household final consumption expenditure exclusively by broad categories of products and there is no one-to-one correspondence between retail trade turnover by industries and household final consumption expenditure by COICOP groups.

6.91. It should also be borne in mind that informal activities may contribute significantly to household final consumption expenditure. In the cases like retail trade, it would be particularly useful to extrapolate the structure of the column totals from already existing SUTs to form initial estimates for subsequent years.

### (c) Products subject to regulations, taxes or subsidies

6.92. It is often possible to obtain detailed data on products that are subject to regulation, taxation or subsidization, since this information is available from the responsible authorities.

6.93. Motor vehicles, alcohol and tobacco are typical examples of products subject to regulation. It may, for example, be possible to use information on motor vehicle registration to determine household final consumption expenditure of motor vehicles. Information on the use of alcohol or tobacco (for example, related to duties paid) could be used to determine consumption of products that are used for household final consumption expenditure, taking into account that these products could also be used for hospitality by businesses or as an input used by restaurants, in which case they would be treated as intermediate consumption and thus excluded from final consumption expenditures by households.

## 2. Final consumption expenditure of NPISHs

6.94. Final consumption expenditure of NPISHs consists of the expenditure, including expenditure whose value must be estimated indirectly, incurred by resident NPISHs on individual consumption goods and services and possibly on collective consumption services (2008 SNA, para. 9.115).

6.95. Similar to the final consumption expenditure of households, it is useful to cross-classify the consumption expenditures of NPISHs by products (according to CPC) and by purpose. The reference classification of these expenditures by purpose is COPNI (United Nations, 2000a), see Box 6.4. by convention, all consumption expenditures of NPISHs are treated as individual consumption (see 2008 SNA, para. 9.107). Thus, all consumption expenditures of NPISHs are described in COPNI, and also in division 13 of COICOP.

6.96. Table 6.7 shows the matrix that links the final consumption expenditures by NPISHs by purpose (according to COPNI) and by product (according to CPC).

6.97. In some countries, NPISHs may produce most of the services within education, health or social protection, while in other countries such services may mainly be produced by general government and private enterprises. It may be appropriate to provide separate columns for COPNI divisions in the use table. Where the activity of NPISHs is negligible, its detailed breakdown can be considered to be less relevant.

6.98. Various data sources will be used to cover the details of NPISHs by industry and by product. It is recommended, for example, that a business survey is used based on a sample of NPISHs selected from the business register. The grossing-up methodology for a sample survey would need to reflect that NPISHs are non-market bodies and not market bodies, in other words, output is the sum of costs and not related to turnover. Other sources may also include company accounts, regulatory bodies and collective group accounts covering, say, a group of trade unions or religious bodies.

**Box 6.4 Classification of the purposes of NPISHs**

The main use of COPNI is to classify expenditures by NPISHs in a manner consistent with the purposes of the individual consumption expenditures of households and general government in order to obtain the SNA aggregate of actual final consumption of households.

COPNI can also be used to facilitate international comparisons of the activities of NPISHs. In many countries, activities of these institutions are an important complement to government activities in terms of supplying education, health and social protection services to the population. In some countries, NPISHs are also becoming prominent in non-traditional areas, such as environmental protection, the protection of human rights and the defence of minority groups.

Nine divisions are distinguished in COPNI:

01 – Housing

02 – Health

03 – Recreation and culture

04 – Education

05 – Social protection

06 – Religion

07 – Political parties, labour and professional organizations

08 – Environmental protection

09 – Services n.e.c.

Note that the nine divisions of COPNI correspond to division 14 of COICOP 2018, which classifies the individual consumption expenditure of NPISHs (see box 6.2).

**Table 6.7 Table linking final consumption expenditures of NPISHs by purpose (COPNI) and by product (CPC)**

| COPNI Division / Products | Final consumption of NPISHs (COPNI) | | | | |
|---|---|---|---|---|---|
| | Housing 01 | Health 02 | … … | Other services n.e.c. 09 | Total 01-09 |
| Product 1 | | | | | |
| Product 2 | | | | | |
| : | | | | | |
| Product N | | | | | |
| Total | | | | | |

## 3. Final consumption expenditure of general government

6.99. General government final consumption expenditure consists of expenditure, including expenditure whose value must be estimated indirectly, incurred by general government on both individual consumption goods and services and collective consumption services (2008 SNA, para. 9.114).

6.100. Final consumption expenditures of general government can be classified in several ways. For example:

- According to whether the goods or services have been produced by market or non-market producers.
- According to whether the expenditures are on collective services or individual goods or services.
- By function or purpose according to the Classification of the Functions of Government (COFOG).
- By type of good or service according to CPC.

6.101. The column of final consumption of general government in the use table is usually underpinned with a matrix linking the final consumption of general government by product and by purpose. The reference classification of final consumption of general government by purpose is

COFOG (United Nations, 2000a) (see Box 6.5). Data from government accounts are usually classified by COFOG groups. This classification may be more or less detailed but should in most cases make it possible to distinguish between individual consumption and collective consumption. Individual consumption corresponds to group 15 of COICOP.

**Box 6.5 Classification of functions of government**

A major use of COFOG is to identify consumption expenditures that benefit individual households and that are transferred to division 15 of COICOP 2018 in order to derive the SNA aggregate of actual final consumption of households (or actual individual consumption). The divisions, groups and classes covering these expenditures are clearly indicated in the classification. COFOG also permits trends in government outlays on particular functions or purposes to be examined over time.

COFOG is used in the analysis and presentation of statistics on government finance. COFOG consists of ten divisions:

- 01 – General public services
- 02 – Defence
- 03 – Public order and safety
- 04 – Economic affairs
- 05 – Environmental protection
- 06 – Housing and community amenities
- 07 – Health
- 08 – Recreation, culture and religion
- 09 – Education
- 10 – Social protection

Each class of COFOG is clearly identified as collective services or individual services. In general, all of classes 01–06 are collective services, as are sections 07.5 and 07.6 of health, sections 08.3–08.6 of recreation, culture and religion, sections 09.7 and 09.8 of education, and sections 10.8 and 10.9 of social protection. These sections cover expenditures on general administration, regulation, research that is not recorded as capital formation and so on. The remaining sections of health, recreation, culture and religion, education and social protection (which dominate each of the classes) are individual services (2008 SNA, para. 9.100).

6.102. Table 6.8 shows the table linking consumption expenditures of the general government by purpose (COFOG) and by product (CPC). An alternative would be to have column headings in terms of industries (ISIC) and the row headings by product (CPC).

6.103. The transformation of the data based on type of function or purpose to industry is very important, for example, as many regulatory and administrative services are classified to the public administration and defence function or purpose but should be classified to industries such as health and education. Again the level of detail is determined by its importance in the country. A split by level of government could depict different characteristics in terms of COFOG categories, inputs and outputs.

**Table 6.8 Table linking final consumption expenditure of general government by COFOG and CPC**

**Collective services**

| Divisions (COFOG) / Products | Collective consumption general government (COFOG) | | | | |
|---|---|---|---|---|---|
| | General public services 01 | Defence 02 | … … | Social protection 10 | Total |
| Product 1 | | | | | |
| Product 2 | | | | | |
| : | | | | | |
| Product N | | | | | |
| Total | | | | | |

**Individual services**

| Divisions (COFOG) / Products | Individual consumption general government (COFOG) | | | | |
|---|---|---|---|---|---|
| | Health 07* | Recreation culture and religion 08* | Education 09* | Social protection 10* | Total |
| Product 1 | | | | | |
| Product 2 | | | | | |
| : | | | | | |
| Product N | | | | | |
| Total | | | | | |

6.104. Individual consumption of general government consists of two parts which may be shown as separate columns in the use table:

- Goods and services produced by general government as a non-market producer
- Goods and services purchased by general government from market producers for onward transmission to households either free or at prices that are not economically significant. These goods and services are not included in the output of general government.

6.105. Data sources for general government primarily rely on central government and local government administrative data, and are mainly provided by the finance ministries and local government bodies. These are often supplemented with specific survey data such as very detailed local government expenditure. Furthermore, some estimates are based on models such as the perpetual inventory model estimating the consumption of fixed capital for both the central government and local government sectors. All these sources may use a COFOG basis or an industry basis – in both cases, they will need a CPC product breakdown.

## F. Gross capital formation part of the use table

6.106. Gross fixed capital formation is measured by the total value of a producer's acquisitions, less disposals, of fixed assets during the accounting period plus certain specified expenditure on services that adds to the value of non-produced assets (2008 SNA, para. 10.32). Gross capital formation is measured by the total value of the gross fixed capital formation, changes in inventories and acquisitions less disposals of valuables (2008 SNA, para. 10.31). In the use table, GCF is usually at least broken down into three separate columns to display its components separately as shown in Table 6.9. These are discussed in the following sections.

**Table 6.9 Categories of gross capital formation**

| | Gross capital formation | | | |
|---|---|---|---|---|
| Products | Gross fixed capital formation | Changes in inventories | Aquisitions less disposals of valuables | Total |
| Product 1 | | | | |
| Product 2 | | | | |
| : | | | | |
| Product N | | | | |
| Total | | | | |

## 1. Gross fixed capital formation

6.107. Gross fixed capital formation is measured by the total value of a producer's acquisitions, less disposals, of fixed assets during the accounting period plus certain specified expenditure on services that adds to the value of non-produced assets (2008 SNA, para. 10.32). Fixed assets are produced assets that are used repeatedly or continuously in production processes for more than one year (2008 SNA, para. 10.11). Gross fixed capital formation is also described as capital investment, fixed investment or capital expenditure.

6.108. One approach to the compilation of this part of the use table is the demand-based approach, which requires detailed information on investment. Under this approach a matrix is compiled linking gross fixed capital formation by industries (according to ISIC), by type of asset (see Box 6.6) and by products (according to CPC). This matrix is often referred to as the "investment matrix". In order to develop such a matrix by industry, and by institutional sector, for each type of asset there should be an allocation to the appropriate product. In some cases, there may be a one-to-one relationship between the asset and product but in the case of machinery, for example, there are many one-to-many relationships.

**Box 6.6 Gross fixed capital formation by type of asset**

Gross fixed capital formation is usually shown by type of asset. The types of assets distinguished in the 2008 SNA are the following (see 2008 SNA, chapter 10, table 10.2).

Gross fixed capital formation by type of asset:

- Dwellings
- Other buildings and structures
  - Buildings other than dwellings
  - Other structures
  - Land improvements
- Machinery and equipment
  - Transport equipment
  - ICT equipment
  - Other machinery and equipment

Weapons systems

Cultivated biological resources

Animal resources yielding repeat products

Tree, crop and plant resources yielding repeat products

Costs of ownership transfer on non-produced assets

Intellectual property products

Research and development

Mineral exploration and evaluation

Computer software and databases

Computer software

Databases

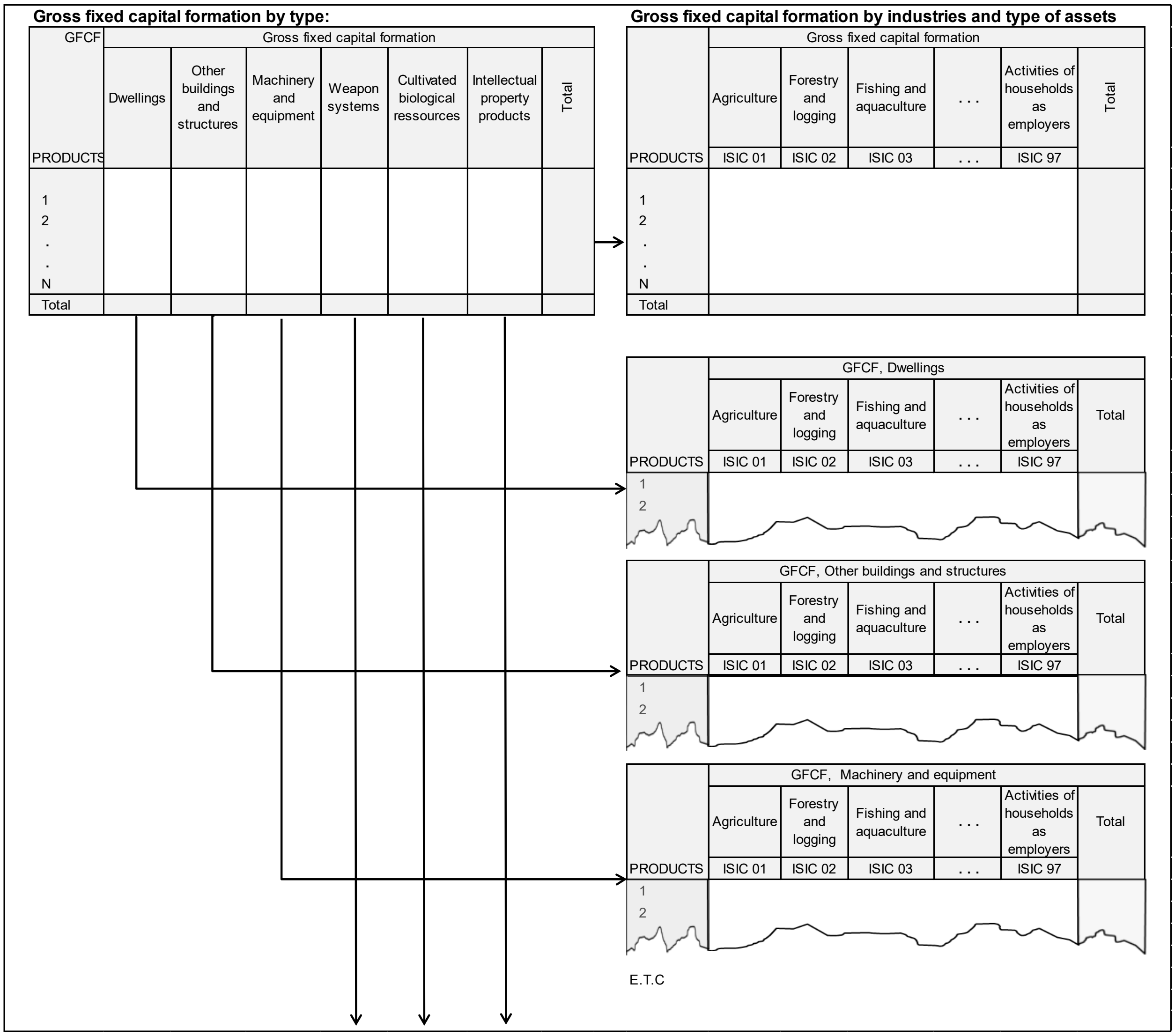
Entertainment, literary or artistic originals

Other intellectual property products

The output and capital formation of research and development are particularly difficult to measure. In theory, the value of the output of research and development is equal to the value of discounted future benefits that businesses get from their research and development investment. These future benefits are difficult to estimate. Furthermore, most research and development is produced on an own-account basis. For that reason, the sum-of-costs approach to the valuation of output will usually be applied. More detail on the impact of capitalizing research and development costs on SUTs and IOTs is provided in annex B to this chapter.

6.109. Table 6.10 shows the structure of the matrix linking gross fixed capital formation by type of asset, by product and by industry. Typically this matrix is based on surveys of capital expenditure, which tend to focus on institutional sectors, industries and assets; supplementary data sources are often also needed, however, such as, for example, specifically designed surveys which collect and provide investment detail by type of product. Detailed information on investments is of particular importance for gross fixed capital formation, which tends to be an erratic series and cannot be modelled easily: for instance, not all businesses buy vehicles every year, and the length of their use will vary across, and within, industries.

**Table 6.10 Table linking gross fixed capital formation by industries, assets and products**




6.110. In countries where such level of detail data is not available, the product flow approach may be applied, using assumptions linking the output of a product to the destination of the product in terms of its purpose. This is a less optimal approach but allows output and demand to be matched.

6.111. It is important to note that gross fixed capital formation – like other product-based variables in the use table – is valued at purchasers' prices. It is recorded, however, by including any non-deductible VAT and excluding any deductible VAT. This will have an impact on those industries and products to which exemption applies and will be consistent with the valuation of the intermediate inputs for the corresponding industries.

6.112. In its simplest version, the use table may show gross fixed capital formation as a single column, and this would also fulfil the requirements for compiling SUTs and some users' needs. The single column approach may be preferred if information on gross fixed capital formation is missing or incomplete. It should, however, be possible to distinguish between broad groups of assets based on the product classification used in the SUTs framework.

6.113. The quality of the product breakdown is greatly enhanced, however, by the greater level of detail linking industries, institutional sectors, assets and products. The disaggregation of gross fixed capital formation by industries and institutional sectors is also needed to calculate the consumption of fixed capital by industry, and in turn, the value of non-market producers' output. The breakdown can be done by columns that correspond fully to the columns for output and intermediate consumption. It may, however, be feasible to limit the number of columns in such a breakdown if precise information from source data is lacking.

6.114. If all combinations of gross fixed capital formation by types, industries and institutional sectors of a detailed matrix were shown as columns in the use table, these columns would completely dominate the presentation. Furthermore, a disproportionate share of the resources needed to balance the SUTs might be required to distribute products between the gross fixed capital formation columns, and finalization of the SUTs might be delayed unnecessarily.

6.115. One practical solution could be to show columns for a few broad categories of industries. Another could be to show only columns for different types of capital formation within the SUTs framework. The breakdown by industries could instead take place outside the central SUTs framework in a subsystem of investment matrices. Here, gross fixed capital formation by product from the final balanced version of the use table could be allocated to specific industries and institutional sectors as a separate process.

6.116. Estimates of gross fixed capital formation by industries have, however, an important role in the preparation of initial column totals for gross fixed capital formation for the use table. Furthermore, a preliminary version of gross fixed capital formation by products and industries can provide the starting point for the gross fixed capital formation columns of the use table.

6.117. Table 6.11 illustrates the gross fixed capital formation by industry and product link to the gross fixed capital formation column in the use table. In essence, this identifies the producers of capital goods in the rows and the investing industries in the columns.

**Table 6.11 Gross fixed capital formation by investing industry**

| INDUSTRIES / PRODUCTS | | INVESTING INDUSTRIES: Agriculture | Manufacturing | Construction | Trade, transport, communication | Financial and business services | Other services | Total at purchasers' prices |
|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Agricultural products | (1) | 128 | 2 | 0 | 4 | 36 | 10 | 180 |
| Manufactured products | (2) | 1 223 | 7 225 | 664 | 5 893 | 9 124 | 2 626 | 26 756 |
| Construction | (3) | 828 | 1 752 | 224 | 3 822 | 15 995 | 2 534 | 25 155 |
| Trade, transport, communication | (4) | 12 | 1 206 | 189 | 2 280 | 1 672 | 684 | 6 043 |
| Financal and business services | (5) | 124 | 4 331 | 82 | 1 324 | 3 065 | 2 245 | 11 170 |
| Other services | (6) | 0 | 0 | 0 | 0 | 0 | 113 | 113 |
| Total | (7) | 2 314 | 14 516 | 1 160 | 13 323 | 29 892 | 8 212 | 69 418 |

Table based on 2011 figures from Austria

*Note*: the products “Trade”, “Transport” and “Communication” of table 6.1 are presented together in table 6.11

6.118. The gross fixed capital formation matrix has further roles to play. The calculation of capital stock data and the calculation of a valuation matrix for non-deductible VAT require an assessment of gross fixed capital formation by product (by producing industry) and investor (by investing industry). In the investment matrix, the user concept of capital – and not the owner concept of capital – should be reflected.

6.119. The assessment of consumption of fixed capital as a component of GVA should be based on empirical capital stock data. The human-made capital stock is derived from cumulative investment of the past in buildings, machinery and transport equipment, based on the actual lifetime of a capital good and allowing for retirements and obsolescence by using the perpetual investor method (see OECD, 2009).

6.120. Consumption of fixed capital is calculated at the current replacement cost of the net capital stock. The net capital stock is defined as the financial value of the gross capital stock still in use. Clearly, it will be easier to estimate these types of matrices on the basis of a rectangular SUTs system with many disaggregated homogeneous products.

### (a) Sources for gross fixed capital formation

6.121. For industries that are covered by business statistics, the source data will usually include information on purchases and sales of capital equipment. It is normally possible to distinguish between gross fixed capital formation in buildings, structures, vehicles and machinery and equipment. Investment in intellectual property products is usually also shown but it is not necessarily classified by categories that can be used for national accounts. For example, these sources will often include purchased software and may also show a value for larger software projects but not all projects produced on own account. The measurement process is further complicated with the inclusion of acquisitions of patents, franchises and goodwill and the fact that research and development may or may not be wholly or partially capitalized in the source data and not necessarily recorded in line with the requirements of national accounts.

6.122. The distinction between intermediate consumption and gross fixed capital formation in business statistics sourced from business accounts may be different from that recorded in the national account. For example, items such as purchased computer software may be recorded as current expenditure in business accounts but as gross fixed capital formation in the national accounts, thus an equal and opposite adjustment is required. There are other conceptual differences between company accounts and national accounts, such as the following:

- Business accounts may not fully show gross fixed capital formation according to economic ownership. Some financially leased assets may be included in investment by their legal owners.

- Sales of existing assets should be treated as a negative gross fixed capital formation valued at the actual prices obtained by the seller. When the sale takes place between two resident producers, the positive and negative investment will cancel out for the economy as a whole, except for costs of change of ownership. In business accounts, the figures for disposals of assets will often be shown at historical cost while the corresponding cumulated depreciation is shown as a separate item. The difference is the bookkeeping value of the sold asset. If the actual price obtained differs from this value, the residual is included in secondary income, and should be reviewed and adjusted for as appropriate. In practice, it can usually be assumed that the difference between the negative gross fixed capital formation and the bookkeeping value of the sold asset is insignificant but there may be important exceptions where figures from company accounts are misleading.

- In business accounts, it is common practice to treat minor or regular purchases of equipment as current expenses. Such acquisitions may not always be identifiable in the accounts. For some big corporations, the threshold for classifying purchases as investment can actually be high, say, $10,000 or more, but practices may vary between countries owing to differences in legislation and taxation rules.

- Own account production of capital goods may be capitalized in business accounts. Even if this is not the case, the accounts may contain information on the value of own account production. The value shown may not, however, be at basic prices as it may only include the direct cost of raw materials and wages and salaries attributed to its production, in which case a correction for indirect costs and gross operating surplus may be appropriate.

- Own account production of intellectual property products may not be directly identifiable in company accounts. Production of software, databases, research and development and literary, artistic or entertainment originals may sometimes have been capitalized as intangible assets in company accounts but may be treated as current expenses. For some intangibles, gross fixed capital formation may be covered by business surveys. In the absence of further detail, it is recommended that gross fixed capital formation is estimated based on the wages and salaries paid for this kind of work with an appropriate mark-up for other expenses and typical gross operating surplus. More details on this matter may be found in the Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2010).

6.123. Information on gross fixed capital formation within general government can usually be found in government accounts. Many of the above issues are also relevant to investment within general government. Accounts of central and local government will usually include a level of detail that reveals the distinction between intermediate consumption and gross fixed capital formation. Extra-budgetary units within general government may, on the other hand, provide less information on the nature of their costs as may also be the case for NPISHs.

6.124. Special care should be taken when projects are partially or wholly financed by capital transfers from outside, for instance from international organizations. In such cases, the accounts may show values that are net of financing from outside. In national accounts, gross fixed capital formation should record the full value of such projects.

6.125. The value of investment covered by business accounts will often give an incomplete picture of total gross fixed capital formation because some industries are only partially covered or lack information on some types of investment. The initial estimates of gross fixed capital formation may be prepared within an investment matrix framework that shows investment by industries, institutional sectors, types and products. In the event that uncertain data and so-called "guestimates" are used in many cells within such a framework, the framework can indicate the cells that are badly covered by source data but the cells should definitely contain values.

**(b) Gross fixed capital formation by products**

6.126. It is recommended that regular business surveys should be used as the key source for gross fixed capital formation by product, in particular since gross fixed capital formation is an erratic time series and cannot be modelled easily. If possible, these surveys should be linked to those collecting details on purchases of goods and services for intermediate consumption, in order to avoid double-counting or missing expenditure. Surveys of the product structure of gross fixed capital formation may exist but may not cover all industries. As for intermediate consumption, it may be possible to find detailed information in the annual reports of enterprises.

6.127. Government accounts contain information providing much more detail than a simple distribution by main types of investment. This information can, including for investment products, typically appear in an unsystematic form and it will need to be coded by product categories in SUTs before it can be used.

6.128. For many industries available information on the product dimension of investment is limited to a few categories or even non-existent. Initial estimates will therefore require some common-sense decisions.

6.129. In the end, the product structure of gross fixed capital formation will to a large extent be determined by the availability of investment products within the SUTs framework. In the simplest case, where other information is unavailable, gross fixed capital formation will alone be determined by the supply of typical investment products that are largely not used for other purposes.

6.130. Very few products are used exclusively for gross fixed capital formation. In most cases, the distribution between intermediate consumption, household final consumption expenditure and gross fixed capital formation that can be estimated using information from business surveys and company accounts is uncertain, in particular if the rows of the SUTs represent broad categories of products. The disaggregation of products can reduce this uncertainty, when the necessary source data are available. For some products, the distribution may be based on other types of information, as in the following examples:

- If an official register of motor vehicles is accessible, it may be possible to identify the changes from year to year in the numbers of different types of cars and lorries by age, size and ownership. Combined with typical prices for the various groups of vehicles, the register may be used to estimate household final consumption expenditure together with gross fixed capital formation by industry of new and used vehicles. Registers may also provide information to help distribute registration taxes by purpose.

- Similarly, it may be possible to use register information to follow the capital stock, and change in capital stock for other types of transport equipment.

- Official registers of buildings may also include information on type, size, use and owners and may be used for the distribution of buildings by purpose. For dwellings and private commercial buildings that are not completely covered by company accounts or business surveys, register information can be used in the estimation of the value of investment.

- Information on investment in buildings, transport equipment or specific types of machinery and investment may be collected by business surveys. Some countries carry out quarterly and annual business surveys covering gross fixed capital formation and underlying details. On the other hand, some countries occasionally carry out comprehensive industrial censuses that may contain information on the use of capital equipment for units that are not covered by other kinds of statistics.

- Household budget surveys can include information on investment in new dwellings and capital repairs. In countries with a large informal economy, household budget surveys may be the most important source for the estimation of investment in buildings, machinery and equipment in small farms (which may also, however, be included in agricultural censuses), small retail trade and repair workshops.

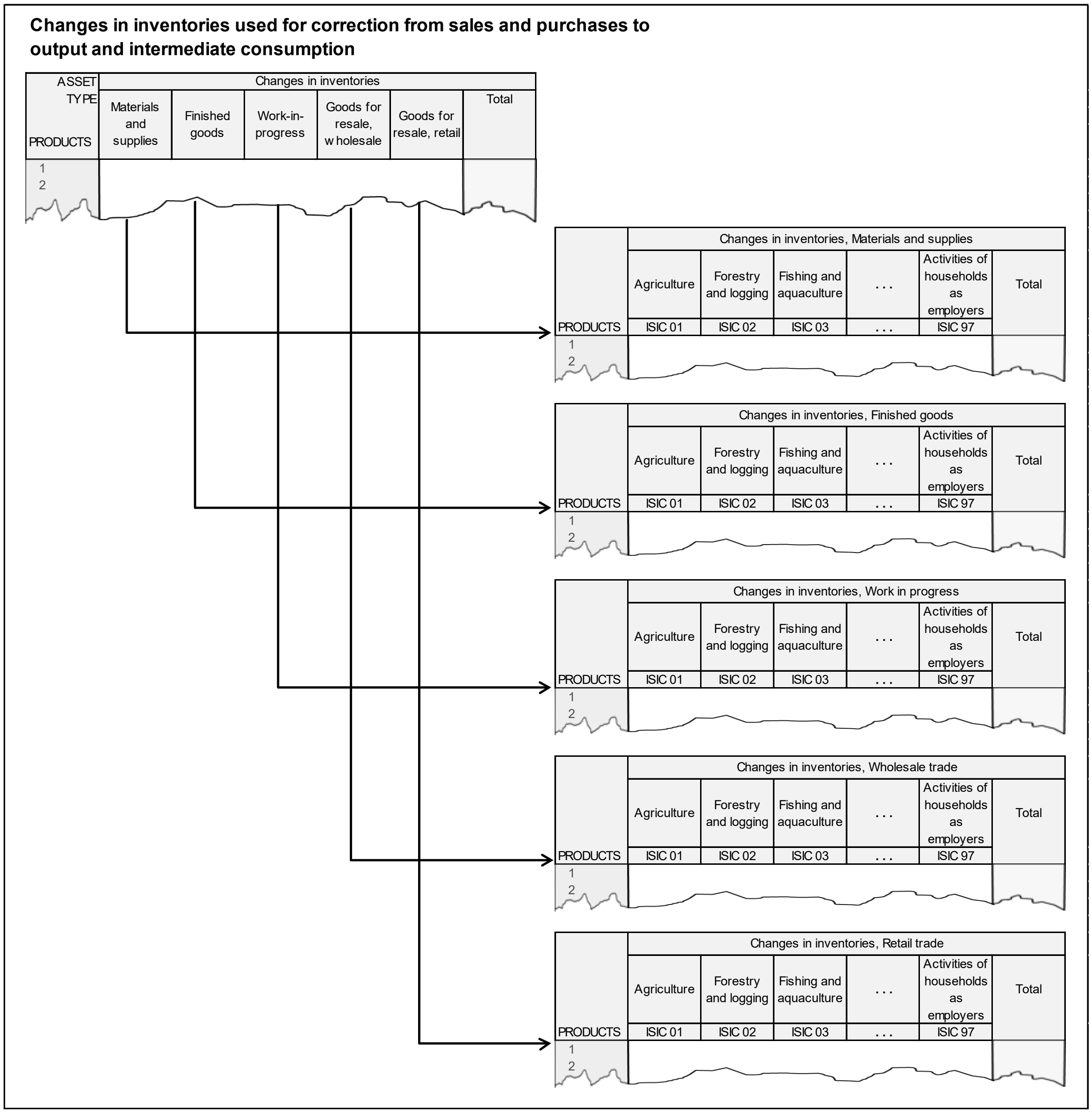
6.131. Furthermore, the product structure of investment tends to be more volatile than the structure of input cost structures. Nevertheless and despite its uncertainties, an initial version of investment by products estimated from the uses side is usually preferred to an estimated distribution based solely on the supply of specific products.

### 2. Changes in inventories

6.132. In order to define changes in inventories, it is useful to define first what is covered by inventories. Inventories are produced assets, consisting of goods and services, that came into existence in the current period or in an earlier period and that are held for sale, use in production or other use at a later date (2008, SNA, para. 10.12). Changes in inventories are measured by the value of the entries into inventories less the value of withdrawals and less the value of any recurrent losses of goods held in inventories during the accounting period. Some of these acquisitions and disposals are attributable to actual purchases or sales but others reflect transactions that are internal to the enterprise (2008 SNA, para. 10.118).

6.133. The change in inventories column in the use table should be underpinned with a matrix linking, as column headings, the classification of industries (for example, ISIC), and, as row headings, the product grouping (for example, CPC) as appearing in the SUTs for each type of asset. Changes in inventories can be analysed by industry and by types of assets, which need to be linked via CPC in the SUTs as illustrated in Table 6.12.

**Table 6.12 Table linking change in inventories industries, assets and products**




6.134. The change in inventories should separately distinguish the following types of assets:

- Materials and supplies, which consist of all products that an enterprise holds in inventory with the intention of using them as intermediate inputs into production.

- Work-in-progress, which consists of output produced by an enterprise that is not yet sufficiently processed to be in a state in which it is normally supplied to other institutional units.

- Finished goods, which consist of goods produced as outputs that their producer does not intend to process further before supplying them to other institutional units.

- Military inventories, which consist of single-use items, such as ammunition, missiles, rockets, bombs and other items, delivered by weapons or weapons systems. Some single-use items such as ballistic missiles highly destructive may be classified as fixed assets in the sense that they provide deterrence services against aggressors.

- Goods for resale, which are goods acquired by enterprises, such as wholesalers or retailers, for the purpose of reselling them to their customers.

6.135. Although change in inventories for all asset types appear in the final uses part of the use table, they also play a role across other parts of the supply table and use table:

- For each industry, intermediate consumption can be calculated as purchases of goods and services less change in inventories of materials, fuels and raw materials.

- For each industry, output can be calculated as sales plus change in inventories of work-in-progress and finished goods. Producers of services may actually have inventories of work-in-progress in the form of projects lasting for more than one accounting period, such as films, advertising campaigns, legal contracts, and so forth.

6.136. The output value in trade can be calculated as sales less purchases less change in inventories of goods purchased for resale without any further processing. If a distinction between wholesale and retail trade is made in SUTs, then the calculation of the output value for each of these industries requires separate values for the change in inventories of goods for resale.

6.137. For estimating output and intermediate consumption, changes in inventories are usually estimated by industry and institutional sector. These detailed breakdowns are, however, seldom shown in the use table.

6.138. It must be noted that the changes in inventories reported by the survey respondents should be adjusted to comply with national accounts definitions: thus the changes in inventories should not include any holding gains or losses. Source data may be presented as output and intermediate consumption instead of sales and purchases. In practice, the data collected may nevertheless contain values of sales and purchases. These data may be replaced by a correction that uses inventories that appear in the company accounts. If such changes include any holding gains or losses, the correct treatment is to remove the original correction for inventory changes and replace it by a correction that uses inventory changes according to national accounts definitions.

6.139. Statistics based on company accounts usually contain information on inventory changes and also on stocks of inventories. The value shown for change in inventories will usually include holding gains and losses and will be misleading if significant price changes take place during the year. A correction for holding gains and losses can usually be based on the nominal values of opening and closing stocks, or the book value levels. It will require the availability of adequate information on price changes during the year. The correction can typically be carried out by the inflation or deflation of opening and closing stocks to the average prices of the year before calculation of the difference. To calculate constant price values of stock of inventories (and changes in current prices), these prices values should be broken down by products for which price indices or volume indicators can be found.

6.140. Annual company accounts may not contain information of opening stocks, in which case it might be necessary to use values of closing stocks from the previous year as a measure of opening stocks. As coverage changes and establishments are reclassified, the observed differences between closing stocks and opening stocks may then need some adjustments at the industry level.

6.141. Given the links between sales, purchases and inventories, along with other variables, it is recommended that the data on inventories are collected via the same survey questionnaires to ensure coherence across the variables being collected with the same source and at the same point in time.

6.142. The Eurostat-OECD Compilation Guide on Inventories (Eurostat and OECD, 2017) provides more detail relating to compilation issues and guidance.

### (a) Estimation of changes in inventories by product

6.143. To fill in the columns for changes in inventories, the totals for this item must be broken down into changes in inventories for the products used in the SUTs and must be completed as part of generating the estimates of output and intermediate consumption.

6.144. For some products, the values of changes in inventories may be calculated based on knowledge of physical opening stocks and closing stocks and information on the development in prices, for example, for crops and livestock in agriculture and for energy products. The calculation of changes in inventories should be an integral part of subsystems used to provide the complete product balances for such products.

6.145. The inventories of most industries include a broad selection of products that are usually not known from statistical sources. The totals of opening stocks and closing stocks used to calculate changes in inventories need to be distributed by products based on assumptions on the product structure for each total. The following are typical examples:

- Inventories of finished goods and work-in-progress can be distributed proportionally with those outputs of each industry that can appear in inventories of goods. Caution will be needed on service products.

- Inventories of raw materials and fuels can be distributed proportionally with the use of inputs of each industry that can appear in inventories.

- Inventories of goods for resale can be distributed using various proxies for the product structure, for example, output or input in specific industries, household final consumption expenditure in specific COICOP groups or gross fixed capital formation of specific types.

- Values of inventories of specific products may already be known from other calculations. Such values can be retained as predetermined values.

- Some products, for instance electricity, are not likely to appear in inventories. Services should only appear in inventories as work-in-progress.

6.146. Calculating the distribution of changes in inventories by products in this way is of course uncertain and it may be adjusted during the balancing of SUTs. There is also a danger that errors in source data will not be detected if changes in inventories are used as balancing items or not subjected to adequate quality assurance. The total of changes in inventories should, at least, only be adjusted in exceptional cases, where this is believed to be the most realistic solution to a balancing problem.

6.147. It should be noted that any balancing adjustment to the asset composition of changes in inventories, or to the total changes in inventories, will affect different parts of the supply table and use table and will have the same total impact on each of the production, income and expenditure approaches to measuring GDP. This is because the various components of changes in inventories feed into the estimation of output and intermediate consumption and, in turn, GVA and final uses, thus the impact of any adjustment will be equal on production, income and expenditure. It is more likely that quality adjustments will be made to source data, where such changes will, and should, change the intermediate consumption and output and, in turn, GVA of the corresponding industries.

### 3. Acquisitions less disposals of valuables

6.148. Valuables are produced goods of considerable value that are not used primarily for purposes of production or consumption but are held as stores of value over time (2008 SNA, para. 10.13). Valuables include precious metals and stones, antiques and other art objects and other valuable items. Acquisitions less disposals of valuables capture these alternative forms of investments. Capital formation in valuables usually needs to be based on the domestic supply of specific goods, that is, imports less exports plus the margin. Valuables are by nature difficult to distribute across industries (based on establishments) as they share certain properties with financial assets, and the industry breakdown does not reflect those valuables held by, for example, households.

6.149. Trade data by detailed product provide a good source for identifying such items. Whereas the margin or fee type data by detailed product may be collected via questionnaires sent, for example, to auctioneers. For SUTs, the product breakdown is key: thus the relevance of imports less exports by type of product. In terms of the purchaser, this is less important, as the purchaser could be industry, government or households.

## G. Exports

6.150. Exports are shown in the use table by product. Depending on the specific user's need, an additional breakdown by column could be provided to show exports by destination. It should be noted that the treatment, issues and sources of data applied to imports of goods and services are also applicable to exports of goods and services. More detail on the imports of goods and services may be found in chapters 4, 5 and 8, including such issues as the new treatment of goods sent abroad for processing.

6.151. In the use table, exports are valued FOB at the point of exit from the exporter's economy. This value includes the cost of transport from the exporter's premises to the border of the exporting economy. FOB price includes:

- Value of goods at basic prices
- Trade and transport services to the border
- Taxes minus subsidies on products; there is no VAT on exports

6.152. Since data on exports on goods are collected on a FOB basis, no further transformation is needed.

### 1. Data sources

6.153. Most countries have comprehensive foreign trade statistics for goods. Data are generally collected according to the Harmonized System, valued at FOB and often available with a high level of detail, say by six-digit or eight-digit Harmonized System codes. Thus the only adjustment needed to the basic data is the conversion between Harmonized System codes and CPC. It is usually possible to convert the data from the Harmonized System classification using a correspondence table from the United Nations website (http://unstats.un.org/unsd/class/default.asp), supplemented by a conversion table that defines the SUTs products as aggregates of CPC classifications.

6.154. Various adjustments would be needed to move the foreign trade statistics on to a balance of payments basis in line with BPM 6, such as the change in economic ownership and the difference crossing the border.

6.155. Foreign trade statistics will also usually include the distribution of exports of goods by countries for all products.

6.156. Enterprises with exports below certain threshold values can be allowed to report their foreign trade without a distribution by products, for example with survey-based external trade statistics. In this case, the values of exports by products will need to be grossed up to cover total exports. The difference between grossed-up and reported values is uncertain, and may need to be corrected during the balancing of SUTs. As for inputs, information on the reported values can be shown together with the grossed-up values in the tables presented to those working on the manual balancing of SUTs before any automated balancing process.

6.157. The main source for data on exports of services is the balance of payments-based data and the sources used to produce these data. The classification according to the EBOPS 2010 (United Nations *et al.* 2011 and IMF, 2009) will usually provide sufficient detail for conversion into the classification used in the SUTs. Failing this, access may be available to statistics that show imports and exports by industries. A conversion into detailed SUTs-based products can be established based on the coding in balance of payments and the information on the industry classification of exporting units.

# Annex A to chapter 6: Sample questionnaire collecting purchases of goods and services for intermediate consumption

A6.1 The extract shown in Figure A6.1 is from a business survey questionnaire from the Statistical Office of Serbia. The data are collected for each industry and by product covering the following:

- Cost of materials
- Closing stocks of materials and fuels

A6.2 Full coverage of goods and services consumed as intermediate consumption to calculate the industry totals is achieved via further tables collecting data on the costs of industrial and non-industrial services, an extract from which is shown in figure A6.2. These data make it possible to calculate the intermediate consumption by product required to populate the intermediate use part of the use table, as shown in table 6.1.

# Figure A6.1 Extract from questionnaire covering costs and closing stocks of raw materials and other material inputs

| No. | Code | Product description | Cost of materials (group of account 5.1) | Closing stocks (group of accounts 10) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 3000 | | TOTAL | | |
| | | AGRICULTURAL PRODUCTS, RAW AND UNPROCESSED PRODUCTS OF PLANT AND ANIMAL ORIGIN | | |
| 3001 | 01.11.1 - 01.11.4 | Cereals, all kinds (except rice), cereal seeds | | |
| 3002 | 01.11.6 - 01.11.7 | Green leguminous vegetables (beans, peas, lentils and other) | | |
| 3003 | 01.11.8 | Soya beans, groundnuts (row ) and cotton seed | | |
| 3004 | 01.11.9 | Other oil seeds - sunflow er, sesame, lin etc. | | |
| 3005 | 01.11.12 | Rice, not husked | | |
| 3006 | 01.13 except 01.13.7 | Vegetables, raw | | |
| 3007 | 01.13.7 | Sugar beet and sugar beet seed | | |
| 3008 | 01.13.8 | Mushrooms and truffles | | |
| 3009 | 01.15 | Unmanufactured tobacco | | |
| 3010 | 01.16 | Fibre crops (lin, cotton and other fibre crops, used in textile industry) | | |
| 3011 | 01.19.1 | Forage crops and vegetative matter for livestock feeding unprocessed form | | |
| 3012 | 01.19.2 | Flow ers and flow er seeds | | |
| 3013 | 01.21 | Grapes | | |
| 3014 | 01.22 - 01.23 | Tropical and subtropical fruits (citrus, figs etc.) | | |
| 3015 | 01.24, 01.25 except 01.25.3 | Other fruits, tree and bush fruits, except nuts (apples, pears, cherries, berries etc.) | | |
| 3016 | 01.25.3 | Nuts (almonds, hazelnut, w alnuts etc.) | | |
| 3017 | 01.26 | Olives, coconuts (row , unprocessed) | | |
| 3018 | 01.27 | Coffee beans, tea leaves, cocoa beans, not roasted | | |
| 3019 | 01.28 | Spices, aromatic, drug and pharmaceutical crops | | |
| 3020 | 01.11.5, 01.14, 01.19.3, 01.29, 01.3 | Vegetables and fruit seeds, other seeds, grass, unprocessed straw and other residues of cereals, seeds for trees and seedings, planting materials, sugar cane and other raw , unprocessed and untreated products of plant origin n.e.c. | | |
| 3021 | 01.4. except 01.45.3 & 01.49.3 | Live animals and raw animal products (unprocessed milk, eggs, natural honey, except raw skins, shorn w ool and skins, see line 3022, etc.) | | |
| 3022 | 01.45.3, 01.49.3 | Raw fur skins, shorn w ool, skins (excluding products of slaughterhouses and industrial meat production, see 1036) | | |
| 3023 | 01.49. part | Other animal products, raw , unprocessed an untreated | | |
| 3024 | 01.7 | Hunting and trapping products, raw | | |
| | | PRODUCTS OF FORESTRY | | |
| 3025 | 02.2 | Wood in the rough - logs, fuel w ood and other row products of forestry | | |
| 3026 | 02.1, 02.3 | Forest trees and seeds, w ild grow ing edible products; natural cork, varnish, balsams and other raw products of forestry n.e.c. | | |
| | | FISH AND OTHER FISHING PRODUCTS, UNPROCESSED AND UNTREATED | | |
| 3027 | 03 | Fish and other fishing products; aquaculture products (raw , unprocessed and untreated) | | |
| | | MINING AND QUARRYING PRODUCTS; UNPROCESSED | | |
| 3028 | 05.1, 05.2 | Coals, hard coal and lignite | | |
| 3029 | 06.1 | Crude petroleum, bituminous or oil shale and tar sands. Note petroleum products - fuels are entered in the row 3118 | | |
| 3030 | 06.2 | Natural gas, processed (Manufactured gas distributed though mains, heating gas and petroleum gases from refineries should be reported in row s 3116 and 3119) | | |
| 3031 | 07.1 | Iron ores | | |
| 3032 | 07.2 | Other metal ores | | |
| 3033 | 08.1 | Stone, sand, and clay and other raw materials for construction, industrial and craft activities | | |
| 3034 | 08.9 | Other mining and quarrying products n.e.c. | | |
| | | MANUFACTURING INDUSTRY PRODUCTS | | |
| | | Food products and other processed products of plant and animal origin; used as reproduced material | | |
| 3035 | 10.11 except 10.11.4 & 10.12.5 | Meat (red meat, including frozen) except live animals and unprocessed and untreated products of animal origin (goes to row s 1021 -1024); raw offal and edible fat and oils | | |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| | | Electricity, refined petroleum products for energy purposes, gas (excluding natural gas), steam, hot w ater, air conditioning (including energy products use for heating) | Account 513 | |
| 3115 | 35.11 | Electricity costs | | |
| 3116 | 35.22 | Manufactured gas for industrial purposes and for heating - gas distributed through mains (excluding natural gas, see 3030, petroleum gas from refineries, see 3119 and industrial and medical gases, see 3069) | | |
| 3117 | 35.30 | Steam and hot w ater, air conditioning supply services | | |
| 3118 | 19.2 | Refined petroleum products - motor, engine and other fuels | | |
| 3119 | 19.2 | Petroleum gases - propane, butane etc. (excluding natural gas and industrial and medical gases) | | |

## Figure A6.2: Extract from questionnaire covering costs of industrial and non-industrial services

| No. | CPA code | Product description | Costs of services | Account code |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 4000 | | TOTAL | | |
| | | Support services directly linked with the production of goods and services | | |
| 4001 | 01.6 part | Support agricultural services to crop production | | 530 |
| 4002 | 01.6 part | Support services to animal production; veterinary services excluded (row 4044) | | |
| 4003 | 02.10.2, 02.4 | Support services to forestry | | |
| 4004 | 09 | Mining support services; services to petroleum and natural gas extraction | | |
| 4005 | 13.3 | Textile finishing services–bleaching, dyeing, printing etc. | | |
| 4006 | 16.10.9 | Drying, impregnation or chemical treatment services of timber and product of wood; support services in the processing of wood and wood products n.e.c. | | |
| 4007 | 25.5 | Forging, pressing, stamping and roll-forming services of metal | | |
| 4008 | 25.6 | Treatment and coating services of metals, machining | | |
| 4009 | 24.5 | Casting services of metal and steel | | |
| | | Subcontracted services in industry and construction, trade services and other intermediation commissions. Note: enter only the value of the services, value of materials of goods excluded | | |
| 4010 | 14, part | Subcontracted operations in textile industry (excluding value of materials) | | 530, 539 |
| 4011 | 15, part | Subcontracted operations in footwear and leather production industry (excluding value of materials) | | |
| 4012 | 16, part | Subcontracted operations in production of processed wood and wood products (excluding value of materials) | | |
| 4013 | 25, part | Subcontracted operations as part of machine industry–processing and finishing materials services (excluding value of materials) | | |
| 4014 | 41, 42, 43 | Subcontracted operations in construction | | |
| 4015 | – | Other subcontracted operations in production of goods of other enterprises (excluding value of materials), please specify | | |
| 4016 | 46.1 | Trade commissions | | |
| 4017 | – | Other intermediation commissions, please specify | | |
| | | Transportation costs, postal and courier services | | |
| 4018 | 49 | Land transport of freight, taxi operation services including rental services of land transport vehicles with operator | | 531 |
| 4019 | 50 | Water transport | | |
| 4020 | 51 | Air transport | | |
| 4021 | 52.2 | Support services for transportation (loading, unloading, hauling, towing, parking services, etc., transportation excluded) | | |
| 4022 | 53 | Postal services under universal obligation | | |
| 4023 | 53 | Other postal and courier services | | |
| | | Repair, maintenance, installation services; conversion, reconstruction and fitting out of transport equipment | | |
| 4024 | 33.1 | Repair and maintenance services of fabricated metal products, machinery and equipment, except motor vehicles | | 532 |
| 4025 | 43 | Repair and maintenance services of buildings and electrical, plumbing, heating and similar installations | | |
| 4026 | 45.2 | Maintenance and repair services of motor vehicles | | |
| 4027 | 95.1 | Maintenance and repair services of computers and communication equipment | | |
| 4028 | 95.2 | Repair services of personal and household goods | | |
| 4029 | 33.2 | Installation services of industrial machinery and equipment | | |
| 4030 | 29.20.4, 29.20.5 | Reconditioning, assembly, fitting out and bodywork services of motor vehicles, except installation, maintenance and repair services | | |
| 4031 | 30.11.9, 30.20.9, 30.30.6 | Conversion, reconstruction and fitting out services of other transport equipment, except installation, maintenance and repair services | | |
| | | Rentals, rents on land, warehousing and storage services | | |
| 4032 | 68.2, part | Rental costs on buildings and office space owned by legal persons (except rents on land) | | 533 |
| 4033 | 68.2, part | Rental costs on buildings and office space owned by natural persons (except rents on land) | | |
| 4034 | 68.2, part | Rents on private land | | |
| 4035 | 68.2, part | Rents on public or state land | | |
| 4036 | 77 | Rental and leasing services of motor vehicles, machinery, equipment and tangible goods (excluding real estate and financial lease) | | |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| | | Expenditure related to the intellectual property (royalties, licence fees, rights of usage, publication, reproduction, transmission, broadcasting and the like), other services n.e.c. Note: services as expenditures; if not capitalised | | |
| 4089 | 58,1 | Royalties for the publication of books, magazines, newspapers, etc. | | 539 or 559 |
| 4090 | 58,2 | Royalties and similar payments for usage of software | | |
| 4091 | 59 | Royalties for publishing (music and movies, TV series) | | |
| 4092 | 60 | Royalties (broadcast rights, etc.) in the production and broadcast of radio and television programs | | |
| 4093 | 71,2 | Certification of products and processes | | |
| 4094 | 77,4 | Royalties and fees for the use of intellectual property if it is not capitalised | | |
| 4095 | 96,01 | Laundry and washing of textile and fur | | |
| 4096 | – | Other industrial and non-industrial services not elsewhere specified please specify | | |

# Annex B to chapter 6: Impact of capitalizing the costs of research and development in SUTs and IOTs

## A. Research and development as fixed capital formation

B6.1 The 2008 SNA introduced changes relating to the treatment of research and development. Research and development is creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of people, culture and society, and to enable this stock of knowledge to be used to devise new applications. The 2008 SNA does not treat research and development activity as an ancillary activity and it recommends that a separate establishment should be distinguished for research and development when possible.

B6.2 The output of research and development should be capitalized as "intellectual property products" except where it is clear that the activity does not entail any economic benefit to its producer (and hence owner), in which case it is treated as intermediate consumption.

B6.3 The 2008 SNA now includes expenditures for both bought-in and own-account research and development as gross fixed capital formation and the depreciation of these assets as consumption of fixed capital.

B6.4 Table B6.1 shows a summary of the impact of these changes using a simplified hypothetical example simply to demonstrate the impact of capitalization. The example is simplified in the sense that it shows only two years and the capitalization of research and development (R&D) is assumed to be introduced in year 1, when there is no increase in the consumption of fixed capital. In reality, the capitalization costs will be spread over several successive years and the consumption of fixed capital will occur in year 1 and throughout the lifetime of the asset.

B6.5 Under 1993 SNA, own-account R&D activity was treated as an ancillary activity and no separate output was estimated in the system, and expenditures for this purpose were not separately identified. Only in those cases, usually unimportant, where R&D services were purchased from outside specialist producers, classified in the research and development activity (ISIC Rev. 4, division 72) or imported, do R&D services appear in the SUTs as intermediate consumption.

B6.6 With the capitalization of R&D expenditures under the 2008 SNA, the output of own-account R&D is separately estimated and allocated to GCF or exports. In practice, the introduction of own-account R&D output in the system has just resulted in additional output with the intermediate inputs being left unaffected, as the intermediate inputs needed to produce the own-account R&D were already included. With the 2008 SNA change of treating research and development not as an ancillary activity, the question for the compilation of SUTs and IOTs is whether the R&D output from own-account R&D activity should be seen as a secondary product from that particular branch or the principal product of the activity “Scientific research and development” ISIC Rev. 4, division 72. This issue of reclassification of own-account R&D activity is considered in the following section.

B6.7 The challenging methodological and practical problems related to the actual estimates of output of own-account research and development are not being dealt with at this point; reference is made to the Manual on Measuring Research and Development in ESA 2010 (Eurostat, 2014a), the Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2010) and specific country documentations. In the following, only some problems of special interest for the compilation of SUTs and IOTs will be highlighted.

**Table B6.1 Summary of the impact of the capitalization of research and development in the new 2008 SNA**

| Indicative impact | Change in the treatment of Research and Development | | | |
|---|---|---|---|---|
| | Market producers | | Non-market producers | |
| | Own account | Bought-in | Own account | Bought in |
| | (1) | (2) | (3) | (4) |
| Intermediate consumption | 0 | -500 | 0 | -500 |
| Non-market consumption of fixed capital | 0 | 0 | (+200) | (+100) |
| Gross operating surplus | +1 000 | +500 | (+200) | (+100) |
| GVA | +1 000 | +500 | (+200) | (+100) |
| Total output | +1 000 | 0 | (+200) | -500 (+100) |
| Output for own final use | +1 000 | 0 | +1 000 | 0 |
| General governemnt or NPISHs final consumtpion expenditures | 0 | 0 | -1 000 (+200) | -500 (+100) |
| Gross fixed capital formation | +1 000 | +500 | +1 000 | *500 |
| Impact on GDP | +1 000 | +500 | 0 (+200) | 0 (+100) |

For own account value of production is 1000. For non-market producers, consumption of fixed capital in Year 2 is 200.

For bought-in, value of intermediate consumption is 500. For non-market producers, consumption of fixed capital in Year 2 is 100.

Year 1 estimates. Estimates in brackets to relate to consumption of fixed capital to impact in Year 2 for non-market producers.

## B. Implications of valuation of output as sum of costs

B6.8 Output for own final use should be valued at the basic prices at which the goods and services could be sold if offered for sale on the market. When reliable market prices cannot be obtained, a second best procedure must be used, in which the value of the output of the goods or services produced for own final use is deemed to be equal to the sum of their costs of production, that is, as the sum of: intermediate consumption; compensation of employees; consumption of fixed capital; a net return to fixed capital; and other taxes (less subsidies) on production. By convention, no net return to capital is included when own-account production is undertaken by non-market producers (2008 SNA, para. 6.125).

B6.9 The calculation of the output of own-account R&D from the sum of costs approach means that the cost structure for this particular type of output will be separately specified; this is a departure from the usual situation where intermediate and primary inputs used for various types of outputs will be indistinguishably lumped together. Based on the known cost structure, it would in principle be possible to create separate establishments for the own-account R&D activity, and if further on this activity was seen as secondary, to reclassify these establishments from the original activity to which they are classified, for example, pharmaceuticals, electronics and so forth, to the specialist activity for scientific research and development (ISIC Rev. 4, division 72).

B6.10 For a number of analytical, methodological and practical reasons, however, such a reclassification is not recommended. These reasons include, primarily, the following:

- There is an analytical interest in keeping track of those economic activities that actively involve R&D and this information would be lost through such a reclassification.

- As each R&D output is uniquely defined, the own-account research and development is usually not suitable for delivery outside the producing unit, and a reclassification would not reflect the economic reality of the activity.

- Given the lack of any other information, it is assumed that the producing unit is also the owner of the resulting R&D capital stock and the associated consumption of fixed capital – this assumption is often not valid.

- The cost structures calculated to derive the estimate of R&D output will not usually have product details corresponding to the SUTs product requirement, and in general, will only exist as internal worksheet exercises not intended for a wider audience.

- If all R&D were reclassified to ISIC Rev. 4, division 72, in many developed countries this division would increase to the same size or even larger than the agricultural sector, and seriously distort the relative proportions, in particular between manufacturing industries and service industries. It would also make industries active in R&D (such as the pharmaceutical industry) rather meaningless truncated residuals compared with the usual perception of the size and structure of these industries and thus the reclassifications would be counterproductive from the point of view of users' needs and a wide-range of analytical purposes.

## C. Own-account research and development as principal or secondary output

B6.11 Research and development services, division 81 of CPC Version 2.1, also existed prior to the capitalization of R&D, and were mainly made up of the services actually sold in the market by enterprises classified in division 72 of ISIC Rev. 4, "Scientific research and development". This was generally small, however, when compared with the total value of own-account R&D estimated in connection with the capitalization.

B6.12 In division 81 of CPC Version 2.1, the subclasses are organized according to the type of research (for example, chemistry, biotechnology, and others), and not according to the economic activities carrying out the R&D, and all R&D services are indicated as characteristic products of ISIC Rev. 4 subclasses 7210 and 7220. This follows logically from the fact that CPC Version 2.1 was not designed for a situation where the overwhelming share of R&D services comes into existence as estimated own-account output in ISIC industries other than ISC Rev. 4, division 72.

B6.13 Under the system of estimated own-account output of R&D services, it would be more appropriate to introduce a CPC structure for R&D similar to the structures for "Maintenance, repair and installation (except construction) services" (CPC Version 2.1, division 87) and for "Manufacturing services on physical goods owned by others" (CPC Version 2.1, division 88) where the subclasses (four digits) are made up industry specific outputs, each corresponding to a characteristic ISIC class (four digits). This means, in particular, that outputs of these services in industries which are active in R&D form principal outputs. When this approach is followed for own-account R&D services, there will be as many subclasses of CPC division 81 as there are industries with R&D activities, and own-account R&D will formally change from a secondary to a principal activity of the producing industries. The adoption of this approach will also have important implications when deriving IOTs from the SUTs, as it will prevent major structural differences between industry-by-industry IOTs and product-by-product IOTs, and avoid truncating research and development-intensive product-adjusted industries in the product-by-product IOTs.

B6.14 In practice, specialized R&D departments of enterprises with major own-account R&D activities may, for various reasons (legal, tax-related, and other), have already been classified in ISIC Rev. 4, division 72, in the business register, and thus be included in business statistics with this activity, rather than the principal activity (for example, pharmaceutical, electronic and so forth) of the parent enterprise.

B6.15 In such cases, the flows between the R&D department classified in ISIC Rev. 4, division 72, and the parent enterprise, and also the applied valuation principles, should be carefully assessed. In this connection, it is important to realize that business accounting practices will usually not follow the principle of capitalizing R&D expenditures. Thus the total output (however estimated) from an R&D department classified in ISIC Rev. 4, division 72, may, in the business accounts, reappear as intermediate consumption in the accounts of the parent enterprise. Depending on the circumstances, one solution might be to reclassify the R&D department back to the activity of the parent enterprise. In national accounts, sometimes legal structures may be overruled if they are found not to reflect economic realities. Alternatively, the intermediate consumption of R&D services could simply be removed from the parent enterprise and instead treated as gross fixed capital formation, but this may leave a truncated enterprise of little analytical interest, as noted above, and it would still be necessary to deal with the valuation of reported output of the R&D department.

## D. Balancing supply and use of research and development services

B6.16 Assuming that the output of R&D services (market, non-market and for own-use) by industry is available from the current national accounts calculations, allocation by user should, in principle, be fairly straightforward, as these services under the 2008 SNA treatment of R&D should be allocated to gross fixed capital formation. There are, however, two problem areas worth mentioning:

- Some research and development purchases are still to be treated as intermediate consumption.
- Foreign trade in research and development services must be taken into account when balancing the R&D services.

B6.17 When market R&D services are purchased by an own-account producer of R&D from a commercial R&D producer (usually, although not necessarily, classified in ISIC Rev. 4, division 72) or imported, it must be decided whether this is an acquisition of an asset or an intermediate product used as an input into the own-account production of R&D. As there is usually insufficient information available on the individual transactions for an informed decision to be made, it is recommended by the Eurostat Manual that, in the absence of any strong evidence to the contrary, all purchases by own-account R&D producers from units classified in ISIC Rev. 4, division 72, (and also purchases by other units in ISIC Rev. 4, division 72) should be treated as intermediate consumption. This assumption will also ease the distribution in cases where no product statistics for the output from ISIC Rev. 4, division 72, are available, as some output may be non-research and development services that would nonetheless usually be allocated to intermediate consumption.

B6.18 The above-mentioned case involving a specialized R&D department classified in division 72 of ISIC Rev. 4 may, however, interfere with this solution, and it is recommended that the SUTs compilers coordinate closely with the compilers of the R&D estimates made for the national accounts.

B6.19 In the 2010 Manual on Statistics of International Trade in Services (United Nations, IMF, OECD, European Union, UNCTAD, UNWTO and WTO, 2011) and Extended Balance of Payments Services Classification (EBOPS, 2010), there are special entries on R&D services, which are explicitly separated from transactions on the results of R&D (for example, royalties and license fees paid for use of patented entities).

B6.20 It would therefore appear that the balancing of the R&D services, also taking into account imports and exports, would be straightforward. The transactions registered in the balance of payments are, however, actual economic transactions where the prices may be quite different from the cost-based valuation of the domestic own-account output of R&D services, and the delimitation of the R&D concept may also deviate. Further balance of payments transactions in R&D may include significant elements of transfer pricing and trade with subsidiaries in low-tax jurisdictions. When the aim is to achieve consistency with existing balance of payments data, the final balancing of the R&D services may be quite difficult, even though the capitalized R&D services allows trade in “used” R&D so that gross fixed capital formation may in principle (though no very realistically) become negative. More detail on these issues may be found in chapter 7 of the guidance on the impact of globalization on national accounts prepared by the Economic Commission for Europe (UNECE, 2011).

# Chapter 7. Compiling the valuation matrices

## A. Introduction

7.1. The compilation of valuation matrices is a fundamental step in the process of compiling SUTs. These matrices are necessary to bridge the different valuation concepts of the product flows. This chapter covers the main concepts and methods of compiling matrices for trade margins, transport margins, taxes on products and subsidies on products. In particular, in section B, the chapter starts with an overview of the valuation concepts in the 2008 SNA and of how the valuation matrices fit within the SUTs presented in chapters 5 and 6. Sections C–E elaborate on each component of the valuation matrices and describe the main compilation steps. The annex to this chapter provides further details on how to compile trade margins for the SUTs from survey data based on a country practice.

## B. Valuation of product flows

7.2. Transactions are valued at the actual prices agreed upon by the purchasers and sellers. Market prices are thus the main reference for the valuation of transactions in the SUTs system, in line with 2008 SNA. In the absence of market transactions, the valuation is made according to costs incurred (for example, for non-market services produced by government) or by reference to market prices for analogous goods and services (for example, for services of owner-occupied dwellings).

### 1. Valuation concepts in the 2008 SNA

7.3. More than one set of prices may be used to value outputs and inputs depending on how taxes and subsidies on products, trade and transport margins are recorded. The 2008 SNA distinguishes three main valuation concepts of the flows of goods and services: the two main recommended valuations being basic prices and purchasers' prices and the lesser used producers' prices.

7.4. The basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, by the producer as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer (2008 SNA, para. 6.51).

7.5. The producers' price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any VAT, or similar deductible tax, invoiced to the purchaser. It excludes any transport charges invoiced separately by the producer (2008 SNA, para. 6.51).

7.6. The purchasers' price is the amount paid by the purchaser, excluding any VAT or similar tax deductible by the purchaser, in order to take delivery of a unit of a good or service at the time and place required by the purchaser. The purchasers' price of a good includes any transport charges paid separately by the purchaser to take delivery at the required time and place (2008 SNA, para. 6.64).

7.7. The difference between these valuation concepts for a product relates to trade margins, transport margins and taxes on products and subsidies on products. The relationship between the three types of prices is as follows:

| | | |
|---|---|---|
| **Basic prices** | + | Taxes on products excluding invoiced VAT |
| | - | Subsidies on products |
| | = | **Producers' prices** |
| | + | Wholesalers' trade margins |
| | + | Retailers' trade margins |
| | + | Separately invoiced transport charges |
| | + | VAT not deductible by the purchaser |
| | = | **Purchasers' prices** |

7.8. The basic price measures the amount retained by the producer and, therefore, the price most relevant for the producers' decision-making and is often reported in business surveys. For imported products, taxes on products include import duties. When the relationship between basic prices and purchasers' prices is compiled for the total economy, the transport charges and trade margins will cancel out because they form only a reallocation of value across products.

7.9. The concept of producers' prices does not form any of the main valuations. The preferred valuation of output and GVA in the SNA is made at basic prices and for intermediate consumption at purchasers' prices. It is worth recognizing that source data from business surveys for sales may be valued at producers' prices. In these cases, data should be adjusted to a basic price valuation before they are entered into the SUTs. If this step is not completed, then a different recording of taxes on products and subsidies on products must be established, and GVA by economic activity would be partly at market prices, a practice which is not recommended by the SNA.

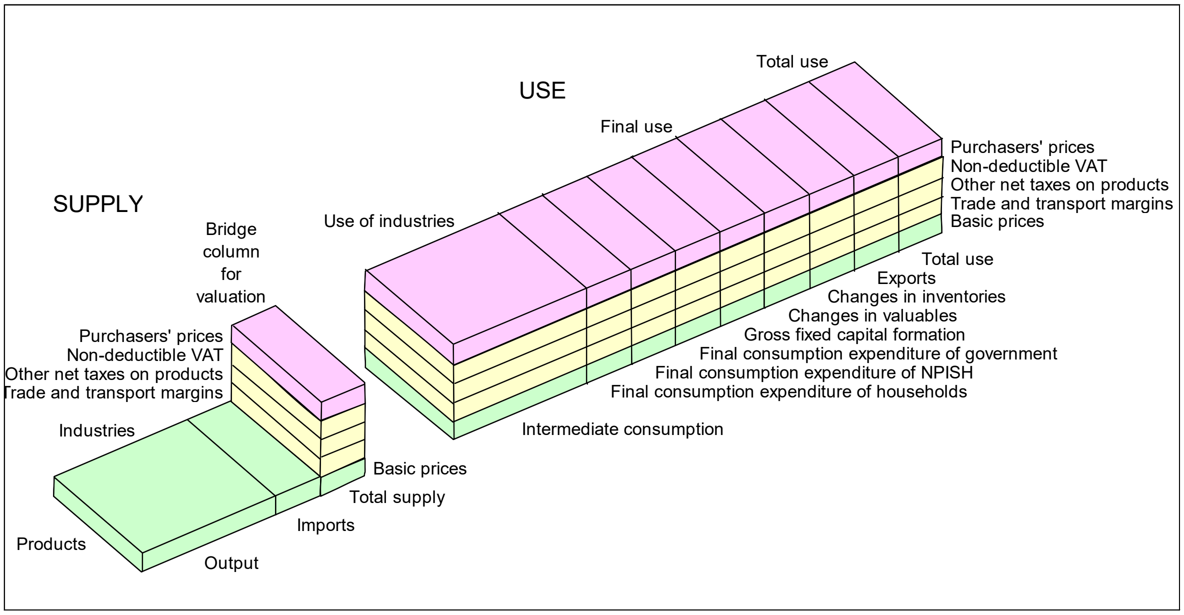
7.10. It is important to note that the relationship between basic price and purchasers' price does not describe a process over time for an identifiable product. In this case, the difference between basic prices and purchasers' prices is likely to contain an element of holding gains and losses while the product is with the producer and with wholesale and retail traders (2008 SNA, para. 3.148). The SNA value concepts are consistently defined in such a way that holding gains and losses do not become part of GVA and GDP. Hence a trade margin is relative to the replace price of the good "at the time it is sold", and the price of intermediate consumption relates to what the producer would have to pay to replace it "at the time it is used".

7.11. The source data used to fill the cells in the SUTs may have different valuations:

- Production and output data are valued at basic prices.
- Intermediate consumption and final uses are valued at purchasers' prices.
- Imports are valued at CIF prices. This is the valuation of a good delivered at the point of entry into the importing economy or the price of a service delivered to a resident, before the payment of any import duties or other taxes on imports or trade and transport margins within the country. In the SUTs framework, for national SUTs, the CIF value is taken to be the basic price of imports of goods.
- Exports are valued at FOB prices. This is the valuation of a good at the point of exit from the exporter's economy or the price of a service delivered to a non-resident, including transport charges and trade margins up to the point of the border, and including any taxes less subsidies on the goods exported. In the SUTs framework, the FOB value is taken to be the purchasers' price of exports of goods.

7.12. It is recommended that the different valuation components of the product flows are separated to ensure that the SUTs framework is balanced in a fully coherent and consistent manner. One of the purposes of the valuation matrices is to bridge the difference between the valuation at basic prices and the valuation at purchasers' prices and to come up with SUTs at basic prices. Figure 7.1 illustrates how the valuation matrices link the supply table with the use table. They comprise all flows that are related to the supply and use of trade margins and transport margins and to taxes and subsidies on products.

**Figure 7.1 Schematic representation of the valuation matrices in the SUTs**




7.13. In the supply table, the valuation matrices consist of columns (the "bridge column" in Figure 7.1) which transform the supply of each product from basic prices to purchasers' prices, and, in turn, match the product values in the use table compiled at purchasers' prices.

7.14. In the use table, the valuation matrices consist of product-by-industry matrices of trade margins, transport margins, taxes on products and subsidies on products which allow for the transformation of the values of the use table from purchasers' prices into basic prices. The availability of such matrices makes possible the balancing of SUTs at basic prices and purchasers' prices and, as recommended in the Handbook, both valuations should be balanced simultaneously.

7.15. Although it is not strictly necessary that a balanced SUTs framework ends up with tables showing valuation both at purchasers' and at basic prices, this is recommended for several reasons. For analytical purposes, the SUTs data must have the same valuation, and usually the basic price version is the most appropriate. This is also the case for the process of transforming the SUTs into IOTs and for the volume estimates in a consistent SUTs framework leading to the estimation of GVA in volume terms, using double deflation.

7.16. For these input-output based analytical purposes, a valuation as uniform as possible of the cells in a row of the use table is essential. The values at purchasers' prices in the different uses will usually be affected by differences in trade and transport margins, and by differences in taxes on products and subsidies on products, according to the specific user. The uniformity requirement is therefore best fulfilled by values at basic prices, although the cells valued at basic prices may still show user specific price variation: this is the most uniform valuation concept that in practice can be achieved.

## 2. Valuation matrices in the SUTs framework

7.17. The valuation matrices comprise information on trade margins, transport margins, taxes on products and subsidies on products. Valuation matrices can be established for the supply table (supply-side valuation matrices) and the use table (use-side valuation matrices). In a balanced SUTs system, the use-side valuation matrices and the supply-side valuation matrices will add up to the same totals. In this section, the full set of valuation matrices is described.

### (a) Supply-side valuation matrices

7.18. The supply-side valuation matrix consists of a set of columns added to the supply table at basic prices to derive the supply at purchasers' prices. These columns comprise trade margins, transport margins, VAT, taxes on products and subsidies on products. Table 7.1 shows the structure of the supply table at basic prices, including a transformation into purchasers' prices. The table corresponds to table 5.2 of chapter 5 and is reproduced here for ease of reference. The left part of this table starts with the domestic output of the various industries by products at basic prices. The inclusion of the imports valued at CIF prices by products generates the total supply by products at basic prices, as shown in column (9).

7.19. In the supply table, the output at basic prices of trade services (of which trade margins form the major part) is included in row (4) and that of transport services in row (5). To arrive at purchasers' prices for each product, the trade margin and transport margin shares of this output have to be reallocated from trade margins and transport services to the traded and transported products. Columns (10) and (11) of Table 7.1 contain the allocation of trade margins and transport margins respectively, with positive entries (+) in the rows of the traded and transported products and negative entries (-) in the rows of trade services and transport services. The totals by row of columns (10) and (11) of trade and transport margins respectively are always zero.

7.20. The columns of taxes less subsidies of products – columns (12)–(14) of Table 7.1 – are also added to total supply at basic prices in order to arrive at the total supply at purchasers' prices. Taxes on products comprise VAT-type taxes, taxes and duties on imports and other taxes on products. Similarly, subsidies on products comprise import subsidies and other subsidies on products. Taxes and subsidies on products should be compiled separately although they may be shown as a single column.

7.21. The addition of columns (10)–(14) to total supply at basic prices of column (9) gives total supply at purchasers' prices in column (16). Columns (10) and (14) thus provide the bridge needed to compare and balance total supply with total use when both sides are valued at purchasers' prices.

7.22. Both trade margins and transport margins can be produced by any industry outside the trade and transport industries. The bulk of the output of trade margins, however, is generally produced by the trade industries and the bulk of transport margins by the transport industries, as illustrated in rows (4) and (5) of Table 7.1.

## Table 7.1 Supply table at basic prices, including a transformation into purchasers' prices

Millions of euros

| | | | INDUSTRIES | | | | | | Output at basic prices | Imports | Total supply at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| PRODUCTS | Agriculture | (1) | 8 782 | 0 | 0 | 0 | 0 | 0 | 8 782 | 3 271 | 12 052 |
| | Manufacturing | (2) | 796 | 182 982 | 643 | 1 808 | 133 | 44 | 186 405 | 124 590 | 310 995 |
| | Construction | (3) | 83 | 961 | 43 060 | 734 | 255 | 179 | 45 272 | 563 | 45 835 |
| | Trade | (4) | 1 | 4 773 | 311 | 54 204 | 640 | 257 | 60 187 | 600 | 60 787 |
| | Transport | (5) | 13 | 465 | 66 | 25 538 | 128 | 125 | 26 335 | 8 150 | 34 485 |
| | Communication | (6) | 160 | 1 781 | 139 | 43 912 | 1 253 | 982 | 48 228 | 6 234 | 54 463 |
| | Finance and business services | (7) | 29 | 8 902 | 698 | 7 588 | 106 909 | 3 381 | 127 508 | 7 061 | 134 569 |
| | Other services | (8) | 3 | 85 | 13 | 1 053 | 143 | 74 346 | 75 643 | 824 | 76 467 |
| | Total | (9) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | 151 293 | 729 653 |
| Adjustments | CIF/FOB adjustments on imports | (10) | | | | | | | | - 97 | - 97 |
| | Direct purchases abroad by residents | (11) | | | | | | | | 6 675 | 6 675 |
| | Total | (12) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | 157 871 | 736 230 |
| | Total of which: | | | | | | | | | | |
| | Market output | (13) | 9 763 | 195 916 | 41 462 | 127 401 | 88 330 | 18 116 | 480 989 | | |
| | Output for own final use | (14) | 104 | 4 029 | 3 468 | 2 134 | 19 890 | 2 670 | 32 295 | | |
| | Non-market output | (15) | 0 | 4 | 0 | 5 302 | 1 241 | 58 528 | 65 075 | | |

| | | | Total supply at basic prices | VALUATION MATRICES | | | | | | Total supply at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Trade margins | Transport margins | VAT | Taxes on products | Subsidies on products | Total | |
| | | | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 12 052 | 1 926 | 274 | 329 | 57 | - 107 | 2 479 | 14 532 |
| | Manufacturing | (2) | 310 995 | 48 838 | 2 540 | 13 175 | 7 866 | - 49 | 72 370 | 383 364 |
| | Construction | (3) | 45 835 | 0 | 0 | 1 529 | 13 | 0 | 1 542 | 47 377 |
| | Trade | (4) | 60 787 | - 52 341 | 0 | 575 | 11 | 0 | - 51 755 | 9 032 |
| | Transport | (5) | 34 485 | 0 | - 2 800 | 558 | 71 | - 448 | - 2 620 | 31 865 |
| | Communication | (6) | 54 463 | 1 493 | 9 | 3 375 | 217 | - 34 | 5 059 | 59 522 |
| | Finance and business services | (7) | 134 569 | 0 | - 22 | 2 706 | 2 159 | 0 | 4 842 | 139 411 |
| | Other services | (8) | 76 467 | 85 | 0 | 1 201 | 576 | 0 | 1 861 | 78 329 |
| | Total | (9) | 729 653 | 0 | 0 | 23 447 | 10 969 | - 638 | 33 778 | 763 431 |
| Adjustments | CIF/FOB adjustments on imports | (10) | - 97 | | | | | | - 97 | - 97 |
| | Direct purchases abroad by residents | (11) | 6 675 | | | | | | 6 675 | 6 675 |
| | Total | (12) | 736 230 | 0 | 0 | 23 447 | 10 969 | - 638 | 40 356 | 770 009 |
| | Total of which: | | | | | | | | | |
| | Market output | (13) | | | | | | | | |
| | Output for own final use | (14) | | | | | | | | |
| | Non-market output | (15) | | | | | | | | |

Table based on 2011 figures from Austria

### (b) Use-side valuation matrices

7.23. The use-side valuation matrices consist of a sequence of matrices – mirroring the shape of the intermediate use and final use parts of the use table – for each component of the valuation, namely, for trade margins, transport margins, taxes on products and subsidies on products.

7.24. Table 7.2 illustrates the use table at purchasers' prices. This table corresponds to table 6.1 of chapter 6 and is reproduced here for ease of reference. It shows the structure of the table, comprising the following three sub-matrices:

- Intermediate consumption matrix showing intermediate consumption for each industry by product
- Final uses matrix showing final uses by type of final use and by product
- GVA matrix showing the components of GVA for each industry

### Table 7.2 Use table at purchasers' prices

Millions of euros

| | | | INDUSTRIES | | | | | | | FINAL USE | | | | | | | | Total use at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agricul-ture | Manufac-turing | Construc-tion | Trade, transport and communication | Finance and business services | Other services | Total | Final consumption expenditure | | | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | | | | | | | | Households | NPISH | General government | | | | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 2 583 | 6 570 | 16 | 371 | 34 | 49 | 9 623 | 3 595 | | | 180 | | - 27 | 1 161 | 4 909 | 14 532 |
| | Manufacturing | (2) | 2 205 | 107 190 | 12 441 | 16 874 | 6 015 | 8 797 | 153 522 | 71 438 | | 3 180 | 26 756 | 2 183 | 3 034 | 123 252 | 229 842 | 383 364 |
| | Construction | (3) | 105 | 2 440 | 9 528 | 2 446 | 3 907 | 1 604 | 20 029 | 1 667 | | | 25 155 | | - 38 | 563 | 27 348 | 47 377 |
| | Trade | (4) | 33 | 1 883 | 119 | 2 240 | 259 | 308 | 4 842 | 3 325 | | | 67 | 45 | | 753 | 4 189 | 9 032 |
| | Transport | (5) | 14 | 4 386 | 267 | 8 399 | 822 | 321 | 14 208 | 5 833 | | 3 370 | | | | 8 453 | 17 656 | 31 865 |
| | Communication | (6) | 34 | 2 563 | 299 | 9 359 | 5 919 | 1 833 | 20 008 | 26 444 | | 121 | 5 976 | | 67 | 6 905 | 39 514 | 59 522 |
| | Finance and business services | (7) | 457 | 13 578 | 4 736 | 20 359 | 29 166 | 9 134 | 77 430 | 38 838 | | 1 006 | 11 170 | | - 178 | 11 145 | 61 981 | 139 411 |
| | Other services | (8) | 8 | 382 | 59 | 1 171 | 415 | 1 794 | 3 829 | 14 923 | 5 416 | 53 373 | 113 | 107 | 1 | 567 | 74 500 | 78 329 |
| | Total at purchasers' prices before adjustments | (9) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 152 800 | 459 939 | 763 431 |
| Adjustments | CIF/FOB adjustments on exports | (10) | | | | | | | | | | | | | | - 97 | - 97 | - 97 |
| | Direct purchases abroad by residents | (11) | | | | | | | | 6 675 | | | | | | | 6 675 | 6 675 |
| | Purchases in the domestic territory by non-residents | (12) | | | | | | | | - 12 945 | | | | | | 12 945 | | |
| | Total at purchasers' prices | (13) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 159 792 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 165 648 | 466 517 | 770 009 |
| GVA | Compensation of employees | (14) | 551 | 30 679 | 10 239 | 37 906 | 22 997 | 41 971 | 144 343 | | | | | | | | | |
| | Other taxes less subsidies on production | (15) | - 1 627 | 1 077 | 546 | 1 755 | 2 004 | 1 103 | 4 858 | | | | | | | | | |
| | Consumption of fixed capital | (16) | 1 845 | 12 750 | 1 542 | 10 917 | 18 934 | 7 480 | 53 469 | | | | | | | | | |
| | Net operating surplus/Net mixed income | (17) | 3 658 | 16 453 | 5 138 | 23 040 | 18 989 | 4 921 | 72 198 | | | | | | | | | |
| | Gross operating surplus/gross mixed income | (18) | 5 503 | 29 203 | 6 680 | 33 957 | 37 923 | 12 401 | 125 667 | | | | | | | | | |
| | GVA | (19) | 4 427 | 60 959 | 17 465 | 73 618 | 62 923 | 55 475 | 274 868 | | | | | | | | | |
| | Total input at basic prices | (20) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | | | | | | | | | |

Table based on 2011 figures from Austria

7.25. The matrices covering intermediate consumption and final uses are valued at purchasers' prices, thus they include trade margins and transport margins, along with taxes on products less subsidies on products. Accordingly, the sum of total intermediate consumption at purchasers' prices (column (7) of Table 7.2) and total final use (column (15) of Table 7.2) gives the total use by product at purchasers' prices, which, in a balanced system, is equal to the total supply by products at purchasers' prices in column (16) of the supply table in Table 7.1.

7.26. Table 7.3 shows the use-side valuation matrices covering trade margins (split between wholesale and retail trade margins), transport margin, VAT, taxes on products and subsidies on products. These matrices have the same structure and dimension as the intermediate consumption and final uses sub-matrices of the use table at purchasers' prices. They show the allocation of the trade margins, transport margins, taxes and subsidies on products to each element of the use table at purchasers' prices. They represent the amounts that must be deducted from each element of the use table at the purchasers' price in order to arrive at the use table at basic prices.

# Table 7.3 Use-side valuation matrices

| | | INDUSTRIES | | | | | | | FINAL USE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Final consumption expenditure | | | | | | | | |
| PRODUCTS | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Households | NPISH | General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | Total use at purchasers' prices |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| **Wholesale trade margins** | | | | | | | | | | | | | | | | | |
| Agriculture | (1) | 31 | 440 | 2 | 63 | 4 | 6 | 547 | 326 | | | 10 | | 4 | 165 | 506 | 1 052 |
| Manufacturing | (2) | 164 | 6 450 | 1 415 | 1 879 | 326 | 1 049 | 11 284 | 5 941 | | 560 | 2 718 | 15 | 265 | 8 995 | 18 493 | 29 777 |
| Construction | (3) | | | | | | | | | | | | | | | | |
| Trade | (4) | - 196 | - 6 910 | - 1 420 | - 1 997 | - 367 | - 1 082 | - 11 972 | - 6 464 | | - 569 | - 2 776 | - 15 | - 273 | - 9 232 | - 19 329 | - 31 301 |
| Transport | (5) | | | | | | | | | | | | | | | | |
| Communication | (6) | 0 | 20 | 3 | 55 | 37 | 27 | 141 | 197 | | 9 | 48 | | 4 | 72 | 330 | 472 |
| Finance and business services | (7) | | | | | | | | | | | | | | | | |
| Other services | (8) | | | | | | | | | | | | | | | | |
| Total | (9) | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 |
| **Retail trade margins** | | | | | | | | | | | | | | | | | |
| Agriculture | (1) | | 3 | 0 | 13 | 0 | 1 | 17 | 856 | | | | | | | 856 | 873 |
| Manufacturing | (2) | 19 | 56 | 20 | 339 | 38 | 90 | 562 | 16 781 | | 477 | 1 142 | 99 | | | 18 499 | 19 061 |
| Construction | (3) | | | | | | | | | | | | | | | | |
| Trade | (4) | - 19 | - 86 | - 25 | - 431 | - 104 | - 150 | - 815 | - 18 363 | | - 511 | - 1 168 | - 184 | | | - 20 226 | - 21 040 |
| Transport | (5) | | | | | | | | | | | | | | | | |
| Communication | (6) | 0 | 27 | 5 | 79 | 66 | 59 | 236 | 725 | | 34 | 26 | | | | 785 | 1 021 |
| Finance and business services | (7) | | | | | | | | | | | | | | | | |
| Other services | (8) | | | | | | | | | | | | 85 | | | 85 | 85 |
| Total | (9) | 0 | | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | | | | 0 | 0 |
| **Transport margins** | | | | | | | | | | | | | | | | | |
| Agriculture | (1) | 7 | 201 | 1 | 7 | 0 | 1 | 217 | 44 | | | 2 | | 1 | 11 | 57 | 274 |
| Manufacturing | (2) | 20 | 1 125 | 191 | 127 | 30 | 64 | 1 557 | 303 | | 21 | 144 | 2 | 26 | 486 | 983 | 2 540 |
| Construction | (3) | | | | | | | | | | | | | | | | |
| Trade | (4) | | | | | | | | | | | | | | | | |
| Transport | (5) | - 27 | - 1 321 | - 191 | - 135 | - 31 | - 65 | - 1 771 | - 347 | | - 21 | - 146 | - 2 | - 27 | - 487 | - 1 030 | - 2 800 |
| Communication | (6) | | 0 | 0 | 1 | 1 | 0 | 4 | 3 | | 0 | 2 | | 0 | 1 | 5 | 9 |
| Finance and business services | (7) | 0 | - 5 | - 1 | - 1 | 0 | 0 | - 7 | - 3 | | 0 | - 2 | 0 | 0 | - 10 | - 15 | - 22 |
| Other services | (8) | | | | | | | | | | | | | | | | |
| Total | (9) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Value added tax (VAT)** | | | | | | | | | | | | | | | | | |
| Agriculture | (1) | 0 | 0 | 0 | 0 | 0 | 3 | 4 | 324 | | | 1 | | | | 325 | 329 |
| Manufacturing | (2) | 18 | 71 | 18 | 68 | 200 | 942 | 1 317 | 10 624 | | 368 | 734 | 132 | | | 11 858 | 13 175 |
| Construction | (3) | 0 | 1 | 7 | 4 | 242 | 185 | 439 | 265 | | | 825 | | | | 1 090 | 1 529 |
| Trade | (4) | 3 | 16 | 4 | 20 | 17 | 39 | 100 | 467 | | | 2 | 7 | | | 476 | 575 |
| Transport | (5) | 0 | 1 | 0 | 9 | 8 | 17 | 36 | 487 | | 34 | | | | | 521 | 558 |
| Communication | (6) | 0 | 1 | 0 | 16 | 207 | 150 | 374 | 2 888 | | 10 | 103 | | | | 3 001 | 3 375 |
| Finance and business services | (7) | 0 | 3 | 3 | 28 | 561 | 713 | 1 308 | 1 235 | | | 163 | | | | 1 398 | 2 706 |
| Other services | (8) | 0 | 0 | 0 | 1 | 17 | 44 | 63 | 921 | | 209 | | 8 | | | 1 138 | 1 201 |
| Total | (9) | 22 | 93 | 32 | 147 | 1 252 | 2 093 | 3 639 | 17 210 | | 621 | 1 830 | 147 | | | 19 807 | 23 447 |
| **Taxes on products (excl. VAT)** | | | | | | | | | | | | | | | | | |
| Agriculture | (1) | 0 | 50 | 0 | 1 | 0 | 0 | 51 | 5 | | | 1 | | 0 | 0 | 6 | 57 |
| Manufacturing | (2) | 62 | 834 | 179 | 1 068 | 212 | 544 | 2 898 | 4 272 | | 6 | 284 | 5 | 7 | 393 | 4 968 | 7 866 |
| Construction | (3) | 0 | 1 | 3 | 1 | 1 | 0 | 5 | 0 | | | 7 | | | | 8 | 13 |
| Trade | (4) | 0 | 5 | 0 | 4 | 0 | 0 | 10 | 1 | | | 0 | 0 | | | 1 | 11 |
| Transport | (5) | 0 | 7 | 1 | 8 | 11 | 3 | 30 | 26 | | 0 | | | | 14 | 40 | 71 |
| Communication | (6) | 0 | 6 | 1 | 14 | 47 | 5 | 72 | 130 | | 0 | 0 | | 0 | 15 | 145 | 217 |
| Finance and business services | (7) | 9 | 88 | 18 | 142 | 172 | 37 | 467 | 936 | | | 755 | | | | 1 691 | 2 159 |
| Other services | (8) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 574 | | 1 | | 0 | | | 575 | 576 |
| Total | (9) | 71 | 991 | 202 | 1 238 | 443 | 590 | 3 535 | 5 944 | | 8 | 1 048 | 6 | 7 | 422 | 7 434 | 10 969 |
| **Subsidies** | | | | | | | | | | | | | | | | | |
| Agriculture | (1) | 0 | - 89 | 0 | 0 | 0 | 0 | - 89 | - 2 | | | - 5 | | 0 | - 11 | - 18 | - 107 |
| Manufacturing | (2) | 0 | - 16 | - 2 | - 3 | - 1 | - 1 | - 24 | - 9 | | 0 | - 2 | 0 | 0 | - 14 | - 25 | - 49 |
| Construction | (3) | | | | | | | | | | | | | | | | |
| Trade | (4) | | | | | | | | | | | | | | | | |
| Transport | (5) | 0 | - 26 | - 2 | - 33 | - 6 | - 10 | - 77 | - 300 | | - 71 | | | | - 1 | - 371 | - 448 |
| Communication | (6) | | | | 0 | | | 0 | - 34 | | | | | | | - 34 | - 34 |
| Finance and business services | (7) | | | | | | | | | | | | | | | | |
| Other services | (8) | | | | | | | | | | | | | | | | |
| Total | (9) | - 1 | - 131 | - 5 | - 36 | - 6 | - 11 | - 190 | - 344 | | - 71 | - 7 | 0 | 0 | - 25 | - 448 | - 638 |
| **Trade and transport margins** | | | | | | | | | | | | | | | | | |
| Agriculture | (1) | 38 | 644 | 3 | 83 | 4 | 8 | 781 | 1 226 | | | 12 | | 5 | 176 | 1 419 | 2 200 |
| Manufacturing | (2) | 203 | 7 631 | 1 626 | 2 345 | 393 | 1 204 | 13 403 | 23 025 | | 1 058 | 4 004 | 117 | 291 | 9 481 | 37 975 | 51 378 |
| Construction | (3) | | | | | | | | | | | | | | | | |
| Trade | (4) | - 215 | - 6 996 | - 1 445 | - 2 428 | - 471 | - 1 233 | - 12 786 | - 24 827 | | - 1 080 | - 3 944 | - 199 | - 273 | - 9 232 | - 39 555 | - 52 341 |
| Transport | (5) | - 27 | - 1 321 | - 191 | - 135 | - 31 | - 65 | - 1 771 | - 347 | | - 21 | - 146 | - 2 | - 27 | - 487 | - 1 030 | - 2 800 |
| Communication | (6) | 1 | 47 | 8 | 136 | 104 | 86 | 381 | 925 | | 44 | 75 | | 4 | 72 | 1 121 | 1 501 |
| Finance and business services | (7) | 0 | - 5 | - 1 | - 1 | 0 | 0 | - 7 | - 3 | | 0 | - 2 | 0 | 0 | - 10 | - 15 | - 22 |
| Other services | (8) | | | | | | | | | | | | 85 | | | 85 | 85 |
| Total | (9) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 |
| **Taxes less subsidies on products** | | | | | | | | | | | | | | | | | |
| Agriculture | (1) | 0 | - 38 | 0 | 1 | 0 | 3 | - 34 | 327 | | | - 3 | | 0 | - 10 | 313 | 279 |
| Manufacturing | (2) | 80 | 888 | 194 | 1 133 | 411 | 1 485 | 4 191 | 14 888 | | 374 | 1 016 | 137 | 7 | 379 | 16 800 | 20 992 |
| Construction | (3) | 0 | 1 | 10 | 5 | 243 | 185 | 444 | 265 | | | 833 | | | | 1 098 | 1 542 |
| Trade | (4) | 3 | 21 | 4 | 24 | 17 | 40 | 109 | 468 | | | 2 | 7 | | | 477 | 586 |
| Transport | (5) | 0 | - 18 | - 1 | - 15 | 13 | 10 | - 11 | 214 | | - 36 | | | | 14 | 191 | 180 |
| Communication | (6) | 0 | 6 | 1 | 30 | 253 | 155 | 446 | 2 984 | | 10 | 104 | | 0 | 15 | 3 112 | 3 558 |
| Finance and business services | (7) | 9 | 91 | 21 | 171 | 733 | 750 | 1 775 | 2 171 | | | 918 | | | | 3 090 | 4 865 |
| Other services | (8) | 0 | 0 | 0 | 2 | 17 | 44 | 63 | 1 495 | | 210 | | 8 | | | 1 713 | 1 777 |
| Total | (9) | 92 | 952 | 229 | 1 349 | 1 689 | 2 672 | 6 984 | 22 810 | | 557 | 2 870 | 152 | 7 | 397 | 26 794 | 33 778 |

Table based on 2011 figures from Austria

7.27. It should be noted that the use-side valuation matrices in Table 7.3 relate to the supply-side valuation matrices in Table 7.1 as follows:

- The sum of the totals in column (16) in Table 7.3 for "Wholesale trade margins" and "Retail trade margins" must be equal to "Trade margins" in the supply-side valuation matrix, namely column (10) of Table 7.1.

- The total in column (16) of Table 7.3 for "Transport margins" must be equal to the "Transport margins" in the supply-side valuation matrix, namely column (11) of Table 7.1.

- The total in column (16) of Table 7.3 for "Value added tax (VAT)" must be equal to the "Value added tax" in the supply-side valuation matrix, namely column (12) of Table 7.1.

- The total in column (16) of Table 7.3 for "Taxes on products (excl. VAT)" must be equal to the "Taxes on products" in the supply-side valuation matrix, namely column (13) of Table 7.1.

- The total in column (16) of Table 7.3 for "Subsidies" must be equal to the "Subsidies on products" in the supply-side valuation matrix, namely column (14) of Table 7.1.

7.28. In general, the information needed to construct the trade and transport margins matrices of Table 7.3 is available only to a limited extent, and some balancing between the supply and use of trade margins and transport margins is necessary. In addition, depending on available data and whether a benchmark or a current SUT is being compiled, it must be assessed whether it is best to start from the supply or the use side when estimating total trade margins and transport margins by products. In the cases when trade and transport margins are estimated first from the supply side, they will serve as a constraint when allocating the supply of trade margins and transport margins to the various use categories.

7.29. There is one type of tax on product, namely VAT, for which it is not possible to start with the supply-side estimates. In the VAT system as set out in the SNA, only non-deductible VAT is recorded as a tax on product, and there is no means by which the actual VAT payers (VAT collectors) can obtain information about the final users and their ability to deduct VAT or not. The structure of VAT by products has therefore to be estimated from the use-side by identifying all user categories not exempted from the VAT system and the appropriate effective tax rate has to be applied to all their purchases of products. One increasingly problematic area is the treatment of digital intermediation platforms in terms both of trade and transport margins and also of the taxes (in particular, VAT) paid to foreign governments.

7.30. Once all the matrices in Table 7.1 are compiled, the next step is to deduct the trade margins, transport margins and taxes less subsidies on products from the use table at purchasers' prices to arrive at the use table at basic prices as shown in Table 7.4. In addition, it is necessary to reallocate the deducted trade margins and transport margins to the specific trade and transport service products distinguished in the product classification applied, and the taxes on products to a separate row. After these steps, the use table is transformed into a valuation at basic prices as shown in Table 7.4.

7.31. It should be noted that all the entries from rows (1)–(9) in Table 7.4 are at basic prices. Row (10) of Table 7.4 contains the net taxes on products which bridge the total use at basic prices with the total use at purchasers' prices, which is shown in row (11) of Table 7.4. This latter coincides with row (9) of the use table at purchasers' prices in Table 7.2.

**Table 7.4 Use table at basic prices**

Millions of euros

| | | | INDUSTRIES | | | | | | | FINAL USE | | | | | | | | Total use at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Final consumption expenditure | | | | | | | | |
| | | | Agricul-ture | Manufac-turing | Construc-tion | Trade, transport and communication | Finance and business services | Other services | Total | Households | NPISH | General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 2 545 | 5 964 | 13 | 287 | 29 | 38 | 8 877 | 2 042 | | | 170 | | - 32 | 996 | 3 176 | 12 052 |
| PRODUCTS | Manufacturing | (2) | 1 922 | 98 670 | 10 621 | 13 397 | 5 211 | 6 108 | 135 928 | 33 525 | | 1 749 | 21 736 | 1 929 | 2 737 | 113 392 | 175 067 | 310 995 |
| PRODUCTS | Construction | (3) | 105 | 2 439 | 9 518 | 2 441 | 3 664 | 1 419 | 19 585 | 1 402 | | | 24 323 | | - 38 | 563 | 26 250 | 45 835 |
| PRODUCTS | Trade | (4) | 245 | 8 857 | 1 560 | 4 644 | 712 | 1 501 | 17 519 | 27 684 | | | 4 008 | 238 | | 9 985 | 43 267 | 60 787 |
| PRODUCTS | Transport | (5) | 41 | 5 724 | 459 | 8 549 | 840 | 376 | 15 990 | 5 967 | | 3 427 | | | | 8 926 | 18 495 | 34 485 |
| PRODUCTS | Communication | (6) | 33 | 2 510 | 290 | 9 194 | 5 562 | 1 592 | 19 181 | 22 535 | | 68 | 5 797 | | 63 | 6 818 | 35 281 | 54 463 |
| PRODUCTS | Finance and business services | (7) | 448 | 13 492 | 4 716 | 20 189 | 28 433 | 8 384 | 75 662 | 36 669 | | 1 006 | 10 254 | | - 177 | 11 156 | 58 907 | 134 569 |
| PRODUCTS | Other services | (8) | 8 | 381 | 59 | 1 169 | 398 | 1 750 | 3 765 | 13 429 | 5 416 | 53 163 | 113 | 14 | 1 | 567 | 72 702 | 76 467 |
| PRODUCTS | Total at basic prices | (9) | 5 348 | 138 038 | 27 236 | 59 870 | 44 849 | 21 167 | 296 507 | 143 252 | 5 416 | 60 492 | 66 548 | 2 182 | 2 852 | 152 403 | 433 145 | 729 653 |
| PRODUCTS | Taxes less subsidies on products | (10) | 92 | 952 | 229 | 1 349 | 1 689 | 2 672 | 6 984 | 22 810 | | 557 | 2 870 | 152 | 7 | 397 | 26 794 | 33 778 |
| | Total at purchasers' prices before adjustments | (11) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 152 800 | 459 939 | 763 431 |
| Adjustments | CIF/FOB adjustments on exports | (12) | | | | | | | | | | | | | | - 97 | - 97 | - 97 |
| Adjustments | Direct purchases abroad by residents | (13) | | | | | | | | 6 675 | | | | | | | 6 675 | 6 675 |
| Adjustments | Purchases in the domestic territory by non-residents | (14) | | | | | | | | - 12 945 | | | | | | 12 945 | | |
| | Total at purchasers' prices | (15) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 159 792 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 165 648 | 466 517 | 770 009 |
| GVA | Compensation of employees | (16) | 551 | 30 679 | 10 239 | 37 906 | 22 997 | 41 971 | 144 343 | | | | | | | | | |
| GVA | Other taxes less subsidies on production | (17) | - 1 627 | 1 077 | 546 | 1 755 | 2 004 | 1 103 | 4 858 | | | | | | | | | |
| GVA | Consumption of fixed capital | (18) | 1 845 | 12 750 | 1 542 | 10 917 | 18 934 | 7 480 | 53 469 | | | | | | | | | |
| GVA | Net operating surplus/Net mixed income | (19) | 3 658 | 16 453 | 5 138 | 23 040 | 18 989 | 4 921 | 72 198 | | | | | | | | | |
| GVA | Gross operating surplus/Gross mixed income | (20) | 5 503 | 29 203 | 6 680 | 33 957 | 37 923 | 12 401 | 125 667 | | | | | | | | | |
| GVA | GVA | (21) | 4 427 | 60 959 | 17 465 | 73 618 | 62 923 | 55 475 | 274 868 | | | | | | | | | |
| | Total input at basic prices | (22) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | | | | | | | | | |

Table based on 2011 figures from Austria

## C. Trade margins

7.32. This section deals with the compilation of the valuation matrix for trade margins. The amounts involved can vary significantly by type of product and can be of great magnitude in total. In most countries, the trade margins may vary between 10 and 25 per cent of the total domestic supply of goods and services.

7.33. The data sources needed for compiling the trade margin estimates by product for the SUTs are special in the sense that they are not necessary when compiling the current national accounts GVA by industry and, for that reason, may not be readily available on an annual basis.

7.34. Whereas information on trade turnover and purchases of goods for resale by industry is usually included in the general business statistics or estimated in order to compile the annual GVA by industry, the situation is different for information on trade turnover and margins by product. These data are generally not as readily available for a number of reasons: most often they are collected at intervals of several years, if at all; or information on trade margin ratios may be available only for a limited number of products and provided by government agencies dealing with price control or monopoly surveillance; or they are limited to what can be derived from current price statistics by, for example, comparing wholesale prices collected for the wholesale price index (WPI) with the prices collected for the consumer price index (CPI).

7.35. It is recommended that a special survey be conducted, in particular for the purpose of compiling benchmark SUTs, that covers all trading activity (both as primary and secondary output) by industry and by product at a level sufficiently detailed to match the level and classification of products applied in the SUTs. The annex to chapter 7 provides an example of a questionnaire used for a survey of this kind, along with a template for the optimal use of the collected data in compiling the SUTs trade margin matrices.

7.36. Even when less than ideal source data are available, it is still necessary to estimate the trade margin matrices. In these cases, however, the results will become more dependent on the assumptions made to populate the trade margin columns in the supply table and the trade margin matrices in the use table. In principle, the same type of trade margin data table (shown in Table 7.5 and in the annex to this chapter) must be generated, irrespective of the coverage or quality of primary source data on trade and trade margins.

### 1. Definition of trade margins

7.37. Even though wholesalers and retailers actually buy and sell goods, the goods purchased are not treated as part of their intermediate consumption as they are resold with only minimal processing such as grading, cleaning and packaging. Wholesalers and retailers are treated as supplying services. Their output is measured by the total value of the trade margins realized on the goods they purchase for resale and some non-margin trade services. This notwithstanding, actual trade turnover is an important supporting variable when compiling the trade margin matrices in the SUTs.

7.38. The 2008 SNA provides the following definition of a trade margin:

> “A trade margin is defined as the difference between the actual or imputed price realized on a good purchased for resale and the price that would have to be paid by the distributor to replace the good at the time it is sold or otherwise disposed of” (2008 SNA, para. 6.146).

7.39. With regard to valuation, the SNA goes on to state as follows:

> “Goods purchased for resale should be valued excluding any transport charges invoiced separately by the suppliers or paid to third parties by wholesalers or retailers: these transport services form part of the intermediate consumption of the wholesalers or retailers” (2008 SNA, para. 6.148).

7.40. This valuation principle means that there can be no transport margins linked to purchases of goods for resale. This follows from the fact that, in the national accounts definition of output from trade activity, the traded goods are not seen as actually flowing in and out of the trade activity.

The trade activity only adds services to the goods that are seen as flowing directly from the producer or importer to the user. As a result, there is no flow to which a transport margin could be attached.

7.41. In practice, the output of wholesalers and retailers is derived as the difference between the trading sales and the costs of goods purchased for resale, adjusted by changes in inventories (see 2008 SNA, para. 6.147):

| | | |
|---|---|---|
| Value of output | = | value of sales |
| | + | value of goods purchased for resale but used for intermediate consumption, compensation of employees, etc. |
| | - | value of goods purchased for resale |
| | + | value of additions to inventories of goods for resale |
| | - | value of goods withdrawn from inventories of goods for resale |
| | - | value of recurrent losses due to normal rates of wastage, theft or accidental damage |

7.42. In order to derive trade margins, either for trading activities of single goods, trading activities of a statistical unit industries or total economy, data on trading sales (trade turnover), data on goods purchased for resale without further processing, and data on inventories of goods for resale at the beginning and at the end of the period must be available. As a rule, business surveys or specialized trade surveys can collect and provide data at the level of trade industries. Trading is also an important secondary activity in many non-trade industries, and trading activities in the system are measured by trade margins, regardless of whether the activity is conducted by traders as their main activity or by other industries as part of their secondary outputs.

7.43. Even though distributive trade is defined as purchases of goods for resale without any transformation, certain operations usually associated with distribution are included in the definition, such as sorting, mixing, breaking bulk and repackaging for distribution into smaller lots. Other services may also be included, if not separately invoiced, such as installation in situ.

7.44. Trade services should be separated at least into two main categories: wholesale and retail. Wholesale is the resale (sale without transformation) of new and used goods to retailers, industrial, commercial, institutional or professional users or to other wholesalers and export. Retailing is the resale (sale without transformation) of new and used goods, mainly to the general public for personal or household consumption or non-resident visitors or for a minor part to business (intermediate consumption and fixed capital formation). This separation is essential for the correct and transparent estimation of the trade channels and the cumulative trade margins for products passing through both the wholesale and the retail trade links.

7.45. The services provided by the trade industry include both margin and non-margin services. Margins services are those related to the trade activity of resale. Non-margin services are other services provided by such trade establishments as repair and installation services. Some trade margins may, however, best be estimated and treated as non-margin services, in other words, should not be calculated as a percentage of the basic value of the underlying goods. This is the case when the underlying goods do not appear in the system, such as used household goods, in particular cars; or when the value of the underlying goods makes up a very small and fluctuating share of the total selling price like scrap materials; and when the underlying goods by convention are not specified by type (as is the case for merchanting, where the goods involved are not covered by the merchandise trade statistics but only appear as a net item in the balance of payments – with acquisitions shown as negative exports, as in SNA 14.73 and 26.21).

7.46. It should be noted that merchanting, and thus trading output, also includes the case of so-called factoryless goods production, where a principal has completely outsourced the transformation process but does not own the input materials (see para. 5.81 of the Guide to Measuring Global Production (UNECE, 2015), although, in paragraphs 2.69-113, an alternative view is explored that treats factoryless goods production units as manufacturers). The treatment as non-margin services means that this part of trading output will not be shown in the trade margin matrices. Where the above-mentioned cases are concerned, this will facilitate the use of the trade margin matrices in volume estimates and analytical uses of the resulting IOTs. With the CIF valuation of imports, there are no imports of trade margins.

7.47. Trade activity is classified in the industrial classification ISIC Rev. 4 under division 45, "Wholesale and retail trade and repair of motor vehicles and motorcycles", division 46, "Wholesale trade, except of motor vehicles and motorcycles", and division 47, "Retail trade, except of motor vehicles and motorcycles". The following should be noted:

- Division 45 is a mixture of both wholesale and retail trade activities, and also of non-trade activities. In the context of SUTs and IOTs, division 45 must be subdivided into repair activities (group 452), and trade activities (groups 451 and 453).
- Group 454 "Sale, maintenance and repair of motorcycles and related parts and accessories" has to be dealt with appropriately, depending on the significance of this activity in the country. This is a heterogeneous group and if the GVA contribution is significant, then the sale, maintenance and repair activities should be separated, as the respective margin ratios are very different.
- Division 46 also covers wholesale on a fee or contract basis which is not part of the trade margin activity. It also covers some merchanting activity.
- Division 47 includes the resale (sale without transformation) of new and used goods, mainly to the general public for personal or household consumption or use, by shops, department stores, stalls, mail-order houses, hawkers and peddlers, consumer cooperatives and other outlets.

7.48. Trade services are classified in CPC Version 2.1 in division 61, "Wholesale trade services", and division 62, "Retail trade services". It should be noted that, even though many industries have output of trade services as either principal or secondary products, the product classification used in the system may distinguish only a few groups such as wholesale and retail trade services.

## 2. Compilation of trade margin matrices

7.49. The compilation of the trade margin matrices in the SUTs may in principle be started either from the supply side or from the use side. In general, especially when compiling a benchmark SUT, the preferred approach is to start with estimating trade margins in the supply side resulting in data on the total amount of trade margins by products. These estimates will then represent the restrictions with which the use-side trade margin estimates have to comply.

7.50. Business surveys or special trade surveys usually provide data on the total output of trade margins by industries (including subdivisions of the trade industries), which then need to be transformed into margins by products if special surveys do not provide this information.

7.51. Starting the compilation of trade margins from the use-side means that estimates are made on the share of trade margins included in each element of the use table at purchasers' prices. The effective trade margin associated with each cell depends both on the typical trade channels for this particular use and on the typical product margin ratios for those parts passing through the wholesale and retail links. Normally, such information cannot be gathered by asking purchasing enterprises and establishments and other users, as they will only be aware of the last step in the distribution channel (where they have purchased the product) but clearly not of the previous steps. Even for the last step, they do not know the margin implicitly invoiced to them. Thus, plausible assumptions both on distributive channels and margin ratios have to be made and, for this purpose, it is useful to have the supply-side trade margin estimates at hand.

7.52. In the case of benchmarked estimates, it is necessary to calculate the full range of supply-side and use-side trade margin matrices by exploiting all available data sources and thus also to establish a basis for subsequent calculation, where the trade margin ratios of the previous years can be taken as the point of departure, and depending on available data, it may in this case be best to start from the use-side, as this represent the most detailed set of trade margin ratios.

7.53. The compilation of trade margins can be organized in three steps. The first two steps can be seen as dealing with estimating the supply-side trade margins by product, while the third step deals with the estimation of the use-side trade margin matrix. Box 7.1 gives a general summary of the three compilation steps for trade margins.

**Box 7.1 Compilation process for trade margins**

| | | | |
|---|---|---|---|
| Supply-side trade margins | **Step 1** | Estimation of turnover and output (trade margins) by principal and secondary trade margin producers. | *Absolute constraint* for totals by producing industries<br><br>*Output estimates* entered into the domestic output part of the supply table |
| | **Step 2** | (a) Estimation of trade turnover matrices (dimension: product by margin producing industry).<br><br>(b) Estimation of product specific trade margin ratios.<br><br>(c) Calculation of total wholesale and retail margins by product.<br><br>(d) Balance step 2 (c) against step 1. | *Relative constraints* for margins by product.<br><br>Result entered into the trade margin columns of the supply table |
| Use-side trade margins | **Step 3** | The starting point is step 2 (d) and the use table, either balanced or unbalanced, and either at purchasers' prices or at basic prices.<br>Main objective:<br>*If use table at purchasers' prices*: To compile the full matrices for trade margins to derive basic price values in each cell, and the corresponding rows for the margin producing industries.<br>*If use table preliminary estimated at basic prices*: To compile the full matrices of trade margins in order to adjust the preliminary estimates of the rows for margin producing industries (often the case in an already established SUTs system)<br>Estimated trade margin matrices are eventually balanced against the constraint in step 1 (absolute constraint) and in step 2 (d) (relative constraint) | Common problems:<br><br>– Question of distribution channels.<br>– No direct information of trade margin ratios by *user* category.<br>– Extensive use of assumptions necessary. |

## (a) Step 1

7.54. Step 1 of the compilation process for trade margins covers the compilation of trade services by industry that must already be part of the current annual national accounts calculations of GVA by industry. The national accounts estimates of output usually do not include a distinction between primary and secondary output. In the case of trade output, however, the situation is different, since trade output must be derived separately as the difference between sales and purchase of goods for resale. The data needed to fill in the domestic production part of the supply table should therefore be readily available, and these calculations are not unique to the SUTs.

7.55. When compiling the SUTs, and in particular benchmark SUTs, there may be a need to take a closer look at existing calculations and to supplement them with more detail, such as, for example, through the introduction of the distinction between wholesale and retail output, if it has not already been done.

7.56. Trading services are an important secondary output in many industries other than trade, such as manufacturing enterprises, barber shops, museums, hotels, recreational and sporting activities, and so forth. Accordingly, as a first step, it should be assessed if current data fully cover all secondary output of trade activity, as some data sources such as industrial statistics may exclude trading, whereas data sources for service industries may not specify trade turnover separately, and some existing estimates may need adjustments. Thus, for certain industries only total sales may be known, without any distinction between trade sales and other sales. Estimates based on plausible assumptions should be made to achieve data on total trade services of the economy.

7.57. Trade turnover should be separated into wholesale trade turnover and retail sale trade turnover, and wholesale trade margins and retail trade margins recorded as different products in the domestic output part of the supply table at basic prices. In business statistics, wholesale and retail trade turnover and margins are often available for the trade industries separately (ISIC Rev. 4, divisions 45, 46 and 47). For industries with trade activity as a secondary activity this breakdown may not be available and, even in cases where trade turnover has been reported separately for wholesale and for retail sales, the value of goods purchased for resale may not be thus subdivided. In this case, wholesale and retail trade margins cannot be derived directly but have to be estimated on the basis of plausible assumptions.

7.58. If no direct separate information on the type of trade (wholesale or retail) is available from surveys, the subdivision can be based on the kind of primary economic activity. Thus all ISIC Rev. 4, division 46, may be assumed to carry out wholesale trade, and all ISIC Rev. 4, division 47, retail trade, whereas ISIC Rev. 4, division 45, must be further broken down, as indicated above. The subdivision of trade for secondary trade producers into wholesale and retail trade has in this case to be based on assumptions. For example, it can be assumed that the trade turnover of restaurants and hotels, hairdressers, cinemas and theatres will probably be retail trade turnover, whereas trade activities of advertising agents will more likely be wholesale trade. Manufacturing industries will often trade in products similar to those that they produce or in complementary products and such sales will usually be of a wholesale type, although some may be sold directly to consumers. Manufacturing industries may also be trading in similar imported goods, and such trade is again, likely to be classified as wholesale trade. There may also be industries where a grouping by size might be relevant for the correct identification of the type of trade activity performed, for example, the trade activity of small bakeries would normally be retail sale, whereas the trade activities of the larger ones would probably be wholesale trade.

7.59. For the purpose of the following calculation steps, these estimates should be made also at the most detailed level of classification of the trade industry available in source statistics. Although these more detailed estimates would not be shown in the supply table at basic prices, they will be very useful when estimating trade margins by products in cases where this information is not available from existing surveys.

7.60. In the discussion above, it has been assumed that the secondary output of trade services remains in the industries of the secondary producers. As explained in chapter 5, however, the SNA recommends the partitioning of horizontally-integrated enterprises that have production in two or more sections of the ISIC Rev. 4 (these sections are broad activity groups such as agriculture and fishing, mining, manufacturing, construction, trade and others) and the creation of new establishments to be classified together with the primary producers of the secondary product if that has not already been done in basic statistics. Such reclassification of secondary output is called "redefinition" and is typically carried out for trade activities in many countries. A redefinition implies that there will be trade activity and output of trade margins only from divisions 45–47 of ISIC Rev. 4. This will significantly simplify the calculations and will also facilitate the estimates of input structures and the calculations of industry-by-industry IOTs. It will not, however, affect the basic methodology outlined in this section and in the annex to this chapter.

7.61. Step 1 results in an estimate of total output of trade services forming an absolute constraint. This value is then disaggregated by products in step 2, as described below.

**(b) Step 2**

7.62. In step 2, the product dimension is in focus, in particular in the allocation of total wholesale and retail trade margins to the products to which the margins apply.

7.63. The output of both wholesale and retail trade services must be first separated into the output of margin activities (trade margins) and the output of non-margin activities (non-margin trade services), such as trade services related to used goods, waste and scrap, and to merchanting. The output of non-margin trade services do not form part of the valuation matrices (see para. 7.45).

7.64. Table 7.5 illustrates how the trade data needed in the supply table are related to the survey data (or primary data obtained in other ways, where necessary by relying on plausible estimates). The yellow shaded cells are data that will feed into the rows for wholesale and retail trade services in the domestic output part of the supply table. They are obtained as explained under step 1 above. Step 2 deals with the problem of distributing the values in the yellow shaded cells to the various products, whereupon the grey shaded column for the total trade margins will form the trade margin columns of the supply table (column (10) of Table 7.1). It should be noted that the trade turnover data appear as supporting variables only; they are not moved forward to the supply table.

7.65. In the situation where data on margins by product are already available, either from current business surveys or from special surveys conducted in connection with the SUTs, the task is limited to aligning the survey results with the product classification used in the SUTs, and to grossing up the results to make them consistent with the output data for trade dealt with in step 1 above.

7.66. In the case where no trade data by product are available, it is necessary to subdivide the margin trade turnover by each industry into turnover and trade margins by the products traded. This should be done separately for wholesale trade turnover and retail trade turnover.

## Table 7.5 Trade turnover and trade margins for wholesale and retail trade margins

| Activity ISIC | Ec. activity 1 | | Ec. activity 2 | | . . . | Trade 45 | | Trade 46 | | Trade 47 | | . . . | Ec. activity n | | SUM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trade turn-over | Trade margin | Trade turn-over | Trade margin | . . . | Trade turn-over | Trade margin | Trade turn-over | Trade margin | Trade turn-over | Trade margin | . . . | Trade turn-over | Trade margin | Trade turn-over | Trade margin |
| Product CPC | Indicate W or R | | Indicate W or R | | . . . | Indicate W or R | | Wholesale (W) | | Retail [R] | | . . . | Indicate W or R | | | |
| 1 | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | |
| : | | | | | | | | | | | | | | | | |
| m | | | | | | | | | | | | | | | | |
| Total wholesale | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | |
| : | | | | | | | | | | | | | | | | |
| m | | | | | | | | | | | | | | | | |
| Total retail | | | | | | | | | | | | | | | | |

7.67. The subdivision by products of trade turnover of each trade service-producing industry will result in the two trade turnover matrices, each of which as the dimensions: “Products (traded) by producing industry (output)”: one matrix for wholesale trade turnover and one matrix for retail trade turnover. These matrices are presented together in Table 7.5. The availability of source data for this subdivision may vary considerably across countries. Even in cases where no direct survey information is available, scattered information may be available, including from administrative sources and related and older surveys, although ad hoc information on specific units may not be representative for the total branch. In this case, it is of particular importance to use data from the most detailed level of subdivisions of the trade industry, as these will indicate the types of products traded.

7.68. Even with the availability of data for subdivisions of the trade industries, the estimation of trade turnover by products is not straightforward. This is the case, for example, with non-specialized trade divisions such as supermarkets and department stores where a wide range of goods are traded (even though, in some cases, it may be possible to get access to computerized cash transactions with detailed information about the goods sold and purchased data from businesses). It is generally easier to make estimates for specialized retail divisions, as their turnover by product is known from everyday life and more uniform. Estimating turnover by product for the wholesale divisions is more difficult because of the range of product mix, although there are branches with a clear concentration on one or a few product groups such as, for example, wholesale trade of motor vehicles and energy products.

7.69. For trade as secondary activity, plausible assumptions must be made about the products traded. For example, for hairdresser trade in cosmetic articles, hotel trade in souvenirs, newspapers, journals, food and beverages, and museum trade in books, multimedia products, and so on, the share of each identified product group in turnover must also be determined. In manufacturing, it can be difficult to estimate trade turnover structures by goods traded without any specific information, as the level of specialization may be very high. Information could be obtained on ad hoc basis by asking selected units with significant trade turnovers. Making these estimates on the basis of plausible assumptions at the highest level of detail may provide acceptable results for the SUTs aggregates, even if only rudimentary information is available.

7.70. Having compiled the two trade turnover matrices in Table 7.5, it is possible to check the wholesale and retail trade turnover against the supply of the goods (domestic production and imports) from the supply table. At this stage, the comparison cannot be done at completely comparable prices, as the supply will be at basic prices and the trade turnover will be inclusive of either wholesale or retail trade margins, or both, but such checks should ensure that the trade turnover estimates are plausible in relation to the supply of the goods. For instance, there should not be much retail trade turnover of intermediate and capital goods; wholesale trade turnover should normally not be much higher than domestic production plus imports (plus wholesale margins); retail trade turnover of consumer goods should not be much higher than household expenditure for these goods. There may, however, be exceptions to these general rules for certain products, such as those that are traded twice within the same chain of distribution. This arises, for example, when one wholesaler imports a product or purchases it from many small producers (such as agriculture) and subsequently resells it to another wholesaler.

7.71. From the two trade turnover matrices, the trade margin matrices of the same dimensions must be derived. This is formally done by multiplying the trade turnover matrix by the assumed product margin ratios as described below.

7.72. The margin ratios are defined here as the share of a trade margin relative to the trade turnover. Margin ratios can be defined at the level of industries, which would show the average margin obtained by margin producing industry (the necessary information is already available from the Step 1 calculations), or at the level of products, where information is usually less readily available, although some countries may conduct regular surveys on percentage trade margins by products, classified by CPC or COICOP. It must in general be assumed that margin ratios are more closely connected with the products traded than with the industry carrying out the trading activity as either primary or secondary production.

7.73. It is obvious that even a single benchmark survey of product-specific trade margins would contribute greatly to the overall quality of the SUTs.

7.74. It is important to be aware of the basis for the calculation of percentage trade margins. When reported by enterprises, the trade margins will often appear as a percentage of the total selling price, including excise taxes and VAT, whereas the compiler of the SUTs will usually need the trade margin as either a percentage of the basic price (when estimating margins in the supply table) or a percentage of the purchasers' price excluding taxes on products (when estimating margins in the use table). The source data on percentage trade margins must therefore be adjusted to the appropriate basis before being applied in the system.

7.75. When specific survey information is missing, alternative sources for product-specific margin ratios must be explored. One possible approach might be to compare the prices observed for the CPI and for the wholesale price index (WPI) for identical products. The same could be achieved by comparing PPIs with WPIs, which could provide proxies for wholesale margin ratios. In the case of regulated prices, the price levels in the different distribution channels may be available, and more generally price information available from the monopoly and price control agencies could be used. The margin ratios of specialized trade branches may be used as proxies for the related product margin ratios. Thus the margin ratio of the retail trade branch selling shoes could be taken as the typical retail margin for shoes. In practice, the usefulness of this approach would depend on the level of detail in the product classification applied, and the availability of data by detailed sub-branches of wholesale and retail activity, which would facilitate linking branches and products.

7.76. Having established a set of product-specific margin ratios, the multiplication of the trade turnover matrix could then be performed on the assumption that these product-specific margin ratios are valid in all industries trading in that product (as primary and as secondary). Next the resulting wholesale and retail trade margins by producing industries must be compared with the total trade margins by industries determined in step 1. The reasons for any differences could be inaccuracies in the trade turnover matrices, in the subdivision between wholesale and retail margins, and in the assumed or derived product margin ratios. These differences must be eliminated either by proportional adjustments or, if appropriate, by more refined methods.

7.77. It should be noted that difficulties in determining trade margins are attributable not only to the often weak data sources but also to the continuing changes in the structure of the trade industries, such as the following:

- Changing forms of supply of trade services
- Concentration in retail trade branches
- Growing size of shops
- Increasing importance of internet trade

7.78. These developments also affect the validity of benchmark estimates that may relatively quickly become outdated.

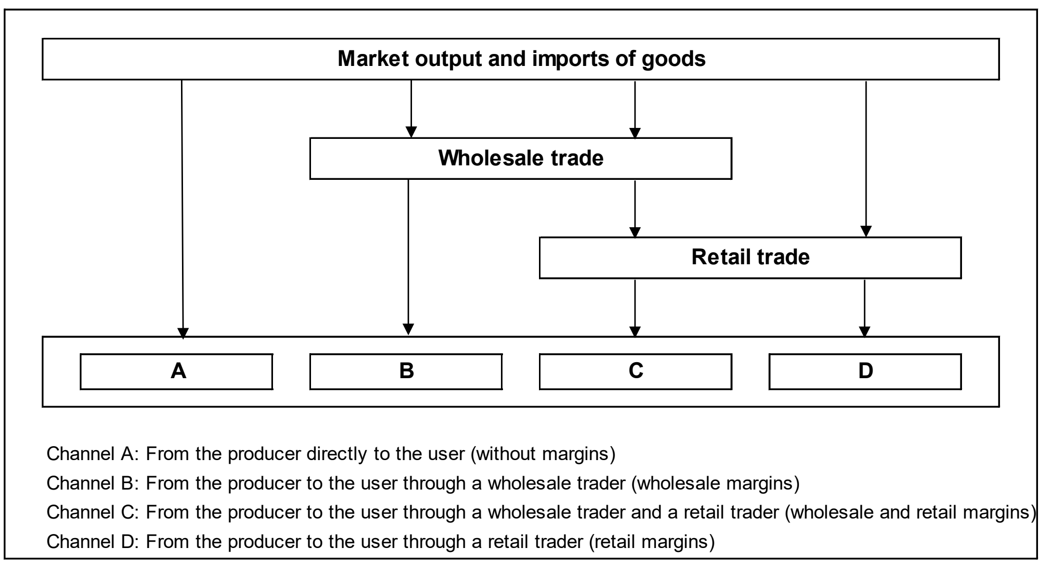
**(c) Step 3**

7.79. Step 3 relates to the calculation of the use-side trade margins matrices. In the previous steps, the question of trade channels has not been dealt with, as the data sources have been either survey data for the trading activities or estimates based on administrative or other indirect sources. When compiling the use table trade margin matrices, however, trade channels become important, as individual users may purchase their goods from different levels of the distribution system, or even directly from producers.

7.80. Direct data sources are more limited for the use table margins than for the supply table based margins. This is because buyers of the goods do not know what share the trade margins constitute in the price that they have paid. Sometimes they do not even know whether they have purchased the good from a trader or not. In cases where the goods have been purchased in a retail shop or from a wholesaler, the buyer will only know that the price paid includes some trade margin but not the full amount of the margin. This is because the distribution channels before the final seller are usually unknown to the buyer.

7.81. Figure 7.2 illustrates in a schematic way the possible distribution channels for goods from the producer of market output and imports of goods to the user. The distribution can go directly from the producer to the user (represented by box A); through wholesale trade (box B) in which case on wholesale margins are applicable; through wholesale and retail trade (box C) in which case both on wholesale and retail margins are applicable; or only though retail trade (box D), in which case only retail margins are applicable.

**Figure 7.2 Alternative distribution channels of goods**




7.82. The calculation of the use table trade margin matrices must therefore be based on plausible assumptions and eventually balanced with the estimated total supply of the trade margins by products. In principle, the following types of information are necessary:

- For each single cell of the use table, the share of total purchases that has been channelled through trade activities (for all involved steps in the distributive channel)
- The margin ratios to be applied for the products actually traded in the particular intermediate or final use part of the use table

7.83. Usually specific knowledge about the distributive channels for the goods in the individual cells is missing. The same holds true for the possible variation of the actual margin ratio across users. For that reason, plausible assumptions have to be made. Concerning the use of wholesale and retail trade channels, the following assumptions may reasonably be made:

- For intermediate consumption, mostly wholesale trade margins and in very few cases retail trade margins are relevant. Retail trade margins for intermediate consumption can be relevant, for example, when stationery and handicrafts materials are being bought by smaller shops and small-scale enterprises.
- For household final consumption expenditure, retail trade margins are mostly relevant, but also with some exceptions when consumers have direct access to wholesale channels , thus generating wholesale trade margins, or are able to buy directly from the producer of the goods (for example, farmers, bakeries, tailors and so forth), thus not involving trading services at all.
- Wholesale services are also connected with household final consumption expenditure as some of the products bought in retail trade may have been delivered from wholesalers, and thus also include wholesale trade margins.
- For gross fixed capital formation, the wholesale channel is the most important and a very small measure of importance also attaches to the retail sale channel, for example, valuables and smaller equipment.
- In changes in inventories, it may reasonably be assumed that only wholesale margins and not retail trade margins can be involved (although the involvement of the latter is theoretically possible). Furthermore, wholesale trade margins can only be allocated to input stocks and trading stocks but not to output stocks, finished products and work-in-progress.
- For exports, it may reasonably be assumed that only wholesale margins may be involved (allowing for retail trade margins allocated to non-residents expenditure).

7.84. For much intermediate consumption, fixed capital information in equipment and machinery, and exports it is possible that no trade margins are involved at all, as bigger enterprises in particular will deal directly with one another. Imported goods are more likely to be bought through wholesalers than domestically produced goods, again depending on the size of the enterprises. Small enterprises will be more inclined to buy certain goods through retail traders.

7.85. The allocation of the trade margins to the individual cells of the use table has to be done in a step-wise manner. VAT and other net taxes on products must first be removed from the use table at purchasers' prices. The remaining value of the cells comprises only basic values and trade margins and is called the "residual" use table at purchasers' prices. It may be better first to estimate the retail trade margins for consumption of households and deduct those amounts in order to get all use data, including household final consumption expenditure, in a more uniform valuation, including only wholesale trade margins, making the allocation of these wholesale trade margins easier and of slightly higher quality. That notwithstanding, the retail margins and the wholesale margins are determined as follows:

- Based on the relationship between the total supply of each product and the trade turnover determined in step 2, it is possible to estimate the average share of the total supply of each product passing through wholesale and retail trade links.
- At this stage, it is necessary to make assumptions about the distributive pattern for each cell, on the proviso that the total trade turnover (separately for wholesale and retail trade) is known from step 2. In this way the absolute amount of each cell passing through either wholesale or retail trade is determined.
- If no specific information is available, it can be assumed that the average wholesale or retail trade margin ratio for the specific product (known from Table 7.5 in step 2) should be applied to the share of the total value passing through this trade link as determined in step 3.

7.86. When the two trade margin matrices have been compiled, they can be deducted from the "residual" use table at purchasers' prices to obtain the use table at basic prices.

7.87. The resulting use table and trade margin matrices should be checked for overall plausibility, regarding both the relationship between allocated wholesale and retail trade margins and that between the use table data at purchasers' prices and the allocated trade margins. In this process, the previously estimated trade margins by products of step 2 may also be reallocated.

7.88. The procedures outlined in this section for estimating the trade margin matrices is one that typically has to be applied when estimating benchmark SUTs. As mentioned above, the approach may be somewhat different when compiling annual tables on a current basis, as it may be better in this case to start from the use table side, taking as the starting point the effective trade margin ratios (in principle the proportion passing through this trade channel multiplied by the actual trade margin ratio) of the previous year as this detailed set of trade margin ratios is less prone to aggregation errors than the application of the average margin ratios by product that can be derived from the supply table.

7.89. The annex to this chapter provides a numerical example where the principles outlined in this section are illustrated in a complete template for the derivation of trade margin matrices, and which clarifies the importance of the distinction between wholesale and retail trade margins in getting the correct results.

## D. Transport margins

7.90. Transport margins are another valuation component relating to the delivery chain of the products from the producer to the final user. Transport margins represent freight services of products when invoiced separately by the seller. Transport margins are transport charges paid separately by the purchaser to take delivery at the required time and place. They are included in the use of products at purchasers' prices but not in the basic price of a manufacturer's output or in the trade margins of wholesalers or retail traders.

7.91. Transport margins include in particular:

- Transport of goods arranged by the manufacturer, the wholesale or the retail trader in such a way that the purchaser has to pay separately for the transport costs even when the transport is done by the manufacturers, wholesale or retail traders themselves.
- Transport of goods from the place where they are manufactured or sold to the place where the purchaser takes delivery of them, in the event that the manufacturer or trader pays a third party for the transport, if this amount is invoiced separately to the purchaser.

7.92. This definition of transport margins means that the transport has to be arranged by the seller (producer or trader). This also means that transport arranged directly by the purchaser (and thus, of course, also directly paid for by the purchaser) is not included in the transport margins.

7.93. The existence of a transport margin is thus related to the way in which the transport costs are paid. This means that transport margins cannot be derived from the output of the respective transport services but that information on the payments between the two related parties of the seller and the buyer is required.

7.94. Since transport margins only occur when transport services are separately invoiced, this means that no partitioning of transactions is necessary because the transport service is already treated as a separate product and necessarily known to the purchaser. (see 2008 SNA, para. 14.130)

7.95. Thus, from a statistical point of view, transport margins should therefore be much easier to deal with and to estimate than the trade margins because they could be surveyed directly, based on information available in the bookkeeping department of the purchaser and because it is not necessary to break down the purchasers' price on the basis of assumptions. In reality, however, it may not be easy to obtain the data, for example, with large companies that keep their bookkeeping departments offshore.

7.96. Based on the definition of transport margins, which is logically connected to the definitions of basic prices, purchasers' prices and trade margins, Box 7.2 provides examples of transport costs which are not recorded as transport margins because they do not contribute to the valuation difference between basic prices and purchasers' prices.

7.97. The value concepts and the consequent transport margins are defined in the 2008 SNA in such a manner as to reflect the way in which the transport costs are treated in business accounts and thus in the source data. When the cost of transport that is arranged by the purchaser is included in the price of the intermediate consumption or final use in the source data, it should be treated as transport margins but not when it is recorded as a separate cost item. Hence the recording of transport costs in the source data will influence the actual delimitation of transport margins, in particular when source data which are not SNA-compatible are not being adapted (by the compiler of the national accounts) to bring them into line with the SNA definition. Such general adaptations of existing source data will in general not be feasible, however, and it may even be questioned whether such adaptation should be attempted at all. Without such adaptation, the concepts of basic value and transport margins would deviate somewhat from the recommended concepts but the overall properties of the system would not be compromised.

7.98. Contrary to the treatment of trade margins, imports of transport margins can exist. This happens when a foreign carrier transports freight into, within, or out of the domestic territory. This would be the case of road, water (only inland waterways), and air (inland) transport. Pipelines within the domestic territory are normally run by a resident enterprise.

**Box 7.2 Examples of transport costs which do not form transport margins**

Transport margins are not the same as actual transport costs. Since these two concepts are often confused, examples of activities which are not recorded as transport margins because they do not contribute to the valuation difference between basic prices and purchasers' prices are listed below:

- If the manufacturers or traders transport the goods themselves and do not invoice the transport separately, these transport costs will be included in the basic price of the manufacturers' output or traders' output. This transport represents an ancillary activity and the individual costs of transport will not be identifiable as transport costs.
- If the manufacturer arranges for the goods to be transported by a third party without a separate invoice for the transport services, the transport costs will be included in the basic prices of the manufacturers' output. These transport costs will be identifiable and recorded as part of the manufacturers' intermediate consumption.
- If wholesale and retail traders arrange for goods to be moved from the point where they take delivery of them to that where another purchaser takes delivery, these costs will be included in the trade margin if no separate charge is made for transport to the purchaser, where these costs will be part of the intermediate consumption by the wholesale trader and retail trader.
- If a household buys goods for final consumption purposes and arranges for transport by a third party, these transport costs are recorded as household final consumption expenditure on transport services and not included in transport margins.
- If a domestic carrier transports goods from country A to country B through the domestic territory (transit transport), this will also not be considered as a transport margin as it does not relate to goods that forms part of domestic supply and use. These transport services will be recorded under exports of services.
- Transport services of domestic carriers outside the domestic territory (merchanting) are not part of the transport margins but form exports of services.
- Freight of used goods, scrap and waste, earth and similar freight connected with construction projects are also not part of transport margins as these goods are not considered as products. This also includes the transport of goods in connection with removals.

7.99. According to the specific modes of transport (such as road, railway, water, air, and pipeline), several kinds of transport margins need to be distinguished, provided they are classified as separate products in the system. In addition, the services of forwarding agencies also form part of the transport margins when paid separately by the buyer. Transport insurance services must also be considered under the same terms as the general definition of transport margins.

7.100. Compared with trade margins, transport margins are of a much lower magnitude in accordance with the definition in the 2008 SNA, which is more restricted than that used in the system based on the 1968 SNA. The transport margin is much more complex, however, not only because of the different kinds of transport margins but also because of the definition itself.

7.101. Furthermore, the data situation gives rise to numerous practical problems. The relationship between the supply of goods and the transport margins connected with them is looser than in the case of trade margins. Thus, transport costs are usually not related to the value of the goods transported; much transport is carried out as an ancillary activity and the manner in which transport costs are paid might differ from product to product and from transaction to transaction.

7.102. According to the 2008 SNA, total imports and exports of goods are to be valued FOB. For the purpose of compiling SUTs, however, total imports will be valued CIF and an appropriate adjustment item should serve for the transition between both valuation concepts. A CIF valuation means that transport costs up to the border of the importing country are included in the CIF-based value.

7.103. Transport services between the border of the importing country and the domestic location of the buyer are thus to be considered as transport margins (if paid for by the buyer and separately invoiced by the seller). By corollary, transport services between the domestic location of the seller and the border in the case of exports are also to be considered as transport margins (if paid for by the buyer and separately invoiced by the seller). Transport services delivered outside the domestic territory by resident producers will never become transport margins but are exports of trade services. Non-resident carriers can also provide transport services within the domestic territory for resident or non-resident buyers.

### 1. Compilation of transport margin matrices

7.104. Before embarking on the task of estimating transport margins, the compiler should carefully study the instructions provided in the business questionnaires used to collect data on sales and purchases and any other sources for these data. The instructions should be studies with a view to determining the extent to which the collected data meet the conditions for the existence of transport margins, and, if that is the case, how closely such transport margins correspond to the SNA definition.

7.105. In particular, the exact way in which the (non-margin) transport costs directly collected in the business surveys or available from other sources have been defined should be examined, in order to clarify if such cost items could possibly include those transport costs that, according to the SNA definition, are to be considered as transport margins. Only after this examination, can a decision be made on the existence or the exact delimitation of the transport margins to be estimated.

7.106. Trade margins make up the bulk of the total output of trade services (the exceptions being only the trade services on used goods, waste and scrap, and trade relating to goods in transit and merchanting), and virtually all trading activity in the economy is covered by the total output of trade services identified in the system. The situation for transport margin activity is quite different. A significant part of all transport activity in an economy takes place as ancillary activity in non-transport industries and is therefore not identified in the system. The intermediate consumption related to the ancillary activity is lumped together with the intermediate consumption related to the principal and secondary activities of the industry. Only the transport services carried out by the transport industries and, if statistically identified, a very minor output of transport services as secondary output in non-transport industries are shown explicitly in the system.

7.107. If transport margins are estimated, it is therefore not possible to assess their importance relative to the total transport activity in the economy, and the estimated transport margins should not be mistakenly perceived to reflect the actual physical freight activities carried out in the economy, comparable to the activities customarily covered by specialized transport statistics. Within the SUTs, the only way to assess total freight activity, ancillary and marketed, is by means of the distribution of those inputs typically used for transport, such as fuel, auto repair, and current taxes on motor vehicles (other taxes on production). On the other hand, these inputs will often – and ideally – have been estimated on the basis of a distribution of all motor vehicles by type and size across industry.

7.108. The size of the transport margins, and even of the total output of freight services, is usually much smaller, relatively speaking, than that of the trade margins. In some cases, the imbalance between the supply and use of a product might even be bigger than the transport margins of that specific product. It is therefore recommended that a careful review be made of those products where important transport services are involved, such as, for example, agricultural and forestry products, energy products, iron and steel products and products related to construction. This situation will vary across countries.

7.109. If no secondary transport activity is shown in the supply table at basic prices, this means that the transport of goods has been arranged by the manufacturer, the wholesale trader or the retail trader in such a way that the purchaser has to pay separately for the transport costs even when the transport is done by the seller .

7.110. As noted above, transport margins could in principle be surveyed directly, on the basis of the purchasers' bookkeeping information. In practice, however, this information is not collected, as coverage of this kind would involve not only the total transport margins paid by the enterprises being surveyed but also their distribution by product and by kind of transport. In addition, even if this information does exist, respondents may have to go back to the individual invoices and collate the data required in order to obtain it. Thus, even though it would be possible to establish such special surveys, for example related to the compilation of benchmark SUTs, it is generally not conducted as it would entail such a large burden for the businesses concerned. When such information is available and sufficiently representative, then this is all that is needed to compile the transport margins of the system.

7.111. Box 7.3 provides four options to consider in the absence of any direct information on transport margins. The argument is support of option 4 is that the matrix of wholesale trade margins will in any event be based on inadequate information, and that it is not possible to ascertain whether the margin associated with a particular cell is the, so to speak, "pure" wholesale trade margin or if it also includes some transport margin. As trade margins will be much higher (by some 10–25 per cent) than any contribution from possible transport margins (around 0.5 per cent), the additional uncertainty introduced by choosing a joint wholesale and transport margin will therefore be rather limited. The input structure of wholesale trade will, however, be somewhat distorted.

**Box 7.3 Options to consider where no data exists on transport margins**

In the absence of any direct information on transport margins, there are basically four ways to proceed:

**Option 1**: In complete absence of any information on transport margins, decide that transport margins are insignificant, given the way in which output and intermediate consumption values are defined, and therefore need not be estimated at all.

**Option 2**: Concentrate on those products where important transport services are involved – normally agricultural and forestry products, energy products, iron and steel products and products related to construction – and collect ad hoc information about transport arrangement from selected enterprises.

**Option 3**: Decide to establish a full matrix of transport margins based on general assumptions about total transport margins and their distribution by products and uses.

**Option 4**: Reroute transport margins by product and by use through wholesale trade. This can be done by estimating for each type of transport output the share being transport margins. Then record this as input into wholesale trade. The output of wholesale trade should be increased by the same amount. This rerouting via wholesale trade recognizes the existence of transport margins but their actual distribution is hidden in an untraceable way in the wholesale trade margin matrix.

Where options 3 and 4 are concerned, the total transport margins by type of transport output could in principle be determined residually as the difference between total supply and the identified uses of each type of transport service. This approach would, however, require a very high degree of confidence in the preliminary estimates of transport costs entered into the use table. As previously noted, transport margins are expected to make up only a very minor share of total transport services. This residual would be highly unreliable, and probably reflect the statistical uncertainty of the estimated output and use data, rather than the actual level of any transport margins.

7.112. On the basis of the supply table alone, it is not possible to distinguish transport services paid for by the seller from those invoiced to the purchaser. Starting from the output of transport services (principal or secondary) in the industries, only total output can be calculated. From this total output, some non-margin services can be clearly deducted. These are the transport services related to transit transport and merchanting, and to used goods, waste and scrap. It will also be possible to deduct some statistically identified transport services paid for by the seller and not invoiced separately or directly paid for by the purchaser. This could still leave a residual, however, that would be much higher than any reasonable estimate of total transport margins.

7.113. Transport costs are usually surveyed in current business statistics, at least as a cost item. By definition, these transport costs relate to the goods produced or traded. If the purchaser arranges the transport, these costs may be incorporated in intermediate consumption. Based on the structure of the output and the products traded, an estimate can be made, based on the structure of the products for which the transport costs have been paid. It is implausible to assume, however, that the transport costs are to some extent proportional to the value of the products produced or traded. Such assumptions and the subsequent estimates will be of limited use.

7.114. The various estimation steps to be followed in calculating the transport margin matrices should as far as possible be separated into the different modes of transport (for example, road, railway, water, air, pipeline, forwarding) and transport insurance; the available data might not be broken down in this way, however, and different estimation methods would need to be applied.

7.115. Given the limited availability of data, it may be better to concentrate on the products with large transport margins and to allocate margins to the remaining products according to certain plausible assumptions. As only a part of all transport services are transport margins, it is difficult to check the resulting data for plausibility. The supply and use of transport margins should of course be equal but estimation of the one side is not independent from estimation of the other side.

7.116. For the forwarding agents' services, the same estimation problem exists as for the transport itself. The forwarding agents' services are much more closely related, however, to the transport costs, and estimates could be based, if available at this stage, on the structure of the transport margins. That said, not all transport is organized by forwarding agents. Forwarding agents are usually engaged in cross-border transport rather than in domestic transport. In evaluating the practical problems connected with the correct estimates of forwarding agents' margin matrices, consideration could be given to the treatment of these services as not being part of the transport margins.

7.117. Transport insurance services are usually a very small part of the transport margins. Here too they may be more important for cross-border transport than for domestic transport. A key difference is that the insurance premiums depend on the value of the goods transported, rather than on the actual transport costs of the freight. Similarly to the forwarding agents' services, and in view of the practical implementation of such services and their limited scope, it could be decided to treat them also as ordinary services outside the margin system.

7.118. Once the use table-based transport margin matrices, whenever relevant, have been estimated, these matrices must be deducted from the use table at purchasers' prices, and the total transport margins by intermediate and final uses are then allocated to the transport service products of the applied product classification.

## E. Taxes on products and subsidies on products

7.119. Taxes on products and subsidies on products are the other major valuation component in addition to the trade and transport margins. Compared with the margins matrices, the elaboration of the matrices of taxes on products and subsidies on products is less complicated because the data situation is usually more favourable and the delimitation and calculation of taxes and subsidies forms an integral part of the regular compilation of national accounts and not just an aspect of the SUTs. Thus the main task arising with regard to taxes on products and subsidies on products when compiling SUTs is the need to establish the relationship between the different kinds of taxes and subsidies and the product flows.

7.120. The matrices for taxes on products and subsidies on products are usually derived by separate calculations for each of those taxes and subsidies and related to the intermediate use and final use parts of the use table. Contrary to the trade and transport margins, no specific information on distribution channels or transport deliveries is needed here; only the relations between the product classification and the individual taxes and subsidies are needed.

7.121. A tax on a product is a tax that is payable per unit of some good or service. The tax may be a specific amount of money per unit of quantity of a good or service (the quantity units being measured either in terms of discrete units or in continuous physical variables such as volume, weight, strength, distance, time, and so forth), or it may be calculated ad valorem as a specified percentage of the price per unit or value of the goods or services transacted. A tax on a product usually becomes payable when it is produced, sold or imported, but it may also become payable in other circumstances, such as when a good is exported, leased, transferred, delivered, or used for own consumption or own capital formation. An enterprise may or may not itemize the amount of a tax on a product separately on the invoice or bill that it submits to its customers (2008 SNA, para. 7.88).

7.122. VAT is a special type of tax on products collected in stages by enterprises but ultimately charged in full to the final purchasers. It is described as a deductible tax, because producers are not usually required to pay to the government the full amount of the tax that they invoice to their customers, being permitted to deduct the amount of tax that they have been invoiced on their own purchases of goods or services intended for intermediate consumption or fixed capital formation. VAT is usually calculated on the price of the good or service, including any other tax on the product. VAT is also payable on imports of goods or services in addition to any import duties or other taxes on the imports (2008 SNA, para. 7.89). General sales and turnover taxes give rise to many of the same compilation problems as VAT.

7.123. A subsidy on a product is a subsidy payable per unit of a good or service. The subsidy may be a specific amount of money per unit of quantity of a good or service, or it may be calculated ad valorem as a specified percentage of the price per unit. A subsidy may also be calculated as the difference between a specified target price and the market price actually paid by a buyer. A subsidy on a product usually becomes payable when the good or service is produced, sold or imported, but it may also be payable in other circumstances, such as when a good is transferred, leased, delivered or used for own consumption or own capital formation (2008 SNA, para. 7.100).

7.124. Three main categories of taxes on products are distinguished:

- VAT-type taxes
- Taxes and duties on imports excluding VAT
- Taxes on products, except VAT and import taxes

7.125. Similarly, there are three main categories of subsidies on product:

- Import subsidies
- Export subsidies
- Other subsidies on products

7.126. The 2008 SNA gives further definitions and lists typical examples for all these different types of taxes and subsidies on products. It should be noted that profits of fiscal monopolies which are transferred to the State are treated as taxes on products, and that losses of government trading organizations and subsidies to public corporations and quasi-corporations may have to be treated as subsidies on products.

7.127. Taxes on products should be recorded on an accrual basis in the national accounts, that is, when the activities, transactions or other events occur that create the liabilities to pay taxes. The amounts to be recorded in the system are determined by the amounts due for payment only when evidenced by tax assessments, declarations or other instruments which create liabilities in the form of clear obligations on the part of taxpayers. The system does not impute missing taxes not evidenced by tax assessments.

7.128. Subsidies on products are recorded when the transaction or the event (production, sale, import, and others) which gives rise to the subsidy occurs.

7.129. The recording in the SNA of transactions related to taxes on products and subsidies on products does not mirror the way in which those involved view them. The system contains no transactions between economic units that are the actual payers (collectors) of taxes on product or the actual receivers of the subsidies on products and government. In the SNA, taxes on products and subsidies on products are recorded only at the level of the total economy and are not payable out of GVA of domestic producers. They are also not split by institutional sector.

7.130. In the context of SUTs, this has the important implication that it is never necessary to consider the actual payment flows related to these taxes and subsidies but only to identify the products to which they relate. It is therefore also irrelevant at which stage in the turnover sequence (producer, wholesaler or retailer) the tax is actually being collected or the subsidy paid out.

### 1. Compilation of taxes on products and subsidies on products matrices

7.131. Generally, the compilation of the taxes on products and subsidies on products matrices consists in three main steps. The first compilation step is the allocation of taxes and subsidies on products by the products of the supply table corresponding to columns (12), (13) and (14) of Table 7.1. The second compilation step is to allocate taxes and subsidies on products to the relevant entries of the use table, as shown in Table 7.3. The third compilation step covers the specific task relating to VAT necessary to calculate non-deductible VAT.

7.132. The allocation of the taxes on products and subsidies on products would be easier when SUTs are compiled at a level of product detail where there is a one-to-one relation between the product classification item and the specific tax and subsidy. Furthermore, in cases where the tax or subsidy was linked to the physical quantities, such additional information might be necessary.

7.133. In the first compilation step, the amounts of the different and specific taxes and subsidies – usually taken directly from the respective government revenue accounts – are allocated to specific products in the SUTs. If these data are not already on an accrual basis, then they must be adjusted from a cash basis to an accrual basis, which can often be done by summary time-adjustments. No further compilation steps would be needed to arrive at the required column of taxes on products (exclusive of VAT) less subsidies on products for the supply table at purchasers' prices, as in columns (13) and (14) of Table 7.1. The allocation of non-deductible VAT depends upon the user and, in general, can only be derived on the basis of the use table, and is covered later in this section.

7.134. The second compilation step refers to the allocation of taxes and subsidies on products to the entries of the use table (intermediate use and final uses) at purchasers' prices and to the separation between "other taxes on products" and "subsidies on products", as in Table 7.3. For those product categories for which the tax or subsidy has been allocated, the share of the tax or subsidy component in the purchasers' price must be calculated. This step needs to be based on the appropriate taxation basis according to tax legislation, and Table 7.3 is the result of the appropriate calculations for each single kind of taxes on products and subsidies on products.

7.135. In order adequately to allocate the taxes and subsidies to the use table elements, not only must the appropriate tax rates be explored but also the share of the use flows at which the tax rate is to be applied. A certain product classification category might include not only flows that are taxed but also other types of products not taxed, and certain products may be free of taxes for certain users. Thus, an effective rate may need to be estimated: for example, the mineral oil tax may not only have different tax rates for the different mineral oil products but some of them might also have a tax rate of zero (for example, aviation fuel) and some users, such as the agriculture industry, may be exempt from tax. As mentioned, this problem may be alleviated by having a sufficiently detailed product classification.

7.136. There may be cases where no rates or limited data are available for the allocation of taxes and subsidies to the use table element. In these cases, a pro rata approach may need to be applied: for example, the total value of tobacco excise duty received by government may need to be prorated against all industries' purchases of tobacco except the principal industry and including components of final uses. This implicitly assumes that all purchasers of tobacco pay the same proportion of duty in relation to the value of their purchase. This is clearly a sub-optimal approach but it achieves an allocation constrained to the corresponding total value in the supply table at purchasers' prices.

7.137. Usually the taxes on products and subsidies on products are restricted to only a small number of products. Furthermore, only a small number of taxes on products cover the bulk of the total value of taxes on products. This situation is even more prevalent with subsidies on products.

7.138. The third compilation step covers a specific tax on products, VAT, which requires separate handling. According to the 2008 SNA, VAT is to be recorded net in that:

- The output of goods and services and imports are valued excluding invoiced VAT.
- Purchases of goods and services are recorded inclusive of non-deductible VAT.

7.139. VAT is recorded as being borne by the purchasers, not the sellers, and then, only by those purchasers who are not able to deduct VAT. This applies to both intermediate consumption and gross capital formation.

7.140. Accordingly, the overwhelming part of non-deductible VAT will be recorded as being levied on final uses, mainly on household final consumption expenditures. A small part of VAT, however, is levied on enterprises and institutions that are exempt from VAT.

7.141. According to the definition of purchasers' prices, only the non-deductible part of VAT is included in the purchasers' prices. Thus, the rows (products) in the use table at purchasers' prices include non-deductible VAT. In order to balance supply and use for each product, the non-deductible VAT by products has to be estimated and either included in column (13) of Table 7.1 or deducted from the use table.

7.142. In general, VAT exemptions are related to products or activities. If an industry has only exempted activities, this causes no problem. In the case of an industry that has exempted and non-exempted activities, however, additional assumptions on the estimation of non-deductible VAT are necessary. In such cases, the ratio of exempted activities and total activities must be applied to intermediate consumption in the estimation of VAT. The exemptions may differ across countries and be dependent on the respective countries' taxation policies. For estimation of VAT by type of product, and by type of use, details should be sought from the relevant tax authorities and should be reviewed annually.

7.143. In order to calculate non-deductible VAT, it is necessary to identify those industries and final users that are exempted from VAT, and therefore not permitted to deduct VAT from their purchases, and to relate the VAT rates (explicit rate or an effective rate depending upon the product mix) to the product classification used. Both steps need to be based on the actual VAT legislation. This calculation will be further complicated where there is more than one VAT rate in operation, as some product items in the product classification applied might be mixed in terms of their VAT tax rates. In this case, additional breakdowns of those product groups would be desirable or an effective rate should be calculated, using a weighting of lower level product detail and VAT rates.

7.144. A certain part of an industry might be VAT-exempt, in which case appropriate subdivisions might be helpful. It could also be the case that certain VAT-exempt industries are normal VAT payers for their secondary outputs. The VAT legislation may also have specific rules for very small enterprises that have to be considered, for example, thresholds for being registered in the VAT system. It is important to note, for VAT exempt industries, that non-deductible VAT must be calculated both for intermediate consumption and also for gross capital formation.

7.145. Examples of exempt-type industries, dependent upon individual countries' tax legislation, tend to cover such industries as postal services, newspapers, housing, banking, insurance, some business services, education services and health services. In addition, small producers below the VAT threshold may also be exempt.

7.146. Total calculated non-deductible VAT derived by using the official tax rates and the purchasers' values of the relevant cells in the use table will generate a theoretical VAT estimate, which should exceed VAT revenue (on accrual basis) received by the government. This is because there will always be some degree of missing VAT due to evasion, cash transactions and fraud involving products that, based on other statistical sources, are included in SUTs. Using the official VAT rates may lead to an over-estimation of theoretical VAT; for example, where the tax law allows reductions for losses on debtors or in countries where there are high thresholds for registration for VAT. It can also be appropriate to lower the rate if local tax authorities are known to be inefficient.

7.147. In the balancing process of the VAT vector and matrices, the theoretical VAT must be adjusted to the revenue received (due to be paid) by government. This adjustment process should be based on information from the tax authorities, such as industries and products where VAT is or is not likely to be paid: for example, general government is likely to be fully compliant whereas households are less so.

7.148. In producing SUTs, it is also important that the rates are reviewed each year to allow for changes in VAT rates, schemes and legislation. For example, if the effective VAT rate on a product changes in mid-year, an appropriate weighted estimate for the period will need to be established.

# Annex A to chapter 7. Example for deriving trade margins in SUTs based on survey data

A7.1 This annex provides an illustration of how to calculate trade margin matrices using survey data. The example is based upon the survey data obtained through the questionnaire shown in figure A7.1, which is used by the Statistical Office of Serbia. Similar information can be obtained with other forms of questionnaires.

**Figure A7.1 Extract of questionnaire**

| No. | Code | Product description | Sales of goods produced by the enterprise (group of accounts 61) | Closing stock of products and work in progress (groups of accounts 10 and 11) | Sales of merchandise (group of account 60) | Trade margin amount or rate % | Closing stocks of goods for resale (group of accounts 13 |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| 1072 | 14.3 | Outerwear, knitted or crocheted; socks, sweaters, vest | | | | | |
| 1073 | 15.1 | Tanned or dressed leather; luggage, handbags, saddlery and harness; dressed and dyed fur | | | | | |
| 1074 | 15.2 | Footwear | | | | | |
| | | **Wood and products of wood and cork, articles of straw and plaiting** | | | | | |
| 1075 | 16.1 | Cut and treated wood for further processing | | | | | |
| 1076 | 16.2 | Wood and products of wood and cork, except furniture (see 1147); articles of straw and plainting | | | | | |
| | | **Paper and paper products** | | | | | |
| 1077 | 17.1 | Pulp, paper and cardboard for further industrial processing and printing | | | | | |
| 1078 | 17.2 | Articles of paper and paperboard for industrial use–boxes, containers and packing material | | | | | |
| 1079 | 17.2 | Articles of paper and paperboard for personal use–paper towels, napkins, toilet paper, cleaning items and deletion of the pulp and paper | | | | | |
| 1080 | 17.2 | Paper stationary and articles of paper and paperboards (notebooks, binders, forms etc..) | | | | | |
| | | **Coke and refined petroleum products - manufacturing (columns 4–5; trade and wholesale (columns 6–8)** | | | | | |

*Source*: Structure of income and expenditure of economic subjects in the republic of Serbia 2011. Statistical office of the Republic of Serbia, 2013.

*Note*: Data were collected for about 250 goods and 50 services according to the Classification of Products by Activity (CPA) used in the European Union, varying from two-digit to four-digit groups. The CPA is consistent with the CPC. The same questionnaire was used for all non-financial market enterprises.

A7.2 The objective of the calculation is to populate table A7.1 with available data in order to obtain the trade margin matrices. If the available data sources are less complete, the results will of course be more dependent on the assumptions used to populate the trade margin columns (in the supply table) and the trade margin matrices (underpinning the use table). Irrespective of the coverage or quality of source data on trade and trade margins, it is important to generate the table illustrated in table A7.1 below.

A7.3 In collecting data from the above questionnaire, the following considerations are followed:

- For all economic activities, trade turnover and either purchase of goods for resale or trade margins (either absolute or as a percentage of either purchasing or selling price), data are collected by type of product.
- The product specification is at least as detailed as the product classification applied in the SUTs, and either uses the same classification or a version that is easily transformed into the SUTs product classification.
- For each product, data are sought on either opening or closing stocks of merchandise to facilitate the calculation of changes in inventories of merchandise needed in the event that the total trade margin is derived from the difference between sales and purchases.
- Surveys usually include total coverage for enterprises above a certain threshold (based on either turnover or employment) and samples for the smaller enterprises. It is assumed that the survey results have been grossed up to cover the whole population.

Based on this information it is possible to compile table A7.1.

A7.4 As shown in table A7.1, the vast majority of trade turnover and output of trade margins (trade services) originates from the three trade activities (ISIC Rev. 4, divisions 45–47), whereas many other industries generate relatively small amounts of trade output as their secondary production. In table A7.1, estimates both of grossed-up trade turnover and trade margins are shown, as this information is needed later in the compilation process.

**Table A7.1 Trade data from survey: trade margins identified separately for wholesale and retail trade margins**

| | Ec. activity 1 | | Ec. activity 2 | | . . . | Trade 45 | | Trade 46 | | Trade 47 | | . . . | Ec. activity n | | SUM: all W | | SUM: all R | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trade turnover | Trade margin | Trade turnover | Trade margin | . . . | Trade turnover | Trade margin | Trade turnover | Trade margin | Trade turnover | Trade margin | . . . | Trade turnover | Trade margin | Trade turnover | Trade margin | Trade turnover | Trade margin |
| | Indicate W or R | | Indicate W or R | | . . . | Indicate W or R | | Wholesale (W) | | Retail [R] | | . . . | Indicate W or R | | W | | R | |
| Product: CPC | | | | | | | | | | | | | | | | | | |
| 1 | 10 | 1 | 15 | 2 | | 0 | 0 | 750 | 90 | 950 | 230 | | 10 | 3 | 800 | 100 | 1 000 | 250 |
| 2 | 0 | 0 | 10 | 4 | | 0 | 0 | 1 000 | 100 | 700 | 300 | | 20 | 8 | 1 100 | 100 | 800 | 400 |
| : | | | | | | | | | | | | | | | | | | |
| Total W | | 5 | | 200 | | | 1 000 | | 9 000 | | 0 | | | 0 | | 11 000 | | |
| Total R | | 0 | | 50 | | | 2 000 | | 0 | | 13 000 | | | 25 | | | | 17 000 |

A7.5 At this stage, it is important to introduce the distinction between wholesale and retail trade margins. In this example, it is assumed that this distinction is not made directly in the survey results (although it can be established from survey returns). It is therefore necessary to make decisions on the type of margin associated with the various combinations of economic production activities and products.

A7.6 First, it may be reasonably assumed that ISIC Rev. 4, division 46, wholesale, produces mainly wholesale trade margins and, similarly, that ISIC Rev. 4, division 47, retail trade, produces mainly retail margins, whereas ISIC Rev. 4, division 45, produces a mix of margins, which must be decided on the basis of the individual products.

A7.7 For trade carried out as secondary activity, it may be assumed, for example, that trade turnover of restaurants and hotels is probably retail trade turnover; the same holds for the trade turnover of such suppliers as hairdressers, cinemas and theatres. On the other hand, trade activities of advertising agents are more likely to be wholesale trade. Manufacturing industries often trade in products similar to those that they produce or in complementary products and the majority of such trade sales are usually of the wholesale type, although some may be sold directly to consumers. These industries may also be trading in similar imported goods and such trade is again likely to be classified as wholesale trade.

A7.8 There will be some products where a trade margin may not be applicable and additional survey detail may be collected that makes it possible to improve the specific nature of these decisions.

A7.9 Once these decisions have been made, the row and column totals for wholesale margins and retail trade margins can be calculated and, for the row totals, also the turnover by product broken down by wholesale and retail turnover. Table A7.1 illustrates how the results of these decisions are fitted into the system. It should also be noted that, at this stage, only absolute and not percentage margins are being processed.

A7.10 As explained in chapter 7, the source data for trade activity and trade margins may in practice be available in a variety of forms and with a varying degree of detail. Different assumptions may therefore be needed to establish the dataset shown in table A7.1, which is essential for deriving the trade margins needed in both the supply table and the use table.

## A. Supply table

A7.11 The trade activity and the trade margin entries needed in the supply table consist of rows for output of margin activities by economic activity in the "domestic output at basic prices" part of the supply table, and of the columns for trade margins needed to transform the values by product from basic prices to purchasers' prices.

A7.12 It will become increasingly clear throughout this process, and beyond, that it is essential to retain the distinction between wholesale trade margins and retail trade margins derived in connection with table A7.1.

A7.13 Table A7.1 resembles the format (product by industry) of the supply table. All necessary information on the output of trade services and trade margins from table A7.1 can be transferred to table A7.2.

A7.14 As explained in chapter 5, many countries may choose to redefine secondary output of trade services in the supply table so that secondary output is classified together with the output of the primary producers. Such a redefinition would mean that there will be trade activity and output of trade margins services only from ISIC Rev. 4, divisions 45–47. In this example, it is assumed that redefinition has taken place. This simplifies all the calculations in this example and facilitates the estimation of the input structures and the calculations of IOTs. The basic methodology outlined in this annex will not be affected, however.

A7.15 It should be noted that the output of trade products may also contain some non-margin items (for example, commissions, fees, margins on second-hand sales, and others), so that total supply from trade may still be positive after deduction of trade margins in the trade margin columns – this reflects actual output produced.

### Table A7.2 Supply table

| | | Economic activity 1 | Economic activity 2 | . . . | Trade 45 | Trade 46 | Trade 47 | . . . | Economic activity n | Output at basic prices | Imports | Supply at basic prices | Wholesale trade margins | Retail trade margins | VAT | Taxes on products | Subsidies on products | Supply at purchasers' price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCTS | 1 | | | | | | | | | | | 1 000 | 100 | 250 | 150 | 20 | | 1 520 |
| | 2 | | | | | | | | | | | 2 000 | 100 | 400 | 200 | | - 10 | 2 690 |
| | : | | | | | | | | | | | | | | | | | |
| | Wholesale | 5 | 200 | | 1 000 | 9 000 | | | 0 | 11 000 | | | - 11 000 | | | | | 0 |
| | Retail | 0 | 50 | | 2 000 | | 13 000 | | 25 | 17 000 | | | | - 17 000 | | | | 0 |
| | : | | | | | | | | | | | | | | | | | |
| | Total | | | | | | | | | | | | 0 | 0 | | | | |

A7.16 Before compiling the trade margin matrices associated with the use table, it is useful to derive a number of ratios from tables A7.1 and A7.2, which are shown in table A7.3.

### Table A7.3 Distribution channels and percentage trade margins

| | | Total supply at purchasers' prices made comparable to trade survey turnover (from Table A7.2) | | Survey turnover, grossed up (from Table A7.1) | | Average percentage of supply passing through wholesale and retail trade channels | | Absolute trade margins (from Table A7.1) | | Average percentage trade margin for traded goods out of comparable prices | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basic value plus wholesale margins | Basic value plus wholesale and retail margins | Trade turnover wholesale | Trade turnover retail | Wholesale | Retail | Wholesale | Retail | Wholesale | Retail |
| PRODUCTS | 1 | 1 100 | 1 350 | 800 | 1 000 | 72.7 | 74.1 | 100 | 250 | 12.5 | 25.0 |
| | 2 | 2 100 | 2 500 | 1 100 | 800 | 52.4 | 32.0 | 100 | 400 | 9.1 | 50.0 |
| | : | | | | | | | | | | |
| | Wholesale | | | | | | | | | | |
| | Retail | | | | | | | | | | |
| | : | | | | | | | | | | |
| | Total | | | | | | | | | | |

A7.17 The question of trade channels (namely, how big a share of the supply of a given product passes through the wholesale or retail channels or both) is central when compiling the use table trade margin matrices as shown in Figure 7.2. Fortunately, there is enough combined information in tables A7.1 and A7.2 to tackle this issue.

A7.18 To calculate these shares, the total supply in the supply table must be made comparable to the turnover concept used for the survey data (assumed to be turnover exclusive of VAT and net of taxes on products). The supply table value concept comparable for the wholesale trade turnover is basic value plus wholesale trade margin (1100 for product 1). For retail trade turnover, the comparable concept is basic value plus both wholesale and retail trade margins (1350 for product 1).

A7.19 The average percentages of supply passing through each of the wholesale and retail trade channels can now be calculated as shown in table A7.3. For product 1, the shares are 72.7 (800/1100) and 74.1 (1000/1350), respectively. It is further possible to calculate the average percentage trade margin for actual traded goods from comparable purchasers' prices. For product 1, the percentage trade margins are 12.5 (100/800) and 25.0 (250/1000), respectively.

A7.20 It should be noted that the percentage trade margins are calculated as percentage of sales prices, as required for the estimates in the use table (and not the usually applied survey percentages from the traders' buying price). It should be noted that the VAT column does not need to be completed to calculate these memo items.

## B. Use table

A7.21 The use table is initially valued at purchasers' prices and this table is the starting point for determining the valuation matrices that will permit the gradual transition of the use table from purchasers' prices to basic prices.

A7.22 The first step is to estimate the VAT matrix, and then to deduct it from the use table at purchasers' prices. In the next step, the matrix for other taxes on products must be determined and deducted, and the matrix for subsidies on products determined and added.

A7.23 The elements in the residual use table resulting from these procedures will consist of only basic values and trade margins, as illustrated in table A7.4, and the task is now to separate each element into its basic value and the possible wholesale and retail trade margins. In order to illustrate the restrictions and sum conditions, it is assumed that only those economic activities specified (1, 2 and n) have intermediate consumption.

### Table A7.4 Use table after removal of net taxes on products

| | | Economic activity 1 | Economic activity 2 | . . . | Economic activity n | Total intermediate consumption | Final consumption expenditure of households | Final consumption expenditure of general government | Gross fixed capital formation | Changes in inventories | Exports | Total use at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCTS | 1 | 100 | 50 | | 150 | 300 | 700 | 50 | 150 | 50 | 100 | 1 350 |
| | 2 | | | | | | | | | | | |
| | : | | | | | | | | | | | |
| | Wholesale | | | | | | | | | | | |
| | Retail | | | | | | | | | | | |
| | : | | | | | | | | | | | |
| | Total | | | | | | | | | | | |

A7.24 The product-by-product procedure uses the information in table A7.3, as illustrated in tables A7.5, A7.6 and A7.7. If a product passes through both a wholesale channel and a retail channel, the retail trade margin comes on the top of the wholesale trade margin, corresponding to the trade margin percentages calculated in table A7.3. Accordingly, the retail trade margins must be estimated first, followed by the wholesale trade margins.

### Table A7.5 Product 1: retail margins

| | Economic activity 1 | Economic activity 2 | . . . | Economic activity n | Total intermediate consumption | Final consumption expenditure of households | Final consumption expenditure of general government | Gross fixed capital formation | Changes in inventories | Exports | Total use at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Starting row (from Table A7.4) | 100 | 50 | | 150 | 300 | 700 | 50 | 150 | 50 | 100 | 1 350 |
| 2. Selected values with retail margin | 50 | | | 150 | 200 | 700 | | 100 | | | 1 000 |
| 3. Retail margin distributed | 13 | 0 | | 38 | 50 | 175 | 0 | 25 | 0 | 0 | 250 |
| 4. Average percentage retail margin | 12.5 | | | 25.0 | | 25.0 | 0.0 | 16.7 | 0.0 | 0.0 | 18.5 |

A7.25 The estimates of the retail trade margins are illustrated for product 1 in table A7.5. From table A7.3, it is known that 1,000 of the 1,350 passes through the retail trade, and the total retail trade margin on this product is 250. The knowledge of these totals provides a good starting position but it is still not known to which of the individual uses (or part thereof) the retail turnover is linked, and it is therefore necessary to decide on (or to make assumptions regarding) the figures to be entered in row (2) – based on which specific knowledge may be at hand, and on common sense, to comply with the restriction that their sum must be 1,000. For example, final consumption expenditure of households is usually assumed to include a high share of the available retail trade margins, whereas intermediate consumption and gross capital formation may have very narrow retail margin, and exports none at all, as non-resident expenditure is a summary adjustment item, and the related margins will be included in the domestic consumption concept.

A7.26 When row (2) in table A7.5 has been determined, the distribution of the retail trade margin can be determined either by distributing the 250 proportionally to the values in row (2), or by applying the percentage retail trade margin of 25 per cent from table A7.3 to the values in row (2). In row (3), the effective percentage retail trade margins relative to the elements of the use table are calculated. These are the percentages that will be used to recalculate the retail trade margin table after changes made to the original data during the balancing.

**Table A7.6 Product 1: wholesale margins**

| | Economic activity 1 | Economic activity 2 | . . . | Economic activity n | Total intermediate consumption | Final consumption expenditure of households | Final consumption expenditure of general government | Gross fixed capital formation | Changes in inventories | Exports | Total use at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Table A7.5 Row (1) minus Row (3) | 87.5 | 50.0 | | 112.5 | 250.0 | 525.0 | 50.0 | 125.0 | 50.0 | 100.0 | 1 100.0 |
| 2. Values with wholesale margin | 50.0 | | | 100.0 | 150.0 | 500.0 | | 100.0 | | 50.0 | 800.0 |
| 3. Wholesale margin distributed | 6.3 | 0.0 | | 12.5 | 18.8 | 62.5 | 0.0 | 12.5 | 0.0 | 6.3 | 100.0 |
| 4. Average percentage wholesale margin | 7.1 | 0.0 | | 11.1 | | 11.9 | 0.0 | 10.0 | 0.0 | 6.3 | 9.1 |

A7.27 A similar procedure is used to determine the distribution of wholesale trade margins in table A7.6. The first row in this table is the first row in table A7.5 minus the estimated retail trade margins. When the estimated wholesale trade margins are deducted from row (1) in table A7.6, the row at basic prices in table A7.7 below is obtained, and thus the desired use table at basis prices has been derived. It should be noted that, in the use table at basic prices, the rows for wholesale and retail products will be made up of the column totals of the two trade margin matrices and, in addition, that they will include any non-margin trade output.

**Table A7.7 Product 1: row in use table at basic prices**

| | Economic activity 1 | Economic activity 2 | . . . | Economic activity 2 | Total intermediate consumption | Final consumption expenditure of households | Final consumption expenditure of general government | Gross fixed capital formation | Changes in inventories | Exports | Total use at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Product 1 at basic prices | 81.3 | 50.0 | | 100.0 | 231.3 | 462.5 | 50.0 | 112.5 | 50.0 | 93.8 | 1 000.0 |

A7.28 Following the outline of these procedures, it is clear why it is essential to distinguish between wholesale and retail trade margins. If this is not done, it will not in practice be possible to manage the problem of successive trade channels. Thus the cumulative trade margin on household consumption of (175+62.5)/463 = 51 per cent of the basic value total could not have been derived directly from the survey results if simply aggregated.

# Chapter 8. Compiling the imports use table and domestic use table

## A. Introduction

8.1. This chapter describes the disaggregation of the use table into the imports use table and the domestic use table. The first table, the imports use table, contains information on the use, in the national economy, of imported products (by product) for intermediate consumption and final uses. The second table, the domestic use table, provides information on the use of domestically produced products (by product) for intermediate consumption and final use. The compilation of these two tables primarily consists in the estimation of the imports use table, since the domestic use table is obtained by subtracting the imports use table from the use table. This chapter therefore focuses mainly on the compilation of the imports use table.

8.2. The compilation of an imports use table is embedded in the SNA and it is important to balance the supply and use of products for the domestic economy, accurately to deflate components of GDP by linking imported intermediate products with appropriate import price deflators, and to ascertain the correct distribution of the changes in the volume of GVA by industry and industry contributions to GDP growth.

8.3. Historically, the compilation of the imports use table was mainly considered as an intermediate step towards the compilation of IOTs (although not an essential step). The imports use table is becoming increasingly important in its own right, however, for analytical purposes. With the globalization of economic activities, exports and imports are growing more rapidly than GDP and the GVA chains in production are becoming more complex and more international. It is therefore very important for the national accounts to provide a sectoral disaggregation of macroeconomic data for both domestic production and imports.

8.4. Over time, many domestic economies have seen significant changes in the import share of domestic supply that can be attributed to changes in international trade, and in particular, trade in goods for processing and other intermediate material inputs. In addition, many multinational enterprises, and previously large domestic businesses, have shifted their production processes around the world, taking advantage of lower production costs and thereby increasing their competitiveness and profitability.

8.5. The set of SUTs at basic prices – both in current prices and in volume terms – that should be compiled includes the following tables:

- Supply and use table at basic prices

- Domestic use table at basic prices
- Imports use table at basic prices

8.6. Since direct information for compiling the use table for imported products is generally rare and available only in exceptional cases, the recommendation is to work on a highly detailed level of product group (which means rectangular SUTs with a detailed product specification). A detailed level will help in identifying the likely users of a specific imported product.

8.7. Chapter 5 provides a detailed description of the concepts and definition of imports of goods and services, where emphasis is placed on the imports by products as part of the total supply of products. In the supply table, imports are only shown as a vector of products covering goods and services. In practice, however, it may be desirable to subdivide the import vector by regions so as separately to identify imports within and outside particular regions. Furthermore, the import vector could show separate columns, for example, displaying goods and services separately. Further elaborations that are very useful for the analysis of global value chains and globalization include splitting residents' expenditure abroad into individual products; separately identifying the transport and insurance margins included in CIF estimates of goods; and separately identifying imports of manufacturing services provided under goods for processing arrangements (ideally, also with complementary information showing the underlying value of goods processed).

8.8. This chapter focuses on the compilation of the imports use table. In particular, Section B describes the structure of the imports use table, provides a numerical example and describes how to obtain the domestic use table. Section C focuses on the compilation of the imports use table and potential issues that arise during the compilation process.

## B. Structure of the imports use table and domestic use table

8.9. Imports consist of purchases of goods and services by residents from non-resident producers and suppliers. In the SNA, total imports are valued FOB. Data on detailed flows of imports by product from foreign trade statistics, however, are usually valued on a CIF basis. To reconcile the different valuations used for total imports and the product components of imports, a global CIF/FOB adjustment on imports is required, and this needs to be allocated in accordance with the type of goods involved. More details on the CIF/FOB adjustment may be found in chapter 5.

8.10. The supply of imports shown in the supply table has to be allocated in the imports use table to the different use categories of intermediate uses and final uses. The general structure of the imports use table is shown in Table 8.1. The table shows the total use of imported products, goods and services, by products and by industries and by final use categories. In the columns, the table has the same format as the use table. It distinguishes two main sub-matrices, one for the intermediate use and one for the final uses of products. The total use of imports must be equal to the total supply of imports of the supply table. This equality is given for each of the products distinguished in the SUTs. Table 8.2 shows a numerical example of the imports use table as part of the SUTs system.

## Table 8.1 Structure of the imports use table

<table>
<tr><th rowspan="2">Industries / Products</th><th colspan="5">Industries</th><th colspan="4">Final uses</th><th rowspan="2">Total use at basic prices</th></tr>
<tr><th>Agriculture</th><th>Manufacturing</th><th>…</th><th>Services</th><th>Total</th><th>Final Consumption</th><th>Gross capital formation</th><th>Exports</th><th>Total</th></tr>
<tr><td>Agriculture<br>Manufacturing<br>…<br>…<br>Other services</td><td colspan="4">Imported products for intermediate consumption at CIF values</td><td>Total imported products for intermediate consumption</td><td colspan="3">Imported products for final uses at CIF values</td><td>Total imported products for final uses</td><td>Imported total use</td></tr>
<tr><td>Total</td><td colspan="5">Intermediate consumption by industry</td><td colspan="4">Total final uses by category</td><td></td></tr>
</table>

## Table 8.2 Numerical example of the imports use table

Millions of euros

| | | INDUSTRIES | | | | | | | FINAL USE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Final consumption expenditure | | | | | | | | |
| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, transport and communication | Finance and business services | Other services | Total | Households | NPISH | General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | Total use at basic prices |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture (1) | 191 | 1 680 | 5 | 170 | 14 | 17 | 2 077 | 1 079 | | | 47 | | 9 | 58 | 1 194 | 3 271 |
| PRODUCTS | Manufacturing (2) | 706 | 55 898 | 4 365 | 5 621 | 1 126 | 2 985 | 70 702 | 20 894 | | 1 422 | 12 310 | 807 | 1 344 | 17 112 | 53 888 | 124 590 |
| PRODUCTS | Construction (3) | | 255 | 197 | 68 | 38 | 5 | 563 | | | | | | | | | 563 |
| PRODUCTS | Trade (4) | | 257 | 0 | 274 | 30 | 39 | 600 | | | | | | | | | 600 |
| PRODUCTS | Transport (5) | 10 | 1 300 | 95 | 2 181 | 265 | 75 | 3 926 | 139 | | 9 | 59 | 1 | 6 | 4 011 | 4 223 | 8 150 |
| PRODUCTS | Communication (6) | 4 | 860 | 65 | 2 449 | 1 267 | 248 | 4 893 | 447 | | 17 | 686 | | 22 | 169 | 1 342 | 6 234 |
| PRODUCTS | Finance and business service (7) | 8 | 1 786 | 106 | 1 566 | 2 654 | 322 | 6 443 | 145 | | | 473 | | | | 618 | 7 061 |
| PRODUCTS | Other services (8) | | 14 | 1 | 110 | 23 | 127 | 275 | 384 | | 47 | | 118 | | | 549 | 824 |
| | Total (9) | 919 | 62 051 | 4 834 | 12 439 | 5 417 | 3 819 | 89 479 | 23 087 | 0 | 1 495 | 13 575 | 926 | 1 381 | 21 350 | 61 814 | 151 293 |

Table based on 2011 figures from Austria

8.11. Once the imports use table is compiled, the domestic use table is obtained by deducting the imports use table from the use table. As shown in Table 8.3, the structure and size of the domestic use table are the same as those of the use table, except for an additional row in the primary inputs section to reflect the sum of the columns in the imports use table. The body of the domestic use table does not include direct or indirect imports of goods and services. Some countries compile and reconcile both the imports use table and domestic use table concurrently, instead of compiling the use table first, followed by compilation of the imports use table and domestic use table. This happens, for example, where there are very good quality data on both imports and domestic use, separately available.

8.12. Table 8.4 provides a numerical example of the domestic use table.

## Table 8.3 Structure of the domestic use table

| Industries / Products | Industries | | | | | Final uses | | | | Total use at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|
| | Agriculture | Manufacturing | … | Services | Total | Final Consumption | Gross capital formation | Exports | Total | |
| Agriculture<br>Manufacturing<br>…<br>Other services | Domestic products for intermediate consumption at basic prices | | | | | Domestic products for final uses at basic prices | | | | Total use by product |
| Total at basic prices | Domestic intermediate inputs at basic prices | | | | | Final uses at basic prices | | | | |
| Use of imported products, CIF | Total imported products for intermediate consumption | | | | | Total imported products for final uses | | | | |
| Taxes less subsidies on products | Net taxes on products for intemediate consumption | | | | | Net taxes on products for final use | | | | |
| Adjustments | | | | | | Adjustments on final uses | | | | |
| Total at purchasers' prices | Intermediate inputs at purchasers' prices | | | | | Final uses at purchasers' prices | | | | |
| Compensation of employees<br>Other net taxes on production<br>Consumption of fixed capital<br>Net operating surplus/net mixed income | Value added by component and by industry | | | | | | | | | |
| Value added at basic prices | Total value added by industry | | | | | | | | | |
| Total inputs at basic prices | Total input by industry | | | | | | | | | |

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## Table 8.4 Numerical example of a domestic use table

Millions of euros

| | | | INDUSTIES | | | | | | | FINAL USE | | | | | | | | Total use at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agricul-ture | Manufac-turing | Construc-tion | Trade, transport and communication | Finance and business services | Other services | Total | Final consumption expenditure: Households | NPISH | General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 2 354 | 4 284 | 8 | 117 | 15 | 21 | 6 800 | 963 | | | 123 | | - 42 | 938 | 1 982 | 8 782 |
| | Manufacturing | (2) | 1 216 | 42 772 | 6 256 | 7 776 | 4 085 | 3 123 | 65 227 | 12 631 | | 327 | 9 426 | 1 122 | 1 393 | 96 280 | 121 178 | 186 405 |
| | Construction | (3) | 105 | 2 184 | 9 321 | 2 373 | 3 625 | 1 414 | 19 021 | 1 402 | | | 24 323 | | - 38 | 563 | 26 250 | 45 272 |
| | Trade | (4) | 245 | 8 601 | 1 560 | 4 370 | 682 | 1 462 | 16 919 | 27 684 | | 1 080 | 4 008 | 238 | 273 | 9 985 | 43 267 | 60 187 |
| | Transport | (5) | 31 | 4 424 | 364 | 6 368 | 575 | 301 | 12 063 | 5 828 | | 3 418 | 87 | 2 | 21 | 4 916 | 14 271 | 26 335 |
| | Communication | (6) | 29 | 1 651 | 226 | 6 745 | 4 295 | 1 343 | 14 289 | 22 088 | | 51 | 5 111 | | 40 | 6 649 | 33 940 | 48 228 |
| | Finance and business services | (7) | 439 | 11 706 | 4 611 | 18 623 | 25 779 | 8 062 | 69 219 | 36 524 | | 1 006 | 9 781 | 0 | - 177 | 11 156 | 58 289 | 127 508 |
| | Other services | (8) | 8 | 367 | 58 | 1 060 | 375 | 1 622 | 3 490 | 13 045 | 5 416 | 53 116 | 113 | - 105 | 1 | 567 | 72 153 | 75 643 |
| | Total at basic prices | (9) | 4 429 | 75 987 | 22 402 | 47 431 | 39 431 | 17 348 | 207 028 | 120 165 | 5 416 | 58 997 | 52 973 | 1 257 | 1 471 | 131 053 | 371 332 | 578 360 |
| | Imports | (10) | 919 | 62 051 | 4 834 | 12 439 | 5 417 | 3 819 | 89 479 | 23 087 | | 1 495 | 13 575 | 926 | 1 381 | 21 350 | 61 814 | 151 293 |
| | Taxes less subsidies on products | (11) | 92 | 952 | 229 | 1 349 | 1 689 | 2 672 | 6 984 | 22 810 | | 557 | 2 870 | 152 | 7 | 397 | 26 794 | 33 778 |
| | Total at purchasers' prices | (12) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 152 800 | 459 939 | 763 431 |
| Adjustments | CIF/FOB adjustments on exports | (13) | | | | | | | | | | | | | | - 97 | - 97 | - 97 |
| | Direct purchases abroad by residents | (14) | | | | | | | | 6 675 | | | | | | | 6 675 | 6 675 |
| | Purchases on the domestic territory by non-residents | (15) | | | | | | | | - 12 945 | | | | | | 12 945 | | |
| | Total at purchasers' prices | (16) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 159 792 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 165 648 | 466 517 | 770 009 |
| GVA | Compensation of employees | (17) | 551 | 30 679 | 10 239 | 37 906 | 22 997 | 41 971 | 144 343 | | | | | | | | | |
| | Other taxes less subsidies on production | (18) | - 1 627 | 1 077 | 546 | 1 755 | 2 004 | 1 103 | 4 858 | | | | | | | | | |
| | Consumption of fixed capital | (19) | 1 845 | 12 750 | 1 542 | 10 917 | 18 934 | 7 480 | 53 469 | | | | | | | | | |
| | Net operating surplus/net mixed income | (20) | 3 658 | 16 453 | 5 138 | 23 040 | 18 989 | 4 921 | 72 198 | | | | | | | | | |
| | Gross operating surplus/gross mixed income | (21) | 5 503 | 29 203 | 6 680 | 33 957 | 37 923 | 12 401 | 125 667 | | | | | | | | | |
| | GVA | (22) | 4 427 | 60 959 | 17 465 | 73 618 | 62 923 | 55 475 | 274 868 | | | | | | | | | |
| | Total input at basic prices | (23) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | | | | | | | | | |

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Table based on 2011 figures from Austria

## 1. Input table for imports

8.13. Table 8.5 shows a numerical example of an input table for imports of goods and services at basic prices. This table is either a product-by-product table or industry-by-industry table but is not an IOT, as imports form an input and not an output.

8.14. It should be noted that the sub-matrices for final uses and the row totals for products are the same in the imports use table and the IOT table of imports. An input table for imports, as already noted, may also be a step in the process of compiling IOTs but not a necessary step. This is covered in more detail in chapter 12 (see box 12.3) on the transformation of SUTs into IOTs, where the transformed imports use table can be applied in two different ways.

8.15. The only way in which it differs from the imports use table in Table 8.2 is that Table 8.5 shows the intermediate use of the imports in a product-by-product format (or this could be an industry-by-industry format). The final use part is unchanged. Chapter 12 provides more details on how the imports use table, and in turn the input table for imports, can be used to produce IOTs where, for imports of goods and services, this is only an input table.

**Table 8.5 Example of an input table for imports at basic prices**

Millions of euros

| | | | PRODUCTS | | | | | | | FINAL USE | | | | | | | | | Total use at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Final consumption expenditure: Households | Final consumption expenditure: NPISH | Final consumption expenditure: General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 176 | 1 722 | 3 | 148 | 14 | 15 | 2 077 | 1 079 | | | 47 | | 9 | 58 | 1 194 | 3 271 |
| | Manufacturing | (2) | 618 | 55 846 | 4 392 | 5 506 | 1 398 | 2 941 | 70 702 | 20 894 | | 1 422 | 12 310 | 807 | 1 344 | 17 112 | 53 888 | 124 590 |
| | Construction | (3) | | 265 | 204 | 47 | 44 | 4 | 563 | | | | | | | | | 563 |
| | Trade, transport and communication | (4) | 9 | 2 095 | 150 | 5 150 | 1 678 | 337 | 9 419 | 586 | | 26 | 745 | 1 | 28 | 4 179 | 5 565 | 14 984 |
| | Finance and business services | (5) | 7 | 1 531 | 97 | 1 527 | 2 974 | 308 | 6 443 | 145 | | | 473 | | | | 618 | 7 061 |
| | Other services | (6) | | 10 | 0 | 108 | 29 | 127 | 275 | 384 | | 47 | | 118 | | | 549 | 824 |
| | Total | (7) | 811 | 61 469 | 4 846 | 12 485 | 6 136 | 3 731 | 89 479 | 23 087 | | 1 495 | 13 575 | 926 | 1 381 | 21 350 | 61 814 | 151 293 |

Table based on 2011 figures from Austria

## 2. Input-output table for domestic output at basic prices

8.16. If the imports use table is subtracted from the use table at purchasers' prices, the corresponding domestic use table can be derived which shows only consumption of domestic produced output. A further step, however, is to subtract and reallocate the trade and transport margins and to deduct the taxes less subsidies on products, in order to achieve the SUTs at basic prices.

8.17. Table 8.6 shows the IOT for domestic output and this forms the basis for input-output analyses. It should be noted that, in this table, the use of imported goods and services is only shown in an aggregated form in one row. More detail on the transformation of SUTs into IOTs may be found in chapter 12.

## Table 8.6 Input-output table for domestic output at basic prices

Millions of euros

| | | | PRODUCTS | | | | | | | FINAL USE | | | | | | | | Output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Final consumption expenditure | | | | | | | | |
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Households | NPISH | General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 2 316 | 4 344 | 4 | 101 | 15 | 19 | 6 800 | 963 | | | 123 | | - 42 | 938 | 1 982 | 8 782 |
| | Manufacturing | (2) | 1 091 | 42 919 | 6 362 | 7 534 | 4 369 | 2 951 | 65 227 | 12 631 | | 327 | 9 426 | 1 122 | 1 393 | 96 280 | 121 178 | 186 405 |
| | Construction | (3) | 73 | 1 883 | 9 927 | 1 969 | 3 890 | 1 279 | 19 021 | 1 402 | | | 24 323 | | - 38 | 563 | 26 250 | 45 272 |
| | Trade, transport and communication | (4) | 239 | 13 805 | 2 109 | 18 364 | 5 909 | 2 846 | 43 272 | 55 600 | | 4 549 | 9 207 | 239 | 334 | 21 550 | 91 479 | 134 750 |
| | Finance and business services | (5) | 370 | 9 320 | 4 530 | 17 653 | 29 781 | 7 564 | 69 219 | 36 524 | | 1 006 | 9 781 | 0 | - 177 | 11 156 | 58 289 | 127 508 |
| | Other services | (6) | 6 | 286 | 51 | 1 066 | 453 | 1 629 | 3 490 | 13 045 | 5 416 | 53 116 | 113 | - 105 | 1 | 567 | 72 153 | 75 643 |
| | Total | (7) | 4 094 | 72 557 | 22 984 | 46 687 | 44 418 | 16 288 | 207 028 | 120 165 | 5 416 | 58 997 | 52 973 | 1 257 | 1 471 | 131 053 | 371 332 | 578 360 |
| | Imports | (8) | 811 | 61 469 | 4 846 | 12 485 | 6 136 | 3 731 | 89 479 | 23 087 | | 1 495 | 13 575 | 926 | 1 381 | 21 350 | 61 814 | 151 293 |
| | Taxes less subsidies on products | (9) | 78 | 862 | 226 | 1 333 | 1 839 | 2 646 | 6 984 | 22 810 | | 557 | 2 870 | 152 | 7 | 397 | 26 794 | 33 778 |
| | Total at purchasers' prices | (10) | 4 983 | 134 889 | 28 056 | 60 506 | 52 393 | 22 665 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 152 800 | 459 939 | 763 431 |
| GVA | Compensation of employees | (11) | 411 | 25 857 | 10 216 | 38 422 | 28 962 | 40 475 | 144 343 | | | | | | | | | |
| | Other taxes less subsidies on produ | (12) | - 1 446 | 717 | 545 | 1 762 | 2 267 | 1 014 | 4 858 | | | | | | | | | |
| | Consumption of fixed capital | (13) | 1 620 | 11 519 | 1 422 | 10 172 | 21 759 | 6 977 | 53 469 | | | | | | | | | |
| | Net operating surplus/net mixed income | (14) | 3 214 | 13 423 | 5 032 | 23 889 | 22 127 | 4 512 | 72 198 | | | | | | | | | |
| | Gross operating surplus/gross mixed income | (15) | 4 834 | 24 942 | 6 455 | 34 061 | 43 886 | 11 489 | 125 667 | | | | | | | | | |
| | GVA | (16) | 3 799 | 51 516 | 17 216 | 74 245 | 75 115 | 52 978 | 274 868 | | | | | | | | | |
| | Total input at basic prices | (17) | 8 782 | 186 405 | 45 272 | 134 750 | 127 508 | 75 643 | 578 360 | | | | | | | | | |

Table based on 2011 figures from Austria

8.18. It should be noted that table 8.6 does not contain any of the adjustment rows shown in table 8.4. The adjustment items are the following:

- CIF/FOB adjustments on exports (recorded as part of imports)
- Direct purchases abroad by residents (recorded as part of exports)
- Purchases in the domestic territory by non-residents (recorded as part of exports)

8.19. In this form, as shown in table 8.6, the IOTs always show the correct GDP; the totals for household final consumption expenditure, exports and imports in the IOTs differ, however, from the totals in the SUTs. Given that all the omitted adjustment items relate to final uses, the GDP calculated from the expenditure side (308,647) is still correct and identical to the results shown in connection with box 2.10. It is always possible to include the corresponding adjustment items in the final IOTs to arrive at the correct totals for household final consumption expenditure, exports and imports, as illustrated in Table 8.7, which is consistent with tables 8.2, 8.4 and 8.6.

8.20. Ideally, the adjustment items should be included in the IOTs for the purpose of consistency with the national accounts framework and the SUTs, and for complete coverage of the economy in analytical uses, as illustrated by table 8.7 (which, to illustrate the point, also shows a net export presentation – this presentation is covered in more detail in chapter 12). Different practices regarding these adjustment items have, however, been emerged across countries and international organizations. Thus the Austrian IOTs shown here replicate the tables contained in the Eurostat database. On the other hand, the IOTs in the OECD input-output database include all adjustment items, to ensure full consistency with national accounts data.

8.21. The problem of how to deal with the adjustment items necessarily arises when compiling empirical IOTs adjustment rows. For ease of exposition and in order not to overload the presentation of the SUTs and IOTs, these additional rows are not included in the numerical examples in this Handbook. Their absence does not mean that they have been distributed by products and thus included in the upper part of the SUTs and IOTs, an arrangement which, for example, some analytical users of IOTs would prefer.

**Table 8.7 Input-output table for domestic output at basic prices, net exports with adjustment items**

Millions of euros

| | | | INDUSTRIES | | | | | | | FINAL USE | | | | | | | | | Total output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Total consumption expenditure | | | | | | | | | |
| | | | Agricul-ture | Manu-facturing | Construc-tion | Trade, transport and commu-nication | Finance and business services | Other services | Total | House-holds | NPISH | General govern-ment | Gross fixed capital formation | Changes in valu-ables | Changes in inven-tories | Exports | Less imports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) |
| PRODUCTS | Agriculture | (1) | 2 492 | 6 065 | 8 | 248 | 29 | 34 | 8 877 | 2 042 | | | 170 | | - 32 | 996 | - 3 271 | - 95 | 8 782 |
| | Manufacturing | (2) | 1 708 | 98 765 | 10 754 | 13 040 | 5 768 | 5 893 | 135 928 | 33 525 | | 1 749 | 21 736 | 1 929 | 2 737 | 113 392 | - 124 590 | 50 477 | 186 405 |
| | Construction | (3) | 73 | 2 148 | 10 131 | 2 016 | 3 934 | 1 282 | 19 585 | 1 402 | | | 24 323 | | - 38 | 563 | - 563 | 25 687 | 45 272 |
| | Trade, transport and communication | (4) | 248 | 15 900 | 2 258 | 23 514 | 7 586 | 3 183 | 52 690 | 56 185 | | 4 575 | 9 951 | 240 | 363 | 25 729 | - 14 984 | 82 060 | 134 750 |
| | Finance and business services | (5) | 377 | 10 851 | 4 627 | 19 180 | 32 755 | 7 872 | 75 662 | 36 669 | | 1 006 | 10 254 | | - 177 | 11 156 | - 7 061 | 51 846 | 127 508 |
| | Other services | (6) | 6 | 297 | 51 | 1 174 | 482 | 1 756 | 3 765 | 13 429 | 5 416 | 53 163 | 113 | 14 | 1 | 567 | - 824 | 71 878 | 75 643 |
| | Total at basic prices | (7) | 4 905 | 134 027 | 27 830 | 59 173 | 50 554 | 20 019 | 296 507 | 143 252 | 5 416 | 60 492 | 66 548 | 2 182 | 2 852 | 152 403 | - 151 293 | 281 852 | 578 360 |
| | Taxes less subsidies on products | (8) | 78 | 862 | 226 | 1 333 | 1 839 | 2 646 | 6 984 | 22 810 | | 557 | 2 870 | 152 | 7 | 397 | | 26 794 | 33 778 |
| | Total at purchasers' prices | (9) | 4 983 | 134 889 | 28 056 | 60 506 | 52 393 | 22 665 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 152 800 | - 151 293 | 308 647 | 612 138 |
| ADJUSTMENTS | CIF/FOB adjustments | (10) | | | | | | | | | | | | | | - 97 | 97 | | |
| | Direct purchases abroad by residents | (11) | | | | | | | | 6 675 | | | | | | | - 6 675 | | |
| | Purchases on the domestic territory by non-residents | (12) | | | | | | | | - 12 945 | | | | | | 12 945 | | | |
| | Total | (13) | 4 983 | 134 889 | 28 056 | 60 506 | 52 393 | 22 665 | 303 492 | 159 792 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 165 648 | - 157 871 | 308 647 | 612 138 |
| VALUE ADDED | Compensation of employees | (14) | 411 | 25 857 | 10 216 | 38 422 | 28 962 | 40 475 | 144 343 | | | | | | | | | | |
| | Other taxes on production | (15) | - 1 446 | 717 | 545 | 1 762 | 2 267 | 1 014 | 4 858 | | | | | | | | | | |
| | Consumption of fixed capital | (16) | 1 620 | 11 519 | 1 422 | 10 172 | 21 759 | 6 977 | 53 469 | | | | | | | | | | |
| | Net operating surplus | (17) | 3 214 | 13 423 | 5 032 | 23 889 | 22 127 | 4 512 | 72 198 | | | | | | | | | | |
| | Gross operating surplus | (18) | 4 834 | 24 942 | 6 455 | 34 061 | 43 886 | 11 489 | 125 667 | | | | | | | | | | |
| | GVA | (19) | 3 799 | 51 516 | 17 216 | 74 245 | 75 115 | 52 978 | 274 868 | | | | | | | | | | |
| | Total input at basic prices | (20) | 8 782 | 186 405 | 45 272 | 134 750 | 127 508 | 75 643 | 578 360 | | | | | | | | | | |

Table based on 2011 figures from Austria

## C. Compilation of the imports use table

8.22. Compilation of the imports use table may be a difficult process because direct information for the estimates of imported products by industry and by final use may not be available or only available in limited cases. As a result, direct information has to be supplemented by reasonable assumptions and indirect techniques. As noted earlier, in a large rectangular SUTs system, many homogenous products can be identified which have to be imported from abroad. Thus, the allocation of goods and services in the use table for domestic output and the use table for imports is easier if a large rectangular SUTs system is available. The two main approaches to the compilation of Imports Use tables are presented below: the first is based on the availability of directly collected data and the second on assumptions regarding the imports.

### 1. Using directly collected data

8.23. There are two major sources for direct information for the imports use table:

- Business surveys which could be developed further, for example, for each industry, more product detail of imports of goods and services by type of product and more information on imports of services

- Trade surveys which provide extensive details of imports of goods. Traditionally, the customs department collects foreign trade statistics.

8.24. The data linking of units' data from trade and business registers provides another source, also ensuring some degree of coherence between the two sources.

8.25. Business surveys (annual or for benchmarked years) generally collect details such as sales by type of product and purchases by type of product. These surveys could be expanded to include additional questions useful for the imports use table, such as the value of purchases of imports of goods and the value of purchases of imports of services.

8.26. For certain industries, it is important to ask specific questions on the imports of goods and services for certain specific products. For example, for the sugar refining industry it may be important to have information on the purchases of sugar beet separate from sugar cane. The economy may have little, or no, domestic production of one or both of these products and would have to rely on imports, which at the two-digit level would appear in the same product classification. This approach of asking for specific details may apply also to other products such as, for example, tobacco and tobacco leaf.

8.27. This use of the business survey data would help to provide an industry total of direct imports. These values could then be developed and matched with imports of goods from the trade data suppliers by product, to help develop the body of the imports use table in terms of intermediate use. This works for direct imports but less so for indirect imports, such as imports sold to manufacturers via resident distributors such as wholesalers. Imports by retailers could, however, be assumed in the main for final use categories. Again, this would need scrutiny, for example small items (not purchased in bulk) like stationery, may be purchased by businesses from retailers. For imports of services, indirect imports should not be an issue, because by their nature services cannot be resold – in other words, they are used only once.

8.28. International trade surveys provide much of the detail by product. Further work is often required, however, to identify the importing industry or industries. For imports of goods, for example, very detailed international trade data from the Harmonized System can be more easily used to link imports to specific products that are used by industries as intermediate consumption and those products that are components of specific categories of final use. These data could be developed with the data collectors to identify the industry to which the importer is classified and the value of imports by product.

8.29. In terms of imports of services, a product-by-industry matrix should be generated for each of the 12 components forming trade in services (applicable to both imports and exports), as illustrated in Box 8.1, which would also highlight various improvements required to imports of services in the balance of payments. For business services, a separate matrix can be generated using imports of services data from business surveys providing details for other variables such as sales and purchases.

8.30. There are various existing sources of data used for imports of services by product, such as the following:

- International trade in services – which collects data from businesses covering their imports and exports of services by product. This is a statistical survey which has advantages over administrative data.
- International passenger survey – which collects expenditure data by product by travellers, at the point of entering or exiting the resident economy (for example, airports and ports). There is a need to separate the expenditure by business travellers (recorded as intermediate consumption) and expenditure by households (recorded as households' final consumption expenditures).
- Specific sources capturing imports of services such as shipping, air transport, financial services, and others.
- Development of non-traditional survey-type sources such as credit card data and international microdata-sharing, for example between national statistical offices.

8.31. For some of the standard services components, however, there are specific issues which need careful handling, for example, disbursements, freight costs, royalties, and so forth.

**Box 8.1 Standard services components of BPM 6**

| | |
|---|---|
| 1 | Manufacturing services on physical inputs owned by others |
| 2 | Maintenance and repair services not included elsewhere (n.i.e.) |
| 3 | Transport |
| 4 | Travel |
| 5 | Construction |
| 6 | Insurance and pension services |
| 7 | Financial services |
| 8 | Charges for the use of intellectual property not included elsewhere (n.i.e.) |
| 9 | Telecommunications, computer, and information services |
| 10 | Other business services |
| 11 | Personal, cultural, and recreational services |
| 12 | Government goods and services n.i.e. |

*Source*: IMF (2009)

## 2. Alternative approach

8.32. As noted, there may be a lack of source data (unless surveys are designed to collect detail data and flows from the trade industry) to estimate so-called "indirect" import use, that is, the ultimate destination of the use of imported goods, and not, say, the wholesaler acting as an intermediary. This situation will often require strong assumptions and indirect techniques to allocate the use of imports by product for each industry and by category of final use by product.

8.33. A widely used approach in estimating import use by product across using industries and categories of final uses is the application of the import proportionality or comparability assumption. This assumes that imports are used in the same proportion across all industry intermediate inputs and final uses (except exports and allowing for imports for re-export purposes). This is often a two-step procedure in which the ratio of imports to domestic supply is first calculated and is then applied to each product that is used by industries as intermediate inputs to production and by categories of final uses (except exports). For example, if imports of semi-conductors represent 50 per cent of the domestic supply of semi-conductors, then it is assumed that each industry that purchases semi-conductors purchases 50 per cent of them from foreign sources. This procedure results in the same distribution of imported products across a given row in the use table, thus providing another reason to work at the most detailed level of products available within the SUTs system, where there are likely to be fewer users of very specific products. Thus this procedure works much better with large numbers of products (for example, 10,000) as opposed to, say, fewer than 100 products. With foreign trade data, there tends to be much more data available by products relative to other data sources. The procedure should, preferably, be applied at basic prices.

8.34. Certain products can be very straightforward to allocate. For example, there are very few users of imports of crude oil in the domestic economy, whereas imports of food are used by many industries and households, or refrigerators may be used by households or in gross fixed capital formation. Nevertheless, the main task remains, namely, to attribute allocation ratios and percentages for each category of imported products across using industries and categories of final uses.

8.35. For this procedure, BEC, or a national variant of BEC, can also be used when applying the import proportionality assumption. BEC allocates imports of goods into categories of intermediate goods, consumer goods and capital goods. The elements of BEC are the subclasses of SITC, which are defined in terms of the Harmonized System. Only broad use categories are distinguished, however, and these are of less help for the intermediate uses by specific industry. Nonetheless, BEC may be helpful in categorizing the products for the imports use table.

8.36. It is worth noting that it is time and resource-consuming, especially for the first time, to generate detailed allocation ratios and percentages covering intermediate use and final uses for each category of imported products.

8.37. In defining the allocation percentages, there is a need also to keep in mind that, as a consequence of secondary output, products are also used in industries where they might not be typical inputs. This may have already been addressed in the use table.

8.38. It is important that the import proportionality assumption or related ratio procedures be used only after direct information about import use has been compiled. Lastly, once the proportionality assumptions have been applied, it is essential to evaluate the generalized results for reasonableness, and to adjust these percentages in the light of an understanding of how the specific economy operates with regard to production chains and purchases of products by final use.

8.39. The product imbalances, and the balancing process, can often be used to correct for implausible results from an initial allocation based on proportions.

8.40. Although the proportionality approach is not time-consuming, the allocation percentages can generally also be applied for other years without any large changes. Usually a great share of total imports will fall under only a few specific product classifications (for example, manufacturing products purchased by manufacturing industries) and efforts should be concentrated on those as, to a large extent, they determine the quality of the resulting imports use table and thus the accuracy of GDP in volume terms and the distribution of GVA by industry.

8.41. A difficult category of final use in respect of the allocation of imports of goods is changes in inventories. First, it is often assumed that the import share of semi-finished and finished products is zero. Second, the category of changes in inventories is a balancing item between the inventories at the end of the period minus the inventories at the beginning of the period without knowing the inflows and outflows over the period. As a result, the sign of the estimate can be positive or negative and, in the latter case, this needs to be handled with caution, otherwise it could lead to implausible values.

8.42. Inventories of finished goods should, however, be treated separately from imports of finished goods for resale without further processing. The latter are goods likely to be held mainly by distributors.

8.43. Lastly, in the process of balancing it must be expected that the procedure may need to be repeated in order to achieve plausible results. As noted, the allocation shares might need to be corrected on the basis of implausible results, which may include negative use elements. Naturally, the allocation of imports to a use element with a zero entry is not permissible and may indicate a wider problem with the level of aggregation.

## D. Specific issues in the compilation of the imports use table

8.44. There are specific issues that need careful consideration when compiling the imports use table. These include the recording of goods sent abroad for processing, investment goods repaired abroad, imports for re-export purposes, and direct expenditures by residents abroad. These specific issues are briefly discussed in this section.

8.45. Other issues include: arrangements within multinational enterprises including transfer pricing; contract manufacturing and manufacturers; factoryless goods production and processors; foreign direct investment relationships; intellectual property products – ownership and cross-border use; international labour movement and remittances; Internet trading; limitations of national data collections; merchanting of goods and services; ownership of property abroad; special-purpose entities; and toll processing and processors. The guide to measuring global production (UNECE, 2015) provides much more detail on how handle these types of issues.

**1. Goods sent abroad for processing**

8.46. Sending materials or partly finished goods to another affiliate or non-affiliate enterprise for processing is an established practice which has become more common with the drop in transport costs, specialization among enterprises and the emergence of new production sources. The enterprise processing the items may be resident in the same country as its client or it may be abroad.

8.47. The procedure of sending material for processing is called "goods sent abroad for processing". This practice is very common in industries such as wearing apparel (clothing); chemicals and the manufacture of electronic and metal goods. One variant of particular interest for the national accounts and balance of payments is goods sent abroad for processing, where the unit in country A (the principal) makes a contract with the unit in country B (the contractor) under which B transforms in a substantive way raw materials or semi-processed goods sent by country A. Throughout the process the principal maintains legal ownership of the raw materials and semi-processed goods, and also of the processed goods. The principal pays the contractor a fee for the processing.

8.48. The issue of how to record the goods sent abroad for processing in national accounts, including SUTs and balance of payments, has been the subject of extensive discussions in connection with successive versions of the SNA and the BPM. The central question has been whether to impute a value of the goods when sent abroad for processing and subsequently for the processed goods when returned to the legal owner and, in this approach, to impute transactions even though no change of ownership has taken place (the gross principle), or just to record the processing fee as a separate service delivered from the processor to the principal (the net principle).

8.49. In the following sections, the different implications of applying either the gross or the net method are illustrated by numerical examples, both for goods sent for domestic processing and for goods sent for international processing. Against this background, the international recommendations established by the 2008 SNA and BPM 6 are explained, with the inclusion of possibilities to deviate from these recommendations to reinforce desirable properties of the SUTs. The Eurostat Manual on Goods Sent Abroad for Processing (Eurostat, 2014b) provides further details in this regard. Lastly, related measurement problems in current economic statistics are also considered.

### (a) Domestic processing

8.50. In the example in Table 8.8, a principal unit classified in Industry 1 sends semi-processed goods (Product A) for further processing to a contractor unit classified in Industry 2. The contractor does not pay for the material received from the principal unit. The value of the goods sent for processing is 100. The value of the goods after processing, assumed to be finished goods requiring no further processing (Product B) is estimated at 180. Processing fees in this example are set, for the sake of simplicity, at 80. In this example, Industry 1 and Industry 2 could also be interpreted as two units belonging to the same industry but, for maximum clarity of the exposition, a two-industry case is chosen.

**Table 8.8 Processing within the country**

**Gross recording**

| | Supply Table | | | Use Table | | |
|---|---|---|---|---|---|---|
| | Industry 1 | Industry 2 | Imports | Industry 1 | Industry 2 | Exports |
| Product A | 100 | | | | 100 | |
| Product B | | 180 | | | | |
| Processing fees | | | | | | |
| Other intermediate consumption | | | | 70 | 30 | |
| GVA | | | | 30 | 50 | |
| Total output | 100 | 180 | 0 | 100 | 180 | 0 |

**Net recording**

| | Supply Table | | | Use Table | | |
|---|---|---|---|---|---|---|
| | Industry 1 | Industry 2 | Imports | Industry 1 | Industry 2 | Exports |
| Prod A | | | | | | |
| Prod B | 180 | | | | | |
| Processing fees | | 80 | | 80 | | |
| Other intermediate consumption | | | | 70 | 30 | |
| GVA | | | | 30 | 50 | |
| Total output | 180 | 80 | 0 | 180 | 80 | 0 |

Note: Industry 1 is the principal and Industry 2 is the contractor.

8.51. Under the gross treatment, transactions of the values of 100 and 180 are imputed, the 100 being the output of Industry 1, and the 180 being the output of Industry 2. As the 180 is assumed to consist of finished goods, they are not, as it were, “returned” to the owner industry but enter the product balance as an output of Product B from Industry 2, even though this industry is not the legal owner. From the point of view of Industry 1, it would be goods for resale which are therefore not recorded as a flow from Industry 1 in the system, except if held in inventories at the end of the period. The processing fees do not appear separately, as they are included in the output of Product B.

8.52. Under the net treatment, the processing fee of 80 is the only output of Industry 2 and it is used as intermediate consumption by Industry 1. The processing fee will be classified as a service and not a good. The output of Industry 1 will be 180. As processing fees can usually be found in current industrial statistics, there are no imputations associated with implementing the net treatment.

8.53. It is noted that the GVA in the two industries (30 and 50 respectively) are identical for the two alternative treatments but the input structures are quite different. For Industry 1, the gross treatment results in a much higher GVA share in output than the net treatment, and vice versa for Industry 2.

### (b) International processing

8.54. In Table 8.9, the gross and net treatments are illustrated for goods sent abroad for processing. The numerical example is essentially identical to that presented for domestic processing, except that now it is assumed that the principal is a resident of Country I, and the processor a resident of Country II, and also that the two-country case involves export and import transactions, either actual or imputed.

**Table 8.9 Goods sent abroad for processing**

**Gross recording (1993 SNA)**

Principal (Country I)

| | Supply Table | | | Use Table | | |
|---|---|---|---|---|---|---|
| | Industry 1 | Industry 2 | Imports | Industry 1 | Industry 2 | Exports |
| Product A | 100 | | | | | 100 |
| Product B | | | 180 | | | |
| Processing fees | | | | | | |
| Other intermediate consumption | | | | 70 | | |
| GVA | | | | 30 | | |
| Total output | 100 | 0 | 180 | 100 | 0 | 100 |

Contractor (Country II)

| | Supply Table | | | Use Table | | |
|---|---|---|---|---|---|---|
| | Industry 1 | Industry 2 | Imports | Industry 1 | Industry 2 | Exports |
| Product A | | | 100 | | 100 | |
| Product B | | 180 | | | | 180 |
| Processing fees | | | | | | |
| Other intermediate consumption | | | | | 30 | |
| GVA | | | | | 50 | |
| Total output | 0 | 180 | 100 | 0 | 180 | 180 |

**Net recording (2008 SNA)**

Principal (Country I)

| | Supply Table | | | Use Table | | |
|---|---|---|---|---|---|---|
| | Industry 1 | Industry 2 | Imports | Industry 1 | Industry 2 | Exports |
| Product A | | | | | | |
| Product B | 180 | | | | | |
| Processing fees | | | 80 | 80 | | |
| Other intermediate consumption | | | | 70 | | |
| GVA | | | | 30 | | |
| Total output | 180 | 0 | 80 | 180 | 0 | 0 |

Contractor (Country II)

| | Supply Table | | | Use Table | | |
|---|---|---|---|---|---|---|
| | Industry 1 | Industry 2 | Imports | Industry 1 | Industry 2 | Exports |
| Product A | | | | | | |
| Product B | | | | | | |
| Processing fees | | 80 | | | | 80 |
| Other intermediate consumption | | | | | 30 | |
| GVA | | | | | 50 | |
| Total output | 0 | 80 | 0 | 0 | 80 | 80 |

8.55. Under the gross treatment, the 100 output of semi-processed goods (Product A) from Industry 1 in Country I is the exports of goods from Country I and imports of goods into Country II, where it is used as intermediate consumption in Industry 2. The output of 180 from Industry 2 (Product B) in Country II is exported to Country I. As the 180 is assumed to consist of finished goods, they are not returned to the owner industry but enter the balance of Product B in Country I as imports of goods. As there is no change of ownership related to the 100 and the 180, the values of these transactions must be imputed, but as later noted these cross-border movements of goods will usually be included in and valued for the external merchandise trade statistics.

8.56. Under the net treatment the semi-processed goods (Product A) disappear, and the processed goods (Product B) will appear as produced in Country I, as actual output from Industry 1. Only processing fees will appear in international trade, under services. As international processing fees are usually covered both by current industrial statistics and by statistics on international trade in services, there are no imputations associated with the implementation of the net treatment of goods sent abroad for processing.

8.57. As for domestic processing, the GVA remains the same for the two approaches but the input structure is significantly different.

8.58. It should be noted that these numerical examples are highly stylized, in order to emphasize the main characteristics of the gross and net treatments. In practice, the difference between the value of the finished goods and the semi-processed goods may not be equal to the processing fee paid, either because the prices have changed over the processing period or because part of the increase in the value of the finished goods reflects the embodiment of intellectual property or trademarks owned by the principal. It may also be that the processed goods require further processing by the principal, in which case an additional entry of intermediate consumption (180 in the example following the gross treatment) would be necessary, and output increased accordingly. It should be noted that these issues will only arise under the gross treatment. The net treatment automatically resolves them.

8.59. In practice, the situation may be much more complicated and prove a significant measurement challenge. For example, goods are often not really sent abroad; for example, they may be purchased abroad. On the other hand, goods do not necessarily return after processing; they can be shipped immediately to a third country for final use.

### (c) Treatment in 2008 SNA and BPM 6

8.60. The treatment of goods sent for processing, as laid out by the 1993 SNA and BPM 5, was quite complex but the main recommendations were that domestic processing should be based on the net treatment (except when transactions take place between two establishments belonging to the same enterprise, in which case the gross treatment should be used), and that international processing should be based on the gross principle. It was indicated in the 1993 SNA that this treatment of goods for processing was designed to facilitate input-output analysis.

8.61. The question raised leading up to the discussion of 2008 SNA was whether there was still a valid reason to record goods for international processing on a gross basis or if the advent of globalization and the growing volumes of goods processed abroad suggest that a change in practice would be appropriate. In response to this discussion, the recommended treatment of goods for processing was changed in the 2008 SNA and BPM 6, in that the change in economic ownership principle was prioritized over the actual movements of goods and physical technology, so that all goods sent for processing (both domestically and internationally) should be treated according to the net principle. This much simplified recommendation is, at the same time, more in line with company accounts and principally avoids imputations but may still require adjustments to ensure that the domestic activity is consistent with that recorded in the imports and exports data.

8.62. The new treatment of goods for processing potentially leads to larger variation in input-output coefficients and it is important to put this change into perspective. In the 1993 SNA, the net treatment was already applied if the goods were sent for processing to a non-affiliated domestic processor. Moreover, input structures change for a number of reasons: for example, because of changes in product mix, more or less use of semi-finished products, changes in capital and labour intensities, and outsourcing of services. The change in goods sent abroad for processing merely adds to the other changes in the 2008 SNA, which in turn change the input-output coefficients.

8.63. The effects on the input structure of the alternative treatments of goods sent for processing are illustrated in Table 8.10 for Industry 1. The input structures when using the gross or net treatment are taken from Table 8.8. To get an idea of what the input structure would have looked like if no goods had been sent for processing, the processing fee has been decomposed into "other intermediates" and "GVA", using the input structure of Industry 2, and the components added to the "net treatment" column to obtain the result in the last column. When looking at the GVA to output ratios of the three input structures, they are obviously quite different. From the standpoint of input-output technology, the structure in the last column would be preferred as neither of the first two columns would be a good approximation. In practice, when following the 2008 SNA, the input structure of an industry sending goods for processing would probably represent a weighted average of the structures in the second and the last column, as the industry will probably also have some primary output that has not been sent for processing. When the share of goods sent for processing changes, the overall input structure of the industry will change even though no technological change has taken place.

**Table 8.10 Industry 1 – Alternative input structures**

| | Gross treatment | Net treatment | Processing fee breakdown | Structure when no processing |
|---|---|---|---|---|
| Processing fees | | 80 | -80 | |
| Other intermediates | 70 | 70 | 30 | 100 |
| GVA | 30 | 30 | 50 | 80 |
| Output | 100 | 180 | | 180 |
| GVA/Output | 0.30 | 0.17 | | 0.44 |

8.64. As already emphasized, Table 8.10 provides a stylized example. There are various business activity models, and mixed models, not just within an industry but within an individual business – with the impact of globalization, this is becoming more prevalent. For example, the same oil company can cover the following three activities:

- Extract the crude oil, refine it and then sell the refined petroleum. This activity has the full input structure as indicated in the final column of Table 8.10.

- Extract the crude oil, sell the crude oil for processing to another company and then purchase the refined petroleum from that company for resale without any further processing. Note, in this case, that there is a change in economic ownership and the oil company undertakes no refining.

- Extract the crude oil, pay another company a processing fee for refining the crude oil (note, no change of economic ownership), and then sell the refined petroleum. Again, the oil company undertakes no refining. This activity is indicated in the second column of Table 8.10.

8.65. If the three activities are separable, then they would reflect different input structures. This illustrates, however, that an individual company, and an industry, can reflect a mix of activities and input structures from both the point of view of the outsourcing industry and the point of view of the processing industry. This makes the data collection, measurement and interpretation of the industry input structures much harder.

8.66. In paragraphs 28.18 and 28.19, the 2008 SNA outlines two ways to proceed that would retain the technical interpretation:

- Option 1: split the economic activity into two: one processing on own account, and one for goods sent for processing.
- Option 2: use the gross recording approach.

8.67. It should be emphasized that option 1 is the recommendation of the 2008 SNA and, for goods sent abroad for processing, BPM 6. Option 2 is shown as a supplementary presentation that may be adopted for reasons of continuity with past practices. Option 1 more accurately reflects the economic processes taking place, while option 2 focuses on the physical transformation process (2008 SNA, para. 28.20). The idea – when seen in the perspective of a published IOT – is rather theoretical, however, as only in very exceptional cases would it be realistic to have the tables include such dual branches, and furthermore this way of reasoning could be extended to cover all other reasons for differences in input structures and thus lead to an expansion of the number of economic activities ad infinitum. In these cases, where the individual producer units represent blends of traditional production and contracting-out, this approach would anyway not be feasible.

8.68. Even in gross recording, the input structures of principals and contractors would probably be quite different from the input structure when processing on own account. Specific adjustments may, however, be appropriate in certain cases. If, for example, the share of oil refining made on contract basis (as a contractor) varies drastically over time, it might be justified to apply the gross treatment in this case, while on the other hand an increasing trend in goods sent abroad for processing should not be counteracted. Practical data problems will also limit the options. Whereas it may be perfectly realistic to implement the gross treatment in the above oil refinery case, it would require industrial insight and data beyond any realistic possibility to adjust for the latter general trend.

8.69. The increasing activity by businesses involving the sending of goods for processing, whether domestically or internationally, will in any event affect the input-output coefficients (both for the principal and the contractor), and imputing sets of data that are completely detached from the actual economic transactions and their statistical recording is not a viable way of dealing with the complications arising from the institutional changes taking place in the economy. The growth of outsourcing under the globalization of markets means that these inherent institutional changes are more rapid and more significant, and this is a phenomenon with which the input-output compilers and analytical users will have to accommodate. This will not be done by making an artificial world of their own that denies these structural changes, rather than exposing them.

**(d) Data and balancing issues**

8.70. There are three main data sources involved in preparing the industry and product estimates for goods sent for processing in the SUTs:

- Industrial statistics in which manufacturers provide information on receipts for doing work to the orders of others (as contractor) and subcontracting expenses (as principal) but in which manufacturers are not asked to estimate values for the materials received for processing or for the processed goods when returned to the principal

- Merchandise trade statistics in which estimated values for the goods sent abroad for processing – and returned from processing abroad – are included as a border crossing principle, rather than following a change of ownership principle

- Statistics on international trade in services in which in-going and out-going processing fees are recorded

8.71. If data from all three data sources are just taken at face value and entered into the SUTs, major imbalances will obviously result.

8.72. Under the net treatment, the merchandise trade related to goods sent abroad for processing will have no counterpart in the data recorded by domestic industrial statistics and must therefore be removed from the merchandise trade data. This will often be possible, where these types of goods have been given a special code in the customs procedure. If, however, they are indistinguishably included, a more comprehensive approach may be needed, based on specific information on industrial practices and processes. Under the net approach, the processing fees recorded in the statistics on international trade in services should be directly applicable, and in principle consistent with (but not equal to) the processing fees recorded in domestic industrial statistics, as these also include payments for domestic processing.

8.73. In order to obtain qualitative data on the fees paid and received for international processing, detailed comparisons of different data sources at the firm level may be required. Survey data on the import and export of services may provide the basis for the fee paid and received but may be incomplete in terms both of respondents and of product detail. These data must be supplemented, and reconciled, with data on industrial production and international goods flows under processing. They must also be consistent with firm data on turnover and costs, ensuring that the domestic account and rest of the world account are consistent.

8.74. Under the gross treatment, the imbalance between supply and use of goods would be removed by imputing additional inputs and outputs for domestic industries corresponding to the merchandise imports and exports related to processing. As the processing fees are in this case embedded in the value of the processed goods, they should be removed from the statistics on international trade in services before these data are entered into the SUTs.

8.75. In order to keep track of the conceptual and data-linked complexities of goods sent for processing, both domestically and internationally, it is recommended that a subsystem be established in which all the related goods and services balances are separately set out and analysed, so as to secure full coverage and consistency in the SUTs before the data are entered into the full system.

### 2. Investment goods repaired abroad

8.76. Investment goods which are sent abroad for major repair result in substantial amounts of value being created in the reconstruction. Both the export and the re-import are part of the import and export flows. In the case of minor repair, maintenance or servicing, however, the flows concerned are not to be recorded under imports and exports. In the case of major repairs, similar problems of recording in the SUTs framework occur. Thus, for practical reasons, it may be assumed that it usually would be only a minor repair. Furthermore, it could be assumed that the cross-border transport of investment goods for repair is quite rare and thus negligible (with the exception of products like aircraft and ships, where the activity and values involved are often very significant).

### 3. Imports for re-export purposes

8.77. Another challenge in the compilation of the imports use table is posed by re-exports. Re-exports are transactions of goods which were previously imported with a change in economic ownership and then exported without any substantial transformation. These re-exports are included as exports in foreign trade statistics. In the case of products that are not produced domestically, any exports of these products could easily be identified as re-exports. It should be noted that – with the exception of transport margins – re-exports of services are, by their very nature, not possible, thus the identification of re-exports is only a problem for goods.

### 4. Direct expenditures by residents abroad

8.78. A further problem which may also be of some importance concerning the data involved is posed by direct purchases abroad by residents in connection with tourism. These direct purchases abroad by residents should cover all purchases of goods and services made by residents while travelling abroad for business or pleasure. Such purchases are part of the import flows and need to be estimated on a product basis. As a result, these purchases must be allocated to intermediate use in the case of business travellers and to household final consumption in the case of private travellers.

### 5. Transit trade

8.79. These are goods admitted under special customs procedures that allow the goods to pass through the territory. They are excluded from the general merchandise of the territory of transit. The issue of transit trade takes various forms, including quasi-transit trade and others, and poses challenges in terms both of statistics and of measurement. For some countries, these may be significant, in particular with large ports. Transit trade, also referred to as "simple transit", and quasi-transit trade flows do appear in merchandise trade statistics and should be excluded from national accounts and balance of payments.

## E. Enhancements to the imports use table for analytical uses

8.80. In addition to those enhancements described above, the analytical potential of the imports use table for users is considerably enhanced if the table also shows supplementary classifications such as the distinction between "competitive imports" and "complementary imports", or imports subdivided by regions, such as country or region of origin.

8.81. Competitive imports are products that are also domestically produced and thus are consequential in estimating an accurate domestic use table. Complementary imports (also referred to as "non-competitive imports") are products that are not domestically produced.

8.82. This distinction is of analytical interest as both types of imports can be expected to have a different relationship with and importance for the national economy. Competitive imports may be the subject of economic analysis concerning substitution policies and effects. Complementary imports, as products not produced in the national economy, are sometimes vital and analyses may focus on the impact of changes in their prices or volume.

8.83. In theory, the distinction between competitive and complementary imports seems to be clear. In practice, however, a number of borderline cases need to be solved. For the validity of this distinction, the product level of disaggregation is of utmost importance. Even at a very detailed product level, it is sometimes difficult to classify the products as competitive or complementary. Furthermore, this classification may not be stable over time.

8.84. Compared to the distinction between competitive and complementary imports, a geographical breakdown of the use table of imports is easier to compile as there may be data problems but no basic conceptual problems. Where goods are concerned, information on the geographical origin of the imports is usually available in foreign trade statistics. For services, the data situation concerning the geographical breakdown of imports is less favourable.

8.85. The main problem in compiling use tables on imports with a geographical breakdown is how to allocate a single product imported from two geographical regions to the respective use categories: should it be allocated proportionally to the assumed users? Similar questions already arise when compiling the use table of imports without geographical breakdowns: is the import share of an imported product the same in all use categories? In consequence, a geographical breakdown might need such additional assumptions to be made, in order to allocate the imports.

# Chapter 9. Compiling SUTs in volume terms

## A. Introduction

9.1. One of the major objectives of national accounts is to provide comprehensive and coherent data which can be used for analysing and evaluating the performance of an economy. Data on the real growth of major economic flows such as production, household consumption, capital formation and exports serve as inputs for formulating economic policy. Furthermore, the national accounts data play a key role in helping to investigate the causal mechanisms within an economy.

9.2. Estimation of the parameters for macroeconomic models by applying econometric methods requires consistent time series of national accounts data with a focus on annual changes. The decomposition of annual current price changes into price changes and volume changes is therefore an important aspect of the compilation of national accounts.

9.3. Contrary to data in current prices, much of the data in volume terms cannot be directly observed. They must be derived from current price data combined with appropriate price and volume indicators, meaning that estimates in volume terms are derived more through modelling or based on proxies rather than estimates used when formulating data in current prices. In addition, the choice of index formulae influences the result of the estimates in volume terms.

9.4. The calculation of price and volume changes for the transactions of goods and services in the national accounts is ideally supported through the use of the SUTs framework. When established in an accounting framework, the volume indices and deflators of several variables at different levels of aggregation are interrelated in a systematic way. By applying an appropriate combination of price and volume index formulae, all the identities and relationships of SUTs in current prices are maintained in the SUTs in volume terms.

9.5. When balanced both in current prices and in volume terms, the SUTs ensure coherent and consistent deflation of the components of the production and expenditure approaches to measuring GDP, together with coherent and consistent estimates of price and volume indices. Another advantage of compiling price and volume measures within the SUTs framework is that price and volume measures can be derived for such important balancing items as GVA and GDP through applying the so-called “double deflation” approach – this is the recommended SNA approach to estimating GVA in volume terms.

9.6. This chapter focuses on the compilation of SUTs in volume terms. In section B it is acknowledged that there are alternative approaches to compiling SUTs in volume terms. Section

C describes the compilation of SUTs in volume terms using the H-Approach and sections D and E present more details on how to deflate the various components of the SUTs. Lastly, section F presents some considerations for compilation of IOTs in volume terms. The balancing of SUTs in current prices and in volume terms (and also at basic prices and at purchasers' prices) is covered in chapter 11.

## B. Recognition of alternative approaches

9.7. Based on issues like the availability of data, resources and time, it is important to note that there are different ways of deflating SUTs, and also different sequences in so doing. In turn, these variations will also generate different balancing schemes and, most important, different degrees of quality for the detail and the aggregates.

9.8. This chapter focuses on a recommended approach, although alternative approaches are available. One such alternative is the deflation of uses at purchasers' prices as inputs to generate the SUTs in volume terms and balance the rest of SUTs, which may be deflated at basic prices (or producer prices), for example, output. This approach may be easier to implement but has in-built incoherence and inconsistency reflected through balancing different valuations. Albeit balanced out, the impact on the quality of the aggregates is implicit (and not explicit), and, in addition, for some areas like gross fixed capital formation is clearly sub-optimal, as appropriate price indices at purchasers' prices are not usually available.

9.9. In addition, SUTs in volume terms for one period can be compiled using SUTs in current prices for one period and deflators. The recommended approach, however, includes a time-series dimension.

9.10. Another alternative approach is to remove taxes, subsidies, trade and transport margins and imports, to deflate domestic output at basic prices (with weighting for exports using export price indices) and to deflate imports using import price indices. Trade and transport margins and taxes and subsidies in volume terms are estimates using rates of the previous year and the volume change at basic prices.

9.11. The underlying principles of this approach form the recommended approach covered in detail in this chapter (referred to as the H-Approach), an overview of which is given in Figure 9.1. This is a transparent, coherent and consistent approach compiling SUTs both in current prices and in previous years' prices and ensuring the better matching of the valuation of current price values with appropriate price indices.

9.12. There are many benefits of the H-Approach as, for example, it allows for the data confrontation to take place in both current prices and in volume terms and also ensures consistent deflation across the national accounts. In addition, the incorporation of high-quality alternatives helps to improve the quality of the SUTs in volume terms, for example, by deflating household final consumption expenditure using CPIs. Using either a dual approach or all the information available, the result is conducive to the production of better quality estimates of household final consumption expenditure but these will be different from those purely based on the CPIs. There is a variety of reasons for the use of CPIs but it does have some drawbacks: for example, CPIs may not allow for discounts or bulk purchases, or fully meet national accounts requirements. Thus, the implicit household final consumption expenditure deflator from the SUTs would be, and should be, different from the CPI. For such areas as capital formation, however, it is unlikely that there is any collection of direct prices at purchasers' prices which can be used to deflate components like gross fixed capital formation, thus alternative proxies, such as producer prices, may be used instead. In these cases, the use of the H-Approach provides a much better basis and results in a higher quality volume estimate.

9.13. The H-Approach presumes SUTs in current prices for the year t, SUTs in current prices for the year t-1 and appropriate deflators are available. This is not, however, a necessary precondition, as SUTs in volume terms can be created with just SUTs in current prices for the year t and appropriate deflators. At the same time, this approach does not reflect the time series dimension and the use of margin and tax rates in the previous year.

## C. Overview of the steps in the H-Approach with a focus on volumes

9.14. This section provides an overview of the compilation process, where Figure 9.1 shows a framework for estimating SUTs simultaneously at purchasers' prices and at basic prices and in current prices and volume terms. This section supplements the description of the H-Approach provided in chapters 2 and 3.

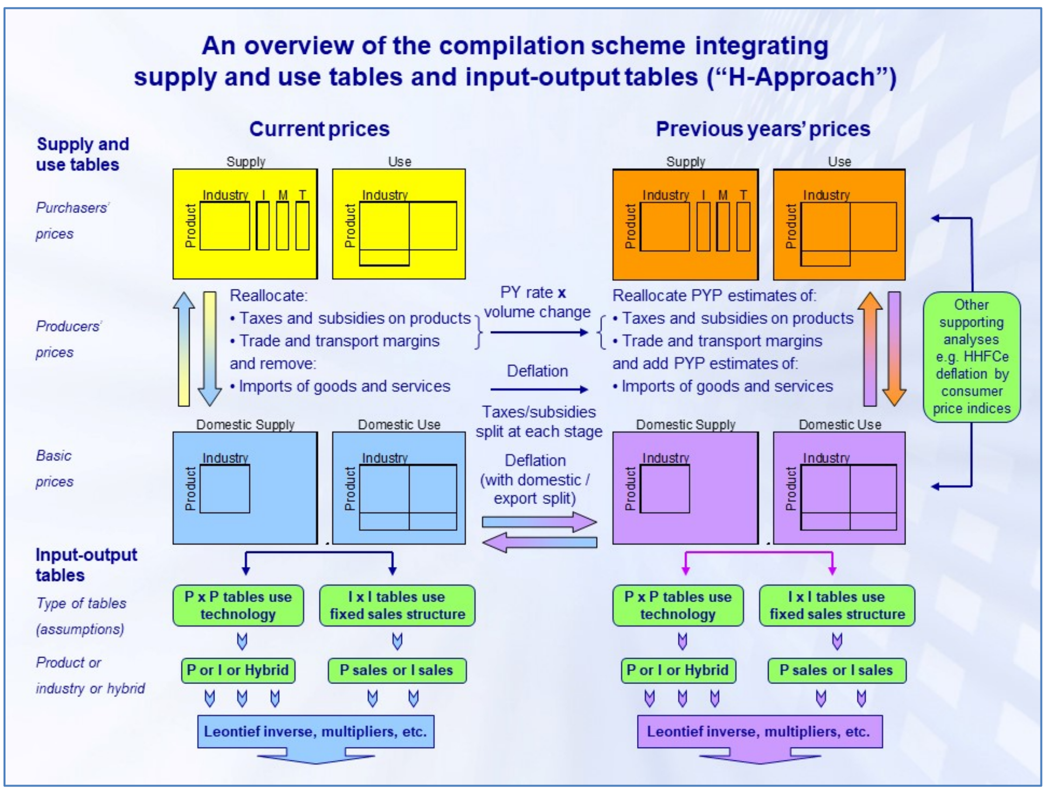
9.15. On the left-hand side of the "H", the current price data are presented, while the right-hand side of the "H" presents the volume data in previous years' prices. In the middle, the links between SUTs in current prices and in volume term (through the process of deflation) are shown, where the SUTs on both sides are valued at basic prices. The two legs below the middle cover the IOTs in current prices and in volume terms. The compilation flow can be from left-top to left-middle then through deflation to the right-middle and then to right-top. As explained in chapter 3, if better final use-based purchasers' price deflators exist, such as CPIs, then a compilation flow starting from the right-top can be incorporated, reversing the process and ensuring a balanced approach at each stage. The H-Approach allows for the use of such deflators and volume-based indicators. In terms of system design, however, there are different options of how better quality price deflators can be used but these need to be clearly set out at the outset. For example, it may be agreed that the deflation of household final consumption expenditure using CPIs gives a better measure of the volume of such expenditure in practice than deflation at basic prices, thus these deflators could be incorporated, with the objective of retaining these results and balancing back to the basic price valuation of household final consumption expenditure.

9.16. This framework is shown as a summary in figures 3.4 and 3.5 covering a simplified version of the outputs in the compilation schematic layout for SUTs and IOTs in current prices and in previous years' prices. Application of this compilation scheme will generate consistent and coherent estimates of volume and price indices for all entries of the SUTs linking the different valuations and the valuation matrices, together with the IOTs.

9.17. Figure 9.1 provides an overview that underpins the annexes covering the sequence and the stage of production processes compiling SUTs in both current prices and in volume terms, provided in chapter 4.

9.18. As stated in the introduction, many of the above transactions in volume terms cannot be directly observed. As a result, volume estimates must be derived from current price data combined with information on price or volume changes. As a consequence, the starting point for volume estimates are the SUTs in current prices as shown in the top left corner of Figure 9.1.

**Figure 9.1 Overview of the compilation schematic layout linking SUTs in current prices and in volume terms**




Compiled by Sanjiv Mahajan June 2009

## 1. Step 1

9.19. Once current price SUTs at purchasers' prices (i.e. top left-hand side of Figure 9.1) have been established, the separation of the valuation matrices covering taxes on products, subsidies on products, trade margins and transport margins, and the separation of the imports use table are used to derive a domestic use table at basic prices (i.e. middle of the left-hand side of Figure 9.1). The compilation of each of these matrices and tables is covered in chapters 7 and 8 of this Handbook.

9.20. At this stage (i.e. middle of the left-hand side of Figure 9.1), the tables for imported goods and services and domestically produced goods and services form the starting point for the compilation of the IOTs in current prices (i.e. bottom of the left-hand side of Figure 9.1) but also the first step in the deflation phase for compiling SUTs in volume terms.

## 2. Step 2

9.21. For intermediate consumption at purchasers' prices in the use table, appropriate price indices are mostly not available. The output and import price indices might be used as an approximation (see below); the optimal process, however, is to compile the use table at basic prices by deduction of the valuation matrices from the use table at purchasers' prices, shown on the left-hand side of Figure 9.1. in order to apply the most appropriate price indices, the use table at basic prices should be split between the uses of imported goods and services (imports use table), separate from the uses of domestically produced goods and services (domestic use table) shown in the middle of the left-hand side of Figure 9.1.

9.22. The domestic use table at basic prices is deflated using appropriate price deflators (or use of volume indicators) applied across each product in both the supply table and use table, allowing for the separation of domestically consumed products and exported products, deflated using export price indices (EPIs). This assumes that the sale price charged by the seller is the same as the purchase price paid by the purchaser. Implicitly, this may not, for example, allow for bulk purchases made at a discounted price. If, however, the deflation is carried out at a very detailed level, then the impact will be insignificant.

9.23. In the ideal case, producer price indices (PPIs) are a correctly weighted average of domestic sales and exports. In practice, however, often a weighted average has to be constructed by applying weights of the previous year. The preferred option is to split produced goods and services between those consumed domestically and those exported, and then to deflate using PPIs and EPIs, respectively.

9.24. The same approach holds for the imports of goods and services when applying import price indices (IPIs).

9.25. Within this step, the use of volume indicators, if appropriate, may form better quality than deflating current prices with inappropriate deflators. Further areas where a different approach for deflation may be considered is handling self-balanced concepts such as FISIM. In current prices, FISIM is balanced across the production, income and expenditure approaches and can be shown in the form of SUTs and there is no need for any balancing adjustments. Therefore, if the SUTs in current prices are balanced at this step, you can remove FISIM as a balanced change leaving the SUTs in current prices (excluding FISIM) still balanced. FISIM can then be deflated separately using an alternative, or more appropriate, deflation approach generating a balanced FISIM in volume terms. Balanced FISIM in volume terms can be added to balanced SUTs in volume terms (excluding FISIM) to give balanced SUTs in volume terms. This ensures good quality, appropriate, consistent and coherent deflation of self-balanced concepts. There are several examples that may be addressed using a self-balanced approach such as insurance, consumption of fixed capital for non-market units, imputed rental of owner-occupied dwellings, etc.

9.26. The above step results in SUTs at basic prices in previous years' prices. These data in volume terms sit in the middle of the right-hand side of Figure 9.1.

9.27. In the case when the SUTs in current prices and at purchasers' prices are already balanced, the above step should result in balanced SUTs at basic prices in previous years' prices, assuming the requirements on prices mentioned above are fulfilled. In practice, however, some balancing will be required.

### 3. Step 3

9.28. Step 3 consists in the deflation of the valuation matrices for taxes, subsidies and margins (trade and transport) by applying the previous year rates to the volumes at basic prices (or volume change as appropriate).

9.29. In combination with the SUTs at basic prices, in previous years' prices, the volume changes can be calculated, and these form the basis for the volume estimates for all the individual entries of the valuation matrices. In this compilation step, there are two key issues:

- First, it is important to check the plausibility of the volume estimates, in particular trade and transport margins for the goods and services which have large changes in quality, as the quality change forms part of the volume changes in the national accounts. The consequences for GVA in the trade and transport industries might be unacceptable.

- Second, separate independent PPIs might be available for transport services. Confrontation with the implicit price indices resulting from the process indicated by Figure 9.1 might lead to unacceptable differences with the observed price indices. This, in turn, may necessitate a re-evaluation of earlier estimates.

### 4. Step 4

9.30. Step 4 consists in the compilation of SUTs at purchasers' prices in previous years' prices – as shown in the top-right corner of Figure 9.1 – by adding the SUTs at basic prices and the valuation matrices in previous years' prices obtained in the previous steps.

9.31. At this stage, additional plausibility checks are available, and in some cases, essential. These may include, as described earlier, the use of household final consumption expenditure in volume terms using CPIs. Confrontation of the resulting implicit price indices from the SUTs at purchasers' prices with observed purchasers' price indices like the CPI may reveal implausible results, leading to the need to re-evaluate and adjust earlier estimates.

9.32. The reassessment and allocation of adjustments may ultimately mean, in some cases, that the current price SUTs at purchasers' prices may need to change or that one or several of the intermediate steps may need to be altered.

9.33. In the case of starting with balanced SUTs in current prices and at purchasers' prices, each transitional step thereafter creates a balanced matrix. As a consequence, the resulting SUTs in previous years' prices both at basic prices and at purchasers' prices will also be balanced. Any adjustments resulting from the additional plausibility checks will be incorporated in a balanced manner and improve plausibility and, in turn, quality.

### 5. Step 5

9.34. Step 5 consists in the compilation of IOTs in previous years' prices using the same assumptions as applied for the compilation of IOTs in current prices. This is shown in the bottom right-hand side of Figure 9.1.

### 6. Other points to note

9.35. Options on the starting point, in other words, whether to use the current price SUTs at purchasers' prices and at basic prices balanced or unbalanced as a starting point, is discussed in chapter 11 of this Handbook. This choice does not alter the steps or the processes of deflation but it will have different impacts on the processes, resources, systems and schedules needed to compile these tables.

9.36. Figure 9.2 shows the links between the table in Figure 9.1 at the current price estimates and in volume estimates for two successive years. In particular:

- The link between the SUTs of year t-1 in current prices of t-1 and the SUTs year t in prices of t-1 are the SUTs with the corresponding volume indices
- The connecting link between the SUTs in current prices of year t and the SUTs of year t in prices of t-1 are the SUTs with the information on price indices

From the SUTs in current prices of year t and year t-1, the SUTs with value indices can be derived.

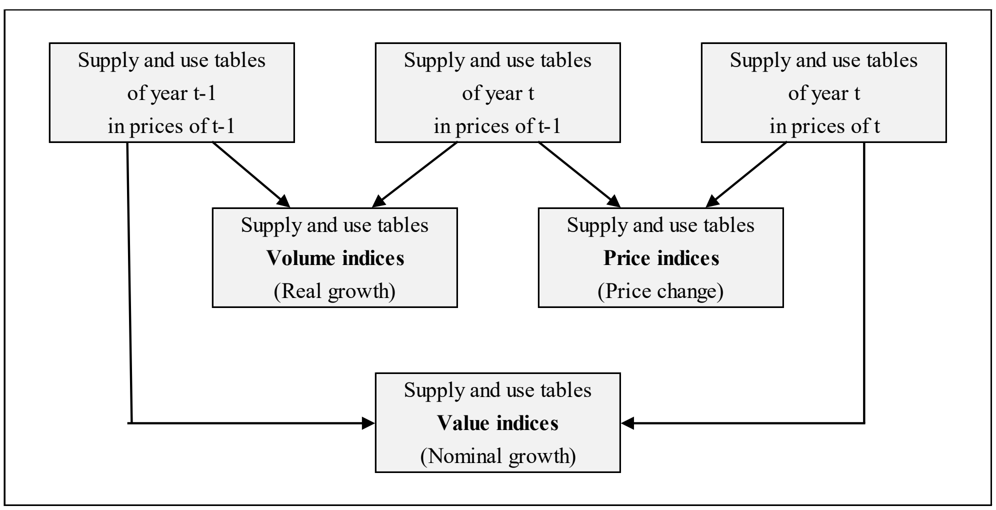
9.37. At the end of this estimation process, a complete picture is available as laid out in Figure 9.2, for every column of the SUTs, not only in current prices but also in previous years' prices for outputs, intermediate uses, final uses and imports of goods and services. It should be noted the SUTs may be unbalanced at this stage.

9.38. This set of data makes it possible to check the consistency of the data, in which process, even if the results in current prices look plausible, the analysis of volume and price data may reveal significant problems. Such analysis may include, for example, a comparison of changes in the volume of output by industry with the corresponding changes in the volume of intermediate consumption and the volume of GVA.

9.39. The analysis in volume terms is far superior, in particular when prices are changing rapidly. In several cases, these data can be checked with actual data in volumes, for example, the use of energy products or the volume of sales by product as in agriculture.

9.40. The value-price-volume analysis can lead to amendments on either of the estimated variables before the balancing process has commenced.

**Figure 9.2 Link between SUTs in current prices and in volume terms**




9.41. An empirical example of SUTs reflecting the components of Figure 9.2 (including prices indices, volume indices and value indices) is shown in Table 9.1 and Table 9.2. From these tables, information on inflation, real growth and nominal growth can be extracted at a detailed level, along with nominal GDP, real GDP growth and the GDP deflator. Table 9.3 also shows that the growth rates for GDP can be directly derived from the SUTs by applying the formulae for the production, income and expenditure approaches.

9.42. It should be noted that the estimates of "direct purchases abroad by residents" and "purchases on the domestic territory by non-residents" in row (11) of Table 9.1 and rows (11) and

(12) of Table 9.2 are not shown separately in these tables but incorporated in the products of the table. This is an alternative presentation of direct purchases abroad by residents and domestic purchases by non-residents: these adjustments form the difference between the national concept and domestic concept of household final consumption expenditure. The breakdown by product allows for more appropriate deflation by product, whereas the two aggregates form a heterogeneous suite of products.

# Table 9.1 Supply table in current prices and in volume terms

| | | | OUTPUT OF INDUSTRIES | | | | | | | Imports | Total supply at basic prices | VALUATION | | | Total supply at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Output at basic prices | | | Trade and transport margins | Taxes less subsidies on products | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| | **Supply table at current prices in year *t*** | | | | | | | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 25 773 | 153 | | | 20 | 16 | 25 962 | 15 384 | 41 346 | 10 903 | 535 | 11 438 | 52 784 |
| | Manufacturing | (2) | 1 262 | 316 757 | 1 757 | 18 741 | 5 157 | 11 821 | 355 495 | 336 807 | 692 302 | 112 979 | 39 419 | 152 398 | 844 700 |
| | Construction | (3) | 92 | 1 104 | 87 896 | 296 | 2 062 | 2 134 | 93 584 | 1 564 | 95 148 | | 8 260 | 8 260 | 103 408 |
| | Trade | (4) | 144 | 9 919 | 356 | 116 902 | 2 893 | 672 | 130 886 | 3 429 | 134 315 | - 109 321 | 829 | - 108 492 | 25 823 |
| | Transport | (5) | 385 | 17 | 69 | 63 645 | 1 348 | 977 | 66 441 | 10 671 | 77 112 | - 14 864 | - 996 | - 15 860 | 61 252 |
| | Communication | (6) | | 4 722 | | 41 679 | 2 895 | 585 | 49 881 | 6 277 | 56 158 | 198 | 3 160 | 3 358 | 59 516 |
| | Finance and business services | (7) | 489 | 6 992 | 1 053 | 13 015 | 195 536 | 73 409 | 290 494 | 55 242 | 345 736 | | 9 124 | 9 124 | 354 860 |
| | Other services | (8) | 304 | 2 512 | | 2 687 | 3 540 | 216 628 | 225 671 | 16 638 | 242 309 | 105 | 3 008 | 3 113 | 245 422 |
| | Total | (9) | 28 449 | 342 176 | 91 131 | 256 965 | 213 451 | 306 242 | 1 238 414 | 446 012 | 1 684 426 | | 63 339 | 63 339 | 1 747 765 |
| Adjustm | CIF/FOB adjustments on imports | (10) | | | | | | | | - 3 569 | - 3 569 | | | | - 3 569 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | |
| | Total | (12) | 28 449 | 342 176 | 91 131 | 256 965 | 213 451 | 306 242 | 1 238 414 | 442 443 | 1 680 857 | | 63 339 | 63 339 | 1 744 196 |
| | **Price index (*t*-1 = 100)** | | | | | | | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 102.0 | 104.1 | | | 100.0 | 100.0 | 102.0 | 106.9 | 103.8 | 97.5 | 107.6 | 97.9 | 102.4 |
| | Manufacturing | (2) | 107.5 | 108.0 | 101.3 | 99.9 | 100.5 | 101.3 | 107.2 | 108.0 | 107.6 | 100.2 | 101.9 | 100.7 | 106.2 |
| | Construction | (3) | 103.4 | 100.8 | 100.5 | 102.1 | 100.9 | 99.8 | 100.5 | 101.6 | 100.5 | | 100.1 | 100.1 | 100.5 |
| | Trade | (4) | 98.0 | 100.1 | 99.2 | 99.7 | 99.9 | 99.9 | 99.7 | 100.0 | 99.7 | 99.5 | 102.3 | 99.5 | 100.4 |
| | Transport | (5) | 102.4 | 100.0 | 101.5 | 102.0 | 101.6 | 101.6 | 102.0 | 102.2 | 102.0 | 103.5 | 99.4 | 103.2 | 101.7 |
| | Communication | (6) | | 97.5 | | 99.6 | 97.4 | 98.3 | 99.2 | 98.3 | 99.1 | 101.5 | 100.5 | 100.6 | 99.2 |
| | Finance and business services | (7) | 102.9 | 101.0 | 100.5 | 100.7 | 100.2 | 101.0 | 100.4 | 101.0 | 100.5 | | 93.6 | 93.6 | 100.3 |
| | Other services | (8) | 102.4 | 100.2 | | 102.2 | 115.9 | 100.8 | 101.0 | 103.4 | 101.1 | 99.1 | 110.2 | 109.8 | 101.2 |
| | Total | (9) | 102.2 | 107.4 | 100.5 | 100.3 | 100.4 | 100.8 | 102.4 | 106.5 | 103.4 | | 100.8 | 100.8 | 103.3 |
| Adjustm | CIF/FOB adjustments on imports | (10) | | | | | | | | 108.1 | 108.1 | | | | 108.1 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | |
| | Total | (12) | 102.2 | 107.4 | 100.5 | 100.3 | 100.4 | 100.8 | 102.4 | 106.5 | 103.4 | | 100.8 | 100.8 | 103.3 |
| | **Supply table of year *t* at previous years' prices** | | | | | | | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 25 274 | 147 | | | 20 | 16 | 25 457 | 14 386 | 39 843 | 11 183 | 497 | 11 680 | 51 523 |
| | Manufacturing | (2) | 1 174 | 293 265 | 1 734 | 18 755 | 5 129 | 11 673 | 331 730 | 311 934 | 643 664 | 112 711 | 38 690 | 151 401 | 795 065 |
| | Construction | (3) | 89 | 1 095 | 87 486 | 290 | 2 043 | 2 138 | 93 141 | 1 540 | 94 681 | | 8 253 | 8 253 | 102 934 |
| | Trade | (4) | 147 | 9 913 | 359 | 117 309 | 2 897 | 673 | 131 298 | 3 428 | 134 726 | - 109 828 | 810 | - 109 018 | 25 708 |
| | Transport | (5) | 376 | 17 | 68 | 62 377 | 1 327 | 962 | 65 127 | 10 444 | 75 571 | - 14 367 | - 1 002 | - 15 369 | 60 202 |
| | Communication | (6) | | 4 845 | | 41 862 | 2 973 | 595 | 50 275 | 6 385 | 56 660 | 195 | 3 144 | 3 339 | 59 999 |
| | Finance and business services | (7) | 475 | 6 925 | 1 048 | 12 924 | 195 168 | 72 709 | 289 249 | 54 690 | 343 939 | | 9 745 | 9 745 | 353 684 |
| | Other services | (8) | 297 | 2 507 | | 2 628 | 3 055 | 214 997 | 223 484 | 16 094 | 239 578 | 106 | 2 729 | 2 835 | 242 413 |
| | Total | (9) | 27 832 | 318 714 | 90 695 | 256 145 | 212 612 | 303 763 | 1 209 761 | 418 901 | 1 628 662 | | 62 866 | 62 866 | 1 691 528 |
| Adjustm | CIF/FOB adjustments on imports | (10) | | | | | | | | - 3 303 | - 3 303 | | | | - 3 303 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | |
| | Total | (12) | 27 832 | 318 714 | 90 695 | 256 145 | 212 612 | 303 763 | 1 209 761 | 415 598 | 1 625 359 | | 62 866 | 62 866 | 1 688 225 |
| | **Volume index (*t*-1 = 100)** | | | | | | | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 99.9 | 96.1 | | | 87.0 | 88.9 | 99.9 | 103.5 | 101.1 | 103.6 | 111.9 | 103.9 | 101.8 |
| | Manufacturing | (2) | 95.4 | 104.5 | 89.4 | 98.5 | 94.4 | 103.1 | 103.8 | 103.3 | 103.6 | 103.6 | 98.7 | 102.3 | 103.3 |
| | Construction | (3) | 127.1 | 129.4 | 104.1 | 117.9 | 89.3 | 99.9 | 103.9 | 101.2 | 103.8 | | 98.2 | 98.2 | 103.4 |
| | Trade | (4) | 79.5 | 94.4 | 104.1 | 104.8 | 99.0 | 90.5 | 103.6 | 101.4 | 103.6 | 103.4 | 98.8 | 103.5 | 104.1 |
| | Transport | (5) | 98.9 | 100.0 | 82.9 | 103.2 | 129.2 | 101.9 | 103.6 | 100.3 | 103.1 | 104.9 | 106.5 | 105.0 | 102.7 |
| | Communication | (6) | | 109.4 | | 101.6 | 109.6 | 97.2 | 102.7 | 97.8 | 102.1 | 97.0 | 97.5 | 97.5 | 101.9 |
| | Finance and business services | (7) | 99.6 | 103.0 | 97.1 | 103.3 | 102.7 | 100.4 | 102.1 | 107.4 | 102.9 | | 98.2 | 98.2 | 102.8 |
| | Other services | (8) | 95.2 | 99.1 | | 99.4 | 100.3 | 100.5 | 100.5 | 98.3 | 100.3 | 94.6 | 101.9 | 101.6 | 100.4 |
| | Total | (9) | 99.6 | 104.2 | 103.6 | 103.3 | 102.4 | 100.6 | 102.6 | 103.5 | 102.8 | | 98.6 | 98.6 | 102.7 |
| Adjustm | CIF/FOB adjustments on imports | (10) | | | | | | | | 100.9 | 100.9 | | | | 100.9 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | |
| | Total | (12) | 99.6 | 104.2 | 103.6 | 103.3 | 102.4 | 100.6 | 102.6 | 103.5 | 102.8 | | 98.6 | 98.6 | 102.7 |
| | **Supply table of *t*-1 at current prices** | | | | | | | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 25 299 | 153 | | | 23 | 18 | 25 493 | 13 900 | 39 393 | 10 799 | 444 | 11 243 | 50 636 |
| | Manufacturing | (2) | 1 230 | 280 614 | 1 939 | 19 032 | 5 431 | 11 317 | 319 563 | 301 843 | 621 406 | 108 774 | 39 201 | 147 975 | 769 381 |
| | Construction | (3) | 70 | 846 | 84 076 | 246 | 2 289 | 2 141 | 89 668 | 1 521 | 91 189 | | 8 404 | 8 404 | 99 593 |
| | Trade | (4) | 185 | 10 503 | 345 | 111 978 | 2 927 | 744 | 126 682 | 3 381 | 130 063 | - 106 185 | 820 | - 105 365 | 24 698 |
| | Transport | (5) | 380 | 17 | 82 | 60 429 | 1 027 | 944 | 62 879 | 10 408 | 73 287 | - 13 701 | - 941 | - 14 642 | 58 645 |
| | Communication | (6) | | 4 428 | | 41 199 | 2 713 | 612 | 48 952 | 6 530 | 55 482 | 201 | 3 224 | 3 425 | 58 907 |
| | Finance and business services | (7) | 477 | 6 724 | 1 079 | 12 509 | 190 079 | 72 409 | 283 277 | 50 908 | 334 185 | | 9 925 | 9 925 | 344 110 |
| | Other services | (8) | 312 | 2 531 | | 2 644 | 3 045 | 213 878 | 222 410 | 16 366 | 238 776 | 112 | 2 678 | 2 790 | 241 566 |
| | Total | (9) | 27 953 | 305 816 | 87 521 | 248 037 | 207 534 | 302 063 | 1 178 924 | 404 857 | 1 583 781 | | 63 755 | 63 755 | 1 647 536 |
| Adjustm | CIF/FOB adjustments on imports | (10) | | | | | | | | - 3 272 | - 3 272 | | | | - 3 272 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | |
| | Total | (12) | 27 953 | 305 816 | 87 521 | 248 037 | 207 534 | 302 063 | 1 178 924 | 401 585 | 1 580 509 | | 63 755 | 63 755 | 1 644 264 |
| | **Value index (*t*-1 = 100)** | | | | | | | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 101.9 | 100.0 | | | 87.0 | 88.9 | 101.8 | 110.7 | 105.0 | 101.0 | 120.5 | 101.7 | 104.2 |
| | Manufacturing | (2) | 102.6 | 112.9 | 90.6 | 98.5 | 95.0 | 104.5 | 111.2 | 111.6 | 111.4 | 103.9 | 100.6 | 103.0 | 109.8 |
| | Construction | (3) | 131.4 | 130.5 | 104.5 | 120.3 | 90.1 | 99.7 | 104.4 | 102.8 | 104.3 | | 98.3 | 98.3 | 103.8 |
| | Trade | (4) | 77.8 | 94.4 | 103.2 | 104.4 | 98.8 | 90.3 | 103.3 | 101.4 | 103.3 | 103.0 | 101.1 | 103.0 | 104.6 |
| | Transport | (5) | 101.3 | 100.0 | 84.1 | 105.3 | 131.3 | 103.5 | 105.7 | 102.5 | 105.2 | 108.5 | 105.8 | 108.3 | 104.4 |
| | Communication | (6) | | 106.6 | | 101.2 | 106.7 | 95.6 | 101.9 | 96.1 | 101.2 | 98.5 | 98.0 | 98.0 | 101.0 |
| | Finance and business services | (7) | 102.5 | 104.0 | 97.6 | 104.0 | 102.9 | 101.4 | 102.5 | 108.5 | 103.5 | | 91.9 | 91.9 | 103.1 |
| | Other services | (8) | 97.4 | 99.2 | | 101.6 | 116.3 | 101.3 | 101.5 | 101.7 | 101.5 | 93.8 | 112.3 | 111.6 | 101.6 |
| | Total | (9) | 101.8 | 111.9 | 104.1 | 103.6 | 102.9 | 101.4 | 105.0 | 110.2 | 106.4 | | 99.3 | 99.3 | 106.1 |
| Adjustm | CIF/FOB adjustments on imports | (10) | | | | | | | | 109.1 | 109.1 | | | | 109.1 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | |
| | Total | (12) | 101.8 | 111.9 | 104.1 | 103.6 | 102.9 | 101.4 | 105.0 | 110.2 | 106.3 | | 99.3 | 99.3 | 106.1 |

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# Table 9.2 Use table in current prices and in volume terms

| | | | INPUT OF INDUSTRIES | | | | | | | FINAL USE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Final consumption expenditure | | | | | | | | |
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Households | NPISH | General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | Total use at purchasers' prices |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| | | | | | | | | | | **Use table at current in year *t*** | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 5 514 | 17 236 | 114 | 205 | 248 | 1 091 | 24 408 | 5 937 | | | 143 | | - 91 | 22 387 | 28 376 | 52 784 |
| | Manufacturing | (2) | 10 133 | 175 862 | 26 285 | 26 880 | 7 573 | 30 984 | 277 717 | 122 814 | | 9 119 | 51 545 | | 1 409 | 382 096 | 566 983 | 844 700 |
| | Construction | (3) | 298 | 1 718 | 24 504 | 1 608 | 2 212 | 15 934 | 46 274 | 453 | | 566 | 54 015 | | | 2 100 | 57 134 | 103 408 |
| | Trade | (4) | 107 | 2 975 | 336 | 7 421 | 2 115 | 576 | 13 530 | 4 750 | | | | | | 7 543 | 12 293 | 25 823 |
| | Transport | (5) | 291 | 3 230 | 162 | 23 566 | 2 738 | 1 903 | 31 890 | 5 679 | | 492 | | | | 23 191 | 29 362 | 61 252 |
| | Communication | (6) | 170 | 3 027 | 1 068 | 13 842 | 7 911 | 6 089 | 32 107 | 10 794 | 868 | | 6 717 | | 2 | 9 028 | 27 409 | 59 516 |
| | Finance and business services | (7) | 2 067 | 36 341 | 7 131 | 46 730 | 61 900 | 52 851 | 207 020 | 77 968 | 5 | 3 585 | 16 820 | | | 49 462 | 147 840 | 354 860 |
| | Other services | (8) | 172 | 2 306 | 1 236 | 4 214 | 4 569 | 13 381 | 25 878 | 55 061 | 4 610 | 153 396 | 1 162 | | 206 | 5 109 | 219 544 | 245 422 |
| | Total | (9) | 18 752 | 242 695 | 60 836 | 124 466 | 89 266 | 122 809 | 658 824 | 283 456 | 5 483 | 167 158 | 130 402 | | 1 526 | 500 916 | 1 088 941 | 1 747 765 |
| Adjustments | CIF/FOB adjustments on exports | (10) | | | | | | | | | | | | | | - 3 569 | - 3 569 | - 3 569 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | | | | |
| | Purchases in the domestic territory by non-residents | (12) | | | | | | | | | | | | | | | | |
| | Total | (13) | 18 752 | 242 695 | 60 836 | 124 466 | 89 266 | 122 809 | 658 824 | 283 456 | 5 483 | 167 158 | 130 402 | | 1 526 | 497 347 | 1 085 372 | 1 744 196 |
| GVA | Compensation of employees | (14) | 2 677 | 42 141 | 18 786 | 71 831 | 70 666 | 111 939 | 318 040 | | | | | | | | | 318 040 |
| | Other taxes less subsidies on production | (15) | - 722 | 176 | 5 | 18 | - 930 | 1 190 | - 263 | | | | | | | | | - 263 |
| | Consumption of fixed capital | (16) | 3 683 | 18 241 | 2 234 | 18 024 | 13 259 | 51 627 | 107 068 | | | | | | | | | 107 068 |
| | Net operating surplus | (17) | 4 059 | 38 923 | 9 270 | 42 626 | 41 190 | 18 677 | 154 745 | | | | | | | | | 154 745 |
| | GVA | (18) | 9 697 | 99 481 | 30 295 | 132 499 | 124 185 | 183 433 | 579 590 | | | | | | | | | 579 590 |
| | Total input at basic prices | (19) | 28 449 | 342 176 | 91 131 | 256 965 | 213 451 | 306 242 | 1 238 414 | 283 456 | 5 483 | 167 158 | 130 402 | | 1 526 | 497 347 | 1 085 372 | |
| | | | | | | | | | | **Price index (*t* -1 = 100)** | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 105.8 | 109.9 | 102.7 | 108.5 | 102.5 | 96.2 | 108.2 | 100.4 | | | 94.7 | | 568.8 | 97.7 | 98.0 | 102.4 |
| | Manufacturing | (2) | 114.1 | 111.5 | 103.3 | 107.0 | 103.9 | 103.5 | 109.2 | 102.1 | | 99.5 | 99.6 | | 85.7 | 106.8 | 104.9 | 106.2 |
| | Construction | (3) | 101.4 | 103.1 | 100.3 | 102.4 | 101.1 | 101.8 | 101.0 | 97.4 | | 97.1 | 100.0 | | | 102.0 | 100.0 | 100.5 |
| | Trade | (4) | 100.0 | 101.2 | 101.2 | 101.7 | 102.4 | 101.8 | 101.7 | 102.2 | | | | | | 97.3 | 99.1 | 100.4 |
| | Transport | (5) | 101.7 | 101.4 | 101.9 | 102.4 | 100.4 | 102.1 | 102.1 | 101.8 | | 103.1 | | | | 101.3 | 101.4 | 101.7 |
| | Communication | (6) | 100.0 | 98.3 | 97.9 | 98.7 | 99.6 | 99.2 | 99.0 | 102.4 | 100.9 | | 96.7 | | 100.0 | 98.1 | 99.5 | 99.2 |
| | Finance and business services | (7) | 101.4 | 100.8 | 100.4 | 100.7 | 101.7 | 98.7 | 100.5 | 101.7 | 100.0 | 101.8 | 95.7 | | | 99.0 | 100.1 | 100.3 |
| | Other services | (8) | 102.4 | 101.4 | 102.1 | 102.5 | 102.4 | 105.6 | 103.9 | 102.7 | 103.8 | 100.2 | 101.7 | | 99.5 | 101.8 | 100.9 | 101.2 |
| | Total | (9) | 109.3 | 109.0 | 101.6 | 102.2 | 101.7 | 101.1 | 104.5 | 102.1 | 103.3 | 100.2 | 99.1 | | 83.0 | 104.9 | 102.6 | 103.3 |
| Adjustments | CIF/FOB adjustments on exports | (10) | | | | | | | | | | | | | | 108.1 | 108.1 | 108.1 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | | | | |
| | Purchases in the domestic territory by non-residents | (12) | | | | | | | | | | | | | | | | |
| | Total | (13) | 109.3 | 109.0 | 101.6 | 102.2 | 101.7 | 101.1 | 104.5 | 102.1 | 103.3 | 100.2 | 99.1 | | 83.0 | 104.8 | 102.6 | 103.3 |
| GVA | Compensation of employees | (14) | 102.7 | 102.1 | 101.3 | 101.8 | 101.5 | 101.4 | 101.6 | | | | | | | | | 101.6 |
| | Other taxes less subsidies on production | (15) | 98.0 | 193.4 | - 500.0 | - 1 800.0 | 98.8 | 113.9 | 48.3 | | | | | | | | | 48.3 |
| | Consumption of fixed capital | (16) | 99.1 | 100.7 | 99.4 | 99.9 | 98.8 | 97.7 | 98.8 | | | | | | | | | 98.8 |
| | Net operating surplus | (17) | 79.8 | 106.1 | 92.4 | 93.1 | 96.3 | 103.8 | 97.7 | | | | | | | | | 97.7 |
| | GVA | (18) | 90.8 | 103.5 | 98.3 | 98.6 | 99.5 | 100.6 | 100.1 | | | | | | | | | 100.1 |
| | Total input at basic prices | (19) | 102.2 | 107.4 | 100.5 | 100.3 | 100.4 | 100.8 | 102.4 | 102.1 | 103.3 | 100.2 | 99.1 | | 83.0 | 104.8 | 102.6 | |
| | | | | | | | | | | **Use table at previous years' prices** | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 5 212 | 15 677 | 111 | 189 | 242 | 1 134 | 22 565 | 5 912 | | | 151 | | - 16 | 22 911 | 28 958 | 51 523 |
| | Manufacturing | (2) | 8 882 | 157 696 | 25 450 | 25 123 | 7 291 | 29 932 | 254 374 | 120 255 | | 9 167 | 51 739 | | 1 645 | 357 885 | 540 691 | 795 065 |
| | Construction | (3) | 294 | 1 667 | 24 422 | 1 570 | 2 188 | 15 654 | 45 795 | 465 | | 583 | 54 033 | | | 2 058 | 57 139 | 102 934 |
| | Trade | (4) | 107 | 2 940 | 332 | 7 299 | 2 065 | 566 | 13 309 | 4 646 | | | | | | 7 753 | 12 399 | 25 708 |
| | Transport | (5) | 286 | 3 186 | 159 | 23 022 | 2 728 | 1 863 | 31 244 | 5 579 | | 477 | | | | 22 902 | 28 958 | 60 202 |
| | Communication | (6) | 170 | 3 079 | 1 091 | 14 028 | 7 939 | 6 139 | 32 446 | 10 538 | 860 | | 6 947 | | 2 | 9 206 | 27 553 | 59 999 |
| | Finance and business services | (7) | 2 039 | 36 056 | 7 102 | 46 387 | 60 856 | 53 536 | 205 976 | 76 632 | 5 | 3 523 | 17 570 | | | 49 978 | 147 708 | 353 684 |
| | Other services | (8) | 168 | 2 274 | 1 210 | 4 112 | 4 461 | 12 675 | 24 900 | 53 632 | 4 443 | 153 068 | 1 143 | | 207 | 5 020 | 217 513 | 242 413 |
| | Total | (9) | 17 158 | 222 575 | 59 877 | 121 730 | 87 770 | 121 499 | 630 609 | 277 659 | 5 308 | 166 818 | 131 583 | | 1 838 | 477 713 | 1 060 919 | 1 691 528 |
| Adjustments | CIF/FOB adjustments on exports | (10) | | | | | | | | | | | | | | - 3 303 | - 3 303 | - 3 303 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | | | | |
| | Purchases in the domestic territory by non-residents | (12) | | | | | | | | | | | | | | | | |
| | Total | (13) | 17 158 | 222 575 | 59 877 | 121 730 | 87 770 | 121 499 | 630 609 | 277 659 | 5 308 | 166 818 | 131 583 | | 1 838 | 474 410 | 1 057 616 | 1 688 225 |
| GVA | Compensation of employees | (14) | 2 606 | 41 261 | 18 537 | 70 563 | 69 589 | 110 413 | 312 969 | | | | | | | | | 312 969 |
| | Other taxes less subsidies on production | (15) | - 737 | 91 | - 1 | - 1 | - 941 | 1 045 | - 544 | | | | | | | | | - 544 |
| | Consumption of fixed capital | (16) | 3 718 | 18 116 | 2 247 | 18 045 | 13 424 | 52 821 | 108 371 | | | | | | | | | 108 371 |
| | Net operating surplus | (17) | 5 087 | 36 671 | 10 035 | 45 808 | 42 770 | 17 985 | 158 356 | | | | | | | | | 158 356 |
| | GVA | (18) | 10 674 | 96 139 | 30 818 | 134 415 | 124 842 | 182 264 | 579 152 | | | | | | | | | 579 152 |
| | Total input at basic prices | (19) | 27 832 | 318 714 | 90 695 | 256 145 | 212 612 | 303 763 | 1 209 761 | 277 659 | 5 308 | 166 818 | 131 583 | | 1 838 | 474 410 | 1 057 616 | |
| | | | | | | | | | | **Volume index (*t* -1 = 100)** | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 102.0 | 103.3 | 119.4 | 71.3 | 103.4 | 101.1 | 102.6 | 101.5 | | | 84.8 | | - 9.1 | 102.0 | 101.1 | 101.8 |
| | Manufacturing | (2) | 99.5 | 106.3 | 101.6 | 99.3 | 99.9 | 97.5 | 103.6 | 99.4 | | 102.8 | 112.5 | | 43.1 | 104.0 | 103.2 | 103.3 |
| | Construction | (3) | 100.7 | 126.0 | 109.8 | 102.3 | 101.2 | 99.8 | 105.9 | 103.3 | | 96.0 | 101.9 | | | 91.6 | 101.4 | 103.4 |
| | Trade | (4) | 97.3 | 99.0 | 108.1 | 99.3 | 99.2 | 95.0 | 99.2 | 99.2 | | | | | | 117.4 | 109.9 | 104.1 |
| | Transport | (5) | 100.0 | 97.7 | 100.0 | 101.7 | 108.4 | 96.4 | 101.5 | 100.8 | | 97.3 | | | | 104.9 | 103.9 | 102.7 |
| | Communication | (6) | 98.8 | 102.5 | 100.6 | 104.7 | 101.3 | 95.3 | 101.6 | 97.5 | 100.0 | | 102.9 | | 7.4 | 107.9 | 102.2 | 101.9 |
| | Finance and business services | (7) | 98.9 | 104.9 | 104.0 | 104.8 | 104.7 | 99.1 | 103.2 | 100.5 | 100.0 | 96.2 | 100.2 | | | 106.2 | 102.2 | 102.8 |
| | Other services | (8) | 99.4 | 103.6 | 98.5 | 107.8 | 102.7 | 99.1 | 101.5 | 101.8 | 99.8 | 99.7 | 98.2 | | 72.6 | 103.1 | 100.2 | 100.4 |
| | Total | (9) | 100.2 | 105.7 | 105.1 | 102.7 | 103.8 | 98.6 | 103.2 | 100.2 | 99.8 | 99.8 | 105.6 | | 42.7 | 104.4 | 102.4 | 102.7 |
| Adjustments | CIF/FOB adjustments on exports | (10) | | | | | | | | | | | | | | 100.9 | 100.9 | 100.9 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | | | | |
| | Purchases in the domestic territory by non-residents | (12) | | | | | | | | | | | | | | | | |
| | Total | (13) | 100.2 | 105.7 | 105.1 | 102.7 | 103.8 | 98.6 | 103.2 | 100.2 | 99.8 | 99.8 | 105.6 | | 42.7 | 104.4 | 102.4 | 102.7 |
| GVA | Compensation of employees | (14) | 100.1 | 100.5 | 98.8 | 101.4 | 101.6 | 100.4 | 100.8 | | | | | | | | | 100.8 |
| | Other taxes less subsidies on production | (15) | 137.2 | - 104.6 | 5.3 | .9 | 94.4 | 136.4 | 55.5 | | | | | | | | | 55.5 |
| | Consumption of fixed capital | (16) | 101.6 | 100.8 | 101.5 | 100.3 | 100.4 | 102.0 | 101.3 | | | | | | | | | 101.3 |
| | Net operating surplus | (17) | 99.7 | 101.2 | 104.8 | 109.0 | 101.5 | 110.7 | 104.7 | | | | | | | | | 104.7 |
| | GVA | (18) | 98.6 | 101.0 | 100.9 | 103.8 | 101.5 | 101.9 | 102.0 | | | | | | | | | 102.0 |
| | Total input at basic prices | (19) | 99.6 | 104.2 | 103.6 | 103.3 | 102.4 | 100.6 | 102.6 | 100.2 | 99.8 | 99.8 | 105.6 | | 42.7 | 104.4 | 102.4 | |

| | | | INPUT OF INDUSTRIES | | | | | | | FINAL USE | | | | | | | | Total use at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Final consumption expenditure: Households | NPISH | General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| | | | | | | | | | | **Use Table of T-1 at current prices** | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 5 108 | 15 176 | 93 | 265 | 234 | 1 122 | 21 998 | 5 823 | | | 178 | | 176 | 22 461 | 28 638 | 50 636 |
| | Manufacturing | (2) | 8 926 | 148 356 | 25 043 | 25 305 | 7 297 | 30 707 | 245 634 | 120 960 | | 8 919 | 45 974 | | 3 820 | 344 074 | 523 747 | 769 381 |
| | Construction | (3) | 292 | 1 323 | 22 247 | 1 534 | 2 161 | 15 686 | 43 243 | 450 | | 607 | 53 047 | | | 2 246 | 56 350 | 99 593 |
| | Trade | (4) | 110 | 2 970 | 307 | 7 347 | 2 082 | 596 | 13 412 | 4 683 | | | | | | 6 603 | 11 286 | 24 698 |
| | Transport | (5) | 286 | 3 260 | 159 | 22 630 | 2 517 | 1 933 | 30 785 | 5 535 | | 490 | | | | 21 835 | 27 860 | 58 645 |
| | Communication | (6) | 172 | 3 004 | 1 084 | 13 401 | 7 835 | 6 439 | 31 935 | 10 806 | 860 | | 6 748 | | 27 | 8 531 | 26 972 | 58 907 |
| | Finance and business services | (7) | 2 062 | 34 384 | 6 828 | 44 243 | 58 107 | 53 998 | 199 622 | 76 231 | 5 | 3 664 | 17 538 | | | 47 050 | 144 488 | 344 110 |
| | Other services | (8) | 169 | 2 194 | 1 229 | 3 815 | 4 345 | 12 786 | 24 538 | 52 706 | 4 451 | 153 552 | 1 164 | | 285 | 4 870 | 217 028 | 241 566 |
| | Total | (9) | 17 125 | 210 667 | 56 990 | 118 540 | 84 578 | 123 267 | 611 167 | 277 194 | 5 316 | 167 232 | 124 649 | | 4 308 | 457 670 | 1 036 369 | 1 647 536 |
| Adjustments | CIF/FOB adjustments on exports | (10) | | | | | | | | | | | | | | - 3 272 | - 3 272 | - 3 272 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | | | | |
| | Purchases in the domestic territory by non-residents | (12) | | | | | | | | | | | | | | | | |
| | Total | (13) | 17 125 | 210 667 | 56 990 | 118 540 | 84 578 | 123 267 | 611 167 | 277 194 | 5 316 | 167 232 | 124 649 | | 4 308 | 454 398 | 1 033 097 | 1 644 264 |
| GVA | Compensation of employees | (14) | 2 603 | 41 042 | 18 765 | 69 595 | 68 466 | 110 000 | 310 471 | | | | | | | | | 310 471 |
| | Other taxes less subsidies on production | (15) | - 537 | - 87 | - 19 | - 106 | - 997 | 766 | - 980 | | | | | | | | | - 980 |
| | Consumption of fixed capital | (16) | 3 660 | 17 973 | 2 213 | 17 989 | 13 366 | 51 781 | 106 982 | | | | | | | | | 106 982 |
| | Net operating surplus | (17) | 5 102 | 36 221 | 9 572 | 42 019 | 42 121 | 16 249 | 151 284 | | | | | | | | | 151 284 |
| | GVA | (18) | 10 828 | 95 149 | 30 531 | 129 497 | 122 956 | 178 796 | 567 757 | | | | | | | | | 567 757 |
| | Total input at basic prices | (19) | 27 953 | 305 816 | 87 521 | 248 037 | 207 534 | 302 063 | 1 178 924 | 277 194 | 5 316 | 167 232 | 124 649 | | 4 308 | 454 398 | 1 033 097 | |
| | | | | | | | | | | **Value index (T-1 = 100)** | | | | | | | | |
| PRODUCTS | Agriculture | (1) | 107.9 | 113.6 | 122.6 | 77.4 | 106.0 | 97.2 | 111.0 | 102.0 | | | 80.3 | | - 51.7 | 99.7 | 99.1 | 104.2 |
| | Manufacturing | (2) | 113.5 | 118.5 | 105.0 | 106.2 | 103.8 | 100.9 | 113.1 | 101.5 | | 102.2 | 112.1 | | 36.9 | 111.1 | 108.3 | 109.8 |
| | Construction | (3) | 102.1 | 129.9 | 110.1 | 104.8 | 102.4 | 101.6 | 107.0 | 100.7 | | 93.2 | 101.8 | | | 93.5 | 101.4 | 103.8 |
| | Trade | (4) | 97.3 | 100.2 | 109.4 | 101.0 | 101.6 | 96.6 | 100.9 | 101.4 | | | | | | 114.2 | 108.9 | 104.6 |
| | Transport | (5) | 101.7 | 99.1 | 101.9 | 104.1 | 108.8 | 98.4 | 103.6 | 102.6 | | 100.4 | | | | 106.2 | 105.4 | 104.4 |
| | Communication | (6) | 98.8 | 100.8 | 98.5 | 103.3 | 101.0 | 94.6 | 100.5 | 99.9 | 100.9 | | 99.5 | | 7.4 | 105.8 | 101.6 | 101.0 |
| | Finance and business services | (7) | 100.2 | 105.7 | 104.4 | 105.6 | 106.5 | 97.9 | 103.7 | 102.3 | 100.0 | 97.8 | 95.9 | | | 105.1 | 102.3 | 103.1 |
| | Other services | (8) | 101.8 | 105.1 | 100.6 | 110.5 | 105.2 | 104.7 | 105.5 | 104.5 | 103.6 | 99.9 | 99.8 | | 72.3 | 104.9 | 101.2 | 101.6 |
| | Total | (9) | 109.5 | 115.2 | 106.7 | 105.0 | 105.5 | 99.6 | 107.8 | 102.3 | 103.1 | 100.0 | 104.6 | | 35.4 | 109.4 | 105.1 | 106.1 |
| Adjustments | CIF/FOB adjustments on exports | (10) | | | | | | | | | | | | | | 109.1 | 109.1 | 109.1 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | | | | | |
| | Purchases in the domestic territory by non-residents | (12) | | | | | | | | | | | | | | | | |
| | Total | (13) | 109.5 | 115.2 | 106.7 | 105.0 | 105.5 | 99.6 | 107.8 | 102.3 | 103.1 | 100.0 | 104.6 | | 35.4 | 109.5 | 105.1 | 106.1 |
| GVA | Compensation of employees | (14) | 102.8 | 102.7 | 100.1 | 103.2 | 103.2 | 101.8 | 102.4 | | | | | | | | | 102.4 |
| | Other taxes less subsidies on production | (15) | 134.5 | - 202.3 | - 26.3 | - 17.0 | 93.3 | 155.4 | 26.8 | | | | | | | | | 26.8 |
| | Consumption of fixed capital | (16) | 100.6 | 101.5 | 100.9 | 100.2 | 99.2 | 99.7 | 100.1 | | | | | | | | | 100.1 |
| | Net operating surplus | (17) | 79.6 | 107.5 | 96.8 | 101.4 | 97.8 | 114.9 | 102.3 | | | | | | | | | 102.3 |
| | GVA | (18) | 89.6 | 104.6 | 99.2 | 102.3 | 101.0 | 102.6 | 102.1 | | | | | | | | | 102.1 |
| | Total input at basic prices | (19) | 101.8 | 111.9 | 104.1 | 103.6 | 102.9 | 101.4 | 105.0 | 102.3 | 103.1 | 100.0 | 104.6 | | 35.4 | 109.5 | 105.1 | |

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# Table 9.3 Gross domestic product in current prices and in volume terms

| Production approach | | Income approach | | Expenditure approach | |
|---|---|---|---|---|---|
| **GROSS DOMESTIC PRODUCT** | | | | | t at current prices |
| Total output at basic prices | 1 238 414 | Compensation of employees | 318 040 | Household final consumption expenditure | 283 456 |
| - Intermediate consumption | - 658 824 | + Other net taxes on production | - 263 | + NPISH final consumption expenditure | 5 483 |
| | | + Capital consumption | 107 068 | + Government consumption expenditure | 167 158 |
| | | + Net operating surplus | 154 745 | + Gross fixed capital formation | 130 402 |
| | | | | + Acquisitions less disposals of valuables | |
| = Value added at basic prices | 579 590 | = Value added at basic prices | 579 590 | + Changes in inventories | 1 526 |
| | | | | + Exports of goods and services | 497 347 |
| + Taxes less subsidies on products | 63 339 | + Taxes less subsidies on products | 63 339 | - Imports of goods and services | - 442 443 |
| = Gross domestic product | 642 929 | = Gross domestic product | 642 929 | = Gross domestic product | 642 929 |
| **INFLATION** | | | | | Annual change of prices in percent |
| Total output at basic prices | 2.4 | Compensation of employees | 1.6 | Household final consumption expenditure | 2.1 |
| - Intermediate consumption | 4.5 | + Other net taxes on production | -51.7 | + NPISH final consumption expenditure | 3.3 |
| | | + Capital consumption | -1.2 | + Government consumption expenditure | 0.2 |
| | | + Net operating surplus | -2.3 | + Gross fixed capital formation | -0.9 |
| | | | | + Acquisitions less disposals of valuables | 0.0 |
| = Value added at basic prices | 0.1 | = Value added at basic prices | 0.1 | + Changes in inventories | -17.0 |
| | | | | + Exports of goods and services | 4.8 |
| + Taxes less subsidies on products | 0.8 | + Taxes less subsidies on products | 0.8 | - Imports of goods and services | 6.5 |
| = Gross domestic product | 0.1 | = Gross domestic product | 0.1 | = Gross domestic product | 0.1 |
| **GROSS DOMESTIC PRODUCT** | | | | | t at prices of previous year |
| Total output at basic prices | 1 209 761 | Compensation of employees | 312 969 | Household final consumption expenditure | 277 659 |
| - Intermediate consumption | - 630 609 | + Other net taxes on production | - 544 | + NPISH final consumption expenditure | 5 308 |
| | | + Capital consumption | 108 371 | + Government consumption expenditure | 166 818 |
| | | + Net operating surplus | 158 356 | + Gross fixed capital formation | 131 583 |
| | | | | + Acquisitions less disposals of valuables | |
| = Value added at basic prices | 579 152 | = Value added at basic prices | 579 152 | + Changes in inventories | 1 838 |
| | | | | + Exports of goods and services | 474 410 |
| + Taxes less subsidies on products | 62 866 | + Taxes less subsidies on products | 62 866 | - Imports of goods and services | - 415 598 |
| = Gross domestic product | 642 018 | = Gross domestic product | 642 018 | = Gross domestic product | 642 018 |
| **REAL GROWTH** | | | | | Annual real growth rates in percent |
| Total output at basic prices | 2.6 | Compensation of employees | 0.8 | Household final consumption expenditure | 0.2 |
| - Intermediate consumption | 3.2 | + Other net taxes on production | -44.5 | + NPISH final consumption expenditure | -0.2 |
| | | + Capital consumption | 1.3 | + Government consumption expenditure | -0.2 |
| | | + Net operating surplus | 4.7 | + Gross fixed capital formation | 5.6 |
| | | | | + Acquisitions less disposals of valuables | 0.0 |
| = Value added at basic prices | 2.0 | = Value added at basic prices | 2.0 | + Changes in inventories | -57.3 |
| | | | | + Exports of goods and services | 4.4 |
| + Taxes less subsidies on products | -1.4 | + Taxes less subsidies on products | -1.4 | - Imports of goods and services | 3.5 |
| = Gross domestic product | 1.7 | = Gross domestic product | 1.7 | = Gross domestic product | 1.7 |
| **GROSS DOMESTIC PRODUCT** | | | | | t-1 at current prices |
| Total output at basic prices | 1 178 924 | Compensation of employees | 310 471 | Household final consumption expenditure | 277 194 |
| - Intermediate consumption | - 611 167 | + Other net taxes on production | - 980 | + NPISH final consumption expenditure | 5 316 |
| | | + Capital consumption | 106 982 | + Government consumption expenditure | 167 232 |
| | | + Net operating surplus | 151 284 | + Gross fixed capital formation | 124 649 |
| | | | | + Acquisitions less disposals of valuables | |
| = Value added at basic prices | 567 757 | = Value added at basic prices | 567 757 | + Changes in inventories | 4 308 |
| | | | | + Exports of goods and services | 454 398 |
| + Taxes less subsidies on products | 63 755 | + Taxes less subsidies on products | 63 755 | - Imports of goods and services | - 401 585 |
| = Gross domestic product | 631 512 | = Gross domestic product | 631 512 | = Gross domestic product | 631 512 |
| **NOMINAL GROWTH** | | | | | Annual nominal growth rates in percent |
| Total output at basic prices | 5.0 | Compensation of employees | 2.4 | Household final consumption expenditure | 2.3 |
| - Intermediate consumption | 7.8 | + Other net taxes on production | -73.2 | + NPISH final consumption expenditure | 3.1 |
| | | + Capital consumption | 0.1 | + Government consumption expenditure | 0.0 |
| | | + Net operating surplus | 2.3 | + Gross fixed capital formation | 4.6 |
| | | | | + Acquisitions less disposals of valuables | 0.0 |
| = Value added at basic prices | 2.1 | = Value added at basic prices | 2.1 | + Changes in inventories | -64.6 |
| | | | | + Exports of goods and services | 9.5 |
| + Taxes less subsidies on products | -0.7 | + Taxes less subsidies on products | -0.7 | - Imports of goods and services | 10.2 |
| = Gross domestic product | 1.8 | = Gross domestic product | 1.8 | = Gross domestic product | 1.8 |

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## D. Price and volume indicators in theory

9.43. The price and volume changes for aggregates are derived from price and volume changes of separate products, preferably at a low level of aggregation. Ideally, price changes on the product level should refer to specific products; for example, every year the prices of exactly the same product can change (in accordance with brand type, weight, quality, and other properties) and should be observed. Generally speaking, in terms of quality, the greater the number of products in the SUTs, the better the required matching of appropriate values and prices.

9.44. The price and volume indicators must meet a number of requirements in order to be appropriate for the estimation of price and volume indices within the SUTs framework. These requirements are discussed in relation to the concept of output. They also apply, however, to all other transactions in goods and services. Examples of the requirements include:

- The prices and quantities should relate directly to output. This means that they should refer to complete end-products and not to contributory activities or to contributory intermediate or primary inputs. In the case of prices, they must also refer to the right valuation, for example, output at basic prices.
- The prices and quantities should have sufficient stratification, meaning that different prices and quantities should be available for all different product groups making up the output.
- The product classification of prices and quantities should have sufficient and detailed matching. This requirement will be fully met, for example, if there is only one product in a product group. If there is more than one product within a product group, an additional requirement is that the composition of the product group does not change over time, which is a weak assumption and not very likely.
- The prices and quantities should be representative for the product group. Usually, prices and quantities available do not cover all products of the product group or are based on a sample survey. Changes in the prices and quantities that are observed should be representative of changes in the prices and quantities that are not observed.
- If prices differ among users for the same products, then separate price indices should be collected and used; this is very important when, for example, distinguishing price changes between domestic users and for export.
- The changes in values resulting from changes of quality should be excluded from the price index and included in the volume index.

9.45. The requirement of matching for volume estimation means that the compilation of SUTs in volume terms will require much more detail in terms of products and prices than is necessary for the compilation of SUTs in current prices. It is preferable, however, that the classification of the SUTs in volume terms should be similar to the level of detail of the SUTs in current prices.

9.46. Considerations relating to the compilation of SUTs in volume terms constitute one of the many criteria to be borne in mind when determining the size of the SUTs – this covered in more detail in chapter 4. The balance between, on the one hand, the assumptions to be made in order to obtain sufficient detail to ensure homogeneity of price and values and, on the other, the gain in quality must be taken into account when determining the classifications in the SUTs.

9.47. For the most part, comprehensive information is not available, either on prices or on quantities. Accordingly, estimates will be based on limited information. It is recognized that limited price data and limited quantity data do not provide the same possibilities. Price information from a sample with a certain size may well be more representative than quantity information from a sample of the same size. This observation is based on the consideration that, if there is a competitive market for a specific product grouping, there will be a tendency to use one price for the total supply of that product. In that case, a relatively small sample will be sufficient for observing the price and price changes of the total supply of that product.

9.48. For their part, however, changes in quantities are less liable to such equalizing tendencies. Thus it is true that, in an expanding market, all producers will try to increase their supply but the realization will depend on restrictive factors, such as production capacity and financing facilities. Alongside fast-growing producers, there will be slow-growing producers and possibly even shrinking producers. This means that, in order to obtain reliable estimates for quantities, the samples will have to be larger – even much larger. As a consequence, it is common practice to derive price indices from price samples and, afterwards, to compile data in volume terms by combining current price data and price indices. In many cases, this approach is efficient and cost-saving.

9.49. Although the standard price method can be applied for many goods and services, there are still a number of transactions for which observation of prices has not been realized or is even not possible. The latter condition applies to certain cases in which, owing to the nature of the definition and measurement of output in current prices, the direct observation of appropriate prices is not possible, such as with non-market services, FISIM and insurance services.

## E. Price and volume indicators in practice

9.50. This section briefly covers a range of price and volume indicators that may be available as the building blocks for the preparation of SUTs in volume terms and are not meant to be exhaustive. These indicators should be considered applicable, as appropriate, to the various parts of the H-Approach, for example, in ensuring consistency as far as possible between the supply table components and the use tables components. The section covers:

- Supply table at basic prices

- Use table at basic prices
- GVA by industry
- Valuation matrices

9.51. More information on the choice of index formulae may be found in chapter 15 of the 2008 SNA and the Handbook on Price and Volume Measures in National Accounts (Eurostat, 2016).

### 1. Supply table at basic prices

9.52. Under this heading, the domestic production of goods and services and imports of goods and services are separately considered.

#### (a) Domestic production: producers' price indices

9.53. The PPIs usually fulfil the general requirements for price indicators, such as valuation, adjustment for quality change and level of detail, and separate prices should preferably be available for domestic sales and for exports. For total output, a weighted average should be used. For this reason, PPIs are the best indicators for the deflation of output of goods and services (either by product as required or by industry).

9.54. Most PPIs are collected as producers' prices, and these will suffice for many industries. Industries paying large amounts of excise duties, however, such as oil, alcohol and tobacco, will require adjustments when, for example, rates have changed. One disadvantage of PPIs is that they are mostly Laspeyres-type indices and might use fixed weighting schemes, generally updated only once every five years. This militates in favour of applying PPIs at the lowest possible level of detail when deflating the domestic supply of products for domestic consumption.

9.55. It is not always possible to observe prices directly because the products of concern are not the same over time, as is the case, for example, with unique goods and services and goods that change rapidly in quality, such as computers, mobile phones, tablets, and so forth.

9.56. If the products in the domestic output part of the supply table which are sold for domestic consumption are deflated using PPIs (or adjusted to form basic price indices), then the same indices need to be used for the corresponding products in the domestic use table on the right-hand side of the H-Approach, thereby ensuring consistency together with balance. The domestic output part of the supply table that is sold for export should be deflated using export price indices for consistency. Export price indices are covered later in this chapter.

9.57. For some products, price indicators other than direct observation may need to be considered. These include tariff indices, model pricing, hedonic price indices, unit value indices, consumer price indices, extrapolation by quantity indicators, input methods, and non-market production.

**(i) Tariff indices**

9.58. Certain types of services (for example, commercial services and services of general medical practitioners) are paid for on a tariff basis, for example, with a fee per time unit. One problem arising with indices of these types is that, in this approach, no account is taken of changes in the quality of the services provided and of changes in the productivity per time unit. Thus, tariff-based price indices are only appropriate deflators if adjustments can be made for changes of quality and productivity or when it is known for sure that such changes are within acceptable limits.

**(ii) Model pricing**

9.59. In the model pricing approach, the producers are asked to provide price estimates for typical products. Model price indices are candidate approximate deflators when there are significant changes in product specification from one year to the next and, in particular, in areas where products are unique. An important advantage of these indices is that, since the same product or project is priced, the quality is unchanged. They do have some disadvantages, however, in such areas as rapid product change and the degree of representation of the observed price change for total supply is questionable.

**(iii) Hedonic price indices**

9.60. Hedonic price indices are candidate deflators when product specification and quality change significantly. This method is based on an assessment of certain measurable characteristics of products. For example, in personal computers, memory and processing speed are two such characteristics. The main advantage is that quality changes are explicitly captured, enabling productivity changes also to be taken into account. A serious drawback is the complexity of the method. Furthermore, the resulting quality adjustment factor seems to be highly dependent on the choice of the characteristics and the choice of the regression model.

**(iv) Unit value indices**

9.61. Unit value indices of a product may be derived when, for both the current year and the base year, information on value and quantity is available for domestic supply (for example, from production surveys). Dividing the values by the corresponding quantities gives the so-called "unit values". Under certain conditions, a unit value index can be applied as a price index, for example, when a PPI is not available. Unit value indices often cover a heterogeneous set of products, and, therefore, their usefulness is generally limited when they are applied to homogeneous products where the quality does not change rapidly over time.

9.62. Unit values are quantity weighted as opposed to the regular price indices, which will be time weighted (such as the annual average of monthly indices). In some cases, where quantities do not move smoothly over the year and prices vary considerably, unit values may be the only approach to get the correct relationship between current price value and volume. Thus we may often choose to rely on unit values for energy products and some agricultural products, with changes in inventories in current prices adjusted accordingly.

**(v) Consumer price indices**

9.63. For some products, CPIs may be used as approximate deflators for domestic supply. This is only possible, however, in cases where private households buy a considerable part, or all, of the supply of a product, and trade and transport margins and taxes and subsidies play a very small part in the value at purchasers' prices. Special attention must be given to changes in tax rates, in particular such taxes as VAT. As only non-deductible VAT should be taken into account, any modification in the legal entitlements to VAT deduction must be treated in the same way as a modification of the rates of invoiced VAT and therefore as a variation of the price of the tax. This effect would not be fully detected if CPI were used to deflate taxes because only the products of final consumption are considered in CPI, and not, for example, those of intermediate consumption of exempt industries.

9.64. The CPIs are serious candidate deflators for service products mainly provided to private households. An advantage of CPIs is that they take due account of changes in quality. On the other hand, most CPIs are of the Laspeyres type and might use fixed weighting schemes, generally updated only once every five years, and this is a disadvantage. This argues in favour of applying CPIs at the lowest possible level of detail when deflating the domestic supply of products for domestic consumption.

**(vi) Extrapolation by quantity indicators**

9.65. Although the standard price method can be applied for many goods and services, there are still some transactions for which observation of prices has not been realized or is even not possible. The latter category includes those cases where, owing to the nature of the definition and measurement of output in current prices, direct observation of appropriate prices is not possible: for example, non-market services, FISIM and insurance companies. If price observation is not possible, then the use of quantity information is an alternative.

9.66. As mentioned above, for some products, it is impossible to collect price data and, in order to decompose a value change in a price change and a volume change, quantity indicators must be used. For some industries, mostly the object of government involvement (for example, public transport, medical services and cultural services) or government supervision (for example, banking and insurance), a considerable volume of detailed quantity data are already collected by the national statistical offices or government agencies. Examples may be found in the medical sector (for example, number of inpatients of short-stay hospitals classified by diagnosis-related groups), the cultural sector (for example, the number of visitors attending theatrical performances), and the banking sector (for example, the number of saving accounts, number of credits granted to commercial and private customers, number of payments on bank accounts). Of course, quantity indicators must fulfil the general requirements concerning quality adjustment.

### (vii) Input methods

9.67. Input methods use the weighted price or volume changes of intermediate and primary inputs as a proxy for the price or volume change of the output of an industry. The advantage of input methods for deflation within a SUTs framework is that the necessary data are readily available, as all inputs exist in the SUTs in current prices and can be deflated on the use table side in a manner consistent with the supply table side. It should be noted that the input method is recommended for capitalized research and development, although it is not the total production of an industry. On the other hand, a considerable disadvantage is that the price and volume indicators are not directly related to output. As a result, the change in GVA in volume terms, and also productivity changes of an industry, cannot be properly calculated. For that reason, input methods must be avoided as far as possible. Another disadvantage is that input methods can only be applied for the total production of an industry and a separate deflation of the different products of an industry is impossible. It should be noted that, although the output method is recommended by the SNA, it should only be used when the method and the results have been tested carefully for an appropriate number of years.

### (viii) Non-market production

9.68. Special attention must be paid to non-market production by general government and NPISHs. By definition, the output of non-market producers in current prices equals the sum of the costs of inputs. As the SUTs accounting rules are valid both in current prices and in volume terms, it can be argued that the output of non-market producers in volume terms equals the sum of inputs in volume terms. This means that, in fact, an input method is applied. This approach, however, places a considerable restraint on the estimation of volume and price indices for the non-market services. Independent estimates of GVA in volume terms and productivity changes are not possible if the input method is used. If non-market services contribute a significant amount in an economy, estimates of the volume growth of such macroeconomic variables as GDP are liable to be biased if input methods are applied. Applying quantity methods can improve the estimates of output and GVA in volume terms. The quantity indicators should preferably be adjusted for changes in quality.

## (b) Imports of goods and services

### (i) Import price indices

9.69. Import price indices usually meet the general requirements for price indicators, such as valuation, adjustment for quality change and detail. Accordingly, import prices are the best indicators for the deflation of import of goods and services. One disadvantage of most import price indices are that they tend to be Laspeyres-type indices and may use fixed weighting schemes, generally updated only once every five years. This militates in favour of the application of import price indices at the lowest possible level of detail when deflating the imports of goods and services.

One problem here is that import price data covering services are of limited availability, necessitating the search for alternatives.

**(ii) Unit value indices**

9.70. Foreign trade statistics often provide the value of imports along with the corresponding quantities at a detailed level. Using this information, unit value indices can be derived. One problem arising with unit value indices when used for deflation purposes is that they often cover a heterogeneous set of product groups. Sometimes the unit of measurement is the kilogram or the unit is simply the number of items. This means that, in many cases, unit value indices have heterogeneity problems, limiting the scope for their use as deflators. If, however, no appropriate information from price statistics is available, and the unit values refer to similar mass products for which the quality does not change rapidly over time, they may be applied as useful proxy deflators.

**(iii) Other proxies**

9.71. Generally, directly observed deflators for services are limited in terms of availability, which means that the deflation of services within SUTs may need to use proxies based on rough assumptions – nonetheless, deflation through SUTs ensures consistency. A good assumption may be that, for every product, the price generating conditions at the domestic market tend to bring about one price, which may hold for both domestic supply and imported services. In terms of the strength of this assumption, the price index of the domestic supply of a service is an acceptable proxy for the price index of the imports of that service. The validity of the assumption depends on whether imports are a large part of the domestic market and on whether imported services are of same quality as domestically produced services.

## 2. Use table at basic prices

9.72. In the ideal scenario, the use table at basic prices can be derived as the sum of the domestic use table at basic prices and the imports use table at basic prices both in volume terms.

### (a) Domestic use table at basic prices

9.73. Assuming a competitive economy, for the deflation of the use table with goods and services from domestic production, PPIs are appropriate price indices, as (in the main, except in such areas as duty-related industries) they are valued at basic prices. In cases where volume indicators are used for the compilation of the volume estimates in the supply table, the residually derived price indices (in other words, the implied price index derived from the difference between the value index and the volume index) can be used. If available, it is better to apply dedicated volume or price indices for specific transactions.

### (b) Imports use table at basic prices

9.74. Assuming a competitive economy, for the deflation of the imports use table, import prices are appropriate price indices. In cases where volume indicators are used for the compilation of the volume estimates in the supply table, the residually derived price indices can be used. If available, again, dedicated volume or price indices should preferably be applied for specific transactions.

## 3. GVA by industry

9.75. Although GVA is not deflated directly, this section covers how GVA is established in volume terms and its constituents.

### (a) Double deflation approach

9.76. Total GVA in current prices by industry is compiled as the difference between output and the intermediate consumption of goods and services. For the estimates in volume terms, the same method is applied. As a result, the following condition holds:

GVA in volume terms *equals* deflated output
*less* deflated intermediate consumption

9.77. The corresponding price and volume indices are derived afterwards. This approach is also known as the "double deflation" approach.

9.78. From a theoretical perspective, this approach is superior to the so-called "single deflation" methods, since it takes into account changes in both the composition of outputs and composition of inputs in order to derive GVA as a residual. With a double deflation approach, the volume index of GVA is the result of independent estimates of the volume indices of output and intermediate consumption, and the results are pre-eminently appropriate for productivity analysis. It is important to note that additional quality assurance checks are often needed when establishing plausible volume growth rates, in particular, where intermediate consumption forms a large proportion of output. There are three variations of the double deflation approach.

9.79. *Double deflation*: As described, "double deflation" covers the deflation of current price estimates for output and of intermediate consumption separately using appropriate price indices. The volume estimate of GVA is derived by subtracting the volume of intermediate consumption from the volume of output.

9.80. *Double extrapolation*: In double extrapolation, the previous year values of output and intermediate consumption are extrapolated using appropriate volume indices, and then the volume estimate of GVA is derived by subtracting the volume of intermediate consumption from the volume of output.

9.81. *Extrapolation and deflation*: This is a combination of the extrapolation of output of the previous year by a volume index and the deflation of intermediate consumption of the current year by a price index; then the volume estimate of GVA is derived by subtracting the volume of intermediate consumption from the volume of output.

**(b) Compensation of employees**

9.82. The compensation of employees is part of total GVA and it is useful to estimate it in volume terms as it increases the range of options for economic analysis using SUTs: for example, the results can be used in the analysis of labour productivity. Another application is in price analysis, where, for example, the price change of the output of an industry is linked to, and explained by, the price changes of the inputs, including compensation of employees.

9.83. The compensation of employees consists of two parts, wages and salaries, both in cash and in kind, and employers' social contributions. The deflation of both parts should be closely connected, since both relate to the same labour input. Thus, both volume indices must be the same, rendering it unnecessary to estimate price and volume indices for both parts separately.

9.84. Since employers' social contributions are liable to complex legislation, it is difficult to observe their price index. This means that, in practice, wages and salaries will be deflated, and the resulting volume index will also be applied in the calculation employers' social contributions in volume terms.

9.85. An important question relates to the appropriate unit of the volume of labour. Many candidate units suffer from heterogeneity; for example, the numbers of employed persons do not give an indication of the number of hours worked per person. Even full-time equivalent jobs are not really an adequate unit since they do not carry information about reductions in working hours and differences in the education level, skill and other attributes of the employees. For this reason, for the purpose of measuring the volume of the input of labour in an industry, the most appropriate quantity unit may be the actual number of hours worked, classified by education level, skill, and other properties. The corresponding price is the value of this unit.

**(c) Other taxes and subsidies on production**

9.86. The payment of other taxes on production is related to the use of certain inputs in the production process or to socially unwelcome results of production processes. Examples of the former include taxes on real estate property, taxes on motor vehicles owned by producers. Levies on pollution caused by production processes represent an example of the latter.

9.87. Taxes can be based on values (for example, the value of a building) or quantities (for example, tons of pollutants), which means that the deflation of other taxes on production is in principle comparable with the deflation of taxes on products, and that the same formulae are applicable. In practice, however, the deflation of other taxes on production is more difficult to achieve because of a serious lack of appropriate indicators for price and volume.

9.88. In principle, price or quantity indicators can be used to derive other taxes on production in volume terms. Because of the complexity of the tariff structure of most taxes and the lack of appropriate data, quantity methods will prevail. The use of quantity indicators requires a direct link between them and the tax. For instance, the indicator for the tax on real estate property needs a direct relation to the amount of real estate property owned by producers. A candidate proxy indicator is the volume index of the total stock real estate property. The index of the total tons of emitted pollutants per kind of pollution tax could serve as an appropriate indicator for taxes on pollution. The price indices are derived afterwards from the combination of the value index and the volume index, and they can be applied for the deflation of the tax payments by industry.

9.89. The practical elaboration of the volume estimation of taxes on production presented above can be similarly applied to subsidies on production.

### (d) Gross operating surplus

9.90. Gross operating surplus in volume terms is a residual item calculated as GVA minus compensation of employees and minus other taxes on production plus subsidies on production. Direct deflation of gross operating surplus is not possible because no appropriate price or volume indices are available. Furthermore, the economic interpretation of gross operating surplus in volume terms is questionable, and many view it as a meaningless concept.

## 4. Valuation matrices

### (a) Trade margins

9.91. Trade margins are the remuneration for the services mainly provided by the trade industry to producers, consumers and exports in the distribution of goods. Trade margins can also be generated by industries other than the trade industry. As with other services, the appropriate deflation of trade services requires price or volume indicators directly related to the service provided. Alongside the difficulty of defining the services provided by the trade industry precisely, numerous aspects influence the quality of the services of the trade industry, such as the amount of information given to the customers, after-sales services, delivery time, assortment, competence of shop assistants and availability of parking lots. As a result, methods to observe or derive price and volume indices based on direct price and quantity indicators are not available.

9.92. As trade margins in current prices are defined as the difference between the value of goods sold and the value of the same goods purchased for resale by trade industry, double deflation would offer an alternative, and theoretically sound solution. This would comprise the independent deflation of sales and purchases for resale, and the subsequent calculation of trade margins in volume terms as the difference. This approach requires high quality price indices for both purchases for resale and sales of products by the trade industry (and other industries as appropriate).

9.93. A third option is to apply a proxy for the estimation of the volume index of the trade margin on a product, based on the assumption that the volume change of trade margins equals the volume change of the underlying product flow. An alternative means of formulating this proxy is to take as the percentage of trade margins in volume terms to be applied on the product flow in volume terms, the percentage of the current prices of period t-1. The percentages of trade margins are defined as the ratio of trade margins and the relevant product flow valued at basic prices. In this option, the price change is a residual item derived from the current price trade margins and the trade margins in volume terms. This method provides better quality results when applied at a detailed product and industry level. Application of the margin rate in the previous year assumes no change in quality on the margin. Some countries do this by taking the mid-point rate between the two years, but other approaches can also be applied.

9.94. For every entry of the use table, if applicable, the trade margins in volume terms can be estimated as:

$$TR_{t/t-1} = TR_{t-1/t-1} \times VI_{flow}$$

where

$TR_{t/t-1}$= trade margins of $t$ in prices of $t-1$

$TR_{t-1/t-1}$= trade margins of $t-1$ in prices of $t-1$

$VI_{flow}$ = volume change of the underlying product

9.95. The underlying assumption is more valid, if the degree to which trade involved in the concerning transactions does not change from one year to another. The position of trade in a market, however, is reflected in what might be termed the "involvement rate", which can be defined as the ratio between turnover of trade and the relevant product flow which can differ from year to year. These changes influence the estimates in volume terms.

9.96. The relation of the flow and the turnover of trade can be written as:

$$VI_{trt} = F \times VI_{flow}$$

where

$VI_{trt}$ = volume index of turnover trade

F = rate of trade in the product flow

Trade margins in volume terms can be written as:

$$TR_{t/t-1} = TR_{t-1/t-1} \times VI_{trt}$$

9.97. If $F = 1$, then the involvement rate of trade in the product flow has not been changed from period $t - 1$ to period $t$, and the volume index of the turnover of trade equals the product flow.

9.98. If $F \neq 1$, then the product flow assumption is not valid. In order to refine the estimates, data must be collected on involvement rates by product (and preferably industry).

9.99. A further major improvement can be achieved by collecting a detailed breakdown of trade margins, by type of product, and by type of outlet, assuming that different outlets provide different qualities of services. In this way, the quality changes due to turnover shifts between outlets can be addressed.

**(b) Transport margins**

9.100. For transport margins, there is more than one way of estimating the volume estimates.

9.101. The first approach is similar to the method for compiling trade margins in volume terms – that is using the rates of the previous year. This implicitly assumes that transport costs are proportional to the value of the product, something which may not be universally true.

9.102. An alternative option for the deflation of transport margins is the use of price indices for the output of transport industries. A necessary condition is the existence of a matrix of transport margins, by type of transport (column) and by type of product (row). By column, the price index of the relevant type of transport can be applied. The resulting volume change of the transport margins can be checked for plausibility with the volume changes resulting from the so-called "margin method". Generally, it is expected that these two volume changes should be similar.

9.103. A further approach is first to derive volume estimates, by applying the volume changes of the transported products on the previous years' results, and, second, to inflate these with the appropriate price indices in order to arrive at current price estimates. Consequently, the initial current price estimates will then be overruled.

**(c) Taxes on products**

9.104. Taxes on products are taxes that are payable per unit of a certain good or service purchased. The tax may be a specific amount of money per unit of quantity of a good or service, or it may be calculated as a specified percentage of the price per unit or value of the goods and services purchased.

9.105. Taxes on products affect the price of a product and not the volume. This means that, for deflation, for a specific product, it is a requirement that the volume index including any taxes on products equals the volume index excluding any taxes on products. As a result, the volume index of the tax must also equal the volume index at basic prices of the product on which the tax is applied. It should be noted, however, that the volume index of GVA for the whole economy will not necessarily move in line with the volume index of GDP as there is no direct link between the volume of taxes on products (or subsidies on products) and the volume of GVA. The taxes on products are directly linked to the sales of goods and services and therefore relate to the volume of output and not to GVA. The volume change of GVA is not necessarily the same as the volume change of output, because the volume change of intermediate consumption might – or will – be different as a consequence of more efficient production, outsourcing and other effects.

9.106. In the case of taxes on products on "quantities", for every entry of the use table, if applicable, taxes on products in volume terms can be estimated as:

$$T_{t/t-1} = T_{t-1/t-1} \times QI_{flow}$$

where

$T_{t/t-1}$ =tax on products $t$ in prices of $t-1$

$T_{t-1/t-1}$ =tax on products $t-1$ in prices of $t-1$

9.107. Examples of this application cover excise duties on tobacco, alcoholic drinks and fuel.

9.108. In the case of taxes on products on "values", for every entry of the use table, if applicable, taxes on products in volume terms can be estimated as:

$$T_{t/t-1} = T_{t-1/t-1} \times VI_{flow}$$

where

$T_{t/t-1}$ =tax on products $t$ in prices of $t-1$

$T_{t-1/t-1}$ =tax on products $t-1$ in prices of $t-1$

9.109. An example of taxes levied on prices is VAT.

9.110. In the case of taxes on products on "value", the price index of the tax is usually different for different transactions. The reason is that they depend on the price index of the value at basic prices of the transactions. Furthermore, different tariffs exist for different products.

9.111. This approach to the calculation of taxes on products can lead to odd-looking results when a new tax appears or an existing tax disappears, as shown in Box 9.1.

**(d) Subsidies on products**

9.112. The practical elaboration of the estimation in volume terms of the taxes on products presented above also applies in the same way to subsidies on products – thus the equations in that section also apply to subsidies on products (with the replacement of T by S).

9.113. It must be recognized that the assumption that the volume change of trade (and transport) margins and taxes and subsidies on products equals the volume change of the transactions at purchasers' prices can lead to unacceptable results – the focus is the volume change at basic prices. For products with a rapid increase of quality (for example, computers, mobile phones, and so forth) and also the volume changes of the relevant valuation layers, this change in quality should be included. This may lead to unacceptable growth rates of GVA and labour productivity for specific branches in wholesale and retail, necessitating ad hoc adjustments.

9.114. Similar to taxes, new subsidies can appear or an existing subsidy disappears, and this is covered in Box 9.1.

### Box 9.1 Treatment of newly introduced and disappearing taxes and subsidies

**Newly introduced and disappearing taxes and subsidies**

When using Laspeyres volume indices and Paasche price indices, taxes on products and subsidies on products affect the price of a product and not the volume, implying that the volume index of the value including tax (or subsidy) of a product equals the volume index of the value excluding tax (or subsidy).

Therefore the volume index of the value including tax (or subsidy) also equals the volume index of the tax (or subsidy) value. In the case of newly introduced or disappearing taxes (or subsidies), these conditions give rise to remarkable results. In the example used to demonstrate the impact, trade and transport margins are omitted for convenience. However, these results are in conformity with the registration of changes in taxes on products as a price change.

**Newly introduced taxes on products**

Applying the guidelines, the volume change at purchasers' prices equals the volume change at basic prices, which means that taxes on products in volume terms equal zero, while the current price amount is not zero, as shown in the table below.

| | Year Current prices | Price index | Year t Volume terms | Volume index | Year t-1 Current prices |
|---|---|---|---|---|---|
| Output at basic prices | 1 000 | 100 | 1 000 | 100 | 1 000 |
| Taxes on products | 100 | 0 | 0 | 0 | 0 |
| Output at purchasers' prices | 1 100 | 110 | 1 000 | 100 | 1 000 |

As expected, the introduction of a tax on products results in an increase in the purchasers' prices.

**Disappearing taxes on products**

Applying the guidelines, the volume change at purchasers' prices equals the volume change at basic prices, which means that taxes on products in volume terms are not zero, while in current prices the amount equals zero, as shown in the table below.

| | Year Current prices | Price index | Year t Volume terms | Volume index | Year t-1 Current prices |
|---|---|---|---|---|---|
| Output at basic prices | 1 000 | 100 | 1 000 | 100 | 1 000 |
| Taxes on products | 0 | 0 | 100 | 100 | 100 |
| Output at purchasers' prices | 1 000 | 91 | 1 100 | 100 | 1 100 |

As expected, the disappearance of a tax on products results in a decrease in the purchasers' prices.

## 5. Use table at purchasers' prices

9.115. The use table at purchasers' prices can be derived from the use table at basic prices and the valuation matrices. In order to ensure consistency in the system, the bridge columns between the supply table at basic prices and the use table at purchasers' prices are derived from the valuation matrices (row totals).

9.116. For the use table at purchasers' prices, alternative options for price and volume estimation are available using indicators appropriate for this valuation. This option entails additional plausibility checks on volumes and prices, in particular for the valuation matrices.

### (a) Intermediate consumption by industries

9.117. Intermediate consumption price indices (ICPIs) usually meet the general requirements such as valuation, adjustment for quality change and detail. For that reason, ICPIs are the best indicators for the deflation of intermediate consumption of goods and services. A key problem, however, is that ICPIs are very rarely collected by national statistics offices and, if available, do not cover intermediate consumption of services. Thus, in a sense, the H-Approach removes this problem by deflating at basic prices (or producers' prices) and at a very disaggregated level by product, in which process a single price can be used for both output and intermediate consumption by product, thereby matching the price paid by the purchaser with the price received by the seller.

9.118. In some cases, where ICPIs are not available, CPIs can be used as proxy deflators for intermediate consumption of products. An important requirement is that market conditions for intermediate use and such areas as household final consumption expenditure are comparable. This means, for example, that the share of wholesale and retail margins in the purchasers' price should be the same. One example of goods where intermediate use and household final consumption expenditure often show comparable price changes is fuel for motor-vehicles.

9.119. In a number of cases, the error in the estimation of total GDP due to the use of less appropriate price indices will be limited. When intermediate consumption accounts for the bulk of the turnover of a domestically produced product, the under-estimation of intermediate consumption and, thus, over-estimation of GVA in one industry will be counter-balanced by an under-estimation of output (product, trade or transport margins), thus an under-estimation of GVA in another industry.

### (b) Exports of goods and services

9.120. Export price indices usually fulfil the general requirements such as valuation, adjustment for quality change and detail. For that reason, export price indices are the best indicators for the deflation of exports of goods and services. One problem here is that the availability of export price statistics covering services tends to be limited. In addition, they often have the added disadvantage of being Laspeyres-type indices and use fixed weighting schemes generally updated only once every five years. This militates in favour of their application at the lowest possible level of detail.

9.121. Where deflation by unit value indices is concerned, foreign trade statistics often provide the value of exports along with the corresponding quantities at a detailed level. From this information, unit value indices can be derived. A problem with unit value indices when used for deflation purposes is that they often refer to heterogeneous product groups. The unit of measurement can be kilos or simply the number of products. That means that, in many cases, unit value indices suffer from heterogeneity issues, limiting the possibilities for their use as deflators. If, however, no appropriate information from producer's price statistics is available and the unit values refer to similar mass products where the quality does not change rapidly over time, then they can be applied as useful proxies of deflators.

9.122. Currently, deflation using exports price data and unit value indices is only possible for the export of goods. Direct deflators for services are limited in availability. A general problem consists in the exact observation of the exports by product group according to the classification in the SUTs. The second, and for deflation most important, problem is that the price observation of exported services is not well developed in many countries. For that reason, in the national accounts, there is a tendency for the deflation of the exports of services to resort to proxies based on rough assumptions.

9.123. A simple but rough assumption is that, for every product, the price index for exports equals the price index of domestic production. Another possibility would be to collect information on the price changes of that service in the customer countries (see imports of services).

### (c) Household final consumption expenditure

9.124. CPIs usually fulfil the general requirements such as valuation, adjustment for quality change and detail. For this reason, CPIs are the best indicators for the deflation of household final consumption expenditure (for both goods and services). Most CPIs are Laspeyres-type, which militates in favour of the application of CPIs at the lowest possible level of detail. Balancing the SUTs at basic prices is complicated when CPIs are used, owing to the differences in valuation. Thus household final consumption expenditure deflated using CPIs should be used to validate the household final consumption expenditure deflated at basic prices and transformed into household final consumption expenditure at purchasers' prices, which is the right-hand side of the H-Approach.

### (d) Government consumption

9.125. Collective and individual government consumption equals government production minus sale of market production by government and own account fixed capital formation. Estimates in volume terms can be derived following the same approach. For social benefits in kind, similar indicators may be used as for consumption of households.

### (e) Gross fixed capital formation

9.126. Specific price indices for fixed capital goods usually fulfil the general requirements such as valuation, adjustment for quality change and detail. For that reason, directly collected specific price indices for capital goods form the best indicators for deflation of gross fixed capital formation in goods. A major problem is that price indices for capital goods are hardly ever collected as part of the collection of prices by national statistics offices, and proxy producer price-type indices are used instead. Again, the disadvantages are that price indices for capital goods are often Laspeyres-type and that they use fixed weighting schemes generally updated only once every five years. This militates in favour of the application of price indices for capital goods at the lowest possible level of detail when deflating the domestic supply of products. For gross fixed capital formation, more weight will be given to deflation through the basic price valuation to purchasers' price valuation on the right-hand side of the H-Approach, when compared with the results using proxy price indices for capital goods.

### (f) Changes in inventories

9.127. The calculations of changes in inventories in current prices and in volume terms are often closely interlinked. If high quality current price estimates can be made because reliable and appropriate data are available, then it is often possible to make high quality estimates in volume terms as well, since the same data are used.

9.128. In the ideal case, information is available on the exact times and quantities of additions to and withdrawals from the inventory and the price of the product at those times. It is then in principle straightforward to calculate the changes in inventories in current prices and in volume terms. Additions and withdrawals have to be valued at the prices prevailing at the times at which they take place. The changes in inventories in volume terms can be calculated by valuing the quantities of additions and withdrawals at the average prices of the previous year.

9.129. In practice, the data available for the calculation of changes in inventories are not sufficient for a perfect estimation. Assumptions and approximations have to be made. The estimation methodology for changes in inventories (both in current prices and in volume terms) is highly dependent on the kind of information on inventories that is available. In general, enterprises will not provide data on quantities but only on the value of their inventories at the beginning and end of the year according to their own bookkeeping system. This makes it difficult to calculate the current price value from the volume change, as the adjustment for holding gains and losses is incorrect or missing.

9.130. These bookkeeping systems also do not generally value inventories according to SNA rules but follow other systems, such as historic cost systems, the LIFO system, and others. In consequence, these values cannot be used directly in the national accounts. In order to calculate correctly the change in volume of inventories, information is needed on the bookkeeping system used in the enterprise. The first step is to estimate the change in volume, and the result should then be multiplied with an appropriate price index to arrive at changes in inventories in current prices. As a result, the quality of this process, and the quality of the subsequent estimates, provides some scope for adjusting the current price changes in inventories in the balancing process.

## F. Input-output tables in volume terms

9.131. As with SUTs, IOTs can be compiled in volume terms. The reference year can in particular be a problem for IOTs, however, because they are often compiled at irregular, non-annual intervals, such as once every five years. This does not line up with other national accounts data which are required by international standards to make use of the previous year as base year in the calculation of volume measures and the chaining of annual data at prices of a fixed reference year.

9.132. The SUTs in volume terms will generally be compiled at prices of the previous year. This makes possible the calculation of growth rates by comparing the volume measures with the current price values of the previous year. Results of the chaining of complete SUTs will not be additive: that is to say, in the resulting SUTs the elements of a given row will not add up to the row total, and the same will be true for the columns. The resulting tables can only be used to analyse the time path of one particular element at a time. They cannot be used to any real effect for such purposes as the analysis of the time path of the total input structure of an industry or the market shares for a product.

9.133. As for IOTs, if they are only compiled once every five years, it is of course possible to use the previous years' prices as well but the results cannot be used to calculate growth rates, and this clearly limits the usefulness of such tables.

9.134. The alternative would be to compile IOTs in prices of the year five years prior to the current year, for example, the year 2010 in prices of 2005. This could be done by performing the same transformation process as for the current price IOTs, but it would require the availability of coherent SUTs in the same valuation, which is a problem when chaining is used, as already mentioned.

9.135. Another possibility for the derivation of such IOTs is to deflate directly the IOTs in current prices by finding appropriate price or volume indices for the products. These should be indices of the price or volume change in the five years between the base year and the current year. This procedure will entail the use of a different base year than for the SUTs in volume terms, introducing the risk of inconsistencies.

9.136. The recommended approach would be to compile IOTs annually, and to apply the same price and volume methodology as used for SUTs.

# Chapter 10. Linking the supply and use tables to the institutional sector accounts

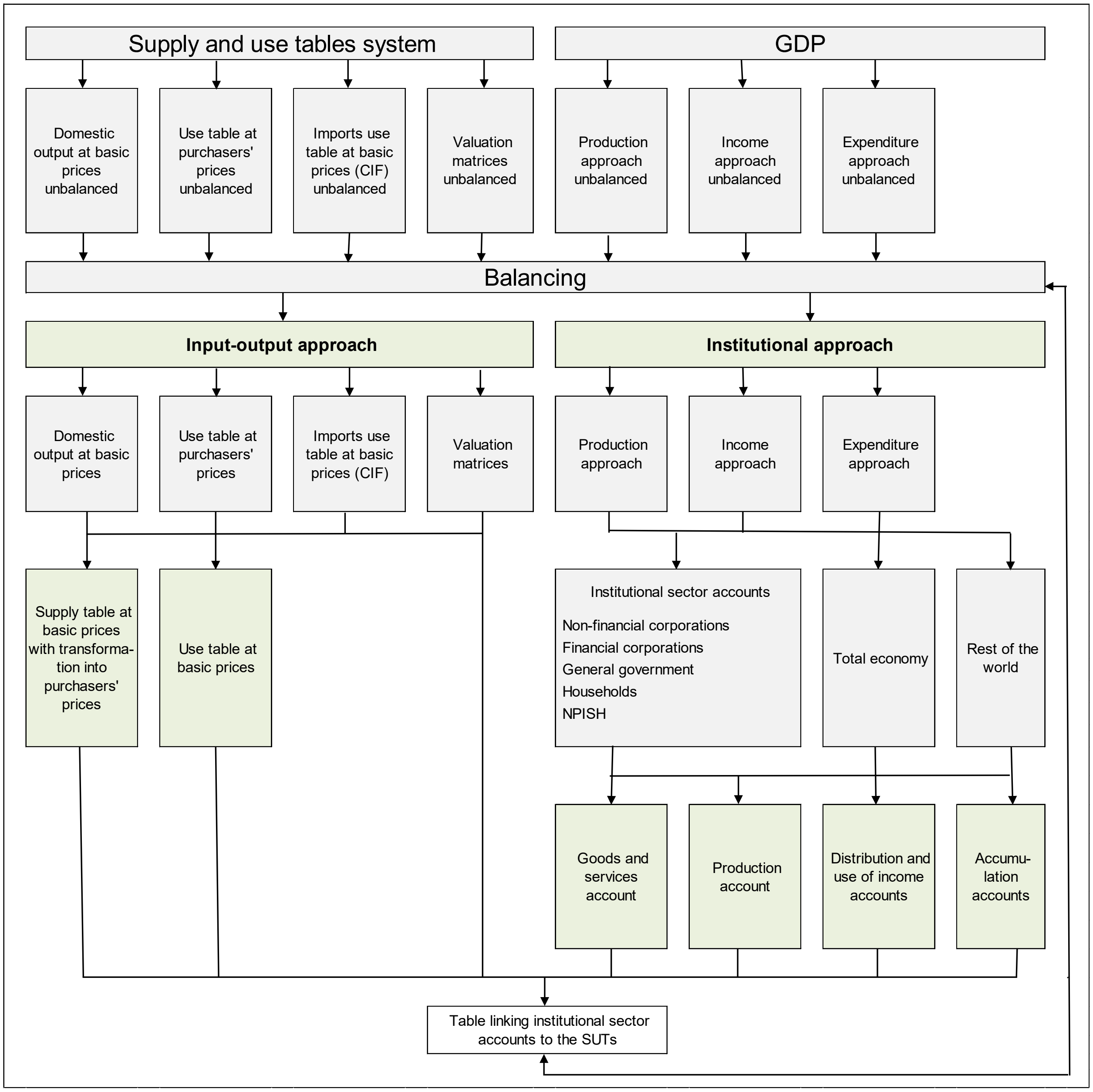
## A. Introduction

10.1. When compiling SUTs, it is important to ensure that they are linked to, and consistent with, the institutional sector accounts of the SNA. This is fundamental to ensuring a full integration of the accounts and also a full integration of the SUTs with the regular annual compilation of the national accounts. In this way data in the SUTs, such as GVA and GDP, are made to be consistent and coherent with the institutional sector accounts, and vice versa. This is achieved through the compilation and balancing process of SUTs incorporating a table that cross-classifies data by industry, by type of factor incomes and by institutional sector.

10.2. Linking SUTs to the institutional sector accounts extends the role of SUTs, enabling them to increase the quality, consistency and coherence of the national accounts, where the SUTs have specific links bringing together parts of the national accounts. Figure 10.1 shows the links between the industry accounts (for example, the SUTs system) and the institutional sector accounts as part of the balancing framework within the national accounts. Figure 10.1 provides a different perspective from that illustrated in figure 1.1 but contains a more detailed diagram linking the two parts of the national accounts framework.

10.3. This chapter describes the links between the SUTs and the institutional sector accounts. Section B provides a description of the institutional sectors in the national accounts and the differences in perspective between the institutional accounts and SUTs. Section C provides a description of how the SUTs are linked to the institutional sector accounts and gives the layout of the table linking these accounts. Section C also provides a numerical example of the linking table and how the SUTs are linked to the goods and services accounts, production accounts and generation of income accounts. Section D presents various approaches to establishing the link between the SUTs and the institutional accounts and describes some issues that may arise in the compilation of the linking table.

**Figure 10.1 Links between the industry accounts and the institutional sector accounts**




## B. Institutional sectors and subsectors

10.4. The institutional sectors of the 2008 SNA group together institutional units on the basis of their principal functions, behaviour and objectives. The following institutional sectors are distinguished in the 2008 SNA:

- *Non-financial corporations*: these are institutional units that are principally engaged in the production of market goods and non-financial services (2008 SNA, para. 4.94).

- *Financial corporations*: these consist of all resident corporations that are principally engaged in providing financial services, including insurance and pension funding services, to other institutional units (2008 SNA, para. 4.98).

- *General government*: this consists of the following groups of resident institutional units: first, all units of central, state or local government; second, all non-market non-profit institutions that are controlled by government units (2008 SNA, para. 4.127). It consists of institutional units that, in addition to fulfilling their political responsibilities and their role of economic regulation, produce services (and possibly goods) for individual or collective consumption mainly on a non-market basis and redistribute income and wealth.

- *Households*: these consist of all resident households (2008 SNA, para. 4.158). Households are institutional units consisting of one individual or a group of individuals. All physical persons in the economy must belong to one and only one household. The principal functions of households are to supply labour, to undertake final consumption and, as entrepreneurs, to produce market goods and non-financial (and possibly financial) services. The entrepreneurial activities of a household consist of unincorporated enterprises that remain within the household except under certain specific conditions.

- *NPISHs*: these consist of all resident non-profit institutions, except those controlled by government, that provide non-market goods or services to households or to the community at large (2008 SNA, para. 4.31).

10.5. Table 10.1 provides a summary of institutional sectors and subsectors with a link to the concepts of market and non-market producers. Often there is a misconception that the distinction between market and non-market producers corresponds to the distinction between the private and public sectors. This is not the case in the national accounts. The public sector includes all resident institutional units controlled directly or indirectly by resident government units. In other words, the public sector consists of all units of the general government sector plus all resident public corporations (2008 SNA, para. 22.164). Accordingly, the public sector includes both market and non-market producers so long as they are controlled directly or indirectly by resident government units.

10.6. It should be noted that the SUTs and the institutional sector accounts reflect different ways of looking at and measuring the economy. In the SUTs, the analysis by products and industries emphasizes the production processes, the flows of goods and services, and the use of primary inputs (for example capital, labour, and others). In this way the units are chosen to reflect technical-economic relations, for example, in units of production such as establishments. As a result, economic activities are studied from the viewpoint of the specific units that carry out the production. The balance between supply (resources) and uses of products constitutes the central element of this type of functional analysis.

10.7. In the institutional approach, the analysis focuses on the generation and distribution of income, and the investment and financing of capital by institutional sectors. In this case, the units that are chosen reflect the general economic behaviour of so-called "institutional units" according to their economic objectives, functions and behaviour.

**Table 10.1 Summary of institutional sectors and subsectors**

| Market / non-market producers | Institutional sectors | Sub-sectors (summary) |
|---|---|---|
| Market | Non-financial corporations | |
| Market | Financial corporations | Central Bank<br>Deposit-taking corporations except the Central Bank<br>Money market funds (MMF)<br>Non-MMF investment funds<br>Other financial intermediaries except insurance corporations and pension funds<br>Financial auxiliaries<br>Captive financial institutions and money lenders<br>Insurance corporations<br>Pension funds |
| Non-market | General government | Central government<br>State government<br>Local government<br>Social security funds* |
| Market | Households | |
| Non-market | Non-profit institutions serving households | |
| n/a | Rest of the world | |

Social security funds may also be grouped at the various government levels.

10.8. Table 10.2 provides a summary of the key features of the SUTs approach and institutional approach. The two types of approaches are linked and should be integrated via the linking table

10.9. Ideally, if a single common unit could meet the needs of both SUTs and the institutional sector accounts, this would further improve the coherence, consistency and compilation of the two areas of the national accounts framework (see also section D on the compilation methods). In the 2008 SNA, however, the recommended unit for the SUTs is the establishment, while for the institutional sector account it is the institutional unit. Information on the legal status and ownership of the establishments is important for the cross-classification of establishments into institutional sectors.

**Table 10.2 Main features of the SUT approach and the institutional sector approach**

| | SUT approach | Institutional sector approach |
|---|---|---|
| Objectives | Production relationship<br>Goods and services flows<br>(equilibrium of resources and uses) | To record the economic data of institutional units grouped in terms of their economic objectives, functions and behaviour |
| Accounts | Goods and services account<br>Production account<br>Generation of income account<br>(integrated in the SUT framework) | A complete system of accounts:<br>goods and services account; production account; distribution and use of income account; accumulation accounts, balance sheets |
| Types of units: | | |
| Elementary | Production units (establishments, etc.) | Institutional units (households, corporations, etc.) |
| Aggregates | Industries (type of economic activity) | Institutional sectors |

10.10. As an establishment always belongs to an institutional unit, it is possible to link the production activities of industries and institutional sectors. The output of an institutional unit is equal to the sum of the outputs of the individual establishments of which the institutional unit is composed, thus including deliveries between establishments within the institutional unit.

10.11. To clarify relationships and contents of industries and institutional sectors, the 2008 SNA proposes the cross-classification of GVA and its components (and if possible, also for output and intermediate consumption) by both industry and by institutional sector. This is essentially the GVA part of the use table broken down also by sectors, in addition, to become the table linking SUTs to institutional sectors.

10.12. In order to implement the table linking SUTs and institutional sector accounts, it would be a great advantage to have clear links between units and institutional sectors on the business register, and as a feature of business survey results. The split by institutional sector of units classified by industry would meet the compilation requirements. This would also facilitate similar cross-classifications for output, intermediate consumption and variables such as gross fixed capital formation and the compensation of employees.

## C. Table linking SUTs and institutional sector accounts

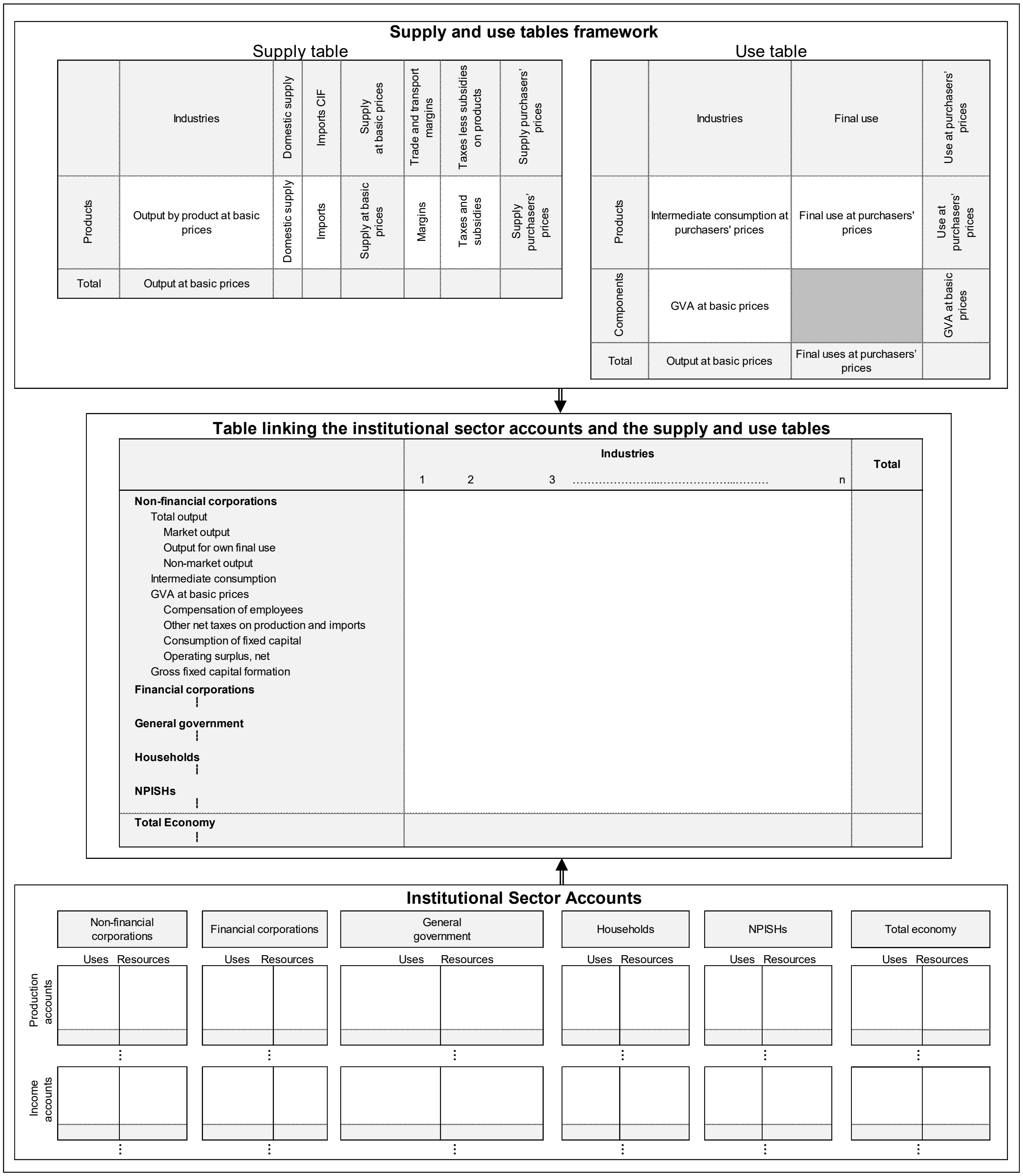
10.13. Figure 10.2 shows how the SUTs are linked to the sequence of accounts by institutional sector through a linking table. The rows of the linking table contain information by institutional sector on the following:

- Transaction of production accounts: total output and intermediate consumption
- Transactions on the generation of income account: GVA, compensation of employees, other taxes less subsidies on production and imports
- Transaction of the accumulation accounts: gross fixed capital formation

10.14. The linking table thus records complete data of three specific sector accounts of the system as a whole: the production account, the generation of income account and the accumulation accounts, broken down simultaneously by industries (by column) and by institutional sector (by row). In this way, the interrelations between the systems become clear and their coherence is ensured in both the institutional sector accounts and the SUTs.

10.15. The starting point for linking the SUTs to the institutional sector accounts is the supply table at basic prices, including a transformation at purchasers' prices and the use table at purchasers' prices. Table 10.3 shows a numerical example of the linking table linking the SUTs in table 5.2 of chapter 5 and table 6.1 of chapter 6 to the institutional sector accounts.

# Figure 10.2 Link between the SUTs and institutional sector accounts



# Table 10.3 Numerical example showing the table linking the SUTs and institutional sector accounts

Millions of euros

| INSTITUTIONAL SECTORS | INDUSTRIES | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | Agriculture (1) | Manufacturing (2) | Construction (3) | Trade, transport and communication (4) | Finance and business services (5) | Other services (6) | |
| **1. Non-financial corporations** | | | | | | | |
| Total output | 1 837 | 196 180 | 37 517 | 112 204 | 53 204 | 8 809 | 409 751 |
| Market output | 1 828 | 192 193 | 37 244 | 110 468 | 52 633 | 8 685 | 403 050 |
| Output for own final use | 9 | 3 988 | 273 | 1 736 | 571 | 124 | 6 701 |
| Other non-market output | | | | | | | |
| Intermediate consumption | 972 | 136 868 | 24 907 | 52 394 | 24 513 | 3 129 | 242 784 |
| Gross value added at basic prices | 864 | 59 313 | 12 611 | 59 810 | 28 691 | 5 679 | 166 967 |
| Compensation of employees | 349 | 29 839 | 9 247 | 32 573 | 13 008 | 4 912 | 89 928 |
| Other net taxes on production and imports | - 133 | 1 017 | 479 | 1 360 | 955 | - 340 | 3 337 |
| Consumption of fixed capital | 165 | 12 533 | 1 370 | 8 598 | 9 208 | 526 | 32 401 |
| Operating surplus, net | 482 | 15 923 | 1 515 | 17 279 | 5 519 | 582 | 41 300 |
| Gross fixed capital formation | 277 | 14 376 | 1 058 | 10 419 | 14 605 | 931 | 41 665 |
| **2. Financial corporations** | | | | | | | |
| Total output | | | | | 25 058 | | 25 058 |
| Market output | | | | | 24 802 | | 24 802 |
| Output for own final use | | | | | 256 | | 256 |
| Other non-market output | | | | | | | |
| Intermediate consumption | | | | | 12 351 | | 12 351 |
| Gross value added at basic prices | | | | | 12 706 | | 12 706 |
| Compensation of employees | | | | | 8 125 | | 8 125 |
| Other net taxes on production and imports | | | | | 926 | | 926 |
| Consumption of fixed capital | | | | | 1 810 | | 1 810 |
| Operating surplus, net | | | | | 1 846 | | 1 846 |
| Gross fixed capital formation | | | | | 1 923 | | 1 923 |
| **3. General government** | | | | | | | |
| Total output | 18 | 225 | | 5 753 | 3 045 | 53 382 | 62 423 |
| Market output | 18 | 221 | | 151 | 1 489 | 578 | 2 457 |
| Output for own final use | | | | 300 | 314 | 2 223 | 2 837 |
| Other non-market output | | 4 | | 5 302 | 1 241 | 50 581 | 57 129 |
| Intermediate consumption | 13 | 149 | | 2 555 | 1 366 | 15 609 | 19 692 |
| Gross value added at basic prices | 5 | 77 | | 3 198 | 1 678 | 37 773 | 42 731 |
| Compensation of employees | 3 | 12 | | 1 494 | 782 | 30 725 | 33 017 |
| Other net taxes on production and imports | 1 | 1 | | 127 | 34 | 1 260 | 1 423 |
| Consumption of fixed capital | 1 | 20 | | 1 582 | 625 | 5 890 | 8 118 |
| Operating surplus, net | 0 | 44 | | - 5 | 237 | - 103 | 173 |
| Gross fixed capital formation | 2 | 11 | | 2 318 | 1 251 | 5 661 | 9 243 |
| **4. Households** | | | | | | | |
| Total output | 8 012 | 3 544 | 7 413 | 16 880 | 28 141 | 9 096 | 73 086 |
| Market output | 7 918 | 3 503 | 4 218 | 16 782 | 9 391 | 8 847 | 50 659 |
| Output for own final use | 95 | 41 | 3 195 | 98 | 18 749 | 249 | 22 428 |
| Other non-market output | | | | | | | |
| Intermediate consumption | 4 455 | 1 975 | 2 559 | 6 270 | 8 307 | 2 746 | 26 311 |
| Gross value added at basic prices | 3 558 | 1 569 | 4 854 | 10 610 | 19 834 | 6 350 | 46 775 |
| Compensation of employees | 198 | 828 | 992 | 3 839 | 1 081 | 1 390 | 8 329 |
| Other net taxes on production and imports | - 1 495 | 60 | 67 | 267 | 89 | - 70 | - 1 081 |
| Consumption of fixed capital | 1 622 | 249 | 183 | 777 | 7 264 | 580 | 10 675 |
| Operating surplus, net | 3 233 | 432 | 3 612 | 5 726 | 11 399 | 4 450 | 28 852 |
| Gross fixed capital formation | 2 036 | 129 | 101 | 586 | 12 114 | 887 | 15 853 |
| **5. Non-profit institutions serving households** | | | | | | | |
| Total output | | | | | | 8 029 | 8 029 |
| Market output | | | | | | 7 | 7 |
| Output for own final use | | | | | | 74 | 74 |
| Other non-market output | | | | | | 7 948 | 7 948 |
| Intermediate consumption | | | | | | 2 356 | 2 356 |
| Gross value added at basic prices | | | | | | 5 672 | 5 672 |
| Compensation of employees | | | | | | 4 944 | 4 944 |
| Other net taxes on production and imports | | | | | | 253 | 253 |
| Consumption of fixed capital | | | | | | 475 | 475 |
| Operating surplus, net | | | | | | 0 | 0 |
| Gross fixed capital formation | | | | | | 734 | 734 |
| **6. Total** | | | | | | | |
| Total output | 9 867 | 199 950 | 44 931 | 134 837 | 109 447 | 79 315 | 578 347 |
| Market output | 9 763 | 195 916 | 41 462 | 127 401 | 88 315 | 18 116 | 480 975 |
| Output for own final use | 104 | 4 029 | 3 468 | 2 134 | 19 890 | 2 670 | 32 295 |
| Other non-market output | | 4 | | 5 302 | 1 241 | 58 529 | 65 077 |
| Intermediate consumption | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 841 | 303 495 |
| Gross value added at basic prices | 4 428 | 60 958 | 17 465 | 73 618 | 62 909 | 55 475 | 274 852 |
| Compensation of employees | 551 | 30 679 | 10 239 | 37 906 | 22 997 | 41 971 | 144 343 |
| Other net taxes on production and imports | - 1 627 | 1 077 | 546 | 1 755 | 2 004 | 1 103 | 4 858 |
| Consumption of fixed capital | 1 788 | 12 803 | 1 553 | 10 958 | 18 908 | 7 472 | 53 480 |
| Operating surplus, net | 3 715 | 16 400 | 5 128 | 22 999 | 19 001 | 4 929 | 72 171 |
| Gross fixed capital formation | 2 314 | 14 516 | 1 160 | 13 323 | 29 892 | 8 212 | 69 418 |

Table based on 2011 figures from Austria

10.16. Among the institutional sector accounts as a whole, it is the goods and services accounts, the production accounts and the generation of income accounts that are important for balancing the SUTs and the institutional sector accounts.

10.17. If the goods and services accounts, production accounts, and generation of income accounts are compiled and balanced in an integrated manner as part of the SUTs compilation and balancing process, then all the components of the first three accounts of the national accounts framework become available from the balanced SUTs. This ensures a high degree of consistency and coherence between the SUTs and the institutional sector accounts. In addition, there is a powerful data quality feedback loop from the institutional sector accounts affecting SUTs, and vice versa.

10.18. Furthermore, when the data for gross fixed capital formation is compiled by industry, by product and by institutional sector and as an integrated input to the use table, this also provides a key link between the SUTs and part of the accumulation accounts. Although these could be compiled as a satellite system, they should be integrated as an input to the SUTs process and are available on a consistent basis after the SUTs are balanced.

10.19. Although this type of approach is recommended, in many countries the SUTs are compiled separately from the institutional sector accounts. See also section D on compilation methods.

### 1. Goods and services accounts

10.20. The goods and services accounts show the total supply of a product for the whole economy, together with how it has been used. The main components for the whole economy balance are:

Output + imports + taxes on products – subsidies on products (Total resources)
equals
Intermediate consumption + final consumption + gross capital formation + exports (Total uses)

10.21. The goods and services are traced through the economy from their original producers (either resident producers or producers abroad) to their users (either resident users or users abroad). With output being valued at basic prices and uses at purchasers' prices, then taxes on products less subsidies on products must be included in the resources part to ensure that a purchasers' prices balance can be struck.

10.22. It is important to note that the goods and services account is by definition in balance and therefore has no balancing item, and all the components are available from the SUTs. In essence, all these are totals of variables available in the SUTs. Table 10.4 shows a numerical example covering goods and services.

**Table 10.4 Goods and services for the whole economy**

Millions of euros

| Uses | Total | Resources | Total |
|---|---|---|---|
| Intermediate consumption | 303 492 | Output | 578 360 |
| Final consumption expenditure | 226 258 | Imports of goods and services | 157 871 |
| Final consumption by households | 159 792 | Taxes less subsidies on products | 33 778 |
| Final consumption by non-profit organisations | 5 416 | Taxes on products | 34 416 |
| Final consumption by government | 61 050 | Subsidies on products (-) | - 638 |
| GCF | 74 612 | | |
| GFCF | 69 418 | | |
| Changes in inventories | 2 335 | | |
| Acquisition less disposal of valuables | 2 859 | | |
| Exports of goods and services | 165 648 | | |
| Total | 770 009 | Total | 770 009 |

Table based on 2011 figures from Austria

## 2. Production account

10.23. The production account shows the transactions relating to the production process and is drawn up for institutional sectors and for industries. For the whole economy, and for each institutional sector, the resources include output and the uses include intermediate consumption.

10.24. The production account generates one of the most important balancing items in the system, namely, GVA, the value generated by any unit engaged in production activity and in turn, the link to the major aggregate, GDP. GVA is economically significant for both the institutional sectors and the industries.

10.25. As with balancing items for all the accounts, value added may be calculated before or after allowance is made for consumption of fixed capital, and is therefore available on a gross or net basis. Given that output is valued at basic prices and intermediate consumption at purchasers' prices, GVA will not include taxes on products and will include subsidies on products.

10.26. The production account at the whole economy level includes among resources, in addition to the output of goods and services, the taxes on products less subsidies on products. This enables GDP at market prices to be obtained as a balancing item.

10.27. Again, all the components are available from the SUTs and are totals for the variables available in the SUTs. Table 10.5 shows a numerical example covering the production account for the whole economy. The same variables underpin the whole economy by the institutional sectors, except that GVA is shown instead of GDP as the balancing item on the uses side.

**Table 10.5 Production account for the whole economy**

Millions of euros

| Uses | Total | Resources | Total |
|---|---|---|---|
| Intermediate consumption | 303 492 | Output | 578 360 |
| | | Market output | 480 989 |
| | | Output for own final use | 32 295 |
| | | Non-market output | 65 075 |
| GDP | 308 647 | Taxes less subsidies on products | 33 778 |
| Consumption of fixed capital | 53 469 | Taxes on products | 34 416 |
| NDP | 255 177 | Subsidies on products (-) | - 638 |
| Total | 612 138 | Total | 612 138 |

Table based on 2011 figures from Austria

10.28. All the estimates for the production account for the whole economy in Table 10.5 can be derived from the SUTs in order to derive GDP. Alongside this, GVA by industry can also be linked and similarly derived from the same SUTs, as shown in Table 10.6.

**Table 10.6 Link between GDP and industry GVA**

Millions of euros

| Industries | Output | Intermediate consumption | Gross value added at basic prices | Taxes on products | Subsidies on products | GDP at market prices |
|---|---|---|---|---|---|---|
| Agriculture | 9 867 | 5 440 | 4 427 | | | |
| Manufacturing | 199 950 | 138 991 | 60 959 | | | |
| Construction | 44 931 | 27 466 | 17 465 | | | |
| Trade, transport and communication | 134 837 | 61 219 | 73 618 | | | |
| Finance and business services | 109 461 | 46 538 | 62 923 | | | |
| Other services | 79 314 | 23 839 | 55 475 | | | |
| Total | 578 360 | 303 492 | 274 868 | 34 416 | 638 | 308 647 |

Table based on 2011 figures from Austria

## 3. Generation of income account

10.29. The generation of income account analyses the extent to which GVA can cover compensation of employees and other taxes less subsidies on production. It measures the gross operating surplus, which is the surplus (or deficit) on production activities before account has been taken of the interest, rents or charges which the production unit must pay on financial assets or on tangible non-produced assets which it has borrowed or rented and must receive on financial assets or on tangible non-produced assets of which it is the owner.

10.30. The gross operating surplus corresponds to the income which the units obtain from their own use of their production facilities. Although the institutional sector accounts have balancing items in each of the accounts, gross operating surplus is the last balancing item in the national accounts framework that can be calculated linking industries, institutional sectors and subsectors.

10.31. In the case of unincorporated enterprises in the household sector, the balancing item of the generation of income account implicitly includes an element corresponding to remuneration for work carried out by the owners or members of their family which cannot be distinguished from their profits as entrepreneur. This is referred to as "mixed income".

10.32. In the case of own account production of accommodation services by owner-occupier households, the balancing item of the generation of income account is an operating surplus, and not mixed income.

10.33. The generation of income account can also be presented by industries and is usually published with the main national accounts releases. These can be shown as the industry columns of the use table and presented as sectors, subsectors and industries which are the source, rather than the destination, of primary income.

10.34. It is essential that these industries (and underlying units) are the same as those applied in the SUTs, the industry-by-industry IOTs and the institutional sector accounts. Where this is not possible at best a clear bridge should be provided, to explain the differences.

10.35. All the components could be available from the SUTs and would consist of totals of variables available in the GVA part of the use table if the SUTs incorporated these components as part of the SUTs compilation and balancing process.

10.36. Table 10.7 shows a numerical example of the generation of income account for the whole economy. It is underpinned by a similar breakdown by institutional sector (and by industry), except that GVA is shown instead of GDP as the starting point, in line with the function of GVA as the balancing item of the production account for each institutional sector.

**Table 10.7 Generation of income account for the whole economy**

Millions of euros

| Uses | Total | Resources | Total |
|---|---|---|---|
| Compensation of employees | 144 343 | GDP | 308 647 |
| Wages and salaries | | | |
| Employers' social contributions | | | |
| Taxes on production and imports | | | |
| Taxes on products | 34 416 | | |
| VAT type taxes | | | |
| Taxes and duties on imports excuding VAT | | | |
| Taxes on products except VAT and import taxes | | | |
| Other taxes on production | 4 858 | | |
| Subsidies | - 638 | | |
| Subdsidies on products | | | |
| Other subsidies on production | | | |
| Gross operating surplus | 125 667 | | |
| Gross mixed income | | | |
| Total | 308 647 | Total | 308 647 |

Table based on 2011 figures from Austria

10.37. The income approach to measuring GDP is obtained by summing together:

- Gross operating surplus
- Compensation of employees

- Taxes on production and imports less any subsidies on production
- Taxes on products and imports less any subsidies on products

## D. Compilation methods

10.38. Using the tables linking the SUTs to the institutional sector accounts, it is possible to make a direct comparison with information from the SUTs and the institutional sector accounts for each period. This at least guarantees that, after the balancing process, consistency is ensured between the SUTs and the sector accounts. Even after independently compiling the SUTs and institutional sector accounts, the linking table may be established to check the consistency of results.

10.39. The compilation procedure is designed in such a way that, in the first stage, the SUTs on the one hand and the institutional sector accounts on the other are independently compiled. In the second stage, the comparison between the two types of information is made in the linking table. In the event of data incompatibilities, a revision process will start on both approaches until a new assessment can be reached.

10.40. There are, however, other possible compilation methods (see Eurostat, 2008) as shown in Box 10.1, used to link the SUTs to the institutional sector accounts.

**Box 10.1 Compilation methods used to link SUTs to the institutional sector accounts**

| General structure of the national accounts compilation procedure | Role of the linking matrix in the compilation process |
|---|---|
| **Method A**<br><br>Independent compilation of SUTs and institutional sector account | Ex post reconciliation of both approaches |
| **Method B**<br><br>Compilation based on instruments and statistical sources of SUTs as a core element with a secondary role assigned to institutional sector accounts | The linking matrix as the first stage in the compilation of institutional sectors accounts |
| **Method C**<br><br>Compilation based on instruments and statistical sources of institutional sectors accounts with a secondary role assigned to SUTs | The linking matrix as the first stage in the compilation of SUTs |
| **Method D**<br><br>Simultaneous compilation of SUTs and institutional sector accounts | The linking matrix as a central instrument in the compilation of the system of national accounts |

10.41. In method A, the two approaches are elaborated in an independent way. The particular role of the linking matrix is to contrast them and to facilitate the reconciliation process. Method B and method C represent opposite alternatives in the compilation of national accounts. Method B builds on the production SUTs methods and corresponding sources of information. Method C starts from the institutional sectors from which SUTs elements will be derived. In both alternatives the role of the linking matrix is similar: it represents the missing link between the two approaches. When the SUTs approach is the starting point, the linking matrix gives data for the first two accounts of institutional sectors – the production and generation of income accounts. In the event that institutional sector accounts are the main and initial stage, the linking matrix helps to distribute data over the different industries as the first stage in the compilation of SUTs.

10.42. The recommended approach would be to start simultaneously from an institutional and SUTs standpoint, as indicated in method D. The advantage of this method is that the two different standpoints are wholly compatible from the very beginning of the national accounts compilation process. In terms of the relevance of the linking table, such a method would mean that it would form the core of the whole compilation process.

10.43. The statistical requirements for this method are significant but, by that token, so are the benefits. The main aspect is that the databases should be structured according to the institutional sector with which the units are associated. As indicated in the linking table, five basic types of information are required (broken down by institutional sectors) to prepare SUTs:

- Production data broken down into matrices by products and industries and valued at basic prices, or at least the total for each industry.
- Intermediate consumption data, broken down by products and industries and valued at purchasers' prices, or at least the total for each industry.
- Data on the cost of primary inputs, particularly wage earners' compensation (with a breakdown of wages and salaries and employers' social contributions), and consumption of fixed capital: these data should be disaggregated by industries.
- Data on the gross fixed capital formation and stock variations broken down by types of products and industries. In the case of gross fixed capital formation, the data are valued at purchasers' prices, while in the case of changes in inventories (stock variations) the data are shown at basic prices.
- Data on labour input broken down by the employers' industries and by employment category (wage and salary earners, self-employed) – also defined by the numbers of people employed and hours worked.

10.44. The availability of such a cross-classified database makes possible the simultaneous compilation of SUTs and institutional sector accounts and increases the overall improvement of all requirements to compile the national accounts as follows:

- One of the main advantages of the linking table is that it allows for the possibility of stating and analysing the different types of production (market, non-market, for own final use) which depend on the institutional approach. Definition of the concepts of market output, output for own final use and other non-market output can only be understood by looking, in addition, at features of the institutional unit and the establishment that produce that output. The distinctions are defined in a top-down way: that is to say, the distinction is first defined for institutional units, then for establishment and then for their output.

- The simultaneous compilation of aspects of institutional sectors and industries is a prerequisite for the estimation of taxes of the value-added type. If some details of intermediate consumption and gross fixed capital formation are available in the suggested approach, then it is possible to achieve a more accurate compilation of VAT.

- The linking table allows for a clear identification of non-market household production activities: the (imputed) production of rental services of owner-occupied dwellings; output of household services produced by employing paid staff; own-account construction, and so forth.

10.45. When the compilation of the linking table is at the core of the compilation of national accounts (as in method D in Box 10.1), it is important to cross-classify the original data by industry and sector. In this regard, it is important to keep the link between national accounting, on the one side, and business accounting and public finance, on the other side, as close as possible.

10.46. From the perspective of compiling the linking table, major problems arise from vertically integrated enterprises. A vertically integrated enterprise is one in which different stages of production, which are usually carried out by different enterprises, are carried out in succession by different parts of the same enterprise (2008 SNA, para. 5.23). Business accounting data will be consolidated, without specific detail on the stages and intra-enterprise transactions involved among the different units. This causes difficulties in distinguishing intermediate consumption and other current costs as output of one stage which is, for example, intermediate consumption of another stage. Moreover, gross operating surplus may not be differentiated among the different parts of the enterprise, thus appropriate adjustments would be required; more details of the type of redefinition required may be found in chapter 5.

10.47. The 2008 SNA recommends (see 2008 SNA, para. 5.26) that, when a vertically integrated enterprise spans two or more sections of ISIC, at least one establishment must be distinguished within each section. With such a treatment, the activities of units engaged in vertically integrated activities will not cross section boundaries of ISIC.

# Chapter 11. Balancing the supply and use tables

## A. Introduction

11.1 The balancing of SUTs is a fundamental step in the compilation process of SUTs. The usefulness of the SUTs is underpinned by the set of identities between elements of the tables which enable the consistent integration of the components of the three approaches to measuring GDP.

11.2 In fact, since the SUTs are populated in the first stage with data derived from many sources, each of which has its own sample and reliability margins, definitions and peculiarities, the basic identities of the SUTs are not satisfied when the tables are first put together (as described in the previous chapters) and the resulting estimates of GDP emerging from the three approaches are likely to be very different, and to differ from year to year. In order to achieve a single, coherent and consistent estimate, all the identities and plausibility relations in the SUTs have to be satisfied, and the initial unbalanced SUTs need therefore to be balanced, preferably using a time series perspective.

11.3 The ideal scenario, linked to the H-Approach to the compilation of SUTs (as shown in figure 9.1), is for the full set of SUTs to be balanced simultaneously at basic prices and at purchasers' prices, as well as in current prices and volume terms. In addition, if the balancing also takes into account the institutional sector accounts, IOTs, PSUTs and EE-IOTs, balanced as a single package or sequentially, the integration and reliability of the system are greatly enhanced.

11.4 This approach, however, is demanding in terms of data, resources and computer systems. In practice, balancing will often be less extensive and sequential procedures will be applied. The sequential theme may, for example, concern volume estimates, valuation matrices or the import matrix. The choice of a variant for the balancing process in practice depends upon criteria such as the availability of data. In the estimation of volume data, the application of appropriate price indices is a key factor to consider.

11.5 Whatever choice is made with regard to the set-up of the balancing, it is important to recognize that any version of the SUTs or a particular stage of the process is not finished until all the subsequent estimates are made and checked for plausibility. The balancing phase is then an iterative process and feedback loops to earlier stages in the process will improve the quality of the final result and can also indicate future improvements to source data.

11.6 The main objective of this chapter is to provide an overview of the balancing of SUTs. Section B provides an overview of the basic identities that need to be satisfied in the SUTs system.

Section C describes different methods of balancing – sequential and simultaneous methods – and a general approach to the investigation and resolution of inconsistencies. Section D describes a step-by-step procedure for simultaneous balancing in current prices and volume terms. Section E describes the benefits of extending the balancing to include the institutional sector accounts, IOTs, PSUTs and EE-IOTs. Lastly, section F provides a list of practical considerations for balancing. These include, for example, the use of automated and manual balancing procedures, the role of balancing in benchmark years and the importance of documenting adjustments to the data. Annex A to this chapter provides a numerical example of how the unbalanced initial SUTs are balanced through a simultaneous balancing process.

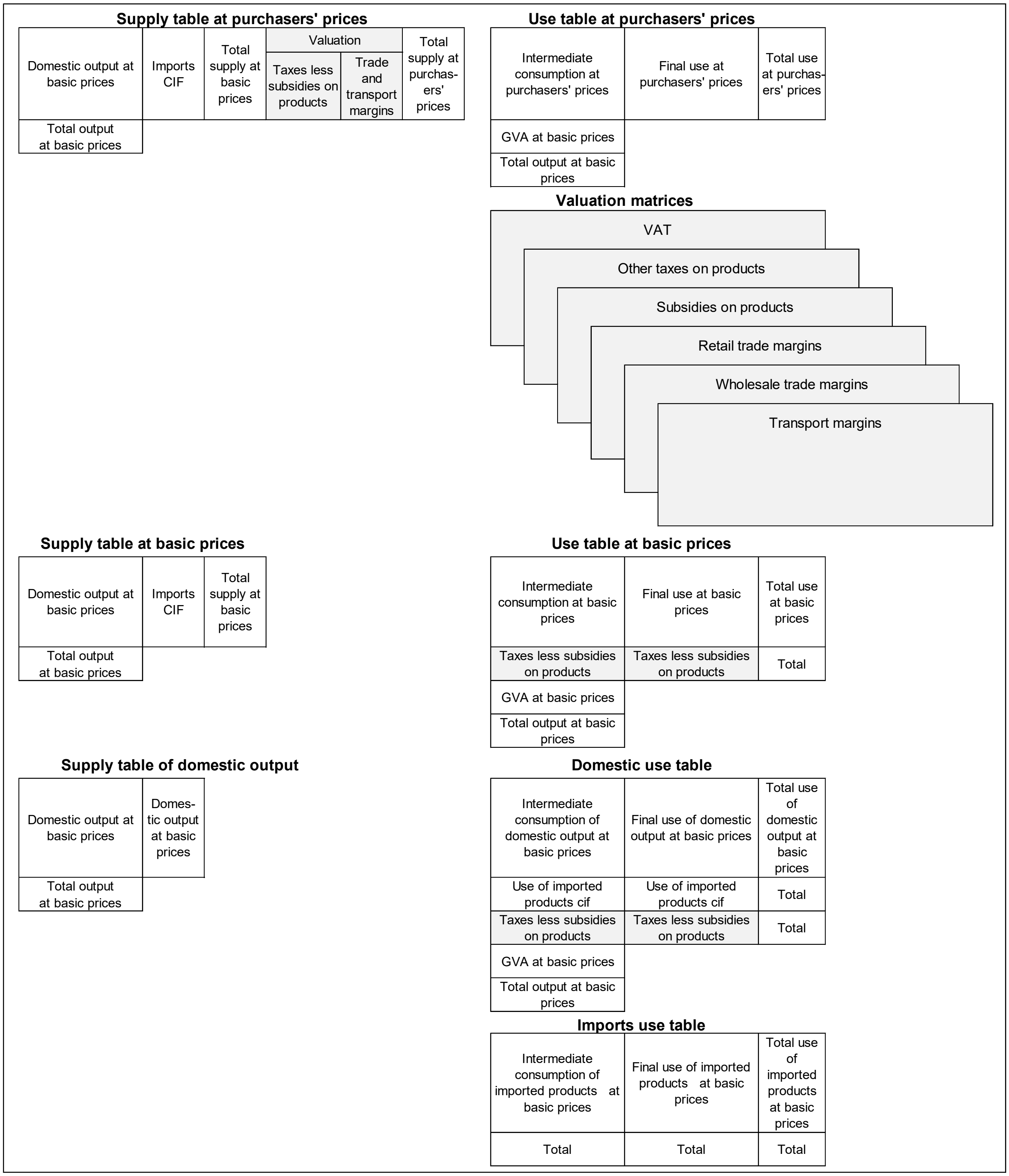
## B. Overview of the system and basic identities

11.7 The balancing starts with a set of tables which consists of the following (in current prices and previous years' prices):

- SUTs at purchasers' prices
- Valuation matrices
- SUTs at basic prices
- Use table at basic prices with a split between the domestic use table and the imports use table

11.8 The full system of SUTs, as presented in figure 2.2 in chapter 2, therefore consists of SUTs both at purchasers' prices and basic prices and a set of valuation matrices bridging the valuation gap between the supply table and the use table, together with the corresponding dimension covering previous years' prices. The use table at basic prices is also split between a table showing uses of domestically produced goods and services (domestic use table) and a table showing the imports of goods and services (imports use table). Although not shown here, the domestic output table at basic prices needs to be split between that for domestic consumption and that for export for the purposes of deflation, as covered in chapter 9. Figure 11.1 shows the full set of tables and matrices irrespective of the price basis. In addition, the IOTs at basic prices, IOTs of domestic output at basic prices and the input tables of imports also play a key feedback role in terms of quality, coherence and consistency (whether through sequential or simultaneous balancing).

**Figure 11.1 Simplified SUTs system**




11.9 In the ideal case, all tables and matrices presented in Figure 11.1 are balanced simultaneously both in current prices (top-down in the scheme and the top left-hand side of the H-Approach) and in volume terms (bottom-up in the scheme and the top right-hand side of the H-Approach). By so doing, it is possible to avoid implausible results such as those showing imports for a product smaller than re-exports (apart from cases when the re-exports have come from inventories) and negative values at basic prices. In addition, the volume and price changes can be judged on plausibility with possible implications for the current price estimates.

11.10 Being an accounting framework, the SUTs have basic identities which are directly linked to the three approaches to measuring GDP. With the inclusion of taxes and subsidies in the SUTs, differences will exist in the identities at the macro (total economy) and the meso (product or industry) level.

### 1. Basic identities of SUTs

#### (a) Supply = use

11.11 The "total supply equals total use" identity must be satisfied for the whole economy (macro level) and also for each product (product level). In the first case, at the macro level, this identity has to be satisfied at purchasers' prices. Total supply at purchasers' prices consists of domestically produced, and imported, goods and services plus taxes on products less subsidies on products. At the macro level, trade and transport margins do not appear separately in this identity because they are part of the output of goods and services at basic prices. Total use consists of intermediate consumption, final consumption of households and government, gross capital formation and exports, which are all valued at purchasers' prices.

11.12 At the product level, the "total supply equals total use" identity is defined both at purchasers' prices and at basic prices. In the first case, the total supply consists of domestically produced and imported goods and services, trade and transport margins plus taxes on products less subsidies on products. The total use consists of intermediate consumption, final consumption, gross capital formation and exports, which are all valued at purchasers' prices.

11.13 In the case of basic prices, the total supply consists only of domestically produced and imported goods and services. The total use consists of intermediate consumption, final consumption, gross capital formation and exports, which are all valued at basis prices. In the basic price case, the trade and transport margins are treated as ordinary services.

#### (b) Output = input

11.14 The "total output equals total input" identity is also defined at different levels: for the whole economy (macro level) and by industry (industry level). For the whole economy, the output is at basic prices and the input consists of intermediate consumption at purchasers' prices and GVA at basic prices.

11.15 At the industry level, this identity is also defined at basic prices. The output is defined at basic prices and the input consists of intermediate consumption at purchasers' prices and GVA at basic prices. The column totals of the valuation matrices appear as separate rows in the SUTs system at basic prices.

### (c) Trade and transport margins "used" = trade and transport margins produced and imported

11.16 In the supply table at purchasers' prices, the trade and transport margins appear in separate columns. These columns provide the total constraint for the relevant valuation matrices. This means that, for each product, the trade and transport margins in the supply table have to be equal to the sum by columns of the relevant valuation matrices (namely, retail trade, wholesale trade and transport margins).

### (d) Value change = volume change x price change

11.17 When the above identities are not satisfied, it is not always easy to discover the causes and, for that reason, it is always helpful to have additional information. For example, incorporating price and volume information helps considerably with identifying and analysing inconsistencies within the SUTs. Preferably, the basic identities referred to above should apply both in current prices and in volume terms. This requirement depends upon the choice of the index formulae. In this case, the combination of the Laspeyres volume index and Paasche price index formula ensures that the identities in this section also hold for the volume terms.

11.18 With the inclusion of volume estimates, the SUTs identities in current prices and in volume terms have to be satisfied, and the less strict relations between variables based on price and volume changes can be judged on plausibility.

11.19 Looking at the industries, it can be seen that the volume change of production is very similar to the volume change of intermediate consumption. This relation is stronger for the output goods and input of raw materials than for services. Nevertheless, when there is a large difference between the two volume changes, this indicates that there may be something wrong in the data and further investigation is advisable.

11.20 When combined with labour data, the volume changes of GVA can be used to calculate changes in labour productivity. It is important to note that the labour data should be calculated on the same basis (for example, using the same statistical unit) as the economic data. This being so, labour productivity is expected to rise gradually every year (except for periods such as the start of a recession). A decrease or a high growth of productivity can also indicate possible mistakes in the data.

11.21 When looking at products in a competitive economy, it is expected that price changes should be more or less the same for all economic agents (except for areas like foreign trade). If the price change of a certain user deviates significantly from the average, this may indicate that something is wrong and further investigation is advisable.

11.22 For household final consumption expenditure, the plausibility of volume changes of products for general use, such as food, can be evaluated comparing them with other indicators such as population growth.

11.23 One optional check would be to view the time series of variables. Sudden breaks in time series can indicate a signal of implausible data in the SUTs. Again, further investigation would be necessary before concluding that adjustments are necessary. For example, the impact of globalization and rapidly changing ways of organizing production processes by enterprises, can lead to justified breaks in time series.

## C. Balancing

11.24 Balancing of the SUTs refers to the iterative process of reconciling differences between the different parts of the SUTs. For balancing, there is no general theory or mathematical programme available enabling the entire process to be automated. There is a clear, controlled role for automated balancing techniques but after, and only after, all the significant imbalances have been resolved manually. In balancing, however, it is very important to follow a systematic approach to problem solving involving basic identities, checks on plausibility and credibility, and the investigation of possible causes of inconsistencies. This section reviews the two main approaches to balancing (sequential and simultaneous balancing) and provides a general guide on how to investigate sources of inconsistency.

### 1. Simultaneous or sequential balancing

11.25 The compilation of SUTs in current prices and in volume terms can be organized in two ways: through a sequential approach whereby the SUTs are balanced first in current prices, subsequently deflated and finally balanced in volume terms; or through a simultaneous approach whereby the SUTs in current prices and in volume terms are balanced at the same time. At the end of the balancing process, the tables in current prices and in volume terms are available and balanced. There are advantages and disadvantages to each approach but, in general, the simultaneous balancing approach is recommended.

11.26 The main advantage of sequential balancing is that it is, in general, less complicated because it is only necessary to deal with values in current prices during balancing and also because there may be a lack of reliable price data at a sufficiently detailed level. The major disadvantage of the sequential approach, however, is that problems encountered while compiling SUTs in volume terms sometimes make it necessary to amend the current price tables that have already been finished, and perhaps even published.

11.27 In general, in the sequential approach, it is preferable to employ an iterative procedure with feedback loops to the SUTs in current prices. Moreover, the SUTs in current prices should not be considered as final until all tables of the SUTs system (including SUTs in volume terms) are checked for coherence and plausibility.

11.28 The main advantage of the simultaneous approach is that it makes it possible to analyse value, price and volume indices in relation to one another. The outcome of the analysis may affect data in volume terms and also current price data. In other words, all three indices must give a plausible picture. This clearly improves the quality of the outcome of the balancing process. It should also be noted that the simultaneous approach can be useful not only in the balancing phase but also in the phase in which basic data are prepared for national accounts purposes. This approach affords an opportunity to check the data by comparing price and volume indices before they are entered in the SUTs system. Simultaneous balancing in current prices and in volume terms may result in a different allocation of adjustments than balancing in current prices only.

11.29 The simultaneous approach requires every transaction of the SUTs to be available, including current prices, deflation detail and prices of the previous year. In order to calculate indices, the system also requires values in current prices of the previous year. For every entry in the SUTs, three values must be available:

- Value for year *t* in prices of *t-1*
- Value in current prices for year *t-1*
- Value in current prices for year *t*

11.30 Figure 11.2 illustrates the above configuration, presented in the form of what might be termed a "six-pack".

**Figure 11.2 Six-pack**

| Description | Data | Description | Data |
|---|---|---|---|
| *t* at current prices | 525 | Price index | 102.9 |
| *t* in prices of *t-1* | 510 | Volume index | 102.0 |
| *t-1* at current prices | 500 | Value index | 105.0 |

11.31 The six-pack table can be used by compilers of national accounts and SUTs to cross-check consistency of data – analytical tools should ensure that such analyses are readily available to aid validation and balancing. Although the results in current prices may at first sight look plausible, an analysis of the volume and price data can show implausible results and lead to adjustments in the current price data. It is important to check the comparison between changes in the volume of output by industry, its intermediate consumption and GVA. When prices are changing rapidly it is particularly evident that analysis in volume terms is to be preferred, for example, in the oil and chemical industries.

11.32 One major advantage of the simultaneous approach is that it provides an opportunity to analyse value, price and volume indices in relation to one another, and the impact of any adjustments on all items of the six-pack immediately, in terms of plausibility, including the impact on macro and meso economic aggregates, such as GDP and GVA by industry.

## 2. Balancing: investigative dimension

11.33 In general, an effective way to approach the balancing process is to investigate the inconsistencies in the SUTs in a systematic manner. The first step would be to select the major inconsistencies. The second step would be to carry out a critical search for results of data processed in compiling the national accounts. With regard to the use table in particular, the main items are the result of partitioning source data into product groups. The allocation may be changed without altering the original aggregates. In practice, it is apparent that not all problems can be solved in this way. The third step would be to consult the expert knowledge of the statistician who is compiling the source statistics. If major inconsistencies still remain, the fourth step would be to contact the reporting company and have a critical discussion regarding the data that it has provided.

11.34 The balancing is driven by two linked underlying themes: the reconciliation of estimates of industry GVA between the income-based and production-based approaches; and the reconciliation of supply and use for each product, essentially through the matching of production and expenditure. As all the components of production, income and expenditure are integrated within a single framework, when the identities are reconciled, the estimates based on the three approaches will be equal.

11.35 It should be noted that these reconciliations must also ensure that consistency and coherence over time is achieved. For example, consistency over time of individual series, both within the SUTs and in suppliers' own detailed series; consistency over time of aggregated series; consistency of estimates in current prices, estimates in volume terms and the implied deflators, both at the aggregate and component level; and consistency in terms of growth rates and levels.

11.36 When assessing these aspects, the impact of revisions to earlier years and the quality of the relative data sources should also be taken into account.

11.37 It should be noted that, during the balancing, the basic identities of SUTs in current prices and, if applicable, in volume terms, must be satisfied and that the values in the SUTs are consistent and plausible, providing a coherent set of price and volume changes. In a set of balanced SUTs, the identities of the framework are satisfied as well as less strict plausibility relationships, such as the volume change of output of goods resembling the volume change of intermediate consumption. Through the process of balancing, the detection of inconsistencies and implausibilities, on the one hand, and the identification of their causes, on the other, forms the most important part of the exercise. With this knowledge, the resolution of any inconsistencies is much more straightforward.

11.38 Any difference between the total supply and total use of any product points to an inconsistency in the system, and forms the start for a balancing procedure in the cause should be sought by:

- Analysing the transformation of source data and the validity of assumptions made (see the various compilation chapters)
- Analysing the underlying source data, if necessary, at the unit level
- Discussing the data with experts in the respective areas or even survey respondents
- Analysing the data in the form of time series
- Carrying out a number of credibility checks, for example, of the following:
  - GVA to total output ratios, while recognizing that activities such as processing require careful consideration
  - Changes in the composition of GVA weights
  - Taxes on products, trade and transport margins as a proportion of the supply and use of products
  - Search for outliers in price and volume ratios (if applicable)
- Comparing data with other data sources (which are not from the statistical office or central bank), for example qualitative and quantitative sources covering specific industries or products such as company reports, regulatory reports, trade association analysis, and others
- Comparing and reconciling inconsistencies between different survey data sources providing different estimates for the same or similar variables (for example, turnover from monthly sources compared with audited annual sources)
- Using other proxy indicators to facilitate the identification of plausible SUTs variables, for example, VAT-based indicators to compare with GVA and turnover
- Analysing related volume ratios for variables such as output and intermediate consumption

11.39 Working with statistical data based on sample surveys and questionnaires, and influenced by, among other things, non-response type issues, involves working with reliability margins (for each cell), so there will inevitably be inconsistencies. The cause would then be a statistical measurement issue. In such a case, balancing could be automated using the reliability margins of the statistics concerned as weights. Some of the methods of automated balancing described later in this chapter are based on this principle.

11.40 Statistics, however, are never ideal and inconsistencies are not only caused by sampling and other such activities, but may be caused by issues that are of a non-statistical nature. It is the sources of these inconsistencies that make manual balancing essential, as a preliminary step towards any form of automated balancing.

## 3. Examples of causes of data inconsistencies

11.41 There could be several reasons for data inconsistencies and they can arise at various stages of the collection and processing of data. Some of the inconsistencies that are frequently encountered in the compilation of SUTs are presented below.

### (a) Inconsistencies in data at the unit level

11.42 For the collection of data on sales and purchases, most statistical units such as enterprises, establishments or kind-of-activity units are defined. These consist of sets of legal units. In the simplest case, the statistical unit is the same as the legal unit but often the statistical unit consists of more than one legal unit. Having a well-defined statistical unit does not necessarily mean that it corresponds, for example, to tax units used by the company concerned for its tax declaration or to the level of consolidation in the bookkeeping. Where the reporting unit uses their bookkeeping or tax records, the reporting unit is not likely to be the same as the statistical unit. This can lead to data missing from certain legal units or even double-counting. This risk increases when data are collected by different agencies, for example, the national statistical offices, national central banks and the tax authorities.

11.43 Another ever-increasing and widespread cause of inconsistencies is the impact of globalization, reflecting issues such as production abroad and the trade flows associated with intellectual property products, together with the impact of any change – or lack of change – of economic ownership. When the unit in a country is the economic owner of all goods and services purchased and sold, it will report its worldwide activity in business statistics, even when the goods concerned never enter the country of residence of the unit. On the other hand, foreign trade statistics on goods are based on goods crossing borders, so data on goods that never enter the country of residence of the unit will be missing. In this case, there is an inconsistency between business statistics and foreign trade statistics, both of which serve as a source for the SUTs system. The Guide to Measuring Global Production (UNECE, 2015) provides extensive detail on how to handle these types of issues.

11.44 Examples of other causes of inconsistencies at the unit level are mismatches and mistakes. One example of a mismatch is the difference between the calendar year and the bookkeeping year, where for a significant number of units the bookkeeping year differs from the calendar year used in the national accounts (and other annual statistics). Entering the bookkeeping data in the questionnaire causes inconsistencies in the SUTs when these data are confronted with other statistics.

11.45 The survey questionnaires for business statistics are designed in such a way that data covering different branches can be compared and added together. The needs of users like national accounts require specific definitions of variables in the survey questionnaires, which cannot always be derived directly from bookkeeping records. When respondents use their own definitions of variables, this may also cause inconsistencies in the SUTs.

11.46 When detailed information on such variables as output and intermediate consumption is sought via survey questionnaires, it is possible that respondents may allocate products to the wrong CPC product code, with the result that the contents of product codes in the SUTs are no longer comparable.

11.47 Last but not least, a business can provide incomplete data. If, for example, data on changes in inventories are lacking, the transformation from either sales to output or purchases to intermediate consumption cannot be made. This will in turn also affect GVA and GDP.

### (b) Inconsistencies in processing survey data

11.48 The processing of collected micro data into subject matter statistics can create inconsistencies. Although procedures for grossing up are routine, the target population is less straightforward. An important issue in this regard is linked to the updating of the business register and the consequence of correctly identifying active or non-active units during the reporting period. A further related issue is the detection and treatment of outliers.

11.49 Small enterprises are often given less detailed survey questionnaires, making it necessary to break down the aggregated variables to the level of detail required of large enterprises. The assumptions made for this calculation may be incorrect. The same holds for the breakdown of variables from business statistics to the product classification used in the SUTs. For the compilation of valuation matrices, the trade and transport margins and taxes and subsidies on production must be allocated to the various users (industries and final consumption categories). If scant detailed information is available, then a range of assumptions is applied, and these may also lead to inconsistencies, in particular in the SUTs at basic prices.

11.50 Another potential cause of inconsistencies is the coverage of the hidden and informal economy. When no estimates for the hidden and informal economy are included in the SUTs, or where those estimates are insufficient, then inconsistencies will arise. When, for example, consumers buy a beer in a bar, they usually do not know whether it is, economically speaking, an "illegal" (for example, smuggled) or a "legal" beer, meaning that it is reported in household consumption, while the "illegal" beer will not be recorded in business statistics.

### (c) Inconsistencies in volume data

11.51 Deflating SUTs data can itself generate inconsistencies in the SUTs in volume terms. As most price index numbers based on observation are Laspeyres indices, inconsistencies result when work is carried out at a level of aggregation above the observation of the price data. The observed price data often do not keep account of discounts, bulk purchases and negotiated prices (in particular in business-to-business sales or business-to-households sales), with the result that they do not always match the actual value of the transactions. The impact is due less to the different prices paid than to the changing weights on price changes. In addition, if the discount bulk purchases and other such items are stable and form a constant share over time, there is little impact.

In the process of balancing the full SUTs system, the implicit price indices resulting from the SUTs system must be reconciled with the observed indices, such as the CPIs and PPIs by specific products.

## 4. Reliability of data in the unbalanced SUTs

11.52 One important and very useful step to be taken before starting the balancing process is the assessment of the reliability and quality of the data in the unbalanced SUTs. In general, less reliable data will, and should, be adjusted to a relatively higher degree. It should, however, be borne in mind that even weaker estimates cannot endlessly absorb inconsistencies; for example, positive changes in inventories for a product for a large number of consecutive years are implausible or generate implausible ratios or movements in ratios, for GVA as a proportion of output or trade margin as a proportion of domestic output at basic prices.

11.53 The quality of the estimates will influence the role that the variable will play in the balancing process of the SUTs. Some variables are predetermined when entered directly into the system and kept at their original value throughout the entire balancing process; for example, data on taxes and subsidies which are directly derived from government administrative data sources and data derived from exhaustive sources (such as regulatory sources).

11.54 A perfect sample with a 100 per cent response rate can still generate inconsistencies. Although such source statistics can be judged as very reliable, they may still be adjusted in the balancing process. Estimates using models, for example fixed input structures based on the previous period, expert guesses, use of data for the previous period, and others, are likely to be adjusted earlier in the balancing process.

11.55 A ranking of the reliability of estimates for entries and aggregates in the SUTs should always be borne in mind, in particular in the manual balancing phase. This ranking information is an essential input for any automated balancing procedures and is covered later in this chapter.

11.56 Box 11.1 and Box 11.2 provide two examples illustrating the simultaneous balancing process. With each example it is very important to have details on the reliability of the data before starting to look for a solution or implementing any adjustments.

11.57 Box 11.1 illustrates a situation where the discrepancies are balanced in current prices and in volume terms. The value, price and volume analysis can lead to adjustment of any of the estimated variables. Sometimes the results can be checked using observed quantity data, which are also available for the supply and use of energy products. Another possible check in the simultaneous approach is the ratio of the volume of GVA to the input of labour.

11.58 The example in Box 11.2 shows that the comparison of volume indices of the main supplier and the main user offers one solution for a balancing problem.

## Box 11.1 Example of discrepancies balanced in current prices and in volume terms

The price and volume changes of domestic production and exports can be compared in the simplified example below (there is need to accept possible inconsistencies between the price indices from the supply and use sides in the use of a simplified example). This example, for demonstration purposes only, excludes margins, taxes, subsidies and imports. The supply minus use shows the discrepancies between supply (domestic production) and use (exports and by other users) in current prices and in volume terms.

| | Supply minus use | Domestic production | Exports | Other uses | | Domestic production | Exports | Other uses |
|---|---|---|---|---|---|---|---|---|
| Value *t* in current prices | -10 | 525 | 420 | 115 | Price index | 102.9 | 100.0 | 103.6 |
| Value *t* in prices of *t-1* | -21 | 510 | 420 | 111 | Volume index | 102.0 | 105.0 | 111.0 |
| Value *t-1* in current prices | 0 | 500 | 400 | 100 | Value index | 105.0 | 105.0 | 115.0 |

In this example, there is a discrepancy both in current prices and in volume terms. The first step is to get an idea about the reliability of the data. In this case, data on both domestic production and exports in current prices are considered to be very reliable. Thus, a sensible solution would be to adjust "other uses". If the price index (102.9) is considered to be correct, the adjustment should be made both in current prices and in volume terms. This results with the following situation.

| | Supply minus use | Domestic production | Exports | Other uses | | Domestic production | Exports | Other uses |
|---|---|---|---|---|---|---|---|---|
| Value *t* in current prices | 0 | 525 | 420 | 105 | Price index | 102.9 | 100.0 | 102.9 |
| Value *t* in prices of *t-1* | -12 | 510 | 420 | 102 | Volume index | 102.0 | 105.0 | 102.0 |
| Value *t-1* in current prices | 0 | 500 | 400 | 100 | Value index | 105.0 | 105.0 | 105.0 |

The discrepancy in current prices has been eliminated but, in volume terms, a discrepancy remains. Assuming that the figures for the price of domestic production are reliable, and that the difference between the volume index of domestic production and exports should not be too large, then the balancing results in an adjustment of the price of the export and a minor adjustment of other uses.

| | Supply minus use | Domestic production | Exports | Other uses | | Domestic production | Exports | Other uses |
|---|---|---|---|---|---|---|---|---|
| Value *t* in current prices | 0 | 525 | 420 | 105 | Price index | 102.9 | 102.7 | 104.0 |
| Value *t* in prices of *t-1* | 0 | 510 | 409 | 101 | Volume index | 102.0 | 102.3 | 101.0 |
| Value *t-1* in current prices | 0 | 500 | 400 | 100 | Value index | 105.0 | 105.0 | 105.0 |

## Box 11.2 Example of simultaneous balancing comparing volume indices

Large discrepancies between volume changes of the main user of important raw materials and volume changes of the main supplier (for instance imports) are an indication for inconsistent data.

| | Supply minus use | Domestic production | Imports | Main user | Other uses | | Domestic production | Imports | Main user | Other uses |
|---|---|---|---|---|---|---|---|---|---|---|
| Value *t* in current prices | 0 | 50 | 468 | 426 | 92 | Price index | 100.0 | 104.0 | 100.0 | 100.0 |
| Value *t* in prices of *t-1* | -18 | 50 | 450 | 426 | 92 | Volume index | 100.0 | 100.0 | 103.9 | 102.2 |
| Value *t-1* in current prices | 0 | 50 | 450 | 410 | 90 | Value index | 100.0 | 104.0 | 103.9 | 102.2 |

In this example, no discrepancy between supply and use in current prices is assumed. The value indices of imports and the main user are both plausible: 104.0 and 103.9 respectively. Analysis reveals, however, that volume indices of imports and the main user differ: 100.0 versus 103.9, which is not plausible. Further analysis is necessary to find the solution for this balancing problem. It is not inconceivable that the value in current prices also needs to be adjusted.

### 5. Documentation

11.59 Many decisions leading to corrections, adjustments and subjective estimates are entered by the balancers, and these may provoke a struggle when referred to other statistical and available sources or when common sense considerations are taken into account. Thus, it is important that the considerations and rationale behind the solutions implemented are visible to other balancers, and the solutions are sustainable and can be reproduced if the same problems are encountered in subsequent years. Such corrections should be recorded in a systematic way.

11.60 It is also important to record separately the steps and links between the source data through to the balanced data so that they can be reviewed in subsequent balancing exercises to investigate source data incoherence, bias and other such factors (Mahajan and Penneck, 1999). For example:

> **National accounts source data** (covering business survey data, household survey data, census data, administrative based data, extrapolations and models (for example, PIM, FISIM), company accounts based data, etc.)
>
> plus coverage (including exhaustiveness) adjustments
> plus conceptual adjustments
> plus quality (data validation) adjustments
> plus balancing and coherence adjustments
>
> equals **national accounts final estimates** on 2008 SNA basis

11.61 Balancing adjustments can, and should, be part of a process table describing the steps taken from the source statistics to the final estimates in the balanced SUTs. If the balancing adjustments are recorded in a systematic manner, they can point to flaws in source statistics or even a bias in the balancing process itself. Again, the feedback loop can be powerful in that suppliers of source data can improve survey questionnaires, data collection, data processing, and other processes, thus cumulatively improving the quality of the national accounts estimates.

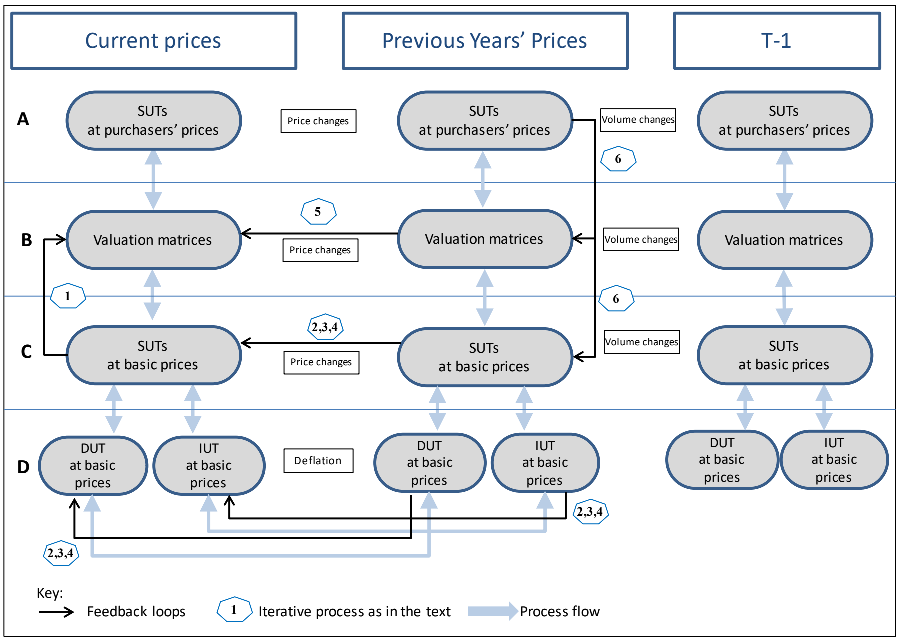
## D. Step-by-step procedure for simultaneous balancing

11.62 This section sets out a step-by-step process for the simultaneous balancing of SUTs in current prices and in volume terms. The process presented below relies on a sequence of tables which starts from the SUTs at purchasers' prices, valuation matrices, SUTs at basic prices, and the domestic use table and imports use table at basic prices. An alternative sequence could be to split the SUTs at purchasers' prices into the domestic use table and imports use table at purchasers' prices. Nevertheless the latter is not a commonly used sequencing of tables and the first is the recommended approach to the compilation of SUTs.

11.63 Figure 11.3 provides a flowchart showing how to carry out the balancing of SUTs indicating what types of balancing are performed at each step. Note that balancing is an iterative process, so the figures shows a number of feedback loops that need to be carried out in order to arrive at a final set of balanced SUTs in current prices and volume terms.

11.64 At the start of the balancing process, an estimate is available for all entries in the full SUTs system both in current prices and in volume terms. In combination with balanced and fixed data of the previous year, volume changes can then be compiled. The balancing effort starts by checking all the inconsistencies and implausible estimates in the system. This is summarized in the sequence of steps below.

**Figure 11.3 Overview of the SUTs balancing framework for simultaneous balancing**




## (a) Differences between supply and use of products at purchasers' prices in current prices

11.65 These types of checks are represented in current prices in part A of Figure 11.3. Differences between the supply and use of products at purchasers' prices in current prices point towards inconsistencies, possibly caused by data processing with national accounts (for example, transformation to national accounts definitions and requirements) or by inconsistencies in observed data (for example, as a result of the impact of globalization).

## (b) Unwanted negative entries in the SUTs at basic prices: parts B and C in current prices

11.66 These types of checks are represented in current prices in parts B and C of Figure 11.3. The unwanted negative entries in the SUTs at basic prices can be caused by mistakes in the calculation of the valuation matrices, which would lead to a recalculation of these matrices. This is a process that should be continued until all unwanted negatives are eliminated and the valuation matrices look plausible. There are cases, however, where negative entries are plausible in areas such as changes in inventories or exports of goods (for example, merchanting). This step forms the first key iterative process of balancing the SUTs system (heptagon 1 in the figure).

**(c) Differences between supply and use of products at basic prices in current prices**

11.67 These checks are represented in current prices in part C of Figure 11.3. These differences will point towards inconsistencies of the type covered in subsection (a) above, due to issues such as data processing inconsistencies in observed data.

**(d) Inconsistencies between domestic supply and use of products from domestic origin and use of imported products in current prices**

11.68 These checks are represented in current prices in part D of Figure 11.3. The use table is initially split into the domestic use table and imports use table independently of the supply table. Thus there may be inconsistencies at the product level such as, for example, the value of exports being larger than the value of domestic supply or the value of re-exports larger than the value of imports. In these cases, values need to be adjusted. The breakdown of the supply of domestic and imports in the supply table can also be used to inform the split between the domestic use table and imports use table.

**(e) Differences between the supply and use of products at basic prices in previous years' prices**

11.69 These checks are represented in previous years' prices in parts C and D of Figure 11.3. When starting with balanced SUTs in current prices, the differences between supply and use of products in volume terms point towards inconsistencies in the applied price indices; for example, failure to deflate domestic output and exports separately or failure to use an appropriate weighted average. Furthermore, there may be weaknesses in the PPIs regarding details on discounts, bulk purchases and negotiated prices which can also cause inconsistencies. In addition, the use of a Laspeyres-type index can also play a role in generating inconsistencies.

11.70 These checks can also reveal errors in the SUTs in current prices. In this case, the SUTs in current prices need to be rebalanced. This forms the second key iterative process in balancing the full SUTs system (heptagon 2 in the figure).

**(f) Plausibility of volume changes of output and intermediate consumption**

11.71 These checks are represented in current prices in part C of Figure 11.3, comparing the SUTs in previous years' prices and the SUTs for period t-1. When combined with previous years data, the deflated SUTs at basic prices in previous years' prices provide a framework for judging the volume changes of output, intermediate consumption and GVA at the industry level. Implausible results will need adjustment of the estimates in volume terms, and if necessary, the current price estimates in the SUTs. This forms the third iterative process in balancing the SUTs system (heptagon 3 in the figure).

**(g) Plausibility of changes in labour productivity**

11.72 These checks are represented in part C comparing the SUTs in previous years' prices and the SUTs for period t-1 in current prices in Figure 11.3. As with the changes in volume of output and intermediate consumption, the changes in labour productivity can be used to assess the plausibility of the resulting GVA in volume terms at both the macro level and the industry level. Implausible results will require adjustment of the estimates in volume terms, and if necessary, the estimates in current prices in the SUTs. This forms the fourth iterative process in balancing the SUTs system (heptagon 4 in the figure).

***(h) Confrontation of implicit price indices of valuation matrices and observed PPIs and changes in tariffs***

11.73 These checks are represented in part (B) in Figure 11.3, confronting the valuation matrices for period t in current and previous years' prices. The volumes for the valuation layers are calculated by applying the rates of the previous year to the estimates in volume terms. Therefore, for all entries of the valuation matrices, implicit prices can be compiled. If available, observed producer prices indices can be compared with these implicit prices indices. It is likely that there will be possibilities for a data confrontation for specific areas, for example, transport services. For taxes and subsidies linked to the value of the transaction concerned (for example, VAT), the changes in tariffs can be used to assess the plausibility of the implicit prices. Implausible results will need adjustment of the estimates in volume terms, and if necessary, the current price estimates in the SUTs. This forms the fifth iterative process in balancing the SUTs system (heptagon 5 in the figure).

**(i) Confrontation of implicit purchasers' price indices resulting from calculation and observed purchasers' price indices such as the CPIs**

11.74 These checks are represented in in current prices and in previous years' prices in part A of Figure 11.3, confronting the SUTs for period t. The SUTs in volume terms at purchasers' prices are compiled as the sum of the SUTs at basic prices and the valuation matrices (all in volume terms). When the SUTs at basic prices are balanced, the SUTs at purchasers' prices are by definition also balanced. At this point in the balancing process, a confrontation of observed purchasers' price-type indices such as the CPI and the calculated implicit purchasers' price indices may show that the latter may be implausible, while accepting that they should not be the same. If there are significant differences, then the estimates in volume terms of all underlying component tables (the valuation matrices, and the SUTs at basic prices) may need to be reconsidered. This forms the sixth iterative process in balancing the SUTs system (heptagon 6 in the figure).

### (j) Overall assessment of the second order effects of balancing steps (a)–(i)

11.75 Through the balancing procedure, the trade and transport margins are very likely to be adjusted as a result of manual and automated corrections. As a consequence, the total use of trade and transport margins will probably not equal the total supply, even if they were in balance in the initial version of the system, and will need to be constrained.

11.76 Similarly, VAT should be recalculated based on the adjusted results in the use table. The total of non-deductible VAT which is the result of the balancing procedure cannot be expected to be an exact match for the VAT receipts based on government accounts. If official rates and tax legislation alone are used in the calculations, the computed VAT total will normally exceed the target; this is closer to the concept of theoretical VAT as opposed to cash-collected VAT (on an accrued basis). To be realistic, however, the model used to estimate VAT should take into account the expected patterns of tax evasion by keeping account of various issues like the hidden economy. Nevertheless, the total estimated VAT will not necessarily equal the government data, so final corrections will be needed. It may be preferable to adjust VAT proportionally in specific columns, where the exact share of VAT liable is uncertain. A final proportional adjustment of VAT on many products, most likely to be household final consumption expenditure, can be used to eliminate the remaining difference.

11.77 One important final check is to ensure that the resulting effective (and implied) tax rates do not exceed the legal rates, for example, the standard rate of VAT.

## E. Alternative balancing methods

11.78 The ideal balancing scenario covered in the previous section based on the H-Approach consists in simultaneously balancing SUTs at basic prices and at purchasers' prices both in current prices and in volume terms. This balancing is data demanding and the choice between simultaneous balancing and any other variation of balancing methods depends heavily upon the availability of data, human resources and information technology systems. If the ideal scenario is not possible, then alternatives can be considered such as, for example, balancing the SUTs at purchasers' prices and balancing at basic prices or prioritizing them or launching an iterative process with feedback loops.

11.79 The choice made among the alternative scenarios will have various consequences, in particular for the use of price indicators. In the ideal scenario, the price indicators optimally match the SUTs being deflated in terms of underlying flows and valuations. Diversion from the ideal scenario will require additional compilation, assumptions and approximations in the use of price indicators.

### 1. Balancing SUTs at basic prices

11.80 Assuming that the balancing process is not ended before all components of the full SUTs are checked for plausibility, the balancing at basic prices only provides a close approximation to the ideal scenario.

11.81 Balancing at basic prices requires stripping out the trade margins, transport margins, taxes on products and subsidies on products from the initial current price use table at purchasers' prices. The deflation of the SUTs then takes place at basic prices, with the application of PPIs and import prices for the supply table and a weighted average of those indicators for the use table. Weights could be derived from the domestic use table and imports use table of the previous year. When the SUTs are balanced both in current prices and in volume terms, the volume changes of the valuation matrices can be compiled, applying the volume changes of the corresponding entries of the use table.

11.82 Subsequently, the SUTs at purchasers' prices including non-deductible VAT, can be derived both in current prices and in volume terms. The resulting price indices can be checked for plausibility with observed indices on household consumption (for example, the CPIs) and export price indices as in the ideal scenario. The price indices resulting from the sequentially compiled domestic use table and imports use table can also be checked for plausibility with the observed PPIs and import price indices.

### 2. Balancing SUTs at purchasers' prices

11.83 Balancing at purchasers' prices requires a very different approach for a number of entries in the SUTs, and in general, more approximations and assumptions because of the lack of appropriate price indices, in particular for those cases where trade and transport margins play a substantial role. As a first step, non-deductible VAT may have to be stripped out from the initial use table, which includes VAT (this step may often be carried out in the preprocessing of source data for the SUTs).

11.84 As the supply table is valued at basic prices, the deflation for this part will be similar to the ideal scenario applying PPIs, import price indices or other appropriate indicators.

11.85 The compilation of the volumes of trade margins, transport margins, taxes on products and subsidies on products using this balancing approach will be performed at an aggregate level. If applicable, at this stage, only the total trade margins, transport margins, taxes on products and subsidies on products for each product are included in the system as part of the bridge columns between the supply table and the use table. In order to compile the volume changes, the volume change of the underlying aggregated flows must be determined. For an accurate estimate of the volume index of the valuation layers, it is therefore very important to determine which part of the supply or use of a product is liable to this valuation layer. For example, the retail trade margins are mainly linked to household final consumption expenditure.

11.86 For deflation of the use table at purchasers' prices (excluding the deflation of VAT), price indicators are required other than those applied in the ideal scenario in particular for intermediate consumption of goods and services and gross fixed capital formation, where the ideal price indices are often not available and must be replaced by proxies. More details may be found in chapter 9.

## F. Extending the balancing of SUTs to include institutional sector accounts, IOTs, PSUTs and EE-IOTs

11.87 The previous section describes a process for a simultaneous balancing of SUTs at basic prices and purchasers' prices both in current prices and in volume terms. It therefore focuses on balancing within a SUTs system, even though the compilation of SUTs is not seen here as a separate and isolated exercice from the compilation of the national accounts and from the compilation of IOTs, PSUTs, EE-IOTs or other satellite accounts that may also be compiled. . This implies that the balancing process has to be extended to ensure a coherent and consistent integration of SUTs with the national accounts (namely, intitutional sector accounts) and related products (for example, IOTs, PSUTs and EE-IOTs).

11.88 The balancing of SUTs can be extended to include additional accounts either in a simultaneous or sequential manner. There are clear benefits in this extended balancing due to the additional feedback loops which would eventually lead to further improvements in the quality of the SUTs, and also the other products in terms of consistency, coherence and integration. Thus, in general, it is recommended that the balancing be extended to include the features outlined in the following subsections.

### 1. Institutional sector accounts

11.89 Together with the SUTs, the institutional sector accounts lie at the core of the national accounts. The sector accounts provide an overview of the various economic activities covering production, consumption, generation of income and distribution of income, accumulation of wealth and relations with the rest of the world. The SUTs and institutional sector accounts thus have several variables in common such as output, intermediate consumption, GVA and its components linked by industry and by institutional sector. Analysing and balancing SUTs and the institutional sector accounts can point to implausible data in SUTs, suggesting the need for a rebalancing of the SUTs, for example highlighting classification issues or showing where cells should have zero or non-zero entries.

11.90 Like the SUTs system, the institutional sector accounts constitute a balancing framework consisting of a set of well-defined variables and a number of basic identities. For the total economy, the production account and the generation of income account are in fact an aggregate of the domestic production part of the SUTs without the dimensions products and industries. One-to-one links exist for production, intermediate consumption and GVA. In addition, compensation of employees is directly linked to the SUTs system. Other macroeconomic variables with a strong link to SUTs and institutional sector accounts include household and government consumption (use of disposable income account), and fixed capital formation (capital account). Lastly, taxes and subsidies on products and other taxes on production appear in both systems.

11.91 From a conceptual point of view, the links between SUTs and institutional sector accounts are strong. In statistical practice, however, it is not always easy to transform industry data on production into institutional sector data and vice versa. For that purpose, a set of tables is constructed with a dual classification. In this table the transactions are classified by industry (SUTs) and by institutional sector (sector accounts) (see the linking table in chapter 10).

11.92 The SUTs are the most developed and detailed framework use for the estimation of GDP and other macroeconomic variables in the scope of production, consumption, gross capital formation, exports, import, and income. The three approaches to measuring GDP are combined in one system based on a great variety of source data which are confronted and compared with one another in order to find possible causes of inconsistencies. The high reliability, strengths, and quality of SUTs estimates ensure that they have a strong influence on the sector accounts. It could be said that, in the main, there is a one-way traffic between SUTs and institutional sector accounts, but the use of dual classification provides possibilities for feedback in both directions. For the time being, feedback is limited because the level of aggregation in the institutional sector accounts is very high, making it difficult to trace back inconsistencies and implausible results on a sector level to specific industries in the SUTs system.

11.93 When GVA by industry from the production approach is available, it should be balanced against the GVA from the income approach for the corresponding industry, linking the factor incomes and the institutional sectors. This link is extremely important between the industry accounts and the institutional sector accounts, as illustrated below:

(a) For each industry, using the production approach:

Total output at basic prices

| | |
|---|---|
| less | total intermediate consumption at purchasers' prices |
| equals | GVA at basic prices (production approach) |

(b) For the corresponding industry, using the income approach reflecting the different factor incomes:

Self-employment income (mixed income and quasi-corporations)

| | |
|---|---|
| plus | gross trading profits of private financial corporations |
| plus | gross trading profits of private non-financial corporations |
| plus | gross trading surplus of public corporations (financial and non-financial) |
| plus | rental income |
| plus | non-market consumption of fixed capital |
| less | holding gains and losses |
| less | intermediate consumption of FISIM |
| plus | other taxes on production and imports |

less other subsidies on production
equals GVA at basic prices (income approach)

11.94 Note that, for each of the factor income components shown in (b), there is an institutional sector breakdown.

11.95 The approaches shown in (a) and (b) bring together within the SUTs framework a range of data from sources such as administrative data and business surveys, and this, when balanced, ensures a better quality estimate first of GVA by industry, then for the whole economy GVA, and hence GDP and GNI.

11.96 The full breakdown in (b) in terms of data may not be available by detailed industry (and by institutional sector) for a range of reasons. The minimum that should be incorporated in the SUTs compilation and balancing process is covered in (c) below:

(c) Gross operating surplus
plus compensation of employees
plus other taxes on production and imports
less other subsidies on production
equals GVA at basic prices (income approach)

11.97 It should be noted again that, for each component shown in (c), there is an institutional sector breakdown.

## 2. IOTs

11.98 The links between the SUTs and IOTs in the bottom left-hand side and right-hand side of the H-Approach have been covered through the links to the separation of imports of goods and services and valuation matrices needed to produce the SUTs at basic prices and the SUTs in volume terms, and then in turn, the IOTs.

11.99 Integrating the production of IOTs with the production and balancing of SUTs makes possible the effective and timely use of powerful feedback loops in indicating data problems within the SUTs or with the steps transforming SUTs to IOTs. For example, addressing negative cell entries in the IOTs can improve the quality of the SUTs. It is recommended that IOTs should be produced (simultaneously or sequentially) alongside SUTs rather than at a much later stage or even less frequently than the SUTs.

## 3. PSUTs and EE-IOTs

11.100 The links with the PSUTs and EE-IOTs are of a different nature because the transactions in the physical SUTs are expressed in other units (for example, kilograms, terajoules, and others) or are more detailed in terms of industries and products. The balancing of PSUTs and EE-IOTs in combination with SUTs and IOTs is described in chapter 13.

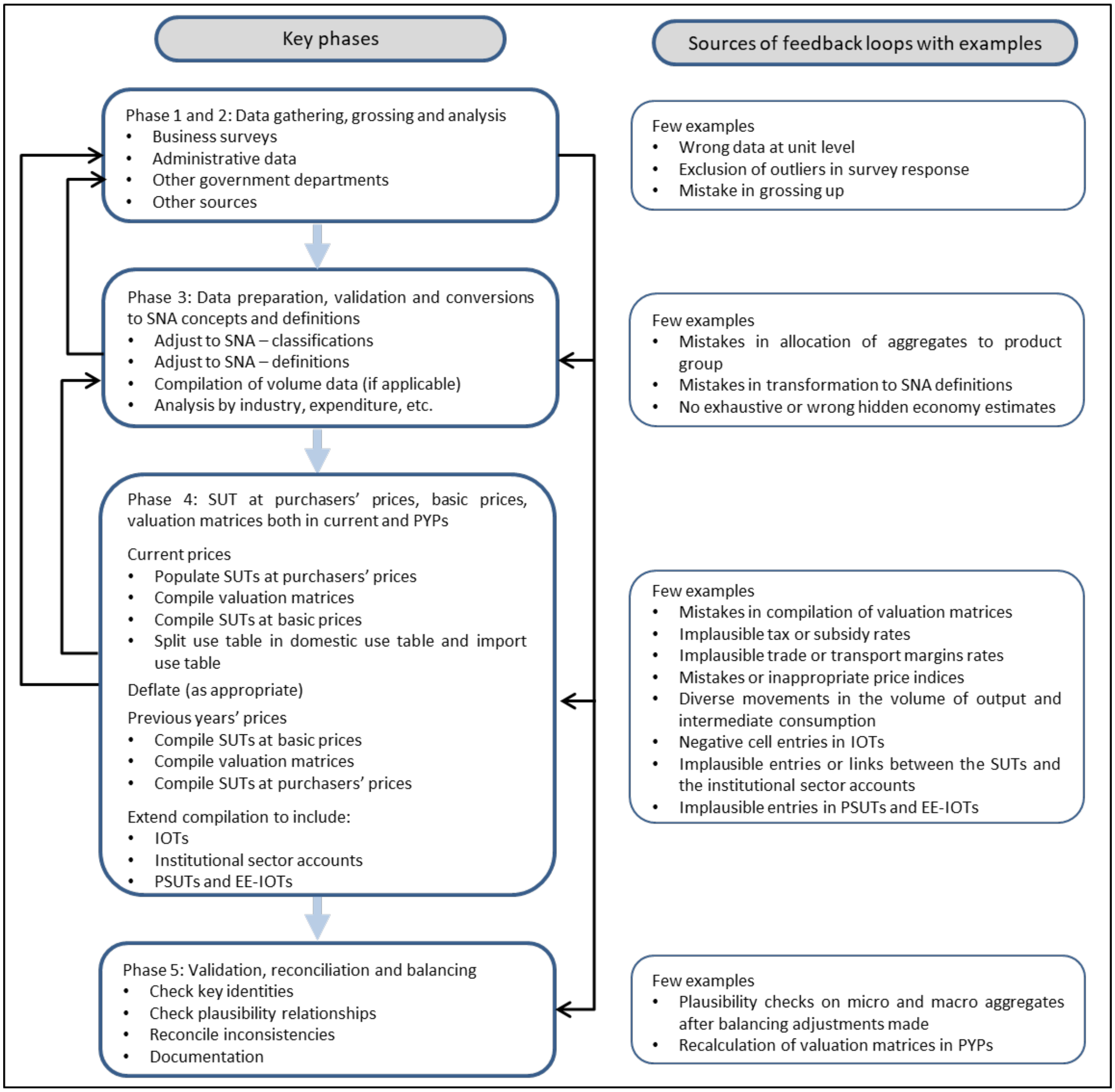
## 4. Key feedback loops generated by the balancing process

11.101 In the ideal scenario, all balancing is performed simultaneously, implying that all feedback loops are part of an integrated process. This includes the feedback loops within the SUTs process together with the loops going back to earlier steps in the full statistical process chain.

11.102 Figure 11.4 illustrates key feedback loops that can be generated from within the balancing process as well as examples of the sources of the feedback loops.

11.103 When the balancing is extended to cover IOTs, the links to the institutional sector accounts, PSUTs, EE-IOTs, and other satellite accounts, there will be more feedback loops that become available than are shown in Figure 11.4, and, in turn, each adds a further data quality improvement dimension.

**Figure 11.4 Sources of feedback loops emanating from the balancing process**




## G. Practical aspects of balancing

11.104 The balancing of SUTs is not a simple task, as it requires priorities to be set because of time and resources constraints. Below are some practical considerations to be considered in the balancing process.

### 1. Automated and manual balancing

11.105 The balancing process covering the full SUTs system incorporates automated and manual balancing. The first step is to separate the inconsistencies between those needing further research and those which can be resolved using automated procedures. In general, large inconsistencies require more attention than smaller ones but such indicators as time series, revision analyses, input-output ratios and labour productivity can also point to serious problems in the data. For the smaller inconsistencies, automated procedures may be used, although they will still require assessment in terms of the quality and plausibility of the results.

11.106 For the inconsistencies selected for manual balancing, a more or less reversed version of the initial full statistical process from surveys to national accounts can be applied. It would start with a critical investigation of the national accounts process, transforming source data into data for use in SUTs. In the use table in particular there are many entries which are the result of splitting aggregated source data to the product level as required in the SUTs. The allocation may be changed without altering the initial aggregate total, and thus GVA. In practice, many of the problems will not be resolved through this approach. The next step is to have recourse to expert knowledge on the specific subject matter and, if major inconsistencies persist, it may prove necessary, as a final step, to contact the survey respondent or source supplier to instigate a critical discussion of the data that they have provided.

11.107 The adjustments to entries in the SUTs will obviously affect other flows and ratios. To systematize the balancing process in order, for example, to take into account inter-industrial relationships, it is helpful to distinguish separable blocks of industries in which the main producers and users of products are represented and to assign to these blocks separate groups of input-output specialist statisticians responsible for balancing. For example, cement is definitely required by the construction industry and cement supplies can therefore be used to cross-check the plausibility of construction estimates. The SUTs can be divided into various groupings of related industries; one section of groupings, for example, could include the following, although this is not an exhaustive list:

- Agriculture, and fishing (ISIC Rev. 4, divisions 01 and 03), manufacture of food products and beverages (ISIC Rev. 4, divisions 10–12), hotels and restaurants (ISIC Rev. 4, divisions 55 and 56)
- Manufacture of metals and metal products (ISIC Rev. 4, divisions 24 and 25) and manufacture of machinery and means of transport industries (ISIC Rev. 4, divisions 26, 29 and 30)
- Forestry (ISIC Rev. 4, division 02) and industries producing wood and wood products (ISIC Rev. 4, divisions 16 and 31)
- Quarrying and non-metallic mineral products (ISIC Rev. 4, divisions 08 and 23) and construction (ISIC Rev. 4, divisions 41 and 43)
- Manufacture of textile (ISIC Rev. 4, division 13) and textile products, footwear (ISIC Rev. 4, divisions 14 and 15)
- Chemical industries, including plastic products (ISIC Rev. 4, divisions 19–22)

- Energy sectors (ISIC Rev. 4, divisions 05, 06 and 35)

11.108 Automation is essential for the preparation and management of the SUTs system. The SUTs information technology system (including the supporting modules and analytical tools and function) will play various roles in the compilation process so it will need to be designed to a high standard and with an eye to the whole range of functions that it has to carry out.

11.109 Many of the calculations in the preparation stage are carried out by automated procedures. At every stage of the process, the information technology system can provide quick and clear overviews of the data in every chosen configuration. The information technology system produces the first parts of the SUTs, which are essential for the detection of major integration problems and, down the line, it enables investigation of the finest details, so that the causes of balancing problems can be detected in the most efficient manner possible. Lastly, the information technology system can help to develop appropriate solutions along with professional and orderly documentation of all the adjustments made during the compilation and balancing processes. The information technology system is a powerful instrument which is indispensable for all operations from the source data through to the final set of balanced SUTs.

11.110 Modules can be designed to eliminate small discrepancies between supply and use at the product level in an adequate and efficient way. This may imply one-dimensional proportional distribution of the discrepancies over a selected set of users.

11.111 Balancing the whole SUTs system requires a multidimensional approach to the reconciliation of inconsistencies and a range of human inputs which cannot be automated. The experiences to date of balancing SUTs in an automated manner have shown that full automated balancing does not yet work; ,the quality generated is poor, many issues require further investigation and, overall, the savings gained are tenuous at best. .Most experiences have shown that a combination of automated and manual statistical techniques and procedures is the best workable solution to the underpinnng of a SUTs system.

11.112 Working with statistical data based on sample surveys, survey questionnaires and influenced by such issues as non-response, means working with sample margins of error. Even when samples are perfect and there is a100 per cent response rate there will be inconsistencies. Statistics therefore constitute a major cause of differences and it could be argued that balancing could be carried out in an automated manner using the sample margins of the statistics concerned as weights. Statistics, however, are never ideal and inconsistencies are not only caused by sampling but also have various causes of a non-statistical nature. It is these causes of inconsistencies that make manual balancing necessary as a preliminary step to be taken prior to using automated balancing.

11.113 The decision as to what can be balanced using automated procedures and what should be done manually depends not only on the nature of the inconsistencies but also on the context of where the balancing takes place.

11.114 If the automated balancing of SUTs is carried out independently for consecutive years, and is applicable to current prices and volume estimates, then the initial discrepancies must be small. Experience has shown that even small differences in initial data can lead to totally different results in RAS (covered in box 11.3) and optimization procedures, which indicates that the balanced SUTs are not comparable over time. As long as the discrepancies are small, the chances that the results will no longer be comparable should also be small.

11.115 One major step forward is to include linkages (for example, growth rate expectations) between consecutive years, preferably including price and volume indicators. In setting such a scenario, the basic identities of the SUTs can be used as a restrictive measure in the automated balancing process and also in the criteria relating to plausibility referred to above. Including price and volume ratios and defined restrictions attributable to them would help to assure the plausibility of growth rates and comparability over time. This also allows for the option of leaving major discrepancies to the automated system.

11.116 Box 11.3 provides a short description of automated methods that are often used to remove some of the inconsistencies in the SUTs.

**Box 11.3 Methods used for automated balancing SUTs**

**RAS method**

The RAS method (the abbreviation is derived from the phrase "raking and scaling") is a well-known and widely used method for data reconciliation. Its aim is to achieve consistency between the entries of some non-negative matrix and pre-specified column totals and row totals. It is very easy to apply and to understand. RAS has a narrow range of applicability, however; for example, it can only be applied to non-negative matrices.

It is used to revise the internal entries in a matrix so that they agree with the margin totals. RAS is used when the margin totals – total supply and use of products, or total output by kind of activity, for example – are believed to be correct but the breakdown inside the matrix is not consistent with the margin totals. Over the years, many extensions, variations and improvements of the RAS method have been developed. Some examples include:

- GRAS (generalized RAS) allows for matrices in which some of the elements are predefined, in addition to the row totals and the column totals. The GRAS method allows for matrices with negative entries (see Lenzen and others, 2007).
- TRAS (three-stage RAS) extends RAS by including constraints on arbitrary subsets of the matrix elements, instead of only fixing row totals and column totals (see Cole, 1992, and Gilchrist and St. Louis, 1999).
- KRAS, as developed by Lenzen and others (2009), includes the aforementioned features of GRAS and TRAS and further generalises RAS for the case of conflicting source data. The simplest case is when two data sources prescribe two different values for the same matrix entry. In order to converge, the original RAS method can use only conflicting values, whereas the KRAS method will use both values and allow for different reliabilities of the data sources.

More details on different updating methods may be found in chapter 18 of this Handbook and in United Nations (1999).

**Stone method**

The Stone method is another method of data reconciliation whereby data are adjusted in order to satisfy a set of linear constraints. In adjusting the initial data, the Stone method uses information on the relative reliabilities of the initial data given in a covariance matrix. Data that are considered to be the most reliable are modified least, and vice versa. The Stone method yields a set of fully reconciled data, with minimum variance. It translates the reconciliation problem into a mathematical (weighted quadratic) optimization problem under linear constraints.

In practical applications of the method, a covariance matrix of the initial data is often unavailable. Accordingly, applications generally use estimates of relative variances. There are several ad hoc methods for estimating relative variances. One method is to have a specialist estimate of 95 per cent confidence intervals and to use the interval sizes as an approximation for variances. Another method may be to distinguish several categories such as "relatively unreliable", "normally reliable" and "relatively reliable", and all variables within the same group are assigned the same variance.

It is often desirable in practice for reconciliation to affect large values more than small values in an absolute sense. If this is the intention, then the following variances may be chosen:

$\mathrm{Var}(x_i) = \theta_i^2 x_i^2$ where, $\theta_i$ is a parameter that depends on the reliability, or reliability category, of $x_i$.

In practice, determining the correct ratios between the various variances is a process of trial and error, which means that one particular ratio is chosen based on a degree of prior knowledge and simple assumptions (for example, that variances are equal in the absence of prior knowledge), and then judging whether the results are acceptable. If not, the variances are then modified.

**Convex quadratic constrained optimization**

An option for balancing SUTs both in current prices and in volume terms simultaneously is the application of loss function, which includes current price and volume estimates and also linear price and volume ratios. The loss function must be minimized under a set of linear constraints, and the loss is defined as the difference between the initial data and the balanced data. For the price and volume ratios, linear constraints are applied. The constraints are either strong or weak.

Strong constraints include, for example, identities of the SUTs and upper and lower boundaries (subsidies should be less than or equal to zero). Weaker constraints include, for example: volume change of output related to volume change of input; ratio of taxes and subsidies to the basic price estimate (in the form of a percentage of the variable-like tax); ratio of margins to the basic price estimate (in the form of a percentage of the margins); and re-exports are smaller than the corresponding imports (weak because of differences in valuation).

More specific constraints at a product level can be specified in this optimization problem. It is also possible to extend the optimization problem and to include, for example, the transformation to industry-by-industry IOTs, including the estimation of valuation matrices.

## 2. Balancing benchmark and consecutive years

11.117 In the ideal situation, the annual SUTs and IOTs present the current state of the art when it comes to balancing of the basic statistics. The data from the annual SUTs and IOTs are further improved, however, with every new benchmarking exercise, leading to an entire new time series. Benchmarking is a regular process in economic statistics, whereby data sources for the same target variable with different frequencies are reconciled and the inconsistencies between the different estimates are corrected. Benchmarking leads to revisions of earlier estimates of the target variables. This section deals with two types of benchmark revisions for SUTs and IOTs – periodic benchmarking and annual benchmarking – and considerations about balancing of SUTs and IOTs in these two cases.

11.118 Periodic benchmarking refers to significant revisions, for example, conceptual changes, new or changed basic data sources that originate from incorporating data from periodic benchmark censuses (which are carried out every five to ten years), revised international guidelines like the 2008 SNA and BPM 6 and other changes that cannot be incorporated on a continuous basis because of resource contraints. Backward revisions to the time series affecting several previous years are also carried out based on the benchmark excersise.

11.119 In general, planning for period benchmark revisions should seek to coordinate all major changes to be synchronized for a common year for implementation, thereby achieving, at a minimum of about once every five years, a maximum degree of consistency within national accounts, balance of payments and other related domains and the statistics concerned are based on the best possible data.

11.120 In this context annual benchmarking mainly refers to the regular revisions to annual accounts made possible by the availability of new and more complete data sources. Annual benchmarking, however, also includes revisions due to the alignment of short-term survey results (say, turnover variable) based on small survey samples with much larger sample-based annual structural surveys. Following the reconciliation of short-term survey sources before the benchmarking process with more complete and detailed annual data sources such as structural statistics, these sources are then fed through the SUTs framework. Combining annual benchmarking and annual chain-linking also ensures that improved accuracy of the levels and growth rates of the economy is reached more quickly, and again, achieved through the SUTs framework.

11.121 Consistency is one of the key elements of mational accounts. Theoretically, the whole time series and every level of detail should be consistent. In practice, it may not be possible to publish all results at the same time, although the SUTs and the main aggregates such as GDP should be fully consistent. More and more years of SUTs are being produced and this poses a growing challenge as to how to maintain their consistency as a long-run dataset. Statistics Denmark, for example, as part of its implementation of the 2008 SNA and BPM 6, ensured that the Danish IOTs were retained on a consistent basis going back to 1966 – a significant exercise in its own right.

11.122 Annual benchmark revisions, as carried out in Ireland and the United Kingdom, entail less of a planning burden in synchronizing a common year, as the changes form an integral process to compiling annual SUTs.

11.123 In theory, the balancing procedure for period benchmark SUTs is the same as for SUTs compiled annually and also for investigations into the causes of inconsistencies and the search for solutions. For non-benchmark years, however, much information can be derived from looking at the previous years. When balanced product-flow systems already exist for the previous year, it can safely be assumed that the general structure of the system will be more or less similar to the preceding year, unless of course specific information is available showing that there are major structural changes in some industries. Together with price and volume estimates, the T-1 data provide a valuable source in detecting inconsistencies in the SUTs.

11.124 For periodic benchmark SUTs, all inconsistencies must be investigated thoroughly and exhaustively. This is even more important as the level estimates of the subsequent years are based on this benchmark. Consequently, the balancing of benchmark SUTs should be carried out manually to a great degree, so that a good quality base can be achieved and the use of automated procedures should be limited to small discrepancies.

### 3. Organization of the balancing function

11.125 The organization of the balancing function can be set up in different ways across teams. The following are possible examples:

- Centralized balancing team – a single person or a very small team of people form the central balancing team whose designated role is to take all the validated and investigated data from the compilation teams and balance the SUTs using the tools (manual and automated) at their disposal. They will lead and coordinate the implementation of balancing adjustments across the components and record the adjustments as "pure" balancing adjustments. They may generate the areas for investigation in liaison with the compilers. The team may also be organized in such a way that it does not simply produce a balanced SUTs dataset but also provides feedback to the compilers on the balancing adjustments as appropriate, for example, household final consumption expenditure or gross fixed capital formation, to enble the compilers to generate publications consistent with the final dataset. Alternatively, the compilers could use the final dataset to generate the publications with no additional data flows in the system.
- Decentralized balancing – here the balancing is devolved to industry, product or topic specialists (for example, energy, household final consumption expenditure or the compilers). They will undertake a row and column balancing process related to their allocated row, column and topic. After so many iterations, the central team may simply use automated tools to achieve a final balance. The role of the central team is different in that it focuses solely on the automated part, whereas the manual balancing is left to the specialists and is also coordinated across the balancers.

11.126 There are pros and cons to either approach:

- In centralized balancing, the control and order assessment and also the overall quality control sit with the central team and form an efficient way of achieving a coherent and high-quality balance. The specialist experts' knowledge can be used for quality assurance of the inputs and the balanced picture.

- In decentralized balancing, the specialist experts' knowledge is more extensively used but requires much more communication and coordination to be effective, and the balancing adjustments and quality adjustments may be less clear.

11.127 In both cases, such issues as documentation, communication and coordination are crucial, and it is also essential to ensure that staff have appropriate skills and knowledge. It is preferable, however, to have a centralized rather than a decentralized balancing arrangement.

# Annex A to chapter 11. Balancing supply and use tables

A11.1 This annex presents a numerical example of the balancing of SUTs in current prices and in previous years' prices in line with the SUTs balancing framework shown in figure 11.3 (fully consistenct with the H-Approach). This provide an example of the type of thinking and issue resolution that goes to achieve a balanced SUTs system. The numbers in the tables in this annex have been divided by 1,000 for readability and presentation purposes; in reality the differences are larger than the small numbers shown. This annex consists of three sections.

A11.2 Section 1 of the annex shows the following (unbalanced) tables:

- Table A11.1: Supply and use tables 2011 in current price (SUTs at purchasers' prices, Taxes less subsidies on products, trade and transport margins, SUTs at basic prices, imports use table and domestic use table).
- Table A11.2: Price indices for supply and use tables 2011 (SUTs at purchasers' prices, taxes less subsidies on products, trade and transport margins, SUTs at basic prices, imports use table and domestic use table). It should be noted that some prices may be based on actual source data or derived from independent volume estimates (using the valuation matrices) or implicit prices, but a complete set of prices is shown for the purposes of this balancing example.
- Table A11.3: Supply and use tables 2011 in previous years' prices (SUTs at purchasers' prices, taxes less subsidies on products, trade and transport margins, SUTs at basic prices, imports use table and domestic use table).
- Table A11.4: Volume indices tables for supply and use tables 2011 (SUTs at purchasers' prices, taxes less subsidies on products, trade and transport margins, SUTs at basic prices, imports use table and domestic use table).
- Table A11.5: Supply and use tables 2010 in current price (SUTs at purchasers' prices, taxes less subsidies on products, trade and transport margins, SUTs at basic prices, imports use table and domestic use table).

A11.3 Section 2 of the annex follows the same sequence of tables but shows the corresponding balanced SUTs system for both price bases. The cells highlighted in yellow are those changed in order to achieve balanced SUTs.

A11.4 Section 3 of the annex provides an overview of the numerical adjustments required to achieve the balanced system.

A11.5 The inconsistencies in the system are revealed by differences between the supply and use at the product level and discrepancies between trade and transport margins in the SUTs at purchasers' prices and the row totals of the respective valuation matrices. The same holds for taxes less subsidies on products. In general, the net operating surplus is used as a balancing item in achieving the identity that the total output equals the total input.

A11.6 If the inconsistencies are relatively small, then automated procedures can be applied to balance the SUTs system simultaneously in the different valuations. In the case of large discrepancies or implausible input-output ratios in volume terms or implausible movements in the price changes on a row, then further research would have to be undertaken before any automated balancing could be applied.

A11.7 In the numerical example, the estimates for agriculture products in current prices show a discrepancy both at purchasers' prices and at basic prices. Conversely, the estimates in previous years' prices are balanced. The latter does not mean that the previous years' price-based data are plausible although, having examined the data on volumes and prices at a more detailed level than presented in the example, it was concluded that the prices were too high and the volumes looked plausible. As a consequence, the estimates in current prices for the supply of agriculture products by the agriculture industry needed to be adjusted.

A11.8 The estimates for manufacturing products show a discrepancy in current and previous years' prices both at purchasers' prices and at basic prices. The difference in the previous years' prices based data at purchasers' prices is somewhat larger than in current prices because the initial estimate of taxes less subsidies on products and trade and transport margins in previous years' prices seems to be very low. The separate use table based on domestic output (namely, domestic use table) and imports (namely, imports use table) shows a big discrepancy for this product group in the domestic use table, which is counterbalanced in the imports use table. In addition to the difference between supply and use of products in current prices and in previous years' prices, there is an implausible price index for exports. In this case, the estimates in previous years' prices can be adjusted in order to get plausible price indices. A second reason for the inconsistency is the delineation of exports and re-exports. At the point when products are imported, it is not always known whether or not the products will be re-exported in the same form. As a consequence, the data available for re-exports from source statistics should be a minimum and the actual estimate in the SUTs will be much higher, as shown in this example. The delineation problem caused a small inconsistency which can be solved by adjusting total exports.

A11.9 The balancing adjustments and approaches applied to the valuation matrices differ between estimates in current prices and estimates in previous years' prices.

A11.10The current price estimates of trade and transport margins (TTM) do not show an inconsistency in the purchasers' prices table; the TTM column is consistent with the output of trade. In the basic price table, however, there is an inconsistency caused by the difference between the TTM matrix and the TTM column in the supply table at purchasers' prices. The gap is 680, which is found on the manufacturing product row.

A11.11Similarly, for taxes less subsidies on products (TLS), there were some differences between the TLS column of the supply table and the total column of the TLS matrix. These inconsistencies appear on the product rows for maufacturing (MAN) and fnance and business services (FBS).

A11.12In both cases, the data in the current price valuation matrices need to be adjusted, as in most cases the current price TLS on products is derived from government data and therefore fixed. The same approach is less strong for TTM, in which the output control totals generally prevail over the estimates of the valuation matrices.

A11.13For the previous years' prices-based estimates of TLS and TTM, the opposite holds because, while the estimates for TTM and TLS on products are compiled using the volume change of the relevant transactions, the estimates in the valuation matrices determine TTM and TLS in previous years' prices, so the TLS and TTM columns of the SUTs at purchasers' prices have to be adjusted.

A11.14Both in current prices and in previous years' prices, the transport products show a discrepancy. In this case the inconsistency was not caused by the valuation matrices but, on looking at the imports use table and through additional research, it was identified that the estimate of import of transport services was too high.

A11.15The discrepancy in communication is shown in both valuation matrices in current prices and in previous years' prices and can also be seen in the domestic use table. On examining the data, it was decided that consumption of households had to be adjusted.

A11.16A similar procedure was followed for financial and business services and other services, in which cases it was decided that the intermediate consumption of TIC and consumption of households should be adjusted respectively. It should be noted that the discrepancy for the FBS product in the basic price table is somewhat larger than in the purchasers' price table because of the wrong estimate in the TLS matrix.

## 1. Unbalanced SUTs system (table A11.1–table A11.5)

### Table A11.1: Supply and use tables 2011 in current prices

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 26.0 | 0.2 | 0.0 | 26.2 | 15.4 | 41.6 | 10.9 | 0.5 | 53.0 |
| MAN | 1.3 | 318.5 | 35.7 | 355.5 | 336.8 | 692.3 | 113.0 | 39.4 | 844.7 |
| CON | 0.1 | 88.0 | 4.5 | 92.6 | 1.6 | 94.1 | | 8.3 | 102.4 |
| TTC | 0.5 | 15.1 | 231.6 | 247.2 | 73.4 | 320.6 | -124.0 | 3.0 | 199.6 |
| FBS | 0.5 | 8.0 | 282.0 | 290.5 | 55.2 | 345.7 | | 9.1 | 354.9 |
| OSE | 0.3 | 2.5 | 222.9 | 225.7 | 16.6 | 242.3 | 0.1 | 3.0 | 245.4 |
| TOT | 28.7 | 432.3 | 776.7 | 1237.7 | 499.1 | 1736.7 | 0.0 | 63.3 | 1800.1 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 5.5 | 17.4 | 1.5 | 24.4 | 5.9 | | | 0.1 | -0.1 | 22.4 | 28.4 | 52.8 | 0.2 |
| MAN | 10.1 | 202.1 | 65.4 | 277.7 | 122.8 | | 9.1 | 51.5 | 1.4 | 383.1 | 568.0 | 845.7 | -1.0 |
| CON | 0.3 | 26.2 | 19.8 | 46.3 | 0.5 | | 0.6 | 53.7 | | 2.1 | 56.8 | 103.1 | -0.7 |
| TTC | 0.6 | 10.8 | 66.2 | 77.5 | 21.4 | 0.9 | 0.5 | 6.7 | 0.0 | 92.3 | 121.8 | 199.3 | 0.3 |
| FBS | 2.1 | 43.5 | 161.8 | 207.3 | 78.0 | 0.0 | 3.6 | 16.8 | | 49.5 | 147.8 | 355.2 | -0.3 |
| OSE | 0.2 | 3.5 | 22.2 | 25.9 | 54.7 | 4.6 | 153.4 | 1.2 | 0.2 | 5.1 | 219.1 | 245.0 | 0.4 |
| TIC | 18.8 | 303.5 | 336.8 | 659.1 | 283.3 | 5.5 | 167.2 | 130.1 | 1.5 | 554.5 | 1142.0 | 1801.1 | -1.0 |
| OTLS | -0.7 | 0.2 | 0.3 | -0.3 | | | | | | | | -0.3 | |
| COE | 2.7 | 60.9 | 254.4 | 318.0 | | | | | | | | 318.0 | |
| CFC | 3.7 | 20.5 | 82.9 | 107.1 | | | | | | | | 107.1 | |
| NOS | 4.3 | 47.2 | 102.2 | 153.7 | | | | | | | | 153.7 | |
| GVA | 9.9 | 128.8 | 439.8 | 578.5 | | | | | | | | 578.5 | |
| TOT | 28.7 | 432.3 | 776.7 | 1237.7 | 283.3 | 5.5 | 167.2 | 130.1 | 1.5 | 554.5 | 1142.0 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | 0.5 | 0.5 |
| MAN | | | | | | | | 39.4 | 39.4 |
| CON | | | | | | | | 8.3 | 8.3 |
| TTC | | | | | | | | 3.0 | 3.0 |
| FBS | | | | | | | | 9.1 | 9.1 |
| OSE | | | | | | | | 3.0 | 3.0 |
| TOT | | | | | | | | 63.3 | 63.3 |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | | | | | 0.1 | 0.5 | 0.5 | |
| MAN | 0.2 | 1.7 | 6.4 | 8.3 | 26.8 | | 0.4 | 2.2 | 0.0 | 1.7 | 31.1 | 39.4 | 0.0 |
| CON | | 0.0 | 2.0 | 2.0 | 0.0 | | 0.1 | 6.1 | | 0.0 | 6.2 | 8.3 | |
| TTC | 0.0 | -0.1 | 1.1 | 1.0 | 1.7 | | -0.1 | 0.4 | | -0.1 | 2.0 | 3.0 | |
| FBS | 0.0 | 0.0 | 4.4 | 4.4 | 1.6 | | 0.1 | 3.0 | | 0.0 | 4.7 | 9.1 | 0.0 |
| OSE | | 0.0 | 0.1 | 0.1 | 2.3 | | -0.4 | 0.7 | | 0.3 | 2.9 | 3.0 | |
| TOT | 0.2 | 1.6 | 14.0 | 15.8 | 32.9 | | 0.1 | 12.5 | 0.0 | 2.0 | 47.5 | 63.3 | 0.0 |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | 10.9 | | 10.9 |
| MAN | | | | | | | 113.0 | | 113.0 |
| CON | | | | | | | | | |
| TTC | | | | | | | -124.0 | | -124.0 |
| FBS | | | | | | | | | |
| OSE | | | | | | | 0.1 | | 0.1 |
| TOT | | | | | | | 0.0 | | 0.0 |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.4 | 1.6 | 0.4 | 2.5 | 3.2 | | | 0.0 | 0.0 | 5.2 | 8.4 | 10.9 | |
| MAN | 0.9 | 20.5 | 9.2 | 30.6 | 39.1 | | 3.1 | 5.1 | -0.1 | 34.5 | 81.7 | 112.3 | 0.7 |
| CON | | | | | | | | | | | | | |
| TTC | -1.3 | -22.2 | -9.6 | -33.1 | -42.3 | | -3.1 | -5.1 | 0.1 | -39.7 | -90.2 | -123.3 | -0.7 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | 0.1 | | | | | 0.0 | 0.1 | 0.1 | |
| TOT | | | | | 0.0 | | | 0.0 | | 0.0 | 0.0 | 0.0 | |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 26.0 | 0.2 | 0.0 | 26.2 | 15.4 | 41.6 | | | |
| MAN | 1.3 | 318.5 | 35.7 | 355.5 | 336.8 | 692.3 | | | |
| CON | 0.1 | 88.0 | 4.5 | 92.6 | 1.6 | 94.1 | | | |
| TTC | 0.5 | 15.1 | 231.6 | 247.2 | 73.4 | 320.6 | | | |
| FBS | 0.5 | 8.0 | 282.0 | 290.5 | 55.2 | 345.7 | | | |
| OSE | 0.3 | 2.5 | 222.9 | 225.7 | 16.6 | 242.3 | | | |
| TOT | 28.7 | 432.3 | 776.7 | 1237.7 | 499.1 | 1736.7 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 5.1 | 15.7 | 1.1 | 21.9 | 2.4 | | | 0.1 | -0.1 | 17.1 | 19.5 | 41.3 | 0.3 |
| MAN | 9.0 | 179.9 | 49.8 | 238.8 | 56.9 | | 5.6 | 44.3 | 1.5 | 346.9 | 455.2 | 694.0 | -1.7 |
| CON | 0.3 | 26.2 | 17.7 | 44.3 | 0.4 | | 0.5 | 47.6 | | 2.1 | 50.6 | 94.8 | -0.7 |
| TTC | 1.8 | 33.0 | 74.8 | 109.6 | 62.0 | 0.9 | 3.7 | 11.4 | -0.1 | 132.1 | 210.0 | 319.7 | 1.0 |
| FBS | 2.1 | 43.5 | 157.4 | 202.9 | 76.4 | 0.0 | 3.5 | 13.8 | | 49.5 | 143.1 | 346.1 | -0.3 |
| OSE | 0.2 | 3.5 | 22.1 | 25.8 | 52.3 | 4.6 | 153.8 | 0.4 | 0.2 | 4.8 | 216.1 | 241.9 | 0.4 |
| TLS | 0.2 | 1.6 | 14.0 | 15.8 | 32.9 | | 0.1 | 12.5 | 0.0 | 2.0 | 47.5 | 63.3 | |
| TIC | 18.8 | 303.5 | 336.8 | 659.1 | 283.3 | 5.5 | 167.2 | 130.1 | 1.5 | 554.5 | 1142.0 | 1801.1 | -1.1 |
| OTLS | -0.7 | 0.2 | 0.3 | -0.3 | | | | | | | | -0.3 | |
| COE | 2.7 | 60.9 | 254.4 | 318.0 | | | | | | | | 318.0 | |
| CFC | 3.7 | 20.5 | 82.9 | 107.1 | | | | | | | | 107.1 | |
| NOS | 4.3 | 47.2 | 102.2 | 153.7 | | | | | | | | 153.7 | |
| GVA | 9.9 | 128.8 | 439.8 | 578.5 | | | | | | | | 578.5 | |
| TOT | 28.7 | 432.3 | 776.7 | 1237.7 | 283.3 | 5.5 | 167.2 | 130.1 | 1.5 | 554.5 | 1142.0 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | 15.4 | | | | |
| MAN | | | | | 336.8 | | | | |
| CON | | | | | 1.6 | | | | |
| TTC | | | | | 73.4 | | | | |
| FBS | | | | | 55.2 | | | | |
| OSE | | | | | 16.6 | | | | |
| TOT | | | | | 499.1 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.8 | 6.4 | 0.5 | 7.7 | 1.2 | | | 0.0 | -0.1 | 6.6 | 7.7 | 15.4 | |
| MAN | 1.3 | 98.0 | 20.9 | 120.2 | 24.5 | | 1.6 | 19.2 | -0.2 | 121.3 | 166.5 | 286.6 | 50.2 |
| CON | 0.0 | 0.5 | 0.4 | 0.9 | | | | 0.7 | | | 0.7 | 1.6 | |
| TTC | 0.0 | 2.7 | 14.0 | 16.8 | 0.7 | | | 2.7 | 0.0 | 52.7 | 56.1 | 72.9 | 0.5 |
| FBS | 0.2 | 14.0 | 24.5 | 38.8 | 0.2 | | | 2.2 | | 14.1 | 16.5 | 55.2 | |
| OSE | 0.0 | 0.5 | 3.9 | 4.5 | 12.0 | | 0.0 | | 0.1 | 0.0 | 12.2 | 16.6 | |
| TLS | | | | | | | | | | | | | |
| TIC | 2.3 | 122.1 | 64.2 | 188.7 | 38.7 | | 1.6 | 24.8 | -0.1 | 194.7 | 259.7 | 448.4 | 50.7 |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 26.0 | 0.2 | 0.0 | 26.2 | | | | | |
| MAN | 1.3 | 318.5 | 35.7 | 355.5 | | | | | |
| CON | 0.1 | 88.0 | 4.5 | 92.6 | | | | | |
| TTC | 0.5 | 15.1 | 231.6 | 247.2 | | | | | |
| FBS | 0.5 | 8.0 | 282.0 | 290.5 | | | | | |
| OSE | 0.3 | 2.5 | 222.9 | 225.7 | | | | | |
| TOT | 28.7 | 432.3 | 776.7 | 1237.7 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 4.3 | 9.3 | 0.6 | 14.2 | 1.2 | | | 0.1 | 0.0 | 10.5 | 11.7 | 26.0 | 0.2 |
| MAN | 7.8 | 81.9 | 28.9 | 118.6 | 32.4 | | 4.0 | 25.1 | 1.6 | 225.6 | 288.7 | 407.4 | -51.9 |
| CON | 0.3 | 25.7 | 17.4 | 43.4 | 0.4 | | 0.5 | 46.9 | | 2.1 | 49.9 | 93.3 | -0.7 |
| TTC | 1.8 | 30.3 | 60.7 | 92.8 | 61.3 | 0.9 | 3.7 | 8.6 | -0.1 | 79.4 | 153.9 | 246.7 | 0.5 |
| FBS | 1.8 | 29.5 | 132.9 | 164.2 | 76.2 | 0.0 | 3.5 | 11.6 | | 35.4 | 126.6 | 290.8 | -0.3 |
| OSE | 0.2 | 3.0 | 18.1 | 21.3 | 40.2 | 4.6 | 153.8 | 0.4 | 0.1 | 4.8 | 203.9 | 225.3 | 0.4 |
| TLS | 0.2 | 1.6 | 14.0 | 15.8 | 32.9 | | 0.1 | 12.5 | 0.0 | 2.0 | 47.5 | 63.3 | |
| TIC | 16.4 | 181.4 | 272.6 | 470.5 | 244.6 | 5.5 | 165.5 | 105.3 | 1.6 | 359.7 | 882.3 | 1352.8 | -51.8 |
| IMP | 2.3 | 122.1 | 64.2 | 188.7 | 38.7 | | 1.6 | 24.8 | -0.1 | 194.7 | 259.7 | 448.4 | |
| TOT | 18.8 | 303.5 | 336.8 | 659.1 | 283.3 | 5.5 | 167.2 | 130.1 | 1.5 | 554.5 | 1142.0 | 1801.1 | -51.8 |
| OTLS | -0.7 | 0.2 | 0.3 | -0.3 | | | | | | | | -0.3 | |
| COE | 2.7 | 60.9 | 254.4 | 318.0 | | | | | | | | 318.0 | |
| CFC | 3.7 | 20.5 | 82.9 | 107.1 | | | | | | | | 107.1 | |
| NOS | 4.3 | 47.2 | 102.2 | 153.7 | | | | | | | | 153.7 | |
| GVA | 9.9 | 128.8 | 439.8 | 578.5 | | | | | | | | 578.5 | |
| TOT | 28.7 | 432.3 | 776.7 | 1237.7 | 283.3 | 5.5 | 167.2 | 130.1 | 1.5 | 554.5 | 1142.0 | | |
| Check | | | | | | | | | | | | | |

# Table A11.2: Price indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.0 | 104.1 | | 102.0 | 106.9 | 103.8 | 97.5 | 107.6 | 102.5 |
| MAN | 107.5 | 108.0 | 100.5 | 107.2 | 108.0 | 107.6 | 101.1 | 103.2 | 106.4 |
| CON | 103.4 | 100.5 | 100.5 | 100.5 | 101.6 | 100.5 | | 100.1 | 100.4 |
| TTC | 101.1 | 99.2 | 100.3 | 100.2 | 110.7 | 102.4 | 100.8 | 101.4 | 103.4 |
| FBS | 102.9 | 100.9 | 100.4 | 100.4 | 101.0 | 100.5 | | 93.6 | 100.3 |
| OSE | | 100.2 | | 101.0 | 103.4 | 101.1 | 99.1 | 110.2 | 101.2 |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | 107.3 | 103.7 | | 101.6 | 103.7 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 105.8 | 109.9 | 98.7 | 108.2 | 100.4 | | | 94.7 | 568.8 | 97.7 | 98.0 | 102.4 | 0.0 |
| MAN | 114.1 | 110.4 | 105.0 | 109.2 | 102.1 | | 99.5 | 99.6 | 85.7 | 106.7 | 104.9 | 106.2 | 0.2 |
| CON | 101.4 | 100.5 | 101.8 | 101.0 | 97.4 | | 97.1 | 100.0 | | 102.0 | 100.0 | 100.5 | 0.0 |
| TTC | 100.9 | 100.1 | 100.8 | 100.7 | 102.2 | | | | | 108.0 | 106.2 | 104.0 | -0.5 |
| FBS | 101.4 | 100.7 | 100.4 | 100.5 | 101.7 | | 101.8 | | | 99.0 | 100.1 | 100.3 | 0.0 |
| OSE | 102.4 | 101.7 | 104.3 | 103.9 | 102.7 | 103.8 | | 101.7 | 99.5 | 101.8 | 100.9 | 101.2 | 0.0 |
| TIC | 109.3 | 107.5 | 101.7 | 104.5 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.7 | 103.2 | 103.6 | -0.3 |
| OTLS | 98.0 | 201.1 | 269.9 | 48.3 | | | | | | | | 48.3 | |
| COE | 102.7 | 101.9 | 101.5 | 101.6 | | | | | | | | 101.6 | |
| CFC | 99.1 | 100.6 | 98.4 | 98.8 | | | | | | | | 98.8 | |
| NOS | 80.9 | 103.2 | 96.2 | 97.7 | | | | | | | | 97.7 | |
| GVA | 91.1 | 102.2 | 99.7 | 100.1 | | | | | | | | 100.1 | |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.7 | 103.2 | | |

| Check | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | 107.6 | |
| MAN | | | | | | | | 103.2 | |
| CON | | | | | | | | 100.1 | |
| TTC | | | | | | | | 101.4 | |
| FBS | | | | | | | | 93.6 | |
| OSE | | | | | | | | 110.2 | |
| TOT | | | | | | | | 101.6 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 92.3 | 612.5 | 91.4 | 230.0 | 100.8 | | | | | 96.2 | 99.8 | 107.6 | |
| MAN | 103.7 | 107.3 | 103.9 | 104.6 | 101.7 | | 98.7 | 93.8 | -100.0 | 104.4 | 101.3 | 101.9 | 1.3 |
| CON | | | 102.2 | 102.1 | 90.7 | | 95.1 | 99.6 | | 100.0 | 99.4 | 100.1 | |
| TTC | | | | 99.4 | 103.3 | | | | | | 102.4 | 101.4 | |
| FBS | 123.1 | 100.0 | 102.0 | 102.1 | 105.7 | | 103.8 | | | 44.4 | 86.4 | 93.3 | 0.3 |
| OSE | | | | 241.7 | 109.2 | | | 101.1 | | | 108.5 | 110.2 | |
| TOT | 105.1 | 110.1 | 103.1 | 103.8 | 102.5 | | 102.3 | 92.5 | -100.0 | 105.0 | 99.8 | 100.7 | 0.8 |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | 97.5 | | |
| MAN | | | | | | | 101.1 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | 100.8 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | 99.1 | | |
| TOT | | | | | | | | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 90.4 | 96.7 | 100.7 | 96.3 | 104.9 | | | 85.7 | 100.0 | 94.0 | 97.9 | 97.5 | |
| MAN | 113.7 | 102.6 | 102.3 | 102.8 | 97.8 | | 97.9 | 97.5 | 93.5 | 99.5 | 98.5 | 99.6 | 1.5 |
| CON | | | | | | | | | | | | | |
| TTC | 105.0 | 102.1 | 102.2 | 102.3 | 98.3 | | 97.9 | 97.5 | 93.8 | 98.8 | 98.4 | 99.4 | 1.4 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | 97.6 | | | | | 104.2 | 99.1 | 99.1 | |
| TOT | | | | | | | | | | | | | |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.0 | 104.1 | | 102.0 | 106.9 | 103.8 | | | |
| MAN | 107.5 | 108.0 | 100.5 | 107.2 | 108.0 | 107.6 | | | |
| CON | 103.4 | 100.5 | 100.5 | 100.5 | 101.6 | 100.5 | | | |
| TTC | 101.1 | 99.2 | 100.3 | 100.2 | 110.7 | 102.4 | | | |
| FBS | 102.9 | 100.9 | 100.4 | 100.4 | 101.0 | 100.5 | | | |
| OSE | | 100.2 | | 101.0 | 103.4 | 101.1 | | | |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | 107.3 | 103.7 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 107.2 | 111.2 | 98.1 | 109.5 | 94.9 | | | 95.6 | 725.0 | 98.9 | 98.0 | 103.8 | 0.0 |
| MAN | 114.4 | 111.4 | 105.6 | 110.2 | 105.5 | | 100.5 | 100.2 | 85.7 | 107.5 | 106.3 | 107.6 | -0.1 |
| CON | 101.4 | 100.5 | 101.7 | 101.0 | 98.3 | | 97.4 | 100.0 | | 102.0 | 100.1 | 100.5 | 0.0 |
| TTC | 103.8 | 101.5 | 101.0 | 101.2 | 99.5 | | 98.5 | 97.0 | 93.7 | 105.0 | 102.8 | 102.2 | 0.2 |
| FBS | 101.2 | 100.7 | 100.4 | 100.5 | 101.7 | | 101.7 | 100.6 | | 99.0 | 100.6 | 100.5 | 0.0 |
| OSE | 102.4 | 101.8 | 104.1 | 103.7 | 102.4 | 103.8 | | 102.5 | 99.5 | 101.5 | 100.8 | 101.1 | 0.0 |
| TLS | 105.1 | 110.1 | 103.1 | 103.8 | 102.5 | | 102.3 | 92.5 | -100.0 | 105.0 | 99.8 | 100.7 | |
| TIC | 109.3 | 107.5 | 101.7 | 104.5 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.7 | 103.2 | 103.6 | 0.1 |
| OTLS | 98.0 | 201.1 | 269.9 | 48.3 | | | | | | | | 48.3 | |
| COE | 102.7 | 101.9 | 101.5 | 101.6 | | | | | | | | 101.6 | |
| CFC | 99.1 | 100.6 | 98.4 | 98.8 | | | | | | | | 98.8 | |
| NOS | 80.9 | 103.2 | 96.2 | 97.7 | | | | | | | | 97.7 | |
| GVA | 91.1 | 102.2 | 99.7 | 100.1 | | | | | | | | 100.1 | |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.7 | 103.2 | | |

| Check | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Imports cif

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | 106.9 | | | | |
| MAN | | | | | 108.0 | | | | |
| CON | | | | | 101.6 | | | | |
| TTC | | | | | 110.7 | | | | |
| FBS | | | | | 101.0 | | | | |
| OSE | | | | | 103.4 | | | | |
| TOT | | | | | 107.3 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 113.0 | 114.5 | 98.0 | 113.2 | 100.1 | | | 100.0 | 207.1 | 102.1 | 101.4 | 106.9 | |
| MAN | 112.6 | 114.4 | 107.2 | 113.1 | 102.0 | | 99.6 | 99.5 | -311.5 | 89.4 | 92.1 | 99.9 | 8.1 |
| CON | 100.0 | 101.0 | 102.0 | 101.4 | | | | 101.8 | | | 101.8 | 101.6 | |
| TTC | 100.0 | 100.5 | | 101.2 | | | | | | 115.2 | 113.9 | 110.7 | -0.1 |
| FBS | 97.0 | 101.4 | 100.4 | 100.8 | 106.7 | | | | | | 101.6 | 101.0 | |
| OSE | 100.0 | 100.8 | 101.4 | 101.4 | 104.2 | | | | 99.0 | 97.1 | 104.1 | 103.4 | |
| TLS | | | | | | | | | | | | | |
| TIC | 110.7 | 112.3 | 102.8 | 108.9 | 102.6 | | 99.6 | 99.4 | -100.8 | 96.5 | 97.6 | 102.0 | 5.3 |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.0 | 104.1 | | 102.0 | | | | | |
| MAN | 107.5 | 108.0 | 100.5 | 107.2 | | | | | |
| CON | 103.4 | 100.5 | 100.5 | 100.5 | | | | | |
| TTC | 101.1 | 99.2 | 100.3 | 100.2 | | | | | |
| FBS | 102.9 | 100.9 | 100.4 | 100.4 | | | | | |
| OSE | | 100.2 | | 101.0 | | | | | |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 106.2 | 109.0 | 98.2 | 107.6 | 90.0 | | | 94.6 | -181.3 | 97.0 | 95.9 | 102.0 | 0.0 |
| MAN | 114.7 | 107.9 | 104.5 | 107.5 | 108.4 | | 100.8 | 100.7 | 98.0 | 120.7 | 116.7 | 113.9 | -6.7 |
| CON | 101.4 | 100.5 | 101.7 | 101.0 | 98.3 | | 97.4 | 100.0 | | 102.0 | 100.0 | 100.5 | 0.0 |
| TTC | 103.9 | 101.5 | 100.9 | 101.2 | 99.5 | | 98.5 | 97.2 | 93.5 | 99.2 | 99.2 | 99.9 | 0.3 |
| FBS | 101.8 | 100.4 | 100.4 | 100.4 | 101.7 | | 101.7 | 100.5 | | 98.0 | 100.5 | 100.4 | 0.0 |
| OSE | 102.5 | 101.9 | 104.7 | 104.2 | 101.9 | 103.8 | | 102.5 | 100.0 | 101.5 | 100.7 | 101.0 | 0.0 |
| TLS | 105.1 | 110.1 | 103.1 | 103.8 | 102.5 | | 102.3 | 92.5 | -100.0 | 105.0 | 99.8 | 100.7 | |
| TIC | 109.1 | 104.4 | 101.4 | 102.8 | 102.0 | 103.3 | 100.2 | 99.0 | 96.1 | 111.5 | 104.9 | 104.2 | -6.4 |
| IMP | 110.7 | 112.3 | 102.8 | 108.9 | 102.6 | | 99.6 | 99.4 | -100.8 | 96.5 | 97.6 | 102.0 | |
| TOT | 109.3 | 107.5 | 101.7 | 104.5 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.7 | 103.2 | 103.6 | -6.4 |
| OTLS | 98.0 | 201.1 | 269.9 | 48.3 | | | | | | | | 48.3 | |
| COE | 102.7 | 101.9 | 101.5 | 101.6 | | | | | | | | 101.6 | |
| CFC | 99.1 | 100.6 | 98.4 | 98.8 | | | | | | | | 98.8 | |
| NOS | 80.9 | 103.2 | 96.2 | 97.7 | | | | | | | | 97.7 | |
| GVA | 91.1 | 102.2 | 99.7 | 100.1 | | | | | | | | 100.1 | |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.7 | 103.2 | | |

# Table A11.3: Supply and use tables 2011 at previous years' prices

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.5 | 0.1 | 0.0 | 25.7 | 14.4 | 40.1 | 11.2 | 0.5 | 51.8 |
| MAN | 1.2 | 295.0 | 35.6 | 331.7 | 311.9 | 643.7 | 111.7 | 38.2 | 793.6 |
| CON | 0.1 | 87.6 | 4.5 | 92.2 | 1.5 | 93.7 | | 8.3 | 102.0 |
| TTC | 0.5 | 15.2 | 231.0 | 246.7 | 66.4 | 313.1 | -123.0 | 3.0 | 193.0 |
| FBS | 0.5 | 8.0 | 280.8 | 289.2 | 54.7 | 343.9 | | 9.7 | 353.7 |
| OSE | 0.3 | 2.5 | 220.7 | 223.5 | 16.1 | 239.6 | 0.1 | 2.7 | 242.4 |
| TOT | 28.1 | 408.4 | 772.5 | 1209.0 | 465.0 | 1674.0 | 0.0 | 62.4 | 1736.4 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 5.2 | 15.8 | 1.6 | 22.6 | 5.9 | | | 0.2 | 0.0 | 22.9 | 29.0 | 51.5 | 0.2 |
| MAN | 8.9 | 183.1 | 62.3 | 254.4 | 120.3 | | 9.2 | 51.7 | 1.6 | 358.9 | 541.7 | 796.1 | -2.5 |
| CON | 0.3 | 26.1 | 19.4 | 45.8 | 0.5 | | 0.6 | 53.7 | | 2.1 | 56.8 | 102.6 | -0.7 |
| TTC | 0.6 | 10.8 | 65.6 | 77.0 | 21.0 | 0.9 | 0.5 | 6.9 | 0.0 | 85.5 | 114.7 | 191.7 | 1.3 |
| FBS | 2.0 | 43.2 | 161.1 | 206.3 | 76.6 | 0.0 | 3.5 | 17.6 | | 50.0 | 147.7 | 354.0 | -0.3 |
| OSE | 0.2 | 3.5 | 21.2 | 24.9 | 53.2 | 4.4 | 153.1 | 1.1 | 0.2 | 5.0 | 217.1 | 242.0 | 0.4 |
| TIC | 17.2 | 282.5 | 331.3 | 630.9 | 277.5 | 5.3 | 166.8 | 131.3 | 1.8 | 524.3 | 1107.0 | 1737.9 | -1.5 |
| OTLS | -0.7 | 0.1 | 0.1 | -0.5 | | | | | | | | -0.5 | |
| COE | 2.6 | 59.8 | 250.6 | 313.0 | | | | | | | | 313.0 | |
| CFC | 3.7 | 20.4 | 84.3 | 108.4 | | | | | | | | 108.4 | |
| NOS | 5.3 | 45.7 | 106.3 | 157.3 | | | | | | | | 157.3 | |
| GVA | 10.9 | 126.0 | 441.2 | 578.1 | | | | | | | | 578.1 | |
| TOT | 28.1 | 408.4 | 772.5 | 1209.0 | 277.5 | 5.3 | 166.8 | 131.3 | 1.8 | 524.3 | 1107.0 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | 0.5 | |
| MAN | | | | | | | | 38.2 | |
| CON | | | | | | | | 8.3 | |
| TTC | | | | | | | | 3.0 | |
| FBS | | | | | | | | 9.7 | |
| OSE | | | | | | | | 2.7 | |
| TOT | | | | | | | | 62.4 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | | | | | 0.1 | 0.5 | 0.5 | |
| MAN | 0.2 | 1.6 | 6.2 | 8.0 | 26.4 | | 0.4 | 2.3 | 0.0 | 1.6 | 30.7 | 38.7 | -0.5 |
| CON | | 0.0 | 2.0 | 2.0 | 0.1 | | 0.1 | 6.1 | | 0.0 | 6.3 | 8.3 | |
| TTC | 0.0 | -0.1 | 1.1 | 1.0 | 1.7 | | -0.1 | 0.5 | | -0.1 | 2.0 | 3.0 | |
| FBS | 0.0 | 0.0 | 4.3 | 4.3 | 1.5 | | 0.1 | 3.9 | | 0.0 | 5.5 | 9.7 | |
| OSE | | 0.0 | 0.0 | 0.0 | 2.1 | | -0.4 | 0.7 | | 0.3 | 2.7 | 2.7 | |
| TOT | 0.2 | 1.5 | 13.6 | 15.3 | 32.1 | | 0.1 | 13.5 | 0.0 | 1.9 | 47.6 | 62.9 | -0.5 |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | 11.2 | | |
| MAN | | | | | | | 111.7 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | -123.0 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | 0.1 | | |
| TOT | | | | | | | 0.0 | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.4 | 1.7 | 0.4 | 2.6 | 3.1 | | | 0.0 | 0.0 | 5.6 | 8.6 | 11.2 | |
| MAN | 0.8 | 20.0 | 9.0 | 29.8 | 39.9 | | 3.2 | 5.2 | -0.1 | 34.7 | 82.9 | 112.7 | -1.0 |
| CON | | | | | | | | | | | | | |
| TTC | -1.2 | -21.7 | -9.4 | -32.3 | -43.1 | | -3.2 | -5.2 | 0.1 | -40.2 | -91.7 | -124.0 | 1.0 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | 0.1 | | | | | 0.0 | 0.1 | 0.1 | |
| TOT | | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.5 | 0.1 | 0.0 | 25.7 | 14.4 | 40.1 | | | |
| MAN | 1.2 | 295.0 | 35.6 | 331.7 | 311.9 | 643.7 | | | |
| CON | 0.1 | 87.6 | 4.5 | 92.2 | 1.5 | 93.7 | | | |
| TTC | 0.5 | 15.2 | 231.0 | 246.7 | 66.4 | 313.1 | | | |
| FBS | 0.5 | 8.0 | 280.8 | 289.2 | 54.7 | 343.9 | | | |
| OSE | 0.3 | 2.5 | 220.7 | 223.5 | 16.1 | 239.6 | | | |
| TOT | 28.1 | 408.4 | 772.5 | 1209.0 | 465.0 | 1674.0 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 4.8 | 14.1 | 1.1 | 20.0 | 2.5 | | | 0.1 | 0.0 | 17.2 | 19.9 | 39.8 | 0.2 |
| MAN | 7.9 | 161.6 | 47.1 | 216.6 | 53.9 | | 5.6 | 44.2 | 1.7 | 322.6 | 428.0 | 644.7 | -1.0 |
| CON | 0.3 | 26.1 | 17.4 | 43.8 | 0.4 | | 0.5 | 47.6 | | 2.1 | 50.6 | 94.4 | -0.7 |
| TTC | 1.8 | 32.5 | 74.0 | 108.3 | 62.4 | 0.9 | 3.8 | 11.7 | -0.1 | 125.8 | 204.4 | 312.8 | 0.3 |
| FBS | 2.0 | 43.2 | 156.8 | 202.0 | 75.1 | 0.0 | 3.4 | 13.7 | | 50.0 | 142.2 | 344.2 | -0.3 |
| OSE | 0.2 | 3.5 | 21.2 | 24.9 | 51.0 | 4.4 | 153.5 | 0.4 | 0.2 | 4.7 | 214.3 | 239.2 | 0.4 |
| TLS | 0.2 | 1.5 | 13.6 | 15.3 | 32.1 | | 0.1 | 13.5 | 0.0 | 1.9 | 47.6 | 62.9 | |
| TIC | 17.2 | 282.5 | 331.3 | 630.9 | 277.5 | 5.3 | 166.8 | 131.3 | 1.8 | 524.3 | 1107.0 | 1737.9 | -1.0 |
| OTLS | -0.7 | 0.1 | 0.1 | -0.5 | | | | | | | | -0.5 | |
| COE | 2.6 | 59.8 | 250.6 | 313.0 | | | | | | | | 313.0 | |
| CFC | 3.7 | 20.4 | 84.3 | 108.4 | | | | | | | | 108.4 | |
| NOS | 5.3 | 45.7 | 106.3 | 157.3 | | | | | | | | 157.3 | |
| GVA | 10.9 | 126.0 | 441.2 | 578.1 | | | | | | | | 578.1 | |
| TOT | 28.1 | 408.4 | 772.5 | 1209.0 | 277.5 | 5.3 | 166.8 | 131.3 | 1.8 | 524.3 | 1107.0 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | 14.4 | | | | |
| MAN | | | | | 311.9 | | | | |
| CON | | | | | 1.5 | | | | |
| TTC | | | | | 66.4 | | | | |
| FBS | | | | | 54.7 | | | | |
| OSE | | | | | 16.1 | | | | |
| TOT | | | | | 465.0 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.7 | 5.6 | 0.5 | 6.8 | 1.2 | | | 0.0 | 0.0 | 6.4 | 7.6 | 14.4 | |
| MAN | 1.1 | 85.6 | 19.5 | 106.2 | 24.0 | | 1.6 | 19.3 | 0.1 | 135.7 | 180.7 | 286.9 | 25.0 |
| CON | 0.0 | 0.5 | 0.3 | 0.9 | | | | 0.7 | | | 0.7 | 1.5 | |
| TTC | 0.0 | 2.7 | 13.9 | 16.6 | 0.7 | | | 2.8 | 0.0 | 45.8 | 49.3 | 65.9 | 0.5 |
| FBS | 0.2 | 13.8 | 24.4 | 38.5 | 0.2 | | | 2.1 | | 13.9 | 16.2 | 54.7 | |
| OSE | 0.0 | 0.5 | 3.9 | 4.4 | 11.6 | | 0.0 | | 0.1 | 0.0 | 11.7 | 16.1 | |
| TLS | | | | | | | | | | | | | |
| TIC | 2.1 | 108.7 | 62.5 | 173.3 | 37.7 | | 1.6 | 24.9 | 0.1 | 201.8 | 266.2 | 439.5 | 25.5 |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.5 | 0.1 | 0.0 | 25.7 | | | | | |
| MAN | 1.2 | 295.0 | 35.6 | 331.7 | | | | | |
| CON | 0.1 | 87.6 | 4.5 | 92.2 | | | | | |
| TRA | 0.5 | 15.2 | 231.0 | 246.7 | | | | | |
| TRN | 0.5 | 8.0 | 280.8 | 289.2 | | | | | |
| COM | 0.3 | 2.5 | 220.7 | 223.5 | | | | | |
| TOT | 28.1 | 408.4 | 772.5 | 1209.0 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 4.1 | 8.5 | 0.6 | 13.2 | 1.3 | | | 0.1 | 0.0 | 10.8 | 12.2 | 25.5 | 0.2 |
| MAN | 6.8 | 75.9 | 27.7 | 110.4 | 29.9 | | 3.9 | 24.9 | 1.7 | 186.9 | 247.3 | 357.7 | -26.0 |
| CON | 0.3 | 25.6 | 17.1 | 43.0 | 0.4 | | 0.5 | 46.9 | | 2.1 | 49.9 | 92.8 | -0.7 |
| TTC | 1.7 | 29.9 | 60.2 | 91.8 | 61.7 | 0.9 | 3.8 | 8.9 | -0.1 | 80.0 | 155.1 | 246.9 | -0.2 |
| FBS | 1.8 | 29.4 | 132.4 | 163.5 | 74.9 | 0.0 | 3.4 | 11.6 | | 36.1 | 126.0 | 289.5 | -0.3 |
| OSE | 0.2 | 3.0 | 17.3 | 20.5 | 39.5 | 4.4 | 153.5 | 0.4 | 0.1 | 4.7 | 202.6 | 223.1 | 0.4 |
| TLS | 0.2 | 1.5 | 13.6 | 15.3 | 32.1 | | 0.1 | 13.5 | 0.0 | 1.9 | 47.6 | 62.9 | |
| TIC | 15.1 | 173.7 | 268.8 | 457.6 | 239.8 | 5.3 | 165.2 | 106.4 | 1.7 | 322.5 | 840.8 | 1298.4 | -26.5 |
| IMP | 2.1 | 108.7 | 62.5 | 173.3 | 37.7 | | 1.6 | 24.9 | 0.1 | 201.8 | 266.2 | 439.5 | |
| TOT | 17.2 | 282.5 | 331.3 | 630.9 | 277.5 | 5.3 | 166.8 | 131.3 | 1.8 | 524.3 | 1107.0 | 1737.9 | -26.5 |
| OTLS | -0.7 | 0.1 | 0.1 | -0.5 | | | | | | | | -0.5 | |
| COE | 2.6 | 59.8 | 250.6 | 313.0 | | | | | | | | 313.0 | |
| CFC | 3.7 | 20.4 | 84.3 | 108.4 | | | | | | | | 108.4 | |
| NOS | 5.3 | 45.7 | 106.3 | 157.3 | | | | | | | | 157.3 | |
| GVA | 10.9 | 126.0 | 441.2 | 578.1 | | | | | | | | 578.1 | |
| TOT | 28.1 | 408.4 | 772.5 | 1209.0 | 277.5 | 5.3 | 166.8 | 131.3 | 1.8 | 524.3 | 1107.0 | | |
| Check | | | | | | | | | | | | | |

# Table A11.4: Volume indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 100.8 | 96.1 | 87.8 | 100.8 | 103.5 | 101.8 | 103.6 | 111.9 | 102.2 |
| MAN | 95.4 | 104.4 | 99.4 | 103.8 | 103.3 | 103.6 | 102.7 | 97.4 | 103.1 |
| CON | 127.1 | 103.2 | 95.6 | 102.8 | 101.2 | 102.8 | | 98.2 | 102.4 |
| TTC | 92.6 | 98.9 | 103.8 | 103.4 | 101.9 | 103.1 | 102.8 | 95.1 | 103.2 |
| FBS | 99.6 | 102.2 | 102.1 | 102.1 | 107.4 | 102.9 | | 98.2 | 102.8 |
| OSE | 95.2 | 99.1 | 100.5 | 100.5 | 98.3 | 100.3 | 94.6 | 101.9 | 100.4 |
| TOT | 100.4 | 103.8 | 102.0 | 102.6 | 103.4 | 102.8 | 104.2 | 97.8 | 102.6 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.0 | 103.4 | 96.5 | 102.6 | 101.5 | | | 84.8 | -9.1 | 102.0 | 101.1 | 101.8 | 0.5 |
| MAN | 99.5 | 105.6 | 98.5 | 103.6 | 99.4 | | 102.8 | 112.5 | 43.1 | 104.3 | 103.4 | 103.5 | -0.3 |
| CON | 100.7 | 110.7 | 100.2 | 105.9 | 103.3 | | 96.0 | 101.3 | | 91.6 | 100.9 | 103.1 | -0.7 |
| TTC | 99.1 | 100.0 | 101.3 | 101.1 | 99.7 | | | | | 104.5 | 103.4 | 102.5 | 0.7 |
| FBS | 98.9 | 104.7 | 103.0 | 103.3 | 100.5 | | 96.2 | | | 106.2 | 102.2 | 102.9 | -0.1 |
| OSE | 99.4 | 101.8 | 101.4 | 101.5 | 101.0 | 99.8 | | 98.2 | 72.6 | 103.1 | 100.0 | 100.2 | 0.2 |
| TIC | 100.2 | 105.5 | 101.5 | 103.2 | 100.1 | 99.8 | 99.8 | 105.3 | 42.7 | 104.3 | 102.4 | 102.7 | 0.2 |
| OTLS | 137.2 | -84.9 | -30.6 | 55.5 | | | | | | | | 55.5 | |
| COE | 100.1 | 100.0 | 101.0 | 100.8 | | | | | | | | 100.8 | |
| CFC | 101.6 | 100.9 | 101.4 | 101.3 | | | | | | | | 101.3 | |
| NOS | 104.4 | 99.9 | 105.9 | 104.0 | | | | | | | | 104.0 | |
| GVA | 100.8 | 100.2 | 102.3 | 101.8 | | | | | | | | 101.8 | |
| TOT | 100.4 | 103.8 | 102.0 | 102.6 | 100.1 | 99.8 | 99.8 | 105.3 | 42.7 | 104.3 | 102.4 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | 111.9 | |
| MAN | | | | | | | | 97.4 | |
| CON | | | | | | | | 98.2 | |
| TTC | | | | | | | | 95.1 | |
| FBS | | | | | | | | 98.2 | |
| OSE | | | | | | | | 101.9 | |
| TOT | | | | | | | | 97.8 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 92.9 | -40.0 | 134.6 | -375.0 | 101.4 | | | | | 110.5 | 103.3 | 111.9 | |
| MAN | 94.3 | 97.2 | 97.6 | 97.5 | 98.2 | | 100.8 | 105.1 | -100.0 | 104.0 | 99.0 | 98.7 | -1.3 |
| CON | | | 98.1 | 98.1 | 105.9 | | 96.5 | 98.2 | | 100.0 | 98.2 | 98.2 | |
| TTC | | | | 92.2 | 98.2 | | | | | | 96.7 | 95.1 | |
| FBS | 130.0 | -14.3 | 100.4 | 100.7 | 102.9 | | 89.0 | | | 225.0 | 96.3 | 98.2 | |
| OSE | | | | 240.0 | 101.0 | | | 101.1 | | | 101.1 | 101.9 | |
| TOT | 96.4 | 99.7 | 98.3 | 98.4 | 98.7 | | 79.8 | 98.2 | -100.0 | 103.5 | 98.7 | 98.6 | -0.8 |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | 103.6 | | |
| MAN | | | | | | | 102.7 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | 102.8 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | 94.6 | | |
| TOT | | | | | | | | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 101.4 | 104.6 | 95.9 | 102.5 | 101.7 | | | 82.4 | -50.0 | 105.4 | 103.9 | 103.6 | |
| MAN | 97.9 | 107.5 | 97.8 | 104.1 | 100.7 | | 101.5 | 118.6 | -183.3 | 105.2 | 103.4 | 103.6 | -0.9 |
| CON | | | | | | | | | | | | | |
| TTC | 99.2 | 107.3 | 97.7 | 104.0 | 100.8 | | 101.5 | 118.5 | -162.0 | 105.2 | 103.5 | 103.6 | -0.8 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | 95.3 | | | | | 92.3 | 94.6 | 94.6 | |
| TOT | | | | | | | | | | | | | |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 100.8 | 96.1 | | 100.8 | 103.5 | 101.8 | | | |
| MAN | 95.4 | 104.4 | 99.4 | 103.8 | 103.3 | 103.6 | | | |
| CON | 127.1 | 103.2 | 95.6 | 102.8 | 101.2 | 102.8 | | | |
| TTC | 92.6 | 98.9 | 103.8 | 103.4 | 101.9 | 103.1 | | | |
| FBS | 99.6 | 102.2 | 102.1 | 102.1 | 107.4 | 102.9 | | | |
| OSE | | 99.1 | | 100.5 | 98.3 | 100.3 | | | |
| TOT | 100.4 | 103.8 | 102.0 | 102.6 | 103.4 | 102.8 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.1 | 103.1 | 95.9 | 102.4 | 101.3 | | | 85.1 | -7.1 | 100.9 | 99.9 | 101.1 | 0.6 |
| MAN | 99.8 | 105.5 | 98.7 | 103.7 | 99.0 | | 103.7 | 112.3 | 45.7 | 104.2 | 103.8 | 103.7 | -0.2 |
| CON | 100.7 | 110.7 | 100.4 | 106.3 | 103.0 | | 96.0 | 101.7 | | 91.6 | 101.2 | 103.5 | -0.7 |
| TTC | 99.1 | 104.7 | 101.0 | 102.1 | 100.5 | | 101.0 | 109.7 | -102.6 | 104.7 | 103.5 | 103.0 | 0.1 |
| FBS | 98.7 | 104.7 | 103.1 | 103.4 | 100.5 | | 96.4 | 102.0 | | 106.2 | 102.5 | 103.0 | -0.1 |
| OSE | 99.4 | 101.6 | 101.4 | 101.4 | 101.0 | 99.8 | | 93.7 | 72.6 | 103.2 | 100.0 | 100.2 | 0.2 |
| TLS | 96.4 | 99.7 | 98.3 | 98.4 | 98.7 | | 79.8 | 98.2 | -100.0 | 103.5 | 98.7 | 98.6 | |
| TIC | 100.2 | 105.5 | 101.5 | 103.2 | 100.1 | 99.8 | 99.8 | 105.3 | 42.7 | 104.3 | 102.4 | 102.7 | -0.1 |
| OTLS | 137.2 | -84.9 | -30.6 | 55.5 | | | | | | | | 55.5 | |
| COE | 100.1 | 100.0 | 101.0 | 100.8 | | | | | | | | 100.8 | |
| CFC | 101.6 | 100.9 | 101.4 | 101.3 | | | | | | | | 101.3 | |
| NOS | 104.4 | 99.9 | 105.9 | 104.0 | | | | | | | | 104.0 | |
| GVA | 100.8 | 100.2 | 102.3 | 101.8 | | | | | | | | 101.8 | |
| TOT | 100.4 | 103.8 | 102.0 | 102.6 | 100.1 | 99.8 | 99.8 | 105.3 | 42.7 | 104.3 | 102.4 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | 103.5 | | | | |
| MAN | | | | | 103.3 | | | | |
| CON | | | | | 101.2 | | | | |
| TTC | | | | | 101.9 | | | | |
| FBS | | | | | 107.4 | | | | |
| OSE | | | | | 98.3 | | | | |
| TOT | | | | | 103.4 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 100.9 | 106.3 | 88.2 | 104.2 | 105.0 | | | 78.8 | -32.2 | 104.5 | 102.9 | 103.5 | |
| MAN | 104.1 | 106.6 | 99.7 | 105.2 | 100.4 | | 92.0 | 117.4 | 3.1 | 86.4 | 90.0 | 95.1 | 8.3 |
| CON | 100.0 | 110.6 | 96.6 | 104.5 | | | | 97.4 | | | 97.4 | 101.2 | |
| TTC | 102.3 | 99.0 | | 100.2 | | | | | | 101.7 | 101.4 | 101.1 | 0.8 |
| FBS | 98.8 | 103.5 | 107.7 | 106.1 | 92.1 | | | | | | 110.8 | 107.4 | |
| OSE | 85.7 | 104.5 | 101.8 | 102.1 | 97.6 | | | | 57.8 | 97.2 | 97.0 | 98.3 | |
| TLS | | | | | | | | | | | | | |
| TIC | 102.3 | 105.9 | 102.9 | 104.8 | 99.7 | | 92.2 | 114.7 | 6.3 | 91.3 | 93.6 | 97.7 | 5.7 |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 100.8 | 96.1 | | 100.8 | | | | | |
| MAN | 95.4 | 104.4 | 99.4 | 103.8 | | | | | |
| CON | 127.1 | 103.2 | 95.6 | 102.8 | | | | | |
| TTC | 92.6 | 98.9 | 103.8 | 103.4 | | | | | |
| FBS | 99.6 | 102.2 | 102.1 | 102.1 | | | | | |
| OSE | | 99.1 | | 100.5 | | | | | |
| TOT | 100.4 | 103.8 | 102.0 | 102.6 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.3 | 101.0 | 103.0 | 101.5 | 98.0 | | | 86.7 | 19.8 | 98.9 | 98.1 | 99.9 | 0.9 |
| MAN | 99.1 | 104.3 | 98.0 | 102.3 | 98.0 | | 109.4 | 108.6 | 79.6 | 122.5 | 116.8 | 111.9 | -8.1 |
| CON | 100.7 | 110.7 | 100.5 | 106.3 | 103.0 | | 96.0 | 101.8 | | 91.6 | 101.3 | 103.5 | -0.8 |
| TTC | 99.0 | 105.3 | 101.1 | 102.4 | 100.5 | | 101.0 | 114.6 | -110.0 | 106.6 | 104.2 | 103.5 | -0.1 |
| FBS | 98.7 | 105.3 | 102.3 | 102.8 | 100.5 | | 96.4 | 98.3 | | 105.3 | 101.5 | 102.2 | -0.1 |
| OSE | 100.0 | 101.2 | 101.3 | 101.2 | 102.1 | 99.8 | | 93.7 | 95.5 | 103.2 | 100.2 | 100.3 | 0.2 |
| TLS | 96.4 | 99.7 | 98.3 | 98.4 | 98.7 | | 79.8 | 98.2 | -100.0 | 103.5 | 98.7 | 98.6 | |
| TIC | 99.9 | 105.3 | 101.2 | 102.7 | 100.2 | 99.8 | 99.8 | 103.3 | 72.5 | 114.6 | 105.5 | 104.5 | -8.0 |
| IMP | 102.3 | 105.9 | 102.9 | 104.8 | 99.7 | | 92.2 | 114.7 | 6.3 | 91.3 | 93.6 | 97.7 | |
| TOT | 100.2 | 105.5 | 101.5 | 103.2 | 100.1 | 99.8 | 99.8 | 105.3 | 42.7 | 104.3 | 102.4 | 102.7 | -8.0 |
| OTLS | 137.2 | -84.9 | -30.6 | 55.5 | | | | | | | | 55.5 | |
| COE | 100.1 | 100.0 | 101.0 | 100.8 | | | | | | | | 100.8 | |
| CFC | 101.6 | 100.9 | 101.4 | 101.3 | | | | | | | | 101.3 | |
| NOS | 104.4 | 99.9 | 105.9 | 104.0 | | | | | | | | 104.0 | |
| GVA | 100.8 | 100.2 | 102.3 | 101.8 | | | | | | | | 101.8 | |
| TOT | 100.4 | 103.8 | 102.0 | 102.6 | 100.1 | 99.8 | 99.8 | 105.3 | 42.7 | 104.3 | 102.4 | | |

# Table A11.5: Supply and use tables 2010 in current prices

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.3 | 0.2 | 0.0 | 25.5 | 13.9 | 39.4 | 10.8 | 0.4 | 50.6 |
| MAN | 1.2 | 282.6 | 35.8 | 319.6 | 301.8 | 621.4 | 108.8 | 39.2 | 769.4 |
| CON | 0.1 | 84.9 | 4.7 | 89.7 | 1.5 | 91.2 | | 8.4 | 99.6 |
| TTC | 0.6 | 15.4 | 222.6 | 238.5 | 65.1 | 303.6 | -119.7 | 3.1 | 187.1 |
| FBS | 0.5 | 7.8 | 275.0 | 283.3 | 50.9 | 334.2 | | 9.9 | 344.1 |
| OSE | 0.3 | 2.5 | 219.6 | 222.4 | 16.4 | 238.8 | 0.1 | 2.7 | 241.6 |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | 449.7 | 1628.6 | 0.0 | 63.8 | 1692.3 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 5.1 | 15.3 | 1.6 | 22.0 | 5.8 | | | 0.2 | 0.2 | 22.5 | 28.6 | 50.6 | |
| MAN | 8.9 | 173.4 | 63.3 | 245.6 | 121.0 | | 8.9 | 46.0 | 3.8 | 344.1 | 523.7 | 769.4 | |
| CON | 0.3 | 23.6 | 19.4 | 43.2 | 0.5 | | 0.6 | 53.0 | | 2.2 | 56.4 | 99.6 | |
| TTC | 0.6 | 10.8 | 64.8 | 76.1 | 21.0 | 0.9 | 0.5 | 6.7 | 0.0 | 81.8 | 110.9 | 187.1 | |
| FBS | 2.1 | 41.2 | 156.3 | 199.6 | 76.2 | 0.0 | 3.7 | 17.5 | | 47.1 | 144.5 | 344.1 | |
| OSE | 0.2 | 3.4 | 20.9 | 24.5 | 52.7 | 4.5 | 153.6 | 1.2 | 0.3 | 4.9 | 217.0 | 241.6 | |
| TIC | 17.1 | 267.7 | 326.4 | 611.2 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | 1692.3 | |
| OTLS | -0.5 | -0.1 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| COE | 2.6 | 59.8 | 248.1 | 310.5 | | | | | | | | 310.5 | |
| CFC | 3.7 | 20.2 | 83.1 | 107.0 | | | | | | | | 107.0 | |
| NOS | 5.1 | 45.8 | 100.4 | 151.3 | | | | | | | | 151.3 | |
| GVA | 10.8 | 125.7 | 431.2 | 567.8 | | | | | | | | 567.8 | |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | 0.4 | |
| MAN | | | | | | | | 39.2 | |
| CON | | | | | | | | 8.4 | |
| TTC | | | | | | | | 3.1 | |
| FBS | | | | | | | | 9.9 | |
| OSE | | | | | | | | 2.7 | |
| TOT | | | | | | | | 63.8 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | | | | | 0.1 | 0.5 | 0.4 | |
| MAN | 0.2 | 1.6 | 6.3 | 8.2 | 26.9 | | 0.4 | 2.2 | 0.0 | 1.6 | 31.0 | 39.2 | |
| CON | | 0.0 | 2.0 | 2.0 | 0.1 | | 0.1 | 6.3 | | 0.0 | 6.4 | 8.4 | |
| TTC | 0.0 | -0.1 | 1.1 | 1.1 | 1.7 | | -0.1 | 0.5 | | -0.1 | 2.0 | 3.1 | |
| FBS | 0.0 | 0.0 | 4.3 | 4.3 | 1.5 | | 0.1 | 4.1 | | 0.0 | 5.7 | 9.9 | |
| OSE | | 0.0 | 0.0 | 0.0 | 2.1 | | -0.4 | 0.7 | | 0.3 | 2.7 | 2.7 | |
| TOT | 0.2 | 1.5 | 13.8 | 15.5 | 32.5 | | 0.1 | 13.8 | 0.0 | 1.8 | 48.2 | 63.8 | |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | 10.8 | | |
| MAN | | | | | | | 108.8 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | -119.7 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | 0.1 | | |
| TOT | | | | | | | 0.0 | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.4 | 1.6 | 0.4 | 2.5 | 3.0 | | | 0.0 | 0.0 | 5.3 | 8.3 | 10.8 | |
| MAN | 0.8 | 18.6 | 9.2 | 28.6 | 39.6 | | 3.2 | 4.4 | 0.0 | 32.9 | 80.2 | 108.8 | |
| CON | | | | | | | | | | | | | |
| TTC | -1.2 | -20.2 | -9.7 | -31.1 | -42.7 | | -3.2 | -4.4 | -0.1 | -38.2 | -88.6 | -119.7 | |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | 0.1 | | | | | 0.0 | 0.1 | 0.1 | |
| TOT | | | | | 0.0 | | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.3 | 0.2 | 0.0 | 25.5 | 13.9 | 39.4 | | | |
| MAN | 1.2 | 282.6 | 35.8 | 319.6 | 301.8 | 621.4 | | | |
| CON | 0.1 | 84.9 | 4.7 | 89.7 | 1.5 | 91.2 | | | |
| TTC | 0.6 | 15.4 | 222.6 | 238.5 | 65.1 | 303.6 | | | |
| FBS | 0.5 | 7.8 | 275.0 | 283.3 | 50.9 | 334.2 | | | |
| OSE | 0.3 | 2.5 | 219.6 | 222.4 | 16.4 | 238.8 | | | |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | 449.7 | 1628.6 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 4.7 | 13.7 | 1.2 | 19.5 | 2.5 | | | 0.2 | 0.2 | 17.1 | 19.9 | 39.4 | |
| MAN | 7.9 | 153.2 | 47.8 | 208.9 | 54.5 | | 5.4 | 39.4 | 3.8 | 309.6 | 412.5 | 621.4 | |
| CON | 0.3 | 23.6 | 17.4 | 41.2 | 0.4 | | 0.5 | 46.8 | | 2.2 | 50.0 | 91.2 | |
| TTC | 1.8 | 31.1 | 73.3 | 106.2 | 62.1 | 0.9 | 3.7 | 10.7 | 0.1 | 120.1 | 197.5 | 303.6 | |
| FBS | 2.1 | 41.2 | 152.1 | 195.4 | 74.8 | 0.0 | 3.5 | 13.4 | | 47.1 | 138.8 | 334.2 | |
| OSE | 0.2 | 3.4 | 20.9 | 24.5 | 50.5 | 4.5 | 154.0 | 0.5 | 0.3 | 4.6 | 214.3 | 238.8 | |
| TLS | 0.2 | 1.5 | 13.8 | 15.5 | 32.5 | | 0.1 | 13.8 | 0.0 | 1.8 | 48.2 | 63.8 | |
| TIC | 17.1 | 267.7 | 326.4 | 611.2 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | 1692.3 | |
| OTLS | -0.5 | -0.1 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| COE | 2.6 | 59.8 | 248.1 | 310.5 | | | | | | | | 310.5 | |
| CFC | 3.7 | 20.2 | 83.1 | 107.0 | | | | | | | | 107.0 | |
| NOS | 5.1 | 45.8 | 100.4 | 151.3 | | | | | | | | 151.3 | |
| GVA | 10.8 | 125.7 | 431.2 | 567.8 | | | | | | | | 567.8 | |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | 13.9 | | | | |
| MAN | | | | | 301.8 | | | | |
| CON | | | | | 1.5 | | | | |
| TTC | | | | | 65.1 | | | | |
| FBS | | | | | 50.9 | | | | |
| OSE | | | | | 16.4 | | | | |
| TOT | | | | | 449.7 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.7 | 5.3 | 0.6 | 6.5 | 1.2 | | | 0.0 | 0.1 | 6.1 | 7.4 | 13.9 | |
| MAN | 1.1 | 80.4 | 19.5 | 101.0 | 23.9 | | 1.8 | 16.4 | 1.7 | 157.1 | 200.9 | 301.8 | |
| CON | 0.0 | 0.5 | 0.4 | 0.8 | | | | 0.7 | | | 0.7 | 1.5 | |
| TTC | 0.0 | 2.7 | 13.8 | 16.6 | 0.7 | | | 2.9 | 0.0 | 45.0 | 48.6 | 65.1 | |
| FBS | 0.2 | 13.3 | 22.7 | 36.3 | 0.2 | | | 1.7 | | 12.8 | 14.6 | 50.9 | |
| OSE | 0.0 | 0.5 | 3.8 | 4.3 | 11.8 | | | | 0.2 | 0.0 | 12.1 | 16.4 | |
| TLS | | | | | | | | | | | | | |
| TIC | 2.0 | 102.6 | 60.8 | 165.4 | 37.8 | | 1.8 | 21.7 | 1.9 | 221.0 | 284.2 | 449.7 | |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.3 | 0.2 | 0.0 | 25.5 | | | | | |
| MAN | 1.2 | 282.6 | 35.8 | 319.6 | | | | | |
| CON | 0.1 | 84.9 | 4.7 | 89.7 | | | | | |
| TTC | 0.6 | 15.4 | 222.6 | 238.5 | | | | | |
| FBS | 0.5 | 7.8 | 275.0 | 283.3 | | | | | |
| OSE | 0.3 | 2.5 | 219.6 | 222.4 | | | | | |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 4.0 | 8.4 | 0.6 | 13.0 | 1.3 | | | 0.1 | 0.1 | 10.9 | 12.5 | 25.5 | |
| MAN | 6.8 | 72.8 | 28.2 | 107.9 | 30.6 | | 3.6 | 22.9 | 2.1 | 152.5 | 211.7 | 319.6 | |
| CON | 0.3 | 23.1 | 17.0 | 40.4 | 0.4 | | 0.5 | 46.1 | | 2.2 | 49.3 | 89.7 | |
| TTC | 1.7 | 28.4 | 59.5 | 89.6 | 61.4 | 0.9 | 3.7 | 7.8 | 0.1 | 75.1 | 148.9 | 238.5 | |
| FBS | 1.8 | 27.9 | 129.4 | 159.1 | 74.5 | 0.0 | 3.5 | 11.8 | | 34.3 | 124.2 | 283.3 | |
| OSE | 0.2 | 2.9 | 17.1 | 20.2 | 38.7 | 4.5 | 154.0 | 0.5 | 0.1 | 4.5 | 202.2 | 222.4 | |
| TLS | 0.2 | 1.5 | 13.8 | 15.5 | 32.5 | | 0.1 | 13.8 | 0.0 | 1.8 | 48.2 | 63.8 | |
| TIC | 15.1 | 165.0 | 265.6 | 445.7 | 239.4 | 5.3 | 165.5 | 102.9 | 2.4 | 281.5 | 796.9 | 1242.7 | |
| IMP | 2.0 | 102.6 | 60.8 | 165.4 | 37.8 | | 1.8 | 21.7 | 1.9 | 221.0 | 284.2 | 449.7 | |
| TOT | 17.1 | 267.7 | 326.4 | 611.2 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | 1692.3 | |
| OTLS | -0.5 | -0.1 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| COE | 2.6 | 59.8 | 248.1 | 310.5 | | | | | | | | 310.5 | |
| CFC | 3.7 | 20.2 | 83.1 | 107.0 | | | | | | | | 107.0 | |
| NOS | 5.1 | 45.8 | 100.4 | 151.3 | | | | | | | | 151.3 | |
| GVA | 10.8 | 125.7 | 431.2 | 567.8 | | | | | | | | 567.8 | |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | | |
| Check | | | | | | | | | | | | | |

## 2. Balanced supply and use tables (tables A11.6–A11.10)

### Table A11.6: Supply and use tables 2011 in current prices

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.8 | 0.2 | 0.0 | 26.0 | 15.4 | 41.3 | 10.9 | 0.5 | 52.8 |
| MAN | 1.3 | 318.5 | 35.7 | 355.5 | 336.8 | 692.3 | 113.0 | 39.4 | 844.7 |
| CON | 0.1 | 89.0 | 4.5 | 93.6 | 1.6 | 95.1 | | 8.3 | 103.4 |
| TTC | 0.5 | 15.1 | 231.6 | 247.2 | 72.9 | 320.1 | -124.0 | 3.0 | 199.1 |
| FBS | 0.5 | 8.0 | 282.0 | 290.5 | 55.2 | 345.7 | | 9.1 | 354.9 |
| OSE | 0.3 | 2.5 | 222.9 | 225.7 | 16.6 | 242.3 | 0.1 | 3.0 | 245.4 |
| TOT | 28.4 | 433.3 | 776.7 | 1238.4 | 498.6 | 1737.0 | 0.0 | 63.3 | 1800.3 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 5.5 | 17.4 | 1.5 | 24.4 | 5.9 | | | 0.1 | -0.1 | 22.4 | 28.4 | 52.8 | |
| MAN | 10.1 | 202.1 | 65.4 | 277.7 | 122.8 | | 9.1 | 51.5 | 1.4 | 382.1 | 567.0 | 844.7 | |
| CON | 0.3 | 26.2 | 19.8 | 46.3 | 0.5 | | 0.6 | 54.0 | | 2.1 | 57.1 | 103.4 | |
| TTC | 0.6 | 10.8 | 66.2 | 77.5 | 21.2 | 0.9 | 0.5 | 6.7 | 0.0 | 92.3 | 121.6 | 199.1 | |
| FBS | 2.1 | 43.5 | 161.5 | 207.0 | 78.0 | 0.0 | 3.6 | 16.8 | | 49.5 | 147.8 | 354.9 | |
| OSE | 0.2 | 3.5 | 22.2 | 25.9 | 55.1 | 4.6 | 153.4 | 1.2 | 0.2 | 5.1 | 219.5 | 245.4 | |
| TIC | 18.8 | 303.5 | 336.5 | 658.8 | 283.5 | 5.5 | 167.2 | 130.4 | 1.5 | 553.5 | 1141.5 | 1800.3 | |
| OTLS | -0.7 | 0.2 | 0.3 | -0.3 | | | | | | | | -0.3 | |
| COE | 2.7 | 60.9 | 254.4 | 318.0 | | | | | | | | 318.0 | |
| CFC | 3.7 | 20.5 | 82.9 | 107.1 | | | | | | | | 107.1 | |
| NOS | 4.1 | 48.2 | 102.5 | 154.7 | | | | | | | | 154.7 | |
| GVA | 9.7 | 129.8 | 440.1 | 579.6 | | | | | | | | 579.6 | |
| TOT | 28.4 | 433.3 | 776.7 | 1238.4 | 283.5 | 5.5 | 167.2 | 130.4 | 1.5 | 553.5 | 1141.5 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | 0.5 | 0.5 |
| MAN | | | | | | | | 39.4 | 39.4 |
| CON | | | | | | | | 8.3 | 8.3 |
| TTC | | | | | | | | 3.0 | 3.0 |
| FBS | | | | | | | | 9.1 | 9.1 |
| OSE | | | | | | | | 3.0 | 3.0 |
| TOT | | | | | | | | 63.3 | 63.3 |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | | | | | 0.1 | 0.5 | 0.5 | |
| MAN | 0.2 | 1.6 | 6.4 | 8.3 | 26.8 | | 0.4 | 2.2 | 0.0 | 1.7 | 31.1 | 39.4 | |
| CON | | 0.0 | 2.0 | 2.0 | 0.0 | | 0.1 | 6.1 | | 0.0 | 6.2 | 8.3 | |
| TTC | 0.0 | -0.1 | 1.1 | 1.0 | 1.7 | | -0.1 | 0.4 | | -0.1 | 2.0 | 3.0 | |
| FBS | 0.0 | 0.0 | 4.4 | 4.4 | 1.6 | | 0.1 | 3.0 | | 0.0 | 4.7 | 9.1 | |
| OSE | | 0.0 | 0.1 | 0.1 | 2.3 | | -0.4 | 0.7 | | 0.3 | 2.9 | 3.0 | |
| TOT | 0.2 | 1.6 | 14.0 | 15.9 | 32.9 | | 0.1 | 12.5 | 0.0 | 2.0 | 47.5 | 63.3 | |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | 10.9 | | 10.9 |
| MAN | | | | | | | 113.0 | | 113.0 |
| CON | | | | | | | | | |
| TTC | | | | | | | -124.0 | | -124.0 |
| FBS | | | | | | | | | |
| OSE | | | | | | | 0.1 | | 0.1 |
| TOT | | | | | | | 0.0 | | 0.0 |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.4 | 1.6 | 0.4 | 2.5 | 3.2 | | | 0.0 | 0.0 | 5.2 | 8.4 | 10.9 | |
| MAN | 0.9 | 20.4 | 9.2 | 30.5 | 39.9 | | 3.1 | 5.1 | -0.1 | 34.5 | 82.5 | 113.0 | |
| CON | | | | | | | | | | | | | |
| TTC | -1.3 | -22.0 | -9.6 | -33.0 | -43.1 | | -3.1 | -5.1 | 0.1 | -39.7 | -91.0 | -124.0 | |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | 0.1 | | | | | 0.0 | 0.1 | 0.1 | |
| TOT | | | | | 0.0 | | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.8 | 0.2 | 0.0 | 26.0 | 15.4 | 41.3 | | | |
| MAN | 1.3 | 318.5 | 35.7 | 355.5 | 336.8 | 692.3 | | | |
| CON | 0.1 | 89.0 | 4.5 | 93.6 | 1.6 | 95.1 | | | |
| TTC | 0.5 | 15.1 | 231.6 | 247.2 | 72.9 | 320.1 | | | |
| FBS | 0.5 | 8.0 | 282.0 | 290.5 | 55.2 | 345.7 | | | |
| OSE | 0.3 | 2.5 | 222.9 | 225.7 | 16.6 | 242.3 | | | |
| TOT | 28.4 | 433.3 | 776.7 | 1238.4 | 498.6 | 1737.0 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 5.1 | 15.7 | 1.1 | 21.9 | 2.4 | | | 0.1 | -0.1 | 17.1 | 19.5 | 41.3 | |
| MAN | 9.0 | 180.1 | 49.8 | 238.9 | 56.1 | | 5.6 | 44.3 | 1.5 | 345.9 | 453.4 | 692.3 | |
| CON | 0.3 | 26.2 | 17.7 | 44.3 | 0.4 | | 0.5 | 47.9 | | 2.1 | 50.9 | 95.1 | |
| TTC | 1.8 | 32.9 | 74.8 | 109.5 | 62.6 | 0.9 | 3.7 | 11.4 | -0.1 | 132.1 | 210.6 | 320.1 | |
| FBS | 2.1 | 43.5 | 157.1 | 202.6 | 76.4 | 0.0 | 3.5 | 13.8 | | 49.5 | 143.1 | 345.7 | |
| OSE | 0.2 | 3.5 | 22.1 | 25.8 | 52.7 | 4.6 | 153.8 | 0.4 | 0.2 | 4.8 | 216.5 | 242.3 | |
| TLS | 0.2 | 1.6 | 14.0 | 15.9 | 32.9 | | 0.1 | 12.5 | 0.0 | 2.0 | 47.5 | 63.3 | |
| TIC | 18.8 | 303.5 | 336.5 | 658.8 | 283.5 | 5.5 | 167.2 | 130.4 | 1.5 | 553.5 | 1141.5 | 1800.3 | |
| OTLS | -0.7 | 0.2 | 0.3 | -0.3 | | | | | | | | -0.3 | |
| COE | 2.7 | 60.9 | 254.4 | 318.0 | | | | | | | | 318.0 | |
| CFC | 3.7 | 20.5 | 82.9 | 107.1 | | | | | | | | 107.1 | |
| NOS | 4.1 | 48.2 | 102.5 | 154.7 | | | | | | | | 154.7 | |
| GVA | 9.7 | 129.8 | 440.1 | 579.6 | | | | | | | | 579.6 | |
| TOT | 28.4 | 433.3 | 776.7 | 1238.4 | 283.5 | 5.5 | 167.2 | 130.4 | 1.5 | 553.5 | 1141.5 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | 15.4 | | | | |
| MAN | | | | | 336.8 | | | | |
| CON | | | | | 1.6 | | | | |
| TTC | | | | | 72.9 | | | | |
| FBS | | | | | 55.2 | | | | |
| OSE | | | | | 16.6 | | | | |
| TOT | | | | | 498.6 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.8 | 6.4 | 0.5 | 7.7 | 1.2 | | | 0.0 | -0.1 | 6.6 | 7.7 | 15.4 | |
| MAN | 1.3 | 98.0 | 20.9 | 120.2 | 24.7 | | 1.6 | 19.2 | -0.2 | 171.3 | 216.7 | 336.8 | |
| CON | 0.0 | 0.5 | 0.4 | 0.9 | | | | 0.7 | | | 0.7 | 1.6 | |
| TTC | 0.0 | 2.7 | 14.0 | 16.8 | 0.7 | | | 2.7 | 0.0 | 52.7 | 56.1 | 72.9 | |
| FBS | 0.2 | 14.0 | 24.5 | 38.8 | 0.2 | | | 2.2 | | 14.1 | 16.5 | 55.2 | |
| OSE | 0.0 | 0.5 | 3.9 | 4.5 | 12.0 | | 0.0 | | 0.1 | 0.0 | 12.2 | 16.6 | |
| TLS | | | | | | | | | | | | | |
| TIC | 2.3 | 122.1 | 64.2 | 188.7 | 38.9 | | 1.6 | 24.8 | -0.1 | 244.7 | 309.9 | 498.6 | |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.8 | 0.2 | 0.0 | 26.0 | | | | | |
| MAN | 1.3 | 318.5 | 35.7 | 355.5 | | | | | |
| CON | 0.1 | 89.0 | 4.5 | 93.6 | | | | | |
| TTC | 0.5 | 15.1 | 231.6 | 247.2 | | | | | |
| FBS | 0.5 | 8.0 | 282.0 | 290.5 | | | | | |
| OSE | 0.3 | 2.5 | 222.9 | 225.7 | | | | | |
| TOT | 28.4 | 433.3 | 776.7 | 1238.4 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 4.3 | 9.3 | 0.6 | 14.2 | 1.2 | | | 0.1 | 0.0 | 10.5 | 11.7 | 26.0 | |
| MAN | 7.8 | 82.1 | 28.9 | 118.8 | 31.4 | | 4.0 | 25.1 | 1.6 | 174.6 | 236.7 | 355.5 | |
| CON | 0.3 | 25.7 | 17.4 | 43.4 | 0.4 | | 0.5 | 47.2 | | 2.1 | 50.2 | 93.6 | |
| TTC | 1.8 | 30.2 | 60.7 | 92.7 | 61.9 | 0.9 | 3.7 | 8.6 | -0.1 | 79.4 | 154.5 | 247.2 | |
| FBS | 1.8 | 29.5 | 132.6 | 163.9 | 76.2 | 0.0 | 3.5 | 11.6 | | 35.4 | 126.6 | 290.5 | |
| OSE | 0.2 | 3.0 | 18.1 | 21.3 | 40.6 | 4.6 | 153.8 | 0.4 | 0.1 | 4.8 | 204.3 | 225.7 | |
| TLS | 0.2 | 1.6 | 14.0 | 15.9 | 32.9 | | 0.1 | 12.5 | 0.0 | 2.0 | 47.5 | 63.3 | |
| TIC | 16.4 | 181.4 | 272.3 | 470.2 | 244.6 | 5.5 | 165.5 | 105.6 | 1.6 | 308.7 | 831.6 | 1301.8 | |
| IMP | 2.3 | 122.1 | 64.2 | 188.7 | 38.9 | | 1.6 | 24.8 | -0.1 | 244.7 | 309.9 | 498.6 | |
| TOT | 18.8 | 303.5 | 336.5 | 658.8 | 283.5 | 5.5 | 167.2 | 130.4 | 1.5 | 553.5 | 1141.5 | 1800.3 | |
| OTLS | -0.7 | 0.2 | 0.3 | -0.3 | | | | | | | | -0.3 | |
| COE | 2.7 | 60.9 | 254.4 | 318.0 | | | | | | | | 318.0 | |
| CFC | 3.7 | 20.5 | 82.9 | 107.1 | | | | | | | | 107.1 | |
| NOS | 4.1 | 48.2 | 102.5 | 154.7 | | | | | | | | 154.7 | |
| GVA | 9.7 | 129.8 | 440.1 | 579.6 | | | | | | | | 579.6 | |
| TOT | 28.4 | 433.3 | 776.7 | 1238.4 | 283.5 | 5.5 | 167.2 | 130.4 | 1.5 | 553.5 | 1141.5 | | |
| Check | | | | | | | | | | | | | |

# Table A11.7: Price indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.0 | 104.1 | | 102.0 | 106.9 | 103.8 | 97.5 | 107.6 | 102.4 |
| MAN | 107.5 | 108.0 | 100.5 | 107.2 | 108.0 | 107.6 | 100.2 | 101.9 | 106.2 |
| CON | 103.4 | 100.5 | 100.5 | 100.5 | 101.6 | 100.5 | | 100.1 | 100.5 |
| TTC | 101.1 | 99.2 | 100.3 | 100.2 | 110.7 | 102.4 | 100.0 | 101.4 | 104.0 |
| FBS | 102.9 | 100.9 | 100.4 | 100.4 | 101.0 | 100.5 | | 93.6 | 100.3 |
| OSE | | 100.2 | | 101.0 | 103.4 | 101.1 | 99.1 | 110.2 | 101.2 |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | 107.3 | 103.7 | | 100.8 | 103.6 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 105.8 | 109.9 | 98.7 | 108.2 | 100.4 | | | 94.7 | 568.8 | 97.7 | 98.0 | 102.4 | |
| MAN | 114.1 | 110.4 | 105.0 | 109.2 | 102.1 | | 99.5 | 99.6 | 85.7 | 106.8 | 104.9 | 106.2 | |
| CON | 101.4 | 100.5 | 101.8 | 101.0 | 97.4 | | 97.1 | 100.0 | | 102.0 | 100.0 | 100.5 | |
| TTC | 100.9 | 100.1 | 100.8 | 100.7 | 102.2 | | | | | 108.0 | 106.2 | 104.0 | |
| FBS | 101.4 | 100.7 | 100.4 | 100.5 | 101.7 | | 101.8 | | | 99.0 | 100.1 | 100.3 | |
| OSE | 102.4 | 101.7 | 104.3 | 103.9 | 102.7 | 103.8 | | 101.7 | 99.5 | 101.8 | 100.9 | 101.2 | |
| TIC | 109.3 | 107.5 | 101.7 | 104.5 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.8 | 103.2 | 103.6 | |
| OTLS | 98.0 | 201.1 | 269.9 | 48.3 | | | | | | | | 48.3 | |
| COE | 102.7 | 101.9 | 101.5 | 101.6 | | | | | | | | 101.6 | |
| CFC | 99.1 | 100.6 | 98.4 | 98.8 | | | | | | | | 98.8 | |
| NOS | 79.8 | 103.2 | 96.2 | 97.7 | | | | | | | | 97.7 | |
| GVA | 90.8 | 102.2 | 99.7 | 100.1 | | | | | | | | 100.1 | |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.8 | 103.2 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | 107.6 | |
| MAN | | | | | | | | 101.9 | |
| CON | | | | | | | | 100.1 | |
| TTC | | | | | | | | 101.4 | |
| FBS | | | | | | | | 93.6 | |
| OSE | | | | | | | | 110.2 | |
| TOT | | | | | | | | 100.8 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 92.3 | 612.5 | 91.4 | 230.0 | 100.8 | | | | | 96.2 | 99.8 | 107.6 | |
| MAN | 103.7 | 106.1 | 103.9 | 104.3 | 101.7 | | 98.7 | 93.8 | -100.0 | 104.4 | 101.3 | 101.9 | |
| CON | | | 102.2 | 102.1 | 90.7 | | 95.1 | 99.6 | | 100.0 | 99.4 | 100.1 | |
| TTC | | | | 99.4 | 103.3 | | | | | | 102.4 | 101.4 | |
| FBS | 123.1 | 100.0 | 102.7 | 102.8 | 105.7 | 103.8 | | | | 44.4 | 86.4 | 93.6 | |
| OSE | | | | 241.7 | 109.2 | | | 101.1 | | | 108.5 | 110.2 | |
| TOT | 105.1 | 108.7 | 103.3 | 103.9 | 102.5 | | 102.3 | 92.5 | -100.0 | 105.0 | 99.8 | 100.8 | |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | 97.5 | | |
| MAN | | | | | | | 100.2 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | 100.0 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | 99.1 | | |
| TOT | | | | | | | | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 90.4 | 96.7 | 100.7 | 96.3 | 104.9 | | | 85.7 | 100.0 | 94.0 | 97.9 | 97.5 | |
| MAN | 113.7 | 102.0 | 102.3 | 102.4 | 99.8 | | 97.9 | 97.5 | 93.5 | 99.5 | 99.5 | 100.2 | |
| CON | | | | | | | | | | | | | |
| TTC | 105.0 | 101.6 | 102.2 | 101.9 | 100.2 | | 97.9 | 97.5 | 93.8 | 98.8 | 99.3 | 100.0 | |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | 97.6 | | | | | 104.2 | 99.1 | 99.1 | |
| TOT | | | | | | | | | | | | | |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.0 | 104.1 | | 102.0 | 106.9 | 103.8 | | | 103.8 |
| MAN | 107.5 | 108.0 | 100.5 | 107.2 | 108.0 | 107.6 | | | 107.6 |
| CON | 103.4 | 100.5 | 100.5 | 100.5 | 101.6 | 100.5 | | | 100.5 |
| TTC | 101.1 | 99.2 | 100.3 | 100.2 | 110.7 | 102.4 | | | 102.4 |
| FBS | 102.9 | 100.9 | 100.4 | 100.4 | 101.0 | 100.5 | | | 100.5 |
| OSE | | 100.2 | | 101.0 | 103.4 | 101.1 | | | 101.1 |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | 107.3 | 103.7 | | | 103.7 |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 107.2 | 111.2 | 98.1 | 109.5 | 94.9 | | | 95.6 | 725.0 | 98.9 | 98.0 | 103.8 | |
| MAN | 114.4 | 111.5 | 105.6 | 110.3 | 104.0 | | 100.5 | 100.2 | 85.7 | 107.6 | 106.2 | 107.6 | |
| CON | 101.4 | 100.5 | 101.7 | 101.0 | 98.3 | | 97.4 | 100.0 | | 102.0 | 100.1 | 100.5 | |
| TTC | 103.8 | 101.1 | 101.0 | 101.1 | 100.8 | | 98.5 | 97.0 | 93.7 | 105.0 | 103.1 | 102.4 | |
| FBS | 101.2 | 100.7 | 100.4 | 100.5 | 101.7 | | 101.7 | 100.6 | | 99.0 | 100.6 | 100.5 | |
| OSE | 102.4 | 101.8 | 104.1 | 103.7 | 102.4 | 103.8 | | 102.5 | 99.5 | 101.5 | 100.8 | 101.1 | |
| TLS | 105.1 | 108.7 | 103.3 | 103.9 | 102.5 | | 102.3 | 92.5 | -100.0 | 105.0 | 99.8 | 100.8 | |
| TIC | 109.3 | 107.5 | 101.7 | 104.5 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.8 | 103.2 | 103.6 | |
| OTLS | 98.0 | 201.1 | 269.9 | 48.3 | | | | | | | | 48.3 | |
| COE | 102.7 | 101.9 | 101.5 | 101.6 | | | | | | | | 101.6 | |
| CFC | 99.1 | 100.6 | 98.4 | 98.8 | | | | | | | | 98.8 | |
| NOS | 79.8 | 103.2 | 96.2 | 97.7 | | | | | | | | 97.7 | |
| GVA | 90.8 | 102.2 | 99.7 | 100.1 | | | | | | | | 100.1 | |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.8 | 103.2 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | 106.9 | | | | |
| MAN | | | | | 108.0 | | | | |
| CON | | | | | 101.6 | | | | |
| TTC | | | | | 110.7 | | | | |
| FBS | | | | | 101.0 | | | | |
| OSE | | | | | 103.4 | | | | |
| TOT | | | | | 107.3 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 113.0 | 114.5 | 98.0 | 113.2 | 100.1 | | | 100.0 | 207.1 | 102.1 | 101.4 | 106.9 | |
| MAN | 112.6 | 114.4 | 107.2 | 113.1 | 102.8 | | 99.6 | 99.5 | -311.5 | 106.6 | 105.3 | 108.0 | |
| CON | 100.0 | 101.0 | 102.0 | 101.4 | | | | 101.8 | | | 101.8 | 101.6 | |
| TTC | 100.0 | 100.5 | | 101.2 | | | | | | 115.2 | 113.9 | 110.7 | |
| FBS | 97.0 | 101.4 | 100.4 | 100.8 | 106.7 | | | | | | 101.6 | 101.0 | |
| OSE | 100.0 | 100.8 | 101.4 | 101.4 | 104.2 | | | | 99.0 | 97.1 | 104.1 | 103.4 | |
| TLS | | | | | | | | | | | | | |
| TIC | 110.7 | 112.3 | 102.8 | 108.9 | 103.2 | | 99.6 | 99.4 | -100.8 | 107.9 | 106.4 | 107.3 | |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.0 | 104.1 | | 102.0 | | | | | |
| MAN | 107.5 | 108.0 | 100.5 | 107.2 | | | | | |
| CON | 103.4 | 100.5 | 100.5 | 100.5 | | | | | |
| TTC | 101.1 | 99.2 | 100.3 | 100.2 | | | | | |
| FBS | 102.9 | 100.9 | 100.4 | 100.4 | | | | | |
| OSE | | 100.2 | | 101.0 | | | | | |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 106.2 | 109.0 | 98.2 | 107.6 | 90.0 | | | 94.6 | -181.3 | 97.0 | 95.9 | 102.0 | |
| MAN | 114.7 | 108.1 | 104.5 | 107.6 | 105.0 | | 100.8 | 100.7 | 98.0 | 108.5 | 106.9 | 107.2 | |
| CON | 101.4 | 100.5 | 101.7 | 101.0 | 98.3 | | 97.4 | 100.0 | | 102.0 | 100.0 | 100.5 | |
| TTC | 103.9 | 101.1 | 100.9 | 101.0 | 100.8 | | 98.5 | 97.2 | 93.5 | 99.2 | 99.7 | 100.2 | |
| FBS | 101.8 | 100.4 | 100.4 | 100.4 | 101.7 | | 101.7 | 100.5 | | 98.0 | 100.5 | 100.4 | |
| OSE | 102.5 | 101.9 | 104.7 | 104.2 | 101.9 | 103.8 | | 102.5 | 100.0 | 101.5 | 100.7 | 101.0 | |
| TLS | 105.1 | 108.7 | 103.3 | 103.9 | 102.5 | | 102.3 | 92.5 | -100.0 | 105.0 | 99.8 | 100.8 | |
| TIC | 109.1 | 104.4 | 101.4 | 102.8 | 101.9 | 103.3 | 100.2 | 99.0 | 96.1 | 104.1 | 102.0 | 102.3 | |
| IMP | 110.7 | 112.3 | 102.8 | 108.9 | 103.2 | | 99.6 | 99.4 | -100.8 | 107.9 | 106.4 | 107.3 | |
| TOT | 109.3 | 107.5 | 101.7 | 104.5 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.8 | 103.2 | 103.6 | |
| OTLS | 98.0 | 201.1 | 269.9 | 48.3 | | | | | | | | 48.3 | |
| COE | 102.7 | 101.9 | 101.5 | 101.6 | | | | | | | | 101.6 | |
| CFC | 99.1 | 100.6 | 98.4 | 98.8 | | | | | | | | 98.8 | |
| NOS | 79.8 | 103.2 | 96.2 | 97.7 | | | | | | | | 97.7 | |
| GVA | 90.8 | 102.2 | 99.7 | 100.1 | | | | | | | | 100.1 | |
| TOT | 102.2 | 105.8 | 100.5 | 102.4 | 102.1 | 103.3 | 100.2 | 99.1 | 83.0 | 105.8 | 103.2 | | |

# Table A11.8: Supply and use tables 2011 at previous years' prices

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.3 | 0.1 | 0.0 | 25.5 | 14.4 | 39.8 | 11.2 | 0.5 | 51.5 |
| MAN | 1.2 | 295.0 | 35.6 | 331.7 | 311.9 | 643.7 | 112.7 | 38.7 | 795.1 |
| CON | 0.1 | 88.6 | 4.5 | 93.1 | 1.5 | 94.7 | | 8.3 | 102.9 |
| TTC | 0.5 | 15.2 | 231.0 | 246.7 | 65.9 | 312.6 | -124.0 | 3.0 | 191.5 |
| FBS | 0.5 | 8.0 | 280.8 | 289.2 | 54.7 | 343.9 | | 9.7 | 353.7 |
| OSE | 0.3 | 2.5 | 220.7 | 223.5 | 16.1 | 239.6 | 0.1 | 2.7 | 242.4 |
| TOT | 27.8 | 409.4 | 772.5 | 1209.8 | 464.5 | 1674.3 | 0.0 | 62.9 | 1737.1 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 5.2 | 15.8 | 1.6 | 22.6 | 5.9 | | | 0.2 | 0.0 | 22.9 | 29.0 | 51.5 | |
| MAN | 8.9 | 183.1 | 62.3 | 254.4 | 120.3 | | 9.2 | 51.7 | 1.6 | 357.9 | 540.7 | 795.1 | |
| CON | 0.3 | 26.1 | 19.4 | 45.8 | 0.5 | | 0.6 | 54.0 | | 2.1 | 57.1 | 102.9 | |
| TTC | 0.6 | 10.8 | 65.6 | 77.0 | 20.8 | 0.9 | 0.5 | 6.9 | 0.0 | 85.5 | 114.5 | 191.5 | |
| FBS | 2.0 | 43.2 | 160.8 | 206.0 | 76.6 | 0.0 | 3.5 | 17.6 | | 50.0 | 147.7 | 353.7 | |
| OSE | 0.2 | 3.5 | 21.2 | 24.9 | 53.6 | 4.4 | 153.1 | 1.1 | 0.2 | 5.0 | 217.5 | 242.4 | |
| TIC | 17.2 | 282.5 | 331.0 | 630.6 | 277.7 | 5.3 | 166.8 | 131.6 | 1.8 | 523.3 | 1106.5 | 1737.1 | |
| OTLS | -0.7 | 0.1 | 0.1 | -0.5 | | | | | | | | -0.5 | |
| COE | 2.6 | 59.8 | 250.6 | 313.0 | | | | | | | | 313.0 | |
| CFC | 3.7 | 20.4 | 84.3 | 108.4 | | | | | | | | 108.4 | |
| NOS | 5.1 | 46.7 | 106.6 | 158.4 | | | | | | | | 158.4 | |
| GVA | 10.7 | 127.0 | 441.5 | 579.2 | | | | | | | | 579.2 | |
| TOT | 27.8 | 409.4 | 772.5 | 1209.8 | 277.7 | 5.3 | 166.8 | 131.6 | 1.8 | 523.3 | 1106.5 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | 0.5 | |
| MAN | | | | | | | | 38.7 | |
| CON | | | | | | | | 8.3 | |
| TTC | | | | | | | | 3.0 | |
| FBS | | | | | | | | 9.7 | |
| OSE | | | | | | | | 2.7 | |
| TOT | | | | | | | | 62.9 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | | | | | 0.1 | 0.5 | 0.5 | |
| MAN | 0.2 | 1.6 | 6.2 | 8.0 | 26.4 | | 0.4 | 2.3 | 0.0 | 1.6 | 30.7 | 38.7 | |
| CON | | 0.0 | 2.0 | 2.0 | 0.1 | | 0.1 | 6.1 | | 0.0 | 6.3 | 8.3 | |
| TTC | 0.0 | -0.1 | 1.1 | 1.0 | 1.7 | | -0.1 | 0.5 | | -0.1 | 2.0 | 3.0 | |
| FBS | 0.0 | 0.0 | 4.3 | 4.3 | 1.5 | | 0.1 | 3.9 | | 0.0 | 5.5 | 9.7 | |
| OSE | | 0.0 | 0.0 | 0.0 | 2.1 | | -0.4 | 0.7 | | 0.3 | 2.7 | 2.7 | |
| TOT | 0.2 | 1.5 | 13.6 | 15.3 | 32.1 | | 0.1 | 13.5 | 0.0 | 1.9 | 47.6 | 62.9 | |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | 11.2 | | |
| MAN | | | | | | | 112.7 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | -124.0 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | 0.1 | | |
| TOT | | | | | | | 0.0 | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.4 | 1.7 | 0.4 | 2.6 | 3.1 | | | 0.0 | 0.0 | 5.6 | 8.6 | 11.2 | |
| MAN | 0.8 | 20.0 | 9.0 | 29.8 | 39.9 | | 3.2 | 5.2 | -0.1 | 34.7 | 82.9 | 112.7 | |
| CON | | | | | | | | | | | | | |
| TTC | -1.2 | -21.7 | -9.4 | -32.3 | -43.1 | | -3.2 | -5.2 | 0.1 | -40.2 | -91.7 | -124.0 | |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | 0.1 | | | | | 0.0 | 0.1 | 0.1 | |
| TOT | | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.3 | 0.1 | 0.0 | 25.5 | 14.4 | 39.8 | | | |
| MAN | 1.2 | 295.0 | 35.6 | 331.7 | 311.9 | 643.7 | | | |
| CON | 0.1 | 88.6 | 4.5 | 93.1 | 1.5 | 94.7 | | | |
| TTC | 0.5 | 15.2 | 231.0 | 246.7 | 65.9 | 312.6 | | | |
| FBS | 0.5 | 8.0 | 280.8 | 289.2 | 54.7 | 343.9 | | | |
| OSE | 0.3 | 2.5 | 220.7 | 223.5 | 16.1 | 239.6 | | | |
| TOT | 27.8 | 409.4 | 772.5 | 1209.8 | 464.5 | 1674.3 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 4.8 | 14.1 | 1.1 | 20.0 | 2.5 | | | 0.1 | 0.0 | 17.2 | 19.9 | 39.8 | |
| MAN | 7.9 | 161.6 | 47.1 | 216.6 | 53.9 | | 5.6 | 44.2 | 1.7 | 321.6 | 427.0 | 643.7 | |
| CON | 0.3 | 26.1 | 17.4 | 43.8 | 0.4 | | 0.5 | 47.9 | | 2.1 | 50.9 | 94.7 | |
| TTC | 1.8 | 32.5 | 74.0 | 108.3 | 62.2 | 0.9 | 3.8 | 11.7 | -0.1 | 125.8 | 204.2 | 312.6 | |
| FBS | 2.0 | 43.2 | 156.5 | 201.7 | 75.1 | 0.0 | 3.4 | 13.7 | | 50.0 | 142.2 | 343.9 | |
| OSE | 0.2 | 3.5 | 21.2 | 24.9 | 51.4 | 4.4 | 153.5 | 0.4 | 0.2 | 4.7 | 214.7 | 239.6 | |
| TLS | 0.2 | 1.5 | 13.6 | 15.3 | 32.1 | | 0.1 | 13.5 | 0.0 | 1.9 | 47.6 | 62.9 | |
| TIC | 17.2 | 282.5 | 331.0 | 630.6 | 277.7 | 5.3 | 166.8 | 131.6 | 1.8 | 523.3 | 1106.5 | 1737.1 | |
| OTLS | -0.7 | 0.1 | 0.1 | -0.5 | | | | | | | | -0.5 | |
| COE | 2.6 | 59.8 | 250.6 | 313.0 | | | | | | | | 313.0 | |
| CFC | 3.7 | 20.4 | 84.3 | 108.4 | | | | | | | | 108.4 | |
| NOS | 5.1 | 46.7 | 106.6 | 158.4 | | | | | | | | 158.4 | |
| GVA | 10.7 | 127.0 | 441.5 | 579.2 | | | | | | | | 579.2 | |
| TOT | 27.8 | 409.4 | 772.5 | 1209.8 | 277.7 | 5.3 | 166.8 | 131.6 | 1.8 | 523.3 | 1106.5 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | 14.4 | | | | |
| MAN | | | | | 311.9 | | | | |
| CON | | | | | 1.5 | | | | |
| TTC | | | | | 65.9 | | | | |
| FBS | | | | | 54.7 | | | | |
| OSE | | | | | 16.1 | | | | |
| TOT | | | | | 464.5 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.7 | 5.6 | 0.5 | 6.8 | 1.2 | | | 0.0 | 0.0 | 6.4 | 7.6 | 14.4 | |
| MAN | 1.1 | 85.6 | 19.5 | 106.2 | 24.0 | | 1.6 | 19.3 | 0.1 | 160.7 | 205.7 | 311.9 | |
| CON | 0.0 | 0.5 | 0.3 | 0.9 | | | | 0.7 | | | 0.7 | 1.5 | |
| TTC | 0.0 | 2.7 | 13.9 | 16.6 | 0.7 | | | 2.8 | 0.0 | 45.8 | 49.3 | 65.9 | |
| FBS | 0.2 | 13.8 | 24.4 | 38.5 | 0.2 | | | 2.1 | | 13.9 | 16.2 | 54.7 | |
| OSE | 0.0 | 0.5 | 3.9 | 4.4 | 11.6 | | 0.0 | | 0.1 | 0.0 | 11.7 | 16.1 | |
| TLS | | | | | | | | | | | | | |
| TIC | 2.1 | 108.7 | 62.5 | 173.3 | 37.7 | | 1.6 | 24.9 | 0.1 | 226.8 | 291.2 | 464.5 | |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.3 | 0.1 | 0.0 | 25.5 | | | | | |
| MAN | 1.2 | 295.0 | 35.6 | 331.7 | | | | | |
| CON | 0.1 | 88.6 | 4.5 | 93.1 | | | | | |
| TRA | 0.5 | 15.2 | 231.0 | 246.7 | | | | | |
| TRN | 0.5 | 8.0 | 280.8 | 289.2 | | | | | |
| COM | 0.3 | 2.5 | 220.7 | 223.5 | | | | | |
| TOT | 27.8 | 409.4 | 772.5 | 1209.8 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 4.1 | 8.5 | 0.6 | 13.2 | 1.3 | | | 0.1 | 0.0 | 10.8 | 12.2 | 25.5 | |
| MAN | 6.8 | 75.9 | 27.7 | 110.4 | 29.9 | | 3.9 | 24.9 | 1.7 | 160.9 | 221.3 | 331.7 | |
| CON | 0.3 | 25.6 | 17.1 | 43.0 | 0.4 | | 0.5 | 47.2 | | 2.1 | 50.2 | 93.1 | |
| TTC | 1.7 | 29.9 | 60.2 | 91.8 | 61.5 | 0.9 | 3.8 | 8.9 | -0.1 | 80.0 | 154.9 | 246.7 | |
| FBS | 1.8 | 29.4 | 132.1 | 163.2 | 74.9 | 0.0 | 3.4 | 11.6 | | 36.1 | 126.0 | 289.2 | |
| OSE | 0.2 | 3.0 | 17.3 | 20.5 | 39.9 | 4.4 | 153.5 | 0.4 | 0.1 | 4.7 | 203.0 | 223.5 | |
| TLS | 0.2 | 1.5 | 13.6 | 15.3 | 32.1 | | 0.1 | 13.5 | 0.0 | 1.9 | 47.6 | 62.9 | |
| TIC | 15.1 | 173.7 | 268.5 | 457.3 | 240.0 | 5.3 | 165.2 | 106.7 | 1.7 | 296.5 | 815.3 | 1272.6 | |
| IMP | 2.1 | 108.7 | 62.5 | 173.3 | 37.7 | | 1.6 | 24.9 | 0.1 | 226.8 | 291.2 | 464.5 | |
| TOT | 17.2 | 282.5 | 331.0 | 630.6 | 277.7 | 5.3 | 166.8 | 131.6 | 1.8 | 523.3 | 1106.5 | 1737.1 | |
| OTLS | -0.7 | 0.1 | 0.1 | -0.5 | | | | | | | | -0.5 | |
| COE | 2.6 | 59.8 | 250.6 | 313.0 | | | | | | | | 313.0 | |
| CFC | 3.7 | 20.4 | 84.3 | 108.4 | | | | | | | | 108.4 | |
| NOS | 5.1 | 46.7 | 106.6 | 158.4 | | | | | | | | 158.4 | |
| GVA | 10.7 | 127.0 | 441.5 | 579.2 | | | | | | | | 579.2 | |
| TOT | 27.8 | 409.4 | 772.5 | 1209.8 | 277.7 | 5.3 | 166.8 | 131.6 | 1.8 | 523.3 | 1106.5 | | |
| Check | | | | | | | | | | | | | |

# Table A11.9: Volume indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 99.9 | 96.1 | 87.8 | 99.9 | 103.5 | 101.1 | 103.6 | 111.9 | 101.8 |
| MAN | 95.4 | 104.4 | 99.4 | 103.8 | 103.3 | 103.6 | 103.6 | 98.7 | 103.3 |
| CON | 127.1 | 104.3 | 95.6 | 103.9 | 101.2 | 103.8 | | 98.2 | 103.4 |
| TTC | 92.6 | 98.9 | 103.8 | 103.4 | 101.1 | 102.9 | 103.6 | 95.1 | 102.4 |
| FBS | 99.6 | 102.2 | 102.1 | 102.1 | 107.4 | 102.9 | | 98.2 | 102.8 |
| OSE | 95.2 | 99.1 | 100.5 | 100.5 | 98.3 | 100.3 | 94.6 | 101.9 | 100.4 |
| TOT | 99.6 | 104.1 | 102.0 | 102.6 | 103.3 | 102.8 | 104.2 | 98.6 | 102.6 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.0 | 103.4 | 96.5 | 102.6 | 101.5 | | | 84.8 | -9.1 | 102.0 | 101.1 | 101.8 | |
| MAN | 99.5 | 105.6 | 98.5 | 103.6 | 99.4 | | 102.8 | 112.5 | 43.1 | 104.0 | 103.2 | 103.3 | |
| CON | 100.7 | 110.7 | 100.2 | 105.9 | 103.3 | | 96.0 | 101.9 | | 91.6 | 101.4 | 103.4 | |
| TTC | 99.1 | 100.0 | 101.3 | 101.1 | 98.8 | | | | | 104.5 | 103.2 | 102.4 | |
| FBS | 98.9 | 104.7 | 102.8 | 103.2 | 100.5 | | 96.2 | | | 106.2 | 102.2 | 102.8 | |
| OSE | 99.4 | 101.8 | 101.4 | 101.5 | 101.8 | 99.8 | | 98.2 | 72.6 | 103.1 | 100.2 | 100.4 | |
| TIC | 100.2 | 105.5 | 101.4 | 103.2 | 100.2 | 99.8 | 99.8 | 105.6 | 42.7 | 104.1 | 102.3 | 102.6 | |
| OTLS | 137.2 | -84.9 | -30.6 | 55.5 | | | | | | | | 55.5 | |
| COE | 100.1 | 100.0 | 101.0 | 100.8 | | | | | | | | 100.8 | |
| CFC | 101.6 | 100.9 | 101.4 | 101.3 | | | | | | | | 101.3 | |
| NOS | 99.7 | 102.0 | 106.2 | 104.7 | | | | | | | | 104.7 | |
| GVA | 98.6 | 101.0 | 102.4 | 102.0 | | | | | | | | 102.0 | |
| TOT | 99.6 | 104.1 | 102.0 | 102.6 | 100.2 | 99.8 | 99.8 | 105.6 | 42.7 | 104.1 | 102.3 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | 111.9 | |
| MAN | | | | | | | | 98.7 | |
| CON | | | | | | | | 98.2 | |
| TTC | | | | | | | | 95.1 | |
| FBS | | | | | | | | 98.2 | |
| OSE | | | | | | | | 101.9 | |
| TOT | | | | | | | | 98.6 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 92.9 | -40.0 | 134.6 | -375.0 | 101.4 | | | | | 110.5 | 103.3 | 111.9 | |
| MAN | 94.3 | 97.2 | 97.6 | 97.5 | 98.2 | | 100.8 | 105.1 | -100.0 | 104.0 | 99.0 | 98.7 | |
| CON | | | 98.1 | 98.1 | 105.9 | | 96.5 | 98.2 | | 100.0 | 98.2 | 98.2 | |
| TTC | | | | 92.2 | 98.2 | | | | | | 96.7 | 95.1 | |
| FBS | 130.0 | -14.3 | 100.4 | 100.7 | 102.9 | | 89.0 | | | 225.0 | 96.3 | 98.2 | |
| OSE | | | | 240.0 | 101.0 | | | 101.1 | | | 101.1 | 101.9 | |
| TOT | 96.4 | 99.7 | 98.3 | 98.4 | 98.7 | | 79.8 | 98.2 | -100.0 | 103.5 | 98.7 | 98.6 | |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | 103.6 | | |
| MAN | | | | | | | 103.6 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | 103.6 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | 94.6 | | |
| TOT | | | | | | | | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 101.4 | 104.6 | 95.9 | 102.5 | 101.7 | | | 82.4 | -50.0 | 105.4 | 103.9 | 103.6 | |
| MAN | 97.9 | 107.5 | 97.8 | 104.1 | 100.7 | | 101.5 | 118.6 | -183.3 | 105.2 | 103.4 | 103.6 | |
| CON | | | | | | | | | | | | | |
| TTC | 99.2 | 107.3 | 97.7 | 104.0 | 100.8 | | 101.5 | 118.5 | -162.0 | 105.2 | 103.5 | 103.6 | |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | 95.3 | | | | | 92.3 | 94.6 | 94.6 | |
| TOT | | | | | | | | | | | | | |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 99.9 | 96.1 | | 99.9 | 103.5 | 101.1 | | | |
| MAN | 95.4 | 104.4 | 99.4 | 103.8 | 103.3 | 103.6 | | | |
| CON | 127.1 | 104.3 | 95.6 | 103.9 | 101.2 | 103.8 | | | |
| TTC | 92.6 | 98.9 | 103.8 | 103.4 | 101.1 | 102.9 | | | |
| FBS | 99.6 | 102.2 | 102.1 | 102.1 | 107.4 | 102.9 | | | |
| OSE | | 99.1 | | 100.5 | 98.3 | 100.3 | | | |
| TOT | 99.6 | 104.1 | 102.0 | 102.6 | 103.3 | 102.8 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.1 | 103.1 | 95.9 | 102.4 | 101.3 | | | 85.1 | -7.1 | 100.9 | 99.9 | 101.1 | |
| MAN | 99.8 | 105.5 | 98.7 | 103.7 | 99.0 | | 103.7 | 112.3 | 45.7 | 103.9 | 103.5 | 103.6 | |
| CON | 100.7 | 110.7 | 100.4 | 106.3 | 103.0 | | 96.0 | 102.3 | | 91.6 | 101.8 | 103.8 | |
| TTC | 99.1 | 104.7 | 101.0 | 102.1 | 100.2 | | 101.0 | 109.7 | -102.6 | 104.7 | 103.4 | 102.9 | |
| FBS | 98.7 | 104.7 | 102.9 | 103.2 | 100.5 | | 96.4 | 102.0 | | 106.2 | 102.5 | 102.9 | |
| OSE | 99.4 | 101.6 | 101.4 | 101.4 | 101.8 | 99.8 | | 93.7 | 72.6 | 103.2 | 100.2 | 100.3 | |
| TLS | 96.4 | 99.7 | 98.3 | 98.4 | 98.7 | | 79.8 | 98.2 | -100.0 | 103.5 | 98.7 | 98.6 | |
| TIC | 100.2 | 105.5 | 101.4 | 103.2 | 100.2 | 99.8 | 99.8 | 105.6 | 42.7 | 104.1 | 102.3 | 102.6 | |
| OTLS | 137.2 | -84.9 | -30.6 | 55.5 | | | | | | | | 55.5 | |
| COE | 100.1 | 100.0 | 101.0 | 100.8 | | | | | | | | 100.8 | |
| CFC | 101.6 | 100.9 | 101.4 | 101.3 | | | | | | | | 101.3 | |
| NOS | 99.7 | 102.0 | 106.2 | 104.7 | | | | | | | | 104.7 | |
| GVA | 98.6 | 101.0 | 102.4 | 102.0 | | | | | | | | 102.0 | |
| TOT | 99.6 | 104.1 | 102.0 | 102.6 | 100.2 | 99.8 | 99.8 | 105.6 | 42.7 | 104.1 | 102.3 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | 103.5 | | | | |
| MAN | | | | | 103.3 | | | | |
| CON | | | | | 101.2 | | | | |
| TTC | | | | | 101.1 | | | | |
| FBS | | | | | 107.4 | | | | |
| OSE | | | | | 98.3 | | | | |
| TOT | | | | | 103.3 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 100.9 | 106.3 | 88.2 | 104.2 | 105.0 | | | 78.8 | -32.2 | 104.5 | 102.9 | 103.5 | |
| MAN | 104.1 | 106.6 | 99.7 | 105.2 | 100.4 | | 92.0 | 117.4 | 3.1 | 102.3 | 102.4 | 103.3 | |
| CON | 100.0 | 110.6 | 96.6 | 104.5 | | | | 97.4 | | | 97.4 | 101.2 | |
| TTC | 102.3 | 99.0 | | 100.2 | | | | | | 101.7 | 101.4 | 101.1 | |
| FBS | 98.8 | 103.5 | 107.7 | 106.1 | 92.1 | | | | | | 110.8 | 107.4 | |
| OSE | 85.7 | 104.5 | 101.8 | 102.1 | 97.6 | | | | 57.8 | 97.2 | 97.0 | 98.3 | |
| TLS | | | | | | | | | | | | | |
| TIC | 102.3 | 105.9 | 102.9 | 104.8 | 99.7 | | 92.2 | 114.7 | 6.3 | 102.6 | 102.4 | 103.3 | |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 99.9 | 96.1 | | 99.9 | | | | | |
| MAN | 95.4 | 104.4 | 99.4 | 103.8 | | | | | |
| CON | 127.1 | 104.3 | 95.6 | 103.9 | | | | | |
| TTC | 92.6 | 98.9 | 103.8 | 103.4 | | | | | |
| FBS | 99.6 | 102.2 | 102.1 | 102.1 | | | | | |
| OSE | | 99.1 | | 100.5 | | | | | |
| TOT | 99.6 | 104.1 | 102.0 | 102.6 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 102.3 | 101.0 | 103.0 | 101.5 | 98.0 | | | 86.7 | 19.8 | 98.9 | 98.1 | 99.9 | |
| MAN | 99.1 | 104.3 | 98.0 | 102.3 | 98.0 | | 109.4 | 108.6 | 79.6 | 105.5 | 104.6 | 103.8 | |
| CON | 100.7 | 110.7 | 100.5 | 106.3 | 103.0 | | 96.0 | 102.4 | | 91.6 | 101.9 | 103.9 | |
| TTC | 99.0 | 105.3 | 101.1 | 102.4 | 100.1 | | 101.0 | 114.6 | -110.0 | 106.6 | 104.0 | 103.4 | |
| FBS | 98.7 | 105.3 | 102.1 | 102.6 | 100.5 | | 96.4 | 98.3 | | 105.3 | 101.5 | 102.1 | |
| OSE | 100.0 | 101.2 | 101.3 | 101.2 | 103.1 | 99.8 | | 93.7 | 95.5 | 103.2 | 100.4 | 100.5 | |
| TLS | 96.4 | 99.7 | 98.3 | 98.4 | 98.7 | | 79.8 | 98.2 | -100.0 | 103.5 | 98.7 | 98.6 | |
| TIC | 99.9 | 105.3 | 101.1 | 102.6 | 100.2 | 99.8 | 99.8 | 103.6 | 72.5 | 105.3 | 102.3 | 102.4 | |
| IMP | 102.3 | 105.9 | 102.9 | 104.8 | 99.7 | | 92.2 | 114.7 | 6.3 | 102.6 | 102.4 | 103.3 | |
| TOT | 100.2 | 105.5 | 101.4 | 103.2 | 100.2 | 99.8 | 99.8 | 105.6 | 42.7 | 104.1 | 102.3 | 102.6 | |
| OTLS | 137.2 | -84.9 | -30.6 | 55.5 | | | | | | | | 55.5 | |
| COE | 100.1 | 100.0 | 101.0 | 100.8 | | | | | | | | 100.8 | |
| CFC | 101.6 | 100.9 | 101.4 | 101.3 | | | | | | | | 101.3 | |
| NOS | 99.7 | 102.0 | 106.2 | 104.7 | | | | | | | | 104.7 | |
| GVA | 98.6 | 101.0 | 102.4 | 102.0 | | | | | | | | 102.0 | |
| TOT | 99.6 | 104.1 | 102.0 | 102.6 | 100.2 | 99.8 | 99.8 | 105.6 | 42.7 | 104.1 | 102.3 | | |

# Table A11.10: Supply and use tables 2010 in current prices

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.3 | 0.2 | 0.0 | 25.5 | 13.9 | 39.4 | 10.8 | 0.4 | 50.6 |
| MAN | 1.2 | 282.6 | 35.8 | 319.6 | 301.8 | 621.4 | 108.8 | 39.2 | 769.4 |
| CON | 0.1 | 84.9 | 4.7 | 89.7 | 1.5 | 91.2 | | 8.4 | 99.6 |
| TTC | 0.6 | 15.4 | 222.6 | 238.5 | 65.1 | 303.6 | -119.7 | 3.1 | 187.1 |
| FBS | 0.5 | 7.8 | 275.0 | 283.3 | 50.9 | 334.2 | | 9.9 | 344.1 |
| OSE | 0.3 | 2.5 | 219.6 | 222.4 | 16.4 | 238.8 | 0.1 | 2.7 | 241.6 |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | 449.7 | 1628.6 | 0.0 | 63.8 | 1692.3 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 5.1 | 15.3 | 1.6 | 22.0 | 5.8 | | | 0.2 | 0.2 | 22.5 | 28.6 | 50.6 | |
| MAN | 8.9 | 173.4 | 63.3 | 245.6 | 121.0 | | 8.9 | 46.0 | 3.8 | 344.1 | 523.7 | 769.4 | |
| CON | 0.3 | 23.6 | 19.4 | 43.2 | 0.5 | | 0.6 | 53.0 | | 2.2 | 56.4 | 99.6 | |
| TTC | 0.6 | 10.8 | 64.8 | 76.1 | 21.0 | 0.9 | 0.5 | 6.7 | 0.0 | 81.8 | 110.9 | 187.1 | |
| FBS | 2.1 | 41.2 | 156.3 | 199.6 | 76.2 | 0.0 | 3.7 | 17.5 | | 47.1 | 144.5 | 344.1 | |
| OSE | 0.2 | 3.4 | 20.9 | 24.5 | 52.7 | 4.5 | 153.6 | 1.2 | 0.3 | 4.9 | 217.0 | 241.6 | |
| TIC | 17.1 | 267.7 | 326.4 | 611.2 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | 1692.3 | |
| OTLS | -0.5 | -0.1 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| COE | 2.6 | 59.8 | 248.1 | 310.5 | | | | | | | | 310.5 | |
| CFC | 3.7 | 20.2 | 83.1 | 107.0 | | | | | | | | 107.0 | |
| NOS | 5.1 | 45.8 | 100.4 | 151.3 | | | | | | | | 151.3 | |
| GVA | 10.8 | 125.7 | 431.2 | 567.8 | | | | | | | | 567.8 | |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | 0.4 | |
| MAN | | | | | | | | 39.2 | |
| CON | | | | | | | | 8.4 | |
| TTC | | | | | | | | 3.1 | |
| FBS | | | | | | | | 9.9 | |
| OSE | | | | | | | | 2.7 | |
| TOT | | | | | | | | 63.8 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | | | | | 0.1 | 0.5 | 0.4 | |
| MAN | 0.2 | 1.6 | 6.3 | 8.2 | 26.9 | | 0.4 | 2.2 | 0.0 | 1.6 | 31.0 | 39.2 | |
| CON | | 0.0 | 2.0 | 2.0 | 0.1 | | 0.1 | 6.3 | | 0.0 | 6.4 | 8.4 | |
| TTC | 0.0 | -0.1 | 1.1 | 1.1 | 1.7 | | -0.1 | 0.5 | | -0.1 | 2.0 | 3.1 | |
| FBS | 0.0 | 0.0 | 4.3 | 4.3 | 1.5 | | 0.1 | 4.1 | | 0.0 | 5.7 | 9.9 | |
| OSE | | 0.0 | 0.0 | 0.0 | 2.1 | | -0.4 | 0.7 | | 0.3 | 2.7 | 2.7 | |
| TOT | 0.2 | 1.5 | 13.8 | 15.5 | 32.5 | | 0.1 | 13.8 | 0.0 | 1.8 | 48.2 | 63.8 | |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | 10.8 | | |
| MAN | | | | | | | 108.8 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | -119.7 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | 0.1 | | |
| TOT | | | | | | | 0.0 | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.4 | 1.6 | 0.4 | 2.5 | 3.0 | | | 0.0 | 0.0 | 5.3 | 8.3 | 10.8 | |
| MAN | 0.8 | 18.6 | 9.2 | 28.6 | 39.6 | | 3.2 | 4.4 | 0.0 | 32.9 | 80.2 | 108.8 | |
| CON | | | | | | | | | | | | | |
| TTC | -1.2 | -20.2 | -9.7 | -31.1 | -42.7 | | -3.2 | -4.4 | -0.1 | -38.2 | -88.6 | -119.7 | |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | 0.1 | | | | | 0.0 | 0.1 | 0.1 | |
| TOT | | | | | 0.0 | | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.3 | 0.2 | 0.0 | 25.5 | 13.9 | 39.4 | | | |
| MAN | 1.2 | 282.6 | 35.8 | 319.6 | 301.8 | 621.4 | | | |
| CON | 0.1 | 84.9 | 4.7 | 89.7 | 1.5 | 91.2 | | | |
| TTC | 0.6 | 15.4 | 222.6 | 238.5 | 65.1 | 303.6 | | | |
| FBS | 0.5 | 7.8 | 275.0 | 283.3 | 50.9 | 334.2 | | | |
| OSE | 0.3 | 2.5 | 219.6 | 222.4 | 16.4 | 238.8 | | | |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | 449.7 | 1628.6 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 4.7 | 13.7 | 1.2 | 19.5 | 2.5 | | | 0.2 | 0.2 | 17.1 | 19.9 | 39.4 | |
| MAN | 7.9 | 153.2 | 47.8 | 208.9 | 54.5 | | 5.4 | 39.4 | 3.8 | 309.6 | 412.5 | 621.4 | |
| CON | 0.3 | 23.6 | 17.4 | 41.2 | 0.4 | | 0.5 | 46.8 | | 2.2 | 50.0 | 91.2 | |
| TTC | 1.8 | 31.1 | 73.3 | 106.2 | 62.1 | 0.9 | 3.7 | 10.7 | 0.1 | 120.1 | 197.5 | 303.6 | |
| FBS | 2.1 | 41.2 | 152.1 | 195.4 | 74.8 | 0.0 | 3.5 | 13.4 | | 47.1 | 138.8 | 334.2 | |
| OSE | 0.2 | 3.4 | 20.9 | 24.5 | 50.5 | 4.5 | 154.0 | 0.5 | 0.3 | 4.6 | 214.3 | 238.8 | |
| TLS | 0.2 | 1.5 | 13.8 | 15.5 | 32.5 | | 0.1 | 13.8 | 0.0 | 1.8 | 48.2 | 63.8 | |
| TIC | 17.1 | 267.7 | 326.4 | 611.2 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | 1692.3 | |
| OTLS | -0.5 | -0.1 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| COE | 2.6 | 59.8 | 248.1 | 310.5 | | | | | | | | 310.5 | |
| CFC | 3.7 | 20.2 | 83.1 | 107.0 | | | | | | | | 107.0 | |
| NOS | 5.1 | 45.8 | 100.4 | 151.3 | | | | | | | | 151.3 | |
| GVA | 10.8 | 125.7 | 431.2 | 567.8 | | | | | | | | 567.8 | |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | 13.9 | | | | |
| MAN | | | | | 301.8 | | | | |
| CON | | | | | 1.5 | | | | |
| TTC | | | | | 65.1 | | | | |
| FBS | | | | | 50.9 | | | | |
| OSE | | | | | 16.4 | | | | |
| TOT | | | | | 449.7 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.7 | 5.3 | 0.6 | 6.5 | 1.2 | | | 0.0 | 0.1 | 6.1 | 7.4 | 13.9 | |
| MAN | 1.1 | 80.4 | 19.5 | 101.0 | 23.9 | | 1.8 | 16.4 | 1.7 | 157.1 | 200.9 | 301.8 | |
| CON | 0.0 | 0.5 | 0.4 | 0.8 | | | | 0.7 | | | 0.7 | 1.5 | |
| TTC | 0.0 | 2.7 | 13.8 | 16.6 | 0.7 | | | 2.9 | 0.0 | 45.0 | 48.6 | 65.1 | |
| FBS | 0.2 | 13.3 | 22.7 | 36.3 | 0.2 | | | 1.7 | | 12.8 | 14.6 | 50.9 | |
| OSE | 0.0 | 0.5 | 3.8 | 4.3 | 11.8 | | | | 0.2 | 0.0 | 12.1 | 16.4 | |
| TLS | | | | | | | | | | | | | |
| TIC | 2.0 | 102.6 | 60.8 | 165.4 | 37.8 | | 1.8 | 21.7 | 1.9 | 221.0 | 284.2 | 449.7 | |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 25.3 | 0.2 | 0.0 | 25.5 | | | | | |
| MAN | 1.2 | 282.6 | 35.8 | 319.6 | | | | | |
| CON | 0.1 | 84.9 | 4.7 | 89.7 | | | | | |
| TTC | 0.6 | 15.4 | 222.6 | 238.5 | | | | | |
| FBS | 0.5 | 7.8 | 275.0 | 283.3 | | | | | |
| OSE | 0.3 | 2.5 | 219.6 | 222.4 | | | | | |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | 4.0 | 8.4 | 0.6 | 13.0 | 1.3 | | | 0.1 | 0.1 | 10.9 | 12.5 | 25.5 | |
| MAN | 6.8 | 72.8 | 28.2 | 107.9 | 30.6 | | 3.6 | 22.9 | 2.1 | 152.5 | 211.7 | 319.6 | |
| CON | 0.3 | 23.1 | 17.0 | 40.4 | 0.4 | | 0.5 | 46.1 | | 2.2 | 49.3 | 89.7 | |
| TTC | 1.7 | 28.4 | 59.5 | 89.6 | 61.4 | 0.9 | 3.7 | 7.8 | 0.1 | 75.1 | 148.9 | 238.5 | |
| FBS | 1.8 | 27.9 | 129.4 | 159.1 | 74.5 | 0.0 | 3.5 | 11.8 | | 34.3 | 124.2 | 283.3 | |
| OSE | 0.2 | 2.9 | 17.1 | 20.2 | 38.7 | 4.5 | 154.0 | 0.5 | 0.1 | 4.5 | 202.2 | 222.4 | |
| TLS | 0.2 | 1.5 | 13.8 | 15.5 | 32.5 | | 0.1 | 13.8 | 0.0 | 1.8 | 48.2 | 63.8 | |
| TIC | 15.1 | 165.0 | 265.6 | 445.7 | 239.4 | 5.3 | 165.5 | 102.9 | 2.4 | 281.5 | 796.9 | 1242.7 | |
| IMP | 2.0 | 102.6 | 60.8 | 165.4 | 37.8 | | 1.8 | 21.7 | 1.9 | 221.0 | 284.2 | 449.7 | |
| TOT | 17.1 | 267.7 | 326.4 | 611.2 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | 1692.3 | |
| OTLS | -0.5 | -0.1 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| COE | 2.6 | 59.8 | 248.1 | 310.5 | | | | | | | | 310.5 | |
| CFC | 3.7 | 20.2 | 83.1 | 107.0 | | | | | | | | 107.0 | |
| NOS | 5.1 | 45.8 | 100.4 | 151.3 | | | | | | | | 151.3 | |
| GVA | 10.8 | 125.7 | 431.2 | 567.8 | | | | | | | | 567.8 | |
| TOT | 28.0 | 393.3 | 757.6 | 1178.9 | 277.2 | 5.3 | 167.2 | 124.6 | 4.3 | 502.5 | 1081.2 | | |
| Check | | | | | | | | | | | | | |

## 3. Balancing adjustments incorporated in the supply and use tables (tables A11.11–A11.14)

No change made in table A11.10, thus no table A11.15.

### Table A11.11 Supply and use tables 2011 in current prices

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.3 | | | 0.3 | | 0.3 | | | 0.3 |
| MAN | | | | | | | | | |
| CON | | -1.0 | | -1.0 | | -1.0 | | | -1.0 |
| TTC | | | | | 0.5 | 0.5 | | | 0.5 |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.3 | -1.0 | | -0.8 | 0.5 | -0.3 | | | -0.3 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.2 |
| MAN | | | | | | | | | | 1.0 | 1.0 | 1.0 | -1.0 |
| CON | | | | | | | | -0.3 | | | -0.3 | -0.3 | -0.7 |
| TTC | | | | | 0.2 | | | | | | 0.2 | 0.2 | 0.3 |
| FBS | | | 0.3 | 0.3 | | | | | | | | 0.3 | -0.3 |
| OSE | | | | | -0.4 | | | | | | -0.4 | -0.4 | 0.4 |
| TIC | | | 0.3 | 0.3 | -0.2 | | | -0.3 | | 1.0 | 0.5 | 0.8 | -1.0 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 0.3 | -1.0 | -0.3 | -1.1 | | | | | | | | -1.1 | |
| GVA | 0.3 | -1.0 | -0.3 | -1.1 | | | | | | | | -1.1 | |
| TOT | 0.3 | -1.0 | | -0.8 | -0.2 | | | -0.3 | | 1.0 | 0.5 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | | | |
| CON | | | | | | | | | |
| TTC | | | | | | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | | | | | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | 0.0 | | 0.0 | | | | | | | | 0.0 | 0.0 |
| CON | | | | | | | | | | | | | |
| TTC | | | | | | | | | | | | | |
| FBS | | | 0.0 | 0.0 | | | | | | | | 0.0 | 0.0 |
| OSE | | | | | | | | | | | | | |
| TOT | | 0.0 | 0.0 | 0.0 | | | | | | | | 0.0 | 0.0 |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | | | |
| CON | | | | | | | | | |
| TTC | | | | | | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | | | | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | 0.1 | | 0.1 | -0.8 | | | | | | -0.8 | -0.7 | 0.7 |
| CON | | | | | | | | | | | | | |
| TTC | | -0.1 | | -0.1 | 0.8 | | | | | | 0.8 | 0.7 | -0.7 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | | | | | | | | | |
| TOT | | | | | | | | | | | 0.0 | 0.0 | 0.0 |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.3 | | | 0.3 | | 0.3 | | | |
| MAN | | | | | | | | | |
| CON | | -1.0 | | -1.0 | | -1.0 | | | |
| TTC | | | | | 0.5 | 0.5 | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.3 | -1.0 | | -0.8 | 0.5 | -0.3 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.3 |
| MAN | | -0.1 | | -0.1 | 0.8 | | | | | 1.0 | 1.8 | 1.7 | -1.7 |
| CON | | | | | | | | -0.3 | | | -0.3 | -0.3 | -0.7 |
| TTC | | 0.1 | | 0.1 | -0.6 | | | | | | -0.6 | -0.5 | 1.0 |
| FBS | | | 0.3 | 0.3 | | | | | | | | 0.3 | -0.3 |
| OSE | | | | | -0.4 | | | | | | -0.4 | -0.4 | 0.4 |
| TLS | | 0.0 | 0.0 | 0.0 | | | | | | | | 0.0 | |
| TIC | | | 0.3 | 0.3 | -0.2 | | | -0.3 | | 1.0 | 0.5 | 0.8 | -1.1 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 0.3 | -1.0 | -0.3 | -1.1 | | | | | | | | -1.1 | |
| GVA | 0.3 | -1.0 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| TOT | 0.3 | -1.0 | | -0.7 | -0.2 | | | -0.3 | | 1.0 | 0.5 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | | | |
| CON | | | | | | | | | |
| TTC | | | | | 0.5 | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | 0.5 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | | | | -0.2 | | | | | -50.0 | -50.2 | -50.2 | 50.2 |
| CON | | | | | | | | | | | | | |
| TTC | | | | | | | | | | | | | 0.5 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | | | | | | | | | |
| TLS | | | | | | | | | | | | | |
| TIC | | | | | -0.2 | | | | | -50.0 | -50.2 | -50.2 | 50.7 |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.3 | | | 0.3 | | | | | |
| MAN | | | | | | | | | |
| CON | | -1.0 | | -1.0 | | | | | |
| TTC | | | | | | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.3 | -1.0 | | -0.8 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.2 |
| MAN | | -0.1 | | -0.1 | 1.0 | | | | | 51.0 | 52.0 | 51.9 | -51.9 |
| CON | | | | | | | | -0.3 | | | -0.3 | -0.3 | -0.7 |
| TTC | | 0.1 | | 0.1 | -0.6 | | | | | | -0.6 | -0.5 | 0.5 |
| FBS | | | 0.3 | 0.3 | | | | | | | | 0.3 | -0.3 |
| OSE | | | | | -0.4 | | | | | | -0.4 | -0.4 | 0.4 |
| TLS | | 0.0 | 0.0 | 0.0 | | | | | | | | 0.0 | |
| TIC | | | 0.3 | 0.3 | | | | -0.3 | | 51.0 | 50.7 | 51.0 | -51.8 |
| IMP | | | | | -0.2 | | | | | -50.0 | -50.2 | -50.2 | |
| TOT | | | 0.3 | 0.3 | -0.2 | | | -0.3 | | 1.0 | 0.5 | 0.8 | -51.8 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 0.3 | -1.0 | -0.3 | -1.1 | | | | | | | | -1.1 | |
| GVA | 0.3 | -1.0 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| TOT | 0.3 | -1.0 | | -0.8 | -0.2 | | | -0.3 | | 1.0 | 0.5 | | |
| Check | | | | | | | | | | | | | |

# Table A11.12: Price indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.0 | | | 0.0 | | 0.0 | | | 0.0 |
| MAN | | | | | | | 0.9 | 1.3 | 0.2 |
| CON | | 0.0 | | 0.0 | | 0.0 | | | 0.0 |
| TTC | | | | | -0.1 | 0.0 | 0.8 | | -0.5 |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.8 | 0.0 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.0 |
| MAN | | | | | | | | | | 0.0 | 0.0 | 0.0 | 0.2 |
| CON | | | | | | | | 0.0 | | | 0.0 | 0.0 | 0.0 |
| TTC | | | | | 0.0 | | | | | | 0.0 | 0.0 | -0.5 |
| FBS | | | 0.0 | 0.0 | | | | | | | | 0.0 | 0.0 |
| OSE | | | | | 0.0 | | | | | | 0.0 | 0.0 | 0.0 |
| TIC | | | 0.0 | 0.0 | 0.0 | | | 0.0 | | 0.0 | 0.0 | 0.0 | -0.3 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 1.1 | 0.0 | 0.0 | 0.0 | | | | | | | | 0.0 | |
| GVA | 0.3 | 0.0 | 0.0 | 0.0 | | | | | | | | 0.0 | |
| TOT | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | | 0.0 | 0.0 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | | 1.3 | |
| CON | | | | | | | | | |
| TTC | | | | | | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | | | | 0.8 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | 1.3 | | 0.3 | | | | | | | | 0.1 | 1.3 |
| CON | | | | | | | | | | | | | |
| TTC | | | | | | | | | | | | | |
| FBS | | | -0.7 | -0.7 | | | | | | | | -0.3 | 0.3 |
| OSE | | | | | | | | | | | | | |
| TOT | | 1.3 | -0.2 | -0.1 | | | | | | | | 0.0 | 0.8 |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | 0.9 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | 0.8 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | | | | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | 0.6 | | 0.4 | -2.0 | | | | | | -1.0 | -0.6 | 1.5 |
| CON | | | | | | | | | | | | | |
| TTC | | 0.6 | | 0.4 | -1.9 | | | | | | -0.9 | -0.5 | 1.4 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | | | | | | | | | |
| TOT | | | | | | | | | | | | | |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.0 | | | 0.0 | | 0.0 | | | 104.2 |
| MAN | | | | | | | | | |
| CON | | 0.0 | | 0.0 | | 0.0 | | | 102.0 |
| TTC | | | | | -0.1 | 0.0 | | | 102.0 |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | | | -103.7 |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.0 |
| MAN | | -0.1 | | -0.1 | 1.5 | | | | | 0.0 | 0.2 | 0.1 | -0.1 |
| CON | | | | | | | | 0.0 | | | 0.0 | 0.0 | 0.0 |
| TTC | | 0.4 | | 0.1 | -1.3 | | | | | | -0.4 | -0.2 | 0.2 |
| FBS | | | 0.0 | 0.0 | | | | | | | | 0.0 | 0.0 |
| OSE | | | | | 0.0 | | | | | | 0.0 | 0.0 | 0.0 |
| TLS | | 1.3 | -0.2 | -0.1 | | | | | | | | 0.0 | |
| TIC | | | 0.0 | 0.0 | 0.0 | | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.1 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 1.1 | 0.0 | 0.0 | 0.0 | | | | | | | | 0.0 | |
| GVA | 0.3 | 0.0 | 0.0 | 0.0 | | | | | | | | 0.0 | |
| TOT | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | | 0.0 | 0.0 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | | | |
| CON | | | | | | | | | |
| TTC | | | | | -0.1 | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | 0.0 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | | | | -0.8 | | | | | -17.2 | -13.2 | -8.1 | 8.1 |
| CON | | | | | | | | | | | | | |
| TTC | | | | | | | | | | | | | -0.1 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | | | | | | | | | |
| TLS | | | | | | | | | | | | | |
| TIC | | | | | -0.5 | | | | | -11.4 | -8.9 | -5.3 | 5.3 |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.0 | | | 0.0 | | | | | |
| MAN | | | | | | | | | |
| CON | | 0.0 | | 0.0 | | | | | |
| TTC | | | | | | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.0 | 0.0 | | 0.0 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.0 |
| MAN | | -0.2 | | -0.1 | 3.3 | | | | | 12.2 | 9.8 | 6.7 | -6.7 |
| CON | | | | | | | | 0.0 | | | 0.0 | 0.0 | 0.0 |
| TTC | | 0.4 | | 0.1 | -1.3 | | | | | | -0.5 | -0.3 | 0.3 |
| FBS | | | 0.0 | 0.0 | | | | | | | | 0.0 | 0.0 |
| OSE | | | | | 0.0 | | | | | | 0.0 | 0.0 | 0.0 |
| TLS | | 1.3 | -0.2 | -0.1 | | | | | | | | 0.0 | |
| TIC | | | 0.0 | 0.0 | 0.1 | | | 0.0 | | 7.4 | 2.9 | 1.9 | -6.4 |
| IMP | | | | | -0.5 | | | | | -11.4 | -8.9 | -5.3 | |
| TOT | | | 0.0 | 0.0 | 0.0 | | | 0.0 | | 0.0 | 0.0 | 0.0 | -6.4 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 1.1 | 0.0 | 0.0 | 0.0 | | | | | | | | 0.0 | |
| GVA | 0.3 | 0.0 | 0.0 | 0.0 | | | | | | | | 0.0 | |
| TOT | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | | 0.0 | 0.0 | | |

# Table A11.13: Supply and use tables 2011 at previous years' prices

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.2 | | | 0.2 | | 0.2 | | | 0.2 |
| MAN | | | | | | | -1.0 | -0.5 | -1.5 |
| CON | | -1.0 | | -1.0 | | -1.0 | | | -1.0 |
| TTC | | | | | 0.5 | 0.5 | 1.0 | | 1.5 |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.2 | -1.0 | | -0.7 | 0.5 | -0.3 | | -0.5 | -0.8 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.2 |
| MAN | | | | | | | | | | 1.0 | 1.0 | 1.0 | -2.5 |
| CON | | | | | | | | -0.3 | | | -0.3 | -0.3 | -0.7 |
| TTC | | | | | 0.2 | | | | | | 0.2 | 0.2 | 1.3 |
| FBS | | | 0.3 | 0.3 | | | | | | | | 0.3 | -0.3 |
| OSE | | | | | -0.4 | | | | | | -0.4 | -0.4 | 0.4 |
| TIC | | | 0.3 | 0.3 | -0.2 | | | -0.3 | | 1.0 | 0.5 | 0.8 | -1.5 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 0.2 | -1.0 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| GVA | 0.2 | -1.0 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| TOT | 0.2 | -1.0 | | -0.7 | -0.2 | | | -0.3 | | 1.0 | 0.5 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | | -0.5 | |
| CON | | | | | | | | | |
| TTC | | | | | | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | | | | -0.5 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | | | | | | | | | | | | -0.5 |
| CON | | | | | | | | | | | | | |
| TTC | | | | | | | | | | | | | |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | | | | | | | | | |
| TOT | | | | | | | | | | | | | -0.5 |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | -1.0 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | 1.0 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | | | | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | | | | | | | | | | | | -1.0 |
| CON | | | | | | | | | | | | | |
| TTC | | | | | | | | | | | | | 1.0 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | | | | | | | | | |
| TOT | | | | | | | | | | | | | |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.2 | | | 0.2 | | 0.2 | | | |
| MAN | | | | | | | | | |
| CON | | -1.0 | | -1.0 | | -1.0 | | | |
| TTC | | | | | 0.5 | 0.5 | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.2 | -1.0 | | -0.7 | 0.5 | -0.3 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.2 |
| MAN | | | | | | | | | | 1.0 | 1.0 | 1.0 | -1.0 |
| CON | | | | | | | | -0.3 | | | -0.3 | -0.3 | -0.7 |
| TTC | | | | | 0.2 | | | | | | 0.2 | 0.2 | 0.3 |
| FBS | | | 0.3 | 0.3 | | | | | | | | 0.3 | -0.3 |
| OSE | | | | | -0.4 | | | | | | -0.4 | -0.4 | 0.4 |
| TLS | | | | | | | | | | | | | |
| TIC | | | 0.3 | 0.3 | -0.2 | | | -0.3 | | 1.0 | 0.5 | 0.8 | -1.0 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 0.2 | -1.0 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| GVA | 0.2 | -1.0 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| TOT | 0.2 | -1.0 | | -0.7 | -0.2 | | | -0.3 | | 1.0 | 0.5 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | | | |
| CON | | | | | | | | | |
| TTC | | | | | 0.5 | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | 0.5 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | | | | | | | | | -25.0 | -25.0 | -25.0 | 25.0 |
| CON | | | | | | | | | | | | | |
| TTC | | | | | | | | | | | | | 0.5 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | | | | | | | | | |
| TLS | | | | | | | | | | | | | |
| TIC | | | | | | | | | | -25.0 | -25.0 | -25.0 | 25.5 |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.2 | | | 0.2 | | | | | |
| MAN | | | | | | | | | |
| CON | | -1.0 | | -1.0 | | | | | |
| TRA | | | | | | | | | |
| TRN | | | | | | | | | |
| COM | | | | | | | | | |
| TOT | 0.2 | -1.0 | | -0.7 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.2 |
| MAN | | | | | | | | | | 26.0 | 26.0 | 26.0 | -26.0 |
| CON | | | | | | | | -0.3 | | | -0.3 | -0.3 | -0.7 |
| TTC | | | | | 0.2 | | | | | | 0.2 | 0.2 | -0.2 |
| FBS | | | 0.3 | 0.3 | | | | | | | | 0.3 | -0.3 |
| OSE | | | | | -0.4 | | | | | | -0.4 | -0.4 | 0.4 |
| TLS | | | | | | | | | | | | | |
| TIC | | | 0.3 | 0.3 | -0.2 | | | -0.3 | | 26.0 | 25.5 | 25.8 | -26.5 |
| IMP | | | | | | | | | | -25.0 | -25.0 | -25.0 | |
| TOT | | | 0.3 | 0.3 | -0.2 | | | -0.3 | | 1.0 | 0.5 | 0.8 | -26.5 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 0.2 | -1.0 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| GVA | 0.2 | -1.0 | -0.3 | -1.0 | | | | | | | | -1.0 | |
| TOT | 0.2 | -1.0 | | -0.7 | -0.2 | | | -0.3 | | 1.0 | 0.5 | | |
| Check | | | | | | | | | | | | | |

# Table A11.14: Volume indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.9 | | | 0.9 | | 0.6 | | | 0.5 |
| MAN | | | | | | | -0.9 | -1.3 | -0.2 |
| CON | | -1.2 | | -1.1 | | -1.1 | | | -1.0 |
| TTC | | | | | 0.8 | 0.2 | -0.8 | | 0.8 |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.9 | -0.2 | | -0.1 | 0.1 | 0.0 | | -0.8 | 0.0 |

Use Table at purchasers' prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.5 |
| MAN | | | | | | | | | | 0.3 | 0.2 | 0.1 | -0.3 |
| CON | | | | | | | | -0.6 | | | -0.5 | -0.3 | -0.7 |
| TTC | | | | | 1.0 | | | | | | 0.2 | 0.1 | 0.7 |
| FBS | | | 0.2 | 0.1 | | | | | | | | 0.1 | -0.1 |
| OSE | | | | | -0.8 | | | | | | -0.2 | -0.2 | 0.2 |
| TIC | | | 0.1 | 0.0 | -0.1 | | | -0.2 | | 0.2 | 0.0 | 0.0 | 0.2 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 4.7 | -2.1 | -0.3 | -0.7 | | | | | | | | -0.7 | |
| GVA | 2.2 | -0.8 | -0.1 | -0.2 | | | | | | | | -0.2 | |
| TOT | 0.9 | -0.2 | | -0.1 | -0.1 | | | -0.2 | | 0.2 | 0.0 | | |
| Check | | | | | | | | | | | | | |

Taxes less subsidies on products

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | | -1.3 | |
| CON | | | | | | | | | |
| TTC | | | | | | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | | | | -0.8 | |

Use Table for taxes less subsidies on products

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | | | | | | | | | | | | -1.3 |
| CON | | | | | | | | | | | | | |
| TTC | | | | | | | | | | | | | |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | | | | | | | | | |
| TOT | | | | | | | | | | | | | -0.8 |

Trade and transport margins

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | -0.9 | | |
| CON | | | | | | | | | |
| TTC | | | | | | | -0.8 | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | | | | | |

Use Table for trade and transport margins

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | | | | | | | | | | | | -0.9 |
| CON | | | | | | | | | | | | | |
| TTC | | | | | | | | | | | | | -0.8 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | | | | | | | | | |
| TOT | | | | | | | | | | | | | |

Supply Table at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.9 | | | 0.9 | | 0.6 | | | |
| MAN | | | | | | | | | |
| CON | | -1.2 | | -1.1 | | -1.1 | | | |
| TTC | | | | | 0.8 | 0.2 | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.9 | -0.2 | | -0.1 | 0.1 | 0.0 | | | |

Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.6 |
| MAN | | | | | | | | | | 0.3 | 0.2 | 0.2 | -0.2 |
| CON | | | | | | | | -0.6 | | | -0.6 | -0.3 | -0.7 |
| TTC | | | | | 0.3 | | | | | | 0.1 | 0.1 | 0.1 |
| FBS | | | 0.2 | 0.1 | | | | | | | | 0.1 | -0.1 |
| OSE | | | | | -0.8 | | | | | | -0.2 | -0.2 | 0.2 |
| TLS | | | | | | | | | | | | | |
| TIC | | | 0.1 | 0.0 | -0.1 | | | -0.2 | | 0.2 | 0.0 | 0.0 | -0.1 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 4.7 | -2.1 | -0.3 | -0.7 | | | | | | | | -0.7 | |
| GVA | 2.2 | -0.8 | -0.1 | -0.2 | | | | | | | | -0.2 | |
| TOT | 0.9 | -0.2 | | -0.1 | -0.1 | | | -0.2 | | 0.2 | 0.0 | | |
| Check | | | | | | | | | | | | | |

Imports CIF

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | |
| MAN | | | | | | | | | |
| CON | | | | | | | | | |
| TTC | | | | | 0.8 | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | | | | | 0.1 | | | | |

Imports Use Table

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | |
| MAN | | | | | | | | | | -15.9 | -12.4 | -8.3 | 8.3 |
| CON | | | | | | | | | | | | | |
| TTC | | | | | | | | | | | | | 0.8 |
| FBS | | | | | | | | | | | | | |
| OSE | | | | | | | | | | | | | |
| TLS | | | | | | | | | | | | | |
| TIC | | | | | | | | | | -11.3 | -8.8 | -5.6 | 5.7 |

Supply Table for domestic output at basic prices

| | AGR | MMC | SER | DP | IMP | SUPbp | TTM | TLS | SUPpp |
|---|---|---|---|---|---|---|---|---|---|
| AGR | 0.9 | | | 0.9 | | | | | |
| MAN | | | | | | | | | |
| CON | | -1.2 | | -1.1 | | | | | |
| TTC | | | | | | | | | |
| FBS | | | | | | | | | |
| OSE | | | | | | | | | |
| TOT | 0.9 | -0.2 | | -0.1 | | | | | |

Domestic Use Table at basic prices

| | AGR | MMC | SER | TIC | FCH | FCN | FCG | GFCF | INV | EXP | TOTfin | TOTpp | Check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGR | | | | | | | | | | | | | 0.9 |
| MAN | | | | | | | | | | 17.1 | 12.3 | 8.1 | -8.1 |
| CON | | | | | | | | -0.7 | | | -0.6 | -0.3 | -0.8 |
| TTC | | | | | 0.3 | | | | | | 0.1 | 0.1 | -0.1 |
| FBS | | | 0.2 | 0.2 | | | | | | | | 0.1 | -0.1 |
| OSE | | | | | -1.0 | | | | | | -0.2 | -0.2 | 0.2 |
| TLS | | | | | | | | | | | | | |
| TIC | | | 0.1 | 0.1 | -0.1 | | | -0.3 | | 9.2 | 3.2 | 2.1 | -8.0 |
| IMP | | | | | | | | | | -11.3 | -8.8 | -5.6 | |
| TOT | | | 0.1 | 0.0 | -0.1 | | | -0.2 | | 0.2 | 0.0 | 0.0 | -8.0 |
| OTLS | | | | | | | | | | | | | |
| COE | | | | | | | | | | | | | |
| CFC | | | | | | | | | | | | | |
| NOS | 4.7 | -2.1 | -0.3 | -0.7 | | | | | | | | -0.7 | |
| GVA | 2.2 | -0.8 | -0.1 | -0.2 | | | | | | | | -0.2 | |
| TOT | 0.9 | -0.2 | | -0.1 | -0.1 | | | -0.2 | | 0.2 | 0.0 | | |

| *Key:* | | |
|---|---|---|
| | AGR | agriculture |
| | CFC | consumption of fixed capital |
| | COE | compensation of employees |
| | CON | construction |
| | DP | domestic product |
| | EXP | exports |
| | FBS | finance and business services |
| | FCG | final consumption expenditure of general government |
| | FCH | final consumption expenditure of households |
| | FCN | final consumption expenditure of non-profit institutions serving households |
| | GFCF | gross fixed capital formation |
| | GVA | gross value added |
| | IMP | imports |
| | INV | inventories (changes in) |
| | MAN | manufacturing |
| | MMC | manufacturing, mining and construction |
| | NOS | net operating surplus |
| | OSE | other services |
| | OTLS | other taxes less subsidies on production |
| | SER | services |
| | SUPbp | supply at basic prices |
| | SUPpp | supply at purchasers' prices |
| | TIC | total intermediate consumption |
| | TLS | taxes less subsidies on products |
| | TOT | total |
| | TOTfin | total at final uses |
| | TOTpp | total at purchasers' prices |
| | TTC | trade, transport and communication |
| | TTM | trade and transport margins |

# Chapter 12. Transforming the supply and use tables into input-output tables

## A. Introduction

12.1 The present chapter describes the methods for transforming SUTs into IOTs (product-by-product and industry-by-industry). The compilation of IOTs is quite different in nature from the compilation of SUTs and is better described as an analytical step or transformation rather than a compilation process.

12.2 Section B below provides an overview of IOTs and a description of the terminology relating to them. Section C focuses on the transformation of SUTs into IOTs. In particular, it describes the tables that form the starting point for the compilation of IOTs, and covers some issues related to when it is necessary to use square rather than rectangular SUTs for the compilation of IOTs, and how to deal with secondary production in IOTs. Section D describes the input-output framework; it outlines the theoretical models for the compilation of IOTs; and it provides numerical examples of transformation of SUTs into IOTs based on the different theoretical models. Section E provides an empirical application of the transformation models. It also discusses general issues on IOTs, such as the relationship between types of tables, technology and share markets; the link between IOTs and official statistics; and the requirements of IOTs. Annexes A and B to this chapter elaborate further on the mathematical derivation of different IOTs and discuss how to handle negatives in IOTs. Annex C provides a list of references for the treatment of secondary production.

## B. Overview of the relationship between IOTs and SUTs

12.3 The SUTs form a central part of the national accounts, providing a framework to bring together a range of data and, through balancing, to ensure the coherency and consistency of various parts of the national accounts. The SUTs thus serve many purposes, in particular, statistical and analytical, not just for producers but also for a range of different users, and their analytical dimension is especially enhanced when the SUTs are transformed into IOTs. For analytical purposes, the assumptions about the relationships between inputs and outputs are required irrespective of whether the products have been produced by the primary industry or by other industries as their secondary output.

12.4 The SUTs constitute the basis for compiling IOTs and it is recommended that they are compiled first, and then the IOTs. This approach makes the best use of data collected from businesses and other sources in order to compile SUTs and then – via a range of assumptions –

move to the basis of the IOTs. The domestic output part of the supply table and the intermediate use part of the use table are always product-by-industry tables and often rectangular, meaning that many more products than industries are distinguished. IOTs, on the other hand, always reflect the same number of industries (industry-by-industry IOTs) or the same number of products (product-by-product IOTs).

12.5 Table 12.1 shows the general structure of a product-by-product IOT at basic prices. A similar table can be compiled for an industry-by-industry IOT where the first quadrant contains an industry-by-industry rather than a product-by-product matrix. In practice, the IOTs can have different presentations, such as input-output tables with net exports. The fundamental elements of the general structure remain the same, however. The different presentations of IOTs and the components are covered later in this chapter. In addition, as noted earlier, for ease of exposition and not to overload the presentation of the SUTs and IOTs, the adjustment items are not included in the numerical examples in this Handbook. This issue is explained further in chapter 8, paragraphs 8.18–8.21.

**Table 12.1 Product-by-product IOT at basic prices**

| | | | PRODUCTS | | | | | | | FINAL USE | | | | | | | | Output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Final consumption expenditure | | | | | | | | |
| | | | Agricul-ture | Manufac-turing | Construc-tion | Trade, transport and communication | Finance and business services | Other services | Total | Households | NPISH | General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | Intermediate consumption of domestic products at basic prices | | | | | | | Final use of domestic products at basic prices | | | | | | | | |
| | Manufacturing | (2) | | | | | | | | | | | | | | | | |
| | Construction | (3) | | | | | | | | | | | | | | | | |
| | Trade, transport and communication | (4) | | | | | | | | | | | | | | | | |
| | Finance and business services | (5) | | | | | | | | | | | | | | | | |
| | Other services | (6) | | | | | | | | | | | | | | | | |
| Total at basic prices | | (7) | | | | | | | | | | | | | | | | |
| Imports | | (8) | Intermediate consumption of imported products | | | | | | | Final use of imported products | | | | | | | | |
| Taxes less subsidies on products | | (9) | Taxes less subsidies on products | | | | | | | Taxes less subsidies on products | | | | | | | | |
| Total at purchasers' prices | | (10) | | | | | | | | | | | | | | | | |
| GVA | Compensation of employees | (11) | GVA at basic prices | | | | | | | | | | | | | | | |
| | Other taxes less subsidies on production | (12) | | | | | | | | | | | | | | | | |
| | Consumption of fixed capital | (13) | | | | | | | | | | | | | | | | |
| | Net operating surplus/Net mixed income | (14) | | | | | | | | | | | | | | | | |
| GVA | | (15) | | | | | | | | | | | | | | | | |
| Input at basic prices | | (16) | | | | | | | | | | | | | | | | |

= empty

12.6 In classical input-output theory, the impact analysis (for example, the effect on GVA of an increase in household final consumption) requires that the output side and the input side are classified in identical ways (either by products or by industries). This enables the direct and indirect effects to be traced through the system: any output will require inputs, which in turn, require further outputs, and so forth. As the basis of the use table is a product-by-industry matrix, it is not possible to directly link the required outputs to the required inputs, and thus it is necessary to transform either the product dimension into an industry dimension or vice versa, which can be achieved by applying the information available in the supply table. Although the impact analysis can also be undertaken by iterative procedures directly based on the supply table and use table datasets, this approach also involves relying on one of the transformation models discussed later in this chapter.

Thus, compiling IOTs is an analytical step and various assumptions have to be made and sometimes adjustments are required for the transformation of SUTs into IOTs.

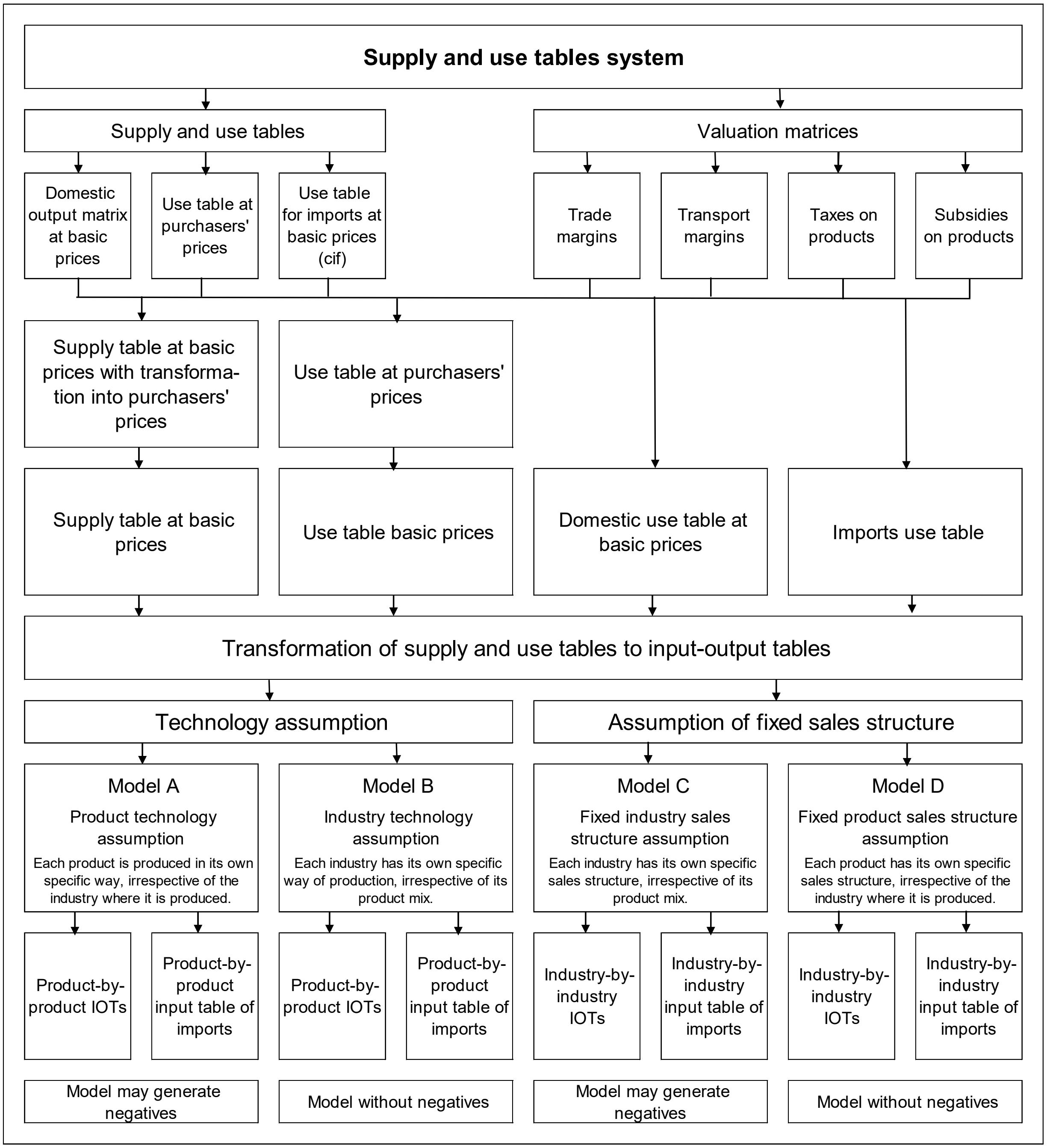
12.7 In the main, the construction of IOTs depends on the treatment of secondary products. Many units may produce only one group of products, which are the primary products of the industry to which they are classified. Some units, however, produce products that are not among the primary products of the industry to which they belong. As a result, there will be many non-diagonal entries in the supply table. The treatment of secondary products rests upon the separation of outputs or inputs associated with secondary products, so that they can be added to the outputs or inputs of the industry in which the secondary product is the characteristic or principal output or, alternatively, to create industry-adjusted product groups.

12.8 As an analytical tool, input-output-based data are conveniently integrated into macroeconomic models in order to analyse the links between final uses and levels of industrial output. Input-output analysis can also serve various analytical purposes such as impact analysis, productivity analysis, employment effects, analysis of the interdependence of structures and analysis of price change. Analytical uses of IOTs are illustrated in chapters 19 and 20 of this Handbook.

12.9 The SUTs at basic prices with a split of the use table between the use of domestically produced products and the use of imported products constitute the starting point for the transformation of SUTs to IOTs. In essence, therefore, this provides the starting point, as shown in figure 2.2, for the bottom left-hand side of the H-Approach for IOTs in current prices and for the bottom right-hand side of the H-Approach for IOTs in previous years' prices.

12.10 Figure 12.1 provides an overview of the various tables that feed into the transformation of SUTs into IOTs and the various types of IOTs linked to the different model assumptions. It is worth noting that, for industry-by-industry IOTs, the corresponding import flow tables does not necessarily need to be transformed to an industry-by-industry format but can be retained in the SUTs format as product-by-industry.

**Figure 12.1 Transformation of SUTs into IOTs**




## 1. Terminology used with reference to IOTs

12.11 Over many years, the terminology associated with symmetric IOTs and SUTs, and the understanding of these tables, have evolved. In particular, the use of the term "symmetric" is often misunderstood. In terms of its lexical meaning, the use of "symmetric" is correct here, in that the

IOTs are square tables (thus allowing, for example, for matrix inversion and the generation of multipliers) and in the way in which the industry-by-industry tables or product-by-product tables are presented. From a conceptual point of view, however, it is incorrect to use the term "symmetric", in that the transformations reflect industry-adjusted product-by-industry IOTs or product-by-product-adjusted industry IOTs, which means, in essence, that there is no symmetry in the dimension of the matrix (more details on this may be found in Box 12.1).

12.12 In addition, in mathematical terms, IOTs are not symmetric matrices, in that the table element ($i$,$j$) is not equal to element ($j$,$i$). In other words, the use of steel by the manufacturing industry of basic metals is not the same as the use of basic metals by the steel industry. Thus in this Handbook, and for future guidance, it is recommended that the term "IOTs" be used, and not "symmetric IOTs".

12.13 It is also worth noting that, in the transformations used in model A and model B shown in Figure 12.1, where technology assumptions are applied, no technology is involved in the physical production processes, but only economic transactions measured in monetary terms. With the transformations, the institutional characteristics of the industries remain unaffected.

12.14 Box 12.1 provides further clarification on some key misunderstandings regarding input-output-related terminology.

**Box 12.1 Clarification of IOTs terminology**

The terminology used to date for IOTs can be traced back to chapter 3 of the 1968 SNA. As the understanding of IOTs has evolved, however, some clarifications need to be made in two specific areas to ensure the correct understanding and correct use of specific terminology.

The first area relates to the use of the term "technology assumptions". This term was previously also applied to the assumptions used for compiling industry-by-industry IOTs from SUTs. Based on the work of Konijn and Steenge (1995), it was clarified that only the much weaker sales structure assumptions were necessary and those actually used in this case. This aspect was further elaborated in Thage (2002) and the new terminology, in which there is a clear distinction between technology assumptions and sales structure assumptions. These contributed to the understanding of the real differences between product-by-product IOTs and industry-by-industry IOTs, and became the new standard terminology with the introduction of the Eurostat Manual on Supply, Use and Input-Output Tables (2008), the 2008 SNA and the ESA 2010 (Eurostat, 2013c).

The second area relates to the use of the terms "product-by-product" IOTs and "industry-by-industry" IOTs. The same term is used to characterize both rows and columns, although their implications are very different. Starting with the use table for intermediate consumption, the products are indicated in the rows and industries indicated in the columns.

- "Product-by-product" IOTs are compiled by adjusting the columns (using technology assumptions) but in this process the industries remain as industries with all the characteristics of the producing units, transforming intermediate and primary inputs into output, including all the institutional characteristics. The industries are not transformed into products.
- "Industry-by-industry" IOTs are compiled by adjusting the rows (using sales structure assumptions) but in this process the products remain as products, just composed in a different way. The products are not transformed into industries.

Accordingly, a more precise terminology reflecting the actual procedures would require the use of different terms reflecting the meaning of the rows and the columns of the IOTs. This may be summarized as follows:

- References to "product-by-product industries" should be replaced by "product-by-product-adjusted industries", retaining the word "industry".
- References to "industry-by-industry" should be replaced by "industry-adjusted product-by-industry", retaining the word "product".

Even though these terms are conceptually correct, they are currently not used. In general, it is important to remember that "product-by-product" and "industry-by-industry" references are short-hand versions of a more descriptive terminology, and to be aware of how this affects the understanding of the contents of the tables.

## C. Conversion of SUTs to IOTs

### 1. Starting point for the transformation

12.15 The starting point for the transformation of SUTs into IOTs consists of the set of the following tables:

- Supply table at basic prices
- Use table at basic prices
- Domestic use table at basic prices
- Imports use table at basic prices

12.16 Although the use table is initially compiled at purchasers' prices, the transformation of the use table into basic prices is viewed as a step towards the compilation of IOTs, which are usually compiled at basic prices and not purchasers' prices. Intermediate uses and final uses calculated at basic prices are one step further removed from the basic statistics collected and actual observations in the economy thus needing the compilation of valuation matrices, as described in chapter 7 of this Handbook.

12.17 The structure and data contents of unbalanced SUTs in current prices, including the domestic use table and imports use table, are covered in detail in chapters 3–8. These chapters cover all the building blocks required in producing the set of tables necessary to compile IOTs. Various issues of particular relevance when compiling IOTs from SUTs, such as statistical units, redefinitions and the relationship between products and industries, are further elaborated in this chapter.

12.18 The recommended approach to the compilation of IOTs is thus the preparation of separate IOTs for domestic output and imported products, which are derived from the domestic use table and the imports use table of the SUTs system. The statistical requirements for such a separation are considerable but the results allow considerable flexibility in the treatment of imports and enable a clear analysis of the changes in the impact of the use of supplies from resident producers and from non-resident suppliers.

12.19 A simple numerical example of IOTs obtained using different models is presented in this chapter. The starting point for the various IOTs is the SUTs in Table 12.2, which include a supply table at basic prices, a domestic use table at basic prices and an imports use table. It should be noted that, in the domestic use table, the imports are still included in the table but shown in a single row so that the resulting table still adds up to the supply table.

**Table 12.2 Numerical example of rectangular SUTs for the transformation**

**Supply table at basic prices**

| | | Industries | | | Output | Imports | Total supply |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufacturing and construction | Services | | | |
| Products | Agriculture | 25.77 | 5.15 | 7.04 | 37.96 | 15.38 | 53.35 |
| | Manufacturing | 1.26 | 313.51 | 35.72 | 350.50 | 399.47 | 749.97 |
| | Construction | 0.09 | 89.00 | 4.49 | 93.58 | 1.56 | 95.15 |
| | Trade, transport and communication | 0.53 | 15.08 | 231.60 | 247.21 | 72.93 | 320.13 |
| | Finance and business services | 12.49 | 8.05 | 262.96 | 283.49 | 55.24 | 338.74 |
| | Other services | 0.30 | 2.51 | 222.86 | 225.67 | 16.64 | 242.31 |
| Total | | 40.45 | 433.31 | 764.66 | 1 238.41 | 561.23 | 1 799.64 |

**Domestic use table at basic prices**

| | | Industries | | | Final use | | | Total use |
|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 4.35 | 9.28 | 0.61 | 13.18 | 0.08 | 10.47 | 37.96 |
| | Manufacturing | 7.78 | 82.09 | 28.90 | 31.15 | 26.74 | 173.83 | 350.50 |
| | Construction | 0.30 | 25.71 | 17.39 | 0.89 | 47.20 | 2.10 | 93.58 |
| | Trade, transport and communication | 1.80 | 30.22 | 60.71 | 68.96 | 8.57 | 76.95 | 247.21 |
| | Finance and business services | 1.82 | 29.48 | 132.56 | 73.04 | 11.63 | 34.97 | 283.49 |
| | Other services | 0.17 | 3.03 | 18.14 | 202.77 | 0.55 | 1.02 | 225.67 |
| Prim | Imports | 2.54 | 123.74 | 78.29 | 75.33 | 36.50 | 244.82 | 561.23 |
| | GVA | 21.70 | 129.78 | 428.07 | | | | 579.54 |
| Total | | 40.45 | 433.31 | 764.66 | 465.33 | 131.27 | 544.17 | |

**Imports use table at basic prices**

| | | Industries | | | Final use | | | Total use |
|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 0.77 | 6.40 | 0.48 | 1.25 | 0.03 | 6.45 | 15.38 |
| | Manufacturing | 1.49 | 99.62 | 34.95 | 61.07 | 30.80 | 171.55 | 399.47 |
| | Construction | 0.00 | 0.52 | 0.35 | | 0.69 | | 1.56 |
| | Trade, transport and communication | 0.04 | 2.69 | 14.05 | 0.73 | 2.72 | 52.70 | 72.93 |
| | Finance and business services | 0.23 | 13.99 | 24.54 | 0.22 | 2.16 | 14.10 | 55.24 |
| | Other services | 0.01 | 0.52 | 3.93 | 12.06 | 0.10 | 0.02 | 16.64 |
| Total | | 2.54 | 123.74 | 78.29 | 75.33 | 36.50 | 244.82 | 561.23 |

## 2. Square versus rectangular SUTs

12.20 A square supply table is required when the assumptions for the transformation into IOTs are based on a product technology assumption (model A) and a fixed industry sales structure model (model C), which require the calculation of an inverse matrix based on the supply table. In most countries, the SUTs are rectangular, with many more products than industries, and this requires an aggregation of the product dimension with the result that the number of industries will determine the dimension of the resulting square SUTs.

12.21 In the case of the industry technology assumption (model B), square matrices are not required but the application of the formula directly to the existing dimensions of the SUTs will result in square IOTs with as many rows and columns as the number of products, which will usually not make much sense, and the aggregation loss of information will not depend on whether the aggregation is made before or after application of the formula.

12.22 Only in the case of the fixed product sales structure assumption (model D), is there a clear gain relative to minimizing the aggregation loss of information by using the formula directly on the SUTs rectangular matrices, resulting in industry-by-industry IOTs with as many rows and columns as the number of industries. On this point, see Thage (2005) and (2011).

12.23 In the cases where aggregation by product is necessary to obtain a square SUTs configuration, each product must be assigned to a primary producer. The existing link between CPC and ISIC provides a guide for the assignment of products to industries. In general, several products will need to be assigned to the same industry. This means that, in the product technology assumption (model A), these products are assumed to share the same input structure. The assignment of products to industries can then be used to aggregate the supply table to obtain a square table. For the product technology assumption (model A), it is not strictly required to aggregate the use table at this stage. In order ultimately to obtain square IOTs, however, an aggregation of the use table will be necessary at some point. It may therefore also be performed before the calculation of the IOTs.

12.24 Table 12.3 shows a numerical example of a square SUTs constructed from the rectangular SUTs shown in Table 12.2.

**Table 12.3 Numerical example of square SUTs for the transformation**

**Supply table at basic prices**

| | | Industries | | | Output | Imports | Total supply |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufacturing and construction | Services | | | |
| Products | Agriculture | 25.77 | 5.15 | 7.04 | 37.96 | 15.38 | 53.35 |
| | Manufacturing and construction | 1.35 | 402.51 | 40.21 | 444.08 | 401.04 | 845.12 |
| | Services | 13.32 | 25.64 | 717.41 | 756.37 | 144.81 | 901.18 |
| Total | | 40.45 | 433.31 | 764.66 | 1 238.41 | 561.23 | 1 799.64 |

**Domestic use table at basic prices**

| | | Industries | | | Final use | | | Total use |
|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 4.35 | 9.28 | 0.61 | 13.18 | 0.08 | 10.47 | 37.96 |
| | Manufacturing and construction | 8.08 | 107.80 | 46.29 | 32.04 | 73.94 | 175.94 | 444.08 |
| | Services | 3.78 | 62.72 | 211.40 | 344.77 | 20.75 | 112.95 | 756.37 |
| Prim | Imports | 2.54 | 123.74 | 78.29 | 75.33 | 36.50 | 244.82 | 561.23 |
| | GVA | 21.70 | 129.78 | 428.07 | | | | 579.54 |
| Total | | 40.45 | 433.31 | 764.66 | 465.33 | 131.27 | 544.17 | |

**Imports use table**

| | | Industries | | | Final use | | | Total use |
|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 0.77 | 6.40 | 0.48 | 1.25 | 0.03 | 6.45 | 15.38 |
| | Manufacturing and construction | 1.49 | 100.14 | 35.30 | 61.07 | 31.49 | 171.55 | 401.04 |
| | Services | 0.28 | 17.20 | 42.52 | 13.02 | 4.98 | 66.81 | 144.81 |
| Total | | 2.54 | 123.74 | 78.29 | 75.33 | 36.50 | 244.82 | 561.23 |

## 3. Secondary production

12.25 The existence of cell entries reflecting secondary production in the square-based supply table is the only reason for the difference between product-by-product and industry-by-industry IOTs. Secondary production thereby creates the need to choose between the alternative product technology assumptions and market share assumptions. In the case of no secondary production, the domestic use table would represent an IOT.

12.26 The 2008 SNA (para. 28.46) distinguishes between three types of secondary products:

- *Subsidiary products* are those products that are technologically unrelated to the primary product.
- *By-products* are those products that are produced simultaneously with another product but which can be regarded as secondary to that product, for example, gas produced by blast furnaces.

- *Joint products* are those products that are produced simultaneously with another product but which cannot be said to be secondary, for example, beef and hide produced by slaughtering animals.

12.27 The importance of secondary production is closely connected to the type of economic unit (for example, establishments versus enterprises) used when collecting data from businesses and compiling the SUTs. Most often, the compiler may not be in a position to distinguish between the three types of secondary products. In consequence, the four standard models for compiling IOTs from SUTs do not make such a distinction, whereas it may play a role when compiling product-by-product IOTs based on the assumption of hybrid technology.

12.28 In most economies, there are probably limited cases of pure subsidiary products, by-products or joint products. In most cases, there are some joint costs and some costs that can be attributed to the distinctive outputs.

12.29 In practice, where certain kinds of secondary production would potentially create problems in the resulting IOTs no matter which transformation formula is used, a priori redefinitions (for example, breakdowns of vertically integrated economic units) may offer possible solutions. Such very special features of production structure will usually be well known to the compilers and could be taken into account on an ad hoc basis. The handling of secondary production in SUTs is covered in more detail in chapter 5.

## 4. Main theoretical models used for the derivation of IOTs

12.30 There are four main transformation methods used to derive IOTs from SUTs. As shown in Figure 12.1 and summarized in Figure 12.2, the four basic transformation models are based on the following assumptions:

- Product technology assumption (model A):

  Each product is produced in its own specific way, irrespective of the industry where it is produced.

- Industry technology assumption (model B):

  Each industry has its own specific way of production, irrespective of its product mix.

- Fixed industry sales structure assumption (model C):

  Each industry has its own specific sales structure, irrespective of its product mix.

- Fixed product sales structure assumption (model D):

  Each product has its own specific sales structure, irrespective of the industry where it is produced.

12.31 The main distinction concerning assumptions is between "technology assumptions" and "sales structure assumptions". Product-by-product IOTs are based on technology assumptions while the industry-by-industry IOTs are derived from sales structure assumptions.

12.32 A technology assumption is a strong assumption in the sense that it is based on production theory that cannot be underpinned by observed statistical data. The sales structure assumptions are weaker assumptions as, in general, they only use observed sales structures for the actual year. Thus, from a statistical perspective, the two types of IOTs reflect quite different approaches.

12.33 A further distinction relates to the fact that model B and model D represent relatively simple breakdowns and subsequent aggregations that in practice can be implemented without any reference to mathematical models, whereas model A and model C can only be implemented by a mathematical transformation that makes each resulting element in the IOTs in principle depend on all elements of the SUTs.

12.34 In general, model A (using the product technology assumption) and model D (using the fixed product sales structure assumption) are widely used by national statistics offices, whereas model B and model C are considered less realistic but presented for formal reasons, as they can be derived in a manner that is mathematically analogous to the two other models.

**Figure 12.2 Basic transformation models**

| | | Product-by-product IOT | Industry-by-industry IOT |
|---|---|---|---|
| Technology | Product technology | **Model A** Each product is produced in its own specific way, irrespective of the industry where it is produced. *Negative elements may occur* | |
| | Industry technology | **Model B** Each industry has its own specific way of production, irrespective of its product mix. *No negative elements* | |
| Sales structure | Fixed industry sales structure | | **Model C** Each industry has its own specific sales structure, irrespective of its product mix. *Negative elements may occur* |
| | Fixed product sales structure | | **Model D** Each product has its own specific sales structure, irrespective of the industry where it is produced. *No negative elements* |

12.35 It is important to note that the assumptions made for the IOTs (whether technology assumptions or sale structure assumptions) relate to the situation in the particular year for which the IOTs are compiled. They do not include any assumptions about constant input proportions or market shares over time. In fact, when IOTs are compiled on an annual basis (or every five years), the time series of these tables can be used to examine the dynamic changes of the input structures in models dealing with the structural development of the economy.

12.36 The task confronting compilers of the rectangular SUTs is to reorganize already highly aggregated data and, when compiling the IOTs, compilers have to deal first with a disaggregation of the SUTs data under certain assumptions and subsequently with an aggregation to derive an IOT. When compared to the real world and the magnitude of products and production processes, even the detailed basic statistics already represent a major aggregation.

12.37 In the various transformation models, each of the products and industries includes many different underlying products and production processes. If, for example, the product technology is assumed, this also implies the assumption that the underlying product composition of the output from any secondary producer is identical to the underlying product composition of the primary producer. Looking below the applied level of aggregation, it is thus implicitly assumed that an industry technology will be applied for the underlying products in order to implement the product technology. This illustrates the interconnections between the various types of assumptions when real world complexities are taken into account.

## D. Input-output framework

12.38 The input-output framework is presented in Box 12.2, with a definition of variables, and a summary of the main transformation models is given in Box 12.3. The information contained in SUTs can be rearranged in the input-output framework as shown in Box 12.2. In Box 12.2 and Box 12.3, the capital letters denote matrices and the small letters vectors. Transpose matrices are written as matrices with the attachment of a superscript (T). Vectors are written as column vectors and row vectors are written as transposed column vectors with the attachment of a superscript (T). In addition, the superscript ^ is used to denote the diagonalization of a vector.

12.39 The benefit of the input-output framework is that all information of the SUTs and IOTs can be integrated into one matrix. The first two rows of the integrated input-output framework in Box 12.2 refer to products. In particular, the first row shows the use of domestic products as intermediate output by industries (the matrix $U_d$) and final uses (the matrix $Y_d$). The matrix $U_d$ has products in the rows and industries in the columns. Similarly, the second row of the integrated input-output framework shows the use of imported products as intermediate output by industries ($U_m$) and final uses ($Y_m$). The matrix $U_m$ has products in the rows and industries in the columns.

12.40 The typical element of the matrix $U_d$, say, in rows *i* and column *j*, represents the amount of product *i* used up in the production of industry *j*. The row sums of this matrix represent the total intermediate use of the various products in production. The column sums represent the intermediate use of all products by the various industries. The matrix $Y_d$ has again products in the rows and final uses categories in the columns. Each element of the corresponding summation vector represents the net final use of a particular domestic product for consumption, capital formation and net exports.

12.41 The third row (and column) of the integrated input-output framework in Box 12.2 relates to industries. Whereas the column sums of V give the domestic output of the various products, the row sums of V give the domestic output of the various industries. These row totals are the elements of the vector of industry outputs (g). The column totals are the elements of the transposed vector of industry output ($g^T$). The third column of the integrated input-output framework shows the total costs required to produce the industry outputs. The column sums of $U_d$ and $U_m$, which represent the cost of intermediate inputs, and the elements of the row vector W, which represent the cost of primary input (value added), determine the value of industry output.

12.42 The fifth row and column of the "Integrated input-output framework" relate to total input and total output of products and industries, but also to total value added and net final expenditures. The system is balanced if total input of products ($x^T$ and $m^T$) equals total output of products (x and m) and total input of industries ($g^T$) equals total output of industries (g). If this is the case, total value added (w) equals total net final expenditure (y).

12.43 In the following, each of the mathematical models defined in Box 12.3 will be illustrated by numerical examples starting from the same SUTs, either rectangular as given by Table 12.2 or aggregated to a square version as shown in Table 12.3.

## 1. Treatment of imports of goods and services in IOTs

12.44 It should be noted that the domestic use table at basic prices of these SUTs also includes the uses of imports which, however, in these tables are separated from the domestic output and grouped together in a single row and classified as a primary input, indicating that the supply and use of imported products does not affect the domestic production circuit.

12.45 In the imports use table included in tables 12.2 and 12.3, the import row is broken down by products. In practice, the procedure will usually be to derive the imports use table by subdividing each element in the total use table into a domestic and an imported share, and subsequently deriving the single import row in the domestic use table as the column sums of the imports use table. Displaying uses of imports in a single row is therefore not usually an alternative to estimating the full imports use table. More details covering the estimation of the imports use table may be found in chapter 8. Numerical examples are presented in the following sections, based on the mathematical models in Box 12.3. All these examples start from the same SUTs, those to be found in Table 12.2 and Table 12.3.

## Box 12.2 Input-output framework for domestic output and imports

**Supply table**

| | Industries | Output | Imports | Supply |
|---|---|---|---|---|
| Products | $V^T$ | x | m | q |
| Output | $g^T$ | | | |

**Domestic use table**

| | Industries | Final use | Use |
|---|---|---|---|
| Domestic products | $U_d$ | $Y_d$ | x |
| Imported products | $U_m$ | $Y_m$ | m |
| GVA | W | | w |
| Output | $g^T$ | y | |

**Integrated supply and use framework**

| | Domestic products | Industries | Final use | Total |
|---|---|---|---|---|
| Domestic products | | $U_d$ | $Y_d$ | x |
| Imported products | | $U_m$ | $Y_m$ | m |
| Industries | V | | | g |
| GVA | | W | | w |
| Total | $x^T$ | $g^T$ | y | |

**Input-output table - product-by-product**

| | Products | Final use | Use |
|---|---|---|---|
| Domestic products | $S_d$ | $Y_d$ | x |
| Imported products | $S_m$ | $Y_m$ | m |
| GVA | E | | w |
| Output | $x^T$ | y | |

**Input-output table - industry-by-industry**

| | Industries | Final use | Output |
|---|---|---|---|
| Domestic industries | $B_d$ | $F_d$ | g |
| Imports from industries | $B_m$ | $F_m$ | m |
| GVA | W | | w |
| Output | $g^T$ | y | |

### Legend

V = Make matrix – transpose of supply matrix (industry-by-product)

$V^T$ = Supply matrix (product-by-industry)

U = Use matrix for intermediates (product-by-industry)

Y = Final use matrix (product-by-category)

F = Final use matrix (industry-by-category)

S = Matrix for intermediates (product-by-product)

B = Matrix for intermediates (industry-by-industry)

E = Gross value added matrix (components-by-homogenous branches)

W = Gross value added matrix (components-by-industry)

$\hat{g}$ = Diagonal matrix of industry output

$\hat{x}$ = Diagonal matrix of product output

y = Row vector of final use

w = Column vector of gross value added

I = Unit matrix

x = Column vector of product output

$x^T$ = Row vector of product output

g = Column vector of industry output

$g^T$ = Row vector of industry output

m = Column vector of total imports

$d$ = Index for domestic origin

$m$ = Index for imported origin

**Input coefficients of use table**

$Z = U(\hat{g})^{-1}$ Input requirements for products per unit of output of an industry (intermediates)

$L = W(\hat{g})^{-1}$ Input requirements for value added per unit of output of an industry (primary input)

**Market share coefficients of supply table**

$C = V^T(\hat{g})^{-1}$ Product-mix matrix (share of each product in output of an industry)

$D = V(\hat{x})^{-1}$ Market shares matrix (contribution of each industry to the output of a product)

**Notes**

Capital letters denote matrices and the small letters vectors.

Transpose matrices are written as matrices with the attachment of a superscript (T).

Vectors are written as column vectors and row vectors are written as transposed column vectors with the attachment of a superscript (T).

Use of superscript ^ indicates diagonalization of a vector.

## Box 12.3 Basic transformations of SUTs to IOTs

| | | |
|---|---|---|
| **Model A: Product-by-product IOTs based on product technology assumption** | | **Negatives possible** |
| Each product is produced in its own specific way, irrespective of the industry where it is produced. | | |
| $T = (D^T)^{-1}$ | Transformation matrix | |
| $S_d = U_d\,T$ | Domestic intermediates | |
| $S_m = U_m\,T$ | Imported intermediates | |
| $E = W\,T$ | GVA | |
| $Y_d = Y_d$ | Final use of domestic products | |
| $Y_m = Y_m$ | Final use of imported products | |
| **Model B: Product-by-product IOTs based on industry technology assumption** | | **No negatives** |
| Each industry has its own specific way of production, irrespective of its product mix. | | |
| $T = C^T$ | Transformation matrix | |
| $S_d = U_d\,T$ | Domestic intermediates | |
| $S_m = U_m\,T$ | Imported intermediates | |
| $E = W\,T$ | GVA | |
| $Y_d = Y_d$ | Final use of domestic products | |
| $Y_m = Y_m$ | Final use of imported products | |
| **Model C: Industry-by-industry IOTs based on fixed industry sales structure assumption** | | **Negatives possible** |
| Each industry has its own specific sales structure, irrespective of its product mix. | | |
| $T = C^{-1}$ | Transformation matrix | |
| $B_d = T\,U_d$ | Domestic intermediates | |
| $B_m = T\,U_m$ | Imported intermediates | |
| $W = W$ | GVA | |
| $F_d = TY_d$ | Final use of domestic products | |
| $F_m = TY_m$ | Final use of imported products | |
| **Model D: Industry-by-industry IOTs based on fixed product sales structure assumption** | | **No negatives** |
| Each product has its own specific sales structure, irrespective of the industry where it is produced. | | |
| $T = D$ | Transformation matrix | |
| $B_d = T\,U_d$ | Domestic intermediates | |
| $B_m = T\,U_m$ | Imported intermediates | |
| $W = W$ | GVA | |
| $F_d = T\,Y_d$ | Final use of domestic products | |
| $F_m = T\,Y_m$ | Final use of imported products | |
| **Model E: Product-by-product IOTs based on a hybrid of technologies chosen to avoid negatives** | | **Negatives possible** |
| Products are produced with product technology assumption or industry technology assumption. | | |
| $V_1 = V \# H$ | Matrix for product technology | |
| $V_2 = V - V_1$ | Matrix for industry technology | |
| $C_1 = V_1^T\ (\hat{g}\ )^{-1}$ | Product mix matrix for product technology | |
| $D_2 = V_2\ (\hat{x}\ )^{-1}$ | Market share matrix for industry technology | |
| $R = C_1^{-1} * (I\text{-diag}(D_2^T * i)) + D_2$ | Hybrid technology transformation matrix | |
| $A = Z\,R$ | Input coefficients intermediates | |
| $R = L\,R$ | Input coefficients value added | |
| $x = (I - Z\,R)^{-1}\,y$ | Output | |
| $S = Z\,R\,\hat{x}$ | Intermediates | |
| $Y = Y$ | Final use | |
| $E = L\,R\,\hat{x}$ | GVA | |
| $V_1$ = Matrix for product technology | | |
| $V_2$ = Matrix for industry technology $(V - V_1)$ | | |
| $g_1$ = Vector of industry output with product technology | | |
| $i$ = Unit vector | | |
| $H$ = Matrix for hybrid technology | | |

12.46 In the numerical examples presented in the following sections, the transformation of the SUTs into IOTs takes place separately for the domestic use table (not including imports) and the imports use table, following the sequence of the formulae in box 12.3. When the input table for imports (ITI) has been derived, it can be presented in two different ways:

- The vector of column sums of the ITI is inserted as a single row into the primary input part of the first subtable. It would also be possible to insert the full ITI into the primary input section of this IOT. Sometimes this type of IOT is also called the national or domestic version, or described as an IOT with endogenous imports because the imports required to produce a certain final use can be calculated using an input-output model based on this type of IOT.
- The full ITI is added, element by element, to the domestic output part of the IOT (the first subtable) to obtain an IOT where no distinction is made between domestically produced products and imported products. This type of IOT can also be obtained directly from the SUTs, with no distinction made between domestic output and imports. This distinction is therefore not a precondition for compiling an IOT. This version of the IOT is described as an IOT with net exports, as imports are treated as a negative final use. Sometimes this type of IOT is also called the global or total version, indicating model assumptions that outputs worldwide are being produced by input structures observed for the domestic producers or, alternatively, that the domestic producers can produce import substitutes without changing their observed input structure. It may also be described as an IOT with exogenous imports as it is necessary to make independent estimates of the imports in analytical uses of an input-output model based on this type of IOT.

12.47 The results of the numerical examples for each model (A, B, C or D) are therefore represented by two different versions of an IOT where:

- Imports of goods and services are treated as a primary input (referred to as an IOT).
- Imports of goods and services are treated as a negative final use (referred as an IOT with net exports).

Both versions of these IOTs are completely self-contained and may be used for analytical applications.

12.48 For illustrative purposes, the following three tables are presented in the numerical examples of IOTs under the different models:

- IOT (including the imports of goods and services as primary inputs)
- Input table for imports
- IOT with net exports

12.49 The sequence of three tables in the following sections showing the results of the numerical examples should not be mistaken to mean that the first two subtables (IOT and input table for imports) are just stepping stones towards obtaining the last subtable, the IOT with net exports. In fact, the entire sequence of calculations could be reversed, as the IOT with net exports can be derived directly from the SUTs without applying an input table for imports and it is possible to move from the IOT with net exports to the IOT by applying the input table for imports. Starting from the SUTs, the IOT with imports as primary input is seen to be more data-demanding than the IOT with net exports.

12.50 An IOT is characterized by its row sums being equal to column sums. This property follows directly from the mathematical formulae applied for the compilation. Furthermore, the row and column sums for the production part of an IOT must be equal to the domestic output by products for product-by-product IOTs and equal to the output by industry for industry-by-industry IOTs. The totals for output either by product or by industry in the SUTs will therefore also appear in the IOTs as clearly demonstrated by the results of the numerical examples in the following sections.

## 2. Product-by-product IOTs

### (a) Product technology assumption (model A)

12.51 The most frequently used method for deriving product-by-product IOTs is that based on the product technology assumption (model A). It is assumed that:

> *Each product is produced in its own specific way, irrespective of the industry where it is produced.*

"Product" is here to be understood as referring to the level of aggregation of products in the SUTs that will make the number of product groups equal to the number of industries. For each of these products, the same proportions of products and factor inputs are assumed to be used to produce one unit of the product, disregarding in which industry the product is actually produced.

12.52 Formally, the product technology assumption seems to be the most applicable in cases of subsidiary production, since in those cases the technologies of primary and secondary products are independent. The product technology assumption does not, however, exclude cases where two or more products are produced in the same process, for example, joint production. When one of the products is also produced elsewhere, and in a different way, then the product technology assumption is not valid.

12.53 The product technology assumption requires the use of square SUTs. The aggregation of products to arrive at a square SUTs leads to some information loss. When such aggregation has been made it also means that each industry will usually produce several primary products, thus underlining the theoretical nature of the assumption that each aggregated product is being produced in only one way.

12.54 Mathematically, model A can be expressed as the post-multiplication of the use matrix with a transformation matrix. The transformation matrix in model A is:

$$T = (D^T)^{-1}$$

where $D$ represents the market share matrix and, together with the intermediate uses, GVA and final uses of the product-by-product IOTs can be calculated as illustrated in Box 12.3. Table 12.4 provides a numerical example of the transformation matrix for the product technology assumption applied to SUTs given in Table 12.3.

**Table 12.4 Transformation matrix for the product technology assumption**

| | | Industries | | |
|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services |
| Products | Agriculture | 1.4809 | -0.2117 | -0.2692 |
| | Manufacturing and construction | -0.0022 | 1.1075 | -0.1053 |
| | Services | -0.0274 | -0.0357 | 1.0631 |

12.55 After the transformation matrix is applied to the original SUTs as illustrated in Box 12.3, the resulting product-by-product IOTs based on product technology (model A) are obtained as shown in Table 12.5.

12.56 It should be noted that, as the final uses are already defined in terms of products in the use table, the final use of domestic products and the final use of imported products remain the same in the IOT. Furthermore, the total inputs by column in the IOTs are equal to total outputs by row in the IOTs with exports and with net exports (even though the totals are not the same in the two tables, owing to the different treatment of imports). The columns of IOTs now describe input structures of products. The final uses are not affected since they are already formulated in terms of products.

12.57 In Table 12.5, there are a few cell entries with negative values. Annex B to chapter 12 describes potential causes and possible treatments of negative cell entries in the product technology assumption. These negatives have a mathematical systematic cause, however, as demonstrated by de Mesnard (2011), and this is also covered in paragraph 12.95 of this chapter.

**Table 12.5 Product-by-product IOTs based on product technology**

Input-output table

| | | Products | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 6.40 | 9.33 | -1.50 | 13.18 | 0.08 | 10.47 | 37.96 |
| | Manufacturing and construction | 10.45 | 116.03 | 35.68 | 32.04 | 73.94 | 175.94 | 444.08 |
| | Services | -0.33 | 61.13 | 217.11 | 344.77 | 20.75 | 112.95 | 756.37 |
| Prim | Imports | 1.34 | 133.72 | 69.52 | 75.33 | 36.50 | 244.82 | 561.23 |
| | GVA | 20.10 | 123.88 | 435.56 | | | | 579.54 |
| Input | | 37.96 | 444.08 | 756.37 | 465.33 | 131.27 | 544.17 | |

Input table of imports

| | | Products | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 1.11 | 6.91 | -0.37 | 1.25 | 0.03 | 6.45 | 15.38 |
| | Manufacturing and construction | 1.01 | 109.33 | 26.58 | 61.07 | 31.49 | 171.55 | 401.04 |
| | Services | -0.79 | 17.48 | 43.31 | 13.02 | 4.98 | 66.81 | 144.81 |
| Total | | 1.34 | 133.72 | 69.52 | 75.33 | 36.50 | 244.82 | 561.23 |

Input-output table with net exports

| | | Products | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Net exports | |
| Products | Agriculture | 7.52 | 16.24 | -1.88 | 14.43 | 0.10 | 1.54 | 37.96 |
| | Manufacturing and construction | 11.47 | 225.36 | 62.26 | 93.11 | 105.44 | -53.55 | 444.08 |
| | Services | -1.12 | 78.60 | 260.43 | 357.79 | 25.73 | 34.95 | 756.37 |
| GVA | | 20.10 | 123.88 | 435.56 | | | | 579.54 |
| Input | | 37.96 | 444.08 | 756.37 | 465.33 | 131.27 | -17.05 | |

### (b) Industry technology assumption (model B)

12.58 The industry technology assumption is based on the assumption that:

*Each industry has its own specific way of production, irrespective of its product mix.*

This assumption applies best to cases of by-products or joint products, since in these cases several products are produced in a single production process.

12.59 The formula for model B can be derived through the following transformation matrix:

$$T = C^T$$

where $C$ is the product-mix matrix and, together with the intermediate uses and GVA of the product-by-product IOTs, it is calculated as illustrated in Box 12.3. The numerical example of the transformation matrix for the industry technology assumption is shown in Table 12.6 and applied to the original matrices in the use table.

## Table 12.6 Transformation matrix for industry technology assumption

| | | Products | | |
|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services |
| Industries | Agriculture | 0.6372 | 0.0335 | 0.3294 |
| | Manufacturing and construction | 0.0119 | 0.9289 | 0.0592 |
| | Services | 0.0092 | 0.0526 | 0.9382 |

12.60 The resulting IOTs based on the industry technology assumption are presented in Table 12.7. In this case, negative cell entries cannot arise since the amounts transferred can never be larger than the amounts available in the columns of the industries. The lack of negatives does not mean, however, that the results are more plausible.

## Table 12.7 Product-by-product IOTs based on industry technology

Input-output table

| | | Products | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 2.89 | 8.80 | 2.55 | 13.18 | 0.08 | 10.47 | 37.96 |
| | Manufacturing and construction | 6.85 | 102.84 | 52.47 | 32.04 | 73.94 | 175.94 | 444.08 |
| | Services | 5.10 | 69.51 | 203.30 | 344.77 | 20.75 | 112.95 | 756.37 |
| Prim | Imports | 3.81 | 119.15 | 81.61 | 75.33 | 36.50 | 244.82 | 561.23 |
| | GVA | 19.31 | 143.79 | 416.45 | | | | 579.54 |
| Input | | 37.96 | 444.08 | 756.37 | 465.33 | 131.27 | 544.17 | |

Input table of imports

| | | Products | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 0.57 | 6.00 | 1.08 | 1.25 | 0.03 | 6.45 | 15.38 |
| | Manufacturing and construction | 2.47 | 94.92 | 39.53 | 61.07 | 31.49 | 171.55 | 401.04 |
| | Services | 0.77 | 18.22 | 41.00 | 13.02 | 4.98 | 66.81 | 144.81 |
| Total | | 3.81 | 119.15 | 81.61 | 75.33 | 36.50 | 244.82 | 561.23 |

Input-output table with net exports

| | | Products | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Net Exports | |
| Products | Agriculture | 3.46 | 14.79 | 3.63 | 14.43 | 0.10 | 1.54 | 37.96 |
| | Manufacturing and construction | 9.32 | 197.76 | 92.00 | 93.11 | 105.44 | -53.55 | 444.08 |
| | Services | 5.88 | 87.73 | 244.30 | 357.79 | 25.73 | 34.95 | 756.37 |
| GVA | | 19.31 | 143.79 | 416.45 | | | | 579.54 |
| Input | | 37.96 | 444.08 | 756.37 | 465.33 | 131.27 | -17.05 | |

### (c) Hybrid technology assumptions

12.61 In general, the product technology assumption is most suitable in cases of subsidiary products, while the industry technology assumption applies best to cases of by-products or joint products. In practice, however, secondary production can occur in different forms in a country. It is thus possible to use hybrid assumptions of product and industry technology. The classical approach to this is to divide the supply table into two parts: one containing the primary and subsidiary products and the other the by-products or joint products. The product technology is applied to the first part, and the industry technology to the second. This is the approach used by, for example, the United Kingdom.

12.62 The mathematical formula under the hybrid technology assumption (model E) is shown in Box 12.3. This formulation is based on a matrix for hybrid technology, H, which is a product-by-industry matrix of "ones" for products that should use the product technology assumption and "zeros" for products that should use the industry technology assumption.

12.63 Table 12.8 provides an example of this hybrid – or mixed – technology model. The model gives no new theoretical viewpoint but is merely a combination of the two techniques presented above. If the matrix for hybrid technology is filled in each cell with ones, this method coincides with the model based on product technology assumption. If negative cell entries are observed, then the challenge is to fill in as few zeros as possible until all negative values have disappeared. In a further step, there are procedures that can be used to remove negative values (see annex B to this chapter).

**Table 12.8 Matrix for hybrid technology**

| | | Industries | | |
|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services |
| Products | Agriculture | 1 | 1 | 1 |
| | Manufacturing and construction | 1 | 1 | 1 |
| | Services | 1 | 0 | 0 |

1 = Product technology assumption

0 = Industry technology assumption

12.64 If, for example, the secondary outputs of the agriculture industry and the secondary output of services by manufacturing used different production processes than the primary producers of these products, a possible method for resolving the problem would be to apply the industry technology assumptions in a selective manner to these products. In Table 12.8, it is assumed that all outputs flagged with ones are produced according to the product technology assumption, while the remaining outputs flagged with zeros in Table 12.8 were produced according to the industry technology assumption. The numerical example of the hybrid technology transformation matrix R is shown in Table 12.9.

**Table 12.9 Transformation matrix for hybrid technology assumption**

| | | Industries | | |
|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services |
| Products | Agriculture | 0.0000 | -0.1770 | 0.1574 |
| | Manufacturing and construction | 0.0000 | 0.9854 | -0.0057 |
| | Services | 1.0000 | 0.1916 | 0.8483 |

12.65 The result of the hybrid technology assumption is presented in table 12.10.

**Table 12.10 IOTs based on the hybrid technology assumption**

Input-output table

| | | Products | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 0.03 | 0.98 | 13.22 | 13.18 | 0.08 | 10.47 | 37.96 |
| | Manufacturing and construction | 2.30 | 98.31 | 61.55 | 32.04 | 73.94 | 175.94 | 444.08 |
| | Services | 10.50 | 79.51 | 187.90 | 344.77 | 20.75 | 112.95 | 756.37 |
| Prim | Imports | 3.89 | 128.74 | 71.95 | 75.33 | 36.50 | 244.82 | 561.23 |
| | GVA | 21.25 | 136.53 | 421.76 | | | | 579.54 |
| Input | | 37.96 | 444.08 | 756.37 | 465.33 | 131.27 | 544.17 | |

Input table of imports

| | | Products | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 0.02 | 5.02 | 2.61 | 1.25 | 0.03 | 6.45 | 15.38 |
| | Manufacturing and construction | 1.75 | 102.16 | 33.01 | 61.07 | 31.49 | 171.55 | 401.04 |
| | Services | 2.11 | 21.56 | 36.33 | 13.02 | 4.98 | 66.81 | 144.81 |
| Total | | 3.89 | 128.74 | 71.95 | 75.33 | 36.50 | 244.82 | 561.23 |

Input-output table with net exports

| | | Products | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Net exports | |
| Products | Agriculture | 0.05 | 6.00 | 15.83 | 14.43 | 0.10 | 1.54 | 37.96 |
| | Manufacturing and construction | 4.05 | 200.47 | 94.56 | 93.11 | 105.44 | -53.55 | 444.08 |
| | Services | 12.61 | 101.07 | 224.23 | 357.79 | 25.73 | 34.95 | 756.37 |
| GVA | | 21.25 | 136.53 | 421.76 | | | | 579.54 |
| Input | | 37.96 | 444.08 | 756.37 | 465.33 | 131.27 | -17.05 | |

## 3. Industry-by-industry IOTs

12.66 Industry-by-industry IOTs may be derived by transferring inputs within the industry columns. The product classification of the rows is transformed into the industry classification (industry-adjusted products) of the columns.

### (a) Assumption of fixed industry sales structures (model C)

12.67 The fixed industry sales structure is based on the assumption that:

*Each industry has its own specific sales structure, irrespective of its product mix.*

12.68 The mathematical formula for the transformation matrix in the case of the fixed industry sales structures model is as follows:

$$T = C^{-1}$$

Where C is the product-mix matrix and, together with the intermediate uses and final uses of the resulting industry-by-industry IOTs, it is calculated as illustrated in Box 12.3.

12.69 The numerical example of the transformation matrix for the industry sales structure assumption is shown in Table 12.11 and the resulting IOTs are presented in Table 12.12.

**Table 12.11 Transformation matrix for the fixed industry sales structure assumption**

| | | Industries | | |
|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services |
| Products | Agriculture | 1.5779 | -0.0193 | -0.0144 |
| | Manufacturing and construction | -0.0256 | 1.0807 | -0.0603 |
| | Services | -0.5523 | -0.0614 | 1.0747 |

## Table 12.12 IOTs based on the fixed industry sales structure assumption

Input-output table

| | | Industries | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Industries | Agriculture | 6.65 | 11.66 | -2.98 | 15.22 | -1.60 | 11.51 | 40.45 |
| | Manufacturing and construction | 8.39 | 112.47 | 37.25 | 13.49 | 78.65 | 183.05 | 433.31 |
| | Services | 1.17 | 55.66 | 224.02 | 361.28 | 17.72 | 104.80 | 764.66 |
| Prim | Imports | 2.54 | 123.74 | 78.29 | 75.33 | 36.50 | 244.82 | 561.23 |
| | GVA | 21.70 | 129.78 | 428.07 | | | | 579.54 |
| Input | | 40.45 | 433.31 | 764.66 | 465.33 | 131.27 | 544.17 | |

Input table of imports

| | | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Industries | Agriculture | 1.18 | 7.92 | -0.54 | 0.61 | -0.63 | 5.91 | 14.46 |
| | Manufacturing and construction | 1.57 | 107.01 | 35.57 | 65.18 | 33.73 | 181.20 | 424.26 |
| | Services | -0.22 | 8.80 | 43.26 | 9.55 | 3.40 | 57.71 | 122.51 |
| Total | | 2.54 | 123.74 | 78.29 | 75.33 | 36.50 | 244.82 | 561.23 |

Input-output table with net exports

| | | Industries | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Net exports | |
| Industries | Agriculture | 7.84 | 19.58 | -3.52 | 15.82 | -2.24 | 2.96 | 40.45 |
| | Manufacturing and construction | 9.96 | 219.48 | 72.82 | 78.67 | 112.39 | -60.02 | 433.31 |
| | Services | 0.95 | 64.47 | 267.28 | 370.83 | 21.12 | 40.00 | 764.66 |
| | GVA | 21.70 | 129.78 | 428.07 | | | | 579.54 |
| Input | | 40.45 | 433.31 | 764.66 | 465.33 | 131.27 | -17.05 | |

12.70 The assumption of fixed industry sales structures seems to be rather unrealistic. Only in a few cases will firms supply all their products in the same proportions to their users (one such example may be secondary trade activities, such as software sold together with computers by a computer-producing firm). In general, it seems more plausible to assume that the secondary products have different destinations than the primary products.

12.71 In Table 12.12, there are a few cell entries with negative values. These tables are of the industry-by-industry kind and the reasons that the cell entries are negative is that these are classically considered to be different from those generated using the product technology. Annex B to this chapter covers the causes and treatment of negative cell entries in the product technology assumption. As with model A, however, these negatives have a mathematical systematic cause, as demonstrated by de Mesnard (2011), also covered in paragraph 12.95 of this chapter.

### (b) Fixed product sales structures assumption (model D)

12.72 A more realistic method, and the one most frequently used for deriving industry-by-industry IOTs is that of a fixed product sales structure, based on the assumption that:

> *Each product has its own specific sales structure, irrespective of the industry where it is produced.*

12.73 The term "sales structure" indicates the proportions of the output of a product in which that product is sold for intermediate uses and final uses.

12.74 The transformation matrix for the fixed product sales structures model (model D) is the following:

$$T = D$$

where $D$ is the market-share matrix and, together with the intermediate uses and final uses of the industry-by-industry IOTs, it can be derived using the formula shown in Box 12.3.

12.75 An important advantage of the market share method (model D) is that IOTs can directly be derived from the rectangular SUTs without any intermediate aggregation to square SUTs; see Thage (2005). Consequently, the question of defining characteristic products and making a formal distinction between primary and secondary production does not arise. As illustrated both in the numerical examples and empirical examples in this chapter, this method reduces the aggregation loss of information. This does not exclude the introduction of special knowledge that modifies this assumption but this must have already taken place in the SUTs compilation system, and thus also in the basic framework of the national accounts.

12.76 The recommended method is therefore to apply model D directly to rectangular SUTs. To illustrate the loss of information that results from the application of model D to the square aggregation of the SUTs, the results of both calculations are shown in this section.

12.77 Table 12.13 illustrates the numerical example of the transformation matrix for the fixed product sales structure assumption applied to the rectangular SUTs in Table 12.2 and the resulting industry-by-industry tables are presented in Table 12.14.

## Table 12.13 Transformation matrix for the fixed product sales structure assumption for rectangular SUTs

| | | Products | | | | | |
|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services |
| Industries | Agriculture | 0.6789 | 0.0036 | 0.0010 | 0.0021 | 0.0441 | 0.0013 |
| | Manufacturing and construction | 0.1357 | 0.8945 | 0.9510 | 0.0610 | 0.0284 | 0.0111 |
| | Services | 0.1853 | 0.1019 | 0.0480 | 0.9368 | 0.9276 | 0.9875 |

## Table 12.14 IOTs based on the fixed product sales structure assumption derived from rectangular SUTs

Input-output table

| | | Industries | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Industries | Agriculture | 3.07 | 7.99 | 6.53 | 12.70 | 0.73 | 9.44 | 40.45 |
| | Manufacturing and construction | 8.00 | 101.85 | 50.13 | 39.04 | 69.68 | 164.61 | 433.31 |
| | Services | 5.15 | 69.96 | 201.63 | 338.25 | 24.37 | 125.30 | 764.66 |
| Prim | Imports | 2.54 | 123.74 | 78.29 | 75.33 | 36.50 | 244.82 | 561.23 |
| | GVA | 21.70 | 129.78 | 428.07 | | | | 579.54 |
| Input | | 40.45 | 433.31 | 764.66 | 465.33 | 131.27 | 544.17 | |

Input table of imports

| | | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Industries | Agriculture | 0.54 | 5.33 | 1.57 | 1.10 | 0.23 | 5.73 | 14.50 |
| | Manufacturing and construction | 1.45 | 91.03 | 33.26 | 54.98 | 28.44 | 157.94 | 367.10 |
| | Services | 0.56 | 27.37 | 43.47 | 19.26 | 7.82 | 81.14 | 179.63 |
| Total | | 2.54 | 123.74 | 78.29 | 75.33 | 36.50 | 244.82 | 561.23 |

Input-output table with net exports

| | | Industries | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Net exports | |
| Industries | Agriculture | 3.60 | 13.32 | 8.09 | 13.80 | 0.96 | 0.68 | 40.45 |
| | Manufacturing and construction | 9.44 | 192.88 | 83.39 | 94.02 | 98.12 | -44.55 | 433.31 |
| | Services | 5.70 | 97.33 | 245.10 | 357.51 | 32.19 | 26.81 | 764.66 |
| GVA | | 21.70 | 129.78 | 428.07 | | | | 579.54 |
| Input | | 40.45 | 433.31 | 764.66 | 465.33 | 131.27 | -17.05 | |

12.78 The row sums (total input) now equal the industry output levels (total output) in the IOT in Table 12.14. In the industry-by-industry IOTs based on a fixed product sales structure, the GVA is unaffected, since this part has already been formulated in terms of industries.

12.79 In order to see the impact of using square rather than rectangular SUTs, IOTs are calculated based on the square SUTs of Table 12.3 and are compared with those obtained above. Thus Table 12.15 and Table 12.16 are the equivalent versions of Table 12.13 and Table 12.14 respectively but based on square SUTs of Table 12.3. Table 12.17 shows the absolute deviation between the two approaches and thus the effect of the loss of information suffered by moving from the rectangular SUTs to the square SUTs as the data base for the transformation.

**Table 12.15 Transformation matrix for the fixed product sales structure assumption for square SUTs**

| | | Products | | |
|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services |
| Industries | Agriculture | 0.6789 | 0.0030 | 0.0176 |
| | Manufacturing and construction | 0.1357 | 0.9064 | 0.0339 |
| | Services | 0.1853 | 0.0905 | 0.9485 |

# Table 12.16 IOTs based on the fixed product sales structure assumption for square SUTs

Input-output table

| | | Industries | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Industries | Agriculture | 3.04 | 7.73 | 4.28 | 15.12 | 0.64 | 9.64 | 40.45 |
| | Manufacturing and construction | 8.04 | 101.09 | 49.20 | 42.52 | 67.73 | 164.72 | 433.31 |
| | Services | 5.13 | 70.97 | 204.82 | 332.35 | 26.39 | 125.00 | 764.66 |
| Prim | Imports | 2.54 | 123.74 | 78.29 | 75.33 | 36.50 | 244.82 | 561.23 |
| | GVA | 21.70 | 129.78 | 428.07 | | | | 579.54 |
| Input | | 40.45 | 433.31 | 764.66 | 465.33 | 131.27 | 544.17 | |

Input table of imports

| | | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Industries | Agriculture | 0.53 | 4.96 | 1.18 | 1.26 | 0.20 | 6.08 | 14.22 |
| | Manufacturing and construction | 1.46 | 92.21 | 33.50 | 55.96 | 28.72 | 158.64 | 370.50 |
| | Services | 0.54 | 26.57 | 43.61 | 18.11 | 7.58 | 80.10 | 176.51 |
| Total | | 2.54 | 123.74 | 78.29 | 75.33 | 36.50 | 244.82 | 561.23 |

Input-output table with net exports

| | | Industries | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Net exports | |
| Industries | Agriculture | 3.58 | 12.69 | 5.46 | 16.38 | 0.85 | 1.50 | 40.45 |
| | Manufacturing and construction | 9.51 | 193.31 | 82.70 | 98.48 | 96.45 | -47.14 | 433.31 |
| | Services | 5.67 | 97.54 | 248.43 | 350.46 | 33.97 | 28.59 | 764.66 |
| GVA | | 21.70 | 129.78 | 428.07 | | | | 579.54 |
| Input | | 40.45 | 433.31 | 764.66 | 465.33 | 131.27 | -17.05 | |

## Table 12.17 Absolute deviation of IOTs based on rectangular SUTs less IOTs based on square SUTs for Model D

Input-output table

| | | Industries | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Industries | Agriculture | 0.02 | 0.25 | 2.25 | -2.42 | 0.08 | -0.19 | 0.00 |
| | Manufacturing and construction | -0.04 | 0.76 | 0.93 | -3.48 | 1.94 | -0.11 | 0.00 |
| | Services | 0.02 | -1.01 | -3.18 | 5.90 | -2.03 | 0.30 | 0.00 |
| Prim | Imports | | | | | | | |
| | GVA | | | | | | | |
| Input | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |

Input table of imports

| | | Industries | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Industries | Agriculture | 0.01 | 0.37 | 0.39 | -0.17 | 0.03 | -0.35 | 0.28 |
| | Manufacturing and construction | -0.02 | -1.18 | -0.24 | -0.98 | -0.28 | -0.69 | -3.40 |
| | Services | 0.01 | 0.81 | -0.14 | 1.15 | 0.25 | 1.04 | 3.12 |
| Total | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Input-output table with net exports

| | | Industries | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Net exports | |
| Industries | Agriculture | 0.03 | 0.63 | 2.64 | -2.59 | 0.11 | -0.82 | 0.00 |
| | Manufacturing and construction | -0.06 | -0.42 | 0.69 | -4.46 | 1.67 | 2.60 | 0.00 |
| | Services | 0.04 | -0.21 | -3.32 | 7.05 | -1.78 | -1.78 | 0.00 |
| GVA | | | | | | | | |
| Input | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |

## 4. Alternative presentation of imports in the IOT

12.80 In the previous tables, imports were presented in two ways in the IOTs as either the primary input (as shown in the first table in table 12.16) or as a negative final use (as shown in the bottom table in table 12.16). In the latter case, imports may either be netted against exports (as in the tables above) or kept in a separate column with a negative sign. In the IOT with net exports in Table 12.18, the net exports of the product “Agriculture”, 1.54, is obtained as 10.47 (from the corresponding entry in the IOT) plus 6.45 minus 15.38 (from the corresponding entry in the input table for imports).

12.81 In an alternative presentation that is sometimes used, the vector of imports (either classified by product or by industry-adjusted products, depending on the type of IOT) is added to domestic output to obtain the total supply as column sums for the production part of the IOT, matching the row sums that include total uses of both domestic output and imports. This import row, however, is neither intermediate consumption nor primary input but just a bookkeeping entry to balance the total use in the corresponding rows. The fourth subtable in table 12.18 illustrates this alternative presentation.

12.82 It should be noted that this alternative presentation can in general not be taken directly as a basis for input-output modelling such as, for example, for calculating impact multipliers. The reason is that the input coefficients, which sum to one, include the import row. Accordingly, in the first round effects, this will imply that all categories of final uses of a particular product have identical import shares, and in the following round effects, imports of similar products will increase proportional to the increases in the domestic output, which is not realistic.

# Table 12.18 Alternative presentations of product-by-product IOTs

Input-output table

| | | Products | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 6.40 | 9.33 | -1.50 | 13.18 | 0.08 | 10.47 | 37.96 |
| | Manufacturing and construction | 10.45 | 116.03 | 35.68 | 32.04 | 73.94 | 175.94 | 444.08 |
| | Services | -0.33 | 61.13 | 217.11 | 344.77 | 20.75 | 112.95 | 756.37 |
| Prim | Imports | 1.34 | 133.72 | 69.52 | 75.33 | 36.50 | 244.82 | 561.23 |
| | GVA | 20.10 | 123.88 | 435.56 | | | | 579.54 |
| Input | | 37.96 | 444.08 | 756.37 | 465.33 | 131.27 | 544.17 | |

Input table of imports

| | | Products | | | Final use | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 1.11 | 6.91 | -0.37 | 1.25 | 0.03 | 6.45 | 15.38 |
| | Manufacturing and construction | 1.01 | 109.33 | 26.58 | 61.07 | 31.49 | 171.55 | 401.04 |
| | Services | -0.79 | 17.48 | 43.31 | 13.02 | 4.98 | 66.81 | 144.81 |
| Total | | 1.34 | 133.72 | 69.52 | 75.33 | 36.50 | 244.82 | 561.23 |

Input-output table with net exports

| | | Products | | | Final use | | | Output |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Net exports | |
| Products | Agriculture | 7.52 | 16.24 | -1.88 | 14.43 | 0.10 | 1.54 | 37.96 |
| | Manufacturing and construction | 11.47 | 225.36 | 62.26 | 93.11 | 105.44 | -53.55 | 444.08 |
| | Services | -1.12 | 78.60 | 260.43 | 357.79 | 25.73 | 34.95 | 756.37 |
| | GVA | 20.10 | 123.88 | 435.56 | | | | 579.54 |
| Input | | 37.96 | 444.08 | 756.37 | 465.33 | 131.27 | -17.05 | |

Input-output table with supply and use

| | | Products | | | Final use | | | Use |
|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing and construction | Services | Final consumption expenditure | Gross capital formation | Exports | |
| Products | Agriculture | 7.52 | 16.24 | -1.88 | 14.43 | 0.10 | 16.93 | 53.35 |
| | Manufacturing and construction | 11.47 | 225.36 | 62.26 | 93.11 | 105.44 | 347.49 | 845.12 |
| | Services | -1.12 | 78.60 | 260.43 | 357.79 | 25.73 | 179.76 | 901.18 |
| | GVA | 20.10 | 123.88 | 435.56 | | | | 579.54 |
| | Output | 37.96 | 444.08 | 756.37 | 465.33 | 131.27 | 544.17 | 2,379.18 |
| | Imports | 15.38 | 401.04 | 144.81 | | | | 561.23 |
| Supply | | 53.35 | 845.12 | 901.18 | 465.33 | 131.27 | 544.17 | |

## E. Empirical application of the transformation models

12.83 As noted above, model A (product-by-product IOTs using the product technology assumption) and model D (industry-by-industry IOTs using the fixed product sales structure assumption) are widely used by national statistics offices. In general, it is difficult to recommend a specific transformation model based on theoretical considerations alone. Ultimately, the choices made by the official producers of IOTs will reflect a range of issues. These will include, for example, available resources, relevance and appropriateness of the source data, statistical policy related to consistency and continuity in the overall statistical system, international reporting obligations, and history and traditions.

12.84 Users of IOTs will seldom specifically state their preference for the type of IOTs so long as the national statistics office retain responsibility for the quality of the tables. The main concern of users will often relate to the basis of the IOTs – whether product-by-product or industry-by-industry – rather than to the type of technology or market share assumptions that have been applied. This is because users will often need to combine the IOTs with other kinds of data to undertake their analysis. For many kinds of analysis, the IOTs must be combined with structural data or time series which are based on industry-based classifications, such as energy and productivity analysis. For other kinds of analysis, for example, those relating to prices, the matching data will usually be available and based on products.

12.85 It should be noted, however, that the type of IOTs will not exclude a priori any kind of analysis. This is because the information contained in the supply table can be used to transform product classified information into the industry classification, and vice versa, just as the transformation tables were defined to compile the four alternative transformation models (models A, B, C and D). Consequently, any input into, and output from, an analysis based on IOTs can be given either a product or an industry classification as required.

12.86 When IOTs from several countries are merged together into an international model, it may be useful to have the same types of tables from all countries. The compilation of such tables is covered in chapter 17.

12.87 Although a few countries produce both product-by-product IOTs and industry-by-industry IOTs at the same time, this approach is not generally recommended. Rather than being helpful, the existence of several types of IOTs may cause confusion among the users. The compilation of alternative types of tables may, however, serve an instructional purpose in illustrating that their direct contents, and in particular the impact tables, may not be that different.

### 1. Examples of product-by-product IOTs and industry-by-industry IOTs

12.88 If the major parts of activities are reported on the diagonal of the supply table, the difference between product-by-product IOTs and industry-by-industry IOTs would then be very small. In the extreme case, without secondary activities (all activities of industries are reported on the diagonal of the supply table), the two types of IOTs converge and the use table becomes an IOT.

12.89 The supply table shows the extent of secondary production as off-diagonal elements when it is aggregated to a square matrix. The observed extent of secondary production depends on the level of aggregation of both products and industries and secondary production and does not therefore possess any observable characteristics of its own. The relative character of the secondary production concept also makes it difficult to justify the input structure of a particular product (say, product number 201 at a certain level of aggregation) being of more interest than the input structure of the other 200 products produced by that industry, just because it is also produced as secondary production in another industry.

12.90 For many countries, the supply table is characterized by having secondary production primarily for manufacturing industries or manufacturing products. For other industries, diagonal elements often dominate with very limited secondary production. There are two reasons for this:

- For service industries, the diagonal structure is usually simply due to the fact that limited product specifications exist, so that the total output from establishments (or even legal or institutional units) must be assumed to be the characteristic output of the industries in which the units are classified in the business register. The recommendation here is that more details should be collected on the service industries' sales by type of product – this will uncover a wide range of issues and improve the quality of the supply and use of products.

- Establishments for industries such as agriculture, construction and trade are often defined in a more product-oriented form in the national accounts than in the business register. In this process, all secondary activities in these industries will already have been transferred to the primary industry before the data are entered in SUTs (as also recommended in the two-step process outlined later in this section) or the data will be alternatively constructed in such a way that, from the outset, little or no secondary production exists such as, for example, agricultural output as the sum of agricultural products, or construction as the sum of the value of new construction and repairs, and so forth. The real benefit here would be to have a more detailed breakdown of such industries with the corresponding product detail.

12.91 In practice, as much as 70 per cent (depending upon the type of economic units applied) of all economic activity may be completely unaffected by whatever transformation procedure is used to construct the IOTs. The technology or transformation problem is thus, in practice, largely limited to the manufacturing industries and their output of industrial products. Considering the simplified way in which the rest of the economy is handled, primarily because of the lack of relevant data sources, the efforts and theoretical refinements attached to the transformation procedures for manufacturing industries should be proportionate.

12.92 The product-by-product IOTs in Table 12.19 were compiled using the product technology assumption (model A). The first table shows the input requirements for domestically produced products for intermediate uses and final uses, while the second table shows the input requirements for imported products for intermediate uses and final uses. The third table reflects the total requirements for intermediate uses and final uses disregarding the origin of the products.

### Table 12.19 Empirical example of product-by-product IOTs

Input-output table

| | | | PRODUCTS | | | | | | | FINAL USE | | | | | | | | Total output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Final consumption expenditure: Households | Final consumption expenditure: NPISH | Final consumption expenditure: General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 2 316 | 4 344 | 4 | 101 | 15 | 19 | 6 800 | 963 | | | 123 | | - 42 | 938 | 1 982 | 8 782 |
| | Manufacturing | (2) | 1 091 | 42 919 | 6 362 | 7 534 | 4 369 | 2 951 | 65 227 | 12 631 | | 327 | 9 426 | 1 122 | 1 393 | 96 280 | 121 178 | 186 405 |
| | Construction | (3) | 73 | 1 883 | 9 927 | 1 969 | 3 890 | 1 279 | 19 021 | 1 402 | | | 24 323 | | - 38 | 563 | 26 250 | 45 272 |
| | Trade, transport and communication | (4) | 239 | 13 805 | 2 109 | 18 364 | 5 909 | 2 846 | 43 272 | 55 600 | | 4 549 | 9 207 | 239 | 334 | 21 550 | 91 479 | 134 750 |
| | Finance and business services | (5) | 370 | 9 320 | 4 530 | 17 653 | 29 781 | 7 564 | 69 219 | 36 524 | | 1 006 | 9 781 | 0 | - 177 | 11 156 | 58 289 | 127 508 |
| | Other services | (6) | 6 | 286 | 51 | 1 066 | 453 | 1 629 | 3 490 | 13 045 | 5 416 | 53 116 | 113 | - 105 | 1 | 567 | 72 153 | 75 643 |
| | Total at basic prices | (7) | 4 094 | 72 557 | 22 984 | 46 687 | 44 418 | 16 288 | 207 028 | 120 165 | 5 416 | 58 997 | 52 973 | 1 257 | 1 471 | 131 053 | 371 332 | 578 360 |
| | Imports | (8) | 811 | 61 469 | 4 846 | 12 485 | 6 136 | 3 731 | 89 479 | 23 087 | | 1 495 | 13 575 | 926 | 1 381 | 21 350 | 61 814 | 151 293 |
| | Taxes less subsidies on products | (9) | 78 | 862 | 226 | 1 333 | 1 839 | 2 646 | 6 984 | 22 810 | | 557 | 2 870 | 152 | 7 | 397 | 26 794 | 33 778 |
| | Total at purchasers' prices | (10) | 4 983 | 134 889 | 28 056 | 60 506 | 52 393 | 22 665 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 152 800 | 459 939 | 763 431 |
| VALUE ADDED | Compensation of employees | (11) | 411 | 25 857 | 10 216 | 38 422 | 28 962 | 40 475 | 144 343 | | | | | | | | | |
| | Other taxes less subsidies on production | (12) | - 1 446 | 717 | 545 | 1 762 | 2 267 | 1 014 | 4 858 | | | | | | | | | |
| | Consumption of fixed capital | (13) | 1 620 | 11 519 | 1 422 | 10 172 | 21 759 | 6 977 | 53 469 | | | | | | | | | |
| | Net operating surplus | (14) | 3 214 | 13 423 | 5 032 | 23 889 | 22 127 | 4 512 | 72 198 | | | | | | | | | |
| | Gross operating surplus | (15) | 4 834 | 24 942 | 6 455 | 34 061 | 43 886 | 11 489 | 125 667 | | | | | | | | | |
| | GVA | (16) | 3 799 | 51 516 | 17 216 | 74 245 | 75 115 | 52 978 | 274 868 | | | | | | | | | |
| | Input at basic prices | (17) | 8 782 | 186 405 | 45 272 | 134 750 | 127 508 | 75 643 | 578 360 | | | | | | | | | |

Input table of imports

| | | | PRODUCTS | | | | | | | FINAL USE | | | | | | | | Total at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Final consumption expenditure: Households | Final consumption expenditure: NPISH | Final consumption expenditure: General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 176 | 1 722 | 3 | 148 | 14 | 15 | 2 077 | 1 079 | | | 47 | | 9 | 58 | 1 194 | 3 271 |
| | Manufacturing | (2) | 618 | 55 846 | 4 392 | 5 506 | 1 398 | 2 941 | 70 702 | 20 894 | | 1 422 | 12 310 | 807 | 1 344 | 17 112 | 53 888 | 124 590 |
| | Construction | (3) | | 265 | 204 | 47 | 44 | 4 | 563 | | | | | | | | | 563 |
| | Trade, transport and communication | (4) | 9 | 2 095 | 150 | 5 150 | 1 678 | 337 | 9 419 | 586 | | 26 | 745 | 1 | 28 | 4 179 | 5 565 | 14 984 |
| | Finance and business services | (5) | 7 | 1 531 | 97 | 1 527 | 2 974 | 308 | 6 443 | 145 | | | 473 | | | | 618 | 7 061 |
| | Other services | (6) | | 10 | 0 | 108 | 29 | 127 | 275 | 384 | | 47 | | 118 | | | 549 | 824 |
| | Total | (7) | 811 | 61 469 | 4 846 | 12 485 | 6 136 | 3 731 | 89 479 | 23 087 | | 1 495 | 13 575 | 926 | 1 381 | 21 350 | 61 814 | 151 293 |

Input-output table with net exports

| | | | PRODUCTS | | | | | | | FINAL USE | | | | | | | | Total output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | Total | Final consumption expenditure: Households | Final consumption expenditure: NPISH | Final consumption expenditure: General government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Net exports | Total | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 2 492 | 6 065 | 8 | 248 | 29 | 34 | 8 877 | 2 042 | | | 170 | | - 32 | - 2 275 | - 95 | 8 782 |
| | Manufacturing | (2) | 1 708 | 98 765 | 10 754 | 13 040 | 5 768 | 5 893 | 135 928 | 33 525 | | 1 749 | 21 736 | 1 929 | 2 737 | - 11 198 | 50 477 | 186 405 |
| | Construction | (3) | 73 | 2 148 | 10 131 | 2 016 | 3 934 | 1 282 | 19 585 | 1 402 | | | 24 323 | | - 38 | 0 | 25 687 | 45 272 |
| | Trade, transport and communication | (4) | 248 | 15 900 | 2 258 | 23 514 | 7 586 | 3 183 | 52 690 | 56 185 | | 4 575 | 9 951 | 240 | 363 | 10 746 | 82 060 | 134 750 |
| | Finance and business services | (5) | 377 | 10 851 | 4 627 | 19 180 | 32 755 | 7 872 | 75 662 | 36 669 | | 1 006 | 10 254 | 0 | - 177 | 4 095 | 51 846 | 127 508 |
| | Other services | (6) | 6 | 297 | 51 | 1 174 | 482 | 1 756 | 3 765 | 13 429 | 5 416 | 53 163 | 113 | 14 | 1 | - 257 | 71 878 | 75 643 |
| | Total | (7) | 4 905 | 134 027 | 27 830 | 59 173 | 50 554 | 20 019 | 296 507 | 143 252 | 5 416 | 60 492 | 66 548 | 2 182 | 2 852 | 1 110 | 281 852 | 578 360 |
| | Taxes less subsidies on products | (8) | 78 | 862 | 226 | 1 333 | 1 839 | 2 646 | 6 984 | 22 810 | | 557 | 2 870 | 152 | 7 | 397 | 26 794 | 33 778 |
| | Total at purchasers' prices | (9) | 4 983 | 134 889 | 28 056 | 60 506 | 52 393 | 22 665 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 1 507 | 308 647 | 612 138 |
| VALUE ADDED | Compensation of employees | (10) | 411 | 25 857 | 10 216 | 38 422 | 28 962 | 40 475 | 144 343 | | | | | | | | | |
| | Other taxes less subsidies on production | (11) | - 1 446 | 717 | 545 | 1 762 | 2 267 | 1 014 | 4 858 | | | | | | | | | |
| | Consumption of fixed capital | (12) | 1 620 | 11 519 | 1 422 | 10 172 | 21 759 | 6 977 | 53 469 | | | | | | | | | |
| | Net operating surplus | (13) | 3 214 | 13 423 | 5 032 | 23 889 | 22 127 | 4 512 | 72 198 | | | | | | | | | |
| | Gross operating surplus | (14) | 4 834 | 24 942 | 6 455 | 34 061 | 43 886 | 11 489 | 125 667 | | | | | | | | | |
| | GVA | (15) | 3 799 | 51 516 | 17 216 | 74 245 | 75 115 | 52 978 | 274 868 | | | | | | | | | |
| | Input at basic prices | (16) | 8 782 | 186 405 | 45 272 | 134 750 | 127 508 | 75 643 | 578 360 | | | | | | | | | |

Table based on 2011 figures from Austria

12.93 The use of model A often results in the observation of some negative elements in the IOTs. The problem of eliminating these negatives is discussed in paragraphs 12.95 and 12.96 below.

12.94 It is classically considered that there are many possible reasons for the negatives. A key and generally accepted reason is that the assumption of a product technology does not reflect the economic reality at that level of aggregation.

12.95 De Mesnard (2011, p. 445) theoretically demonstrates, however, that the problem consists not in the negatives that eventually occur in the IOTs but in the negatives that are systematically present in the inverse matrices $C^{-1}$ and $D^{-1}$. This arises when there is at least one negative per row and one negative per column in each non-diagonal block of $C^{-1}$ and $D^{-1}$. Hence the negatives that appear when deriving IOTs from SUTs are structurally inevitable. Moreover, as matrices $C^{-1}$ and $D^{-1}$ are Markovian (in other words, they are matrices of coefficients), the negatives are forbidden, mathematically speaking. For that reason, computing these inverse matrices becomes meaningless, even if no negatives are present in the IOTs.

12.96 The simple possibility of negatives is sufficient to treat the derivation of IOTs using model A and model C with caution. The traditionally proposed approaches to fixing the problem of negatives deal only with part of the problem, i.e. the impact on the non-negative entries and their plausibility is not addressed. The difficulty cannot be fully resolved by arranging the data in accordance with the approaches to dealing with only the negatives in the product technology or by creating a mixed hypothesis as laid out in annex B to this chapter.

12.97 An empirical example of industry-by-industry IOTs with the application of model D for the same country and year is shown in table 12.20.

12.98 The difference between product-by-product IOTs and industry-by-industry IOTs for some elements can be considerable, which is to be expected depending upon the reported level of industries' secondary output. The differences between using rectangular tables and square tables in model D can also be significant, as shown in table 12.17. As the column sums in the two types of tables are different, referring to product and industry totals, respectively, the elements are not directly comparable, and the effective differences between the two tables can best be studied against the background of the corresponding impact tables.

# Table 12.20 Empirical example of industry-by-industry IOTs

Input-output table

| | | | INDUSTRIES | | | | | | | FINAL USE | | | | | | | | Total output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Total | Final consumption expenditure | | | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | | Households | NPISH | General government | | | | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| INDUSTRIES | Agriculture | (1) | 2 374 | 4 384 | 38 | 209 | 35 | 42 | 7 083 | 1 320 | 0 | 4 | 182 | 0 | - 37 | 1 315 | 2 784 | 9 867 |
| | Manufacturing | (2) | 1 220 | 43 620 | 6 818 | 9 290 | 5 744 | 3 623 | 70 315 | 14 707 | 2 | 614 | 13 684 | 1 129 | 1 403 | 98 097 | 129 635 | 199 950 |
| | Construction | (3) | 112 | 2 350 | 8 988 | 2 454 | 3 623 | 1 411 | 18 939 | 1 747 | 0 | 21 | 23 357 | 5 | - 34 | 895 | 25 992 | 44 931 |
| | Trade, transport and communication | (4) | 344 | 14 918 | 2 466 | 17 970 | 6 739 | 3 475 | 45 912 | 54 542 | 15 | 4 416 | 8 963 | 220 | 291 | 20 477 | 88 925 | 134 837 |
| | Finance and business services | (5) | 367 | 10 175 | 3 912 | 16 397 | 22 678 | 7 131 | 60 660 | 34 641 | 1 | 847 | 4 505 | 3 | - 160 | 8 964 | 48 801 | 109 461 |
| | Other services | (6) | 11 | 539 | 179 | 1 110 | 613 | 1 666 | 4 119 | 13 207 | 5 398 | 53 097 | 2 283 | - 101 | 7 | 1 305 | 75 196 | 79 314 |
| | Total at basic prices | (7) | 4 429 | 75 987 | 22 402 | 47 431 | 39 431 | 17 348 | 207 028 | 120 165 | 5 416 | 58 997 | 52 973 | 1 257 | 1 471 | 131 053 | 371 332 | 578 360 |
| | Imports | (8) | 919 | 62 051 | 4 834 | 12 439 | 5 417 | 3 819 | 89 479 | 23 087 | | 1 495 | 13 575 | 926 | 1 381 | 21 350 | 61 814 | 151 293 |
| | Taxes less subsidies on products | (9) | 92 | 952 | 229 | 1 349 | 1 689 | 2 672 | 6 984 | 22 810 | | 557 | 2 870 | 152 | 7 | 397 | 26 794 | 33 778 |
| | Total at purchasers' prices | (10) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 152 800 | 459 939 | 763 431 |
| VALUE ADDED | Compensation of employees | (11) | 551 | 30 679 | 10 239 | 37 906 | 22 997 | 41 971 | 144 343 | | | | | | | | | |
| | Other taxes less subsidies on production | (12) | - 1 627 | 1 077 | 546 | 1 755 | 2 004 | 1 103 | 4 858 | | | | | | | | | |
| | Consumption of fixed capital | (13) | 1 845 | 12 750 | 1 542 | 10 917 | 18 934 | 7 480 | 53 469 | | | | | | | | | |
| | Net operating surplus | (14) | 3 658 | 16 453 | 5 138 | 23 040 | 18 989 | 4 921 | 72 198 | | | | | | | | | |
| | Gross operating surplus | (15) | 5 503 | 29 203 | 6 680 | 33 957 | 37 923 | 12 401 | 125 667 | | | | | | | | | |
| | GVA | (16) | 4 427 | 60 959 | 17 465 | 73 618 | 62 923 | 55 475 | 274 868 | | | | | | | | | |
| | Input at basic prices | (17) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | | | | | | | | | |

Input table of imports

| | | | INDUSTRIES | | | | | | | FINAL USE | | | | | | | | Total at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Total | Final consumption expenditure | | | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total | |
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | | Households | NPISH | General government | | | | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| INDUSTRIES | Agriculture | (1) | 198 | 1 769 | 9 | 210 | 21 | 27 | 2 235 | 1 255 | | 0 | 48 | 0 | 11 | 78 | 1 392 | 3 627 |
| | Manufacturing | (2) | 695 | 55 370 | 4 335 | 5 821 | 1 335 | 2 986 | 70 542 | 20 684 | | 1 413 | 12 550 | 804 | 1 332 | 17 011 | 53 795 | 124 337 |
| | Construction | (3) | 1 | 595 | 215 | 96 | 52 | 9 | 969 | 22 | | 0 | 32 | 1 | 8 | 79 | 142 | 1 111 |
| | Trade, transport and communication | (4) | 16 | 2 736 | 177 | 4 728 | 1 617 | 345 | 9 619 | 580 | | 24 | 664 | 4 | 30 | 4 128 | 5 431 | 15 049 |
| | Finance and business services | (5) | 9 | 1 521 | 94 | 1 408 | 2 291 | 320 | 5 643 | 159 | | 10 | 133 | 0 | 1 | 44 | 347 | 5 990 |
| | Other services | (6) | 0 | 60 | 4 | 177 | 100 | 131 | 472 | 386 | | 47 | 147 | 116 | 0 | 9 | 706 | 1 178 |
| | Total | (7) | 919 | 62 051 | 4 834 | 12 439 | 5 417 | 3 819 | 89 479 | 23 087 | | 1 495 | 13 575 | 926 | 1 381 | 21 350 | 61 814 | 151 293 |

Input-output table with net exports

| | | | INDUSTRIES | | | | | | | FINAL USE | | | | | | | | Total output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Total | Final consumption expenditure | | | Gross fixed capital formation | Changes in valuables | Changes in inventories | Net exports | Total | |
| | | | Agriculture | Manufacturing | Construction | Trade, transport and communication | Finance and business services | Other services | | Households | NPISH | General government | | | | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| PRODUCTS | Agriculture | (1) | 2 573 | 6 153 | 47 | 419 | 56 | 69 | 9 318 | 2 575 | 0 | 4 | 230 | 0 | - 26 | - 2 233 | 550 | 9 867 |
| | Manufacturing | (2) | 1 915 | 98 990 | 11 153 | 15 111 | 7 078 | 6 610 | 140 857 | 35 391 | 2 | 2 027 | 26 234 | 1 933 | 2 735 | - 9 229 | 59 092 | 199 950 |
| | Construction | (3) | 113 | 2 945 | 9 204 | 2 550 | 3 676 | 1 420 | 19 908 | 1 769 | 0 | 21 | 23 389 | 6 | - 26 | - 138 | 25 023 | 44 931 |
| | Trade, transport and communication | (4) | 360 | 17 654 | 2 643 | 22 698 | 8 356 | 3 819 | 55 531 | 55 123 | 15 | 4 440 | 9 627 | 224 | 321 | 9 556 | 79 306 | 134 837 |
| | Finance and business services | (5) | 376 | 11 697 | 4 006 | 17 805 | 24 969 | 7 451 | 66 303 | 34 800 | 1 | 856 | 4 638 | 3 | - 159 | 3 019 | 43 158 | 109 461 |
| | Other services | (6) | 12 | 599 | 182 | 1 287 | 713 | 1 797 | 4 591 | 13 594 | 5 398 | 53 144 | 2 430 | 16 | 7 | 135 | 74 724 | 79 314 |
| | Total | (7) | 5 348 | 138 038 | 27 236 | 59 870 | 44 849 | 21 167 | 296 507 | 143 252 | 5 416 | 60 492 | 66 548 | 2 182 | 2 852 | 1 110 | 281 852 | 578 360 |
| | Taxes less subsidies on products | (8) | 92 | 952 | 229 | 1 349 | 1 689 | 2 672 | 6 984 | 22 810 | | 557 | 2 870 | 152 | 7 | 397 | 26 794 | 33 778 |
| | Total at purchasers' prices | (9) | 5 440 | 138 991 | 27 466 | 61 219 | 46 538 | 23 839 | 303 492 | 166 063 | 5 416 | 61 050 | 69 418 | 2 335 | 2 859 | 1 507 | 308 647 | 612 138 |
| VALUE ADDED | Compensation of employees | (10) | 551 | 30 679 | 10 239 | 37 906 | 22 997 | 41 971 | 144 343 | | | | | | | | | |
| | Other taxes less subsidies on production | (11) | - 1 627 | 1 077 | 546 | 1 755 | 2 004 | 1 103 | 4 858 | | | | | | | | | |
| | Consumption of fixed capital | (12) | 1 845 | 12 750 | 1 542 | 10 917 | 18 934 | 7 480 | 53 469 | | | | | | | | | |
| | Net operating surplus | (13) | 3 658 | 16 453 | 5 138 | 23 040 | 18 989 | 4 921 | 72 198 | | | | | | | | | |
| | Gross operating surplus | (14) | 5 503 | 29 203 | 6 680 | 33 957 | 37 923 | 12 401 | 125 667 | | | | | | | | | |
| | GVA | (15) | 4 427 | 60 959 | 17 465 | 73 618 | 62 923 | 55 475 | 274 868 | | | | | | | | | |
| | Input at basic prices | (16) | 9 867 | 199 950 | 44 931 | 134 837 | 109 461 | 79 314 | 578 360 | | | | | | | | | |

Table based on 2011 figures from Austria

## 2. Relationship between types of table, technology and market shares

12.99 The product-by-product IOTs are closely related to a particular understanding of the concept of a "product". In economic theory, products in general are produced by means of products, labour and capital. Each product is characterized by a separate production function which describes a specific technology, and a technology is fully described in terms of a set of products and primary inputs. It is difficult, however, to establish an analogy between this theoretical approach and the properties of statistical IOTs, as they represent two different levels of abstraction.

12.100 At the input-output level of aggregation, there are no, as it were, “homogeneous” products or production processes for individual products. The economy consists of thousands or even millions of producing units, of which hardly any two are completely identical, and there are millions of different products and even more production processes. The recommendations on how to construct IOTs are often based on numerical or mathematical examples that assume that, at a high level of aggregation, the economy can be represented by a set of homogeneous products and production functions. These models may not always convey useful advice on how to solve the practical problems faced by the compiler of IOTs.

12.101 When compared to the real world, with its magnitude of products and production processes, even detailed basic statistics already represent a major aggregation. Statistics on products are collected at a maximum level of detail, say around 10,000 products, and that is only in selected areas such as foreign trade statistics and, perhaps, the output from manufacturing industries. Furthermore, products that are identical in a physical sense are different in an economic sense when they are sold at different prices to different purchasers and possibly even for different purposes. The concept of basic prices has been developed in an attempt to define a valuation specifically for this possibility. Purchases for intermediate consumption by products are at best collected for establishments, and in most cases, the statistical coverage of purchases is irregular or highly aggregated or both.

12.102 Individual production processes do not lie within the realm of official statistics and thus observed data for various production technologies do not usually exist. Economic statistics deal with transactions and only exceptionally with technical transformations. Furthermore, any relevant technology description should comprise the type of capital and labour used in the production process and the intermediate inputs. In the discussion on how IOTs can be compiled, the term “technology” is used in a broader sense than in its usual applications.

12.103 Independently of the approach chosen, it is obvious that any single element in IOTs represents a unique basket of products. The measurable degree of heterogeneity of these baskets is closely related to the elementary or most detailed level of product that is identified. In many countries, the SUTs are compiled for rather aggregated product groups, often not more than a few hundred groups, and a level of 2,000–3,000 groups is considered very detailed in an international context. Only when there are more product groups than industries in SUTs, together with the compilation of tables in volume terms, is it possible to identify the variation in the basket along a row of the use table. In cases where the methods and the number of products used in the SUTs compilation system are very aggregated (both in current prices and in volume terms), the result will be data that, on the surface, may comply with theoretical assumptions about homogeneity, as all lower level evidence operating at such an aggregated level would have been eliminated in the compilation process.

12.104 Each establishment has its own unique institutional and organizational characteristics, which may influence the composition of its purchases to the same extent as they are influenced by the underlying technical production processes Two establishments producing identical products may have quite different input (purchase) structures, depending on the degree of reliance on purchases of semi-fabricated products, outsourcing of certain activities, whether it owns its capital equipment and buildings rather than leasing or renting them, and other factors, and in general on the degree of vertical integration of the various production processes.

12.105 For a proper understanding of the character of input-output data, it is essential to accept that there is no way to eliminate completely the institutional characteristics of an economy from SUTs or IOTs. As institutional arrangements change over time in individual countries, and may vary considerably across countries, it is obvious that the interpretation of SUTs and IOTs as a description of a technical production system has serious limitations.

12.106 Where the analytical properties of IOTs are concerned, it is important to note that, in practice, all analytical uses of IOTs must implicitly assume an industry technology, no matter how the tables have originally been compiled. In view of the limited amount of secondary activities and from an analytical point of view the distinction between a product and an industry technology is thus of limited relevance. Furthermore, any product-by-product IOTs in practice are manipulated industry-by-industry IOTs, as they still include all the institutional establishment (or even enterprise) characteristics of the data collected and the basis of the SUTs.

### 3. Input-output and official statistics

12.107 Many countries have been compiling IOTs over a considerable span of years, either every five years or at irregular intervals, and a growing number of countries are now compiling annual SUTs and IOTs as an integrated part of their national accounts. These experiences can also help to identify procedures that underpin recommendations on best practices.

12.108 It is generally accepted that the tables that best fulfil the standard quality criteria are those of the model A type (product-by-product IOTs using the product technology assumption) and model D type (industry-by-industry IOTs using the fixed product sales structure assumption), see Thage (2001). These tables reflect the accumulated experience and current practice of those countries most permanently involved in the compilation of IOTs.

12.109 There is no ideal type of table against which to measure the quality of the outcome. That said, however, the IOTs exist as an important part of official statistics and should as such fulfil central quality criteria, including user needs.

12.110 The main quality characteristics of industry-by-industry IOTs and product-by-product IOTs are:

(a) Transparency:

- Industry-by-industry IOTs based on the fixed product sales assumption can be derived from SUTs without much further effort and in such a way that negative elements do not appear. They provide more transparency on the compilation procedure.

- Product-by-product IOTs based on the product technology assumption are derived from SUTs in a complex procedure. If negative elements appear, a new balancing procedure is required. Manual balancing causes less transparency.

(b) Comparability:

- Industry-by-industry IOTs are closer to statistical sources, business survey results and actual observations, and also to the SUTs. More direct comparability is guaranteed with national accounts data and other industry-based statistics.

- Product-by-product IOTs are further away from statistical sources and business survey results. The results have been compiled in an analytical step which results in less comparability with the sources but more comparability across countries – this will also depend upon each industry and product case and the level of aggregation.

(c) Inputs:

- IOTs identify for each industry the input requirements from other industries. The same is true for the categories of final uses. Mixed bundles of goods and services, rather than homogenous products, are reported for intermediate uses and final uses.

- Product-by-product IOTs have a clear input structure in terms of products for intermediate uses and GVA for the compensation of labour and capital for product defined industries.

(d) Resources and timeliness:

- Industry-by-industry IOTs are less resource-intensive to produce and can be directly derived from SUTs at basic prices. This requires less resources and guarantees better timeliness.

- The compilation of product-by-product IOTs based on the product technology is more demanding as negatives may appear. These tables require more resource and balancing efforts. The publication of results is delayed.

(e) Analytical potential:

- The specific type of IOTs (product-by-product or industry-by-industry) will not exclude any kind of analysis. This is because the information contained in the supply table can be used to transform product classified information into the industry classification, and vice versa, in the same way as that in which the transformation tables were defined to compile the four alternative transformation models (models A, B, C and D). Consequently, any data input into, and output of results from, an analysis based on IOTs can be given either a product or an industry classification as needed.

(f) User-friendliness

- The compilation of IOTs integrated with SUTs on a regular basis despite the practical problems associated with IOTs encourages their use.

12.111 The size of sampling and non-sampling errors associated with the primary data on which the SUTs are based, and the fact that a considerable part of the data content of the SUTs is usually obtained by survey grossing-up methods, extrapolations, estimates from a subjective-based nature and even model calculations should be borne in mind when choosing the method for constructing IOTs. Furthermore, purchases data for intermediate consumption by products are at best collected for establishments, and in most cases, the statistical coverage of purchases is irregular or highly aggregated. Another important source of error in the detailed output and input data is connected with the transformation from observed data on sales and purchases to the national accounts concepts of production and intermediate consumption, the fact that sales and purchases are not evenly distributed over the year and the challenge of measuring changes in inventories.

12.112 Thus the effects of non-sampling errors, misclassifications and biases in grossing-up methods may represent sources of errors more important than the total secondary production, at a particular level of aggregation. The possibilities for the identification and correction of such errors are limited, once they have already passed the test of a balanced SUTs system. Compilation methods for the IOTs should therefore not assume an accuracy of the data that is not commensurate with the actual knowledge about data quality.

### 4. Taking account of IOTs requirements when compiling the SUTs: redefinitions

12.113 When SUTs statistics are compiled, it is essential to take into account the desired properties and compilation methods of IOTs. By making appropriate choices of the groupings and structure of SUTs, it is possible to construct a database which is relevant and useful in the current national accounts and which, at the same time, can be transformed into IOTs with a minimum of data manipulation.

12.114 There are some procedures related to the compilation of the SUTs that are useful to observe before the transformation to the IOTs. This represents the first step of the two-step process or redefinition process which is applied in many countries with extensive experience in producing IOTs and covered in chapter 5. There are many country-specific variants or methods, in particular for countries covering only enterprise units in their economic statistics. In France, for example, the first step is carried to such an extent that the supply table becomes diagonal only. The second step is thus superfluous.

12.115 The first step of the two-step process defines the industries in SUTs (and in the activity tables of the national accounts) in such a way that no industries have secondary production in other sections of ISIC, although this is not often fully achieved and therefore requires a second step. The sections of ISIC Rev. 4 are broad industry groups such as agriculture, forestry and fishing (section A), mining and quarrying (section B), manufacturing (section C), construction (section F), and so forth. If the establishments for which statistics are available do not automatically meet this condition, it is the task of the national accountants to make further breakdowns and create new establishments until this condition is fulfilled both for horizontally and vertically integrated units. Such additional breakdowns are typically made manually, based on the best available information and judgement of the national accountants. Often there is limited intermediate consumption data available for establishments created in this way. The redefinition can be implemented just by moving some parts of the totals for intermediate consumption between industries, thus also facilitating the subsequent compilation of the detailed input structures in the use table.

12.116 There are two important points to be noted concerning this procedure:

- This redefinition reflects compliance with the 2008 SNA concerning the definition of units of homogeneous production (2008 SNA, paras. 5.52–5.54). Compliance with the SNA definition of industries is essential for the usefulness of the data classified by activity not only for input-output purposes but also for their analytical relevance. Industries should therefore ideally be defined in the same way in the production accounts, in SUTs and in IOTs.

- This method should not be seen as representing a mixed technology assumption. The first step is only to ascertain that the basic principles for compiling production accounts according to the SNA are being followed. In the second step, IOTs are compiled on the assumption of fixed product sales structures.

12.117 The redefinitions mainly relate to such activities as agriculture, energy, construction and trade. These breakdowns and reclassifications could be seen as the use of a product technology assumption. This will not result in negative elements. Often very specific information on input structures that could not possibly be identified from the SUTs alone is used in the redefinitions.

12.118 As this redefinition takes place before the SUTs are populated, it is often not even necessary to assume a specific input structure for the redefined output as the transfers only take place between output and input totals of the industries. This facilitates the compilation of SUTs. If, for example, all construction has a priori been transferred to the construction industry, there will be no need to distribute construction materials to practically all industries in SUTs – a procedure which would be both very time-consuming and unreliable, as source data for such inputs would usually be lacking.

12.119 The redefined industries become "pure" in the sense that they have no secondary production and all secondary output of these products has been transferred to the redefined industries. The redefined industries are not, however, homogeneous in any strict meaning of this term, as they may still produce many different products with separate input structures, price movements and distributions by users.

12.120 In some countries, the business registers do not contain much detail on establishments and concentrate on enterprise units. In general, data problems do not, however, exempt those compiling national accounts from compliance with the SNA rules. Experience shows that, in cases where the starting point are the SUTs with enterprise defined activities and product-by-product IOTs are calculated on the assumption of a product technology, the successive rounds of recalculations (using the negatives as indicators) lead to changes to the original SUTs that basically (at least for changes related to the elimination of the big negatives) reflect the type of redefinitions described in the first step of the two-step process. In such cases, it is more straightforward and efficient first to carry out the redefinitions in the SUTs in a systematic manner, as negatives that appear at a later stage will have a low signal value and may lead to unsystematic and arbitrary adjustments in the SUTs.

12.121 If the national accounts and SUTs are based on enterprise-type units, it may not be realistic to compile redefined SUTs with a redefined industry classification that does not comply with the current national accounts tables. When it comes to the construction of the IOTs, it is still possible to use the two-step process, by first adjusting the (rectangular) SUTs as outlined above, and subsequently compiling industry-by-industry IOTs based on the assumption of fixed product sales structures, without first having to aggregate to square SUTs. Even though the comparability of the classifications for IOTs and national accounts will not be perfect, the advantages of limited aggregation loss of information together with the simplicity of the method will still be retained.

# Annex A to chapter 12. Mathematical derivation of different IOTs

## A. Product-by-product IOTs and industry-by-industry IOTs

A12.1 Over the past 60 years, there have been many descriptions generalizing the matrix multiplication for the IOTs. For example, using the method proposed by Rueda-Cantuche and ten Raa (2009), the starting point for the construction of the product-by-product IOTs is the amount of product $i$ used by industry $j$ (to produce product $k$): intermediate use $u_{ij}$. Schematically, the transformation underlying product-by-product IOTs is:

product $i$ → industry $j$ → product $k$

A12.2 For the industry-by-industry IOTs, this will be viewed as a product $i$ contribution to the delivery from industry $j$ to industry $k$. This is:

industry $j$ → product $i$ → industry $k$

A12.3 This common framework for IOTs is made precise by indexing the so-called input-output coefficients by three subscripts. The first subscript indexes the input, the second the observation unit, and the third the output.

A12.4 A product-by-product input-output coefficient, $a_{ijk}$, is defined as the amount of product $i$ used by industry $j$ to make one unit of product $k$. Similarly, the industry-by-industry input-output coefficient, $b_{jik}$, is defined as the delivery by industry $j$ in product market $i$ per unit of output of industry $k$.

A12.5 As shown in figure A12.1, in the construction of product-by-product IOTs industry $j$'s secondary products $v_{jk}$, and their input requirements, $a_{ijk}v_{jk}$, are transferred out from industry $j$ to industry $k$; the flipside of the coin is that products produced elsewhere as secondary products $v_{kj}$ and their input requirements $a_{ikj}v_{kj}$ are transferred in from industries $k$. Hence, the amount of product $i$ used to make product $j$ becomes:

$$u_{ij} - \sum_{k \neq j} a_{ijk}v_{jk} + \sum_{k \neq j} a_{ikj}v_{kj} \qquad (1)$$

A12.6 The same reasoning extends to industry-by-industry IOTs as shown in figure A12.2. In constructing industry-by-industry IOTs, the secondary products (produced by industry $j$) $v_{ji}$, and their deliveries to industries $k$, $b_{jik}v_{ji}$, are transferred out from market $i$ to industry $j$; here the reverse case is that market product $j$ produced elsewhere as secondary $v_{ij}$ and their corresponding deliveries $b_{ijk}v_{ij}$ must be transferred in from markets $j$. Hence, the amount delivered by industry $i$ to industry $k$ becomes:

$$u_{ik} - \sum_{j\neq \mathrm{i}} b_{jik}v_{ji} + \sum_{\mathrm{j}\neq \mathrm{i}} b_{ijk}v_{ij} \qquad (2)$$

In addition to figures A12.1 and A12.2, see also de Mesnard (2004a) for a complete economic circuit approach.

## B. Product-by-product IOTs

A12.7 There are alternative ways of deciding how much input corresponds with output for product-by-product IOTs. Ten Raa and Rueda-Cantuche (2003) provides a range of the available methods (see annex C to this chapter for a summary of the different types of methods). Two outstanding methods are:

- The product technology assumption (model A)
- The industry technology assumption (model B)

A12.8 These are also used by a few national statistics offices combined into the hybrid (or mixed) technology assumption.

A12.9 While these assumptions have been considered as opposite or even competing, the reality is that both technology assumptions can be derived in an unifying framework, under alternative assumptions of the variation of input-output coefficients across industries (ten Raa and Rueda-Cantuche, 2007). The product technology assumption postulates that all products have unique input structures, irrespective of the industry of fabrication (removal of the second subscript in (1)), and thus implies the following condition:

$$a_{ijk} = a_{ik} \text{ for all } j$$

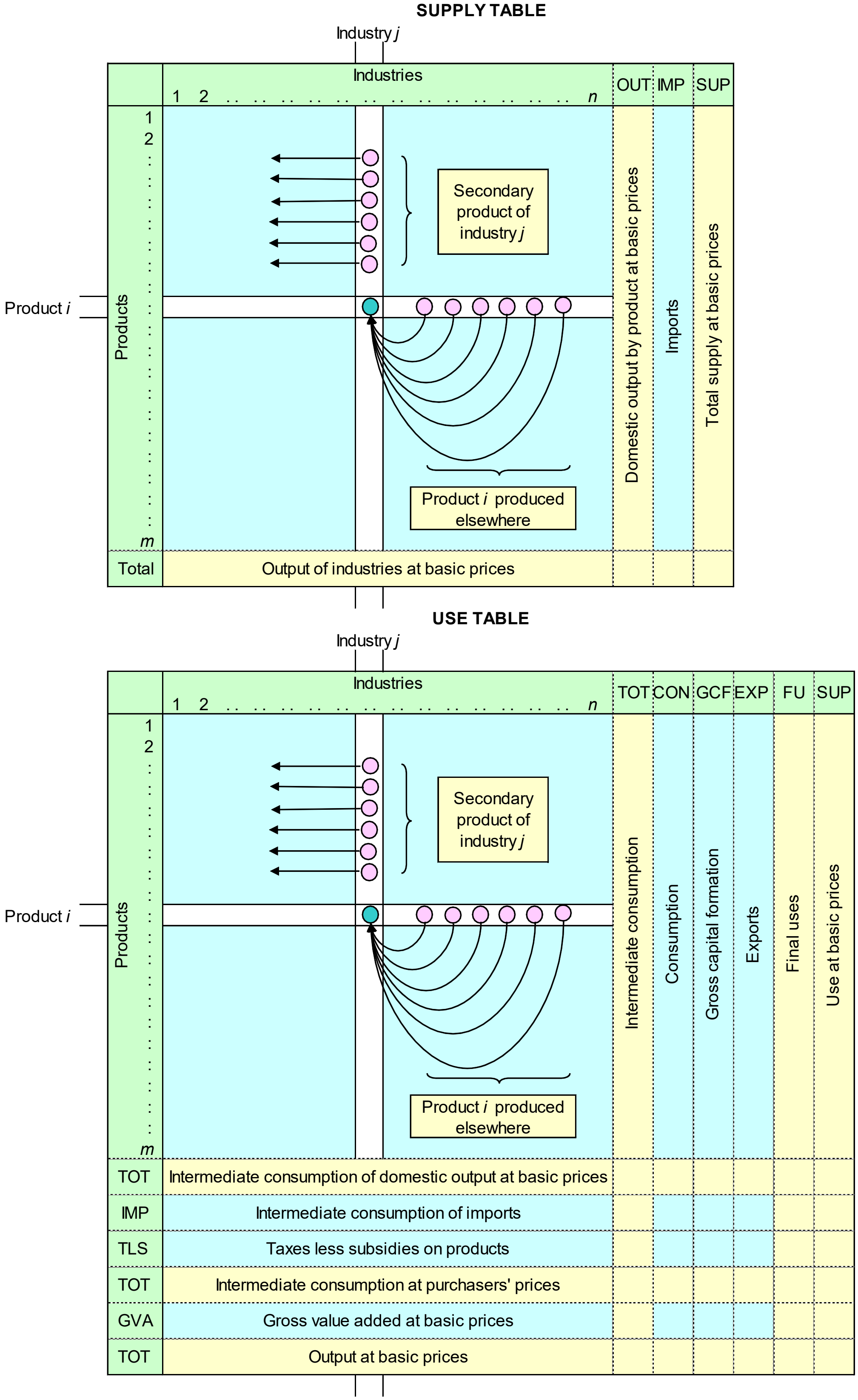
A12.10 The resulting IOTs using the product technology assumption may contain negative values when the total consumption of input $i$ for the making of secondary outputs of industry $j$ exceeds the total use of product $i$ by the industry $j$, either for its primary or for its secondary products.

A12.11 On the other hand, the industry technology assumption postulates that all industries have the same input structure, irrespective of the products which they produce (removal of the third subscript in (1)). Accordingly:

$$a_{ijk} = a_{ij} \text{ for all } k$$

A12.12 Using the industry technology assumption, the IOTs values are non-negative.

## Figure A12.1 Transfers made for the product-by-product IOTs



## C. Industry-by-industry IOTs

A12.13 There are two main models for the construction of industry-by-industry IOTs:

- The assumption of a fixed industry sales (FI) structure postulates that each industry has its own specific sales structure, irrespective of its product mix (model C).
- The alternative assumption of a fixed product sales (FP) structure postulates that each product has its own specific market shares (deliveries to industries), independent of the industry where it is produced. The market shares refer to the shares of the total output of a product delivered to the various intermediate and final users (model D).

A12.14 Rueda-Cantuche and ten Raa (2009), in company with many others, use an encompassing framework for the construction of industry-by-industry IOTs. The fixed industry sales structure assumption postulates that all industries have unique input structures, irrespective of the product market (removal of the second subscript in (2)). Consequently, fixed industry sales coefficients may be defined accordingly:

$$b_{jik} = b_{jk} \text{ for all } i$$

The supply table needs to be square and negatives may emerge from this assumption.

A12.15 Alternatively, the fixed product sales structure assumption assumes that product $i$'s unitary deliveries to industry $k$ must be independent of the supplier industry $j$. Therefore, all products require unique industry deliveries, irrespective of the industry of fabrication (removal of the first subscript in (2)):

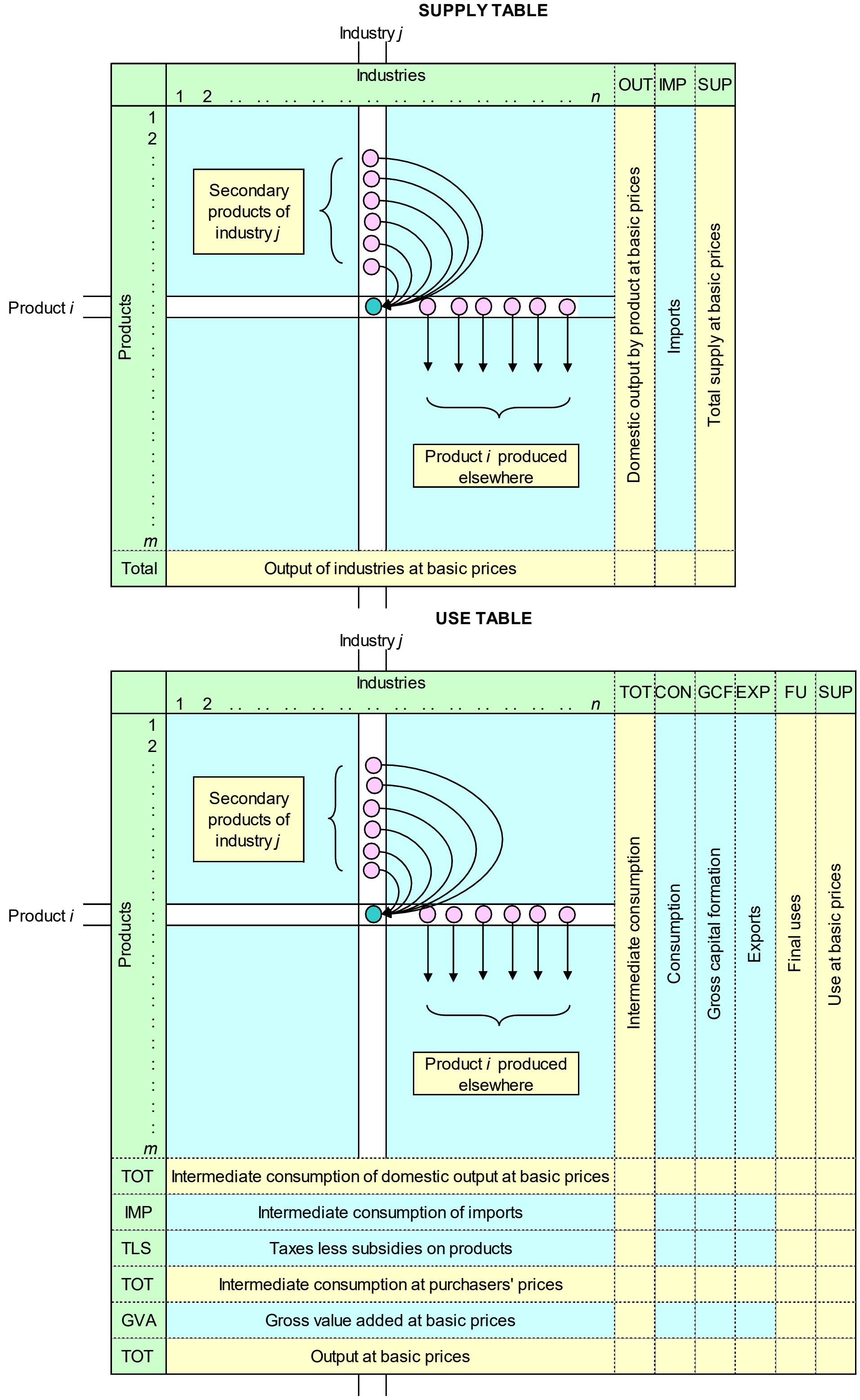
$$b_{jik} = b_{ik} \text{ for all } j$$

The supply table does not need to be square and negatives do not emerge from this assumption.

A12.16 It is reasonable to assume that secondary outputs have destinations different from those of the primary outputs. This is why the fixed product sales structure assumption attracts more attention in the literature (see Thage and ten Raa (2006) or Yamano and Ahmad (2006)). Moreover, FP has no negative elements, unlike FI, because of the inversion of the supply table.

A12.17 Canada, Denmark, Finland, the Netherlands, Norway, the United States and OECD are examples of systems that fully or partially adopt FP to compile industry-by-industry IOTs (Yamano and Ahmad, 2006).

**Figure A12.2 Transfers made for the industry-by-industry IOTs**



## D. Use of a hybrid technology assumption for product-by-product IOTs

A12.18 The product and the industry technology assumptions represent the two main methods used for the construction of product-by-product IOTs from SUTs. Although, however, the assumptions are commonly regarded in the literature as opposites, some national statistical offices apply hybrid product and industry technology assumptions to produce product-by-product IOTs. In some cases, the non-negativity of one of the assumptions is enough for it to be used more widely than a single (non-hybrid) technology assumption. In particular, for hybrid models, the choice of products for which either the product technology assumption or the industry technology assumption will be used is mainly based on expert judgements and seldom on empirical analyses.

A12.19 Rueda-Cantuche and ten Raa (2013) present several empirical tests that provide conclusions on the choice of technology assumption for product-by-product IOTs (such as, in the construction of the use tables, the assumption that individual establishment data with a full input specification exist may not be feasible within the tests).

A12.20 Following the expression (1), these authors showed that the tests can provide acceptance and rejection regions for the competing technology assumptions allowing a hybrid technology model in which some secondary products are treated by the one assumption and others by the other assumption. These tests will enable national statistical offices to apply more tailored hybrid technology assumptions, which can be complemented with expert judgments in order to improve the entire compilation process.

A12.21 Overall, producers of IOTs should be cautious. The results from these tests should not lead to rejection of the product technology assumption and the conclusion that it is unrealistic. On the contrary, the lack of homogeneity in the product classification is constantly biasing final acceptance or rejection decisions in favour of the competing model (industry technology).

A12.22 It should be noted, however, that detailed product data on inputs and outputs at the level of individual units are required and valued at basic prices, which are not readily available from business surveys. Businesses report data on goods and services with insufficient specification and mostly at purchasers' prices. There are many examples of partly specified inputs, for example, single aggregates for a mixed bunch of goods (food and drinks in hotels and restaurants; consumption of building materials in construction firms; office materials used in businesses, and others) and the "other costs" items, which may include a large variety of products. It might be common practice to use assumptions that come close to product or industry technology assumptions to complete the full specification of firms' data on inputs and outputs but this should preferably be carried out with the use of actual data or structures of other firms or establishments with the same economic activity and similar numbers of workers.

A12.23 Besides, firms report the price paid, including trade and transport margins and (if any) net taxes on products (purchasers' prices), so some adjustments need to be applied in order to get firms' input data valued at basic prices.

A12.24 These tests could lead to statistically significant conclusions on the selection of the most appropriate technology assumption but the power of the tests might be largely affected by the heterogeneity in the product classification, the insufficiently detailed breakdown of products and the measurement errors by the business. These tests may be used as a guide towards the selection of one of the two technology assumptions in the construction of hybrid technology-based product-by-product IOTs, for example, as performed by at least one regional statistical office (Catalonia, Spain).

# Annex B to chapter 12. Classical causes and treatment of negative cell entries in the product technology

## A. Classical causes of negative elements in the product technology

B12.1 As mentioned in chapter 12, the product technology assumption may generate negative values because of the systematic negatives in $C^{-1}$ and $D^{-1}$. We indicate here the various classical reasons that were considered for the appearance of negative elements, for example:

- There may be multiple technologies for the production of a product.
- The economic transactions may not fully record technological relations.
- The products may represent heterogeneous elements.
- There may be data errors in the SUTs.

B12.2 In this annex, these factors are briefly reviewed and possible solutions proposed. The reader is encouraged to consult ten Raa and Rueda-Cantuche (2013) for a thorough review of the classical issues and available solutions, including algorithmic procedures for the elimination of negatives which will not be covered in full in this annex.

### 1. The product technology assumption may be incorrect

B12.3 This means that there is a product that is produced in two different ways. Clearly, there are cases where this is true, for example in the chemical industry, where there are often different processes that lead to exactly the same product. Negatives could be created when one process uses inputs that are not used by another. This assumption is likely to be only valid at a very detailed level (for example, for kind-of-activity unit or local kind-of-activity unit) and possibly not applicable at the level of aggregation used in SUTs.

### 2. Economic transactions are recorded rather than technological relations

B12.4 In principle, the SUTs record all transactions between establishments and enterprises. These are economic transactions and do not necessarily describe technology. For example, two companies employ the same process to produce a product. One of the companies subcontracts a large part of the process, whereas the other company performs the whole process in house. The two companies will thus show different input structures in the use table for the same output, possibly leading to negatives.

B12.5 Another situation that could lead to negative elements is where the company operates vertically integrated production processes. For example, consider the production of cheese at a dairy farm. The milk produced at the farm and used in the production of cheese is not recorded either as an input or as an output of the dairy farm. Hence, it looks as if the farm produces cheese without using milk. If the cheese were to be transferred to the dairy industry, and the input structure of the dairy industry were to be applied to this cheese, a negative input for milk would appear for the dairy farm.

B12.6 Non-market output creates a special problem in the application of the product technology assumption. Non-market output is valued by convention as the sum of the costs incurred in its production, with net operating surplus being zero. This is applied at the level of the producing unit and not by product. Secondary market products are valued at their market prices but the value of the total output of the unit is determined by the costs. If, therefore, the secondary products are transferred to the (market) industry where it is produced as primary product, a negative may arise for the net operating surplus.

## 3. Heterogeneity in data and classifications

B12.7 Negatives can be generated by heterogeneity in the data. Heterogeneity is unavoidable because products and industries need to be aggregated in SUTs. In the numerical example used in this chapter, the manufacturing products produced by agriculture could be totally different products from – or perhaps a subset of – the products produced by the manufacturing industry. It is clear that assuming the product technology in such a case would create problems. It is recommended therefore that the product technology assumption should always be applied at the most detailed level of products possible, allowing for the requirement of square SUTs.

B12.8 The classifications play an important role here. As mentioned earlier, the international classifications may be based on a variety of criteria that are not always the most appropriate for input-output analysis. An example is footwear. The CPC does not distinguish footwear of different materials. More important, it provides a distinction of footwear by use. Aggregating leather and plastic shoes in a single column of the SUTs would, however, create heterogeneity in the description of the production processes and may lead to negatives when another industry produces one of the two types of shoes as secondary output.

## 4. Errors in the SUTs data

B12.9 Last but not least, negatives can be caused by errors in the SUTs starting point for transformation or parts of the transformation itself, in terms of the trade margins, transport margins, taxes on products and subsidies on products.

B12.10 This is an important consideration, because it could provide insights about the quality of the elements of the SUTs system. In this way, the compilation of the IOTs can provide a useful and powerful feedback loop for checking the plausibility of the SUTs data. This experience has shown that IOTs should be compiled simultaneously with SUTs to enable the results of the IOTs to be immediately incorporated back into the SUTs. This approach may not hold when a long run of SUTs need to be revised as a consequence of methodological changes or a new ISIC or a new SNA.

## B. Overall strategy for removing negatives

B12.11 As already indicated, the negatives in model A and model C have a structural cause. If it use of these models is mandatory, there are various empirical ways to resolve these negatives.

B12.12 Ideally, all the negatives should be removed manually, once the cause of the negatives has been identified, and the SUTs and IOTs rebalanced, as appropriate. If, however, the available resources, time or information are limited, alternative strategies for resolving these negatives may need to be applied. For example, model A is applied and negative cell entries are generated and a three-step approach could be applied:

- All large, or significant, negative cell entries are investigated, resolved and rebalanced – these changes could affect the SUTs or any of the steps in the transformation to the IOTs. In this process, some positive cell entries may be identified as implausible and may also need to be changed.
- Small negatives are eliminated by applying some form of automated procedure.
- The plausibility of the results is reviewed and changes are made, if necessary.

## C. Specific approaches to dealing with negatives

B12.13 There are various ways of dealing with negatives, including:

- Merging industries
- Changing the primary producer
- Applying industry technology within the product technology framework
- Introducing new products
- Correcting errors in the SUTs
- Making manual corrections to IOTs
- After the above steps, using the Almon method used to remove any small negative cell entries

### 1. Merging industries

B12.14 If two or more products are produced more or less simultaneously, it is often difficult to distinguish the processes by which they were produced. For example, two closely related industries are restaurants (ISIC Rev. 4, group 561) and bars (ISIC Rev. 4, group 563). Restaurants will have substantial secondary output of beverage serving services (CPC Version 2.1, group 634, the main product of bars), while bars will have considerable secondary output of food serving services (CPC Version 2.1, group 633, the main product of restaurants). It will be difficult to distinguish separate input structures for beverage serving services and food serving services, since both services are usually provided simultaneously, essentially constituting a form of joint production. Trying to distinguish separate input structures by applying the product technology may lead to negative elements.

B12.15 It would be better to aggregate such industries and hence the products before applying the product technology. The assumption is then that both products are produced in the same production process – this is far from ideal and not in line with the recommended approach, to operate at the most detailed level possible. Merging the industries removes the secondary outputs and prevents negatives, and can offer a convenient solution to many cases. The apparent disadvantage of increasing the heterogeneity of the database is in fact not so important, since the input structures that are being merged are in any event similar.

### 2. Changing the primary producer

B12.16 It was noted that it is essential to know which industry is the primary producer for each product if the product technology assumption is applied. In some cases, negatives are created because the initially chosen primary producer of a product is not the right one (for example, research and development). In such a case, the input structure of another industry might be more appropriate for use as the starting point.

B12.17 It must be noted that, in most cases, there are many more products than industries, and hence there can be products in respect of which it is not immediately obvious who the primary producer may be, in particular when the products are fairly heterogeneous.

### 3. Apply industry technology within the product technology framework

B12.18 In the event that the product technology is not valid because there are in fact two ways of producing a product, the resulting problem may be resolved by applying the industry technology assumption. The industry technology assumption posits that all products produced by the industry are produced in the same production process. Thus it does not matter, for example, whether the outputs of the agriculture industry are called agricultural products or manufacturing products, they can all be treated as if they were primary products. The secondary output of manufacturing products could thus be added to the primary output. However, the same adjustments have to be made in the use table: in other words, the corresponding amounts have to be transferred from the manufacturing products row to the agricultural products row and these amounts have to be allocated to the appropriate users. It is easy to see that this problem is precisely the same as that encountered when compiling industry-by-industry IOTs. If available, actual data could be used in support of this assumption.

B12.19 The drawback of this solution is that it leads to a reclassification of products. The heading "agricultural products" in the IOTs would no longer encompass the same products as the same heading in SUTs. This could pose problems for interpretation and for users. In that case, this solution could still be applied in cases where the reclassification stays within the product groups distinguished in the most detailed published tables.

### 4. Introducing new products

B12.20 Another possibility is to introduce a new product. It could well be that there are two or more ways to produce a given product. If there is sufficient information on the different production processes available, this could be added to strengthen the homogeneity of the IOTs. The drawback of this method is that it is relatively labour and data-intensive. If, however, all products are defined as characteristic in the industry where they are actually produced, then the product technology is in practice replaced by an industry technology.

### 5. Correcting errors in the SUTs

B12.21 Wherever it can be established that negatives (or other implausible results) are caused by errors, these should of course be repaired by correcting the data.

B12.22 The problem here is that IOTs are usually compiled after the closing of the accounts and the SUTs. This is more often the case in countries where IOTs are compiled less regularly, for example, once every five years. In such cases, when the compilation of the IOTs reveals problems or errors in the SUTs, these can often only be resolved at the next benchmark revision and therefore inconsistencies may have to be reflected to produce plausible IOTs.

### 6. Making manual corrections to IOTs

B12.23 Lastly, if large negatives remain that cannot be dealt with by any of the above solutions, for example, because it would significantly affect the compatibility with the original SUTs, they could be resolved by manually correcting the results of the product technology.

B12.24 After the large negative values have been removed and, where applicable, after manually adjusting some clearly incorrect positive elements, the remaining small negatives can also be eliminated by setting them to zero, as in Armstrong (1975). The final balancing to match the totals can be carried out with the use of a mathematical routine such as the RAS procedure or other methods as covered in chapter 18 of this Handbook. This is the case when these negatives may be considered to be the normal "noise" in the compilation process, due to unavoidable heterogeneity and statistical error within the normal confidence ranges.

### 7. Almon method

B12.25 Depending upon the diversity of industries' secondary activities, model A (product technology assumption) may generate product-by-product IOTs with negative entries.

B12.26 Almon developed an alternative method which is consistent with the product technology assumption but calculates product-by-product IOTs from SUTs without any negative entries (Almon, 2000). The most effective application of the Almond method should be considered when all of the above procedures have been used, and the focus is only to remove the last small suite of negative entries. The Almond method should not be used alone and directly applied to the original SUTs.

B12.27 The method applies the product technology by calculating IOTs row by row and taking care of negatives as soon as they appear. It monitors the transformation process outlined for model A in a step-by-step manner for each row (in other words, product) and, when a negative cell entry occurs, the amounts transferred are reduced until the negative value is absorbed.

B12.28 The method leaves the row totals unaffected but there is no guarantee that the column totals are maintained. It is therefore necessary to perform a RAS procedure or a similar procedure to rebalance the row and column totals.

B12.29 The fact that no negative cell entries appear also means that the negative cell entries cannot be used to analyse the quality and plausibility of the SUTs. The results of the Almon method can, however, be checked by recalculating the use table. In a manner similar to that outlined above, this check provides information, such as on areas where the structure of SUTs or the product assumptions can be improved.

B12.30 Box B12.1 shows the application of the Almon method in removing small negatives for a small numerical example.

**Box B.1 Almon method**

Clopper Almon developed a method (Almon, 2000) to compile product-by-product IOTs from SUTs using the product technology assumption without negative cell entries.

In scenario A, the traditional transformation of the SUTs to IOTs with the product technology assumption (model A) does not result in negative flows. A marginal change in the use table in scenario B does, however, result in negative cell entries.

In scenario A, the Almon method generates the same result as the traditional transformation with model A. In Scenario B, however, it is demonstrated how negative cell entries can be avoided by using the Almon procedure.

The final result of the Almon method reflects the fact that rennet is only used in the cheese industry. In addition, the Almon procedure gives an indication in the sheet "New use table" of the manner in which the use table can be revised to avoid negative cell entries in the compiled product-by-product IOTs. In fact, in the example adduced by Almon, the "New use table" of scenario B corresponds with the original use table of Scenario A.

## SCENARIO A

**Supply table**

| Products | Industries: Cheese | Ice Cream | Chocolate | Rennet | Other | q |
|---|---|---|---|---|---|---|
| Cheese | 70 | 30 | | | | 100 |
| Ice Cream | 20 | 180 | | | | 200 |
| Chocolate | | | 100 | | | 100 |
| Rennet | | | | 20 | | 20 |
| Other | | | | | 535 | 535 |
| g' | 90 | 210 | 100 | 20 | 535 | |

**Use table**

| Products | Industries: Cheese | Ice Cream | Chocolate | Rennet | Other | y | q |
|---|---|---|---|---|---|---|---|
| Cheese | | | | | | 100 | 100 |
| Ice Cream | | | | | | 200 | 200 |
| Chocolate | 4 | 36 | | | | 60 | 100 |
| Rennet | 14 | 6 | | | | | 20 |
| Other | 28 | 72 | 30 | 5 | | 400 | 535 |
| W | 44 | 96 | 70 | 15 | 535 | | 760 |
| g' | 90 | 210 | 100 | 20 | 535 | 760 | |

### Product technology assumption

**Product-by-product input-output table**

| Products | Products: Cheese | Ice Cream | Chocolate | Rennet | Other | Y | q |
|---|---|---|---|---|---|---|---|
| Cheese | | | | | | 100 | 100 |
| Ice Cream | | | | | | 200 | 200 |
| Chocolate | | 40 | | | | 60 | 100 |
| Rennet | 20 | | | | | | 20 |
| Other | 30 | 70 | 30 | 5 | | 400 | 535 |
| W | 50 | 90 | 70 | 15 | 535 | | 760 |
| q' | 100 | 200 | 100 | 20 | 535 | 760 | |

### Almon procedures

**Product-by-product input-output table**

| Products | Products: Cheese | Ice Cream | Chocolate | Rennet | Other | Y | q |
|---|---|---|---|---|---|---|---|
| Cheese | | | | | | 100 | 100 |
| Ice Cream | | | | | | 200 | 200 |
| Chocolate | | 40 | | | | 60 | 100 |
| Rennet | 20 | | | | | | 20 |
| Other | 30 | 70 | 30 | 5 | | 400 | 535 |
| W | 50 | 90 | 70 | 15 | 535 | | 760 |
| q' | 100 | 200 | 100 | 20 | 535 | 760 | |

**New use table**

| Products | Products: Cheese | Ice Cream | Chocolate | Rennet | Other | Y | q |
|---|---|---|---|---|---|---|---|
| Cheese | | | | | | 100 | 100 |
| Ice Cream | | | | | | 200 | 200 |
| Chocolate | 4 | 36 | | | | 60 | 100 |
| Rennet | 14 | 6 | | | | | 20 |
| Other | 28 | 72 | 30 | 5 | | 400 | 535 |
| W | 44 | 96 | 70 | 15 | 535 | | 760 |
| g' | 90 | 210 | 100 | 20 | 535 | 760 | |

## SCENARIO B

**Supply table**

| Products | Industries: Cheese | Ice Cream | Chocolate | Rennet | Other | q |
|---|---|---|---|---|---|---|
| Cheese | 70 | 30 | | | | 100 |
| Ice Cream | 20 | 180 | | | | 200 |
| Chocolate | | | 100 | | | 100 |
| Rennet | | | | 20 | | 20 |
| Other | | | | | 535 | 535 |
| g' | 90 | 210 | 100 | 20 | 535 | |

**Use table**

| Products | Industries: Cheese | Ice Cream | Chocolate | Rennet | Other | y | q |
|---|---|---|---|---|---|---|---|
| Cheese | | | | | | 100 | 100 |
| Ice Cream | | | | | | 200 | 200 |
| Chocolate | 3 | 37 | | | | 60 | 100 |
| Rennet | 15 | 5 | | | | | 20 |
| Other | 28 | 72 | 30 | 5 | | 400 | 535 |
| W | 44 | 96 | 70 | 15 | 535 | | 760 |
| g' | 90 | 210 | 100 | 20 | 535 | 760 | |

### Product technology assumption

**Product-by-product input-output table**

| Products | Products: Cheese | Ice Cream | Chocolate | Rennet | Other | Y | q |
|---|---|---|---|---|---|---|---|
| Cheese | | | | | | 100 | 100 |
| Ice Cream | | | | | | 200 | 200 |
| Chocolate | -1.67 | 41.67 | | | | 60 | 100 |
| Rennet | 21.67 | -1.67 | | | | | 20 |
| Other | 30 | 70 | 30 | 5 | | 400 | 535 |
| W | 50 | 90 | 70 | 15 | 535 | | 760 |
| q' | 100 | 200 | 100 | 20 | 535 | 760 | |

### Almon procedures

**Product-by-product input-output table**

| Products | Products: Cheese | Ice Cream | Chocolate | Rennet | Other | Y | q |
|---|---|---|---|---|---|---|---|
| Cheese | | | | | | 100 | 100 |
| Ice Cream | | | | | | 200 | 200 |
| Chocolate | | 40 | | | | 60 | 100 |
| Rennet | 20 | | | | | | 20 |
| Other | 30 | 70 | 30 | 5 | | 400 | 535 |
| W | 50 | 90 | 70 | 15 | 535 | | 760 |
| q' | 100 | 200 | 100 | 20 | 535 | 760 | |

**New use table**

| Products | Products: Cheese | Ice Cream | Chocolate | Rennet | Other | Y | q |
|---|---|---|---|---|---|---|---|
| Cheese | | | | | | 100 | 100 |
| Ice Cream | | | | | | 200 | 200 |
| Chocolate | 4 | 36 | | | | 60 | 100 |
| Rennet | 14 | 6 | | | | | 20 |
| Other | 28 | 72 | 30 | 5 | | 400 | 535 |
| W | 44 | 96 | 70 | 15 | 535 | | 760 |
| g' | 90 | 210 | 100 | 20 | 535 | 760 | |

# Annex C to chapter 12. Examples of reviews of approaches to the treatment of secondary products

| Treatment of secondary products | | |
|---|---|---|
| **Year** | **Source or author(s) as appropriate** | **Reference to specific pages** |
| **Transfer of outputs only** | | |
| **Transfer method** | | |
| 1961 | Stone | Pages 39–41 |
| 1973 | United Nations | Page 25 |
| 1985 | Fukui and Seneta | Page 178 |
| 1986 | Viet | Pages 16–18 |
| 1990 | Kop Jansen and ten Raa | Page 215 |
| 1994 | Viet | Pages 36–38 |
| **Stone method or by-product technology model** | | |
| 1961 | Stone | Pages 39–41 |
| 1973 | United Nations | Page 26 |
| 1984 | Ten Raa, Chakraborty and Small | Page 88 |
| 1985 | Fukui and Seneta | Page 178 |
| 1986 | Viet | Pages 15–16 |
| 1990 | Kop Jansen and ten Raa | Page 215 |
| 1994 | Viet | Page 38 |
| **European System of Integrated Economic Accounts (ESA) Method (EUROSTAT, 1979)** | | |
| 1986 | Viet | Pages 18–19 |
| 1990 | Kop Jansen and ten Raa | Page 214 |
| 1994 | Viet | Pages 38–40 |
| **TRANSFER OF INPUTS AND OUTPUTS** | | |
| **Lump-sum or aggregation method** | | |
| 1974 | Office for Statistical Standards | Page 116 |
| 1985 | Fukui and Seneta | Page 177 |
| 1990 | Kop Jansen and ten Raa | Page 214 |
| 1994 | Viet | Pages 42–43 |
| **Methods with a single technology assumption – product technology model** | | |
| 1968 | United Nations | Pages 48–51 |
| 1968 | van Rijckeghem | Pages 607–608 |
| 1970 | Gigantes | Pages 280–284 |
| 1973 | United Nations | Pages 26–32 |
| 1975 | Armstrong | Pages 71–72 |
| 1984 | Ten Raa, Chakraborty and Small | Page 88 |

| | | |
|---|---|---|
| 1986 | Viet | Page 20 |
| 1990 | Kop Jansen and ten Raa | Page 215 |
| 1994 | Viet | Page 41 |
| **Methods with a single technology assumption – industry technology model** | | |
| 1968 | United Nations | Pages 48–51 |
| 1970 | Gigantes | Pages 272–280 |
| 1973 | United Nations | Pages 26–32 |
| 1975 | Armstrong | Pages 71–72 |
| 1984 | Ten Raa, Chakraborty and Small | Pages 88–89 |
| 1985 | Fukui and Seneta | Page 178 |
| 1986 | Viet | Page 21 |
| 1990 | Kop Jansen and ten Raa | Page 215 |
| 1994 | Viet | Pages 40–41 |
| **Methods with a single technology assumption – activity technology model** | | |
| 1994 | Konijn | Pages 143–184 |
| 1995 | Konijn and Steenge | Pages 426–433 |
| **Hybrid technology assumption methods – mixed product and industry technology assumptions** | | |
| 1968 | United Nations | Pages 48–51 |
| 1970 | Gigantes | Pages 284–290 |
| 1973 | United Nations | Pages 33–34 |
| 1975 | Armstrong | Pages 72–76 |
| **Hybrid technology assumption methods – product technology assumption and by-product technology method** | | |
| 1984 | Ten Raa, Chakraborty and Small | Page 90 |

# Chapter 13. Compiling physical supply and use tables and environmentally extended input-output tables

## A. Introduction

13.1 Industrial growth and a rapidly growing world population are having a major impact on the global environment and allocation of material resources. Most changes in the environment are brought about by human activities and these activities result in a flow of materials. The flow of resources from the natural environment to the economy is a prerequisite of production, while flows of residuals from the economy to the environment are the consequence of production and consumption. A full understanding of these processes requires a complete description of the physical dimension of the economy and its interaction with the environment.

13.2 PSUTs and EE-IOTs are used to describe the magnitude (measured by tons or other physical measuring units) and the nature of materials and products flowing in the economy, within the economy and between the economy and nature. They show how the natural resources (natural inputs) enter, are processed and subsequently, as products, are moved around the economy, used and finally returned to the natural environment in the form of residuals (emissions, waste, waste water, and so forth). The exchange of products between the domestic economy and the rest of the world is also described in the PSUTs and EE-IOTs.

13.3 The SEEA Central Framework (United Nations, FAO, IMF, OECD and World Bank, 2014) sets out the internationally agreed standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics for environmental-economic accounts. The SEEA is fully consistent with the SNA. It uses an accounting structure and concepts, definitions and classifications consistent with the SNA in order to facilitate the integration of environmental and economic statistics.

13.4 The SEEA Central Framework describes a set of accounts that are relevant for the analyses of the interactions between the environment and the economy. The present chapter focuses on the compilation of PSUTs and the EE-IOTs. Section B presents the structure of PSUTs and the relevant definitions and classifications of natural inputs and residuals. This section also covers the accounting and balancing identities and the principles of physical flow accounting. Section C covers the compilation steps for PSUTs and the way in which they fit into the overall process provided in chapter 3 of this Handbook. This section will also cover the data sources potentially used for the compilation of PSUTs.

13.5 Section D describes how to extend standard economic IOTs in monetary units to include information on the environment in physical units in the environmental extended IOTs. This section focuses on two types of EE-IOTs, namely the single region IOTs and the hybrid IOTs. The compilation steps for EE-IOTs are described in section E. Two country examples on the compilation of PSUTs are presented at the end of section F.

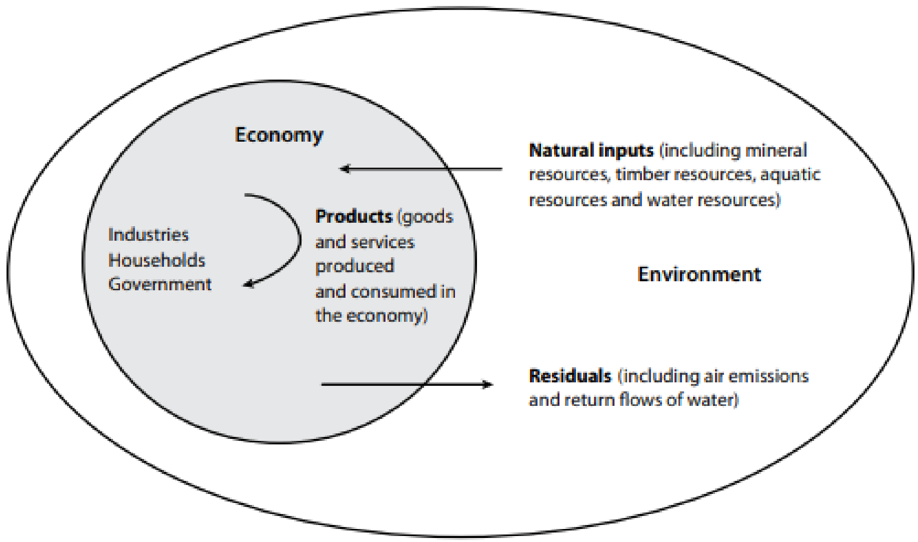
13.6 The presentation of the material in this chapter does not necessarily reflect the order of compilation of PSUTs and environmental extended IOTs recommended to countries. The compilation of environmental accounts in general, and more specifically of the PSUTs and EE-IOTs, is carried out in a gradual manner, starting with the compilation of those modules of the 2012 SEEA that reflect countries' priorities and resource availability. Given the scope of the 2012 SEEA, it is not possible to provide detailed practical guidance for compilation of the accounts for the various environmental domains (such as water, energy, forestry and others) in this Handbook. The aim of this chapter, therefore, is rather to provide the conceptual link of the PSUTs and EE-IOTs with the compilation of the SUTs and IOTs of the SNA, showing how to mainstream their compilation with that of SUTs and IOTs. More guidance on the compilation of the accounts may be found on the website of the United Nations at https://seea.un.org, and Eurostat at http://ec.europa.eu/eurostat/web/environment/methodology. Box 13.1 also presents a list of selected reference material.

13.7 Physical IOTs are also an extension of the SUTs framework designed to take into account environmental considerations. They consist of a transformation of the PSUTs into physical IOTs, although, because of the difficulties, conceptual and practical, in the compilation of physical IOTs, the focus of the 2012 SEEA has shifted more towards the compilation of EE-IOTs rather than physical IOTs. One conceptual disadvantage of the physical IOTs, for example, is that they do not allow for a distinction between different types of inputs and outputs. Inputs of products and natural inputs are combined together in physical IOTs to generate a single output, which combines products and residuals. This limits the environmental analyses that can be made by combining physical accounts. On the practical side, the choice of the physical unit used to measure the various types of products, natural inputs and residuals is also not simple. This chapter, therefore, does not elaborate further on the compilation of physical IOTs, although some countries do in fact compile them; from this point on in the Handbook, the focus will be primarily on EE-IOTs as opposed to physical IOTs.

## B. Overview of PSUTs

13.8 The SEEA provides the conceptual foundation for the extensions of the SNA that will include the environment. The SEEA Central Framework records flow from the environment to the economy (natural input), within the economy (product flows), and from the economy to the environment (residuals). Figure 13.1 provides a schematic representation of the physical flows of natural inputs, products and residuals between the environment and the economy.

**Figure 13.1 Physical flows of natural inputs, products and residuals**




Source: SEEA 2012 Central Framework.

13.9 PSUTs record physical flows of natural inputs, products and residuals in physical units of measurement. They are used to assess how an economy supplies and uses natural resources and they examine changes in production and consumption patterns over the accounting period. In combination with data from monetary SUTs, they allow for analyses of changes in productivity and intensity in the use of natural inputs and the release of residuals. Physical flows within the environment, namely, natural flows of materials and energy, lie outside the scope of PSUTs.

13.10 For the recording of physical flows, the structure of the SUTs of the SNA is extended by additional rows and columns in order to accommodate physical flows between the economy and the environment.

13.11 As shown in Table 13.1, PSUTs consist of a pair of tables which have the same format or structure. By row, the two tables show the various physical flow types, namely natural inputs, products and residuals. By column, they show the various origins and destinations supplying and using the flow items, namely industries (production activities), households (consumption activities), accumulation (changes in stocks of produced assets and product inventories), the rest of the world and the environment.

13.12 The physical supply table shows which physical flows are provided by which source (industries, households, accumulation, rest of the world, or the environment). In other words, it shows the physical flows by origin. The physical use table shows where the physical flows are used or received (namely, production, consumption, accumulation activity and others). In other words, it shows the physical flows by destination. The SEEA Central Framework notes that the general framework shown in Table 13.1 may be articulated either fully or partly.

## Table 13.1 General PSUT[9]

Simplified structure of the physical supply table

| | Industries | Industries: Agriculture, forestry, etc. | Industries: Mining and quarrying | Industries: ... | Industries: Services | Imports | Final consumption | Gross capital formation/accumulation | Environment | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Natural inputs | Mineral and energy resources<br>Water<br>... | | | | | | | | Flows from the environment **(A)** | Total supply by natural inputs **(TSNI)** |
| Products | Agriculture, forestry, etc.<br>Ores and minerals; etc.<br>...<br>Services | Output by product by industry **(C)** | | | | Imports by product **(D)** | | | | Total supply by product **(TSP)** |
| Residuals | Solid waste<br>Wastewater<br>... | Residuals generated by industry **(I)** | | | | Residuals received from the rest of the world **(L)** | Residuals generated by final consumtpion **(J)** | Residuals from scrapping and demolition of produced assets and emissions from controlloed landfill sites **(K)** | Residuals recovered from the environment **(M)** | Total supply by residuals **(TSR)** |
| Total Supply | | | | | | | | | | |

Simplified structure of the physical use table

| | Industries | Industries: Agriculture, forestry, etc. | Industries: Mining and quarrying | Industries: ... | Industries: Services | Exports | Final consumption | Gross capital formation/accumulation | Environment | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Natural inputs | Mineral and energy resources<br>Water<br>... | Extraction of natural inputs **(B)** | | | | | | | | Total use by natural inputs **(TUNI)** |
| Products | Agriculture, forestry, etc.<br>Ores and minerals; etc.<br>...<br>Services | Intermediate consumption by product and by industry **(E)** | | | | Exports by product **(H)** | Final consumption by product and by category **(F)** | Gross capital formation/accumulation **(G)** | | Total use by product **(TUP)** |
| Residuals | Solid waste<br>Wastewater<br>... | Collection and treatment of waste and other residuals **(N)** | | | | Residuals sent to the rest of the world **(P)** | | Accumulation of waste in controlled landfilled **(O)** | Residual flows direct to the enviornment **(Q)** | Total use by residuals **(TUR)** |
| Total Use | | | | | | | | | | |

Empty by definition | Blank cells may contain relevant flows

13.13 As indicated in chapter 2, the section of the PSUTs related to products provides the physical measurements of the flows that are recorded in the monetary SUTs presented in previous chapters. Many of the flows of products recorded in monetary terms relate to the use of products originating from the environment, for example, the manufacture of wood products, or to activities and expenditures associated with the environment, for example, environmental protection expenditure. It should be noted that the monetary and physical SUTs of the SEEA are compiled for either a specific underlying environmental theme or for an entire range of environmental themes. This means that the industry and product breakdown shown in the tables explicitly identify the relevant industries and products for the environmental theme in question. For example, when compiling SUTs for water in physical and monetary units, the industry breakdown will explicitly identify the industry distributing water, the industry treating wastewater and the major industries abstracting and using water. Similarly, on the product side, the relevant products for water will be explicitly

[9] Based on table 3.2.1 of the SEEA 2012 Central Framework

identified. The monetary and physical tables are therefore compiled with the same breakdown, and indicators can be calculated using consistent physical and monetary information.

### (a) Natural inputs, products and residuals

13.14 The starting point for understanding the PSUTs is to have a clear understanding of the terminology used in the construction of such tables. The definition of products is the same as that used within the national accounts, namely that products (goods and services) are the result of production. They are exchanged and used for various purposes: as inputs in the production of other goods and services, as final consumption or for investment (2008 SNA, para. 2.36). Natural inputs and residuals do not fall within the national accounts boundaries but are defined in the SEEA Central Framework in order to account for the physical interrelations between the national economy and the natural environment.

13.15 Natural inputs are all physical inputs that are moved from their location in the environment as a part of the economic process, or are directly used in production. They include natural timber resources and water resources that are extracted from the environment. Natural inputs should not be confused with products. In the case of mining activities, for example, natural inputs, such as gross ore, are input flows to the mining industry and only become products once they are an output of the mining industry, such as processed ore and concentrates.

13.16 The three broad classes of natural inputs are distinguished in the SEEA and listed below. Table 13.2 provides the classes of natural input as defined by the SEEA Central Framework:

(a) *Natural resource inputs*: these are material resources extracted from the natural environment. They include materials actually used in production, and also natural resource residuals, which are natural resource inputs that do not subsequently become products but instead return immediately to the environment;

(b) *Natural inputs of energy from renewable sources*: these include inputs such as solar and hydro energy captured by economic units;

(c) *Other natural inputs*: these include inputs such as those from soil (for example, soil nutrients) and from air (for example, oxygen taken up in combustion processes and carbon dioxide absorbed by cultivated plants).

## Table 13.2 Classes of natural input

| | |
|---|---|
| **1** | **Natural resource inputs** |
| 1.1 | Extraction used in production |
| 1.1.1 | Mineral and energy resources |
| 1.1.1.1 | Oil resources |
| 1.1.1.2 | Natural gas resources |
| 1.1.1.3 | Coal and peat resources |
| 1.1.1.4 | Non-metallic mineral resources (excl. coal & peat resources) |
| 1.1.1.5 | Metallic mineral resources |
| 1.1.2 | Soil resources (excavated) |
| 1.1.3 | Natural timber resources |
| 1.1.4 | Natural aquatic resources |
| 1.1.5 | Other natural biological resources (excluding timber and aquatic resources) |
| 1.1.6 | Water resources |
| 1.1.6.1 | Surface water |
| 1.1.6.2 | Groundwater |
| 1.1.6.3 | Soil water |
| 1.2 | Natural resource residuals |
| **2** | **Inputs of energy from renewable sources** |
| 2.1 | Solar |
| 2.2 | Hydro |
| 2.3 | Wind |
| 2.4 | Wave and tidal |
| 2.5 | Geothermal |
| 2.6 | Other electricity and heat |
| **3** | **Other natural inputs** |
| 3.1 | Inputs from soil |
| 3.1.1 | Soil nutrients |
| 3.1.2 | Soil carbon |
| 3.1.3 | Other inputs from soil |
| 3.2 | Inputs from air |
| 3.2.1 | Nitrogen |
| 3.2.2 | Oxygen |
| 3.2.3 | Carbon dioxide |
| 3.2.4 | Other inputs from air |
| 3.3 | Other natural inputs n.e.c. |

13.17 Residuals refer to flows of solid, liquid and gaseous materials and energy that are discarded, discharged or emitted by the economy and households to the environment (for example, emissions to air and water) through processes of production, consumption and accumulation. The SEEA Central Framework distinguishes the following groups of residuals:

(a) *Solid waste*: this covers discarded materials that are no longer required by the owner or user. Solid waste includes materials that are in a solid or liquid state but excludes wastewater and small particulate matter released into the atmosphere;

(b) *Wastewater*: this is discarded water that is no longer required by the owner or user. Water discharged into drains or sewers, water received by water treatment plants and water discharged directly into the environment is all considered wastewater. Wastewater includes return flows of water which are flows of water directly into the environment, with or without treatment. All water is included, regardless of its quality, including returns from hydroelectric power generators;

(c) *Emissions*: these are substances released into the environment by establishments and households as a result of production, consumption and accumulation processes. Generally, emissions are analysed by type of receiving environment (air, water and soil) and by type of substance, as further defined below:

(i) *Emissions to air*: these consist of gaseous and particulate substances released into the atmosphere by establishments and households as a result of production, consumption and accumulation processes;

(ii) *Emissions to water*: these are substances released into water resources by establishments and households as a result of production, consumption and accumulation processes;

(iii) *Emissions to soil*: these are substances released into the soil by establishments and households as a result of production, consumption and accumulation processes;

(d) *Dissipative uses of products*: this covers products that are deliberately released into the environment as part of production processes. For example, fertilizers and pesticides are deliberately spread on soil and plants as part of agricultural and forestry practice, and in some countries salt is spread on roads to improve road conditions for drivers;

(e) *Dissipative losses*: these are material residues that are an indirect result of production and consumption activity. Examples include particulate abrasion from road surfaces, abrasion residues from car brakes and tyres, and zinc from rain collection systems;

(f) *Natural resource residuals*: these are natural resource inputs that do not subsequently become incorporated into production processes and instead return immediately to the environment. Natural resource residuals are recorded as a generation of residuals by natural resource extracting industries and as a flow of residuals directly into the environment. These flows therefore do not become products nor do they enter the economy. An example of a natural resource residual is cooling water which is abstracted to cool plants such as electricity generation plants, chemical manufacturing plants, and others. Once the water cools the plant, it is returned generally into the same place in the environment. It is important to monitor these residuals because of their environmental impact.

13.18 Table 13.3 provides examples of the types of materials and components that are commonly included in the different groups of residuals for analytical purposes, depending on whether the focus of the analysis is on the purpose behind the discard (for example, solid waste), the destination of the substance (for example, emissions to air), or the processes leading to the emission (for example, dissipative losses).

**Table 13.3 Typical components for groups of residuals[10]**

| Group | Typical components |
|---|---|
| Solid waste (includes recovered materials)[a] | Chemical and health-care waste, radioactive waste, metallic waste, other recyclables, discarded equipment and vehicles, animal and vegetal wastes, mixed residential and commercial waste, mineral wastes and soil, combustion wastes, other wastes |
| Wastewater[a] | Water for treatment and disposal, return flows, reused water |
| Emissions to air | Carbon dioxide, methane, dinotrogen oxide, nitrous oxides, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, carbon monoxide, non-methane volatile organic compounds, sulphur dioxide, ammonia, heavy metals, persistent organic pollutants, particulates (e.g., PM10 dust) |
| Emissions to water | Nitrogen compounds, phosphorus compounds, heavy metals, other substances and (organic) compounds |
| Emissions to soil | Leaks from pipelines, chemical spills |
| Residuals from dissipative use of products | Unabsorbed nutrients from fertilizers, salt spread on roads |
| Dissipative losses | Abrasion (tyres/brakes), erosion/corrosion of infrastructure (roads, etc.) |
| Natural resource residuals | Mining overburden, felling residues, discarded catch |

* This list of typical components for groups of residuals can also be applied to certain flows defined as products.

13.19 Another way in which residuals are considered is in terms of losses. This is of particular interest in the analysis of physical flows of energy and water. Four types of losses are identified according to the stage at which they occur within the production process:

(a) Losses during extraction are those that occur during extraction of a natural resource before there is any further processing, treatment or transportation of the extracted natural resource. Losses during extraction exclude natural resources that are re-injected into the deposit from which they were extracted;

(b) Losses during distribution are losses that occur between a point of abstraction, extraction or supply and a point of use;

(c) Losses during storage are losses of energy products and materials held in inventories. They include evaporation, leakages of fuels (measured in mass or volume units), wastage and accidental damage. Excluded from the scope of inventories are non-produced assets, even though they might be considered as being stored;

(d) Losses during transformation refer to the energy lost, for example in the form of heat, during the transformation of one energy product into another.

[10] Table 3.2.4 of the SEEA 2012 Central Framework

### (b) Accounting and balancing identities

13.20 As explained in chapters 1 and 2, SUTs are linked together through various accounting and balancing identities. PSUTs, which represent the environmental extensions of the SNA-based SUTs in physical terms, also include a range of important accounting and balancing identities. The starting point for the balancing of the PSUTs is the supply and use of product identity, which recognizes that, within the economy, the amount of a product supplied must be equal in physical units to that used within the economy or exported. Thus:

*Total supply of products (TSP) = Total use of products (TUP)*

where

*Total supply of products (TSP)* = Domestic production (C) + imports (D)

*Total use of products (TUP)* = Intermediate consumption (E) + household final consumption (F) + gross capital formation (G) + exports (H)

The references in parentheses relate to specific parts of the PSUTs illustrated in Figure 13.1.

13.21 In the PSUTs, the supply and use of product identity also holds in physical units for flows of natural inputs and residuals:

*Total supply of natural inputs (TSNI) = Total use of natural inputs (TUNI)*

*Total supply of residuals (TSR) = Total use of residuals (TUR)*

13.22 These identities also relate to the fundamental physical law underpinning the PSUTs, namely the conservation of mass and energy. These physical identities imply the existence of material and energy balances for all individual materials within the system. It can be demonstrated that, over an accounting period, the following is true:

Flows of materials into an economy must equal the flows of materials out of an economy, plus any net additions to stock in the economy.

This is known as the input-output identity.

13.23 The net additions to the stock comprise additions and deductions over an accounting period in:

(a) Gross capital formation in investment goods and inventories of products;

(b) Physical flows of residuals to and from the rest of the world;

(c) Residuals recovered from the environment (for example, oil collected following an oil spill);

(d) Accumulation of solid waste in controlled landfill sites (excluding emissions from these sites).

13.24 Thus, the input-output identity describing the physical flows between an economy and the environment may represented as follows:

*Materials into the economy* = *Materials out of the economy* + *Net additions to stock in the economy*

where

*Materials into the economy* = Natural inputs (A) + Imports (D) + Residuals received from the rest of the world (L) + Residuals recovered from the environment (M)

*Materials out of the economy* = Residual flows to the environment (Q) + Exports (H) + Residuals sent to the rest of the world (P)

*Net additions to stock in the economy* = Gross capital formation (G) + Accumulation in controlled landfill sites (O) - Residuals from produced assets and controlled landfill sites (K)

13.25 This identity can be applied at the level of an entire economy and also at the level of an individual industry or household, in which case the notion of imports and exports refers to flows to and from other industries in the economy and also those to and from the rest of the world.

13.26 Natural resource residuals are recorded in the PSUTs, first as a supply from the environment and use of natural inputs by the economy (parts (A) and (B) in Table 13.1) and then as returning flow to the environment (parts (I) and (Q) in Table 13.1). Accordingly, unlike natural inputs, they do not become products and are not recorded in the block of rows for products in the PSUTs.

13.27 PSUTs can be compiled for a single specific environmental domain such as water or energy, but also for a larger set of domains. In either case, these accounting identities and a common set of accounting principles can be applied. In particular, clear boundaries must be established in respect of the point of transition between the environment and the economy.

### (c) Recording principles of physical flow accounting

13.28 When compiling PSUTs there are specific recording principles that should be followed, in particular with regard to the gross and net recording of physical flows, the treatment of international flows of goods, and the treatment of goods for processing. These are described below.

### (i) Gross and net recording of physical flows

13.29 PSUTs record flows between the environment and the economy, flows between different economic units and, where applicable, flows within economic units. This recording of flows is referred to in the SEEA as “gross recording”. The main advantage of a gross recording approach is that a full reconciliation of all flows at all levels of the SUTs, for example, by industry and by product, can be made.

13.30 Recording all of these flows may, however, hide some key relationships so, for analytical purposes, alternative consolidations and aggregations of flows have been developed. These alternative approaches are often referred to as “net recordings”, although the nature of the consolidations and aggregations varies and there is therefore no single application of net recording.

13.31 One example of the difference between gross and net recording is that of PSUTs for energy. When PSUTs for energy are compiled on a gross basis, they show all flows of energy between economic units. Some of these are flows of energy products to energy producers which transform one energy product into a different one (the burning of coal to generate electricity in electric power plants is one example) while other flows are destined for end-users (as is the case with delivery of electricity to households). PSUTs on the basis of net recording exclude non-consumptive energy use, which is the transformation of one energy product into another product, thus allowing for a greater focus on the end use of energy.

13.32 Generally, care should be taken when using and interpreting the terms “gross” and “net” and clear definitions of inclusions and exclusions should be sought and provided.

### (ii) Treatment of international flows

13.33 The treatment of physical flows to and from the rest of the world needs careful articulation. In line with the SNA, the underlying principle applied in the SEEA is that relevant flows are attributed to the country of residence of the producing or consuming unit. This differs from the territory-based principle of recording, which is applied in a number of statistical domains such as energy statistics and energy balances. This principle attributes the relevant flows to the country in which the producing or consuming unit is located at the time of the flow.

13.34 In accordance with both the 2008 SNA and BPM 6, the residence of an institutional unit is determined by the economic territory with which it has the strongest connection (2008 SNA, paras. 4.10–4.15). In the majority of situations, the concepts of territory and residence are closely aligned. Nevertheless there are cases that require careful consideration in order to choose the appropriate recording. These include international transport, tourist activity and natural resource inputs, as further explored below.

13.35 *International transport*: to ensure consistency with other sections of the accounts, the appropriate recording of international transport activity is centred on the residence of the operator of the transport equipment, which is usually the location of the headquarters of the transport operator. Accordingly, regardless of the distances travelled, the number of places of operation, whether the transport service is supplied to non-residents or whether the transport service is between locations in different countries, all revenues, inputs (including fuel, wherever purchased) and emissions are attributed to the country of residence of the operator.

13.36 Special attention must be made to the bunkering of fuel, primarily for ships and aircrafts. The recording of bunkering of fuel is a transaction between the operator of the transport service and the owner of the fuel. If the owner of the fuel is a resident of the rest of the world, the refuelling of a ship operated by a resident unit is considered to be an import, independently of where the refuelling takes place. In fact, there could well be a variety of special arrangements whereby a unit resident in a country stores fuel in another country while still retaining ownership of the fuel itself. Following the principles of the SNA and the BPM, it is the ownership rather than the location of the fuel that is relevant. In this way if country A established a bunker in country B and transports fuel to that country in order to refuel a ship that it operates, then the fuel is considered to have remained in the ownership of country A and no export of fuel to country B is recorded. The fuel stored in country B is therefore not necessarily all attributable to country B. This treatment is likely to differ from the recording utilized in international trade statistics, and it may be necessary to make adjustments to source data in order to align the recording to this treatment.

13.37 *Tourist activity*: the recording of tourist activity in the physical SUTs is consistent with the recording of international transport activity in that the concept of residence is central. Tourists include all those travelling outside their country of residence, including short-term students (those studying abroad for less than 12 months), people travelling for medical reasons and those travelling for business or pleasure. The consumption activity of a tourist travelling abroad is attributed to the tourist's country of residence and not to the location of the tourist when the consumption is undertaken. Thus, purchases made in a country by a tourist are recorded as an export by the country visited and as an import of the country of residence of the tourist. Solid waste generated in the country by tourists should generally be attributed to local enterprises (for example, hotels and restaurants). Emissions from local transport used by tourists (for example, taxis, minibuses, nationally operated rental cars and so forth) are attributed to the local transport company. In addition, as is the case with international transport, emissions from aircraft and other long-distance transport equipment are attributed to the country of residence of the operator. In neither case are the emissions attributed to the tourist. Emissions from cars are also attributed to the country of residence of the operator (in this case, the driver of the car), whether the car is owned by the driver or hired from a car rental firm (SEEA 2012 Central Framework, paras. 3.127–3.129).

13.38 It should be noted, however, that analyses of the impact of tourism on the economy or on the environment could be made by expanding existing flows to identify the proportion attributable to tourism activity. This is shown in the tourism satellite accounts (United Nations, Commission of the European Communities, Eurostat, UNWTO and OECD, 2010).

13.39 *Natural resource inputs*: these are physical inputs into the economy from the environment. In line with the 2008 SNA, natural resources that are legally owned by non-residents are considered to be owned by a notional resident unit and the non-resident legal owner is shown as the financial owner of the notional resident unit. Consequently, the extraction of natural resource inputs must occur within a country's economic territory by economic units that are resident in the country.

13.40 The major exception to this kind of treatment occurs in respect of natural aquatic resources. Following accounting conventions, the harvest of aquatic resources is allocated to the residence of the operator of the vessel undertaking the harvesting rather than to the location of the resources. Accordingly, the quantity of natural resource input that should be recorded for a country is equal to the quantity of aquatic resources caught by vessels whose operator is resident in that country, regardless of where the resources are caught. Natural resource inputs are not recorded for the harvest of aquatic resources by vessels operated by non-residents in national waters nor are the exports recorded in this situation. In the accounts of the country to which the non-resident operator is connected, there should be entries for natural resource inputs for aquatic resources caught in non-national waters but no reduction in national aquatic resources in the asset accounts for this harvest.

### (iii) Treatment of goods for processing

13.41 It is increasingly common for goods from one country to be sent to another country for further processing before being returned to the original country; sold in the processing country; or sent to other countries. In situations where the unprocessed goods are sold to a processor in a second country, there are no particular recording issues. In situations where the processing is undertaken on a fee-for-service basis, however, and there is no change of ownership of the goods (the ownership remains with the original country), the financial flows are unlikely to relate directly to the physical flows of goods being processed. Further details are covered in chapter 8.

13.42 From a monetary accounts perspective, the enterprise processing the goods assumes no risk associated with the eventual marketing of the products, and the value of the output of the processor is the fee agreed for the processing. This fee is recorded as an export of a service to the first country. One consequence of this treatment is that the recorded pattern of inputs for the enterprise that is processing goods on behalf of another unit is quite different from the pattern of inputs when the enterprise is manufacturing similar goods on its own account.

13.43 Although this treatment is in line with that of the SNA and provides the most appropriate recording of the monetary flows, it does not correspond to the physical flows of goods. Consequently, a different treatment of goods for processing is recommended for PSUTs. This entails recording the physical flows of goods, both as they enter into the country of the processing unit and as they leave that country. Tracking the physical flows in this way enables a clearer reconciliation of all physical flows in the economy and also provides a physical link to the recording of the environmental effects of the processing activity in the country in which the processing is being undertaken, including, for example, emissions to air. The same considerations apply to flows of goods for repair and merchanting.

13.44 Depending on the products and industries that are of interest, reconciliation entries may be required if accounts combining physical and monetary data are to be compiled.

## C. Compilation of PSUTs

13.45 The SEEA Central Framework provides the primary source for definitions, classifications and methods to be employed in developing the PSUTs. This section covers the compilation steps for PSUTs and how they fit into the overall process based on the GBSPM provided in chapter 3 of this Handbook. This section also covers possible data sources used for the compilation of PSUTs. It is worth noting that only a limited number of countries produce the full set of PSUTs and that, as a result, many countries lack well-established practices in this domain. This chapter does provide a general approach, but national practices will have to take into account national circumstances such as data availability, resources, systems and user needs, as described in chapters 3 and 4 of this Handbook.

13.46 Generally, compilers of PSUTs are not responsible for primary data collection such as the conducting of surveys and censuses. The role of compilers is rather to collate and integrate information from a range of sources to provide a coherent and consistent picture of the theme or topic that is the focus of the accounts and to ensure that the PSUTs are produced alongside the corresponding SUTs and IOTs as being well integrated with the core national accounts. One important role of the compiler, therefore, is to understand the various sources of information, including their scope, coverage, item definition, and other attributes. and to be able to adjust them if necessary to fit into the accounting framework of the SEEA.

13.47 As the source data for PSUTs come from a variety of different sources, an action plan needs to be developed to collect all the necessary information to compile the PSUTs and to include activities to be developed by the different stakeholders, including the different departments within the national statistics office and other relevant agencies in charge of natural resources management, such as the Ministry of the Environment. This, in turn, requires the establishment of institutional arrangements to clarify the roles and responsibilities of each stakeholder and to facilitate the sharing of responsibilities and data among the different stakeholders.

### 1. List of individual components of SEEA physical flow accounts

13.48 Section B provides a comprehensive examination of the systems of physical flow accounts. In practice, the flexible and modular approach of the SEEA implementation strategy recommends that the compilation of the SEEA accounts should start with individual component accounts that have been identified as priorities. Table 13.4 provides a list of individual components of a full set of physical flow accounts in the SEEA Central Framework.

**Table 13.4 List of individual components of SEEA physical PSUTs**

| PSUTs | Topics covered (reference to the SEEA 2012 Central Framework (CF) paragraph) |
|---|---|
| | |
| Full set of SUTs for materials | All resources and materials (energy, water, air emissions, water emissions, solid waste) (CF 3.45) |
| Economy-wide material flow accounts | Supply and consumption of energy; air emissions, water emissions, and solid waste (CF 3.279) |
| PSUTs for water | Supply (precipitation) and consumption of water (CF 3.186) |
| PSUTs for energy | Supply and consumption of energy (CF 3.140) |
| Air emissions accounts | Air emissions ($CO_2$, pollutants) (CF 3.233) |
| Water emissions accounts | Water emissions (CF 3.257) |
| Waste accounts | Solid wastes (CF 3.268) |

## 2. Data sources

13.49 In practice, the methods used in compiling PSUTs (whether for individual components or a full set of components) require the use of a wide range of data sources and can be constrained in large part by the nature of the data available. Using existing data sources wherever possible is therefore fundamental when building PSUTs. All available sources should be reviewed for possible use in physical SUTs, with or without adjustments, to fit within the conceptual framework. This forms the basis for the improvement of existing data sources or even the development of new sources to fill the gaps. Table 13.5 identifies the common national data sources for each SEEA component accounts and the corresponding physical SUTs.

**Table 13.5 Common national data sources and links to SEEA component accounts**

| **Data source** | **SEEA component accounts and corresponding PSUTs** |
|---|---|
| **Environment statistics** | |
| Emissions inventory (Pollutant release and transfer registry) | • Air emissions accounts<br>• Water emissions account |
| Water statistics | • Water emissions account<br>• Water PSUTs<br>• Water asset accounts |
| Energy statistics | • Air emissions<br>• Energy PSUTs<br>• Mineral and energy asset accounts |
| Waste statistics | • Waste accounts |
| Other environment statistics | • Land cover accounts<br>• Forest accounts |
| **Economic statistics** | |
| National accounts | • Energy PSUTs<br>• Mineral and energy asset accounts |

| | |
|---|---|
| | • Environmental protection expenditures<br>• Environmental taxes and subsidies<br>• Environmental goods and services sector |
| International trade statistics | • Material flow accounts |
| Business statistics | • Environmental protection expenditures<br>• Environmental goods and services sector |
| Government finance statistics | • Environmental protection expenditures<br>• Environmental taxes and subsidies |
| Other (for example, administrative data) | • Mineral and energy asset accounts |

13.50 A non-exhaustive list of material that is relevant for the compilation of each individual component of SEEA physical flow accounts and the corresponding PSUTs is provided in Box 13.1.

### Box 13.1 Selected reference material

**Reference material on several topics:**

United Nations website: https://seea.un.org/

Eurostat website: http://ec.europa.eu/eurostat/web/environment/methodology

**Material flows**

- Eurostat guidance developed for its environmental-economic accounting programme of work on material flow accounting
- Forthcoming SEEA technical note on material flow accounting

**Water**

- Guidelines for the Compilation of Water Accounts and Statistics, prepared by the United Nations Statistics Division, 2014
- SEEA Water, 2012
- The forthcoming SEEA technical note on water accounting
- International Recommendations for Water Statistics, 2012
- FAO guidance on collecting data in AquaStat – see http://www.fao.org/nr/water/aquastat/main/index.stm
- Eurostat guidance developed for its environmental-economic accounting programme of work on water-flow data

**Energy**

- Forthcoming SEEA Energy
- The forthcoming SEEA technical note on energy accounting
- The 2014 International Recommendations for Energy Statistics
- International Energy Agency guidance on collecting energy statistics
- Eurostat guidance from its environmental-economic accounting programme for energy flow data

**Air emissions**

- Forthcoming SEEA technical note on air emission accounting
- IPCC guidance on the measurement of emissions in the Framework Convention on Climate Change
- FAO guidance from its programme of work on measuring greenhouse gas emissions in agriculture

- Eurostat guidance from its environmental-economic accounting programme of work on air emissions flow data

**Agricultural products and related environmental flows**

- Forthcoming SEEA Agriculture, Forestry and Fisheries
- Guidance in the FAOSTAT website
- FAO handbooks and guidance on the collection of national agricultural production data, including the ten-year agricultural census
- Global Strategy to Improve Agricultural and Rural Statistics
- Eurostat information on the collection of agricultural statistics
- Guidance on the compilation of the European Economic Accounts for Agriculture and Forestry by Eurostat

**Forestry products and related environmental flows**

- Forthcoming SEEA Agriculture, Forestry and Fisheries
- Guidance for the FAO five-year global Forest Resource Assessment
- Guidance for the Joint Forest Sector Questionnaire
- The 2002 European Framework for Integrated Environmental and Economic Accounting for Forests

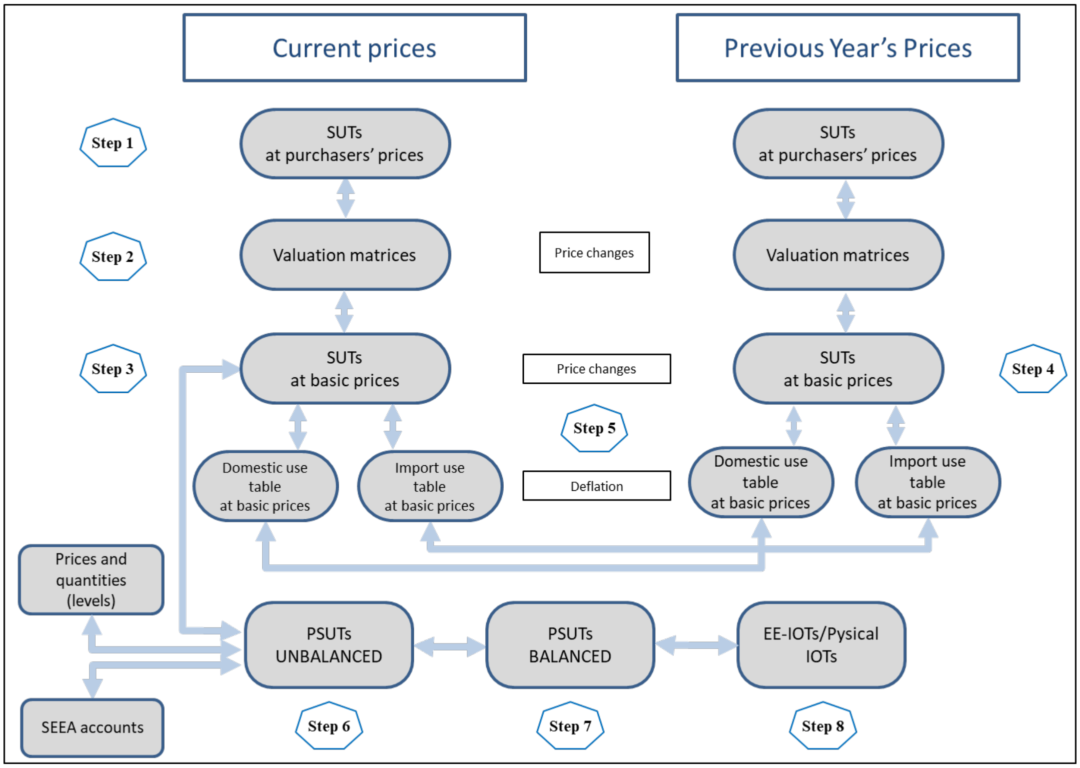
**Fisheries products and related environmental flows**

- Forthcoming SEEA Agriculture, Forestry and Fisheries
- FAO guidance on collecting fisheries statistics in FishStat - http://www.fao.org/fishery/statistics/software/fishstatj/en
- 2004 FAO handbook on Integrated Environmental and Economic Accounting for Fisheries

## 3. Overall strategy for the compilation of PSUTs

13.51 Figure 13.2 shows an overview of the general compilation process. It should be noted that steps 6, 7 and 8 in Figure 13.2 link to, and fit in with, box G in figure 3.4 of chapter 3, showing the compilation system for SUTs and IOTs.

**Figure 13.2 Overview of the compilation system for PSUTs**




13.52 Wherever possible, directly observed quantity data on natural input, product and residual flows is recommended for use in the compilation of PSUTs. In an ideal scenario, the data available for all sections of the SUTs and PSUTs are initially compiled unbalanced and are subsequently balanced simultaneously (or sequentially, if appropriate). In this situation, steps 5 and 7 in figure 13.2 would be merged, replacing the existing step 7.

13.53 In practice, however, countries that compile SUTs and PSUTs often start with balanced SUTs. In addition, since exhaustive source data for PSUTs are generally not available (and often not compiled within the national accounts), the SUTs compiled within the national accounts are converted into PSUTs by applying price and quantity data as an initial estimate of PSUTs. In this situation, figure 13.2 reflects practical considerations where step 5 is separate from step 7. Nonetheless, the process of compiling unbalanced PSUTs and balancing PSUTs allows for a feedback loop to the SUTs, irrespective of whether the SUTs and PSUTs are balanced simultaneously (or sequentially, if appropriate).

### *Steps 1–5*

13.54 The compilation steps for the SUTs may be found in earlier chapters (from step 1 to step 5 in Figure 13.3), as follows:

- *Step 1 – compilation of SUTs at purchasers' price*: see chapters 3, 4, 5 and 6.

- *Step 2 – compilation of valuation matrices*: see chapter 7.
- *Step 3 – compilation of SUTs at basic prices*: see chapter 7.
- *Step 4 – compilation of domestic use tables, import use tables and SUTs at basic prices and in volume terms*: see chapters 8 and 9.
- *Step 5 – balancing the SUTs simultaneously (or sequentially) in current prices and in volume terms*: see chapter 11.

***Step 6: Conversion of SUTs at basic prices to PSUTs***

13.55 The SUTs are converted into PSUTs using information on the level of prices and data on quantities from several sources. This step generates an unbalanced set of PSUTs, variations of which approach are presented in the case studies later in this chapter. Information on prices can be derived from several sources. In the ideal case, business statistics provide data on output and intermediate use in both monetary and physical terms. The derivation of prices to be applied to the SUTs is straightforward. These data, however, often have incomplete coverage or are very limited; in addition to depending upon the level of aggregation, there may be large price variations per physical unit within a product group.

13.56 Where the quantities available are taken from basic statistics, they can be applied directly without using prices. Furthermore, the price and quantity details can provide an effective feedback loop regarding the quality of the current price values in the SUTs.

13.57 These initial estimates can be overruled if specific information for certain industries or expenditure categories is available. Examples of such sources include business surveys and household budget surveys. For example, in the case of agriculture, food processing industries and energy industries, there is generally a great deal of physical data and price levels available.

13.58 One specific source for household final consumption is scanner data provided by the retail industry (for example, supermarkets). Applying the price levels derived from this source to household final consumption valued at purchasers' prices result in an alternative, and probably, a higher quality estimate of physical data.

13.59 For some outputs, neither price levels nor quantity data can be usefully applied, for example construction, for which an input method is applied, meaning that output in physical terms by definition equals the sum of inputs in physical terms.

13.60 In addition to physical data for supply and use of product, the physical flows of natural resources and residuals without a monetary value must be included. This mainly concerns the flows between the economy and the environment, such as extraction from natural sources, air emissions, and other such processes. It is also true that flows with no monetary value can exist within an economy, such as waste. Some of these physical flows form part of the accumulation in the economy.

13.61 The physical supply table records natural input, product and residual flows that occur as the result of a decrease in stock, such as, for example, waste that arises from demolishing a building or the carbon dioxide emissions that are released from landfills. On the basis of the type of waste that is being produced, a distinction is made between waste that results from the production process and waste that results from discarding capital. Moreover, the use table records additions to stock and the dumping of waste in landfills. Additions to stock are not always easy to estimate and are often part of a balancing entry, as with the addition of buildings and infrastructure.

***Step 7: Balancing the PSUTs***

13.62 Compiling PSUTs in the manner described above may result in unbalanced PSUTs. This may reflect the use of data from different sources, insufficient matching of prices and quantities or the existence of implausible results. Additional adjustments are then necessary in order to generate balanced PSUTs.

13.63 In the balancing of PSUTs, the following identities covering the physical flows should be checked:

(a) For each industry, that the amount of materials and resources going in equals the amount of materials and resources coming out;

(b) For each product, that the amount that is supplied equals the amount that is used.

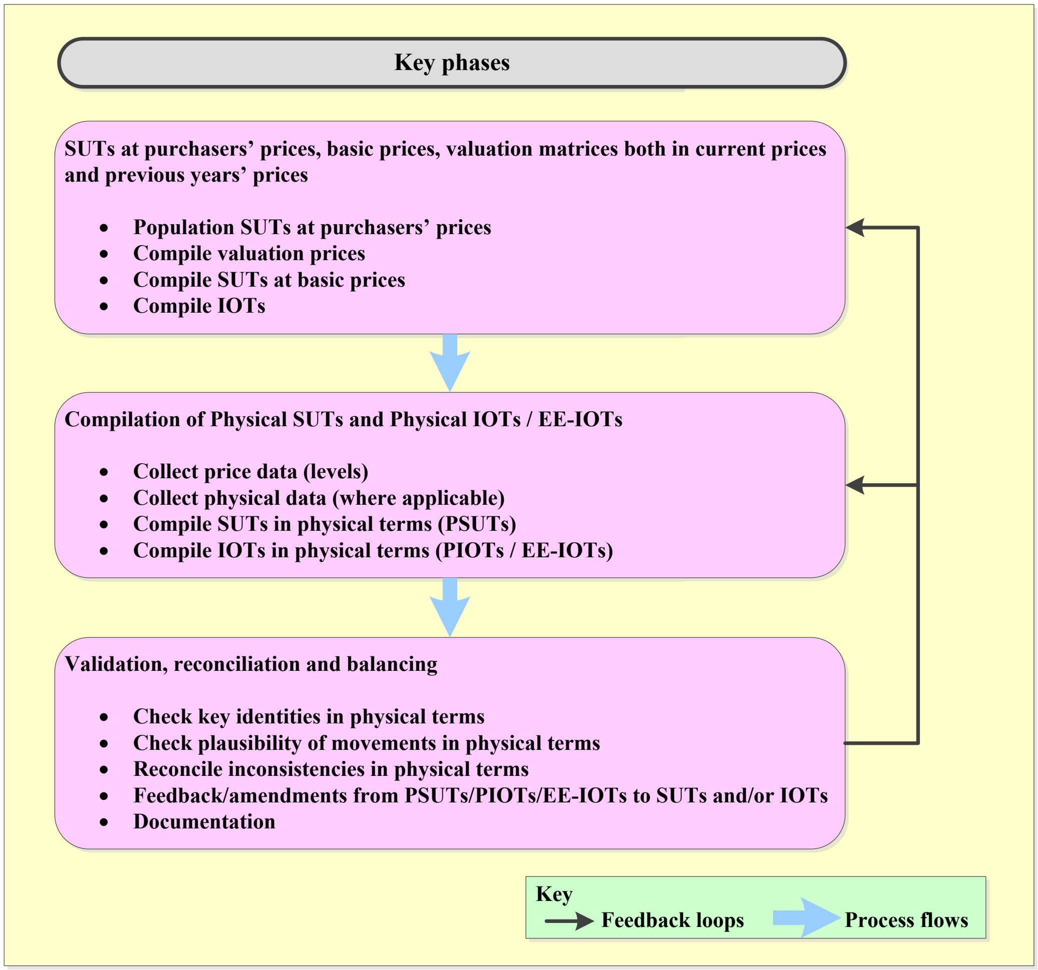
13.64 It should be noted that the balancing of PSUTs may often identify inconsistencies in the monetary SUTs, thus providing a feedback loop into the monetary SUTs. For this reason, it is often recommended to balance the SUTs simultaneously in monetary (current prices and volume) terms and physical units. In this case, steps 5 and 7 would be merged into a new step 7, in which SUTs and PSUTs would be balanced at the same time.

***Step 8: Transformation of PSUTs into EE-IOTs***

13.65 In general, as soon as balanced PSUTs become available, they can be transformed into EE-IOTs , using the same assumptions and techniques that are used to transform monetary SUTs into IOTs (industry-by-industry or product-by-product).

13.66 When the compilation of PSUTs is performed simultaneously with that of monetary SUTs both in current prices and in volume terms, an extensive set of feedback loops could be used to improve the monetary SUTs. Figure 13.3 shows the key feedback loops in producing and balancing the PSUTs and EE-IOTs.

**Figure 13.3 Key feedback loops in producing and balancing the PSUTs and environmental extended IOTs**




13.67 In practice, the PSUTs will be compiled using the final balanced SUTs as a starting point. The option for feedback to the SUTs, while it is then limited to the year or periods in question until the next revision cycle, is still very useful. Any inconsistencies detected in balancing the PSUTs may be used as additional information to guide the compilation and balancing of the next revision of the affected SUTs. In some countries, this may have to wait for the next benchmark revision year.

## D. Environmental extended IOTs

13.68 The EE-IOTs are integrated datasets that combine information from standard monetary IOTs and information on environmental flows, such as flows of natural inputs and residuals which are measured in physical units. This section focuses on two types of EE-IOTs, namely the single region IOTs and the hybrid IOTs. Reference to the multi-region IOTs will be made in this chapter and expanded in chapter 17. The intent of this section is to introduce the main types of EE-IOTs, to show key parts of their compilation, and to discuss some of the measurement issues associated with them.

## 1. Single region IOTs

13.69 The single region IOTs consist of monetary IOTs extended to include environmental flows in physical units. These tables are called “single region” tables as they are compiled for a single territory (which can be either a country or a group of countries) and where the category “rest of the world” includes all other territories or countries. This is in contrast with multi-region IOTs, where the tables consist of sets of IOTs for more than one country and are combined in such a way that intra-country relationships are explicitly identified. Chapter 17 of this Handbook elaborates on multi-region IOTs.

13.70 Table 13.6 shows a simplified version of single region IOTs. It gives a detailed description of domestic production processes and transactions within a single country (or region). An IOT is usually structured as a product-by-product table or and industry-by-industry table. Table 13.6 shows an industry-by-industry table of $j$ industries. The rows show the outputs of an industry, while the columns provide information about the inputs required in the production process of an industry.

**Table 13.6 Single region IOT with environmental data**

| ***Data in monetary terms*** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Industries | | | Final use | | | Total output |
| | | $1$ | ... | $j$ | Final consumption | Gross capital formation | Exports | |
| Industries | 1 | | | | | | | |
| | ... | | $Z$ | | $C$ | $f$ | $e$ | $q+m$ |
| | $j$ | | | | | | | |
| Value added | | | $v$ | | | | | |
| Total inputs | | | $q$ | | $c_{tot}$ | $f_{tot}$ | $e_{tot}$ | |

| ***Data in physical (non-monetary) terms*** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Natural inputs / residuals | | | $r$ | | | | | $r_{tot}$ |

Notations:

- $Z$: Matrix of intermediate consumption ($j$ by $j$ matrix)
- $c$: Final consumption
- $f$: Gross capital formation
- $e$: Exports

- $v$: Value added
- $q$: outputs of domestic industries
- $m$: denotes the use of imported goods and services
- $r$: Environmental flows (i.e. natural inputs or residual flows) taken from SEEA
- subscript $j$ denotes industry
- subscript $tot$ denotes totals.

13.71 The output of the industries is the sum of intermediate consumption ($Z$) (which is a $j$ by $j$ matrix) and final use categories such as final consumption ($c$), gross capital formation ($f$) (including changes in inventories), and exports ($e$). It should be noted that, for all these categories, this is the sum of domestically produced goods and services and imported products, namely $Z = Z_d + Z_m$, $c = c_d + c_m$, $f = f_d + f_m$, $e = e_d + e_m$ (subscript $d$ denotes the use of domestically produced inputs and $m$ the use of imported goods and services). The inputs for each domestic industry comprise the intermediate inputs ($Z$) and value added categories ($v$). Since the inputs into an industry must equal the outputs, the column sums are thus equal to the outputs ($q$) of domestic industries, while the row sums are equal to domestic output plus the imported products ($q + m$). All the variables with the subscript $tot$ are vectors that show the totals for those respective row or columns.

13.72 The intermediate input matrix, $Z$, of IOTs is therefore a square matrix (in other words, it contains the same number of rows and columns).

13.73 The IOT is then augmented with environmental data by industry (denoted by the vector $r$ in Table 13.6), which may be taken from the relevant SEEA accounts. In most applications these data relate to flows of natural inputs and residuals. The conceptual foundation for environmental extensions to SNA-based IOTs, represented by the EE-IOTs, is described in the System of Environmental-Economic Accounting 2012 – Applications and Extensions (United Nations, European Commission, FAO, IMF, OECD and World Bank, 2017).

13.74 Having PSUTs available greatly facilitates the compilation of EE-IOTs, as the environmental information is already organized into an accounting framework consistent with the framework of the IOTs in terms of concepts, definitions and classifications. Extending the monetary IOTs with available environmental statistics, however, and adjusted when necessary, for the concepts and classifications of the SEEA, may be a starting point toward the compilation of environmental-economic accounts in countries, starting with the implementation of the SEEA.

13.75 IOTs can be constructed as industry-by-industry or product-by-product tables. When a product-by-product based structure is used for IOTs, adjustments to the environmental data are necessary, since data on environmental flows are most commonly collected and classified by industry. The adjustment of environmental flow data in terms of industries and products will also arise when SUTs form the basis for the representation of flows within the economy. SUTs are generally structured with columns representing industries and rows representing products, with substantially more products than industries. Examples of EE-SUTs are emerging in the literature and may benefit from some analysis since they provide additional detail by product.

## 2. Hybrid IOTs

13.76 Hybrid IOTs consist of IOTs augmented with data in physical units for the input and output of selected industries. Table 13.7 shows a hybrid IOT where data for the industry $J$ (shaded area in Table 13.7) are also measured in physical terms. Many studies, for example, have analysed energy using IOTs where the output of the energy industries is measured in gigajoules or another energy unit. The source data from this type of data could, for example, be based on the PSUTs for energy. Note that because the columns contain a mix of entries in different units (some monetary and some physical), it is not possible to aggregate entries within a column. Summation across each row is, however, possible.

**Table 13.7 Single region IOT in hybrid units**

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">Industries</td><td colspan="3">Final use</td><td rowspan="2">Total output</td></tr>
<tr><td>1</td><td>…</td><td>J</td><td>Final consumption</td><td>Gross capital formation</td><td>Exports</td></tr>
<tr><td rowspan="4">Industries</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>…</td><td></td><td>Z</td><td></td><td>C</td><td>F</td><td>e</td><td>q+m</td></tr>
<tr><td>J</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>J (physical units)</td><td></td><td>$z_{phisical}$</td><td></td><td></td><td></td><td></td><td>$z_{tot}$</td></tr>
<tr><td colspan="2">Value added</td><td></td><td>v</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

13.77 For environmental analysis, it remains relevant to extend the hybrid IOTs using information on flows of natural inputs and residuals, as in the case of the single region IOTs. The advantage of using physical units within the core IOTs is that, in many cases, this provides a better description of the technological relationships for industries that have a reasonably large share of physical rather than service-based flows. Hence, when applying the analytical techniques, there is likely to be a better estimation of the direct and indirect environmental pressures across the economy. It is important to note that the mathematical specifications of the input-out model apply, irrespective of the units of the rows of the hybrid IOTs. The details of these types of models for energy are provided in chapter 9 of Miller and Blair (2009).

13.78 This type of EE-IOTs incorporates elements of life-cycle analysis and process analysis since it is possible to reflect the chain of flows between economic units in physical terms in the context of an economy wide set of flows.

## E. Compilation of EE-IOTs

13.79 The compilation of the EE-IOTs, in particular single region IOTs, consists of two parts:

i. Monetary IOTs (upper block of Table 13.6)

ii. Environmental data by industry. In most applications these data relate to flows of natural inputs and residuals (lower block of Table 13.6)

**Table 13.8 Industry-by -industry IOTs (upper block of Table 13.6)**

<table>
<tr><td colspan="10">Data in monetary terms</td></tr>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">Industries</td><td colspan="3">Final use</td><td rowspan="2">Total output</td></tr>
<tr><td>1</td><td>...</td><td>j</td><td>Final consumption</td><td>Gross capital formation</td><td>Exports</td></tr>
<tr><td rowspan="3">Industries</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>...</td><td></td><td>$Z$</td><td></td><td>$c$</td><td>$f$</td><td>$e$</td><td>$q+m$</td></tr>
<tr><td>j</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Value added</td><td></td><td>$v$</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Total inputs</td><td></td><td>$q$</td><td></td><td>$c_{tot}$</td><td>$f_{tot}$</td><td>$e_{tot}$</td><td></td></tr>
</table>

13.80 The monetary IOTs (Table 13.8) are derived from the SUTs following the steps described in the previous chapters of this Handbook.

**Table 13.9 Environmental data by industry (lower block of Table 13.6)**

<table>
<tr><td colspan="9">Data in physical (non-monetary) terms</td></tr>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">Industries</td><td colspan="3">Final demand</td><td rowspan="2">Total output</td></tr>
<tr><td>1</td><td>...</td><td>J</td><td>Final consumption</td><td>Gross capital formation</td><td>Exports</td></tr>
<tr><td>Natural inputs / residuals</td><td></td><td></td><td>$r$</td><td></td><td></td><td></td><td></td><td>$r_{tot}$</td></tr>
</table>

13.81 The environmental data are organized by industry in Table 13.9. Examples of such data items are resource use and emission per industry. In most applications these data relate to flows of natural and residual inputs. Details of the common national data sources and relevant materials for each SEEA component of accounts of physical flows may be found in tables 13.4 and 13.5 above.

13.82 The environmental data do not necessarily have to be derived from PSUTs. Usually, the information on environmental flows, the basic data, will not be strictly aligned with the measurement boundaries of the SEEA. Care should therefore be taken to record appropriately, with adjustment as necessary, entries for purchases made abroad by tourists and for re-exports. Careful attention should also be paid to the general issue of recording data on a residence basis rather than a territory basis. Having balanced PSUTs behind the information in table 13.9 helps to guarantee the reliability of the information and the consistency between monetary and physical data (ensured by the balancing feedback loops).

13.83 In addition to the materials listed in Box 13.1, a number of databases have been developed that incorporate physical flows and environmental information. They require the integration of data from various data domains as envisaged in the EE-IOTs: the 2012 WIOD (Dietzenbacher and others, 2013, and Timmer, 2012) and the projects on an environmental accounting framework using externality data and input-output tools for policy analysis (EXIOPOL) and compiling and refining of economic and environmental accounts (CREEA) funded by the European Union.

13.84 There are a number of measurement issues that should be borne in mind when compiling the EE-IOTs. In the 2008 SNA, imports and exports are defined on the basis of ownership rather than physical flows. In physical terms, however, a difference in the recording of some flows of products (for example, goods sent abroad for processing) may need to be taken into account (see chapter 3 of the SEEA Central Framework for more details of the treatment in physical terms). Consequently, analysis seeking to use information in both monetary and physical terms may require adjustment to either data set to ensure an alignment in the treatment of certain flows.

13.85 Basic environmental statistics may not be in strict alignment with the measurement boundaries of the SEEA. Care should therefore be taken to record, and adjust if necessary, in an appropriate manner, entries for purchases made abroad by tourists, re-exports and the general issue of recording data on a residence basis rather than on that of territory (further details may be found in section 3.3 of the SEEA 2012– Central Framework).

## F. Country examples

13.86 This section presents two country examples in the compilation of PSUTs: Denmark and the Netherlands. An example of the compilation of EE-IOTs may be found in chapter 19, section D.

### 1. Danish PSUTs

13.87 In Statistics Denmark, the compilation of SUTs is not just an integral part, it even serves as the backbone of the annual Danish national accounts in current prices and in previous years' prices. Every year, as part of the final annual national accounts, the SUTs are constructed using a classification level including 117 industries, 135 groups of final use, and approximately 2,350 products, of which approximately 1,800 may be characterized as goods (physical products).

13.88 The PSUTs follow as closely as possible, where applicable, the layout, classifications and definitions, and methods used for the Danish SUTs and IOTs. Furthermore, in order to ensure correspondence between the SUTs and IOTs, on the one hand, and the PSUTs, on the other, and to speed up the data handling and construction of the tables, the information technology system and database used for balancing and preparing the monetary tables have been extended to include the physical information.

13.89 The accounts for waste and water are produced independently of the SUTs. The monetary and physical energy accounts are produced as part of the SUTs process and enter directly into the national accounts SUTs and the PSUTs, respectively. The emissions accounts are subsequently based on PSUTs for energy, with some additions for non-energy-related air emissions. It should be noted that Statistics Denmark also produces physical IOTs after the PSUTs have been produced and, in this process, all the physical accounts fit directly into an environmental extended IOTs framework.

13.90 The PSUTs are integrated with, and build partly on, the existing Danish economy-wide material flows accounts, energy and air emission accounts.

13.91 The economy-wide material flows accounts are based on information from resource extraction statistics, fisheries statistics, agricultural statistics and foreign trade statistics. All information is available in tons.

13.92 The system of PSUTs is constructed as a further layer to the SUTs. This means that the same classifications of industries and products are used for the physical flows. For the final uses, a slightly different classification is used. Thus, the physical flows are less relevant for some consumption groups while, on the other hand, it may be more appropriate to classify households' final consumption expenditures according to whether the consumption involves durable goods or not.

13.93 For the Danish PSUTs, more than 100 types of natural resources (various types of biomass and minerals) and 40 types of residuals (types of solid waste and air emissions) were added to the classification of materials and products, giving a total of approximately 2,000 items along the materials and products dimension of the system.

13.94 Figure 13.4 shows the complete system of monetary and physical flow data, including monetary data on products, and physical data on natural inputs, products and residuals. The top layers are monetary data, including, on the supply side, basic prices only and, on the use side, basic prices, trade margins, taxes, and purchasers' prices. The bottom (light blue) layer is physical data measured in tons. For products, there is a one-to-one correspondence between the monetary data and the physical data.

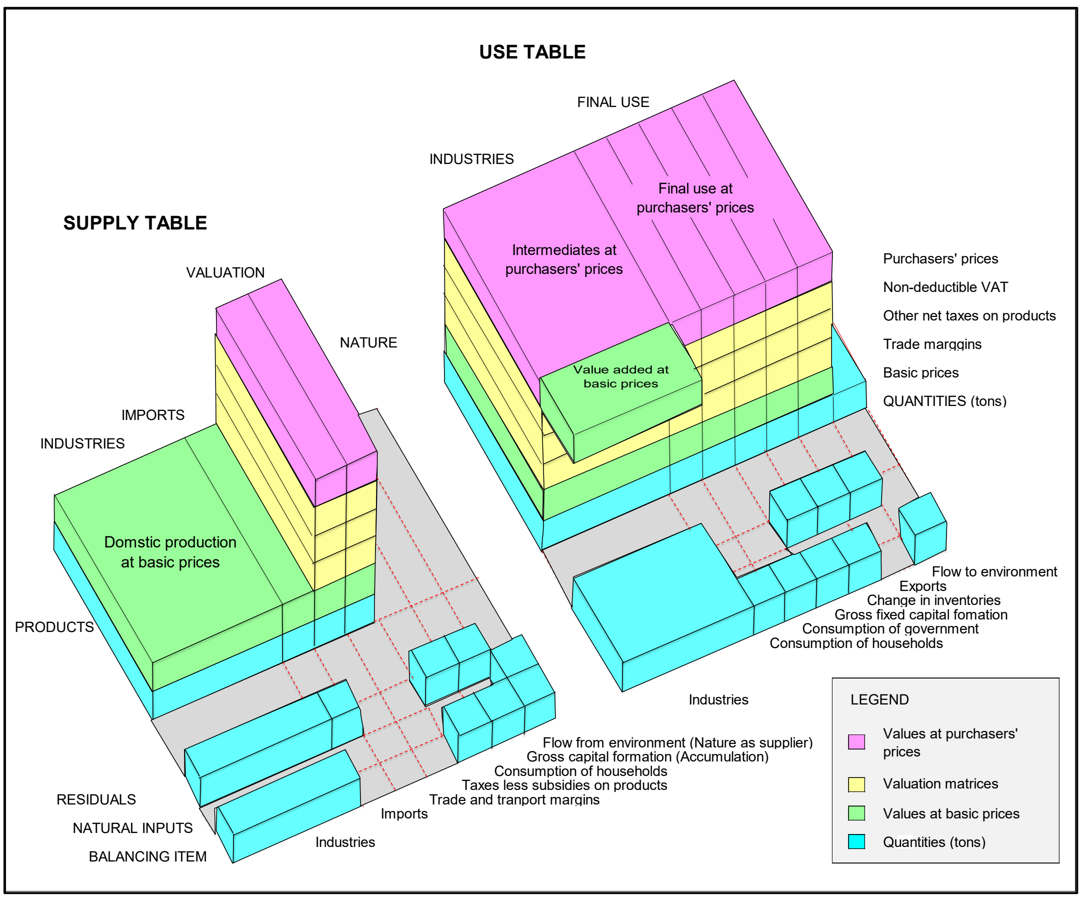
13.95 In front of the physical layer of products, as shown in figure 13.4, the data for natural resources are added. The environment is added as the supplier of natural resources, while the industries (intermediate consumption) are the only users.

13.96 The residuals are also added to the layer of products. The supply comes from industries and households. It should be noted that, unlike in the SUTs, the households are now also represented on the supply side, since they also generate residuals. The users of residuals are both industries and the environment. Residuals such as waste for incineration go into the waste treatment industry, while air emissions go into the environment.

13.97 In practice, all monetary and physical data illustrated in Figure 13.4 are stored and managed in a file using a common system of transaction codes and classifications. Each flow is identified first by a product code for the natural resource, product or residual. This code is followed by a transaction code (covering type, origin or destination), classification (the specific industry, and so forth) and then the data for basic prices, wholesale and retail margins, taxes (excluding VAT) less subsidies on products, VAT, purchasers' prices and finally the quantity (in tons).

13.98 The Danish energy accounts present the supply and use of 40 types of energy products. The supply and use of products are broken down by domestic industries, households, imports and exports and other parameters. The Danish energy accounts are made up using various measuring units: monetary units (Danish kroner), natural physical units (tons, cubic metres, and so forth) and energy units (petajoules). Tons are used for the purpose of the PSUTs.

**Figure 13.4 Danish SUTs framework extended with physical flows**



13.99 Data on energy-related air emissions of carbon and sulphur are drawn from the Danish air emission accounts. The air emission accounts show the energy-related and other types of air emissions of various substances from industries and households. The $CO_2$ and $SO_2$ air emissions are converted into carbon and sulphur, based on the molecule weights. This procedure is used since the oxygen used for the combustion of energy is not included on the input side of the PSUTs system.

13.100 In addition to the economic-environmental accounts, a number of other data sources are used:

- Waste statistics (physical data) broken down by waste fractions
- Water statistics (physical data)
- Foreign trade statistics
- Production statistics (physical and monetary data)
- Agricultural, forestry and fishery statistics (physical data)
- SUTs from the national accounts (monetary data)
- Assumptions used in transforming the SUTs to IOTs

13.101 As a general rule, water is not included in the Danish PSUTs. In order to balance inputs and outputs, however, it is necessary to account for the inclusion of water in some products (for example, beverages), on the input side and the evaporation of water from products (for example from slaughtered animals) on the output side. Water supplied for production purposes in agriculture, horticulture, forestry and fishery is implicitly included when calculating the input of natural resources from the harvested biomass weight. Information on the quantities of water added to products is also obtained by including existing structural information, and by estimations carried out during the general balancing process.

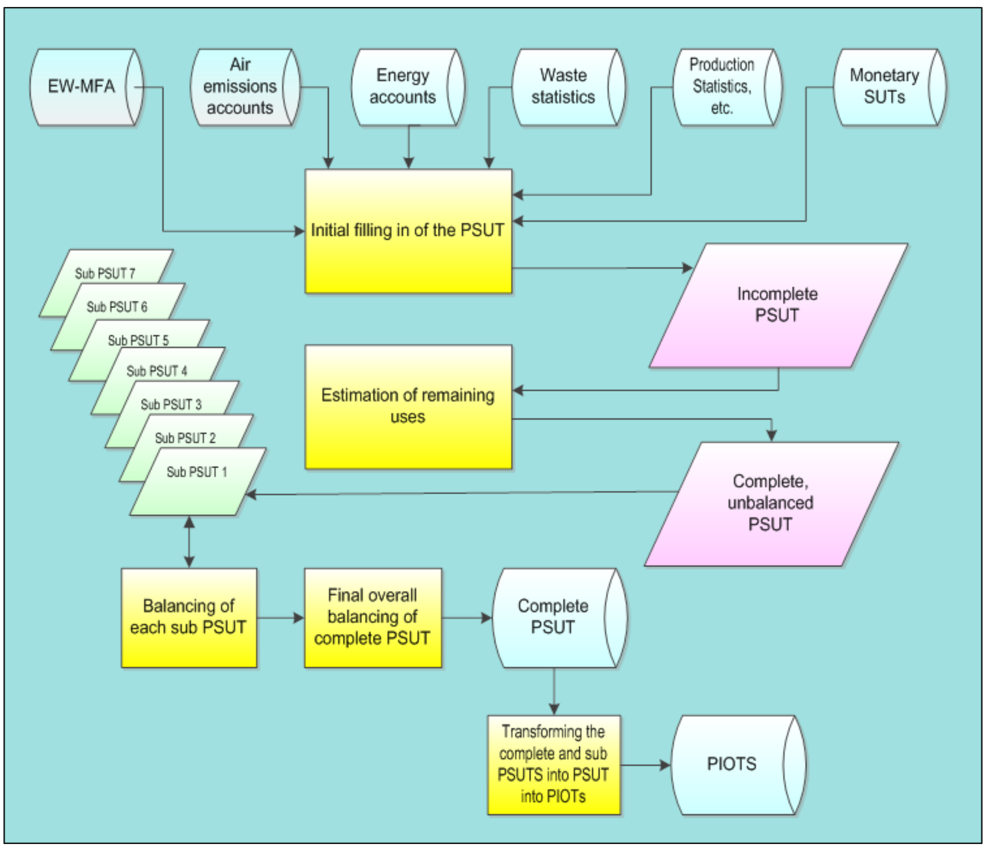
13.102 The foreign trade statistics include very detailed data on the imports and exports of products. The information is available in both monetary values and quantities measured in tons, and sometimes also additional physical units (such as cubic metres).

13.103 The compilation of domestic production in tons broken down by industries is primarily based on the production statistics of Statistics Denmark for the manufacturing industries while agricultural, forestry and fishery statistics are used for the corresponding primary industries. In the case of a number of items in the product balances, there is no information in the product statistics on the weight in tons, and this is therefore estimated indirectly. In those cases where alternative quantitative information has been given in, for example, cubic metres or pieces, a conversion is made from such conversion factors as specific gravity or weight per piece. In other cases, the quantities are estimated on the basis of value and corresponding unit volume price. As price and quantitative information is available for exports in almost all product balances based on the foreign trade statistics, the unit volume prices are typically calculated on the basis of the proportionality between the basic price and the weight of the exported item.

13.104 Thus, all cells for resource flows, all cells for imports and exports and domestic production and most cells for residual flows can initially be filled out by using the physical data sources as described above. By contrast, with a few exceptions, it is not possible to fill out the various domestic uses of products from the basic data. Those exceptions include agricultural products and energy products, where reliable data on the uses can be found in many cases.

13.105 Figure 13.5 shows the various stages in transforming basic data and statistics into PSUTs.

**Figure 13.5 From source data to PSUTs**




## Balancing the PSUTs

13.106 It is a fundamental principle of accounting that the flow of materials (natural resources, products and residuals) into a single industry or into households must be precisely matched by a corresponding accumulation or flow from the industry or household group.

13.107 Although the initial filling out and estimations ensure that, for each product, the total supply equals total use, there is no guarantee that the material balance for the industries and households in question actually exists.

13.108 For each of the 117 industries and the households represented in the PSUTs, it is therefore necessary to adjust the inputs or outputs until a complete balance between material inputs and outputs (including accumulation) is obtained.

13.109 The balancing is undertaken, among other factors, in the light of information on the technical production conditions in the industries, obtained from different technical reports and additional statistical information. In addition to this, it is necessary, in a very large number of cases, to use estimates and common-sense considerations.

13.110 The reconciliation of the inputs and outputs in the Danish PSUTs system is carried out for 11 subgroups of materials (natural resources, products and residuals) corresponding to relatively similar or coherent groups of materials, for which there is an apparent connection between inputs and outputs. The groups are: energy, agricultural products, glass, metallic minerals, construction minerals, plastic, wood and paper, rubber, chemical products and fertilizers, lubricants and oil waste, and other materials.

13.111 The 11 individual sub-P SUT systems are reconciled before a final reconciliation of the total PSUTs takes place, because it is easier and more logical to focus on inputs and outputs of products that are physically connected through the production processes. For example, when the sub-physical SUTs for energy are reviewed, these will include the input flows of natural gas, crude oil and biomass used for energy production, all energy products and energy-related residuals, while all other products are excluded. The energy-related residual flows comprise air emissions of carbon and sulphur, other energy-related air emissions and solid waste of fly ash and, for instance, desulphurization products, and others.

13.112 For other groups besides energy, there are in practice certain links between them, for example, inputs of chemical products and fertilizers are used in relation to the production of animal and crop products. The existence of these links between the different groups means that it is not possible to make a complete balance within one single group, and instead an interim balancing item is introduced for each subgroup in the system (except for energy). When positive for an industry, this artificial residual represents a net input of materials belonging to other groups in the industry. When negative, this means that the industry delivers products of the specific material type to be used as inputs for the production of products of another material type.

13.113 If the balancing of the 11 subgroups is carried out with complete accuracy, the individual balancing items will cancel each other out when they are added up. In practice this is not the case, since the balancing items will also include uncertainties and inconsistencies introduced during the initial phases and balancing processes. Accordingly, it is necessary to make a final balancing to ensure that the artificial residuals sum to zero.

13.114 Table 13.10 shows a numerical example of PSUTs for Denmark for the year 2009 (it should be noted that the data in Table 13.10 were preliminary). The supply table shows that 104.9 million tons of natural inputs were extracted from the environment in Denmark. All these inputs were used by Danish industries. In all, 295.5 million tons of products were supplied, of which 232.6 million and 62.9 million tons were Danish output and imports, respectively. The 295.5 million tons of products were used as follows: 176.4 million tons were used for intermediate consumption by industries; 18.9 million tons were used in household consumption; 62.0 million tons were used for gross capital formation; and 38.3 million tons were exported. Industries generated 48.7 million tons of residuals and households 18.9 million tons of residuals.

**Table 13.10 PSUTs in Denmark**

Physical supply table — 1000 tons

| | Industries | Housholds | Govern-ment | Accu-mulation | Rest of the world | Environ-ment | Total supply |
|---|---|---|---|---|---|---|---|
| Natural inputs | | | | | | 104 965 | 104 965 |
| Products | 232 603 | | | | 62 901 | | 295 505 |
| Residuals | 48 732 | 18 867 | | | | | 67 600 |
| Total | 281 336 | 18 867 | | | 62 901 | 104 965 | 468 069 |

Physical use table — 1000 tons

| | Industries | Housholds | Govern-ment | Accu-mulation | Rest of the world | Environ-ment | Total supply |
|---|---|---|---|---|---|---|---|
| Natural inputs | 104 965 | | | | | | 104 965 |
| Products | 176 370 | 18 867 | | 61 958 | 38 309 | | 295 505 |
| Residuals | | | | | | 67 600 | 67 600 |
| Total | 281 335 | 18 867 | | 61 958 | 38 309 | 67 600 | 468 069 |

Denmark 2009 = Grey cells are null by definition.

13.115 The use table shows that all these residuals go into the environment. Following the SEEA Central Framework conventions, residuals that are sent to controlled landfills should be recorded as accumulation in the economy, but for these simplified Danish SUTs they are not recorded as such.

13.116 Table 13.10 also shows that the basic bookkeeping identities covered above are all fulfilled. For accumulation, rest of the world and environment, there is no balance between supply and use of products, but when all three items are considered together, the total supply equals total use. This indicates that, in 2009, Danish imports exceeded Danish exports and that the extraction of natural inputs from the environment exceeded the amount of residuals that were returned to the environment. In this way the exchange of materials between the Danish economy and the rest of the world, plus nature, showed a surplus of 62.0 million tons of material. This amount is exactly equal to the accumulation of materials in the economy as shown in the column for accumulation.

## 2. PSUTs in the Netherlands

13.117 The PSUTs compiled by Statistics Netherlands are fully in line with the standards set out by SEEA. The starting point for the PSUTs is the balanced SUTs, compiled as part of the national accounts. While the physical flows have a monetary value, the flows without a monetary value are added on (for example natural inputs, waste and emissions). The integration of all physical flows in the PSUTs generates a consistent and coherent set of data which are also consistent with the monetary information contained in the monetary SUTs of the SNA. As a consequence, such economic variables as labour and GVA can be analysed in combination with the physical data shown in the PSUTs. Statistics Netherlands regularly compiles SUTs, IOTs and PSUTs, but not physical IOTs.

### (a) Structure of the PSUTs for the Netherlands

13.118 The PSUTs follow as closely as possible the structure and classifications of the SUTs. One important difference between the SUTs and PSUTs is that the PSUTs also include the physical flows that do not have a monetary value. In the supply table, air emissions and waste are recorded (the former under the heading balancing item in the example below). In the use table, recycled waste and extraction from the environment are taken into account. In addition, a balancing item is introduced in order to achieve the material balance at the industry level, which consists of items such as emissions other than carbon dioxide, the supply and use of water, and others.

13.119 Table 13.11 shows an example of the SUTs for the Netherlands for 2010 and Table 13.12 shows the corresponding PSUTs for the same year.

# Table 13.11 SUTs for the Netherlands, 2010

Supply table at basic prices

Million Euro

| | | | INDUSTRIES | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Agriculture (1) | Manufacturing and construction (2) | Services (3) | Total (4) | Imports (5) | Total supply at basic prices (6) |
| PRODUCTS | Agriculture | (1) | 25 299 | 153 | 41 | 25 493 | 13 900 | 39 393 |
| | Manufacturing | (2) | 1 230 | 282 553 | 35 780 | 319 563 | 301 843 | 621 406 |
| | Construction | (3) | 70 | 84 922 | 4 676 | 89 668 | 1 521 | 91 189 |
| | Trade, transport and communication | (4) | 565 | 15 375 | 222 573 | 238 513 | 20 319 | 258 832 |
| | Finance and business services | (5) | 477 | 7 803 | 274 997 | 283 277 | 50 908 | 334 185 |
| | Other services | (6) | 312 | 2 531 | 219 567 | 222 410 | 16 366 | 238 776 |
| | Total | (7) | 27 953 | 393 337 | 757 634 | 1 178 924 | 404 857 | 1 583 781 |
| | CIF/FOB adjustments on imports | (8) | | | | | - 3 272 | - 3 272 |
| | Direct purchases abroad by residents | (9) | | | | | | |
| | Total | (10) | 27 953 | 393 337 | 757 634 | 1 178 924 | 401 585 | 1 580 509 |

Use table at basic prices

Million Euro

| | | | INDUSTRIES | | | | FINAL USE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Final consumption expenditure | | | | | | | |
| | | | Agriculture (1) | Manufacturing and construction (2) | Services (3) | Total (4) | Households (5) | NPISH (6) | General government (7) | Gross fixed capital formation (8) | Changes in inventories (9) | Exports (10) | Total (11) | Total use at basic prices (12) |
| PRODUCTS | Agriculture | (1) | 4 679 | 13 686 | 1 152 | 19 517 | 2 461 | | | 161 | 168 | 17 086 | 19 876 | 39 393 |
| | Manufacturing | (2) | 7 921 | 153 180 | 47 758 | 208 859 | 54 468 | | 5 373 | 39 357 | 3 775 | 309 574 | 412 547 | 621 406 |
| | Construction | (3) | 292 | 23 573 | 17 370 | 41 235 | 399 | | 522 | 46 786 | | 2 247 | 49 954 | 91 189 |
| | Trade, transport and communication | (4) | 1 790 | 31 077 | 73 293 | 106 160 | 62 054 | 860 | 3 725 | 10 673 | 77 | 75 283 | 152 672 | 258 832 |
| | Finance and business services | (5) | 2 052 | 41 219 | 152 096 | 195 367 | 74 771 | 5 | 3 546 | 13 442 | | 47 054 | 138 818 | 334 185 |
| | Other services | (6) | 169 | 3 429 | 20 925 | 24 523 | 50 518 | 4 451 | 153 957 | 461 | 285 | 4 581 | 214 253 | 238 776 |
| | Total at basic prices | (7) | 16 903 | 266 164 | 312 594 | 595 661 | 244 671 | 5 316 | 167 123 | 110 880 | 4 305 | 455 825 | 988 120 | 1 583 781 |
| | Taxes less subsidies on products | (8) | 222 | 1 493 | 13 791 | 15 506 | 32 523 | | 109 | 13 769 | 3 | 1 845 | 48 249 | 63 755 |
| | Total | (9) | 17 125 | 267 657 | 326 385 | 611 167 | 277 194 | 5 316 | 167 232 | 124 649 | 4 308 | 457 670 | 1 036 369 | 1 647 536 |
| | CIF/FOB adjustments on exports | (10) | | | | | | | | | | - 3 272 | - 3 272 | - 3 272 |
| | Direct purchases abroad by residents | (11) | | | | | | | | | | | | |
| | Purchases on the domestic territory by non-residents | (12) | | | | | | | | | | | | |
| | Total at purchasers' prices | (13) | 17 125 | 267 657 | 326 385 | 611 167 | 277 194 | 5 316 | 167 232 | 124 649 | 4 308 | 454 398 | 1 033 097 | 1 644 264 |
| GVA | Compensation of employees | (14) | 2 603 | 59 807 | 248 061 | 310 471 | | | | | | | | 310 471 |
| | Other taxes *less* subsidies on production | (15) | - 537 | - 106 | - 337 | - 980 | | | | | | | | - 980 |
| | Consumption of fixed capital | (16) | 3 660 | 20 186 | 83 136 | 106 982 | | | | | | | | 106 982 |
| | Net operating surplus | (17) | 5 102 | 45 793 | 100 389 | 151 284 | | | | | | | | 151 284 |
| | GVA | (18) | 10 828 | 125 680 | 431 249 | 567 757 | | | | | | | | 567 757 |
| | Total | (19) | 27 953 | 393 337 | 757 634 | 1 178 924 | 277 194 | 5 316 | 167 232 | 124 649 | 4 308 | 454 398 | 1 033 097 | 2 212 021 |

= Grey cells are null by definition.

Netherlands 2010

## Table 13.12 PSUTs for the Netherlands, 2010

Physical supply table — Million kilogram

| | | | INDUSTRIES | | | | Households | Accumulation | Imports | Flow from environment | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing and construction | Services | Total | | | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| PRODUCTS | Agriculture | (1) | 43 592 | 31 | | 43 623 | | | 26 779 | | 70 402 |
| | Manufacturing | (2) | 182 | 334 216 | 16 345 | 350 743 | | | 328 027 | | 678 770 |
| | Construction | (3) | | | | | | | | | |
| | Trade, transport and communication | (4) | | | | | | | | | |
| | Finance and business services | (5) | | | | | | | | | |
| | Other services | (6) | | | | | | | | | |
| | Total | (7) | 43 774 | 334 247 | 16 345 | 394 366 | | | 354 806 | | 749 172 |
| | Waste | (8) | 74 596 | 50 944 | 5 136 | 130 676 | 9 297 | 6 059 | 15 350 | | 161 382 |
| | Extraction | (9) | | | | | | | | 143 679 | 143 679 |
| | Balancing item | (10) | 75 143 | 258 891 | 88 265 | 422 299 | 85 219 | | | 282 455 | 789 973 |
| | Total | (11) | 193 513 | 644 082 | 109 746 | 947 341 | 94 516 | 6 059 | 370 156 | 426 134 | 1 844 206 |

Physical use table — Million kilogram

| | | | INDUSTRIES | | | | Households | Accumulation | Exports | Re-exports | Flow to environment | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agriculture | Manufacturing and construction | Services | Total | | | | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| PRODUCTS | Agriculture | (1) | 5 957 | 41 879 | 1 875 | 49 711 | 2 437 | 216 | 10 197 | 7 841 | | 70 402 |
| | Manufacturing | (2) | 17 955 | 292 152 | 47 582 | 357 689 | 31 280 | 7 573 | 184 069 | 98 159 | | 678 770 |
| | Construction | (3) | | | | | | | | | | |
| | Trade, transport and communication | (4) | | | | | | | | | | |
| | Finance and business services | (5) | | | | | | | | | | |
| | Other services | (6) | | | | | | | | | | |
| | Total | (7) | 23 912 | 334 031 | 49 457 | 407 400 | 33 717 | 7 789 | 194 266 | 106 000 | | 749 172 |
| | Waste | (8) | 76 602 | 68 068 | | 144 670 | | 1 495 | 15 217 | | | 161 382 |
| | Extraction | (9) | 38 778 | 101 095 | 3 806 | 143 679 | | | | | | 143 679 |
| | Balancing item | (10) | 54 221 | 140 888 | 56 483 | 251 592 | 60 799 | 101 610 | | | 375 972 | 789 973 |
| | Total | (11) | 193 513 | 644 082 | 109 746 | 947 341 | 94 516 | 110 894 | 209 483 | 106 000 | 375 972 | 1 844 206 |

= Grey cells are null by definition.

Netherlands 2010

## Transformation from SUTs to PSUTs

13.120 The starting point for the compilation of PSUTs (in kilograms) is the balanced SUTs valued at basic prices. In addition to the data used for the SUTs, there are several data sources available covering prices and quantities. The most important sources are:

- Foreign trade statistics
- Data on output of manufacturing
- Data on intermediate use from business statistics (limited)
- Scanner data from supermarkets
- Price information from branch organizations and dedicated research institutes (mainly with regard to agriculture)

- Quantity data on energy and energy-related products from the energy accounts

13.121 Following the approach of Konijn, de Boer and van Dalen (1995), the initial estimates for the physical use of products are compiled by applying import prices to the monetary use table. The physical supply is initially estimated by applying export prices to the monetary supply table. The justification for this is that a large share of the domestic production of goods is exported, while a large share of the use of goods is imported.

13.122 If specific data are available, these initial estimates are overruled in the next step. The business statistics dedicated to the composition of output provide information on prices and quantities of the supply of goods for manufacturing at the three-digit or four-digit level of NACE Revision 2. This information is especially useful in cases where the products are not homogeneous, leading to a difference in prices among industries. It may also happen that differences in quality between products lead to differences in prices. For example, meat produced by slaughterhouses will probably be of a different quality than meat produced by the food-processing industry. As a consequence, there will be a difference in price levels between the meat products emanating from these two industries.

13.123 For a limited number of industries, price information for the intermediate inputs is available and this can be used to overrule the initial physical estimates based on import prices. Additional price information collected by branch organizations and research institutes is also used. The most important examples cover price data for agricultural products; together with harvest estimates, these provide a sound base for estimating the physical flows in this area.

13.124 Scanner data provided by supermarkets are a valuable source of information for the transformation of the whole or part of the consumption of households into physical units.

13.125 In addition to the price information, the physical information observed is used in compiling the PSUTs. This mainly covers the data on agriculture and energy (crude oil, fuel, natural gas, electricity, and other forms of energy). Data on energy are derived from energy accounts.

13.126 Through the application of this information on balanced SUTs, PSUTs for all relevant products may be prepared, even though these PSUTs are not balanced.

13.127 In addition to the physical flows for supply and use of products, the physical flows for materials not having a monetary value are included. These mainly concern flows between the economy and the environment, such as air emissions, extraction of natural resources, the input of oxygen in combustion processes and waste. Adding these flows will make it possible to analyse the balance of physical input and physical output at the industry level. Emission and waste statistics are the main sources for making initial estimates for these physical flows. The items mentioned only cover parts of the non-monetary flows; the extraction of water by the production of beverages, for example, is missing. When the PSUTs are balanced, the adjustments for these missing items are made.

## Accumulation

13.128 On the supply side the material flows are incorporated, resulting from the reduction of physical stocks of products. Examples include the growing availability of physical residuals due to the demolition of machines and buildings and air emissions from controlled landfills. A distinction is made between types of waste, such as the waste resulting from a production process and the waste resulting from scrap of capital goods, for example.

13.129 On the use side, the additions to the capital stock (gross fixed capital formation, both monetary and physical) and the accumulation of waste in landfills are taken into account. As the estimates of the accumulation part of the PSUTs are not straightforward, they form a less reliable part of the PSUTs.

## Balancing the PSUTs

13.130 The initial estimates of the PSUTs are not balanced – neither at product level (rows) nor at industry level (columns). There are several causes underlying the inconsistencies between the supply and use of products in the PSUTs. As observed previously, products which are not homogeneous can give rise to inconsistencies because the prices may differ significantly between the various producing and using industries. The assumption that output is mainly exported and intermediate use is mainly imported is not always valid. When significant parts of domestic output are used domestically, inconsistencies are likely to appear. Lastly, some of the source data could be inaccurate.

13.131 The balancing of the PSUTs has three steps:

- Detection and balancing of major inconsistencies at the product level
- Detection and balancing of major discrepancies between input and output in physical terms by industry
- Automated balancing of minor inconsistencies

13.132 During the balancing at the product level, major inconsistencies between supply and use on a product level are resolved by analysing the link between the physical volumes of outputs and the physical volumes of inputs (for example the number of cattle entering the slaughterhouses and the volume of meat produced). In this stage, the input from the branch specialists is used in judging the plausibility of the results.

13.133 In the balancing of the input and output in physical terms by industry, the material flows to and from the environment are taken into account. In the supply table, the carbon dioxide and water emissions in combustion processes are taken into account. In the use table, the oxygen necessary for combustion is recorded. A specific estimate is made for nitrogen ($N_2$) extracted from the air in producing ammonia. Estimates for the other emissions to the air or water are not made because they are relatively small compared to carbon dioxide emissions. The above mentioned items, excluding carbon dioxide emissions resulting from combustion, are recorded as part of the balancing item with the industries in the PSUTs.

13.134 In addition to the above mentioned flows, the balancing item consists of the water content of products. The production of beverages has a relatively low intermediate input of raw materials because the main input is water, which is extracted from the environment.

13.135 The opposite can also happen in that the water content is reduced in the production process. In the PSUTs for the Netherlands, separate estimates are made for the water content of products, and, in this way, the estimates by industry are made on whether the balance of the water is supplied to or extracted from the environment. This information is used to judge the plausibility of the balancing items by industry.

13.136 In many cases, a balancing item is necessary for those types of industries where services are produced but where a considerable proportion of inputs consist of goods, for example restaurants and pubs. A meal in a restaurant is recorded as a service, while the inputs are goods and services.

13.137 In the construction industry, the physical estimate of output is relatively low because no direct estimate is made of the physical value of dwellings, buildings, roads, etc. as a consequence of a lack of data. The physical output for construction is accounted for in the balancing item in the supply table.

13.138 As a consequence, the theoretical contents of the balancing item may vary greatly between industries.

13.139 The remaining minor inconsistencies are balanced using an automated balancing procedure similar to the approach used for balancing the SUTs, as covered in chapter 11 of this Handbook.

# Chapter 14. Supply and use tables and quarterly national accounts

## A. Introduction

14.1 The previous chapters of this Handbook focused primarily on the compilation of annual SUTs. SUTs can also play an important role, however, in the compilation of quarterly national accounts, by ensuring the consistency and coherence of the estimation of the accounts.

14.2 Although the ideal scenario is for SUTs to be compiled and published on a quarterly basis and benchmarked with the annual SUTs, this is often difficult to achieve, owing, for example, to data unavailability, lack of human and financial resources and time constrains. Nonetheless, quarterly SUTs provide a key tool for the compilation of quarterly national accounts or as a minimum a validation tool of such accounts.

14.3 For both quarterly and annual SUTs, an integrated approach to balancing in current prices and in volume terms and also at basic prices and at purchasers' prices will ensure a high degree of consistency and coherence.

14.4 The present chapter provides an overview of ways in which SUTs can be used to improve the quarterly national accounts. Since there are various scenarios that can be used in practice, this chapter focuses only on three main situations which represent the use of SUTs in various degrees in the compilation of the quarterly national accounts.

14.5 A progressive approach could be implemented whereby the annual SUTs are first used to improve the quarterly national accounts, then the quarterly supply and use of product-based models are put in place to edit and validate the quarterly national accounts and, lastly, quarterly balanced SUTs are compiled and published when appropriate data sources and validation processes are developed.

14.6 Section B of this chapter provides a general overview of the quarterly national accounts and the main differences between their compilation and that of annual national accounts, in respect of data sources, revisions, timings, level of detail and other characteristics, and the issue of benchmarking the quarterly national accounts with the annual national accounts. Section C describes in more detail the uses of SUTs in the compilation of the quarterly national accounts. Reference sources that provide additional detail include: Eurostat (2013b) Handbook on Quarterly National Accounts and the IMF (2017) Quarterly National Accounts Manual.

## B. Quarterly national accounts

14.7 The quarterly national accounts constitute a system of integrated quarterly time series coordinated through an accounting framework. The quarterly national accounts adopt the same principles, definitions and structure as that applied in the annual national accounts. In principle, the quarterly national accounts cover the entire sequence of accounts and balance sheets in the SNA. In practice, the constraints of data availability, time, and resources mean that the quarterly national accounts are usually less complete than their annual counterparts.

14.8 The main purpose of the quarterly national accounts is to provide a picture of current economic developments much more quickly than the annual national accounts and more comprehensive than those provided by individual short-term indicators. Thus, the quarterly national accounts may be seen as positioned between the annual national accounts and specific short-term indicators in many of these purposes. The quarterly national accounts are commonly compiled by combining annual national account data with short-term source statistics and annual national account estimates (for example, benchmarked to annual estimates).

14.9 In general, in the identification of sources and design of methods, the same principles apply to both the annual and the quarterly national accounts. The quarterly national accounts data sources are generally more limited, however, in detail and coverage than those available for the annual national accounts because of issues of data availability, collection cost, and timeliness and this may affect the level of detail of the quarterly national accounts. Some compilation issues that are more pertinent to the compilation of either the short-term indicators or the quarterly national accounts include:

- Monthly or quarterly type adjustments (for example, working days, trading days, moving holidays, leap years, etc.)
- Seasonal adjustment (for example, handling annual sale periods, use of autoregressive integrated moving average (ARIMA) models, trend cycle estimation)
- Quarterly chain-linked volume estimates
- Deriving estimates of quarterly variables consistent with annual benchmarks
- Smoothing
- Forecasting and nowcasting

14.10 In addition, the compilation of the quarterly national accounts is not to be considered in isolation but as a consistent and coherent part of the annual national accounts process and part of a time series. This will entail additional work in the compilation of the quarterly national accounts to benchmark the quarterly national accounts with the annual national accounts, on the one side, and to revise previous quarters as more information becomes available, on the other. Issues with the data sources and benchmarking are further considered below.

### 1. Data sources

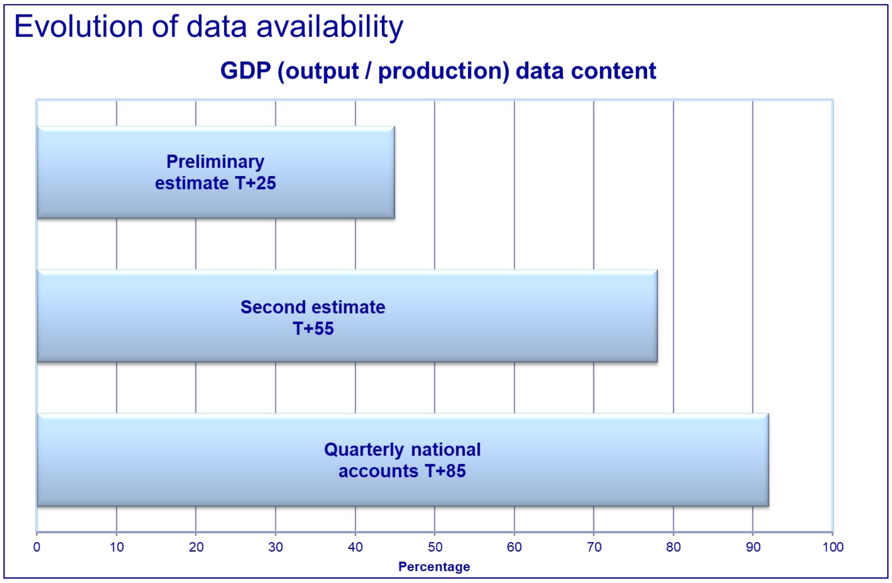
14.11 Ideally, the same data sources used for the annual estimates of GDP should be used for the quarterly estimates. This is often not possible, however, because the data are not available on a quarterly basis (in other words, detailed breakdowns are not available) or less timely, and, when they are available, the higher frequency data may be less accurate and reliable.

14.12 For example, the present practice in the United Kingdom for early GDP data releases is as follows:

- First (preliminary) estimate of United Kingdom GDP is released some 25 days after the quarter.
- Second estimate of the GDP is released some 55 days after the quarter.
- Third estimate of the GDP is released some 85 days after the quarter, together with the full quarterly national accounts, balance of payments and the institutional sector non-financial and financial accounts.

14.13 The first estimate of United Kingdom GDP contains a mix of collected data (for example, data from business surveys and administrative data) and data based on forecasts and nowcasts to complete the picture. Here the short-term indicators play a key role. The first estimate is heavily based on the production (or output) approach to measuring GDP using proxies to estimate output and an assumption that GVA moves in line with output in the short-term. At this stage, there are very limited data underlying the expenditure approach to measuring GDP. With the move to the second estimate and through to the third estimate, more and more data become available replacing the earlier forecasts of missing data for both approaches. By the time the third estimate is produced, there are also some data available for the income approach to measuring GDP.

**Figure 14.1 Quarterly GDP production (output) aggregate: data availability and estimation in the United Kingdom**




14.14 Figure 14.1 shows how the quarterly data underlying the production (output)-based aggregate evolve over time, in which process the collected data replace early forecasts and nowcasts of missing data. Similarly, Figure 14.2 shows how the underlying components of the expenditure approach to measuring GDP evolve over time.

**Figure 14.2 Quarterly GDP expenditure components: data availability and estimation in the United Kingdom**

| Expenditure GDP | 1st estimate 25 days | 2nd estimate 55 days | 3rd estimate 85 days | 1st annual Sum of four quarters | 2nd annual Benchmarking and annual SUTs |
|---|---|---|---|---|---|
| Households + NPISHs | | 45% | 85% | 100% R | 100% B |
| General government | | 60% | 60% | 100% R | 100% B |
| GFCF + valuables | | 55% | 80% | 100% R | 100% B |
| Changes in inventories | | 65% | 85% | 100% R | 100% B |
| Net exports of goods | | 100% | 100% | 100% R | 100% B |
| Net exports of services | | 60% | 80% | 100% R | 100% B |
| **Total** | Limited data | 60% | 80% | 100% R | 100% B |

R = revised
B = benchmarked

14.15 Many countries have monthly and quarterly surveys collecting a wide-range of economic information but generally not with the same level of detail or coverage of the corresponding annual surveys. Various totals may be collected but no breakdowns, for example, total turnover may be collected but not with a product breakdown. Thus the structure of the last annual SUTs (preferably in volume terms) or the last dataset collected helps to provide the ratios and percentages needed to break down the totals to be carried forward in the compilation process prior to any quarterly balancing process.

14.16 Similarly, administrative data, where available, can also be used in the quarterly national accounts. Some administrative data, however, may not be timely enough for the quarterly national accounts, such as, for example, labour costs or self-employment incomes.

14.17 The quarterly national accounts may therefore be less accurate than the more comprehensive annual national accounts for a number of reasons, including the following:

- Less information is available on a quarterly basis than on an annual basis and there is more reliance on proxy indicators.
- The basic quarterly statistics are often less robust than the annual equivalents (for example, the annual data may be available through annual audited accounts).
- The sample sizes in the quarterly business surveys are smaller.

- There are greater sample and non-sample errors in the data sources.

- Balancing is not completed through quarterly SUTs, whereas the SUTs framework may be applied annually.

14.18 It is therefore important to have a framework that allows for the confrontation of the different data sources and their reconciliation. The SUTs framework allows for the analysis and reconciliation of data inconsistencies thanks to which a coherent picture is provided of GDP and its components.

## 2. Data reconciliation, benchmarking and revisions

14.19 An important step in the compilation of the quarterly national accounts is the benchmarking of these accounts with the annual national accounts when the latter become available. This is a necessary step to ensure that the quarterly national accounts are consistent with the annual accounts and with the short-term evolution of quarterly indicators. Benchmarking refers to the procedures used to maintain consistency among the time series available at different frequencies (in this case, annual and quarterly) for the same target variable.

14.20 The need to synchronize the implementation of major revisions including benchmarking was briefly covered in chapter 11. These exercises should, in particular, be implemented, compiled and balanced through a SUTs framework both in current prices and volume terms and also at basic prices and at purchasers' prices.

14.21 Since quarterly data sources are not of the same quality as the equivalent of the annual data sources (for reasons already mentioned above, such as smaller survey samples, coverage, and others), benchmarking usually consists of adjusting quarterly data to match annual (or quinquennial) benchmarks. Once the quarterly national accounts have been benchmarked with the annual national accounts, both the quarterly and the annual national accounts are consistent in the sense that the annual accounts are the sum (or the average) of the quarterly accounts.

14.22 Before the benchmarking exercise is undertaken, a separate reconciliation exercise should be considered, requiring dedicated resource and time. This involves reconciling the data from the short-term and quarterly survey source and the annual source. For example, the annual growth rate and current price level for, say, turnover, should be aligned. The same reconciliation principle before benchmarking applies to all other variables (for example, gross fixed capital formation, purchases of goods and services, and others) where such a link exists across short-term, quarterly and annual surveys. In a sense, this reconciliation process improves the quality of source data and, in turn, lessens the full impact of the automatic benchmarking focus, thereby helping to reduce the need for future revisions. Use of this investigative and reconciliation approach may mean that the short-term and quarterly survey source estimates should be changed, or the annual survey estimates changed or a combination of both. This process will help to ensure that the highest quality source estimate is used for benchmarking and may mean that this estimate is different from that which would have been generated via a direct benchmarking approach without this reconciliation step.

14.23 In the quarterly national accounts, benchmarking serves two purposes:

- Quarterly distribution (or interpolation) of annual data to construct time series of benchmarked quarterly national accounts estimates (referred to as "back series")
- Quarterly extrapolation to derive the quarterly national accounts estimates for quarters for which annual national accounts benchmarks are not yet available ("forward series")

14.24 Various techniques are used to benchmark the quarterly national accounts to the annual national accounts. These include, for example, pro rata benchmarking methods, the proportional Denton methods, the proportional Cholette-Dagum method with first-order autoregressive error (which incorporate the Chow-Lin methods (Chow and Lin, 1971) and its variants as particular cases), and others. The IMF Quarterly National Accounts Manual (IMF 2017) provides a detailed review of these methods. The forthcoming Handbook on Backcasting (United Nations, forthcoming) provides guidance on backcasting time series in national accounts.

14.25 It should be noted that it is highly important to capture rapid changes in the economy within quarterly periods (or annual periods) which may go unnoticed in the annual or five-yearly structural statistics. For example, with the impact of globalization, the advent of new industries and products, rapid technological change and other developments, it is recommended that data on sales and purchases are collected more regularly through business surveys. This will ensure that structural change is picked up quickly and will reduce reliance on modelled results that depict smooth series.

14.26 By collecting more data it will be possible to ensure that key structural changes are not overlooked within a given year. Even such traditional industries as electricity, gas, oil and the like change their input structures rapidly. For example, changes such as privatization (for example, leading to the non-consolidation of the electricity and gas industries, by separating such functions as generation, transmission, distribution and supply), the use of environmentally more friendly inputs (for example, the use of gas or nuclear fuel by the electricity industry, as opposed to coal), the contracting out of certain processes (for example, billing services), and others. Much more detail should be collected on, for example, an annual basis and perhaps only control totals need to be collected on a quarterly basis, which assume the same structural breakdowns as in the previous annual configuration.

14.27 In general, the incorporation of new annual data for one year requires the revision of previously published quarterly data for several years in order to avoid introducing distortions in the series. Similarly, the annual benchmarking of previously published quarterly national accounts estimates can generate revisions to the quarterly data. In principle, previously published quarterly national accounts estimates for all preceding and following years may have to be adjusted to ensure that the short-term movements are preserved as far as possible. In practice, however, with most benchmarking methods, the impact of new annual data will gradually diminish and approach zero for sufficiently distant periods. It is also worth noting that the first estimates of the annual national accounts tend to be based on the annualized quarterly accounts, which, through such processes as, for example, seasonal adjustments, may change previously published quarterly estimates.

14.28 Ideally, revisions to quarterly indicators should be incorporated in the quarterly national accounts series as soon as possible to reflect the most up-to-date short-term information available. This is particularly relevant for the forward series, which should immediately incorporate revisions to preliminary values of the indicators for the previous quarters on the basis of more up-to-date and comprehensive source data. If revisions to preliminary information in the current year are disregarded, the quarterly national accounts may easily lead to biased extrapolations for the subsequent periods. For the back series, revisions to previous years of the indicator should be reflected in the quarterly national accounts series at the time when revisions to new or revised annual national accounts benchmarks are incorporated and they should be implemented through the SUTs framework.

14.29 The benchmarking (and revisions) of the quarterly national accounts with the annual national accounts is an important aspect to consider for the compilation of quarterly SUTs. In fact, when quarterly SUTs are compiled, these should also be benchmarked with the annual SUTs in order to provide a consistent set of figures on a quarterly and annual basis. The techniques used for the benchmarking and revisions are largely similar to those used for the quarterly national accounts.

## C. SUTs and quarterly national accounts

14.30 Quarterly GDP is typically calculated by aggregating a limited number of components, derived either from the production side (in other words, the GVA of economic activities plus net taxes on products), from the expenditure side (consumption plus capital formation plus net exports), or from the income side, although this last is less common. In most countries, the production approach is the preferred approach for deriving the official quarterly GDP measure. The production-based GDP is then used as a predetermined variable in the expenditure decomposition. This situation generally has two consequences: the first is that one of the expenditure items is derived residually (such as changes in inventories or household consumption); the second is that statistical discrepancies are presented as a residual item between the production-based GDP and the sum of the expenditure components. Either way, the inconsistencies between expenditure and production components are not properly investigated and addressed. As a result, the quality of the quarterly GDP estimate may be compromised.

14.31 One way of achieving consistent quarterly GDP data at a detailed product level is to compile quarterly SUTs. A set of SUTs is considered the best framework for GDP compilation in the 2008 SNA, at any frequency. Some countries with sophisticated national accounts systems derive their official quarterly GDP from quarterly SUTs (for example, the Netherlands compiles quarterly SUTs). In effect, the main advantage of using the SUTs framework is that it helps to fill data gaps of specific items with missing information, which could be a very complicated task in a quarterly national accounts system based on aggregate variables. The development of a quarterly SUTs system may, however, be extremely demanding in terms of resources. Countries should be aware that the preconditions for the successful development of quarterly SUTs include having a well-established system of annual SUTs; sophisticated staff with significant SUTs and national accounts skills and expertise; and a willingness to revolutionize the existing quarterly national accounts compilation system. There are four sets of quarterly SUTs that should – or could – be compiled:

- SUTs in current prices, unadjusted
- SUTs in previous years' prices, unadjusted
- SUTs in current prices, seasonally adjusted
- SUTs in previous years' prices, seasonally adjusted

14.32 Even if data for quarterly SUTs are not available in a comprehensive framework, a partial version in the form of product balances for particular products can provide some of the benefits of SUTs for balancing. The validation process of quarterly national accounts is performed by means of a simplified quarterly supply-use model derived on the basis of assumptions from the most recent annual SUTs. Some countries use apply the SUTs framework on a quarterly basis typically at a less detailed level than annually and as a compilation and validation tool where the detailed results are not intended for publication.

14.33 The main advantage of using SUTs in the process of validating the quarterly GDP is that inconsistencies calculated at the aggregate level can be transformed into detailed imbalances between total supply and total use of specific products (or between total output and total input of specific economic activities, if the fixed input-output ratio assumption is relaxed). This detailed view makes it possible to pinpoint the major sources of inconsistencies and enables compilers to identify the most critical areas of intervention. The editing process should be reiterated until the quarterly GDP data show a satisfactory degree of consistency in the quarterly supply-use model.

14.34 This validation tool can be helpful in assessing the consistency of both quarters that are benchmarked to closed years, and quarters that are extrapolated from the latest annual benchmark. Although the quarterly data are benchmarked to consistent annual data, they may still lack consistency at the quarterly level owing to seasonal effects, outliers, and other sub-annual effects. These effects may introduce distortions in the measurement of short-term changes of GDP, with possible consequences for the determination of business cycle turning points. In extrapolation, a supply-use model for validation can be particularly useful in verifying that the quarterly aggregate GDP figures are internally consistent.

14.35 There are three main ways in which the SUTs framework can be used for the compilation of quarterly national accounts and described in the following section of this chapter. They comprise the following measures:

- Use of annual SUTs with a product-flow method for the compilation of quarterly national accounts
- Use of a partial quarterly SUTs-based model to validate quarterly national accounts
- Compilation of quarterly balanced SUTs to underpin the compilation of quarterly national accounts

14.36 Country practices may use different variations of these methods but the main considerations presented here are still valid.

### 1. Annual SUTs and the quarterly national accounts

14.37 When only annual SUTs are available, they can be used in aid to the compilation of quarterly national accounts in combination of a product-flow method. The product-flow method essentially consists of a simple form of the SUTs but requires much less and up-to-date information. This is in contrast with the SUTs which require full information on the supply of products which come from both domestic production and imports and on the uses of products for their own production (i.e. intermediate consumption), final consumption, gross capital formation and exports. The product-flow approach, based on the SUTs, requires a bridge between basic prices and purchasers' prices.

14.38 The annual SUTs are used to derive ratios that are applied to quarterly totals or to make extrapolation. In the Federal Statistical Office of Germany, the product-flow method is used in the calculation of gross fixed capital formation in machinery and equipment. The domestic supply is first determined from base statistics with a detailed breakdown of goods. By applying capital formation ratios (from the previous SUTs or IOTs) and adding some supplementary information and adjustments, machinery and equipment can be derived from this. The product-flow method is mainly based on sources that are available on a quarterly basis, for example, the production statistics, or even on a monthly basis, for example, turnover surveys and foreign trade statistics. As a result, the up-to-date quarterly accounts follow the flow pattern from the annual accounts. The quarterly results may be aggregated to form annual results. Gross fixed capital formation in machinery and equipment is determined at a very fine level of product disaggregation as the difference between product supply (production plus imports) and exports.

14.39 Table 14.1 demonstrates the type of information required to balance the supply and the use of products (goods and services) at purchasers' prices. Any differences have to be allocated to the supply of goods and services or the use of goods and services or both.

**Table 14.1 Balancing supply and use of products**

| No | Code | PRODUCTS \ CATEGORIES | Output at basic prices | Imports CIF | Trade margins | Transport margins | Taxes on products | Subsidies on products | Supply at purchasers' prices | Intermediate consum[tion | Final consumption expenditure by households | Final consumption expenditure by NPISH | Final consumption expenditure by government | Gross fixed capital formation | Changes in valuables | Changes in inventories | Exports | Total use at purchsers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| 1 | 01111 | Wheat, seed | | | | | | | | | | | | | | | | |
| 2 | 01112 | Wheat, other | | | | | | | | | | | | | | | | |
| 3 | 01121 | Maize (corn), seed | | | | | | | | | | | | | | | | |
| ⋮ | ⋮ | | | | | | | | | | | | | | | | | |
| 3150 | 97990 | Other miscellaneous services n.e.c. | | | | | | | | | | | | | | | | |
| 3151 | 98000 | Domestic services | | | | | | | | | | | | | | | | |
| 3152 | 99000 | Services provided by extra-territorial org. | | | | | | | | | | | | | | | | |
| | | Total | | | | | | | | | | | | | | | | |

## 2. Quarterly SUTs-based model to aid validation of the quarterly national accounts

14.40 A quarterly SUTs-based model consists of a partial compilation of quarterly SUTs-based on existing national accounts data and on modelling of the remaining data that are required in a SUTs approach. The quarterly SUTs-based model uses the relationships in the annual tables to expand the level of detail available on a quarterly basis, to ensure a better articulation of the relationships between the different approaches to measuring GDP and thus to assist in the identification of possible inconsistencies. The quarterly SUTs-based model uses the economic relationships between variables in the latest available annual SUTs (referred to as the "reference year tables") to generate the additional product detail required to complete the quarterly SUTs. The fundamental assumption underlying the model is that the economic relationships that apply in the reference year tables, in theory and in volume terms, remain the same during the subsequent quarterly estimation periods. As the substantial component is based on modelled data, it is not generally used to compile the quarterly national accounts, but is used instead as a validation tool in the compilation process. It helps to identify and resolve inconsistencies in the data and, in the longer run, it may help to identify areas of improvements of the accounts and lead the way for the establishment of a regular compilation of quarterly SUTs.

14.41 In general, a quarterly SUTs-based model makes use of the relationships in the latest annual SUTs and expands the data of the quarterly national accounts roughly to the level of detail in the annual SUTs. The underlying assumption is that the industry and product structure in the quarterly SUTs is relatively stable until the next set of annual SUTs become available. As industries and economies are constantly changing and with ever greater rapidity, this assumption – albeit valid –

becomes weaker, especially in current prices. In this case, coefficients of the previous quarter should be used, where data are available.

14.42 The quarterly SUTs-based model is best applied to data that have been seasonally adjusted in volume terms. As mentioned earlier, a quarterly SUTs-based model should be based on ratios calculated from annual SUTs. Annual-to-quarter assumptions work better for volume estimates than for current price estimates, as the price component may be subject to sudden changes even in the short term. For example, large swings in international oil prices may significantly modify the input-output ratios of high-energy-consuming industries such as transport. Similarly, assumptions from annual SUTs are better suited for seasonally adjusted data. Seasonal effects may change the annual relationships between variables, so it would be inappropriate to apply annual ratios in the distribution of quarterly patterns not adjusted for seasonality.

14.43 It may be useful to note that, in order to accommodate a time dimension in the quarterly SUTs-based model, the basic SUTs will need to be expanded to create a suite of interrelated tables in which each table has a time dimension covering the total estimation period.

14.44 The first step in the construction of a quarterly SUTs-based model is to create a domestic output table at basic prices from the production-based GDP estimates. The domestic output table distributes output by economic activity into primary and secondary products. Quarterly output is usually calculated in the quarterly national accounts system by economic activity, very often by assuming a stable relationship with GVA in volume terms. A quarterly distribution of the output of economic activities can be made by taking the shares of primary and secondary products from the most recent annual SUTs. This assumption reflects the mix of products produced by an industry, in volume terms and seasonally adjusted, should remain fairly stable in the short-term.

14.45 The next step is to populate the remaining elements contained in the supply table. Quarterly data on imports of goods and services are readily accessible with sufficient detail from the merchandise trade statistics and balance of payments data; it should therefore not be complicated to populate the imports column with actual data. In absence of detailed data, the structure of imports of goods separate from the imports of services from the annual SUTs can be used to distribute the total quarterly imports of goods and services. This assumption may not work well, however, for such economies as those with large shares of imported capital goods, which can cause swift changes in the mix of imports and their destination for use.

14.46 The supply table is completed with the transformation of basic prices into purchasers' prices, which is the valuation needed for the supply of products to match the valuation for the use of products in the use table.

14.47 The first transformation required is to allocate trade and transport margins among the various products. This calculation can be done using the structure of margins by product from the annual SUTs. As the total amount of margins is known from the quarterly domestic output table, the initial allocation of margins by product (based on the annual SUTs) must be reconciled with the total amount. A similar two-step transformation is performed for taxes less subsidies on products. The initial allocation of net taxes based on the flows of output is reconciled with the total quarterly net taxes provided by government data.

14.48 The intermediate consumption part of the use table should also be linked to the production-based GDP estimates. Intermediation consumption by industry should preserve the fixed (or stable) relationship between GVA and output. Hence, total intermediate costs by industry are to be distributed on the basis of the intermediate input structure in the annual SUTs. The assumption of a stable intermediate input structure is reasonable for relatively short periods of time in volume terms. This is not true in current prices, because of short-term price volatility. When compiling quarterly SUTs (in current prices and in previous years' prices, unadjusted and seasonally adjusted), the assumption of stable product structures by industry may be acceptable for seasonally adjusted data in volume terms. The seasonality of output and intermediate consumption may cause the quarterly structure of unadjusted data to differ from the annual structure; here it would be better to use the ratios from the SUTs of the same quarter of the preceding year.

14.49 The last step in the calculation of the quarterly SUTs-based model is to break down each of the final use components by product. The use table should be based on the quarterly estimates of expenditure components that are as independent as possible from the production-based quarterly GDP estimates.

14.50 The quarterly total flows in the use table are distributed by product using the simplest assumption that the shares in the annual SUTs for each final use category remain stable in the short term in volume terms. This assumption may be satisfactory for household consumption, which presents fairly regular patterns dominated by frequent purchases (food, housing, transportation, and so forth), but it may not hold true, even in the short-term, for other final use categories. For example, purchases of certain capital goods may be very volatile, introducing substantial differences in the product shares. The same can happen with exports, in particular for small, open economies. Once again, this assumption may work well only for quarterly and seasonally adjusted data and in volume terms.

14.51 For changes in inventories, it is very unlikely that the product allocation in a given year will remain the same for each quarter. Inventory levels can move very rapidly between quarters under the influence of different phases in the economy, movements that can substantially modify the product shares estimated in the annual SUTs. An alternative assumption for calculating quarterly inventories in the SUTs-based model is to link the opening and closing levels of inventories to the supply of products (output plus imports). The difference between the closing and opening stocks (inventory levels) would give an estimate of the changes in each quarter. In this case, however, for practical reasons, it is preferred that the quarterly distribution for the type of product for the changes in inventories shall be based on the annual SUTs.

14.52 Once all the elements of the quarterly SUTs-based model are generated and put in place, it is possible to compare and analyse the discrepancies between total supply and total use for each individual product. This is the main objective of using a SUTs-based model for validating the components of quarterly GDP. Although the quarterly tables are constructed with several assumptions, they can provide a very useful insight into the sources of aggregate discrepancies arising from the aggregate quarterly GDP estimates and can help in identifying at detailed levels where new, and significant, product imbalances have materialized.

**(a) Reference year**

14.53 The reference year plays an important role in the structure of the quarterly SUTs-based model as the ratios from the annual SUTs influence the breakdown of the quarterly totals. The natural choice here is to use the latest year of the annual SUTs. The repeated referencing of the quarterly SUTs model involves re-specifying the level and composition of outputs and intermediate inputs for each industry to reflect the relationships in the latest reference year. Updating the reference year ensures that changes in economic relationships are captured in the quarterly SUTs-based model as soon as possible, although the reference year may lag one or two years behind the quarterly national accounts data.

14.54 For some years, the structural changes in the economy may be relatively small, with change occurring incrementally in response to such factors as technological advances and changing consumer tastes. Some events, however, may have a significant impact on the cost structure of industries and take place rapidly. For example, a severe drought is likely to change the relationship between the supply of products and the intermediate use of products for the agriculture industry.

**(b) Seasonally adjusted data versus unadjusted data**

14.55 One priority when using SUTs to validate the components of quarterly GDP is to ensure that all the assumptions made maximize the preservation of the time series properties of the quarterly national accounts and avoid any breaks between quarters. The use of seasonally adjusted data facilitates the application of annual ratios to distribute quarterly data. Ratios taken from the annual SUTs of contiguous years, when available, however, can be substantially different. This could necessitate steps between the last quarter of one year (based on a set of ratios from that year) and the first quarter of the following year (based on a different set of SUTs). In such cases, instead of using fixed quarterly ratios, the annual ratios in the two different years can be interpolated to smooth out the transition between the two levels.

14.56 For the quarterly national accounts data, unadjusted for seasonal effects, a quarterly SUTs-based model using annual assumptions poses greater challenges. The relationship between economic variables can be highly seasonal. For example, the share of purchases of tourism services during a holiday period is certain to be higher than the annual average. If proper assumptions can be made about the seasonal variation, however, a quarterly SUTs-based model for unadjusted data can reveal inconsistencies between the seasonality of production and expenditure data. For example, seasonal peaks and troughs are expected to appear in the same quarters along the supply and use of specific product rows. A quarterly SUTs-based model based on unadjusted data could reveal inconsistencies when related quarterly national accounts variables are based on indicators with diverging seasonal patterns.

14.57 An approach to consider in obtaining quarterly and seasonally adjusted benchmarked chain-linked data may be:

- Step 1: Seasonally adjust quarterly national accounts data at the highest level of breakdown and obtain the corresponding seasonal factors.
- Step 2: Derive seasonally adjusted data at previous years' prices.
- Step 3: Obtain different aggregates seasonally adjusted at previous years' prices simply by adding up the corresponding components.
- Step 4: Balance the quarterly SUTs and chain-link the results.
- Step 5: Carry out a residual seasonality analysis (in some cases, this involves changing the seasonal factors using the balanced unadjusted series, and then returning to step 1).

### (c) Data in current prices versus data in volume terms

14.58 The construction of quarterly SUTs (fully balanced or nearly balanced) in volume terms can help in analysing the consistency of the quarterly national accounts figures in current prices. The final quarterly SUTs in previous years' prices can be reflated with available price indices (for example, producer prices, consumer prices, imports and exports prices). Discrepancies in the resulting quarterly SUTs in current prices can reveal inconsistencies in the price statistics at a detailed product and industry level. Furthermore, the results from the quarterly SUTs-based model can be compared with the current price estimates derived from the quarterly national accounts system. In this way, a quarterly SUTs-based model can also be beneficial for improving the quality of the estimate of the GDP deflator.

### (d) Level of detail and classification

14.59 The level of detail for a quarterly SUTs-based model is to be chosen with pragmatism. Theoretically, the desire may be to build quarterly SUTs with hundreds of rows and columns to improve the robustness of the assumptions, but development and maintenance of such large systems of quarterly SUTs may be unsustainable. Quarterly SUTs-based models should be simplified versions of existing annual SUTs. The level of detail of the quarterly national accounts system must be borne in mind when deciding on the number and type of products and economic activities of the quarterly SUTs-based model.

14.60 When quarterly GDP is calculated using only the production approach, the quarterly SUTs-based model can be used to develop a rudimentary estimate of quarterly GDP using the expenditure components. Many countries do not calculate quarterly GDP by expenditure because of the lack of source data (in other words, the lack of a continuous household consumption data source). Product-flow assumptions from available annual SUTs, such as fixed shares underpinning the breakdown of final use, can be used to allocate the production-based estimates between the different uses. With this approach, however, the resulting GDP estimate using the expenditure approach would be constructed from the production-based GDP data and no discrepancy would appear between the two estimates. Consequently, the quarterly GDP by expenditure could not be considered an independent measure of the GDP.

14.61 The classification used in the quarterly SUTs-based model should reflect the classification used in the annual SUTs and the quarterly national accounts and therefore the underlying data sources.

### 3. Quarterly SUTs for quarterly national accounts

14.62 The compilation of balanced quarterly SUTs is the best option for the compilation of coherent and consistent quarterly national accounts but it poses certain challenges, such as data availability and data coverage, timeliness of the data processing and balancing and ensuring an appropriate level of resources.

14.63 Most of the considerations covered in the previous section also hold for the compilation and publication of quarterly SUTs. The compilation of quarterly SUTs often relies, however, on a wider set of source data with high frequency and a more complete balancing process. Some countries regularly compile and publish quarterly SUTs. The text below is based primarily on experience in the Netherlands with the compilation of quarterly SUTs.

#### (a) Quarterly SUTs in the Netherlands

14.64 In the Netherlands, the quarterly estimate of GDP and its components covering both the production and expenditure approaches to measuring GDP are compiled using quarterly SUTs. The quarterly SUTs are simultaneously compiled in current prices and in volume terms.

14.65 For each quarter, two estimates are made: a flash estimate which is published at T+45 days and a firmer estimate which published at T+90 days. When making the estimate for the fourth quarter, the first three quarters are updated in order to get a best possible first flash estimate of the reporting year concerned. The four quarterly SUTs also form the base for estimates for the preliminary years combined with new information for certain industries and expenditure categories, such as government, banking and insurance, health services and foreign trade.

14.66 Like the annual SUTs, the quarterly SUTs are balanced at purchasers' prices excluding VAT (use table). The valuation gap between output at basic prices and the supply at purchasers' prices is covered through the additional columns on trade and transport margins and taxes and subsidies on products in the supply table. In addition, non-deductible VAT is recorded in a separate row in the use table.

14.67 The quarterly SUTs cover estimates in both current prices and in volume terms. The volume-based estimates are expressed in average prices of the previous year. The choice for the price base ensures the additivity of the four quarters to annual figures in volume terms. In order to estimate volume changes, the corresponding quarter of T-1 must also be expressed in average prices of T-1.

14.68 For each cell of the SUTs, the following data are available:

$CP_{i,t} = \sum_i (P_{i,t} * Q_{i,t})$, current prices of quarter $i$ of year $T$

$PYP_{i,t} = \sum_i (P_{t-1} * Q_{i,t})$, volume terms of quarter $i$ of year $T-1$ expressed in average prices of the year T-1

$AYP_{i,t-1} = \sum_i \left(P_{t-1} * Q_{i,t-1}\right)$, volume terms of quarter $i$ of year $T-1$ expressed in average prices of the year $T-1$

$CP_{i,t-1} = \sum_i (P_{i,t-1} * Q_{i,t-1})$, current prices of quarter $i$ of year $T-1$

$PI_{i,t/t-1} = CP_{i,t}/PYP_{i,t}$, price index of quarter $i$ of $T$ expressed in the average prices of year $T-1$

$PI_{i,t-1/t-1} = CP_{i,t-1}/AYP_{i,t-1}$, price index of quarter $i$ of $T-1$ expressed in the average prices of year $T-1$

$VI_{i,t} = PYP_{i,t}/AYP_{i,t-1}$, volume index of quarter $i$ of $T$ compared with quarter $i$ of $T-1$.

**(b) Source data**

14.69 Compared with the annual data, the source data for quarterly estimates are less detailed and are often less reliable. In addition to the lack of detail, the main shortcomings include the lack of data covering intermediate consumption and changes in inventories.

14.70 For manufacturing and commercial services, the main data sources for turnover are based on VAT or surveys. For agriculture, data on quantities and prices are available. For the flash estimate, government budget data are used, while for more reliable estimates, quarterly government accounts are available for a large part of government. Data on financial institutions are provided by the central bank. Health care is estimated using a model approach.

14.71 Estimates for exports and imports of goods and services are based on data derived from foreign trade statistics. Household consumption is based on data from retail trade, and specific information like vehicle registration.

14.72 When gross fixed capital formation is not available on a quarterly basis, estimates can be derived from the supply of capital goods following a product-flow approach. For specific parts, additional information is available in the form of vehicle registrations, the details of aeroplanes and ships, and other elements.

14.73 For changes in inventories, only limited information is available and estimates are made during the process of balancing combined with the seasonal pattern of the previous year.

14.74 No quarterly data are available for trade and transport margins. These are estimated using the ratios and percentages from the annual SUTs of the previous year. For the volume estimates, this process is governed by the rules described in chapter 9. If this assumption is applied for current prices, changes in the percentage of trade and transport margins may go unnoticed until the next annual SUTs are compiled.

14.75 For the deflation of the quarterly SUTs, producer price indices, import and export prices and consumer price indices are available. The observed data are transformed into indices which have as their base the average prices of T-1.

14.76 As very little data for intermediate consumption are available, the initial estimates are based on the assumption of fixed input-output coefficients in volume terms. For each industry, each product forming intermediate consumption, the ratio to total output of the corresponding quarter of T-1 is applied to the estimates in volume terms of the quarter being estimated. In order to get current price estimates, the volume estimates are inflated using the above mentioned price indices. When balancing, these initial estimates of intermediate consumption are adjusted and reconciled with the estimates of supply.

### (c) Balancing

14.77 The balancing of quarterly SUTs is very similar to the balancing of annual SUTs. The balancing process starts with the detection of large inconsistencies which need additional analysis and detailed investigation and these are then balanced manually. One significant difference between the balancing of quarterly and annual SUTs is the reliability of the estimates of intermediate consumption. The same identities must hold and the same plausibility checks can be applied. In the case of quarterly SUTs, however, more and larger adjustments are made to intermediate consumption, although they must be limited to the extent that the balanced results show plausible movements over time and plausible input-output ratios.

14.78 In the balancing process, other checks are also undertaken of such factors as links with the labour accounts. Changes in labour productivity constitute an important indicator for judging plausibility. For the more reliable estimates in the quarterly SUTs, a balanced link with the quarterly sector accounts is also established.

### (d) Benchmarking or reconciliation

14.79 To ensure consistency between the quarterly accounts and the annual accounts benchmarking or reconciliation may be necessary. This is designed to ensure that:

(a) The sum of the four quarters in current prices equals the annual estimates in current prices;

(b) The sum of the four quarters of year T in average prices of the previous year (T-1) equals annual estimates of T in prices of the previous year (T-1);

(c) The sum of the four quarters, for example, for T-1 in average prices of T-1 equals the annual estimates of T-1 in current prices (of T-1).

14.80 In the Netherlands approach, the preliminary annual estimates are the sum of the four quarters combined with annual information for specific industries or expenditure categories (for example, government, banking and insurance, health services and foreign trade). After having reconciled large discrepancies between quarterly and annual information for those specific items, the balancing of the four quarters and the annual information is carried out simultaneously, using automated procedures.

14.81 For the final estimates, for most industries the annual source data are available including intermediate consumption and changes in inventories. The final annual estimate of the SUTs is made autonomously and is not linked to the updated quarterly SUTs. Accordingly, for the final estimates, the quarterly SUTs must be benchmarked or reconciled with the annual SUTs. After having reconciled the large discrepancies between quarterly and annual SUTs, the benchmarking of the four quarters is carried out simultaneously, using automated procedures.

# Chapter 15. Disseminating supply, use and input-output tables

## A. Introduction

15.1 Data dissemination is an important activity for any statistical production process as it provides the users with a range of statistics produced to internationally agreed guidelines. Presenting SUTs and IOTs to the users in a clear, transparent and user-friendly manner is thus an important task of the statisticians. The present chapter provides an overview of the elements that should be considered when disseminating SUTs and IOTs. It starts in section B with the description of how users' needs must be identified in order to tailor the dissemination of data to the main types of users of SUTs and IOTs. Section C describes the importance of having a dissemination strategy and the elements that should be covered in that strategy. Section D describes the importance of the communication strategy in the dissemination of statistics, as, in today's world, statistical information is not just made available to users but is communicated to them in a way that it is more accessible and understandable. Section E provides examples of dissemination formats of SUTs and IOTs and lists frequently published tables. Lastly, section F elaborates on the Statistical Data and Metadata Exchange (SDMX), which was developed for the purposes of sharing data and metadata for national accounts and which includes a module for SUTs and IOTs.

## B. User identification

15.2 Economic statistics have a wide variety of users making very different uses of the statistics. The SUTs, IOTs and other related products provide important analytical tools for many types of users, including all levels of government, international organizations, the private sector, research institutions and the public, including the media and other bodies. These users may be grouped into two main categories in respect of the intensity with which they make statistical use of the information disseminated. There are general data users (such as journalists, students, teachers, small businesses or ordinary citizens who have simple data requirements but from a great range of information) and analytical users (such as government departments, local authorities, researchers, and international organizations with complex data requirements on detailed variables, time series and regional breakdowns).

15.3 An awareness and understanding of the possible users and of their needs is vital not only for the compilation of SUTs and IOTs (the identification of users' needs is the first phase of the statistical compilation process; see chapter 3) but also for the identification of effective ways to disseminate the statistical information. Knowing who the users are helps to guide the kind of message being conveyed when statistics are released in a language accessible to users (who may not have the technical expertise necessary to follow the nuances of national accounts or to draw on such references as the SNA or BPM).

15.4 To meet the different demands, the dissemination of SUTs and IOTs can take place through a variety of channels. The media and the general public generally make use of press releases, which present the main findings from the SUTs and IOTs. Detailed information on SUTs and IOTs is usually presented in the yearbooks of individual countries; this information can be used by researchers, students and international organizations. Special publications may also be prepared, including time series and detailed data, accompanied by metadata and, on occasion, a short economic analysis based on these indicators. These publications may be used for a variety of purposes by governments, researchers, academic media and international organizations. Lastly, the use of electronic platforms makes it possible to reduce the costs of dissemination and to make the information more usable and accessible, such as, for example, through the websites of the different national statistics offices.

## C. Dissemination strategy

15.5 The compilation of SUTs and related products in general forms a small subset of the data compiled by the national statistical office or national central bank but a key and very rich dataset in terms of the interlinkages between all stakeholders in an economy – all producers of goods and services and all consumers of goods and services. Thus, the dissemination of SUTs and IOTs should form part of a more comprehensive dissemination strategy pursued by the office compiling these tabulations.

15.6 The dissemination strategy includes various elements such as determining what information is made available, ensuring its timeliness and coherence between the disseminated data sets, maintaining statistical confidentiality, applying a revision policy, identifying user needs, selecting formats and means of dissemination, and disseminating metadata and information on data quality.

15.7 The dissemination strategy is to be developed and formulated in line with the Fundamental Principles of Official Statistics (2013), see Box 15.1. Principle 1, in particular, states that "…official statistics are to be compiled and made available on an impartial basis by official statistical agencies to honour the entitlement of citizens to public information" and sets out clear guidance for dissemination.

**Box 15.1 Fundamental Principles of Official Statistics**

**Principle 1**

Official statistics provide an indispensable element in the information system of a democratic society, serving the Government, the economy and the public with data about the economic, demographic, social and environmental situation. To this end, official statistics that meet the test of practical utility are to be compiled and made available on an impartial basis by official statistical agencies to honour citizens' entitlement to public information.

**Principle 2**

To retain trust in official statistics, the statistical agencies need to decide according to strictly professional considerations, including scientific principles and professional ethics, on the methods and procedures for the collection, processing, storage and presentation of statistical data.

**Principle 3**

To facilitate a correct interpretation of the data, the statistical agencies are to present information according to scientific standards on the sources, methods and procedures of the statistics.

**Principle 4**

The statistical agencies are entitled to comment on erroneous interpretation and misuse of statistics.

**Principle 5**

Data for statistical purposes may be drawn from all types of sources, be they statistical surveys or administrative records. Statistical agencies are to choose the source with regard to quality, timeliness, costs and the burden on respondents.

**Principle 6**

Individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons, are to be strictly confidential and used exclusively for statistical purposes.

**Principle 7**

The laws, regulations and measures under which the statistical systems operate are to be made public.

**Principle 8**

Coordination among statistical agencies within countries is essential to achieve consistency and efficiency in the statistical system.

**Principle 9**

The use by statistical agencies in each country of international concepts, classifications and methods promotes the consistency and efficiency of statistical systems at all official levels.

**Principle 10**

Bilateral and multilateral cooperation in statistics contributes to the improvement of systems of official statistics in all countries.

*Adopted by the General Assembly at its 73rd plenary meeting, on 29 January 2014*

15.8 To help establish good dissemination practices, there is a range of information and good practice already available. For example, the General Data Dissemination Standards (IMF, 2013) were developed by IMF to assist member countries not in a position to subscribe to the Special Data Dissemination Standards to develop nevertheless a sound statistical system as the basis for timely dissemination of data to the public. The purpose of the General Data Dissemination Standards is to encourage member countries: to improve data quality, to provide a framework for evaluating needs for data improvement and setting priorities in this respect, and to guide countries in disseminating comprehensive, timely, accessible, and reliable economic, financial, and sociodemographic statistics to the public. ECE has developed a set of publications providing guidance to statistical organizations in the communication and dissemination of statistics (see UNECE, 2009). These publications have been prepared within the framework of the ECE work sessions on the communication and dissemination of statistics.

15.9 Other examples of dissemination practices may be found in statistics codes of practice, such as the European Union Statistics Code of Practice (Eurostat, 2011a), the United Kingdom Code of Practice for Statistics (United Kingdom Statistical Authority, 2009), and others.

## 1. Release calendar

15.10 The availability of a release calendar is important for the users. Knowing when the information is released and disseminated will enable users to plan their activities accordingly. The compilation and release schedule should be realistic for compilers and, at the same time, useful for users. In addition, it is often a good practice to announce in advance the precise dates at which particular data series will be released. The advance release calendar should be posted at the beginning of each year, or at least well in advance of the release date, on the websites of the agencies responsible for dissemination. This will also help to provide evidence that there has been no political or ministerial interference in the production and dissemination of official statistics.

15.11 Figure 15.1 shows an example of a national release calendar covering SUTs, IOTs and national accounts.

**Figure 15.1 Release calendar covering SUTs, IOTs and national accounts: Statistics Denmark**

| Statistics Denmark national accounts publication schedule for 2017 (including revision schedule) | | | | | |
|---|---|---|---|---|---|
| Month of publication | Year T Q1 | Year T Q2 | Year T Q3 | Year T Q4 | Year T |
| Middle May of year T | A | | | | |
| End May of year T | P | | | | |
| End June of year T | R | | | | |
| Middle August of year T | - | A | | | |
| End August of year T | R | P | | | |
| End September of year T | R | R | | | |
| Middle November of year T | - | - | A | | |
| End November of year T | R | R | P | | |
| End December of year T | R | R | R | | |
| Middle February of year T+1 | - | - | - | A | |
| End February of year T+1 | R | R | R | P | P (SQ) |
| End March of year T+1 | R | R | R | R | R (SQ) |
| End June of year T+1 | R | R | R | R | R (SQ) |
| Beginning November of year T+1 | - | - | - | - | R (AP1) |
| End November of year T+1 | R | R | R | R | - |
| Beginning November of year T+2 | - | - | - | - | R (AP2) |
| End November of year T+2 | R | R | R | R | - |
| Beginning November of year T+3 | - | - | - | - | F |
| End November of year T+3 | F | F | F | F | - |

**Note:**

| | |
|---|---|
| A | Advanced or flash GDP estimate (GDP 45) |
| P | Preliminary QNA figures (QNA60) |
| R | Revised (applies both to QNA90 and to successive revisions) |
| F | Final (applies both to annual and quarterly figures) annual figures include final SUTs and IOTs. |
| SQ | Sum of quarters |
| AP1 | First preliminary annual calculation including IOTs. |
| AP2 | Second preliminary annual calculation including IOTs. |

The revisions of the quarterly figures in November T+1, T+2 and T+3 are made in order to make the quarterly figures consistent with the annual figures.

**The above detail has been compiled by Sanjiv Mahajan (Office for National Statistics, United Kingdom) (as at February 2017).**

## 2. Data revision and revision policies

15.12 Revisions are an essential part of data compilation. They occur as a consequence of the trade-off between the timeliness of published data and their reliability, accuracy and comprehensiveness. To address this trade-off, the responsible agencies often compile and disseminate the provisional data that are then revised when new and more accurate data become available. Although, in general, repeated revisions may be perceived as reflecting negatively on the reliability of official data, attempts to avoid them by producing accurate but very delayed data will result in failure to meet users' needs.

15.13 Figure 15.2 shows the United Kingdom quarterly and annual revision (including SUTs) policy to the first estimate of quarterly GDP through successive quarterly exercises through to annual benchmarking. The pending revision policy (quarterly or annual) and description of revisions are communicated well in advance so that users can prepare appropriately. This is even more important for significant revisions, such as a new version of the SNA or industrial classification or methodological changes and takes place through the publication of articles, organization of seminars, and other measures. Although descriptions are provided, the exact estimates are not available until the release day.

**Figure 15.2 Measuring United Kingdom GDP and SUTs: revision policy**

| Month | Revision time frame – United Kingdom GDP estimate for 2013 Q1 (First UK quarterly GDP estimate and subsequent revisions through to annual benchmarking) | | |
|---|---|---|---|
| | Release | Brief description | Revised periods |
| Apr-13 | 1st estimate | Preliminary estimate of GDP (after 25 days) | No revisions |
| May-13 | 2nd estimate | 2nd estimate of GDP (after 55 days) | 2013 Q1 only |
| Jun-13 | 3rd estimate (Quarterly exercise) | Quarterly national accounts (after 85 days) GDP, BoP, financial and non-financial accounts for all institutional sectors also released at the same time. | Up to past 13 quarters |
| Sep-13 | Annual exercise ONS Blue Book and Pink Book | 2013 Q1 potentially revised | Annual and quarterly revisions back to 1990 Q1. SUTs revisions back to 1997. |
| Dec-13 | Quarterly exercise | 2013 Q1 potentially revised | Up to past 11 quarters |
| Mar-14 | Quarterly exercise | 2013 Q1 potentially revised | Up to past 12 quarters |
| Jun-14 | Quarterly exercise | 2013 Q1 potentially revised | Up to past 13 quarters |
| Sep-14 | Annual exercise ONS Blue Book and Pink Book | 1st annual exercise Partial benchmarking | Annual revisions back to 1948. Quarterly revisions back to 1955. SUTs revisions back to 1997. |
| Dec-14 | Quarterly exercise | 2013 Q1 potentially revised | Up to past 11 quarters |
| Mar-15 | Quarterly exercise | 2013 Q1 potentially revised | Up to past 12 quarters |
| Jun-15 | Quarterly exercise | 2013 Q1 potentially revised | Up to past 13 quarters |
| Sep-15 | Annual exercise ONS Blue Book and Pink Book | 2nd annual exercise Benchmarking short-term indicators 1st annual balancing exercise through SUTs | Annual revisions back to 1985. Quarterly revisions back to 1985. SUTs revisions back to 1997. |
| : | : | : | : |
| : | : | : | : |

**Note:**
The revision policy can, and does, vary for quarterly exercises, for example, to allow for exceptional cases. Always determined well in advance.
For each quarterly / annual exercise, whatever the policy for periods open to revision, it applies to all variables, accounts and institutional sectors.
The periods open to revision cover both current prices and previous years' prices as well as reflect annual chain-linking of the volume data.
**The above detail has been compiled by Sanjiv Mahajan (Office for National Statistics, United Kingdom) (as at February 2017).**

15.14 In general, countries are encouraged to develop a well-designed revision policy that is carefully managed and coordinated with other areas of statistics and then communicated to users well in advance. The development of such a policy should aim at providing users with the necessary information to cope with revisions in a more systematic manner. The absence of coordination and planning of revisions will be seen as a quality problem by users. Essential features of a well-established revision policy are a predetermined schedule, reasonable stability from year to year, openness, advance notice of reasons for the revision and its effects, easy access of users to sufficiently long time series of revised data, and the adequate documentation of revisions in statistical publications and databases.

15.15 In general, errors (statistical or data processing errors) should be corrected as soon as they are detected. In some cases, the compiling agency may decide to carry out a special revision for the purposes of reassessing the data coverage or data compilation methods, which could lead to significant changes in the historical time series. It is recommended that such revisions be announced in advance and the reasons for such revisions, along with an assessment of their possible impact on the available data, should be given (see also the forthcoming United Nations Handbook on Backcasting Methodology).

### 3. Confidentiality

15.16 One of the most important policy concerns relevant to data dissemination is the preservation of statistical confidentiality. Statistical confidentiality is necessary in order to gain and keep the trust of both respondents to statistical surveys and users of the statistical information. Principle 6 of the Fundamental Principles of Official Statistics (see Box 15.1) stipulates that individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons or not, are to be strictly confidential and used exclusively for statistical purposes. It is therefore important that appropriate disclosure checking procedures are in place as part of the dissemination process. In some cases, permissions may be sought from a business to publish information which helps to reduce the number of disclosive cells. Where data validation by an external organization or a specific expert is necessary or significant benefits as part of data quality assurance are expected or have been previously demonstrated, unreleased non-confidential information may be provided in such cases under strict and agreed conditions for the purposes of validation and quality before its official release.

### 4. Metadata

15.17 Metadata may be defined as “data about data” which enable and facilitate sharing, querying, understanding and using statistical data over the different stages of collection, compilation and dissemination, and at their various levels of aggregation, from microdata to macrodata. They encompass administrative facts about the data (such as, who has created them and when) and definition of the concepts applied along with a description of how the data were collected and processed before they were disseminated or stored in a database. Metadata are important for users and also play a crucial role in the statistical production process, as common standards and definitions should be followed to the extent possible throughout all statistical domains, in order to facilitate the linking and integration of statistical information.

15.18 As metadata are generated and processed during every step of the compilation process, there is a strong need for a metadata management system to ensure that the appropriate metadata retain their links with data. Metadata dissemination should be an integral part of the dissemination strategy. A good practice in this regard is the active linking of metadata to the statistical data that they describe, and vice versa, by implementing metadata-driven systems and management systems for metadata throughout the various stages of the statistical production process. There are several information model specifications that can contribute to achieving this goal, most notably SDMX (see section F). While such specifications are designed to enable performance of different functions, they can be used together in the same system, or complement one another, in the compilation and exchange of data and metadata. Box 15.2 provides examples of reference metadata in the SDMX metadata structure for SUTs and IOTs.

**Box 15.2 Reference metadata in the SDMX metadata structure for SUTs and IOTs**

| | |
|---|---|
| 1. Contact | 11. Quality management |
| 2. Metadata update | 12. Relevance |
| 3. Statistical presentation | 13. Accuracy |
| 4. Unit of measure | 14. Timeliness and punctuality |
| 5. Reference period | 15. Coherence and comparability |
| 6. Institutional mandate | 16. Cost and burden |
| 7. Confidentiality | 17. Data revision |
| 8. Release policy | 18. Statistical processing |
| 9. Frequency of dissemination | 19. Comment |
| 10. Accessibility and clarity | |

Source: http://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/data/database

## D. Communications of SUTs and IOTs with users

15.19 The production, analysis and dissemination of official statistics must be done in a transparent and accessible way. To aid all users, information is provided through different channels, such as websites, regular press releases, news releases, statistical reports and emails.

15.20 All communications should be supported by a solid relationship with the media, which are likely to be the main distributors of public statistics to the general public. In this way, the information is available to all users at the same time without privileged access, although there may be a limited number of people who, for specific reasons, are granted time-limited pre-release access.

15.21 The communications department in the statistical office or central bank is responsible for the relationship between the office or the bank and the media, by organizing and coordinating press briefings, press conferences and interviews with experts, processing requests from journalists and fulfilling other requirements such as handling media crises or issuing correction responses to media comments. In addition, lock-in-type briefings for journalists and media reporters may be undertaken just ahead of a release to enable the quick, timely and efficient dissemination of material by the media moments after the official releases.

15.22 This type of approach should be followed with most official press releases, in particular those which may contain market-sensitive material. With lock-in procedures of this type, attendees would not be allowed the use of mobile phones or other electronic devices or access to the Internet. They would operate within an environment controlled by the national statistical office or central bank in which all connections pass through a central switch which the office or bank can manually turn on and off, thereby preventing any leaks before release. These approaches also contribute to strengthening the public perception of statistical independence, trust and confidence and give assurance that there is no government interference with official statistics.

15.23 The link between the media officers and the statistician is important. Media training should be provided for all statisticians who come into contact with the media as this lies outside the scope of the work of the professional statistician.

15.24 To communicate national accounts data effectively, a press release, report or article should be designed to perform the following tasks:

- Interpret the tables of numbers and graphs clearly
- Tell a story about the data;
- Catch the reader’s attention quickly with a headline or a graph
- Be written in a clear and accessible way, with minimal use of economic and statistical jargon
- Be easily understood, interesting and entertaining
- Encourage others, including the media, to use the national accounts data appropriately to add impact to what they are communicating

15.25 Before preparing such materials, the target audience should be identified in a first step. It is also important to be aware of the available communications media, including the press, television, radio, Internet and the rapidly evolving social media options.

## E. Dissemination format for SUTs and IOTs

15.26 More often than not, SUTs and IOTs data tends to be annual data and less up-to-date than the latest quarterly estimate of GDP. Nonetheless, this does not mean that a newsworthy story cannot be extracted from the SUTs and IOTs data to form the basis of a news release. On the contrary, often newspaper headlines can be generated from the releases of SUTs and IOTs.

15.27 SUTs and IOTs data are disseminated mostly via the national statistical office or central bank websites with dedicated topic web pages and through various file formats. Press releases, articles and analyses may be disseminated in PDF form, as these are easier for users to print, while the data are also provided on line in Excel or alternative formats, to enable users to easily manipulate the data to suit their needs – this aspect is very important in meeting user needs. In any event, the national statistical office or central banks need to ensure that whatever format they use is user-friendly.

15.28 The released SUTs and IOTs and related articles and analyses can be produced and published as separate printed publications, and also provided as web-based analyses. Given the increasing popularity of data visualization, appropriate graphics could, even should, be used in releasing SUTs and IOTs-based material to make the products more understandable, and accessible, to users who are unfamiliar with them.

15.29 Other analyses such as satellite accounts for energy and air emissions are often linked to web pages for SUTs and IOTs. These data are presented using exactly the same principles, definitions and classifications in national accounts and SUTs and IOTs, and it is therefore possible to combine data for use in a wider range of analyses of economic trends and structures. This approach adds considerable value to the user, especially in terms of ensuring the availability in close proximity of consistent and coherent related products.

15.30 The SUTs data may be disseminated in various forms and formats, for example, using open data formats, tabular data structures, and in other ways. SUTs can be disseminated in a structured template format, for example, in Excel, with several worksheets covering different parts of the framework for a specific year. This structured template format has to adhere to good practice, discipline and stability and comply with metadata standards in order to be effective. Below are examples of tables, after disclosure testing, that could be considered as part of the dissemination of SUTs, with the main tables shown in italics:

- Supply table at basic prices, including transformation into purchasers' prices
- Use table at purchasers' prices
- Valuation matrices
- Use table at basic prices with the split of domestic use table and imports use table
- GVA by industry (for each industry, analyses by the type of factor incomes and by institutional sector)
- General government final consumption expenditure table (separating central government and local government, analyses of each industry column (by ISIC) and product row (by CPC)

- Household final consumption expenditure table (analyses by COICOP (column) and by CPC (row), as well as analyses by type of durables and services)
- NPISHs table (analyses of each industry column (by ISIC) and product row (by CPC), and column (by COPNI) and product row (by CPC)
- Gross fixed capital formation table (analyses of each industry column (by ISIC) and product row (by CPC ))
- Production account by industry and by institutional sector
- Generation of income account by industry and by institutional sector
- PSUTs and EE-IOTs

15.31 Similarly, an Excel workbook approach could be used for IOTs and related analyses for a specific year. Examples of what to include when disseminating IOTs are provided below:

- Industry-by-industry IOTs or product-by-product IOTs or both
- Leontief inverse
- Multipliers, such as output, employment, employment costs, and others
- Range of environmental accounts, such as, for example, EE-IOTs, air emissions accounts, energy accounts, and others

15.32 The above approach provides data for a specific year. Assuming the structure of the templates are the same for each year, derived analyses or analytical tools or a menu-driven analyses or pivot tables could be provided to allow for time series analyses or revision analyses of any cell in the framework or ratio-type analyses. Further examples of such derived analyses may include:

- Export shares of goods and services by product
- Import penetration of goods and services by product
- Net trade in goods and services by product
- Labour and capital productivity by industry

15.33 Furthermore, the national statistical office or central bank could provide functional analyses meeting a range of user needs. More examples are provided in the "Additional reading" section at the end of this Handbook and include the following:

- Specific cross-cutting sectors, such as the "digital sector", "sharing economy", "creative sector", "food sector", "oil and gas sector" and "sports sector"
- Concentration ratios for businesses by industry
- Satellite accounts, for example, agriculture, tourism, health and education

## F. Statistical Data and Metadata Exchange initiative

15.34 Seven institutions, namely the BIS, European Central Bank, Eurostat, IMF, OECD, United Nations and the World Bank sponsor the SDMX initiative to foster standards for the exchange of statistical information. The standard in the present instance is an International Organization for Standardization (ISO) standard (ISO Technical Specification 17369:2013, which revises ISO Technical Specification 17369:2005). It offers an information model for representing statistical data and metadata, together with formats to represent this model (SDMX-EDI and several SDMX-ML formats). It also proposes a standard way of implementing web services, including the use of registers.

15.35 The SDMX information model covers various elements, as described below:

- *Descriptor concepts*: In order to make sense of statistical data, it is necessary to know the concepts associated with them. For example, on its own, the figure 1.2953 is somewhat meaningless but if we know that it is an exchange rate for the United States dollar against the euro on 23 November 2006, it already makes more sense.
- *Packaging structure*: Statistical data can be grouped together at the following levels: observation level (the measurement of a phenomenon); series level (the measurement of a phenomenon over time, usually at regular intervals); group level (a group of series, a well-known example being the sibling group, a set of series which are identical except for the fact that they are measured with different frequencies); and data-set level (comprising several groups covering, for example, a specific statistical domain). The descriptor concepts mentioned above can be attached at various levels in this hierarchy.
- *Dimensions and attributes*: There are two types of descriptor concepts: dimensions, which both identify and describe the data, and attributes, which are purely descriptive.
- *Keys*: Dimensions are grouped into keys, which allow a particular set of data (a series, for example) to be identified. The key values are attached at the series level and given in a fixed sequence. By convention, frequency is the first descriptor concept and the other concepts are assigned an order for that particular data set. Partial keys can be attached to groups.
- *Code lists*: Every possible value for a dimension is defined in a code list. Each value on that list is given a language-independent abbreviation (code) and a language-specific description. Attributes are represented either by codes or free-text values. Since the sole purpose of an attribute is to describe and not to identify the data, this does not pose a problem.
- *Data structure definitions*: A data structure definition (data classification scheme) specifies a set of concepts which describe and identify a set of data. It indicates which concepts are dimensions (identification and description) and which are attributes (just description), and it gives the attachment level for each of these concepts on the basis of the packaging structure (data set, group, series or observation), together with their status (mandatory or conditional).

It also specifies which code lists provide possible values for the dimensions and gives possible values for the attributes, either as code lists or free-text fields.

15.36 The SDMX data structure definitions for national accounts data exchange covers a module for the SUTs and IOTs. It is envisaged that the implementation of SDMX-compliant databases will facilitate the data and metadata exchange.

# Part four

# Chapter 16. Regional supply and use tables

## A. Introduction

16.1 SUTs compiled at the national level, like the national accounts, can often conceal differences in the economic and social development between various regions within the country. In recent years, there has been increasing interest in compiling regional national accounts along with regional SUTs, which, in a manner consistent with their national counterparts, provide more detailed and disaggregated information for regional economic analysis, fiscal and monetary policy and monitoring. The term "regional" refers in this chapter to subnational areas that make up the country under consideration.

16.2 Many of the issues arising when compiling regional SUTs and IOTs are similar to those encountered in the compilation of regional national accounts, such as, for example, assigning transactions to multi-regional units where the centre of predominant economic interest is situated in more than one region within the country, or assigning transactions to national units for which the centre of predominant economic interest cannot be geographically located (this is the case, for example, of governments, national railways, electricity corporations, and other entities) (see 2008 SNA, paras. 18.47–18.51).

16.3 Other issues involve the compilation of the interregional trade flow matrices. Since in the regional accounts each region is treated as a different economic territory, transactions with other regions are treated as external transactions. With external transactions it is important, however, to distinguish between those with the rest of the world and those with other regions within the country, in order explicitly to maintain the link with the national accounts.

16.4 The present chapter provides, in section B, a general description of the two main methods – top-down and bottom-up – used to compile regional SUTs and IOTs. The issues arising in the compilation of regional SUTs are presented in section C, using the practical country example of Canada. This country example is representative of the conceptual and practical issues commonly encountered in the compilation of regional SUTs and IOTs.

## B. Issues arising in and methods for the compilation of regional SUTs and IOTs

16.5 There are a number of statistical issues associated with the compilation of regional accounts. These include the selection of the relevant statistical unit, the treatment of productive activities crossing regional boundaries, data availability, confidentiality and the consistency of matching micro estimates and macro-estimates.

16.6 In general, the statistical units that are particularly relevant for compiling regional aggregates are establishments and enterprises. Enterprises often cover activities in more than one region and are therefore not entirely suitable for regional accounts. Establishments are often preferred, as they are strictly delimited to single geographical localities. Some issues also arise, however, with the choice of establishments, for instance, full information may not be available at the establishment level. In addition, mobile equipment such as ships, trains, planes cannot be categorized as local units. They must be attached to local units in an appropriate and consistent way. Sites where there is no labour activity (such as railway crossings or automated signal boxes) also cannot be categorized as local units.

16.7 The case when a producer unit has only one site does not generally pose conceptual issues. In practice, however, many producer units have sites in more than one region and are active in more than one industry (multiregional and heterogeneous units). Depending on the information available for the different types of statistical unit, whether local units, establishments or enterprises, the classification at local and aggregated level should be as consistent as possible in order to obtain reliable regional aggregates, for each region and by industry, that are also consistent with the national aggregates.

16.8 Some productive activities cross regional boundaries. These include, for example, transport services and energy supply. Producer units may also operate in more than one region either at permanent sites or on a temporary basis; thus, for example, builders may undertake work in different regions. This interregional activity must be allocated consistently between regions. For this purpose two general approaches may be used: the residence approach and the territorial approach.

16.9 The residence approach consists in allocating GVA to the region where the unit is resident and the gross fixed capital formation to the region where the producer unit owning the goods actually uses them. The residence approach is particularly difficult to apply in the energy and transport industries. In brief, the residence approach means that GVA obtained from transporting goods across several regions is not split between the regions but allocated to one region, that in which the producer unit is resident. In addition, gross fixed capital formation in national infrastructure networks is allocated to the region where the unit in charge of the infrastructure is resident rather than where the asset is located.

16.10 In the territorial approach, activities resulting from factors of production would be allocated to the region in which the economic activities are actually carried out, irrespective of the resident regions of either the factor of production or the production units. The activities of a builder, for example, would be allocated to the region where the building site is located. Interregional transport activity would be split between the regions and gross fixed capital formation on energy and transport networks would be allocated to the region where the asset is located. In more general terms, the activity resulting from factors of production would be allocated to the region in which the economic activities are actually carried out, irrespective of the resident regions of either the factor of production or the production units.

16.11 Data availability represents a major constraint when compiling regional accounts, SUTs and IOTs. The availability of regional statistics has a significant impact on the method chosen for the compilation of regional accounts, in particular for the compilation of trade flows across regions within a country.

16.12 Where there is a smaller territory of reference, represented by the regions of a country, more issues regarding confidentiality may arise as greater granularity is likely to create more data disclosure issues.

16.13 Another important issue arising in connection with the compilation of regional accounts, SUTs and IOTs is that of the coherence and consistency of the accounts at regional and national levels and also the matching of micro-estimates and macro-estimates.

16.14 As noted above, the two main methods for compiling regional national accounts, and thus regional SUTs and IOTs, are the top-down and bottom-up methods. The bottom-up (or ascending) method of estimating a regional aggregate involves collecting (or using) data at establishment level and adding them together to derive the regional value of the aggregate. The method is referred to as “bottom-up” because the elements for calculating the aggregate are directly collected at the local level.

16.15 The top-down method consists in the disaggregation at the regional level of the national accounts aggregates without any attempt to single out the establishment or local unit. The national figure is distributed using an indicator which is as close as possible to the variable to be estimated. For example, wages and salaries might be allocated to regions using total employment multiplied by average earnings from a different statistical source. Such variables like gross fixed capital formation, however, are much more difficult to allocate meaningfully in economic terms across several regions as there are no linked proxies. The method is named “top-down” because the aggregate is allocated to a region and not to a local unit and the notion of a local unit does not always underpin the estimates. Sometimes an indicator is used to allocate an aggregate to regions.

16.16 In general, the bottom-up method is preferred but it relies on the availability of detailed data collected at regional level. In practice, the choice of the method is usually determined by the availability of data and the legislative and administrative arrangements in the country, and the methods often used consist of a combination of the two methods above. More information on the comparison between the top-down and bottom-up methods and methods for the compilation of regional accounts may be found in Eurostat (2013a) and (1995), and Eding and others (1999).

## C. Example of bottom-up methods for regional SUTs: Canadian experience

16.17 This section outlines practical issues arising in the compilation of regional SUTs using a bottom-up approach, through a description of the experience of Statistics Canada. The issues encountered by Statistics Canada reflect, to a great extent, general issues and the description of those issues is therefore put forward as a country example.

16.18 The section begins with an overview of the development and evolution of the annual Canadian regional input-output programme since its inception in the late 1990s. It then describes the interregional accounting framework and the methods used to address specific issues such as regional trade flows, valuation, and other conceptual issues in the regional accounts. The section concludes with an account of the lessons learned by Statistics Canada and future directions for the Canadian programme, providing a useful insight for other countries at various stages of their statistical development.

### 1. Development and evolution of regional economic accounts

16.19 The Canadian macroeconomic accounts programme produces comprehensive annual provincial and territorial input-output accounts. These consist of detailed rectangular SUTs built for the most part through the bottom-up approach, with the national SUTs being the sum of the provinces and territories. They are released some two and a half years after the reference period in question and are fully integrated with the other regional dimensions of the Canadian System of Macroeconomic Accounts programme. This includes more timely annual estimates of income-based and expenditure-based GDP and of real GDP by industry for Canada's provinces and territories. They draw on a well-developed statistical feeder system, including economic surveys, tax data and other administrative and regulatory sources. They are entrenched in regional fiscal policy implementation and make possible a range of important interregional analyses and applications.

#### (a) Evolution of interregional accounts

16.20 The need for regional accounts to provide a rigorous framework for economic analysis has long been recognized in Canada. The Canadian economy is characterized by a high degree of regional diversity and specialization, and also by a high volume of trade among provinces and territories.

16.21 Regional input-output accounts evolved out of national programmes with a long history in Canada. They started with developing the components of the income approach to measuring GDP and final domestic demand by province in 1981. The accounts replicated the concepts and framework at the national level but were constructed with more limited information. Rather than employ bottom-up estimation by region, they were generally based on approximate allocations of more robust statistics built at the national level. The early accounts were experimental in nature and lacked the critically important regional trade flows which were subsequently developed when the enabling regional SUTs framework was in place.

16.22 Experimental IOTs for Canadian provinces and territories were developed on an ad hoc basis as resources permitted and included the reference years 1974, 1979, 1984 and 1990. These tables were primarily intended for modelling purposes and used data from existing statistical programmes designed to compile estimates at the national level. Unlike their national counterparts, they were not fully integrated with the standard national accounts programme and did not serve as benchmarks for national accounts compilation.

16.23 Official annual regional SUTs were introduced in the Canadian System of Macroeconomic Accounts programme with the reference year 1997, when a significant investment was made in provincial economic statistics to improve their quality for use in specific regional fiscal policy applications. In particular, the regional tables would ensure the necessary quality and provide sufficient detail for use in allocating revenue from the newly introduced harmonized sales tax, a VAT-type tax applied among the federal government and participating provinces.

16.24 Starting in 1997, a comprehensive programme was implemented to compile fully integrated national, provincial and territorial statistics for three components of the Canadian System of Macroeconomic Accounts on an annual basis:

- Income and expenditure dimension
- Provincial and territorial GDP by industry
- Input-output accounts

16.25 Use of the regional accounts was thereafter integrated in fiscal formulae spelled out in federal regulations.

**(b) Development of statistical feeder systems**

16.26 The new role played by regional accounts called for a significant improvement in the quality and detail of economic source data at subnational level. To fulfil this role, an agency-wide project known as the Project to Improve Provincial Economic Statistics was launched in 1996. A principal mandate of the project was to ensure that provincial statistics used to build the new accounts were adequately reliable for intergovernmental revenue-sharing and for critical scrutiny by participating governments. Since fiscal formulae relied on provincial shares to determine revenue entitlements, it was also necessary that estimates were uniformly reliable across all provincial jurisdictions. The existing survey framework and infrastructure were overhauled and revamped, and a range of new annual business surveys introduced.

16.27 A critical strategy of the Project to Improve Provincial Economic Statistics was to integrate the content of the economic survey programme through the introduction of the Unified Enterprise

Survey. Among its features, this survey included a centralized survey frame operated through an enhanced business register with the regular profiling of the organizational structure of large and complex enterprises, to ensure their accurate representation of establishments by region. The strategy focused on the collection of production, employment, sales and other requisite information at the establishment level to ensure an accurate reflection of the region where operations took place, while maintaining coherence at the enterprise level.

16.28 A second element of the Project to Improve Provincial Economic Statistics was to enhance access by Statistics Canada to, and its capacity to make use of, administrative records such as corporate tax files. Increased reliance on administrative records allowed data collection at substantially lower cost and with minimal response burden. The principal administrative database is the General Index of Financial Information, consisting of the financial statements of all Canadian businesses based on corporate income tax records. Extensive use is also made of other tax data on income statistics such as personal tax and personal income.

16.29 More recently, the objectives of the Unified Enterprise Survey are being advanced through an expanded harmonization initiative at Statistics Canada known as the Integrated Business Statistics Program. This new framework further integrates survey operations, including content, collection and processing, with a view to realizing important efficiency objectives. It also benefits from a more mature system of administrative data sources. Unlike the Unified Enterprise Survey, which was limited to annual economic surveys covering specific industries (manufacturing, services and distributive trades) the Integrated Business Statistics Program will eventually cover all industries and activities surveyed, both annual and sub-annual.

### 2. Regional accounting framework

16.30 The Canadian SUTs are rectangular in format, permitting the articulation of many products per industry covering both outputs and inputs. A product may thus be produced by many industries and purchased by many users. The national and the interregional tables record 230 industries based on the North American Industry Classification System (NAICS) and 490 products, along with 278 categories of final uses, comprising:

- 100 household final consumption expenditure groups
- 54 industry groups for gross fixed capital formation in machinery and equipment
- 54 industry groups for gross fixed capital formation in construction
- 54 industry groups for gross fixed capital formation in intellectual property
- 2 inventory groups
- 9 categories of government and NPISH expenditure

- 5 categories for imports and exports

16.31 The regional accounts in Canada are compiled for 14 regions, which comprise 10 provinces, 3 territories and 1 territorial enclave.

16.32 In order effectively to integrate national and regional concepts and conventions, Statistics Canada focused on two principal areas: the development of interregional trade flows and the regionalization of production. These are described in the following sections.

### (a) Interregional trade flows

16.33 The accounting framework of the interregional (or interprovincial, as they are known in Canada) SUTs is an extension of the framework of the national SUTs. It consists of two sets of tables:

- SUTs for each region

- Interregional trade flows table

16.34 The format of regional SUTs differs from that of national tables in one essential respect. The final expenditure categories include regional import and regional export columns, in addition to the foreign export and foreign import columns of the national tables. This is represented in Table 16.1.

**Table 16.1 SUTs framework for interregional SUTs**

**National**

| | | Products | | | | Industries | | | | Final uses | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agriculture, forestry, etc. | Ores and minerals; etc. | ... | Services | Agriculture, forestry, etc. | Mining and quarrying | ... | Services | Final Consumption | Gross capital formation | Exports to ROW | Imports from ROW | |
| Products | Agriculture, forestry, etc. | | | | | | | | | | | | | |
| | Ores and minerals; etc. | | | | | | | | | | | | | |
| | ... | | | | | | | | | | | | | |
| | Services | | | | | | | | | | | | | |
| Industries | Agriculture, forestry, etc | | | | | | | | | | | | | |
| | Mining and quarrying | | | | | | | | | | | | | |
| | ... | | | | | | | | | | | | | |
| | Services | | | | | | | | | | | | | |
| Gross value added | | | | | | | | | | | | | | GDP |
| Total | | | | | | | | | | | | | | |

Zero by definition

....

**Region 2**

**Region 1**

| | | Products | | | | Industries | | | | Final uses | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agriculture, forestry, etc. | Ores and minerals; etc. | ... | Services | Agriculture, forestry, etc. | Mining and quarrying | ... | Services | Final Consumption | Gross capital formation | Exports to ROW | Imports from ROW | Exports to other Regions | Imports from other Regions | |
| Products | Agriculture, forestry, etc. | | | | | | | | | | | | | | | |
| | Ores and minerals; etc. | | | | | | | | | | | | | | | |
| | ... | | | | | | | | | | | | | | | |
| | Services | | | | | | | | | | | | | | | |
| Industries | Agriculture, forestry, etc | | | | | | | | | | | | | | | |
| | Mining and quarrying | | | | | | | | | | | | | | | |
| | ... | | | | | | | | | | | | | | | |
| | Services | | | | | | | | | | | | | | | |
| Gross value added | | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | | |

Zero by definition

16.35 The interregional trade flow tables provide a further regional breakdown for each column of regional export and import. This is a matrix which identifies the exporting and importing regions for each product. The data sources used in developing the flows are:

- Annual survey of manufacturers (destination of shipments)
- Annual wholesale survey (origin and destination)
- Surveys on transportation origin and destination
- Surveys on destination of services data from business services
- Travel survey of the residents of Canada

16.36 Trade flows are conceptually reflected by the sale of products from one region (or abroad) to another. Exports originate from a region if the goods or services are produced or withdrawn from inventories of an establishment in the region. The region of export or import refers to the ultimate region of origin and destination rather than the port of landing or the regions where goods are shipped. A regional export also occurs when goods and services are purchased within a region by non-residents, such as hotel accommodation, meals or entertainment. Similarly, imports are defined if the goods or services are destined for the region's current expenditure or capital expenditure, used as intermediate inputs by establishments in the region or make up additions to inventories. Goods shipped into a region but destined for another region do not constitute imports.

**(b) Valuation**

16.37 Trade flows of goods are valued at basic prices. By this definition, the valuation of a good excludes all costs associated with transportation, distributive trade (wholesale and retail) mark-ups and also taxes on products. This method of valuation is preferable to purchasers' prices, since it more accurately measures the value of trade flows of goods and services by permitting the decomposition of purchasers' price into its separate costs.

16.38 To illustrate this point, we may take a good produced in Quebec purchased by a wholesaler in Ontario and subsequently sold to a customer in Alberta via a retailer. A Manitoba trucker transports the good from Quebec to Alberta. As a final consumer, Alberta is importing from three provinces: Quebec, Ontario and Manitoba. The basic price value of the good is an import from Quebec; the wholesale mark-up is an import from Ontario; while the transportation service is an import from Manitoba. The retail margin is Alberta's own production and, hence, no interprovincial trade flow is generated. If the trade flows were valued at purchasers' prices for the above example, this could only be represented as a single trade flow from Quebec to Alberta, and the activity occurring in Ontario and Manitoba would not be shown.

### (c) Accounting identities

16.39 The principal accounting identities used in the derivation of interregional and international trade flows of goods and services are described below.

16.40 In each province and for each product, the total domestic supply must equal the sum of sales to the rest of the world (international exports), sales to other provinces (interregional exports), and sales within the province itself. Total domestic supply is defined as the value of production plus shipments out of the inventories of producers, wholesalers and retailers. Estimates of the total domestic supply originate with the regional SUTs. Each side of the identity (whether trade flows or components of total domestic supply) is often measured from different data sources.

16.41 In each province and for each product, the total domestic use must equal the sum of purchases from the rest of the world (international imports), purchases from other provinces (interprovincial imports), and purchases from its own province. Total domestic use is equal to final domestic use plus intermediate domestic use (inputs into the production process) plus additions to inventories of producers, wholesalers and retailers. Again, estimates of the total domestic use originate with the regional SUTs. Each side of the identity (whether trade flows or components of total domestic use) is often measured from different data sources.

16.42 In each region and for each product, the total domestic supply minus total domestic use equals total exports minus total imports. This yields a measure of net trade by province and by product.

16.43 For each product, the sum of international exports and imports by region is identical to their national counterparts.

16.44 For each product, interregional exports and imports are the same when summed over all provinces since one region's exports must be another region's imports.

16.45 For each product, the sum for all regions' total domestic supply and use, combined with foreign supply and use equal the national values of total supply and total use.

16.46 Goods purchased outside Canada and re-exported to the rest of the world are not part of the regional identities. They are recorded as a separate element, as a trade flow from the rest of the world to outside Canada.

16.47 The above identities collectively form an accounting framework for adjusting source data, filling data gaps and analysing the quality and consistency of trade flow estimates. They are particularly important because, although several sources exist that indicate trade flows, they are often not adequate for developing a complete matrix of interregional trade flows.

16.48 It is worth noting, that surveys on destinations are very unusual and difficult to undertake. It is essential, however, to include wholesale trade to be able to follow deliveries. Chile is another country that undertakes such surveys for its five-yearly benchmark SUTs.

16.49 The rectangular framework allows the trade flow pattern obtained from the sources mentioned to be prorated iteratively, for example, using the RAS technique, to the domestic supply and domestic use control totals originating from the provincial SUTs. This is carried out in respect of the above identities for each product at the highest level of detail possible, the 490 products.

16.50 Table 16.2 presents the accounting framework and identities reviewed and also a summary of the total of all interregional and international trade flows for the year 2010. There is a similar table for each of the 490 products, in which all the above-mentioned accounting identities are in place.

### Table 16.2 Interregional and international trade flows by province and territory, 2010

Millions Canadian dollars

| | Destination | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Origin | N.L. | P.E.I. | N.S. | N.B. | Que. | Ont. | Man. | Sask. | Alta. | B.C. | Y.T. | N.W.T. | Nvt. | Govt. Abr. | Rest of the world | Supply | Exports to Rest of the world | Exports to other regions |
| N.L. | 31 678 | 78 | 946 | 1 949 | 2 103 | 1 351 | 328 | 56 | 314 | 108 | 3 | 16 | 7 | | 10 959 | 49 897 | 10 959 | 7 259 |
| P.E.I. | 90 | 7 241 | 273 | 275 | 183 | 369 | 21 | 19 | 54 | 30 | | | | | 927 | 9 483 | 927 | 1 315 |
| N.S. | 870 | 377 | 55 273 | 1 325 | 1 587 | 2 170 | 220 | 159 | 592 | 461 | 9 | 37 | 28 | | 6 354 | 69 461 | 6 354 | 7 834 |
| N.B. | 959 | 586 | 1 663 | 44 450 | 3 852 | 1 853 | 265 | 106 | 874 | 347 | 11 | 43 | 17 | | 12 377 | 67 404 | 12 377 | 10 577 |
| Que. | 1 597 | 339 | 2 453 | 3 116 | 498 869 | 38 721 | 2 317 | 1 792 | 7 696 | 6 001 | 78 | 316 | 246 | 19 | 78 083 | 641 643 | 78 083 | 64 692 |
| Ont. | 3 280 | 829 | 5 394 | 4 722 | 40 717 | 958 738 | 8 083 | 6 267 | 24 535 | 18 364 | 305 | 609 | 408 | 224 | 186 975 | 1 259 450 | 186 975 | 113 737 |
| Man. | 112 | 35 | 211 | 182 | 2 152 | 6 235 | 76 824 | 1 880 | 2 811 | 1 686 | 25 | 72 | 29 | | 12 909 | 105 162 | 12 909 | 15 430 |
| Sask. | 38 | 27 | 102 | 128 | 1 016 | 5 736 | 2 254 | 82 644 | 5 142 | 1 621 | 15 | 42 | 27 | | 26 130 | 124 922 | 26 130 | 16 148 |
| Alta. | 683 | 92 | 750 | 743 | 5 543 | 19 861 | 5 409 | 11 658 | 373 317 | 15 459 | 313 | 811 | 332 | | 79 807 | 514 779 | 79 807 | 61 655 |
| B.C. | 287 | 87 | 671 | 577 | 5 014 | 10 451 | 1 603 | 1 966 | 13 089 | 301 484 | 402 | 282 | 168 | | 41 527 | 377 609 | 41 527 | 34 598 |
| Y.T. | 2 | | 4 | 4 | 22 | 133 | 7 | 9 | 38 | 92 | 3 511 | 23 | 6 | | 313 | 4 164 | 313 | 341 |
| N.W.T. | 9 | 1 | 10 | 4 | 111 | 659 | 23 | 28 | 133 | 87 | 17 | 5 999 | 85 | | 2 122 | 9 286 | 2 122 | 1 166 |
| Nvt. | 5 | | 9 | 2 | 50 | 387 | 11 | 7 | 33 | 12 | 1 | 31 | 3 376 | | 21 | 3 945 | 21 | 548 |
| Abroad | | | | | | 9 | | | | | | | | 1 374 | 1 | 1 384 | 1 | 9 |
| Rest of the world | 7 997 | 973 | 10 369 | 14 605 | 100 959 | 214 299 | 13 746 | 14 420 | 60 944 | 49 740 | 396 | 846 | 287 | 528 | 24 708 | 514 817 | 24 708 | |
| Demand | 47 607 | 10 665 | 78 128 | 72 083 | 662 178 | 1 260 971 | 111 109 | 121 010 | 489 573 | 395 493 | 5 086 | 9 127 | 5 018 | 2 146 | 483 213 | 3 753 407 | 458 505 | 335 308 |

| | N.L. | P.E.I. | N.S. | N.B. | Que. | Ont. | Man. | Sask. | Alta. | B.C. | Y.T. | N.W.T. | Nvt. | Govt. Abr. | Rest of the world | Supply |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Imports from Rest of the world | 7 997 | 973 | 10 369 | 14 605 | 100 959 | 214 299 | 13 746 | 14 420 | 60 944 | 49 740 | 396 | 846 | 287 | 528 | 24 708 | 514 817 |
| Imports from other regions | 7 932 | 2 451 | 12 486 | 13 027 | 62 350 | 87 934 | 20 539 | 23 946 | 55 312 | 44 269 | 1 179 | 2 283 | 1 355 | 244 | | 335 308 |

Canada 2010

16.51 The numbers along each row, except those on the diagonal, represent the exports of the province or territory identified at the head of the row toward the other provinces or territories and the rest of the world. The last number along a row represents the total domestic supply of the exporting region. Total domestic supply estimates are derived from the regional SUTs.

16.52 The numbers down each column, except those on the diagonal, represent the imports of the region identified at the top of the column from other regions and the rest of the world. The last number at the bottom of a column represents the total domestic use of the importing region. Total domestic use estimates are derived from the regional SUTs.

16.53 The estimates along the diagonal represent the value of the goods produced and consumed within the same region. The estimate on the diagonal at the "world" intersection represents goods imported from outside Canada and re-exported to the rest of the world. These re-exported international imports have been excluded from both international imports and exports of all regions.

16.54 It should be noted that, since one region's exports forms another region's imports, the Canada total of interregional exports is equal to that of total interregional imports. Finally, the number on the diagonal at the intersection of the total supply column and total use row represents Canada's total supply or use from both domestic and foreign sources.

16.55 As the trade flows are derived in a fully balanced set of provincial SUTs, whereby the supply and use constraints are derived from these tables, changes in trade flows are often traceable to changes in these supply and use constraints. Furthermore, these constraints yield net trade estimates which provide reliable constraints for the derivation of provincial trade flows.

## 3. Conceptual issues involved in regionalization of economic accounts

16.56 In paragraph 18.47, the 2008 SNA identifies three types of institutional units that require different treatments in the regionalization of accounts:

- Regional units
- Multiregional units
- National units

16.57 Multiregional units have their centre of predominant economic interest in more than one region. National units such as national governments have a centre of predominant economic interest that is not located geographically, not even in the sense of a multiregional location. When regional source data are available, a bottom-up-approach is applied, in which the sum of (actual) provincial data becomes the national total. This is applied with all goods-producing industries, distributive trade and several service industries. In cases where there are no detailed regional data, the approach used is generally top-down where national estimates are allocated to regions based on industry-specific methodologies. Starting with the 1997 reference year, when regional surveys and other sources came on stream, the top-down approach is used in only a few areas in the Canadian input-output accounts.

16.58 The accounting framework was developed to ensure the effective integration of national and regional concepts and conventions. The accounting framework incorporated the following conventions which are further described in the next sections:

- An additional region that covers foreign production such as that of embassies and armed forces abroad.

- Consistent and economically meaningful treatment for the head offices for multiregional corporations.
- Regionalization of central government expenditures, construction projects, and the output of the air transportation industry.
- Treatments for regionalization of financial services, such as banking and insurance.

**(a) Spatial boundary: extra-regional foreign production**

16.59 Developing regional accounts in an existing national framework will involve certain economic activities that properly belong in the national jurisdiction but are not associated with any specific region. Examples include embassies, armed forces stationed abroad and activities relating to off-shore oil and gas extraction. With off-shore activities in relation to Canada, these do not pose a regionalization problem as, under the constitution, each province and territory has its respective jurisdiction over off-shore resources. The activities of embassies and armed forces stationed abroad, however, do not take place within the spatial boundary of a province or territory and, although part of national GDP, they have no economic impact on the region where the main responsibility centre is located. Rather than allocating activity across regions and thereby distorting GDP, a fourteenth region was created to accommodate such activities.

**(b) Head offices**

16.60 Head offices and other ancillary units, such as warehouses, serve all establishments that make up an enterprise. They often undertake significant expenditure on behalf of their establishments by, for example, purchasing data processing services delivered to constituent establishments or incurring costs that benefit them indirectly, such as wages of managers, advertising services, and other requirements. Head offices typically do not receive corresponding revenue from their establishments for these services.

16.61 The problem of multi-establishment head offices and ancillary units has two key dimensions: classification and allocation.

16.62 As stated in the 2008 SNA: "If an establishment undertaking purely ancillary activities is statistically observable, in that separate accounts for the production it undertakes are readily available, or if it is in a geographically different location from the establishments it serves, it may be desirable and useful to consider it as a separate unit and allocate it to the industrial classification corresponding to its principal activity" (para. 5.41).

16.63 This treatment ensures that GVA generated by head offices is recognized in the region of the head office. If the head office expenses were allocated to all constituent establishments in different regions, the head office would be effectively "moved" to other regions. Consequently, the actual host region's GVA, and in turn GDP, would be reduced or understated, while those of other regions would be overstated.

16.64 In order to preserve the GVA and GDP associated with the head office in the region of its actual residence, the treatment adopted in the Canadian accounts is to impute an output for the services provided by the head office equal to the sum of its own intermediate expenses plus the compensation of employees that staff the head office. In addition to these costs, a consumption of fixed capital component may be added to the imputation of output when adequate data are available. This step, however, is not followed in the Canadian accounts. The output of the head office would then be shown as a purchased input of all establishments in all industries and regions served by the head office.

16.65 Up to the 2014 reference year, the Canadian accounts do not include a separate head office industry. Outputs, inputs and GVA relating to head offices and ancillary units are classified to the industry of their primary establishment.

### (c) Output of central government

16.66 The output of central government and local government services is defined as the sum of the costs incurred in producing the services. The costs consist of intermediate inputs, compensation of employees, consumption of fixed capital, and other taxes less subsidies on production (see 2008 SNA, para. 6.94). Canada's system of government consists of three main levels: federal, provincial or territorial, and municipal. The last two levels of government do not present regionalization problems because their services are limited to the geographical boundaries of a single region.

16.67 Activities of the central or federal government are undertaken on behalf of all residents of Canada in all regions. As such, the federal government is a resident of all regions. In the allocation of federal government expenditures, the central conceptual question is that of where the goods and services are used in order to produce the government output. The convention adopted for this purpose is that production occurs in the region where transactions occur, in other words, where wages and salaries are paid, intermediate inputs are used and physical capital is consumed. This criterion is more relevant for national accounts because it is the impact of federal government activity on the regional economy that is most relevant for measuring production and in presenting regional policy choices. When the region where services are consumed is not identifiable, an approximation is made of the actual flow of goods and services. For example, the expenditure related to a coast guard vessel which patrols several provinces is assigned to the province of the home port of the vessel.

16.68 Another criterion considered but not implemented in the Canadian accounts calls for the allocation of federal government revenues and expenditures on the basis of benefits received by each region. Based on this approach, referred to as the "service benefit criterion", federal expenditures would be allocated on a per capita basis regardless of the regions in which they are incurred. This criterion assumes that federal expenditures generate services benefiting every Canadian.

**(d) Taxes**

16.69 In Canada, taxes on production are predominantly collected by local and provincial governments. Activities of these governments fall completely within boundaries of regions and present no regionalization problems.

16.70 Taxes on products are levied by all three levels of government: federal, provincial and municipal. Only federal taxes applicable to, and collected in, all provinces and territories present a regionalization issue. The federal government exacts a number of consumption taxes on goods and services, the largest of which are the goods and services tax, fuel tax and federal excise taxes, such as the sales tax on tobacco. These taxes on products are allocated to regions where taxable products are consumed for intermediate use or purchased as final use categories. Similarly, other federal product taxes such as excise duties, excise taxes and import duties are distributed based on the regional consumption of the relevant products.

**(e) Construction**

16.71 In the Canadian input-output accounts, construction is defined as the putting in place of buildings and structures by specialized trades managed by general contractors. Activity by construction contractors and by industries and governments on their own account are combined into a single industry group. This treatment was adopted in response to data limitations, since the values of materials and services are not available separately for construction contractors and own-account producers. It is preferable to assign an input product such as ready-mix concrete, for example, to a total construction activity than to distribute it among contract and own-account producers. This entails the shift of materials and labour compensation from industries undertaking own-account construction to the construction industry.

16.72 Construction is broken down into eight structural types: residential construction; non-residential building construction; transportation engineering construction; oil and gas engineering construction; electric power engineering construction; communications engineering construction; other engineering construction; and repair construction. Each structural type is treated as an industry with outputs, intermediate inputs and GVA components. Hence, the subcontractor's sales of special trades to general contractors are netted out of production and intermediate inputs, materials, services and primary factors are routed directly to the construction industry.

16.73 Following this concept of construction, the GVA generated belongs in the region where the structure is put into place, regardless of the residence of the contractor or its labour force. When regional boundaries are crossed by contractors, a notional establishment is created that employs the labour and capital dedicated to the project in the region where the work is carried out.

### (f) Air transportation

16.74 In Canada, there are very few dominant players in the air transportation industry, so that, at the provincial level, data sources show an over-representation of revenue in provinces where the corporate head offices of the national air carriers are located. As a result, the revenue from these sources is not very amenable for use in regionalization of the output. Other data are available on revenue by province but these data are based on the point of sale, which does not represent production as much as it does consumption. Although data are also available on the origin and destination of passengers, these do not include the intermediate steps of the journeys. Given the limitations of the available datasets, it was decided to distribute the national output of this industry over provinces using GVA by province. The provincial distribution of compensation of employees is obtained from personal income tax data. Gross operating surplus is allocated at a provincial level, based on consumption of fixed capital data by province.

### (g) Financial institutions

16.75 The regional distribution of financial institutions presents specific problems that involve both conceptual issues relating to the nature of production and measurement challenges that are the subject of current debate in many countries. The Canadian System of Macroeconomic Accounts has determined approaches to the regionalization of statistics on financial services, taking into account currently employed national concepts and conventions.

### (i) Banks and other deposit-accepting credit intermediaries

16.76 These institutions are legally authorized to accept deposits, and produce two distinct products: FISIM and other explicit, fee-for-service financial services. Where the regional allocation of FISIM is concerned, output is produced whether a lender provides funds to a bank or a borrower receives funds from a bank. Each type of transaction comprises a component of FISIM. Using this concept of output, production in the regions will vary depending on how much borrowing and lending activity takes place in each region, with some regions potentially showing flows of net lending and others showing net borrowing from other regions. This is consistent with the notion of an intermediation service underlying the SNA concept, where production is deemed to occur when funds are either borrowed or lent out. The Canadian System of Macroeconomic Accounts uses a provincial distribution of assets and liabilities that has sufficient detail for the allocation of FISIM by sector across the provinces. Output of FISIM by province is then calculated as the sum of the allocated national sectoral FISIM using the closest available proxy of loan or deposit. The second product of deposit-accepting institutions is financial services for which explicit fees are charged. Regional estimates for the output of these products present no conceptual problems, although a number of practical difficulties and data gaps remain. For instance, as fee incomes are not reported by region, total fees at the national level must be allocated to regions. Average levels of assets and liabilities by region are used as a guide for the allocation of fees relating to each type of asset or liability; thus, for example, the amounts held in cheque accounts are used to allocate fees earned from managing cheque accounts. Wages by province are used for fee types that do not have an associated logical asset or liability.

#### (ii) Life and non-life insurance

16.77 Like other financial services, life insurance and non-life insurance underwriters tend to be located in one region, whereas their clients and regional networks are dispersed across all regions. Since the most crucial part of insurance provision is risk management through risk pooling and re-insurance, there is a compelling argument that the security offered by an insurance policy is a product of risk pooling. Accordingly, the regional location of insurance production is taken to be that of the head office province. For its part, however, the network that distributes and delivers these services is located across all regions. In relation to these regional operations, the insurer incurs wages and salaries, commissions paid to sales staff, other intermediate expenses, and depreciation of physical capital located at their regional offices. A part of total output of insurance is therefore produced by its regional operations and must be allocated accordingly. Wages by province are used to carry out this allocation, as these represent the most reliable data by province available. A direct consequence of this concept of production is that production and consumption of services are geographically separated and generate interregional flows of payment between the producing and consuming regions.

#### (iii) Investment brokers

16.78 There are two distinct services offered by investment brokers. First, brokerage services, consisting of the purchase and sale of publicly traded financial assets such as bonds, equities and others are provided to clients. While they may interact with their clients through their network of local offices located in the regions, brokers provide these services by executing trades at their head office locations. Trades are executed at exchanges or through the electronic trading networks and electronic settlement infrastructure owned and operated by brokerage houses. Clearly, there is some production taking place in the head office province, where either the virtual or the physical exchanges follow client instructions and transact their trade. Second, these services are sometimes combined with the provision of financial advice to clients in their region of residence. Wages, salaries and commissions are paid in line with the services provided in regions. These services are produced and consumed in the same region, while that part of the service that relates to trade execution is produced in the head office province and consumed in the province of the client's residence. Since no adequate data exist on transactions by province of residence of clients, the costs of these services are presently allocated to provinces using proxies relating to investment income.

#### (iv) Open-end investment (mutual) funds

16.79 In Canada, members of the public can purchase units of mutual funds, which in turn invest their funds in a wide range of financial assets. The funds contract out the portfolio management to asset-management companies, and purchase professional services to manage the investments and ensure compliance with regulatory requirements. These fees are known collectively as management and administrative expenses and are usually expressed as a ratio to the net asset value of the fund (management expense ratio) and represent the output of the mutual fund. The money managers and other professional service providers are located in all regions of the country, so output does not coincide with the location of the mutual fund. Since the money management company is most often the fund sponsor, the regional location of the investment manager and fund tend to coincide. A practical means of allocating output regionally is therefore to use the fund location. A secondary expense (and output) associated with purchase of mutual fund units is incurred because companies sponsoring a fund, that is, marketing and distributing units of the fund, often charge a fee against the fund to compensate their licensed sales forces and financial advisors who recommend the fund. Such sales charges related to mutual funds are allocated to regions using data on labour compensation by region. The geographical location of the consumption of investment fees is straightforward because it depends on the region where the beneficiaries or investors are located. Since no data are available on the regional residence of funds' beneficiaries, household expenditure on mutual funds services is allocated to regions using proxies related to investment income. Consequently, there will be interprovincial exports of these services from those regions where money management is concentrated and imports of services into other regions.

## 4. Lessons learned and future directions

### (a) Role of SUTs in the Canadian system of national accounts

16.80 The Canadian regional SUTs are at the core of the Canadian System of Macroeconomic Accounts, serving as a statistical audit for consistency, integrity and comprehensiveness. The SUTs framework ensures coherence across programmes, with the SUTs functioning as a benchmark for integrated programmes of the Canadian System of Macroeconomic Accounts, including the income approach and expenditure approach to measuring GDP, GDP by industry and provincial labour productivity. The detailed SUTs also make possible the estimation of regional trade flows up to the latest reference year, which in turn allows for the estimation of interregional trade flows in the current period using a projected SUTs approach.

16.81 In order to assure quality across the integrated programmes of the Canadian System of Macroeconomic Accounts, annual reconciliation processes are conducted between the various internal stakeholders in Statistics Canada. This ensures important feedback on national estimates, including feedback to survey partners producing source data. Work-in-progress quality reviews carried out with provincial government statistical counterparts are also integrated into the annual cycle and provide additional quality checks.

16.82 In addition to the benchmarking and quality assurance role, the availability of regional SUTs has enabled Statistics Canada to maintain provincial input-output models and analytical products. Statistics Canada is therefore able to offer customized, client-specified economic impact simulations to clients on a cost-recovery basis. There is increasing appetite to undertake this work, with a view to gaining a better understanding of the regional impacts of infrastructure projects, for example, in the oil and gas industry. Specialized analyses are also undertaken for key clients such as the simulation of the impact of tax policy alternatives. The tables are also used in experimental work to develop, for example, estimates of subregional GDP for municipalities and provincial multi-factor productivity. Statistics Canada also offers regular regional workshops to educate potential users about these models and analytical products.

**(b) Challenges**

16.83 The production of detailed annual regional SUTs adds significantly to the cost and operational complexity of the statistical programme and involves a number of other significant challenges arising in the Canadian context, notably the following.

16.84 *Heightened scrutiny of data*: Since the data are used to allocate tax revenue across provincial governments (similar to the situation in the European Union, where national accounts data are used to determine member States' monetary contributions to the Union) and to equalize fiscal capacity across provinces through appropriate fiscal arrangements, they are subject to a great deal of scrutiny at the detailed product level. Tax outputs are key deliverables and quality must be maintained at a very detailed level. This accountability limits the flexibility to use approximate top-down modelling techniques in estimation and favours direct compilation from source data to ensure that estimates are transparent and justifiable.

16.85 *Confidentiality*: The broad use of detailed data presents challenges in terms of confidentiality and the need to suppress data to safeguard confidentiality. Efforts need to be made to develop a confidentiality mask to suppress data in such cells but also to minimize additional suppressions to avoid disclosure by deduction or by residual, thereby avoiding releasing only very aggregate estimates by province. Work is also required to adapt aggregations to ensure maximum information can be released. Although publicly released data used to include aggregations and suppressed cells, access to the full detail has been made available to all users as of 2016.

**(c) Costs**

16.86 While deemed worth the investment, Canadian regional SUTs are costly to maintain. Some 50 staff members are involved in the input-output programme within the Canadian System of Macroeconomic Accounts (this staffing level is unusually high but indicates the high priority attached to this work and its impact). In addition, substantial investment is made in collecting the source data required to build the estimates. In a recent modernization exercise, the industry and product classifications were streamlined. Detail that was considered no longer relevant was eliminated and new detail added in areas of growing economic importance, for example, the services industries and oil and gas.

### (d) Operational complexity

16.87 Maintaining a complex and detailed integrated programme involves coordinating a series of reconciliation and feedback processes on an annual cycle. It also entails constant active interaction with partners across a broad spectrum of sources to ensure that data requirements are met. These requirements are particularly challenging in periods of downsizing and constrained resources to maintain quality of outputs.

### (e) Historical continuity

16.88 This issue arises in particular when historical revisions are undertaken. In the Canadian System of Macroeconomic Accounts, the last, so to speak, “big-bang” historical revision was undertaken in 2012 with the introduction of the 2008 SNA. This involved a lengthy and complex decision-making process and, for cost-benefit reasons, it was not possible to recompile the tables back in time. It was therefore decided to undertake a backcasting exercise using a modelled approach for analytical purposes, implemented over time as allowed by capacity constraints. The Canadian System of Macroeconomic Accounts is moving to a new approach of more frequent, smaller-scale revisions across all programmes. A new mechanism is therefore needed to assure coherence across time that can be continuously maintained.

# Chapter 17. Multi-country supply and use tables and input-output tables

## A. Introduction

17.1 Although the focus of this Handbook is generally on national SUTs and national IOTs, there is growing demand for these instruments to capture the structure and mechanism of cross-border fragmentation of production activities. The development in recent years of multi-country SUTs and IOTs has been primarily driven by academic and policymaking interests in three key areas of global governance.

17.2 The first area is the link between the environment and the economy. There is a growing need to respond to the range of data demands for environmental analyses that cover policy, regulation and taxation and, more generally, will facilitate a better understanding of the cross-border impacts of economic activity on the environment. The study of the carbon footprint offers a view that complements production-based emission estimates as it gives a consumption-based perspective which identifies the driving forces behind emissions from the demand side (for example, final products associated with highest carbon dioxide emissions). The multi-country SUTs and IOTs with environmental extensions, such as carbon intensities and others, constitute a powerful analytical tool for tracking the footprint of production activities all over the world (see Wiedmann, 2009, and Carbon Trust, 2011).

17.3 The second area of interest relates to the rapidly changing features of international trade and governance. The "trade in value-added" analysis attempts to trace international flows of GVA embodied in traded products across economic activities and countries. The traditional approaches in studies of this kind rely heavily on information sourced from individual firms. The multi-country SUTs and IOTs-based analysis complements these traditional approaches, yet provides a wider perspective for analysing the nexus of inter-industrial linkages at the global scale (see OECD and WTO, 2013, and Inomata, 2014, for a non-technical introduction to the concept of trade in value-added). In addition, Inomata (2017) provides an extensive overview of the analytical frameworks of SUTs and IOTs for the study of global value chains.

17.4 Multi-partner country SUTs are of central importance in the satellite accounting framework for measuring global value chains. The Expert Group on International Trade and Economic Globalization Statistics was created by the United Nations Statistical Commission in 2015 with the task of preparing a handbook on a system of extended national accounts and integrated business statistics. In this handbook, measurement of the interconnectedness of economies is dealt with by properly accounting for global value chains while maintaining a national perspective.

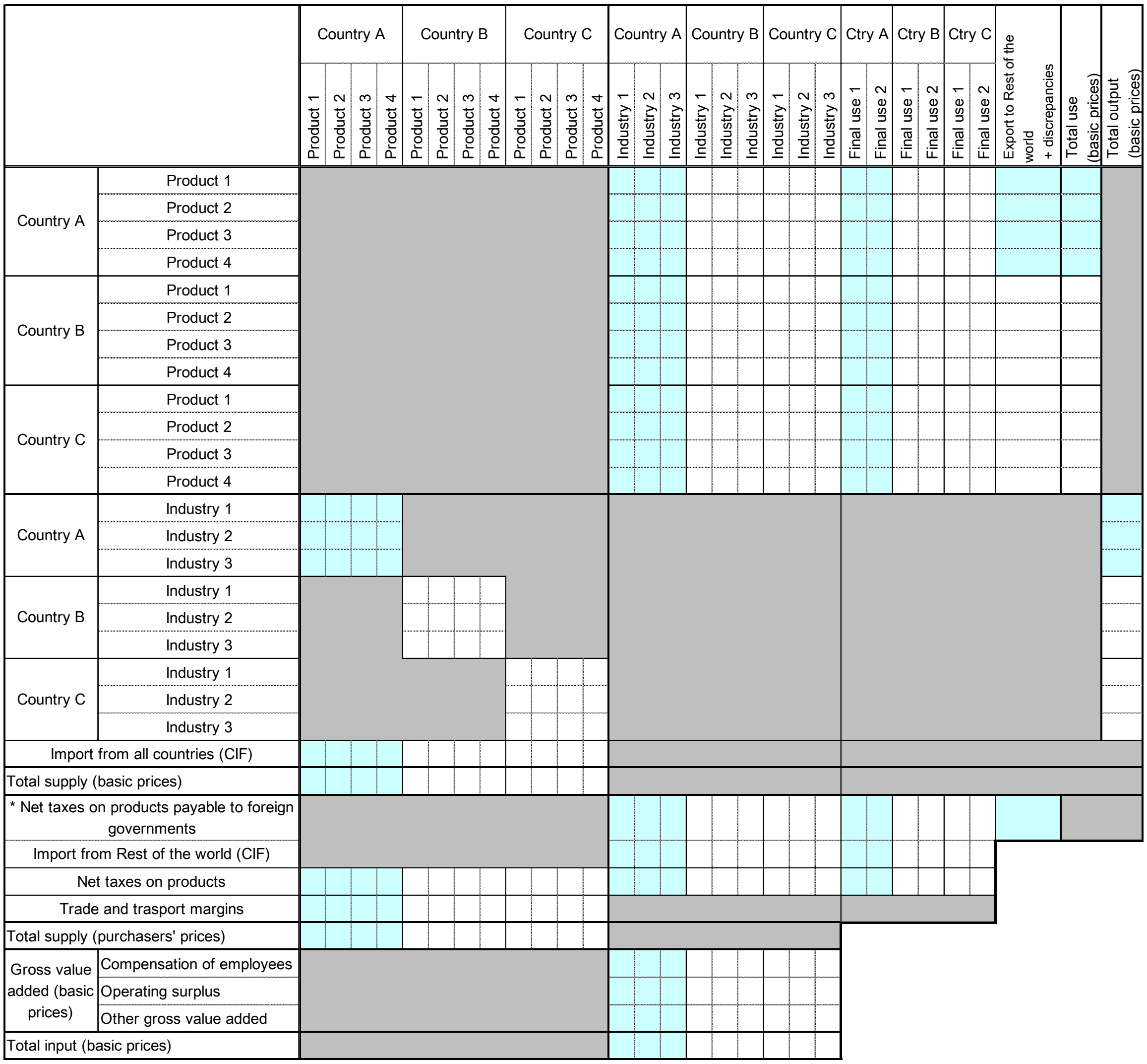
17.5 The third area of significant policy and business relevance concerns the impact of globalization on labour markets. Globalization has promoted international trade and production, yet, at the same time, we can observe a growing wealth disparity between those who are connected to global growth and those who are not. Linking multi-country SUTs and IOTs to the driving forces of global growth, in particular in the light of labour productivity and employment, will provide insights on the relationship between globalization and income distribution within a given country. To this end, employment, wages and other labour-related dimensions are regularly added to multi-country SUTs and IOTs (examples include the European Full International and Global Accounts for Research in Input-Output Analysis (FIGARO) project and the OECD-WTO trade in value added database), and national statistics offices are encouraged to consider adding these dimensions to their own SUTs.

17.6 The main objective of the present chapter is to provide a schematic description of the compilation procedure of multi-country SUTs and IOTs. Section B starts with an overview of the tables and then addresses some methodological and practical issues that arise during their compilation. Section C sets out a simplified compilation procedure. Section D introduces the efforts that have been undertaken so far at the international level to build the databases and section E describes areas of further work.

## B. Overview of multi-country SUTs and IOTs and main compilation issues

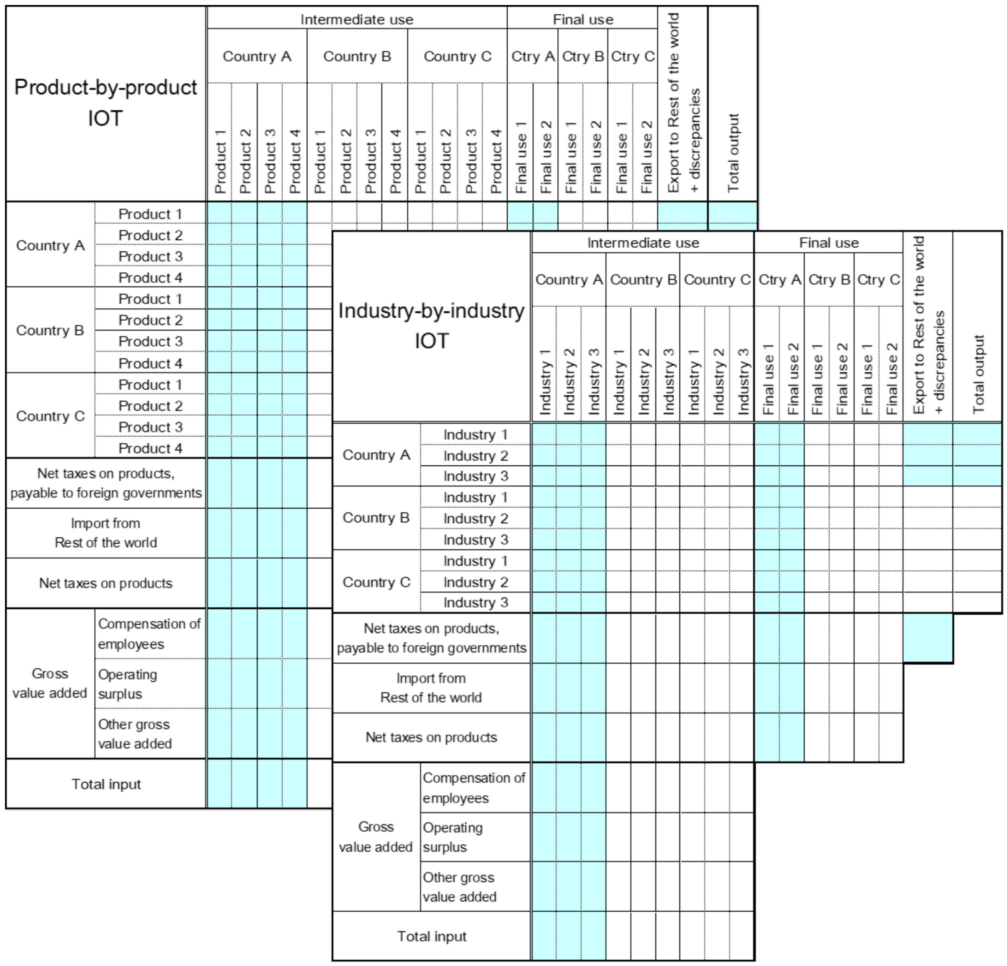
17.7 Multi-country SUTs and IOTs bring together the national tables of different countries into a single format, and thus have the same basic structure as the national SUTs and IOTs. The distinctive feature of multi-country tables, however, is that these tables explicitly present international transactions in the form of import matrices and export matrices by trading partners, which makes possible the comprehensive mapping of global production networks. Figure 17.1 and Figure 17.2 show a simplified format of multi-country SUTs and IOTs respectively, for the case of three countries with four products and three industries. The cells shaded in blue refer to the entries based on the source data of Country A, while segments without cells (shaded in grey) in the multi-country SUTs correspond to non-existent data by construction.

# Figure 17.1 Schematic representation of multi-country SUTs (three-country case)




* Except to those of the countries in Rest of the world

**Figure 17.2 Schematic representation of multi-country IOTs (three country case)**




17.8 As described in chapter 12, the SUTs system offers a flexible solution for choosing an appropriate type of model for the IOTs. The choice of model depends upon the nature of the research question that the model is seeking to satisfy.

17.9 Product-by-product IOTs are, in theory, generally recognized as providing better matching for the technical coefficients, yet for practical consideration, industry-by-industry IOTs may work better for policy analyses. This is because most of the analytical extensions in this research area are often derived from ancillary data such as carbon emission accounts, employment tables or capital stock matrices and these data are typically constructed on an industry basis rather than a product basis. In particular, the information on GVA is collected and shown at the industry level in the use table, which endorses the choice of industry-by-industry multi-country IOTs for the analyses of trade in value added. In addition, it is generally recognized that construction of the product-by-product IOTs is more demanding than the industry-by-industry IOTs from the viewpoint of data requirements and assumptions.

## 1. Valuation

17.10 There are different valuation schemes for SUTs and IOTs and each scheme has its own advantages and disadvantages, as reviewed in chapter 7. This Handbook, in line with the 2008 SNA, recommends basic prices for SUTs and IOTs and, in turn, this applies for the multi-country SUTs and IOTs.

17.11 If a country only compiles tables based on either producers' price or purchasers' price, these should be converted to the basic price valuation (for variables like GVA and output), including the export column, which is valued at FOB in the purchasers' price table, by the use of appropriate information on trade and transport margins and taxes less subsidies on products.

## 2. Classifications of constituent national SUTs and IOTs

17.12 Each national SUT and IOT may have its own product and industry groupings aligned with international classifications as appropriate. Table 4.1 in chapter 4 provides a flavour of the differences in terms of the number of products and industries used in various countries. The weights of different products and industries can also vary significantly. Countries with large agriculture-based economies have relatively detailed classifications covering their agricultural industry, whereas industrialized economies attribute more comprehensive coverage to the manufacturing industries. In consequence, the product and industry classifications (and their breakdown) used in national SUTs and IOTs reflect the characteristics of the economy concerned, and a precise concordance system that bridges national classifications and the classification used for multi-country SUTs and IOTs (referred to as "uniform classification") is absolutely essential for compiling consistent tables.

17.13 In general, a product and industry concordance system has a tree-like structure in which one product or industry of the uniform classification corresponds to one or several items in national classifications. If the concordance system has a clear-cut structure – namely, one to one, or one to many – then the aggregation of national tables into the uniform classification of multi-country tables will be much easier.

17.14 The problem arises when a single item in national tables is associated with several categories of the uniform classification. In such cases, preliminary disaggregation of the corresponding rows and columns of the national tables is required to ensure the appropriate reallocation of values under the uniform classification. This can be achieved by using the split ratios derived from other sources such as industrial statistics or business surveys.

17.15 The use of international classifications such as ISIC Rev. 4 for industries and CPC Version 2.1 for products in national tables will enormously facilitate the compilation of multi-country SUTs and IOTs.

### 3. Supplementary national data

17.16 For the compilation of multi-country SUTs and IOTs, supplementary data are needed which may not be part of the regular set of tables compiled at the national level. As a starting point, it is important to have national SUTs at basic prices which are not always available on an annual basis. In the European Union, for example, member States are required to transmit yearly national supply tables at basic prices and use tables at purchasers' prices, and, every five years, the valuation tables, the use tables at basic prices, including a split between domestic and imports, and the IOTs, including a split between domestic and imports. In addition, data needs for multi-country SUTs and IOTs go beyond these requirements and these need to be prepared for all countries participating in the scheme. The necessary additional data include:

- Import data (CIF) and export data (FOB), by product and by country of origin and of destination. The values of re-exports must be clearly distinguished in the data since they are recorded separately in the export vector of the imports use table (but not in the domestic use table) in the national SUTs. The 2008 SNA mentions the overall CIF/FOB adjustment (see, for example, 2008 SNA, para. 28.11 and chapter 5 of this Handbook) but here the total amount would need to be disaggregated by products and countries.
- Rates of international freight and insurance costs (in respect of CIF import values), by product and by country of origin. Only very few countries have the data available from their data sources; others typically estimate them based on certain assumptions and raw data. This data item can be shared, however, if a country is also able to collect import data on an FOB basis.
- Rates of domestic trade margins, preferably those on domestic export, by product and by industry. Some countries have separate information for wholesale and retail margins respectively.
- Rates of domestic freight transport costs, preferably those on domestic export, by product and by industry.
- Rates of net taxes on domestically produced products (in other words, not including those levied on imported products such as duties and import product taxes), by product and by industry.

17.17 The imports and exports of goods data may be directly constructed from foreign trade statistics, notably the international merchandise trade statistics database prepared by the United Nations. This database does not, however, distinguish between domestic exports and re-exports. This aspect is generally addressed through the use of other related sources, such as the data on the country of consignment for imports, for example, the data in the Comext database, for the European Union. It is advisable to present the data for intermediate uses and the data for final uses separately, by drawing on an appropriate reference such as the United Nations Classification by Broad Economic Categories (BEC) or the OECD Bilateral Trade Database by Industry and End-

Use (BTDIxE). The imports and exports of services data by product, and by country of origin and of destination should be supplemented wherever available, for example, from the balance of payments, business surveys and other such sources.

17.18 The data covering international freight and insurance costs are limited, necessitating some estimation work on the data available to make up for the missing information. Most of the empirical literature on international trade employs gravity equations, using the geographical distance between trading partners as a main explanatory variable for these costs (see, for example, Gaulier and Zignago, 2010). To address this need, OECD has produced detailed estimates of CIF/FOB margins for those countries where data are not available, and includes these data together with official published data in its database (see Miao and Fortanier, 2017).

17.19 By contrast, the data on domestic trade margins, transport costs and taxes less subsidies on products are usually presented in national SUTs.

## 4. Bilateral trade data

17.20 In compiling the multi-country SUTs and IOTs, bilateral trade data should be as coherent as possible, with equivalent data reported by partner countries, yet in reality there are substantial discrepancies between mirror statistics declared by two partners.

17.21 One of the sources of these discrepancies is inherent in the trade statistics themselves. This is often referred to as the problem of trade asymmetries. Theoretically, Country A's export of a particular product to Country B should be equal to Country B's import of that product from Country A. In practice, however, this is often not the case. The main causes of the asymmetries phenomenon include:

- Difference in valuation schemes of import (= CIF) and export (= FOB).
- Recorded difference between the country of origin (for import) and the country of destination (for export). While the former is identified on the basis of several criteria (product's custom code, GVA, etc.), the latter is typically assigned to the most immediate shipping destination.
- Improper declaration of product classification at the customs border, either entry or exit.
- Incorrect specification of re-exports and re-imports.
- Shipping time-lag across different accounting periods (quarters or years).
- Differences in the coverage of transactions referred to as "merchanting" trade.
- Goods entering or leaving the territory illegally, such as smuggling.
- other unspecified transactions, such as, among others, the issue of confidentiality.

Guo, Webb and Yamano (2009) provide a further description of the problem.

17.22 The discrepancies in the table may also be attributed to mismatches between the record of international transactions in SUTs and national accounts and those of the custom statistics, which aggravate the statistical discrepancies in the multi-country SUTs and IOTs.

## 5. Goods sent abroad for processing and merchanting trade

17.23 With the growing impact of globalization, the production process is becoming increasingly fragmented and dispersed among a number of different locations in various countries. The sending of goods abroad for processing is a production arrangement under which a manufacturer sends out materials or semi-finished products to foreign contractors for further processing, without a change in legal ownership of the products throughout the arrangement.

17.24 The issues associated with the choice of recording principles of goods sent abroad for processing are discussed in chapter 8. Accordingly, only the points relevant for the compilation of multi-country SUTs and IOTs are covered in this chapter.

17.25 The 2008 SNA and BPM 6 generally recommend the net principle for recording the transaction of goods sent for processing, both domestically and across countries. Foreign trade statistics (notably customs statistics) on the other hand record physical flows of goods based on a border-crossing principle rather than a change of economic ownership principle. In constructing multi-country tables by integrating the information of foreign trade statistics; accordingly, the values of goods sent abroad for processing must be removed from trade statistics in order to maintain consistency under the net principle.

17.26 Likewise, merchanting is a trading activity where a merchant generates profits by purchasing goods, typically primary products such as metals, oil, coal, gas, cereals, coffee and others, from the resident of one foreign country and then resells them at a higher price to the resident of another foreign country, without either changing the condition of goods and or needing to move the goods across the border of the merchant's home country.

17.27 Merchanting trade is not considered in the international merchandise trade statistics since it does not involve any physical inflow or outflow of goods across the national border of the merchant's home country. Only the export and import of goods between third countries as a result of merchanting are recorded.

17.28 The 2008 SNA and BPM 6 treat merchanting trade as net exports of goods by the merchant's home country (defined as the sum of negative export for the acquisition of the goods and positive exports for their resale). Hence, some adjustment is required to harmonize the records in the balance of payments with those in foreign trade statistics.

17.29 In BPM 6 the activity is considered under the goods account in line with the change of ownership principle in the 2008 SNA. Accordingly, trade asymmetries will be created if trading parties follow different versions of the BPM.

17.30 The need for these adjustments has already been pointed out in chapter 8 for the construction of the imports use table, yet the problem spills over to the compilation of multi-country tables. The failure to apply a necessary adjustment will result in the aggravation of statistical discrepancies in the multi-country SUTs and IOTs.

### 6. Diversity of presentation formats

17.31 Despite the fact that SUTs and IOTs form a central part of the SNA, a comparison of the various national tables of any individual country will exhibit different features and characteristics, reflecting that country's institutional idiosyncrasies such as different legal and taxation schemes along with such issues as the availability of data. In addition, there may be a legacy of country practice, whereby, for example, only either SUTs or IOTs are compiled, or, in cases where both SUTs and IOTs are compiled, the former are produced from the latter and not vice versa as recommended by the SNA. In line with the 2008 SNA, countries are encouraged to compile national SUTs first, and then the IOTs, using the SNA-based methodologies and concepts and various international classifications such as ISIC and CPC. This also helps to improve the quality, comparability and compilation processes of the multi-country tables.

17.32 Consequently, the compilers of multi-country SUTs and IOTs have to conduct a thorough examination of both conceptual and methodological differences between countries in the estimation of basic statistics for the national SUTs and IOTs and, if necessary, to carry out the initial adjustment of these tables by setting them out in a harmonized format prior to the compilation of multi-country SUTs and IOTs. In general, it is often the case that the statistics of detailed and information-rich tables need to be adjusted to bring them into line with those that are less detailed in order to achieve a uniform appearance, unless there is a good prospect of obtaining additional information so that the less detailed tables can then be upgraded. As a result, there is always a trade-off between the level of uniformity and the level of information embedded in generating consistent multi-country SUTs and IOTs and, hence, careful and thorough consideration is required in making adjustment rules.

17.33 Table 17.1 lists some examples of adjustment targets for national IOTs that constitute the Asian international input-output tables. The list demonstrates the diversity of presentation formats across the tables and, therefore, the difficulty of their harmonization. A detailed description of the methods applied may be found in Inomata (2016).

**Table 17.1 Adjustment targets for national tables of selected countries in the Asian international input-output table for the year 2000**

| | China | Indonesia | Japan | Rep. of Korea | Malaysia | Philippines | Singapore | Thailand | United States |
|---|---|---|---|---|---|---|---|---|---|
| 1. Conversion of valuation | | | | | | | | | |
| of private consumption expenditure | | | | | x | | x | | x |
| of Export vectors | | | | | x | | x | | |
| of Import matrix/vector | | | x | x | | x | | x | x |
| 2. Negative entries | | | | x | | | | | |
| 3. Dummy sectors | x | | x | x | x | | x | | x |
| 4. Machine-repair sector | x | | x | | | x | | | x |
| 5. FISIM | | | x | | x | | x | x | |
| 6. Special treatment of import/export | | | | | | | | | |
| for water transport | | | | | | | | | x |
| for "pure import" of gold | | | | | | | | | x |
| for re-export | | | | | x | | | | |
| for telecommunication | | | | x | | | | | |
| 7. Producers of government services | | | | | | | | x | x |

Source: Inomata (2016)

## C. Compilation procedure

17.34 Multi-country IOTs can be compiled either from national SUTs or national IOTs. In general, however, the preferred method for compiling multi-country IOTs is to use national SUTs as basic constituent tables. Using this approach, an imports use table of each country is analysed by country of origin and linked together with the international domestic use table to form the multi-country use table. The entire table is then transformed to square multi-country IOTs by an appropriate technology or fixed sales structure assumptions as covered in chapter 12.

17.35 The benefit of using SUTs rather than IOTs as inputs to the multi-country IOTs is concerned with three main issues:

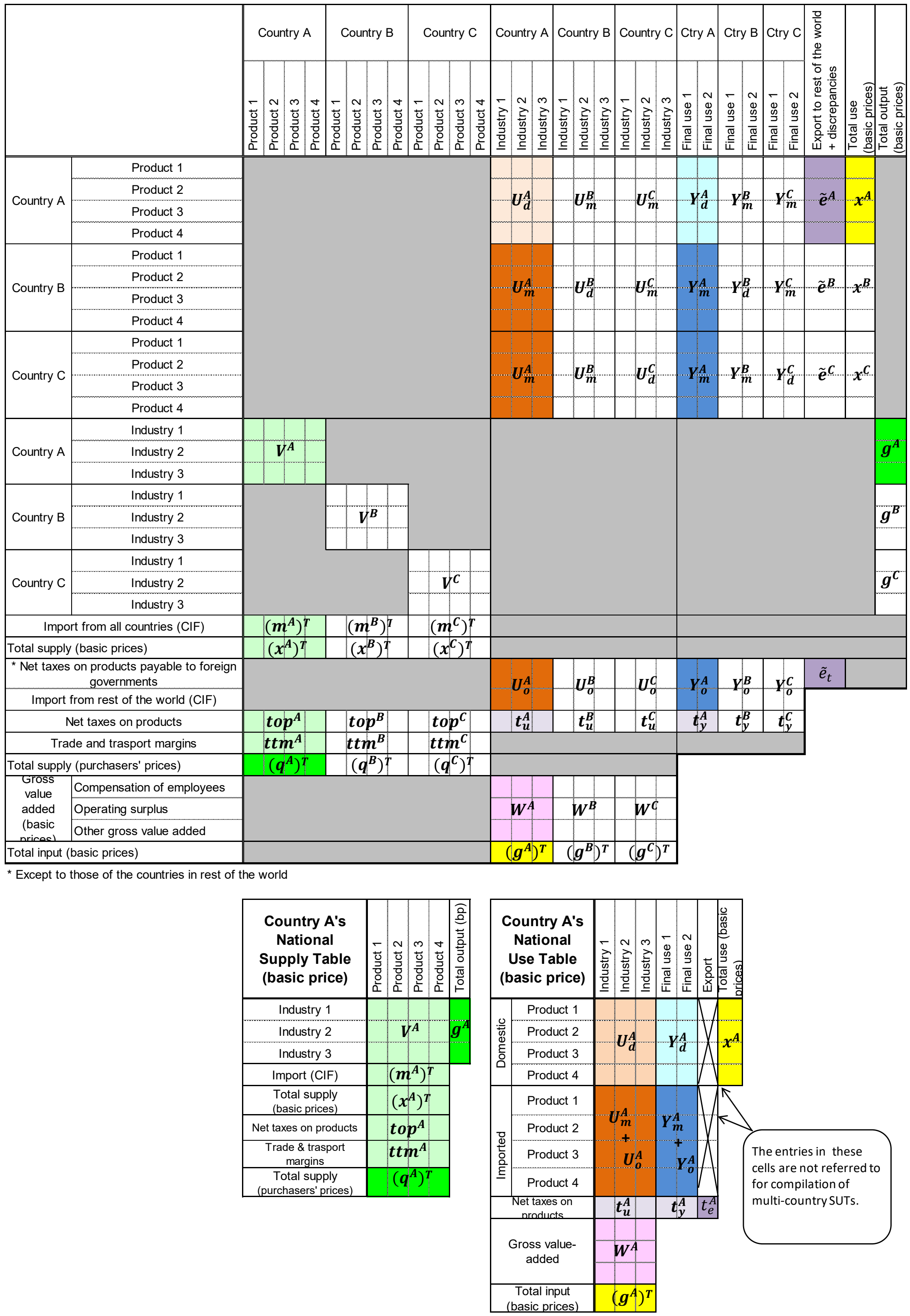
- The use of SUTs makes it possible to retain the information from source data on the input structures of industries in the form of multi-country use tables.
- When the imports use table is split, row by row, by the country of origin, the country shares from the trade statistics are used. Since the rows of the use table are shown as product categories, it is possible to split the import matrices at the product level, which is usually more detailed than the industry level. This improves the quality of the final product (namely, multi-country IOTs) when only non-survey methods are applied in the process.

- Both industry-by-industry and product-by-product types of multi-country IOTs can be derived from the system of multi-country SUTs depending on the analytical objective of users.

17.36 For these reasons, and with an expectation that an increasing number of national SUTs will become available in the foreseeable future, these guidelines propose the SUTs approach for compilation of multi-country IOTs, building on the method developed in the WIOD, see Timmer (2012). Alternative methodologies used by different institutions are shown in section D.

17.37 Figure 17.3 presents the entire image of the system of multi-country SUTs for the three-country case with four products and three industries. The segments without cells (shown in grey shading) correspond to non-existent data by construction. The other coloured cells refer to the entries based on the source data of Country A with each colour showing the link to the relevant segment in the national SUTs.

# Figure 17.3 System of multi-country SUTs and its conceptual correspondence to a national SUTs framework



17.38 Taking the notations provided in box 12.2 in chapter 12, the following key may be provided:

$V^r$ Domestic output matrix (= transpose of supply matrix)

$U_d^r$ Intermediate use matrix for domestic products

$U_m^r$ Intermediate use matrix for imported products from partner countries

$U_o^r$ Other entries for intermediate uses, including imports from the rest of the world

$Y_d^r$ Final use matrix for domestic products

$Y_m^r$ Final use matrix for imported products from partner countries

$Y_o^r$ Other entries for final uses, including imports from the rest of the world

$\tilde{e}^r$ Export to the rest of the world and statistical discrepancies

$top^r$ Net taxes on products, by product

$ttm^r$ Trade and transport margins, by product

$m^r$ Total import, by product

$\tilde{e}_t$ Net taxes on products paid out by the countries in the rest of the world

$t_u^r$ Net taxes on products for intermediate use, by industry, derived through the conversion process of matrices into basic price by using $top^r$ in the supply table

$t_y^r$ Net taxes on products for final use, by final demand sector, derived through the conversion process of matrices into basic price by using $top^r$ in the supply table

$t_e^r$ Net taxes on products for export, derived through the conversion process of the export vector into basic price by using $top^r$ in the supply able

$W^r$ Gross value added

$q^r$ Total supply, purchasers' price

$x^r$ Total supply/use, basic price (= total output by product)

$g^r$ Total input/output, basic price, by industry

bp Basic price

pp Purchasers' price

CIF Cost, freight and insurance

where superscript r is country code (r=A, B, and C), and superscript T indicates a transpose of a vector/matrix. Upper-case bold italic refers to a matrix, lower-case bold italic to a vector, and lower-case italic to a scalar.

17.39 As shown in Figure 17.3, the domestic transaction parts (in pale colours) of the multi-country SUTs can be directly transplanted from the original tables after the relevant aggregations into the uniform product and industry classification. In contrast, international transaction parts (in dark colours) require some processing before linking, as illustrated in Figure 17.3.

17.40 In order to integrate the national SUTs into multi-country SUTs, various common criteria need to be met for these constituent tables, most of which are already assumed in the recommendations provided throughout this Handbook. By and large, the tables should be:

- Consistent with key national accounts aggregates.
- Valued at basic prices, and expressed in common currency (for example, the United States dollar), using the year-average of IMF official exchange rates (the linking via external trade data at world market prices makes official exchange rates acceptable).
- Aggregated into the uniform product and industry classifications.
- Harmonized across the different sources in terms of their presentation format (see section B.6 above).
- Split between the domestic use table and imports use table of the same dimension. The export vector in the domestic use table should contain only domestically produced products, and it should not include re-exports, which should be separately presented in the export vector of the imports use table.

17.41 Once the classifications of the constituent national SUTs have been harmonized and supplementary data have been gathered, the compilation of multi-country SUTs can then be organized in the following four steps:

Step 1: Splitting the imports use able by country of origin

Step 2: Converting valuation of the imports use table from CIF to basic prices

Step 3: Creating the export vector to the rest of the world

Step 4: Linking and reconciliation of the table

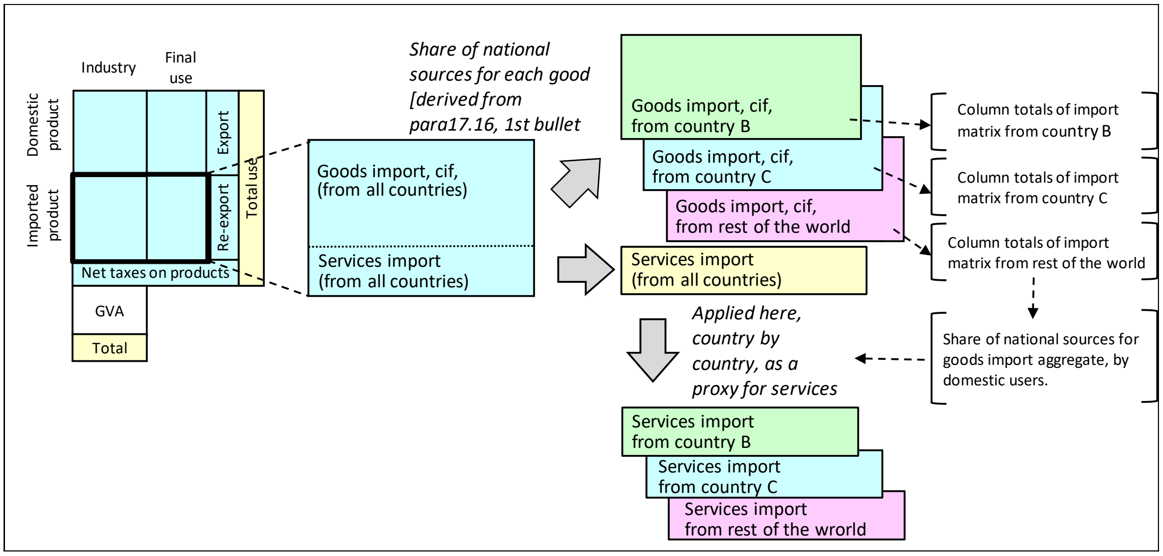
**Step 1:Splitting the imports use table by country of origin**

17.42 The first step of this stylized example is to split the imports use table using the share of national origins for each imported product as shown in Figure 17.4. The goods transaction part is split by the shares derived from foreign trade statistics (see the first bullet point in the description of data in paragraph 17.16). Here, it assumes an identical distribution structure of an imported product among domestic users, irrespective of the countries from which the product is sourced (this is known as the "proportionality assumption"). Bilateral trade asymmetries should be reconciled as far as possible prior to using these data in order to minimize statistical discrepancies in the linked table, as outlined in section 4 of this chapter.

17.43 If the information on partner countries for imports of services is available, the same treatment as for imports of goods may be applied to splitting the import matrix of services.

Otherwise, the service transaction part may be split by referring to the aggregate shares of goods transaction as a proxy, as indicated on the right-hand side of Figure 17.4.

**Figure 17.4 Splitting the import matrix by country of origin**

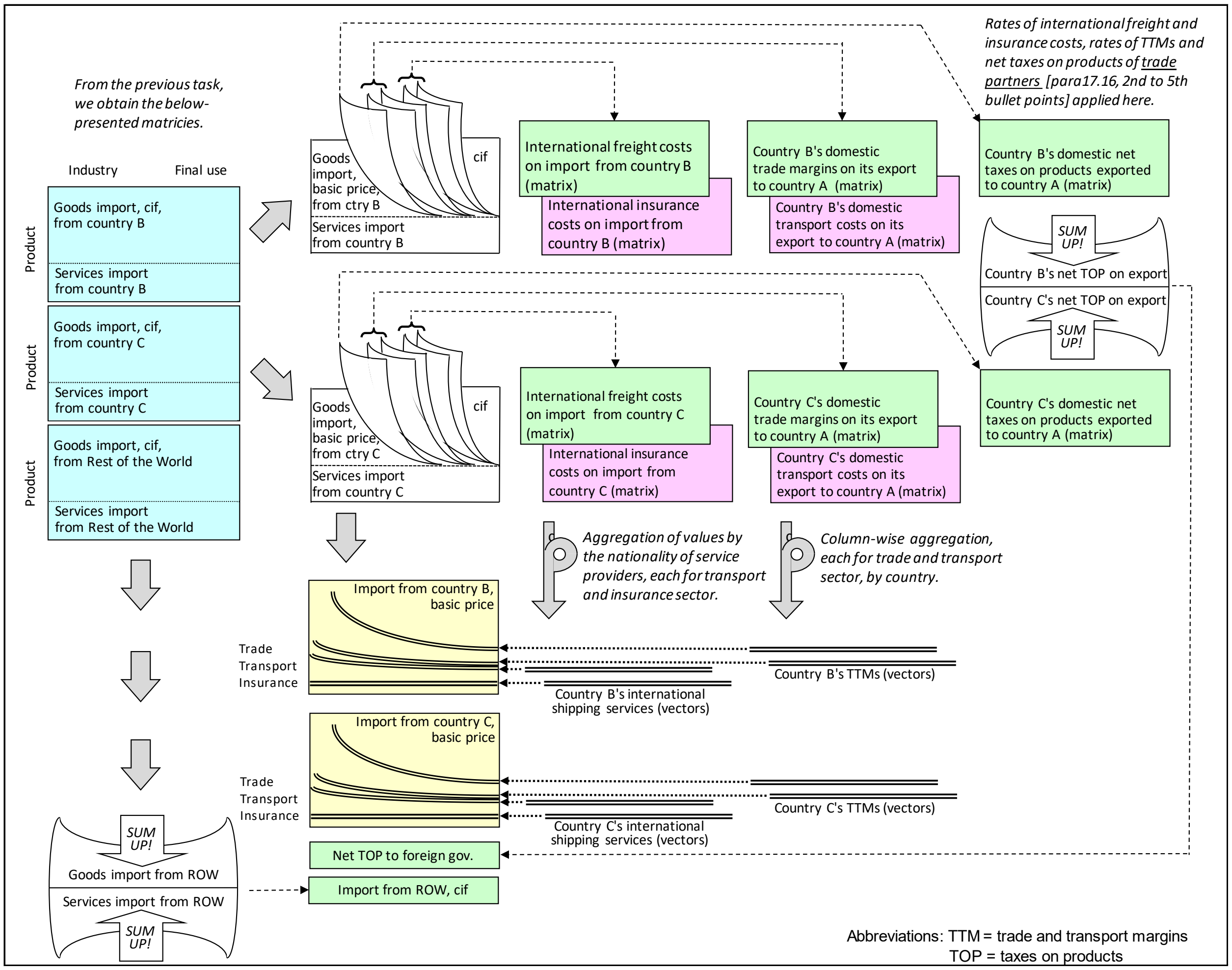



**Step 2:Converting valuation of the imports use table from CIF to basic prices**

17.44 Since the import transaction is valued in CIF, it must be converted to basic prices from the partner country's standpoint. This process is important in order to achieve a valuation that is consistent between domestic products and imported products, and to approximate a mirror relation between its own import and the partner's export (noting that the export vectors in the benchmarked national use tables are now valued at basic prices, not at FOB). The margins are individually removed by applying the respective margin rates in the correct order (see the description of all the bullet points, except the first, in paragraph 17.16). Figure 17.5 shows the steps for handling the valuation conversion.

17.45 As shown in the right-hand side of the figure, "taxes less subsidies on products payable to foreign governments" are aggregated column by column across all countries of origin into a single row vector, which is presented separately in the multi-country SUTs and IOTs.

**Figure 17.5 Converting valuation scheme**




17.46 By contrast, the domestic trade and transport margins, for the delivery of goods from factories to ports in the exporting countries, are individually aggregated by columns, country by country, and the trade margins are merged into the "trade" sector, and the transport margins into the "transport" sector of the corresponding import matrices. This is based on the recognition that trade and transport margins embodied in imported products are considered as the import of trade and transport services. It should be noted, therefore, that for the separation of trade and transport margins and, likewise, of taxes less subsidies on products, the rates of partner countries, rather than the country's own rates, must be applied.

17.47 For international freight and insurance costs, the residence of service providers should be identified using information from the third sources, in addition to the origins and destinations of international shipping. In the current OECD inter-country input-output tables, for example, international transport margins are redistributed to countries of origin according to the export share of the transport services of each country concerned using the service trade data derived from various sources. The values are then added to the corresponding sector (transport or insurance) of countries from which these services are sourced. In the event that the residence of the service providers cannot be identified, the international freight and insurance matrices are aggregated by column across all countries of origin into a single row vector, which is separately presented in the table.

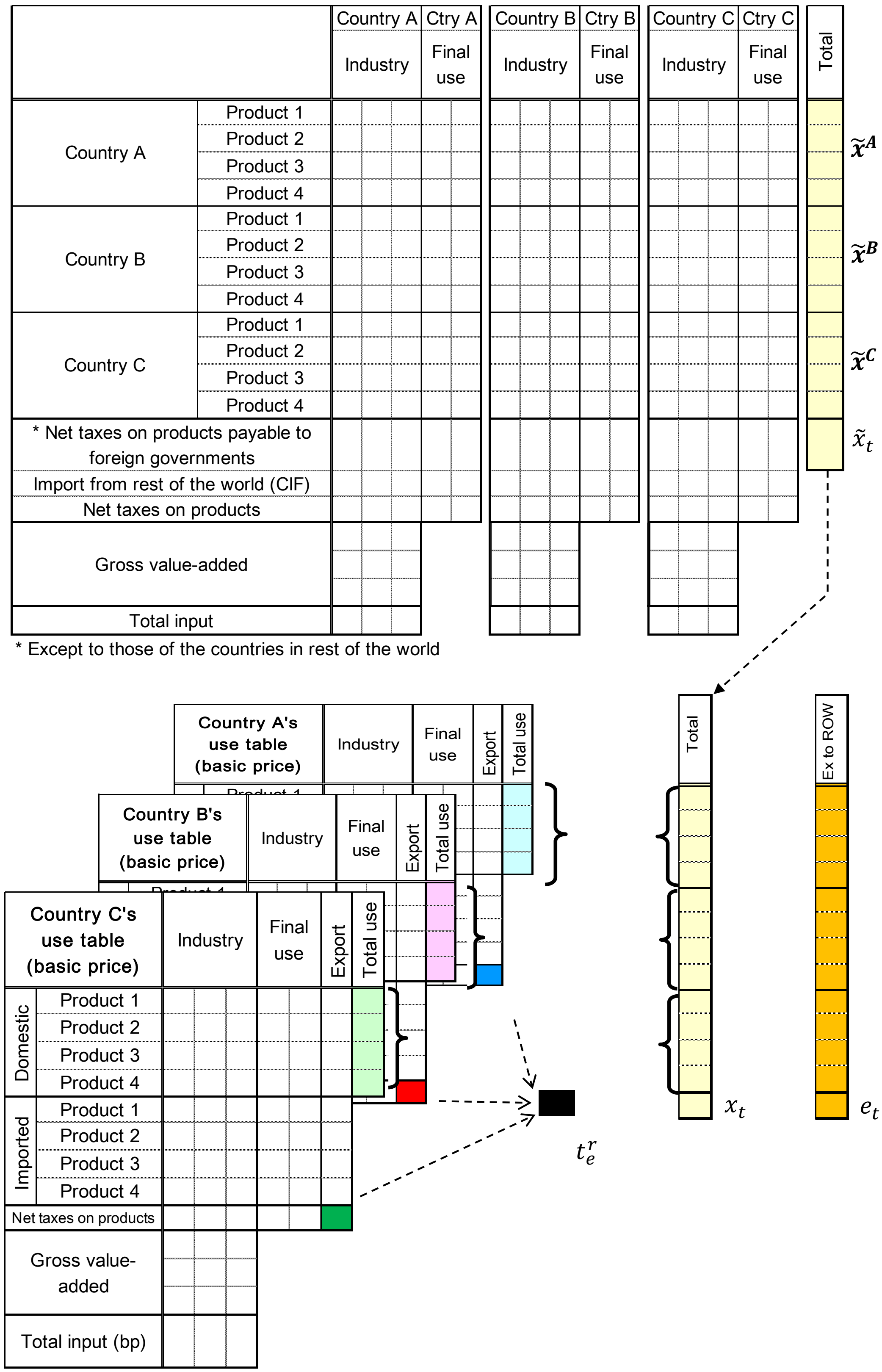
17.48 The imports from the rest of the world are aggregated by column to form a vector, valued at CIF.

17.49 The outcome of these steps is the generation of the multi-country use tables, which provide the core information for compiling the multi-country IOTs.

**Step 3 Creating the export vector to rest of the world**

17.50 Assuming mirror trade relations, the import uses (both intermediate and final) by country of origin in the multi-country use table are considered to represent exports of the corresponding trade partners to the respective importers in the table. The exports to any remaining countries other than these importers are lumped together in the vector of export to rest of the world. A simple three-country case is presented in Figure 17.6.

**Figure 17.6 Formation of the export vector to rest of the world**



17.51 As shown in Figure 17.6, for the three-country case (Countries A, B and C), the vector can be simply derived as a difference between the row totals of juxtaposed multi-country use tables ($\tilde{x}^A, \tilde{x}^B, \tilde{x}^C$) on the one hand, and the total uses in the original national use tables ($x^A, x^B, x^C$) on the other, element by element.

17.52 Net taxes on products for rest of the world are derived as a difference between the corresponding row total in the multi-country use tables ($\tilde{x}_t$) and the sum of net taxes on profits entries in the export columns of all countries' use tables ($\sum_{\mathrm{r}} \mathrm{t}_{\mathrm{e}}^{\mathrm{r}} = \mathrm{t}_{\mathrm{e}}^{\mathrm{A}} + \mathrm{t}_{\mathrm{e}}^{\mathrm{B}} + \mathrm{t}_{\mathrm{e}}^{\mathrm{C}}$). This relation stands as set out below.

17.53 Entries in the row, "Net taxes on products payable to foreign governments", show the amount of cross-national transfer of net tax revenues, as embodied in traded products, among the three Countries A, B and C. On the other hand, the sum of net taxes on products for export in all three countries' use tables represents the entire flow of cross-national tax revenues to these countries from all over the world. The difference lies, therefore, in the net taxes paid out by the countries in the rest of the world, embodied in imported products from the three countries. This is a balancing item rather than a statistic of any analytical significance.

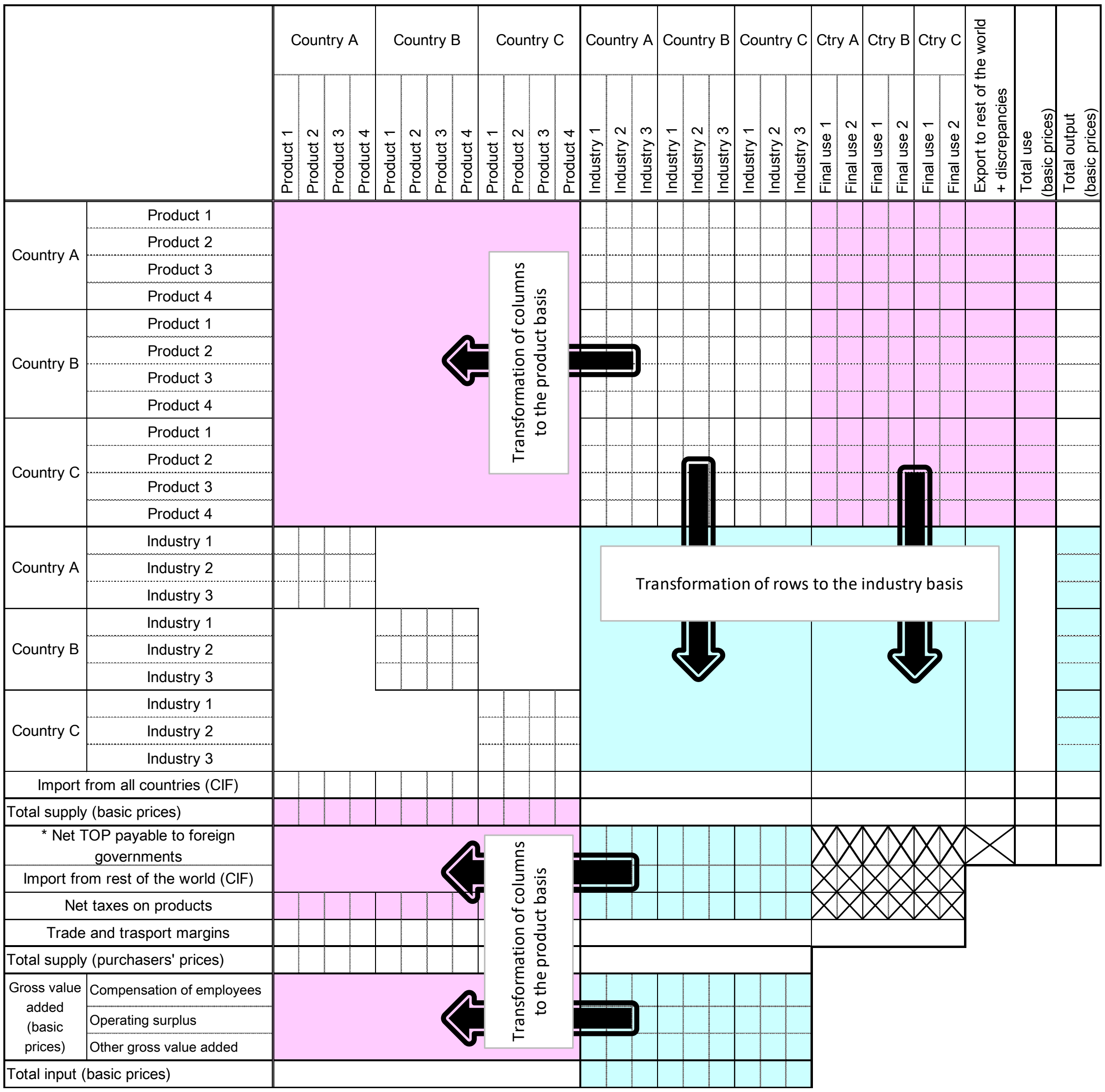
17.54 Treatment of this kind for the rest of the world inevitably leads to the characterization of the vector as a residual of the entire multi-country IOTs matrix, containing various statistical discrepancies. These discrepancies arise out of the linking process as a reflection of the confrontation of data from different sources, when the export data in each national use table are replaced by the import transaction matrices of trading partners assuming a mirror relation between the two partners.

17.55 This could be explicitly presented in the final multi-country SUTs and IOTs by naming the vector "Export to rest of the world and statistical discrepancies".

**Step 4 Linking and reconciliation of the table**

17.56 As a result of steps 1, 2 and 3, all the pieces of the jigsaw puzzle are now ready for linking, which produces the system illustrated in Figure 17.3. The system can now be transformed to the product-by-product or industry-by-industry multi-country IOTs, as presented in figure 17.2. Figure 17.7 shows an image of the transformation. The areas shaded pink form the product-by-product multi-country IOTs and the areas shaded blue form the industry-by-industry multi-country IOTs. The entries in the cells with a cross are shared between the two types of tables. The transformation to multi-country IOTs is based on the information given by the domestic output matrices ($V^A, V^B, V^C$ in f), in line with the conversion formulae shown in chapter 12 for the transformation of SUTs into IOTs.

**Figure 17.7 Transformation to multi-country IOTs**




* Except to those of the countries in rest of the world

17.57 The final stage covers the reconciliation of the table, which has the following three tasks to complete:

- Cross-checks between key aggregate figures of the linked table and corresponding macro-statistics from national sources, such as national accounts and foreign trade statistics.
- Investigation of the causes and the correction of errors if there is any outstanding mismatch.
- Application of an automated balancing method for rounding up the table, such as the RAS algorithm, where necessary. It is however advised that the use of such an automated method should be restricted to the final round-up of the table, and only after thorough cognitive

adjustment of the matrix. In addition, a number of constraints must be set for the maximum use of the available information (see Ahmad, Wang and Yamano, 2013).

## D. Multi-country input-output database initiatives

17.58 Since the early 2000s, a number of multi-country SUTs and IOTs databases have been developed by the scientific community and international organizations. The background papers relating to each initiative are listed in Box 17.1 below.

**Box 17.1 Background papers of each database initiative**

| | |
|---|---|
| AIIOT (Asian international input-output tables) | Meng, Zhang and Inomata (2013) |
| Eora-MRIO (Eora multi-region input-output tables) | Lenzen and others (2013) |
| EXIOPOL (environmental accounting framework using externality data and input-output tools for policy analysis)-EXIOBASE | Tukker and others (2013) |
| FIGARO (full international and global accounts for research in input-output analysis) | Rueda-Cantuche and others (2017) |
| Global MRIO Lab | Lenzen and others (2016) |
| GTAP-MRIO (multi-region input–output table based on the global trade analysis project database) | Peters, Andrew, and Lennox (2011) |
| OECD ICIO (inter-country input-output tables) | http://www.oecd.org/sti/ind/tiva/tivasourcesandmethods.htm |
| WIOD (World Input-Output Database) | Dietzenbacher and others (2013) and Timmer (2012) |

17.59 The database initiatives in Box 17.1 were originally developed in response to different policy needs and scientific aims, such as the following:

- EXIOBASE and Eora tackle environmental issues.
- GTAP-MRIO considers trade policy measures and impacts.
- OECD-ICIO, FIGARO and WIOD feature global production and value-added trade. OECD-ICIO and WIOD also provide data on social, economic and environmental indicators at the industry level that can be used for a wide range of applications.
- AIIOT focuses on the production networks in East Asia.

17.60 These international initiatives also differ in terms of their underlying data sources, their country coverage, the time span of the data available, the level of detail for industries and products, accessibility to the database and the methodological choices in the compilation process.

17.61 Methodological choices have to be made when building up multi-country SUTs and IOTs. GTAP-MRIO uses trade data as a benchmark for adjusting the SUTs and IOTs, while the other models start from the SUTs or IOTs and then benchmark them to national accounts statistics using trade data. In the case of EXIOBASE, FIGARO and WIOD, the SUTs are the first dominant input, while, for AIIOT, the IOTs form the base. For OECD-ICIO, Eora and the Global MRIO Lab, there is a mix of SUTs and IOTs, although, in its data gathering, OECD is moving to a fully SUTs-based approach for future editions. Specific challenges, such as the treatment of re-exports, the CIF/FOB adjustment and the method used to reconcile trade data, will vary from one model to another. In general, the United Nations International Trade Statistics Database, known as UN Comtrade, is used for trade statistics, although some models complement it with specific datasets of national sources, for example, EU Comext, the statistical database on trade of goods managed by Eurostat, for the European Union.

17.62 As noted above, it is important to have the data at basic prices for both supply tables and use tables, in order to build multi-country SUTs and IOTs. Many national use tables are compiled and disseminated at purchasers' prices. Estimation is therefore needed to compile the use table at basic prices when the data are not available from the country in question. EXIOBASE, FIGARO and OECD-ICIO are based on the available data – and therefore reflect the use table at basic prices when disseminated – or estimated from existing information. WIOD estimates the use table at basic prices, using the procedure referred to as SUT-RAS. GTAP-MRIO constructs the data with the use of information on multi-country margins and taxes. In Eora and the Global MRIO Lab, the use tables at basic prices are constructed through a large-scale optimization procedure. Similar approaches are follows in estimating the imports matrices, with extensive use of the proportionality assumption.

17.63 The earlier sections of this chapter presented the standard practice of preparing the imports use table by country of origin, which involves splitting the import matrix by using national origin shares of for each imported product. Alternatively, the OECD Regional-Global TiVA Expert Group takes a dual approach to this method. The export values in partner countries' use tables are allocated, country by country, using the distribution ratios set out in the rows of the import matrix (converted to FOB) in order to form mirror statistics. Since the values in the derived import matrices are benchmarked to partner countries' export data in FOB valuation, this provides a more solid link to the SUTs of the exporting countries.

17.64 In 2018, the OECD-ICIO tables underlying the TiVA database were updated to the 2008 SNA methodology. In the same year, the Eurostat FIGARO project provided European reference data based on the latest international classifications and the ESA 2010 – an adaptation of the 2008 SNA for the European Union. The data also include specific adjustments for merchanting trade and goods sent abroad for processing (see section B.5 of this chapter), as the FIGARO project has a particular focus on the trade asymmetries within the European Union.

**Box 17.2 Overview of the main features of the various databases**

| Database name | Number of countries | Number of industries and products | Years | Availability of data |
|---|---|---|---|---|
| AIIOT | 10 (8 for 1975 table) | 76 products (56 for 1975 table, 77 for 1985 table) | 1975, 1985, 1990, 1995, 2000, 2005 | Yes |
| EORA | 187 | Varying across countries; simplified version with 26 industries | 1990–2013 | Yes |
| EXIOBASE Versions 2 and 3 are more enhanced | 43 countries; 5 world regions | 220 products; 163 industries | 2000, 2007 | Yes |
| FIGARO | 28 EU countries; USA; rest of the world | 64 industries; 64 products | 2010; 2010–2017 (in progress) | Yes |
| Global MRIO Lab | 220 countries | Flexible choice: 6357 product, industry root classification | 1990–2015 (preliminary data) | Yes |
| GTAP-MRIO | 140 GTAP regions | 57 GTAP commodities | 2004, 2007, 2011 | Only to GTAP members |
| OECD ICIO | 64 (including rest of the world) | 34 industries; 34 products | 1995, 2000, 2005, 2008–2011; nowcasted for 2012–2014 | Yes (TiVA indicators only) |
| WIOD (2013 release) | 41 (including rest of the world) | 35 industries; 35 products | 1995–2011 | Yes |
| WIOD (2016 release) | 44 (including rest of the world) | 56 industries; 56 products | 2000–2014 | Yes |

TiVA: trade in value added

## E. Way ahead

17.65 The multi-country SUTs and IOTs can be continually improved and extended in various directions. Currently, the areas listed below are among those most in need of attention from the statistical communities:

- Bilateral trade symmetries
- Rest of the world
- Proportionality assumption
- International freight and insurance costs
- Direct purchases by travellers
- Firm heterogeneity
- Factor income transfers

- Subregionalization of multi-country SUTs and IOTs

### 1. Making trade data symmetric

17.66 The problem of bilateral trade asymmetries, which has been extensively discussed in the previous section, constitutes one of the key obstacles to the construction of consistent and harmonized multi-country SUTs and IOTs.

17.67 OECD, WTO, Eurostat and other international organizations are currently engaged in a joint undertaking, in collaboration with various national statistics offices, to develop benchmark trade datasets of both goods and services in which the problem of asymmetry is resolved in keeping with the constraints of national accounts. The use of these benchmark data in the compilation of multi-country SUTs is expected significantly to reduce the aforementioned discrepancies (see Fortanier and Sarrazin, 2016, and Fortanier and others, 2016).

### 2. Coverage of more countries and reduction of those included in the rest of the world

17.68 In their format, the multi-country SUTs and IOTs described in this chapter treat any country whose SUTs are not integrated into the table as outside the system and assign them to the category “Rest of the world”. As the globalization of economic activities continues apace, however, the cross-border production networks are also constantly expanding and involving more countries which, to date, have not received much attention. Added to which, the newcomers to the international networks may grow faster thanks to their participation in more sophisticated production-sharing among countries. As a result, they may have a significant impact on the global production system and failure to include them in the model will become increasingly inappropriate, as noted by Stadler, Steen-Olsen and Wood (2014).

17.69 Some existing multi-country IOTs, notably the OECD inter-country input-output tables and the European Commission-funded WIOD have featured the rest of the world as a single, endogenous region in the transaction matrices. This enables the multi-country Leontief inverse to be derived in respect of the corresponding segments, as demonstrated in Dietzenbacher and others (2013).

17.70 By contrast, the Eora database developed by the University of Sydney and the Global MRIO Lab developed by Project Réunion use all relevant information to estimate unavailable transaction matrices with the aid of a powerful estimation algorithm, and thereby maximize the number of endogenous countries, with the result that “Rest of the world” as a residual of the system becomes almost negligible in terms of transaction volumes (see Lenzen and others, 2013).

### 3. Departure from the proportionality assumption

17.71 Countries with less well-developed statistical bases often resort to the proportionality assumption in preparing their imports use tables, as described in chapter 8. This approach assumes an identical distribution structure of a product among different domestic users, no matter whether it is imported or domestically produced. While the assumption could be acceptable for a highly disaggregated use table, it may cause some inappropriate allocation of imported goods when products with different degrees of foreign sourcing are bundled together under the same product category.

17.72 The problem spills over to the construction of the imports use table by country of origin for the multi-country SUTs and IOTs. For example, the production chain of a cellular phone, from design, research and manufacture to distribution, may be spread across different countries, with the parts and components being produced in certain countries and then assembled into a finished product in another country. If the finished phones and their parts are all bundled together in the use table under the label of, for example, “Telephone sets, including telephones for cellular networks or for other wireless networks; other apparatus for communication in a wired or wireless network” (CPC Version 2.1, 4722), the array of sourcing countries for this product category will differ in respect of those listed for household final consumption (buying finished products, and hence more imports from the country of final assembly) and those for industries (buying parts and components, and hence more imports from other countries). As a result, the proportionality among different users of the product will be disturbed.

17.73 With these types of cases, it is recommended that a special survey is conducted on key imported products, or that, wherever available, the information from business registers is integrated, in order to identify the products’ distribution structures among domestic users to a sufficient level of detail. Any additional information of this kind will significantly improve the quality of multi-country SUTs and IOTs. Constructing import data by end-use categories (BEC or BTDIxE) is an improvement on the proportionality assumption.

17.74 It would seem, however, that it is not only in respect of trade in goods but also in respect of trade in services that the data should be developed in this direction, alongside the search for more information on detailed service categories and partner countries than is currently available in the statistics on balance of payments and other variables.

### 4. Direct purchases by travellers

17.75 In the current SUTs framework, the household final consumption expenditures in the use table are recorded on a domestic territorial basis with macro-adjustment rows of “Direct purchases abroad by residents” and “Purchases on the domestic territory by non-residents”. The counterbalancing entries for imports and exports are presented along these rows and respective columns in the supply table and the use table, as shown in chapters 5 and 6.

17.76 With the increasing flow of people crossing borders, however, it is advisable to record household final consumption expenditures at the national level by product, accompanied by a corresponding adjustment for the elements in the import and export vectors. To this end, the entries in the adjustment rows should be expanded and redistributed by product, with an appropriate reference to external sources such as international passenger surveys (for example, expenditure on food, alcohol, hotels, travel, leisure and shopping). It is noted that the spending by business travellers must be separated out in these data, as this expenditure should be recorded as intermediate consumption by an industry.

### 5. Disaggregation of industries by firm's characteristics

17.77 With the rapid growth in foreign direct investment over the past few decades, production technology in developing economies has acquired a new feature. The technological heterogeneity within single industries, for example, among domestically oriented producers, processing exporters and non-processing exporters or between large enterprises and small and medium-sized firms, would suggest that the current treatment of SUTs and IOTs is less effective in analysing the structure of global production sharing.

17.78 To remedy this shortcoming, the multi-country SUTs and IOTs may be extended by further disaggregating their industrial sectors by firm's characteristics. Ideally, this breakdown should be provided in the context of the construction of national SUTs, possibly through the development and application of structured firm-level micro data. In many cases, however, the relevant data build on existing national sources, for example, by linking firm-level trade data and business registers, and thereby aim to identify such characteristics of traders as their size (number of employees), type (exporter or importer) or type of ownership (foreign controlled or domestically controlled). These efforts include such attributes as trade by enterprise characteristics, services trade by enterprise characteristics and foreign affiliate statistics. Interest in this area and the associated needs for analysis are rapidly growing, as indicated by Piacentini and Fortanier (2015), and OECD (2015).

### 6. Incorporation of factor income transfers

17.79 With the ever-growing mobility of people and transfer of capital across borders, the multi-country SUTs and IOTs will better capture the nature of economic interdependency if they can be extended to embrace the cross-border transfer of factor incomes (repatriation). This is particularly relevant when considering the growing impact of multinational corporations on the international distribution of income and wealth. Identifying these flows requires not only a breakdown of SUTs by firm ownership but also a more detailed disaggregation of GVA using information from business surveys along with statistics on foreign direct investment.

### 7. Subregionalization of multi-country IOTs

17.80 In the current multi-country SUTs and IOTs framework, referred countries are treated as points of transaction in the international production networks. A national economy, however, also has a spatial dimension. It makes little sense to treat such countries as Brazil or the Russian Federation in the same manner as Costa Rica or Singapore. In particular, as a result of the increasing relocation of production capacities across borders, it is possible to envisage a region in one country having stronger economic ties with regions in foreign countries than with its own domestic neighbours.

17.81 The multi-country SUTs and IOTs can be extended to capture cross-border economic linkages on a region-to-region basis, for example, from Guangdong province in China to Tohoku region in Japan, by embedding the inter-regional IOTs of referred countries in a single multi-country IOT matrix, as covered by Inomata and Meng (2013).

# Chapter 18. Projecting supply, use and input-output tables

## A. Introduction

18.1 For a variety of analytical purposes, users often require comparable SUTs and IOTs. This means, for example, that they need SUTs and IOTs to be available with regular frequency and in accordance with specific schedules. In practice, however, SUTs may be compiled on an annual basis or every five years or even at irregular time intervals. A similar situation can occur with IOTs.

18.2 In general, a projection problem consists of knowing one single base table (SUTs or IOTs) and estimating a target table, possibly with additional information such as known row or column totals or even certain table elements. A variety of methods, techniques and approaches is available for the projection of SUTs and IOTs and dealing with the missing data gaps. Projections are generally carried out by analysts and researchers but, depending on the situation, some projection models could be used in support of regular compilation in specific circumstances. Accordingly, these techniques not only serve analytical purposes but they can also help producers, for example, in dealing with periods between benchmarked years.

18.3 The present chapter provides a review of various projection methods and techniques, along with references to work in literature, to help in overcoming the problem of incomplete data and making possible the estimation and projection of SUTs and IOTs. The chapter starts, in section B, with a description of the needs for projection methods. It then provides, in section C, a review of the general approaches and categorization of the projection methods, including a historical perspective on some of the literature most relevant to the scope and content of this Handbook. Section D presents a numerical example of three projection methods: the generalized RAS (GRAS) method, the SUT-RAS method, and the Euro method. Lastly, section E provides a description of the criteria to be considered when choosing a projection method.

## B. Situations needing projection methods

18.4 Projection methods may be useful in a range of circumstances, such as when the required SUTs or IOTs are not available on time, or when there is need to reconcile inconsistent information with varying reliability, to carry out the historical revisions to ensure a consistent time series of the tabulations, to compile multiregional SUTs and IOTs; and, lastly, to surmount the issue of incomplete data due to confidentiality requirements. These circumstances are described in the following paragraphs.

18.5 *Timeliness*: The frequency and timeliness of SUTs and IOTs compiled at national level vary enormously among countries and this often poses a major constraint in policy research at the global level. There is need, accordingly, to use non-survey-based methods to estimate SUTs and IOTs for missing years or to update previous SUTs and IOTs with revised totals.

18.6 *Balancing*: During the balancing process in the compilation of SUTs and IOTs, there are many cases where data for specific cells, or groups of cells, in the tables are well known (through specific data sources, such as business surveys, government based data and others) or there is reliable information on certain column or row totals. At the same time, there could also be cases where data from the different data sources are conflicting in that the national statistics offices assign different levels of reliability to the different sources. Guidance on how to resolve this conflict is very limited; examples include: Dalgaard and Gysting (2004); Tarancón and del Río (2005); and Lenzen, Gallego and Wood (2009).

18.7 *Revisions*: It is often necessary to revise existing benchmark SUTs and IOTs to reflect, for example, a new version of the SNA or a new classification. Projection approaches may be required for the reason that official SUTs and IOTs, going back a number of years, are not usually revised when more recent data have been estimated or when a change has occurred in the statistical concepts or methodological issues, such as the advent of 2008 SNA or revised classifications like ISIC Rev. 4. It is not expected that national statistics offices will provide SUTs and IOTs based on the 2008 SNA for all the back years and benchmarks. Accordingly, it will be necessary to blend survey-based data with sound mathematical techniques to avoid discontinuities in the SUTs and IOTs, as shown in Rueda-Cantuche, Amores and Remond-Tiedrez (2013).

18.8 *Multiregional or multi-country analysis*: The role of multiregional and multi-country analysis has grown in significance over the past two decades, with the use of multiregional SUT and IOT databases to inform worldwide policy research issues such as climate change, international trade, competitiveness and sustainable production and consumption policies (see chapter 17). A number of international projects have used some of these projection methods for the estimation and projection of missing national SUTs and IOTs and for the balancing, where necessary, of the multiregional databases. Major examples of these databases include:

- WIOD, Dietzenbacher and others (2013);
- EXIOBASE, Tukker and others (2013);
- GTAP-MRIO database, Andrew and Peters (2013);
- Eora database, Lenzen and others (2013);
- Asian International Input-Output Tables, Meng and others (2013);
- OECD ICIO database;
- Eurostat single SUTs and IOTs for the European Union and the euro area, Eurostat (2011b).

18.9 *Confidentiality*: The issue of confidentiality may make some national datasets incomplete because of the suppression of data due to confidentiality requirements. This problem may be overcome with the use of projection methods in research analysis. The gaps will also vary across countries in that, for example, their legislative systems and treatment of data collected from businesses may differ.

## C. General approaches to projection from a historical perspective

18.10 As mentioned, the general balancing and projection approach basically relies on having available a single base table (SUTs, IOTs or SAMs) and at least the row and column totals for the incomplete table. Alternatively, Mínguez and others (2009) and Oosterhaven and others (2011) consider several complete tables as base tables, regardless whether they constitute a time series of IOTs or a group of different IOTs from different regions. Furthermore, in some circumstances row or column totals may also be missing, as described in Eurostat (2008) and Temurshoev and Timmer (2011).

18.11 There are three different ways – including a modified version of the distinction made by Lenzen and others (2009) – of dealing with the projections, in which data gaps for the interior elements of the tables outnumber the external constraints in the form, for example, of row and column totals. These are:

- Constrained optimization methods based on probability and information theory or based on distance measures.
- Proportional scaling methods, which may be one-sided or bi-proportional.
- Modelling-based methods.

18.12 Some of the projection methods may in principle be used in the reconciliation of information from different data sources and in the process of balancing SUTs and IOTs. The following section presents a brief description of this application of projection methods.

### 1. Historical overview of projection methods

18.13 This historical overview pivots around the general problem of balancing and projecting SUTs and IOTs and any other related matrices (such as valuation matrices) concerning the different price valuations covered in the 2008 SNA, primarily basic prices and purchasers' prices and the distinction between domestic uses and import uses, wherever appropriate.

18.14 It should be noted that, although the projection problem has given rise to a number of attractive mathematical features, they are often not combined with survey data, other data sources or expert opinions on certain key elements such as rows, columns or individual cells. Only very recently have there been any attempts to follow the so-called hybrid strategy (Miller and Blair, 1985, p. 336), as a means of capturing the best of both: selective survey and expert information and mathematical projection techniques. This is highly recommended whenever possible.

18.15 Huang and others (2008) describe the projection problem as a linear or non-linear programming problem, which may be expressed as:

$$Minimize\ f(\boldsymbol{X})$$

Subject to: $\sum_{j=1}^{n} x_{ij} = u_j \ \ \forall i = 1, \dots, m$

$$\sum_{i=1}^{m} x_{ij} = v_j \ \ \forall i = 1, \dots, n$$

$$z_{ij} \geq 0 \qquad \forall i, j$$

where: $z_{ij}$ is the ratio derived from $x_{ij} = z_{ij}\, a_{ij}$, $a_{ij}$ being the original entry and $x_{ij}$ the target entry in matrix $\boldsymbol{X}$. Row and column totals are represented by $u_i$ and $v_j$, respectively. The matrix has $m$ rows and $n$ columns and may be either rectangular $(m \neq n)$ or square $(m = n)$.

18.16 Solutions to this problem may take the form of a simple iterative proportional scaling process or may lead to substantial programming requirements with sometimes long run-times, such as non-linear objective functions.

18.17 This group of methods has been categorized under the general term "constrained optimization methods" and may be split into two groups depending on the type of objective function $f(\,)$:

- The first group, in general, has in common the fact that the methods minimize some measure of distance between all elements of the two matrices, the prior and the estimated projection. There are many types of distance measures, such as absolute differences, and square differences as shown in Box 18.1.
- The second group comprises objective functions that are based on the statistical concept of Kullback-Leibler (K-L) divergence, also denoted as information loss, taken from the probability and information theory laid out by Kullback and Leibler (1951). In short, the K-L divergence of two probability distributions $Q$ and $P$ is a measure of the information lost when $Q$ is used to approximate $P$. The measure $Q$ typically represents an approximation of $P$ and, evidently, the solution to the problem provides a minimum information loss. This concept was first linked to the RAS solution by Uribe and others (1965).

18.18 Within this framework, Bacharach (1970) used technical coefficients which to some extent could be considered as a measure of probabilities, bounded between 0 and 1 and non-negatives, to prove that the solution to this problem could also be expressed in terms of a simple bi-proportional iterative scaling method, which was the so called RAS method used by Stone (1961). Bachem and Korte (1979) and Batten (1983) also contributed to this idea.

18.19 The extension of this statistical concept to a transactions matrix prompted considerable discussion, given that the elements of the matrices are no longer coefficients but (positive and negative) absolute values. Key examples may be found in: Günlük-Senesen and Bates (1988); Junius and Oosterhaven (2003); Huang and others (2008); Lenzen and others (2007); and Lemelin (2009). The solutions do not always turn out to be simple scaling methods, however, as shown by Stone and others (1942); Robinson and others (2001); Golan and others (1994); Rodrigues (2014); Lugovoy and others (2015); and Fernández and others (2015), the last of whom also proved the Bayesian approach with success.

18.20 Alternatively, there are other methods that do not necessarily have to be written in the form of a programming problem, such as those proposed by Tilanus (1968) and Timmer (2005), and these have been categorized as proportional scaling methods. This category may also include other one-sided or bi-proportional methods.

18.21 Lastly, there are other methods that use input-output modelling-based methods to project SUTs and IOTs, such as the Leontief price and quantity models used by Snower (1990); Beutel (2002) and (2008); and Valderas (2015); the time series analysis covered by Wang and others (2015); and the econometric methods used by Kratena and Zakarias (2004).

18.22 Box 18.1 presents a summary of the literature using methods for balancing and projecting SUTs and IOTs and provides a broad overview of the different methods available. Details of all these methods may be found in their respective references. The present review also takes account of what, to the best of our knowledge, are the earliest related contributions, even though they were not initially conceived for use in input-output accounts. These, however, are not included in Box 18.1 but reflected instead in the text of this chapter.

# Box 18.1 Methods for projection of SUTs and IOTs

| Year | Author(s) | Summary of methodology |
|---|---|---|
| | **Proportional scaling methods** | |
| 1960 | Osborne | Diagonal similarity scaling (DSS) |
| 1964 | (*) Matuszewski, Pitts and Sawyer | Proportional correction method (PCM) |
| 1968 | (*) Tilanus | Statistical correction method (SCM) |
| 1970 | Ehret | Procedure of selected coefficients (PSC) |
| 1974 | Evers | Procedure of selected coefficients (PSC) |
| 2005 | (*) Timmer, Aulin-Ahmavaara and Ho | EUKLEMS |
| 2008 | Eurostat | Procedure of selected coefficients (PSC) |
| 2011 | (*) Temurshoev, Webb and Yamano | EUKLEMS |
| 2013 | Pereira, Carrascal and Fernandez | PATH-RAS (or GLOBAL MODEL) |
| 2013 | Rueda-Cantuche, Beutel, Remond-Tiedrez and Amores | Good practices guidelines (GPG) |
| 2013 | Rueda-Cantuche, Amores and Remond-Tiedrez | RACE |
| | **Constrained optimization methods (based on probability and information theory)** | |
| 1961 | Stone | RAS |
| 1963 | Paelinck and Waelbroeck | MRAS |
| 1970 | Bacharach | RAS |
| 1972 | Stäglin | Method of double proportion patterns (MDPP) |
| 1986 | Israilevich | ERAS |
| 1988 | Günlük-Senesen and Bates | GRAS |
| 1994 | Golan, Judge and Robinson | Minimization sum of cross-entropies (MSCE) |
| 1999 | Gilchrist and St. Louis | TRAS |
| 2003 | Junius and Oosterhaven | GRAS |
| 2004 | Dalgaard and Gysting | Commodity-flow balancing algorithm (CFB) |
| 2008 | Eurostat | Method of double proportion patterns (MDPP) |
| 2009 | Lenzen, Gallego and Wood | KRAS |
| 2011 | Temurshoev and Timmer | SUT-RAS |
| 2014 | Rodrigues | Bayesian approach for SUTs (BY-SUT) |
| 2015 | Fernández, Hewings and Ramos | Crossentropy-based Bayesian approach (BY-CE) |
| 2015 | Lugovoy, Polbin and Potashnikov | Bayesian approach for IOTs (BY-IOT) |
| | **Constrained optimization methods (based on distance measures)** | |
| 1961 | Friedlander | Normalized square differences (NSD) |
| 1964 | Matuszewski, Pitts and Sawyer | Normalized absolute differences (NAD) |
| 1968 | Almon | Square differences (SD) |
| 1971 | Jaksch and Conrad | Least squares method (LS) |
| 1987 | Hartoorn and van Dalen | Generalization of least squares differences (HvD) |
| 1988 | Kuroda | Square (weighted) relative differences (KUR) |
| 2001 | Lahr | Weighted absolute differences (WAD) |
| 2004 | Lahr and de Mesnard | Absolute differences (AD) |
| 2004 | Jackson and Murray | Global change constant (GCC) |
| 2004 | Jackson and Murray | Sign-preserving absolute differences (SPAD) |
| 2004 | Jackson and Murray | Weighted square differences (WSD) |
| 2004 | Jackson and Murray | Sign-preserving square differences (SPSD) |
| 2005 | Tarancón and del Río | Analisis Numerico Algebraico Interactivo Sectorial (ANAIS |
| 2008 | Huang, Kobayashi and Tanji | Improved square differences (ISD) |
| 2008 | Huang, Kobayashi and Tanji | Improved normalized square differences (INSD) |
| 2008 | Huang, Kobayashi and Tanji | Improved weighted square differences (IWSD) |
| 2008 | Eurostat | Least squares method (LS) |
| 2008 | Rampa | Weighted least squares (WLS) |
| 2009 | Mínguez, Oosterhaven and Escobedo | Cell-corrected RAS (CRAS) |
| | **Modelling-based methods** | |
| 1990 | Snower | TAU-UAT |
| 2002 | Beutel | EURO |
| 2004 | Kratena and Zakarias | Econometrics-based method (ECO) |
| 2008 | Eurostat | EURO |
| 2008 | Beutel | SUT-EURO |
| 2015 | Valderas | SUT-EURO |
| 2015 | Wang, Wang, Zheng, Feng, Guan and Long | Matrix Transformation Technique (MTT) |

Notes: (*) One-sided proportional methods.

## 2. RAS method

18.23 There are some features common to all the proportional scaling methods and constrained optimization methods that are based on the minimum information loss principle (information theory). These usually provide a solution that is simple to implement, relatively quick, that preserves signs and has minimum data requirements. The prevailing method is the so-called RAS method.

18.24 RAS was first developed for use with IOTs and, in particular, applied to the intermediate inputs part of the use table. It consists in changing the structure of the known base table as little as possible. Let us suppose that there are two square matrices of technical coefficients, $A$ and $B$. All the elements in $A$ are known but only some of the elements of $B$ are known, such as:

- Total industry output, which means that we are implicitly considering industry-by-industry IOTs
- GVA by industry and, therefore, by difference, intermediate consumption by industry, $u_j$
- Total final uses by products and, therefore, by difference, the sum of outputs of products to industries for intermediate consumption, $v_j$

18.25 The problem is how to project the elements of $B$ in such a way that they are as close as possible to the corresponding elements of $A$, subject to the known marginal column and row totals, as described by Toh (1998). In the RAS method such closeness is achieved by minimizing the following K-L-based objective function described by Bacharach (1970):

$$Minimize \sum_i \sum_j b_{ij} \ln\left(\frac{b_{ij}}{a_{ij}}\right)$$

Subject to:

$$\sum_j b_{ij} x_j = u_i$$

$$\sum_i b_{ij} x_j = v_j$$

18.26 The solution is the set of $r$ and $s$ scaling factors, which satisfy:

$$b_{ij} = r_i a_{ij} s_j$$

$$\sum_j r_i a_{ij} s_j x_j = u_i \qquad (1)$$

$$\sum_i r_i a_{ij} s_j x_j = v_j \qquad (2)$$

18.27 For bi-proportional methods, this problem could be expressed either in terms of technical coefficients or transaction values, as shown by de Mesnard (1994) and Dietzenbacher and Miller (2009), illustrating that the results are indeed equivalent.

18.28 In matrix terms, $B = RAS$, $R$ and $S$ being diagonal matrices with the corresponding $r$ and $s$ scaling factors in the main diagonal. There is no direct solution, however, to the scaling factors $r$ and $s$. Instead, the following simple and iterative procedure, which converges to the desired totals, may be applied. It starts by choosing a first set of $r$ scaling factors, say all equal to 1, and the elements of $s$ are computed using equation (2). These $s$ scaling factors are then used in equation (1) for the calculation of the $r$ scaling factors, which can be fed back into equation (2) to derive new estimated $s$ scaling factors. The process is repeated until the values of the scaling factors are not changed between iterations within a certain threshold or a sufficient number of times. De Mesnard (1994) demonstrates that the solution to the RAS problem is independent of the initial values of $r$ and $s$ and it therefore remains unchanged.

18.29 The origins of the RAS method go back several decades – Bregman (1967) attributes this method to the 1930s Leningrad architect Sheleikhovsky, who used this approach to estimate transportation traffic flows. Kruithof (1937) also used the RAS approach to estimate telephone communication traffic flows. Nonetheless, it was not until Deming and Stephan (1940) that this approach became accessible to social scientists and Lahr and de Mesnard (2004) that it was available in the English language. Since then, there have been many applications to fields other than SUTs and IOTs, such as migration and transportation flows, international and interregional trade, voting patterns, and others.

18.30 According to Lahr and de Mesnard (2004), it was Leontief (1941) who first used bi-proportional techniques within the context of input-output analysis with the aim of identifying the sources of inter-temporal change in the elements of IOTs. Nevertheless, it was Sir Richard Stone, as evidenced by Stone and others (1942), Stone (1961), Stone (1962) and Stone and Brown (1962), who waved the banner on behalf of the RAS method within the field of input-output analysis. For further details of the historical background of the RAS method, see Bacharach (1970), Lecomber (1975), Polenske (1997) and Miller and Blair (2009).

18.31 The RAS method was used extensively by Bacharach (1970) to update old IOTs to a more recent or even future period for which only the row and column totals were available. Similarly, Hewings (1969) and (1977) also applied bi-proportional techniques to the problem of regionalizing national IOTs, given some row and column totals at the regional level. Later, Oosterhaven and others (1986) combined both ideas to solve the problem of updating interregional IOTs. Miller and Blair (2009) provide an overview of this issue.

18.32 There is no doubt that RAS has been one of the most successful methods in terms of the number of applications where it has been used. Following Jackson and Murray (2004) and Lahr and de Mesnard (2004), the main features contributing to the extensive use of RAS may be summarized as follows:

- In terms of information theory, the RAS solution ensures minimum information loss, when we use the input structure of an original IOT as an approximation of the input structure of the target IOT. In other words, the target table is as close as possible to the prior.
- RAS is sign preserving and does not allow the conversion of zero elements from the original matrix into non-zero elements in the target table, and does not yield negative values, which is helpful for input structures.
- The iterative solution to the RAS method is simple to understand and straightforward to programme and apply.
- RAS has the minimum data requirements: only row and column totals.
- Scaling factors $r$ and $s$ may be interpreted as substitution and fabrication factors, respectively. The former (by rows) are meant to be a measure of the degree to which an input has replaced or has been replaced over time by other inputs, while the latter refers to the extent to which the initial industry mix of the economy varies (by columns). Van der Linden and Dietzenbacher (1995), de Mesnard (2002) and de Mesnard (2004a) all point out that a meaningful interpretation of the RAS-type scaling factors is only possible if transformed into relative values, for example, through normalization, but never with the absolute values of $r$ and $s$. Interestingly, Toh (1998) also demonstrates that $r$ and $s$ can also be interpreted as statistical estimates obtained through the method of instrumental variables, allowing for asymptotic standard errors and confidence intervals.

18.33 The RAS method also has a number of drawbacks, however. These include the following:

- Projection of the intermediate matrix only may not be sufficient to build up the target IOTs. There are other missing components, such as GVA and final uses, which may also contain legitimate negative values, such as changes in valuables and inventories, and other net taxes on production.
- The RAS method requires row and column totals to be known, and sometimes these are missing and have to be estimated. It may also occur that less information is available on these totals, as for example when only industry output or column totals are available.
- The RAS method can only deal with a single price valuation at a time, while the SNA defines several price valuations, such as basic prices and purchasers' prices, together with current prices and in volume terms. These may in fact be even more disaggregated, as is the case when trade margins are shown separate from transport margins or consumption is split between domestic output and imports.
- Sign-preservation is a feature of RAS that may also be seen as a drawback – where the cell value can switch sign between periods, as, for example, with taxes less subsidies on products

or changes in inventories. Lenzen and others (2014) successfully address this issue, however, and propose a mathematical solution.

- If RAS is carried out successively over a number of years, hysteresis problems will arise, leading to discontinuities and potential errors, as shown by Lenzen and others (2012).
- The RAS method cannot handle conflicting external data and cannot incorporate constraints on the row or column totals or any set of interior elements unless it is properly extended, as in Gilchrist and St. Louis (1999) and Oosterhaven and others (1986) or unless the KRAS method demonstrated by Lenzen and others (2009) is used with non-unitary coefficients. For example, the total of trade margins must be equal to the total output of trade industries at basic prices and this may not occur automatically. The supply and use of products and industries must be balanced in advance.
- The RAS method does not allow the use of relative reliabilities on the initial tables and on external constraints which would be advisable for the computation of interval estimates rather than point estimates. In fact, the RAS method may generate implausible results which require further adjustments. For research purposes, however, Miller and Blair (2009) claim that, as long as the resulting multipliers perform well, they should still be used.
- The dimension of the initial and target tables must be the same, making it impossible to address the problem of a change in the classification or methodological systems. This means that the number of industries and products may change from one system to the other.

### (a) Further extensions of RAS – with less information

18.34 Different variants of the RAS method have been used with the aim of circumventing the limitations presented above. One of these is a further extension of the RAS method to enable it to operate with less information.

18.35 Günlük-Senesen and Bates (1988) define the generalized RAS (GRAS) method, which was further formalized mathematically by Junius and Oosterhaven (2003). The GRAS method allows for positive and negative values in the initial tables and is sign preserving, like the RAS method. The RAS method can be considered as a special case of the GRAS method. Unlike RAS, however, the objective function of the GRAS method has been somewhat controversial in the sense that it eventually does not really represent the K-L divergence or minimum information loss principle, as shown by Lemelin (2009).

18.36 The latest versions of the GRAS method are used in Lenzen and others (2007), Huang and others (2008) and Temurshoev and others (2013). In particular, the latter authors present a GRAS analytical solution that has no need of high performance, non-linear solvers, as in Lenzen and others (2007). They also deal with full non-positive rows and/or columns, for example, the row elements of trade industries in a trade margins matrix are always negative, and infeasible RAS cases as covered by Miller and Blair (2009, page 336). In practice, this is very helpful since small positive numbers are often added to the initial table in order to guarantee convergence.

18.37 Another advantage of the GRAS analytical solution proposed by Temurshoev and others (2013) is that ensures control of the convergence process by setting the desired threshold level, which is not straightforward when using solvers. Furthermore, and as mentioned earlier, the scaling factors derived from the analytical solution have economic interpretations, described by Stone (1961), Toh (1998), van der Linden and Dietzenbacher (2000), that cannot be found if solvers are used.

18.38 Similar to the RAS method, however, the GRAS method needs to have known row and column totals, a precondition which is sometimes unrealistic if the projections are extended to SUTs rather than relating just to IOTs. Indeed, the total product outputs are not usually known and, consequently, row totals are not known. To solve this problem, Temurshoev and Timmer (2011) propose the SUT-RAS method, which has an additional number of advantages compared with the GRAS method. The SUT-RAS method was extensively used in the construction of the World Input-Output Database, as seen in Dietzenbacher and others (2013). Most significant, the SUT-RAS method can be applied in a variety of settings: basic prices, purchasers' prices and with a distinction between domestic and import uses, while the GRAS method is envisaged to be applied only to a single price valuation at a time, for example, basic prices, and to total uses. Moreover, the SUT-RAS method is conceived as a joint estimation of rectangular SUTs such that total supply and total use match both for products and industries. Similarly, Temurshoev and others (2011) and Timmer (2005) propose the so-called EUKLEMS[11] method, which is based on using one constraint only, the condition of columns sums to the total (covering industry output), resulting in a one-sided RAS-type technique.

18.39 Where the lack of information is concerned, the situation might be worse in some cases. Information may even be completely unavailable on industry outputs (the column totals). In this context, there are two outstanding methods that were designed for the purpose of projecting SUTs and IOTs using a minimum set of data requirements:

- Euro method for IOTs described by Beutel (2002); Eurostat (2008); and SUT-Euro (Euro method for SUTs) described by Beutel (2008) and Valderas (2015)
- Path-RAS method described by Pereira and others (2013), also denoted as the Global Method

18.40 Instead, these methods require GVA by industries, total final uses of the different categories, total taxes less subsidies on products, and total imports.

[11] The acronym KLEMS is formed from the categories which it covers, namely: capital (K), labour (L), energy (E), material (M) and service inputs (S).

18.41 The SUT-Euro method cannot handle rectangular SUTs and should be used with IOTs or square SUTs only. In particular, the SUT-Euro method has been used extensively by Eurostat in the estimation of European SUTs and IOTs, provided that the number of industries and products was the same within the context of the CPA and NACE classifications used in the European Union. The Path-RAS method as described in Pereira and others (2013) is only designed for IOTs but recent work in progress by Pereira and Rueda-Cantuche (2013) has proved that it can also be extended to either square or rectangular SUTs. It estimates SUTs jointly (as in SUT-RAS), distinguishing between domestic and import uses, and it consists of an iterative process that allocates the deviations obtained in each iteration to final uses and GVA using a weighted average of the conflicting estimates of the corresponding intermediate uses.

18.42 The SUT-EURO and the Path-RAS methods may be very helpful when disaggregating national or regional SUTs and IOTs into smaller geographical areas where GVA by industries are usually better known than industry outputs.

### (b) Further extensions of RAS – with more information

18.43 None of the above methods uses any additional information other than row or column totals of the target tables, if even that. The situation may arise, however, where additional external information is available on the interior elements of the target SUTs and IOTs or on the constraints that may be useful for the projections. Indeed, Szyrmer (1989), Gilchrist and St Louis (1999), Lenzen and others (2006) and de Mesnard and Miller (2006) all came to the same conclusion that the introduction of partial information improves the outcomes of the RAS-type projections. The RAS methods can thus be extended to cover the case that additional information is available.

18.44 Earlier work in the 1960s took the form of a modified RAS described by Paelinck and Waelbroeck (1963). The particular known cell values were set at zero and subtracted from the row and column totals. The RAS method was then applied to the remaining cells and, here necessary, the known cells placed back in the projected table. This solution may, however, create too many zeros in the modified initial table, leading to unsolvable RAS situations. More refined methods and applications were developed later by Barker (1975); in ERAS as described by Israilevich (1986); by Oosterhaven and others (1986); Batten and Martellato (1985); Snower (1990); Cole (1992); Jackson and Comer (1993); in TRAS as described by Gilchrist and St Louis (1999) and (2004); by Planting and Guo (2004); and in SUT-RAS as described by Temurshoev and Timmer (2011).

18.45 By adding external known information or external additional constraints to the target tables which are different from those of the column and row totals, it is possible to move one step further from a full automated mathematical process to a more elaborated, and expertly guided, method for the estimation of SUTs and IOTs.

18.46 A distinction is generally made between "projection", either in time – namely updating – or by regions, namely regionalization, and "estimation". The availability of extra information on subsets of elements and also on additional external constraints transforms a projection problem into an estimation problem.

18.47 Furthermore, the estimation problem can also be transformed into a compilation problem. Let us assume that, in the IOTs (industry-by-industry), the final use of one product is known, together with the total output of the industry producing it. Subsequently, the total intermediate use of the same product is given by difference but there is no guarantee that it will be feasible, in other words, positive. This is an example of conflicting external data, as explained by Lenzen and others (2009), and RAS-type methods cannot handle these data. Incidentally, this may be an entirely routine situation faced by national statistics offices in their task of compiling SUTs and IOTs. For this reason, we have identified these types of methods as being more akin to compilation tasks than to estimation or projection methods. Moreover, initial SUTs produced in national statistics offices will never be balanced, as they are based on data from several different data sources. In fact, this scenario is similar to that of balancing supply and uses of products and the inputs and outputs of industries.

18.48 With this in mind, table 18.1 shows a categorization of the methods presented in Box 18.1, along with providing information about whether the focus of the methods is on SUTs or IOTs (either with a transaction matrix or with a technical coefficient matrix, A).

18.49 Lenzen and others (2009) propose a balancing method that incorporates the following properties:

- Handles non-unity coefficients, such as constraints on any subset of matrix elements instead of fixing row and column sums only.
- Handles conflicting external data and inconsistent constraints.
- Allows for relative reliabilities of initial estimates and of external constraints.
- Deals with negative values and, if required, can be sign preserving.

**Table 18.1 Categorization of methods**

| | Projection | Estimation | Compilation |
|---|---|---|---|
| SUTs | EUKLEMS*<br>Path-RAS**<br>SUT-EURO*<br>SUT-RAS** | GPG*<br>RACE* | CFB**<br>BY-SUT* |
| IOTs/A | AD, DSS, EURO*, GCC, GRAS, HvD, (I)SD, (I)NSD, (I)WSD, KUR, LS, MDPP, MSCE, NAD, PCM, PCS, RAS, SPAD, SPSD, SCM, TAU-UAT, WAD | BY-CE, CRAS, ECO ERAS, MRAS, MTT* TRAS | ANAIS**<br>BY-IOT*<br>KRAS**<br>WLS* |

(*) Refers to methods for which neither column nor row totals are available.

(**) Refers to methods for which only column totals are available.

IOTs/A refers to IOTs either with a transaction matrix or with a technical coefficient matrix A.

The remaining methods comprise a base table and known column and row totals of the target table.

For an explanation of the abbreviations, see box 18.1 above.

18.50 Lenzen and others (2009) term their method KRAS (from "konfliktfreies" ("conflict-free") RAS). It is a kind of RAS-type iterative procedure that can deal with all the four desirable properties identified above. In the first step, it minimizes a GRAS-type objective function, as stated in Lenzen and others (2007), subject to constraints. The second step adjusts conflicting constraints simultaneously with the transaction matrix, whenever the first step fails to match them. The adjustments to the constraint constants are regulated according to their degree of uncertainty, as described by Lemelin (2009). It should be noted that the main advantage of KRAS over the general constrained optimization methods in dealing with conflicting data and inconsistent constraints is that it has fewer programming requirements and long run times. As noted by Lenzen and others (2009), the KRAS method aims to deal with the manual removal of inconsistencies in the constrained system in a systematic and automated way.

18.51 A comparable method is the SUT-RAS, which is a particular case of the KRAS method, developed as a solution to the general balancing problem. The SUT-RAS provides an easier and simple algorithm for the computation of the scaling factors and accommodates basic prices and purchasers' prices; domestic and import uses; and external additional information. In this sense, it avoids the construction steps needed to build up the constraint matrix in the event of a general formulation of the optimization problem.

18.52 There are two other contributions that are closely linked to compilation tasks. Dalgaard and Gysting (2004) present an algorithm for balancing commodity flow systems that can handle product flow systems for Denmark within the context of the 1993 SNA and which allows for six different price concepts. The supply and use of products and industries' inputs and outputs do not need to be balanced in the initial SUTs and, in the same approach used by Lahr (2001), they use information on the relative reliability of the unbalanced column sums and other information incorporated into the balancing procedure. Their work was based on the automated balancing approach described in Stone and others (1942), Byron (1978) and Stone (1984) for the situations where rows and column totals were endogenous variables.

18.53 In direct contrast to RAS-type methods, Dalgaard and Gysting (2004) do not allow for constant relative reliabilities for the column totals in the initial use table at purchasers' prices. Instead, they suggest a choice based on how likely they consider the values to be sure. For example, values for the intermediate consumption of public administration and exports were 100 per cent reliable, given that this information usually comes from the government budget and foreign trade statistics, respectively. Other data based on annual high quality accounting statistics, such as business surveys, were assigned a 90 per cent reliability, while other less certain areas, such as gross fixed capital formation and household final consumption expenditure, were given 70 per cent confidence. Interestingly, the results were compared against the official, manually compiled SUTs and the deviations were found to be no more than 0.13 per cent of GDP, producing economically meaningful, and apparently quite robust, results. This was the first work reporting a real large-scale (500 products and 100 uses of products) SUTs balancing process in the context of the 1993 SNA, and blending manual and semi-automated methods. Pedullà (1995) made an earlier attempt for Italy but with smaller tables.

18.54 For their part, however, Tarancón and del Río (2005) developed the ANAIS method and tested it for Spain (1994). This essentially comprised an individual and global minimization of relative discrepancies between the elements of the initial and target IOTs, including not only intermediate uses but also final uses and primary inputs. The ANAIS method uses all kinds of information to avoid variations in the coefficients that could be mathematically feasible but difficult to accept from the compiler's standpoint. This is completed through the specification of a set of constraints that would benchmark coefficients with economic aggregates derived from national accounts or macroeconomic models. One of its main advantages is an interactive process which ensures that the results are consistent with the external information and expert guidance, and it provides a solution with interval estimates rather than point estimates.

18.55 The use of other elements of the SUTs and IOTs that differ from intermediate uses alone is not common to many methods presented in this chapter, for example:

- TAU-UAT described by Snower (1990)
- Euro described by Beutel (2002) and SUT-Euro described by Beutel (2008)
- Commodity Flow Balancing described by Dalgaard and Gysting (2004)
- ANAIS described by Tarancón and del Río (2005)
- SUT-RAS described by Temurshoev and Timmer (2011)

Some of the above approaches make a distinction between uses of domestic output and imports.

18.56 The issue of reliability of the initial tables and of the external constraints has also been addressed, although at a level quite remote from the RAS-type developments by Lahr and de Mesnard (2004). The earlier works did not actually document the relative reliability used in their analyses, as described by Allen and Lecomber (1975), Stephan (1942) and Stone and others (1942). It was not until Jensen and McGaurr (1976) that they were explicitly justified. Lahr (2001) and Dalgaard and Gysting (2004) use relative reliability rates in RAS-type constrained optimization methods to deal with the uncertainty of the external constraints specific to the optimization problem. Their approaches are somewhat limited, however, since they are unable to deal with inconsistent totals or conflicting data. Apart from the KRAS method described by Lenzen and others (2009), general constrained optimization methods are typically the methods that, by comparison with RAS-type methods, can more easily handle different data reliabilities and conflicting external information, as described by Golan and others (1994) and Robinson and others (2001).

18.57 In a slightly different context, Rodrigues (2014) studied the projection and balancing of statistical economic data with a best guess, initial values, and uncertainty measures of the outcomes. This Bayesian approach considers the projected and balanced outcomes as random variables rather than point estimates. Rodrigues shows that methods such as generalized least squares, weighted least squares (Rampa, 2008) and bi-proportional methods such as RAS are particular cases of a more general framework. For example, the relative uncertainties of the values of both interior parts and of row and column sums obtained through the RAS method are implicitly assumed to be identical, and this is not necessarily always true.

### 3. Constrained optimization methods based on distance measures

18.58 There are other types of linear or non-linear constrained optimization methods characterized by minimizing some measure of distance between all the elements of the prior and the estimated tables. None of these methods, however, can preserve the sign of the original table, whereas if some non-negativity constraints are applied, then these methods can do so. There might, however, be a collateral effect in terms of a larger number of zeros in the estimated tables, as covered by Lahr and de Mesnard (2004). Some of them can handle non-negative matrices only.

18.59 In order to circumvent these two drawbacks, distance measures have been modified, for example by Huang and others (2008) and Temurshoev and others (2013), in order to be able to handle negative values and preserve signs.

18.60 Box 18.1 provides a list of the different distance based optimization methods available in the literature. Broadly speaking, they can be grouped into:

- *Absolute differences*: Lahr and de Mesnard (2004); Matuszewski and others (1964); Lahr, (2001); Jackson and Murray (2004); and Tarancón and del Río (2005).
- *Square differences*: Almon (1968); Friedlander (1961); Jackson and Murray (2004); Huang and others (2008); Kuroda (1988); Jacksch and Conrad (1971); Harthoorn and van Dalen (1987); and Mínguez and others (2009).

18.61 The solutions to these optimization methods can sometimes be very complicated if external information or potentially conflicting data are added. The works of Harrigan and Buchanan (1984), Zenios and others (1989) and Nagurney and Robinson (1992) are good examples. The combination of equality and inequality conditions, for example, non-negativity, require quadratic programming methods and the solving of bounded constrained optimization problems that notably complicate the scheme. Within this context, the KRAS method provides a RAS variant able to deal with conflicting external data and inconsistent constraints with fewer programming requirements and long run times than in general constrained optimization methods.

## 4. Proportional scaling methods

18.62 The basic idea of proportional scaling methods is to correct a given matrix by row (and by column for bi-proportional methods) with a diagonal matrix of correction factors. There are proportional scaling methods that are not based on the minimum information loss principle. A few of these are one-sided proportional methods, in the sense that the scaling is only made either on rows or on columns, as, for example, shown in Matuszewski and others (1964), Tilanus (1968) and Timmer (2005), and the others are bi-proportional techniques. The former methods provide inefficient estimations since they make adjustments just by column or by row. Moreover, the EUKLEMS method described by Timmer (2005) requires somewhat arbitrary adjustments to make SUTs consistent with regard to the derived product total outputs described by Temurshoev and others (2011).

18.63 Eurostat has developed a set of guidelines for the estimation of missing SUTs and IOTs of countries in order to estimate single European or euro area SUTs and IOTs, using a proportional scaling methods based on current or previous year SUTs and IOTs or available valuation matrices. The guidelines are discussed in Rueda-Cantuche and others (2013b).

18.64 Another bi-proportional scaling method is the Path-RAS method referred to earlier. This method is intended for use whenever rows and column totals are missing and it can be applied both to SUTs and IOTs. This is described in Pereira and others (2013) and in Pereira and Rueda-Cantuche (2013).

18.65 Lastly, the new changes in the accounting systems, such as in the 2008 SNA and BPM 6, bring new challenges in the field of projections of SUTs and IOTs. One of the most important challenges for research policy analysis is how to avoid a break in series of SUTs and IOTs caused by changes in the classifications of products (CPC) and industries (ISIC) or a change in the methodologies, such as those introduced with the 2008 SNA.

18.66 All the methods mentioned so far assume the same classification and methodology, both for the initial and the target SUTs and IOTs. Eurostat and the European Commission's Joint Research Centre developed an algorithm, RACE (Rueda-Cantuche, Amores, and Remond-Tiedrez, 2013) to convert SUTs and IOTs from old classifications of products (CPC) and industries (ISIC) into new ones. As expected, the results depend on the specific bridge tables of each country, whenever available.

## 5. Modelling-based methods

18.67 The modelling-based methods are not based on the minimization of some distance function or some information loss principle, but rely on modelling assumptions that try to capture the changes from the initial to the target tables. By construction, the projected or estimated SUTs and IOTs are those that minimize some distance function or some information loss principle subject to some constraints. It cannot be guaranteed, however, that the projected or estimated tables are going to be close to the reality that they are meant to represent. De Mesnard (1997 and 2004b) interprets this gap between projection and target tables as a measure of structural change.

18.68 It is worth noting that Minguez and others (2009) have shown with CRAS that the use of multiple region-specific tables may improve the updated results, except in cases where the structural changes, for example, oil price hikes, have to be projected. Then, the best outcome is likely to be obtained using only the most recent tables.

18.69 To this end, some authors have proposed modelling approaches to the general balancing or projection problem, rather than following the broadly used conservative approach of minimizing information losses. The extent to which those modelling hypotheses will stand up to the minimum information loss principle depends very much on the way in which national statistics offices actually compile SUTs and IOTs. If they are compiled by looking at the structures of previous years, it may be logical to think that modelling-based methods will not likely perform better than their counterparts. The Leontief price and quantity models are used in the TAU-UAT method, as described by Snower (1990), while the Leontief quantity model alone is used in the EURO method, described by Beutel (2002) and Eurostat (2008), and the SUT-EURO method, described by Beutel (2008) and Valderas (2015), whereas Kratena and Zakarias (2004) use econometric methods instead.

## 6. Manual balancing versus automated balancing

18.70 The projection models described above could provide some useful elements to be considered in the regular compilation of SUTs and IOTs, in particular during the balancing process. There are differing viewpoints regarding the use and benefits of manual balancing, versus automated balancing. There is an argument that automated balancing will yield results superior to those obtained with any manual balancing that does not explicitly optimize a distance function, as described by Stone and others (1942). This view, however, is not shared by, for example, the majority of national statistics offices which compile national accounts and SUTs and IOTs. As Dalgaard and Gysting (2004, page 170) point out, "based on the experience that many errors in primary statistics are spotted in the course of a balancing process that is predominantly manual, compilers are typically convinced that a (mainly) manual balancing process yields results of higher quality".

18.71 Irrespective of the different viewpoints, there is no doubt that some sort of automated balancing is unavoidable when many periods have to be rebalanced following a comprehensive revision. The same is generally true when SUTs and IOTs are compiled on the basis of provisional figures of the national accounts system.

18.72 Hence, following the approach of Lahr and de Mesnard (2004) and Miller and Blair (2009), it would be advisable for producers and users to share more knowledge and experience with one another, in particular in relation to the reliability of data and possible subjectivity of reliability assessments of the existing mathematical projection techniques. As it happens, this chapter offers a good step in this direction, where the aim is to ensure that mathematical techniques are more often combined with survey data, other data sources and expert opinions on certain key elements like rows, columns or individual cells.

## D. Numerical examples

18.73 This section presents numerical examples for three of the methods described above: the GRAS, SUT-RAS and SUT-EURO methods. These methods have been selected on the basis of the following criteria: their easy and simple implementation; different types of external data needed to operate the three approaches (for example, row and column totals; column totals only; and none of them); and their better performance compared with other similar methods.

18.74 Many articles have been published in which the RAS method is tested against RAS variants and other constrained optimization methods. As mentioned earlier, Szyrmer (1989), Gilchrist and St. Louis (1999), Lenzen and others (2006), de Mesnard and Miller (2006) and Mínguez and others (2009) have shown that the introduction of known partial information improves the results of the RAS-type projections, such as TRAS and CRAS. In addition, the RAS method has been assessed against entropy theoretic methods, as described in McDougall (1999), various constrained optimization methods based on distance measures, such as in Pavía and others (2009) and Tarancón and del Río (2005), and econometric methods, as in Kratena and Zakarias (2004). The results generally favour the RAS method over the other options.

18.75 The GRAS method also outperformed certain constrained optimization methods based on distance measures (see Murray, 2004; Oosterhaven, 2005; Strømman, 2009; and Temurshoev and others, 2011), proportional scaling methods (see Temurshoev and others, 2011), and other modelling based methods (see Temurshoev and others, 2011).

18.76 With regard to those methods that deal with SUTs instead of IOTs and technical coefficients, Temurshoev and Timmer (2011) and Valderas (2015) demonstrate that the SUT-RAS method outperforms the SUT-EURO and EUKLEMS methods whenever industry output (column totals) is available. Nevertheless, the SUT-EURO method may still be preferable over the SUT-RAS method for the projection of SUTs and IOTs whenever row and column totals are missing, provided that the particular case cannot be handled by the SUT-RAS method.

18.77 Based on the considerations above, the GRAS, SUT-RAS and SUT-EURO methods have been selected to show numerical examples of projection. The GRAS method is applied to the situation where row and column totals are known. The SUT-RAS method assumes unknown product outputs (row) but known industry outputs (columns). The SUT-EURO method is applied to the case where both row and column totals are missing.

18.78 The numerical examples are based on the set of data presented in Box 18.2. The box shows the SUTs and IOTs for Austria for the years 2005 (base year) and 2006, at basic prices. The official SUTs have been aggregated to four products and three industries, which make them rectangular with more products than industries. The amount of taxes less subsidies on production paid by the agriculture industry has been changed into a negative value for illustrative purposes. The GRAS, SUT-RAS and SUT-EURO methods are applied to selected tables in box 18.2.

### Box 18.2 SUTs and IOTs for Austria, 2005 and 2006

| Supply 2005 | | Industries | | | Total output | Imports | Total Supply |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | | | |
| Products | Agriculture | 6826 | | | 6826 | 2209 | 9035 |
| | Manuf. and const. | 725 | 172430 | 3320 | 176475 | 97313 | 273788 |
| | Trade to busin. services | 2 | 4433 | 45440 | 49875 | 645 | 50520 |
| | Other services | 249 | 4345 | 209547 | 214141 | 16958 | 231099 |
| Total | | 7802 | 181208 | 258307 | 447317 | 117125 | 564442 |

| Supply 2006 | | Industries | | | Total output | Imports | Total Supply |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | | | |
| Products | Agriculture | 7455 | | | 7455 | 2429 | 9884 |
| | Manuf. and const. | 682 | 190892 | 3695 | 195269 | 105962 | 301231 |
| | Trade to busin. services | 2 | 4722 | 47528 | 52252 | 575 | 52827 |
| | Other services | 228 | 4968 | 222262 | 227458 | 18636 | 246094 |
| Total | | 8367 | 200582 | 273485 | 482434 | 127602 | 610036 |

| Use 2005 | | Industries | | | Final Use | | Total |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | 1784 | 2777 | 340 | 1448 | 477 | 6826 |
| | Manuf. and const. | 987 | 37706 | 20218 | 43014 | 74550 | 176475 |
| | Trade to busin. services | 301 | 9761 | 5668 | 27221 | 6924 | 49875 |
| | Other services | 452 | 18475 | 57943 | 118725 | 18546 | 214141 |
| Imports | Agriculture | 115 | 980 | 141 | 920 | 53 | 2209 |
| | Manuf. and const. | 480 | 42057 | 8228 | 28991 | 17557 | 97313 |
| | Trade to busin. services | 1 | 249 | 395 | | | 645 |
| | Other services | 39 | 3491 | 9476 | 1373 | 2579 | 16958 |
| Taxes less subsidies on products | | -93 | 1024 | 4720 | 18215 | 117 | 23983 |
| GVA | | 3736 | 64688 | 151178 | | | 219602 |
| Total | | 7802 | 181208 | 258307 | 239907 | 120803 | |

| Use 2006 | | Industries | | | Final Use | | Total |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | 2000 | 3235 | 262 | 1456 | 502 | 7455 |
| | Manuf. and const. | 1121 | 45637 | 21410 | 44683 | 82418 | 195269 |
| | Trade to busin. services | 280 | 10026 | 6022 | 28331 | 7593 | 52252 |
| | Other services | 443 | 19937 | 62302 | 124292 | 20484 | 227458 |
| Imports | Agriculture | 115 | 1102 | 131 | 1005 | 76 | 2429 |
| | Manuf. and const. | 452 | 47054 | 8599 | 29831 | 20026 | 105962 |
| | Trade to busin. services | 1 | 219 | 355 | | | 575 |
| | Other services | 42 | 3515 | 10197 | 1515 | 3367 | 18636 |
| Taxes less subsidies on products | | -77 | 955 | 4438 | 18731 | 243 | 24290 |
| GVA | | 3990 | 68902 | 159769 | | | 232661 |
| Total | | 8367 | 200582 | 273485 | 249844 | 134709 | |

| IOT (ixi) 2005 | | Industries | | | Final Use | | Total |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | 1788.8 | 2958.749 | 483.5352 | 1763.462 | 807.4829 | 7802 |
| | Manuf. and const. | 989.41 | 37780.53 | 21869.52 | 46880.48 | 73688.06 | 181208 |
| | Services | 745.82 | 27979.72 | 61815.95 | 141764.1 | 26001.46 | 258307 |
| Imports | Agriculture | 117.01 | 1156.335 | 184.1869 | 1040.407 | 127.5801 | 2625.519 |
| | Manuf. and const. | 470.33 | 41217.36 | 8367.596 | 28372.14 | 17240.32 | 95667.74 |
| | Services | 47.662 | 4403.309 | 9688.217 | 1871.449 | 2821.099 | 18831.74 |
| Taxes less subsidies on products | | -93 | 1024 | 4720 | 18215 | 117 | 23983 |
| GVA | | 3736 | 64688 | 151178 | | | 219602 |
| Total | | 7802 | 181208 | 258307 | 239907 | 120803 | |

| IOT (ixi) 2006 | | Industries | | | Final Use | | Total |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | 2004.5 | 3419.031 | 392.9584 | 1737.56 | 812.9417 | 8367 |
| | Manuf. and const. | 1120.9 | 45652.04 | 23297.04 | 48968.74 | 81543.25 | 200582 |
| | Services | 718.57 | 29763.92 | 66306 | 148055.7 | 28640.8 | 273485 |
| Imports | Agriculture | 116.61 | 1269.412 | 169.7097 | 1110.434 | 148.7118 | 2814.882 |
| | Manuf. and const. | 443.36 | 46128.63 | 8771.805 | 29214.82 | 19693.76 | 104252.4 |
| | Services | 50.028 | 4491.957 | 10340.49 | 2025.751 | 3626.533 | 20534.75 |
| Taxes less subsidies on products | | -77 | 955 | 4438 | 18731 | 243 | 24290 |
| GVA | | 3990 | 68902 | 159769 | | | 232661 |
| Total | | 8367 | 200582 | 273485 | 249844 | 134709 | |

18.79 The numerical example of the GRAS method is based on square tables (IOTs) and the SUT-EURO method relies on square SUTs. For illustrative purposes, this chapter focuses on the construction of industry-by-industry IOTs, instead of using the official product-by-product IOTs, because it is more likely to know the projected industry output control totals than the projected product output control totals. In addition, for the numerical example, fixed product sales structures (model D) have been assumed in the estimation of the IOTs.

## 1. Generalized RAS (GRAS) method

18.80 In this example, the GRAS method is applied to the IOT for 2005 to project the IOT for 2006 when the row and column totals are known for 2006. The estimated IOT for 2006 is then compared to the real 2006 IOT of Box 18.2.

18.81 In order to run the GRAS method, the following steps must be followed:

**Step 1:** The IOTs ($T$) must be split up into a matrix $P$ with non-negative values and a matrix $N$ with negative values in absolute terms, see Box 18.4. This means that: $T = P - N$.

**Step 2:** Assuming a vector $r$ of one's as the starting point, calculate: $p_j(r) = \sum_{i=1}^{8} r_i p_{ij}$ and $n_j(r) = \sum_{i=1}^{8} \frac{n_{ij}}{r_i}$

**Step 3:** Calculate: $s_j = \frac{v_j + \sqrt{v_j^2 + 4p_j(r)n_j(r)}}{2p_j(r)}$ with $v_j$ being the projected column totals. Note that Temurshoev and others (2013) propose a different formulation in which $p_j(r) = 0$.

**Step 4:** Calculate: $p_i(s) = \sum_{j=1}^{5} p_{ij} s_j$ and $n_i(s) = \sum_{j=1}^{5} \frac{n_{ij}}{s_j}$.

**Step 5:** Calculate a new vector $r$ such that: $r_i = \frac{u_i + \sqrt{u_i^2 + 4p_i(s)n_i(s)}}{2p_i(s)}$, with $u_i$ being the projected row totals. Note that Temurshoev and others (2013) propose a different formulation in which $p_i(s) = 0$.

**Step 6:** Repeat steps 2–5 until the difference between the $s_j$s obtained from the $(k+1)$-th iteration and the $s_j$s obtained from the $k$-th iteration is less than a certain threshold (for example $10^{-8}$) for all the elements. Convergence needs to be guaranteed.

**Step 7:** Construct the projected table using the following formulation for the $k$-th iteration: $t_{ij} = r_i(k) p_{ij} s_j(k) - \frac{n_{ij}}{r_i(k) s_j(k)}$

18.82 Box 18.3 shows the numerical results of the first two iterations and the projected IOTs after 11 iterations (or the imposition of a threshold of $10^{-8}$). It is noteworthy that the projected IOT for 2006 provides almost exactly the same official GDP of the year 2006 and that its weighted average percentage error is 1.7 per cent when compared to the industry-by-industry IOTs (calculated using model D of Eurostat (2008), p. 347) for Austria for 2006.

# Box 18.3 Results using the GRAS Method

**Matrix P**

| | IOT 2005 | Industries: Agricul-ture | Industries: Manuf. and const. | Industries: Services | Final use: Dom. demand | Final use: Exports | Total |
|---|---|---|---|---|---|---|---|
| Domestic | Agriculture | 1 789 | 2 959 | 484 | 1 763 | 807 | 7 802 |
| | Manuf. and const. | 989 | 37 781 | 21 870 | 46 880 | 73 688 | 181 208 |
| | Services | 746 | 27 980 | 61 816 | 141 764 | 26 001 | 258 307 |
| Imports | Agriculture | 117 | 1 156 | 184 | 1 040 | 128 | 2 626 |
| | Manuf. and const. | 470 | 41 217 | 8 368 | 28 372 | 17 240 | 95 668 |
| | Services | 48 | 4 403 | 9 688 | 1 871 | 2 821 | 18 832 |
| Taxes less subsidies on products | | | 1 024 | 4 720 | 18 215 | 117 | 24 076 |
| GVA | | 3 736 | 64 688 | 151 178 | | | 219 602 |
| Total | | 7 895 | 181 208 | 258 307 | 239 907 | 120 803 | |

**Matrix N**

| | IOT 2005 | Industries: Agricul-ture | Industries: Manuf. and const. | Industries: Services | Final use: Dom. demand | Final use: Exports | Total | r(0) |
|---|---|---|---|---|---|---|---|---|
| Domestic | Agriculture | | | | | | | 1 |
| | Manuf. and const. | | | | | | | 1 |
| | Services | | | | | | | 1 |
| Imports | Agriculture | | | | | | | 1 |
| | Manuf. and const. | | | | | | | 1 |
| | Services | | | | | | | 1 |
| Taxes less subsidies on products | | 93 | | | | | 93 | 1 |
| GVA | | | | | | | | 1 |
| Total | | 93 | | | | | | |

***Iteration 1***

| | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports |
|---|---|---|---|---|---|
| p_j(r) | 7895 | 181208 | 258307 | 239907 | 120803 |
| s(1) | 1.071 | 1.107 | 1.059 | 1.041 | 1.115 |
| n_j(r) | 93 | | | | |

| | | p_i(s) | n_i(s) | *r(1)* |
|---|---|---|---|---|
| Domestic | Agriculture | 8 439 | | 0.991 |
| | Manuf. and const. | 197 027 | | 1.018 |
| | Services | 273 849 | | 0.999 |
| Imports | Agriculture | 2 826 | | 0.996 |
| | Manuf. and const. | 103 759 | | 1.005 |
| | Services | 20 277 | | 1.013 |
| Taxes less subsidies on products | | 25 231 | 87 | 0.966 |
| GVA | | 235 666 | | 0.987 |

***Iteration 2***

| | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports |
|---|---|---|---|---|---|
| p_j(r) | 7 851 | 181 215 | 256 691 | 240 090 | 122 205 |
| s(2) | 1.077 | 1.107 | 1.065 | 1.041 | 1.102 |
| n_j(r) | 96 | | | | |

| | | p_i(s) | n_i(s) | *r(2)* |
|---|---|---|---|---|
| Domestic | Agriculture | 8 442 | | 0.991 |
| | Manuf. and const. | 196 197 | | 1.022 |
| | Services | 273 819 | | 0.999 |
| Imports | Agriculture | 2 825 | | 0.996 |
| | Manuf. and const. | 103 573 | | 1.007 |
| | Services | 20 305 | | 1.011 |
| Taxes less subsidies on products | | 25 246 | 86 | 0.966 |
| GVA | | 236 694 | | 0.983 |

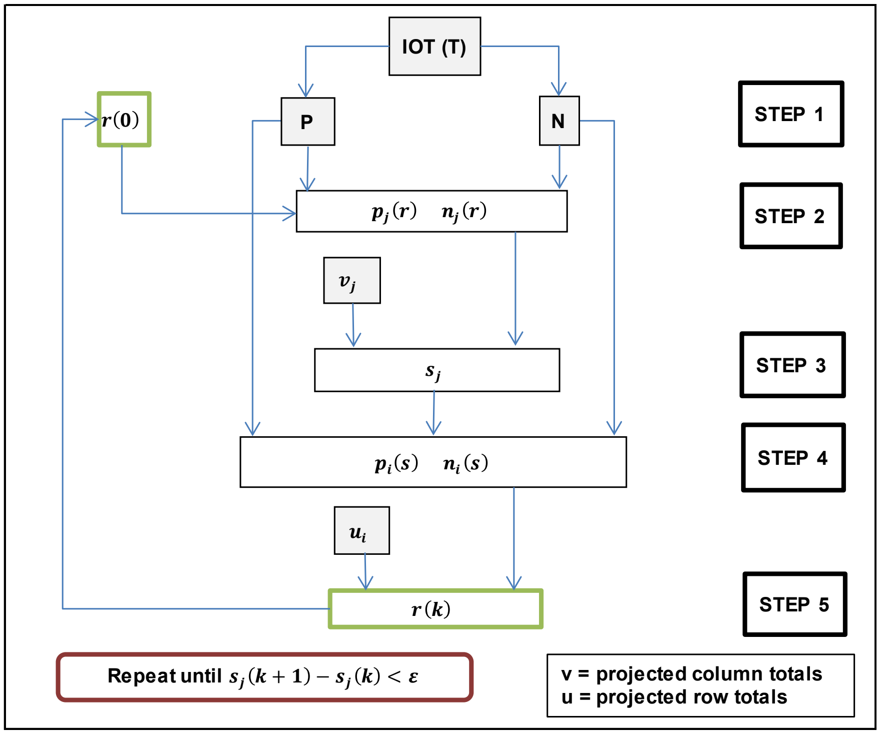
| | | | | | |
|---|---|---|---|---|---|
| s(2) - s(1) | 0.006 | 0.000 | 0.007 | -0.001 | -0.013 |

***After 11 iterations (threshold 0.0000001)***

| | IOT 2006 | Industries: Agricul-ture | Industries: Manuf. and const. | Industries: Services | Final use: Dom. demand | Final use: Exports | Total |
|---|---|---|---|---|---|---|---|
| Dom | Agriculture | 1 914 | 3 242 | 520 | 1 816 | 876 | 8 367 |
| | Manuf. and const. | 1 106 | 43 183 | 23 460 | 49 833 | 83 000 | 200 582 |
| | Services | 793 | 30 636 | 66 496 | 147 186 | 28 374 | 273 485 |
| Imp | Agriculture | 126 | 1 277 | 198 | 1 077 | 140 | 2 818 |
| | Manuf. and const. | 511 | 45 941 | 8 901 | 29 665 | 19 028 | 104 046 |
| | Services | 52 | 4 963 | 10 574 | 1 983 | 3 167 | 20 738 |
| Taxes less subsidies on products | | - 89 | 1 096 | 4 876 | 18 283 | 124 | 24 290 |
| GVA | | 3 955 | 70 245 | 158 462 | | | 232 661 |
| Total | | 8 367 | 200 582 | 273 485 | 249 844 | 134 709 | |

18.83 Box 18.4 shows a flow diagram of the GRAS method for updating IOTs.

**Box 18.4 Flow diagram of the GRAS method**




## 2. SUT-RAS method

18.84 The SUT-RAS method consists of adjusting SUTs to new column totals but unknown row totals. In this case, the SUT-RAS method is applied to the 2005 SUTs in Box 18.2 to project the SUTs to 2006 with information on the column totals for 2006. This means that, for the projection year, the following information must be available: industry outputs; GVA totals by industry; totals of final use categories; total imports; and total taxes less subsidies on products. It should be noted that the version of the SUT-RAS method presented here has been adjusted to account separately for taxes less subsidies on products.

18.85 The matrix may be rectangular, as shown in the numerical example. Moreover, an integrated input-output framework is used for the joint projection of SUTs, as shown in Box 18.5. This framework may be split into three different matrices: domestic intermediate and final uses ($d$); imported intermediate and final uses, extended with an additional row accounting for taxes less subsidies on products ($m$); and the domestic supply table or transpose of the supply table ($v$).

18.86 To run the SUT-RAS method, the following steps must be followed:

**Step 1:** As in the previous case, the initial table, $F$, must be split into a matrix $P$ with non-negative values and a matrix $N$ with negative values in absolute terms.

This means that: $F = P - N$. In addition, the matrices $P^d$, $P^m$ and $P^v$ are separately distinguished in matrix $P$ and $N^d$, $N^m$ and $N^v$ in matrix $N$ to denote the part of the matrix accounting for domestic uses ($d$), imported uses and taxes less subsidies on products ($m$) and supply of products by industries ($v$), respectively. In this example the dimensions of the matrices are: (4 by 5), (5 by 5) and (3 by 4), respectively, in submatrices of both $P$ and $N$. The vector of product imports for the base year is denoted with $m = \{m_1, m_2 \dots m_5\}$.

**Step 2:** Set a vector $s$ of ones (5 by 1), another vector $r^v$ of ones (3 by 1) and a scalar $r = 1$, as starting points, calculate vectors $r^d$ *and* $r^m$ with dimensions (4 by 1) and (5 by 1), respectively, as follows:

$$r_i^d = \sqrt{\frac{n_i^d}{p_i^d}}$$

and

$$r_i^m = \sqrt{\frac{\sum_{j=1}^5 \frac{n_{ij}^m}{s_j} + r\, m_i}{\sum_{j=1}^5 p_{ij}^m s_j}}$$

where $p_i^d = \sum_{j=1}^5 p_{ij}^d s_j + \sum_{j=1}^3 \frac{n_{ij}^v}{r_j^v}$ and $n_i^d = \sum_{j=1}^5 \frac{n_{ij}^d}{s_j} + \sum_{j=1}^3 p_{ij}^v r_j^v$

**Step 3** Use vectors $r^d$ and $r^m$ obtained from step 2 to compute new vectors $s$, $r^v$and $r$, with dimensions (5 by 1), (3 by 1) and (1 by 1), as follows:

$$r_i^v = \frac{x_i + \sqrt{x_i^2 + 4\left(\sum_{j=1}^4 \frac{p_{ij}^v}{r_j^d}\right)\left(\sum_{j=1}^4 n_{ij}^v r_j^d\right)}}{2\sum_{j=1}^4 \frac{p_{ij}^v}{r_j^d}}$$

$$s_j = \frac{u_j + \sqrt{u_j^2 + 4p_j^s n_j^s}}{2p_j^s}$$

$$r = \frac{MT}{\sum_{i=1}^5 \frac{m_i}{r_i^m}}$$

where $p_j^s = \sum_{i=1}^4 r_i^d p_{ij}^d + \sum_{i=1}^5 r_i^m p_{ij}^m$, $n_j^s = \sum_{i=1}^4 \frac{n_{ij}^d}{r_i^d} + \sum_{i=1}^5 \frac{n_{ij}^m}{r_i^m}$ and $MT$ is the overall sum of imports plus taxes less subsidies of the projected year.

**Step 4:** Repeat steps 2 and 3 with the new revised vectors $s$, $r^{v}$ and $r$ until the difference between the $r^{d}$ of the $(k+1)$-th iteration and the $r^{d}$ of the $k$-th iteration is less than a certain threshold for all the elements. The same must apply to the elements of $r^{m}$. Convergence needs to be guaranteed.

**Step 5:** Construct the projected table $F$ and its components, $F^{d}$, $F^{m}$ and $F^{v}$, using the following formulation for the $k$-th iteration:

$$f_{ij}^{d} = r_{i}^{d}(k)\, p_{ij}^{d}\, s_{j}(k) - \frac{n_{ij}^{d}}{r_{i}^{d}(k)\, s_{j}(k)}$$

$$f_{ij}^{m} = r_{i}^{m}(k)\, p_{ij}^{m}\, s_{j}(k) - \frac{n_{ij}^{m}}{r_{i}^{m}(k)\, s_{j}(k)}$$

$$f_{ij}^{v} = \frac{r_{i}^{v}(k)\, p_{ij}^{v}}{r_{j}^{d}(k)} - \frac{r_{j}^{d}(k)\, n_{ij}^{v}}{r_{i}^{v}(k)}$$

**Step 6:** At the end, the elements of the projected vector of imports and taxes less subsidies on products can be derived from either one of these two equivalent mathematical expressions:

$$r\frac{m_{i}}{r_{i}^{m}(k)} = \sum_{j=1}^{5} f_{ij}^{m}$$

18.87 Box 18.5 shows the results for the first three iterations and the projected SUTs after 20 iterations. It is worth noting that the projected SUT for 2006 provides almost exactly the same official GDP of the year 2006 (about 0.4% deviation) and that its weighted average percentage error is 1.1% when compared to the official SUT of Austria for 2006 in Box 18.2. At the end, the GVA components are simply added to the projected table, since they are assumed to be known.

## Box 18.5 Results using the SUT-RAS method

**Austria 2005 SUT**

**Matrix P**

| | | PRODUCTS | | | | INDUSTRIES | | | FINAL USE | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Trade to busin. services | Other services | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | | | | | 1 784 | 2 777 | 340 | 1 448 | 477 | 6 826 |
| | Manuf. and const. | | | | | 987 | 37 706 | 20 218 | 43 014 | 74 550 | 176 475 |
| | Trade to busin. services | | | | | 301 | 9 761 | 5 668 | 27 221 | 6 924 | 49 875 |
| | Other services | | | | | 452 | 18 475 | 57 943 | 118 725 | 18 546 | 214 141 |
| Imports | Agriculture | | | | | 115 | 980 | 141 | 920 | 53 | 2 209 |
| | Manuf. and const. | | | | | 480 | 42 057 | 8 228 | 28 991 | 17 557 | 97 313 |
| | Trade to busin. services | | | | | 1 | 249 | 395 | | | 645 |
| | Other services | | | | | 39 | 3 491 | 9 476 | 1 373 | 2 579 | 16 958 |
| Taxes less subsidies on products | | | | | | | 1 024 | 4 720 | 18 215 | 117 | 24 076 |
| Industries | Agriculture | 6 826 | 725 | 2 | 249 | | | | | | 7 802 |
| | Manuf. and const. | | 172 430 | 4 433 | 4 345 | | | | | | 181 208 |
| | Services | | 3 320 | 45 440 | 209 547 | | | | | | 258 307 |
| Total | | 6 826 | 176 475 | 49 875 | 214 141 | 4 159 | 116 520 | 107 129 | 239 907 | 120 803 | |

**Matrix N**

| | | PRODUCTS | | | | INDUSTRIES | | | FINAL USE | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Trade to busin. services | Other services | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | | | | | | | | | | |
| | Manuf. and const. | | | | | | | | | | |
| | Trade to busin. services | | | | | | | | | | |
| | Other services | | | | | | | | | | |
| Imports | Agriculture | | | | | | | | | | |
| | Manuf. and const. | | | | | | | | | | |
| | Trade to busin. services | | | | | | | | | | |
| | Other services | | | | | | | | | | |
| Taxes less subsidies on products | | | | | | 93 | | | | | 93 |
| Industries | Agriculture | | | | | | | | | | |
| | Manuf. and const. | | | | | | | | | | |
| | Services | | | | | | | | | | |
| Total | | | | | | 93 | | | | | |

Pd | Pm | Pv — empty cell — Nd | Nm | Nv

***Iteration 1***

| p_d | n_d | r_d | r_m | p_v | n_v | r_v | p_s | n_s | su (1) | r (1) |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 826 | 6 826 | 1 | 1 | 7 802 | | 1.072 | 4 159 | 93 | 1.07325 | 1.07642 |
| 176 475 | 176 475 | 1 | 1 | 181 208 | | 1.107 | 116 520 | | 1.13011 | |
| 49 875 | 49 875 | 1 | 1 | 258 307 | | 1.059 | 107 129 | | 1.06149 | |
| 214 141 | 214 141 | 1 | 1 | | | | 239 907 | | 1.04142 | |
| | | | 1 | | | | 120 803 | | 1.11511 | |

***Iteration 2***

| p_d | n_d | r_d | r_m | p_v | n_v | r_v | p_s | n_s | su (2) | r (2) | dev r_d | dev r_m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 454 | 7 320 | 0.991 | 0.996 | 7 860 | | 1.064 | 4 142 | 92 | 1.077 | 1.072 | -0.0090 | -0.0042 |
| 193 060 | 195 158 | 1.005 | 0.992 | 180 298 | | 1.112 | 116 292 | | 1.132 | | 0.0054 | -0.0085 |
| 53 440 | 53 019 | 0.996 | 0.995 | 258 588 | | 1.058 | 107 142 | | 1.061 | | -0.0039 | -0.0053 |
| 227 193 | 226 936 | 0.999 | 0.997 | | | | 239 927 | | 1.041 | | -0.0006 | -0.0027 |
| | | | 1.012 | | | | 121 011 | | 1.113 | | | |

***Iteration 3***

| p_d | n_d | r_d | r_m | p_v | n_v | r_v | p_s | n_s | su (3) | r (3) | dev r_d | dev r_m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 466 | 7 266 | 0.987 | 0.993 | 7 890 | | 1.060 | 4 135 | 92 | 1.079 | 1.069 | -0.0045 | -0.0026 |
| 192 998 | 196 111 | 1.008 | 0.989 | 179 857 | | 1.115 | 116 255 | | 1.133 | | 0.0026 | -0.0023 |
| 53 447 | 52 992 | 0.996 | 0.992 | 258 690 | | 1.057 | 107 114 | | 1.062 | | -0.0003 | -0.0024 |
| 227 183 | 226 718 | 0.999 | 0.995 | | | | 239 858 | | 1.042 | | -0.0005 | -0.0021 |
| | | | 1.010 | | | | 121 145 | | 1.112 | | | |

*(…)*

***Iteration 20***

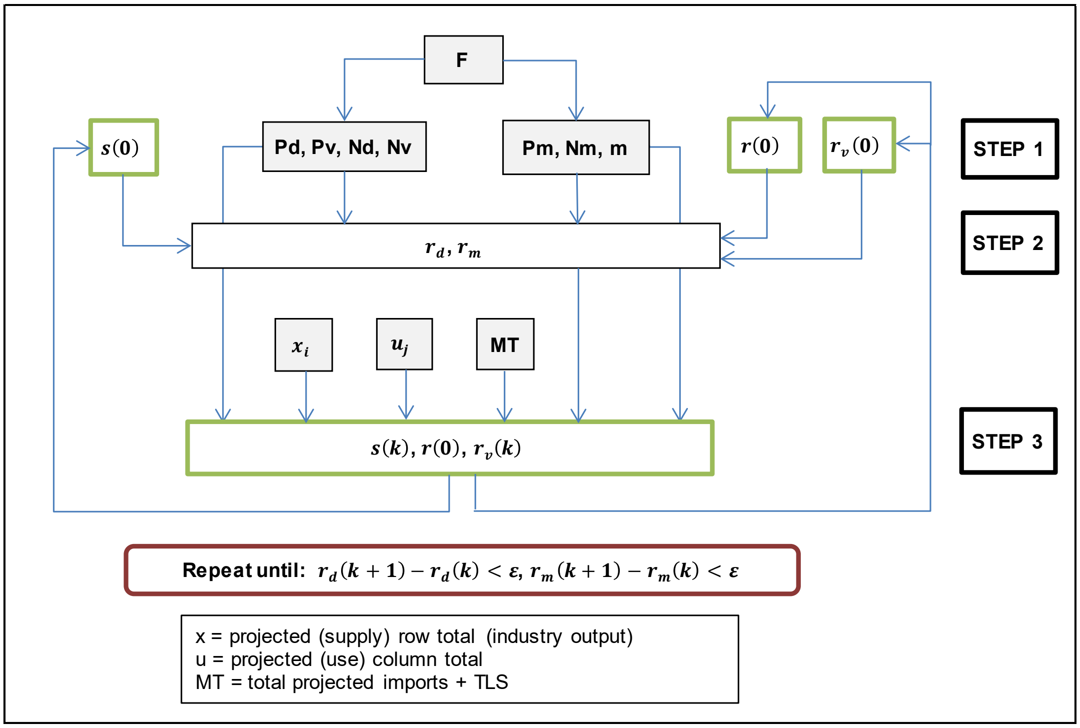
| p_d | n_d | r_d | r_m | p_v | n_v | r_v | p_s | n_s | su (20) | r (20) | dev r_d | dev r_m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 474 | 7 215 | 0.982 | 0.991 | 7 916 | | 1.057 | 4 129 | 92 | 1.081 | 1.067 | 0.0000 | 0.0000 |
| 192 875 | 197 079 | 1.011 | 0.987 | 179 386 | | 1.118 | 116 222 | | 1.133 | | 0.0000 | 0.0000 |
| 53 457 | 52 977 | 0.995 | 0.990 | 258 803 | | 1.057 | 107 080 | | 1.062 | | 0.0000 | 0.0000 |
| 227 261 | 226 557 | 0.998 | 0.993 | | | | 239 778 | | 1.042 | | | |
| | | | 1.008 | | | | 121 292 | | 1.111 | | | |

**Supply and use framework at basic prices**
**Austria 2006 SUT-RASed**

| | | PRODUCTS | | | | INDUSTRIES | | | FINAL USE | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Trade to Busin. Services | Other services | Agricul-ture | Manuf. and const. | Services | Dom. Demand | Exports | |
| Domestic | Agriculture | | | | | 1 894 | 3 091 | 355 | 1 482 | 520 | 7 343 |
| | Manuf. and const. | | | | | 1 078 | 43 184 | 21 704 | 45 306 | 83 694 | 194 966 |
| | Trade to Busin. Services | | | | | 324 | 11 009 | 5 992 | 28 236 | 7 655 | 53 217 |
| | Other services | | | | | 488 | 20 900 | 61 438 | 123 517 | 20 566 | 226 909 |
| Imports | Agriculture | | | | | 123 | 1 100 | 148 | 950 | 58 | 2 379 |
| | Manuf. and const. | | | | | 512 | 47 021 | 8 622 | 29 808 | 19 241 | 105 204 |
| | Trade to Busin. Services | | | | | 1 | 279 | 415 | | | 695 |
| | Other services | | | | | 42 | 3 927 | 9 990 | 1 420 | 2 844 | 18 223 |
| Industries | Agriculture | 7 343 | 758 | 2 | 264 | | | | | | 8 367 |
| | Manuf. and const. | | 190 737 | 4 979 | 4 866 | | | | | | 200 582 |
| | Services | | 3 471 | 48 235 | 221 779 | | | | | | 273 485 |
| Taxes less subsidies on products | | | | | | - 85 | 1 169 | 5 051 | 19 125 | 131 | 25 390 |
| VA | | | | | | 3 990 | 68 902 | 159 769 | | | 232 661 |
| Total | | 7 343 | 194 966 | 53 217 | 226 909 | 8 367 | 200 582 | 273 485 | 249 844 | 134 709 | |

18.88 Box 18.6 shows a flow diagram of the SUT-RAS method for updating SUTs and IOTs.

**Box 18.6 Flow diagram of the SUT-RAS method**




## 3. SUT-Euro method

18.89 The SUT-Euro method is used to project SUTs on the basis of a base year SUT. In this numerical example it is used to project the SUT for Austria for the year 2006 based on the SUT at basic prices for 2005. The method requires the following information: GVA totals by industry; totals of final use categories; total imports; and total taxes less subsidies on products. In practice, the growth rates of this information are used instead of their actual values, as shown in table 2 in Box 18.7. In addition, the SUT-Euro method assumes that the shares of industries in the production of products – market shares – remain constant, as shown in table 1 in Box 18.7. The fully fledged matrix may be rectangular, as shown in the numerical example, although there must be the same number of industries as products.

18.90 The initial SUTs consists of the following components all expressed at basic prices:

- Domestic and imported intermediate use matrix (product by industry)
- Domestic and imported final use matrix (product by category of final use)
- Supply matrix (product by industry)
- Vector of total GVA of industries

- Vector of total taxes less subsidies on products by industries and final use categories

18.91 Each of the iterations of the SUT-EURO method comprises two steps; a flow diagram of the entire process may be seen in box 18.8.

18.92 The first step of the first iteration defines domestic and imported intermediate and final uses, the vector of GVA, the vector of taxes less subsidies on products, and the supply table of the projected SUT. This first estimation of the (unbalanced) use table (table 5 in Box 18.7) is basically a cell-wise arithmetic average (except for GVA, which is set to the values of the projected year), which is derived from applying the corresponding growth rates to the columns (table 3 in Box 18.7) and rows (table 4 in Box 18.7) of the initial use table.

18.93 The growth rates used in table 4 in Box 18.7, row scaling, correspond to the GVA growth rates of the corresponding industries for which the product is primary output. The same growth rates for domestically produced products and imported products are also assumed as starting values. Subsequently, the total product outputs from the projected use table are allocated row-by-row in a manner proportional to the initial supply table, namely, constant market shares, in order to obtain the first estimation of the supply table at basic prices. This table is not shown in Box 18.7.

18.94 As a result, the total industry outputs and total industry inputs will not be equal after this first step. Similarly, the GDP calculated from the use side, 258,432, differs from the GDP calculated from the supply side, 257,346, as it can be derived from the data in table 5 of Box 18.7.

18.95 Accordingly, for the purpose of making the current projected SUTs consistent, it is assumed that the input structures of industries, including domestic and imported inputs, GVA and taxes less subsidies on products (see table 6 in Box 18.7) and the actual values of final uses of products (see table 5 in Box 18.7) from the first step are valid. Given this assumption, the fixed product sales structure model determines consistent industry output and input levels (see model D in Eurostat, 2008, p. 351). This second step ensures consistency of the industry outputs and inputs, and the supply and use of products (see tables 7 and 8 in Box 18.7), but it deviates from macroeconomic statistics, GVA by industry, final uses of categories, total GVA, overall sum of taxes less subsidies on products and total imports.

18.96 At the end, the total product outputs, from the consistent use table are allocated row by row in a manner proportional to the initial market shares, in order to obtain a consistent estimation of the supply table at basic prices.

18.97 The growth rates initially used are then adjusted in an iterative procedure in order to bring the difference between the actual and projected growth rates, in each of the iterations, below a certain threshold. The observed deviations ($dev_k$) are used to correct these rates in such a manner as to ensure that, if the model overestimates or underestimates the available macroeconomic statistics, the corresponding growth rates are decreased or increased appropriately. This is done through the correction factors shown in row (4) of table 9 in Box 18.7, which are defined as follows:

$$c_k = \begin{cases} 1 + \dfrac{[(dev_k - 1) \cdot 100]^{\varepsilon}}{100}, if\ dev_k > 1 \\ 1 + \dfrac{[(1 - dev_k) \cdot 100]^{\varepsilon}}{100}, if\ dev_k < 1 \end{cases}$$

where $dev_k$ is actual value / projected value and $\varepsilon\ =\ 0.9$.

18.98 The first step of the second iteration computes the projected SUTs components as in the first iteration, namely, domestic and imported intermediate and final uses, the vector of GVA, the vector of taxes less subsidies on products, and the supply table. As was the case with the first step of the first iteration, the results do not ensure the equality of industry outputs and inputs.

18.99 The consistent industry outputs and inputs are again obtained using the fixed product sales structure model, which is then used to derive consistent SUTs of the second iteration in exactly the same manner as defined earlier for the first iteration. It is worth noting that the input structures are derived endogenously from the outcomes of the first step of the second iteration. As a result, a new deviation vector is obtained, which quantifies the deviation of the projected growth rates from the macroeconomic statistics.

18.100 If the difference between the actual and projected growth rates is acceptable, the resulting SUTs are the final outcome of the projection of the SUT-EURO method. Otherwise, the steps of the second iteration are repeated until the projected variables approximate or are identical to those of the macroeconomic statistics. It must be noted that each subsequent iteration starts with the computation of new correction factors, which are then used to correct the growth rates from the previous iteration.

18.101 Box 18.7 shows the results of the projected SUTs after the fiftieth iteration. It can be seen that the deviations are sufficiently small to stop the iterative process. It should be noted that the projected table for the SUTs for 2006 provides almost exactly the same official GDP of the year 2006 (about -0.001% deviation), and that the weighted average percentage error is 1.8% compared against the official SUT for 2006, as in Box 18.2.

18.102 The convergence in the SUT-Euro method can always be found by changing the tolerance level (ε) until convergence is reached. One last important point to note concerning the SUT-Euro method is that it requires the number of industries and products to be equal. Thus, even if the SUT-Euro method distinguishes between products and industries, strictly speaking, it does not allow for rectangular SUTs estimation.

# Box 18.7 Results using the SUT-Euro method

**Table 1**

| Market shares | | Products: Agricul-ture | Products: Manuf. and const. | Products: Services |
|---|---|---|---|---|
| Indust. | Agriculture | 1.00 | 0.00 | 0.00 |
| | Manuf. and const. | 0.00 | 0.98 | 0.03 |
| | Services | 0.00 | 0.02 | 0.97 |
| Total | | 1.00 | 1.00 | 1.00 |

**Table 2**

| | TLS | VA | | | Final Use | | Imports |
|---|---|---|---|---|---|---|---|
| Growth | 1.013 | 1.068 | 1.065 | 1.057 | 1.041 | 1.115 | 1.089 |

***Iteration 1***

**Table 3** (1)

| | | Industries: Agricul-ture | Industries: Manuf. and const. | Industries: Services | Final Use: Dom. demand | Final Use: Exports | Total |
|---|---|---|---|---|---|---|---|
| Domestic | Agriculture | 1 905 | 2 958 | 359 | 1 508 | 532 | 7 262 |
| | Manuf. and const. | 1 054 | 40 162 | 21 367 | 44 796 | 83 132 | 190 511 |
| | Services | 804 | 30 075 | 67 226 | 151 991 | 28 402 | 278 498 |
| Imports | Agriculture | 123 | 1 044 | 149 | 958 | 59 | 2 333 |
| | Manuf. and const. | 513 | 44 797 | 8 696 | 30 192 | 19 578 | 103 775 |
| | Services | 43 | 3 984 | 10 432 | 1 430 | 2 876 | 18 764 |
| Taxes less subsidies on products | | - 99 | 1 091 | 4 988 | 18 969 | 130 | 25 080 |
| GVA | | 3 990 | 68 902 | 159 769 | 0 | 0 | 232 661 |
| Total | | 8 332 | 193 013 | 272 986 | 249 844 | 134 709 | |

**Table 4** (1)

| | | Industries: Agricul-ture | Industries: Manuf. and const. | Industries: Services | Final Use: Dom. demand | Final Use: Exports | Total |
|---|---|---|---|---|---|---|---|
| Domestic | Agriculture | 1 905 | 2 966 | 363 | 1 546 | 509 | 7 290 |
| | Manuf. and const. | 1 051 | 40 162 | 21 535 | 45 816 | 79 406 | 187 971 |
| | Services | 796 | 29 841 | 67 226 | 154 240 | 26 917 | 279 019 |
| Imports | Agriculture | 123 | 1 047 | 151 | 983 | 57 | 2 359 |
| | Manuf. and const. | 511 | 44 797 | 8 764 | 30 880 | 18 701 | 103 652 |
| | Services | 42 | 3 953 | 10 432 | 1 451 | 2 726 | 18 603 |
| Taxes less subsidies on products | | - 94 | 1 037 | 4 780 | 18 448 | 118 | 24 290 |
| GVA | | 3 958 | 68 535 | 160 168 | 0 | 0 | 232 661 |
| Total | | 8 293 | 192 336 | 273 419 | 253 364 | 128 435 | |

**Table 5** (1)

| | | Industries: Agricul-ture | Industries: Manuf. and const. | Industries: Services | Final Use: Dom. demand | Final Use: Exports | Total |
|---|---|---|---|---|---|---|---|
| Domestic | Agriculture | 1 905 | 2 962 | 361 | 1 527 | 521 | 7 276 |
| | Manuf. and const. | 1 053 | 40 162 | 21 451 | 45 306 | 81 269 | 189 241 |
| | Services | 800 | 29 958 | 67 226 | 153 115 | 27 660 | 278 759 |
| Imports | Agriculture | 123 | 1 045 | 150 | 970 | 58 | 2 346 |
| | Manuf. and const. | 512 | 44 797 | 8 730 | 30 536 | 19 139 | 103 714 |
| | Services | 42 | 3 968 | 10 432 | 1 440 | 2 801 | 18 684 |
| Taxes less subsidies on products | | - 97 | 1 064 | 4 884 | 18 709 | 124 | 24 685 |
| GVA | | 3 990 | 68 902 | 159 769 | 0 | 0 | 232 661 |
| Total | | 8 328 | 192 858 | 273 003 | 251 604 | 131 572 | |

**Table 6** (1)

| | | Industries: Agricul-ture | Industries: Manuf. and const. | Industries: Services |
|---|---|---|---|---|
| Domestic | Agriculture | 0.23 | 0.02 | 0.00 |
| | Manuf. and const. | 0.13 | 0.21 | 0.08 |
| | Services | 0.10 | 0.16 | 0.25 |
| Imports | Agriculture | 0.01 | 0.01 | 0.00 |
| | Manuf. and const. | 0.06 | 0.23 | 0.03 |
| | Services | 0.01 | 0.02 | 0.04 |
| Taxes less subsidies on products | | -0.01 | 0.01 | 0.02 |
| GVA | | 0.48 | 0.36 | 0.59 |
| Total | | 1.00 | 1.00 | 1.00 |
| Output | | 8351 | 194527 | 273058 |

**Table 7** (1)

| Consistent | | Industries: Agricul-ture | Industries: Manuf. and const. | Industries: Services | Final Use: Dom. demand | Final Use: Exports | Total |
|---|---|---|---|---|---|---|---|
| Domestic | Agriculture | 1 911 | 2 987 | 361 | 1 527 | 521 | 7 307 |
| | Manuf. and const. | 1 056 | 40 510 | 21 455 | 45 306 | 81 269 | 189 596 |
| | Services | 802 | 30 217 | 67 239 | 153 115 | 27 660 | 279 034 |
| Imports | Agriculture | 123 | 1 054 | 150 | 970 | 58 | 2 355 |
| | Manuf. and const. | 513 | 45 184 | 8 732 | 30 536 | 19 139 | 104 104 |
| | Services | 43 | 4 002 | 10 434 | 1 440 | 2 801 | 18 720 |
| Taxes less subsidies on products | | - 97 | 1 073 | 4 885 | 18 709 | 124 | 24 695 |
| GVA | | 4 001 | 69 498 | 159 801 | 0 | 0 | 233 301 |
| Total | | 8 351 | 194 527 | 273 058 | 251 604 | 131 572 | |

**Table 8** (1)

| Consistent | | Industries: Agricul-ture | Industries: Manuf. and const. | Industries: Services | Total |
|---|---|---|---|---|---|
| Products | Agriculture | 7307 | 0 | 0 | 7307 |
| | Manuf. and const. | 779 | 185250 | 3567 | 189596 |
| | Services | 265 | 9277 | 269491 | 279034 |
| Total | | 8351 | 194527 | 273058 | 475937 |

**Table 9** (1)

| | VA Agricul-ture (1) | VA Manuf. and const. (2) | VA Services (3) | Dom. demand (4) | Exports (5) | Total value added (6) | Taxes less subsidies on products (7) | Imports (8) |
|---|---|---|---|---|---|---|---|---|
| Actual | 1.0680 | 1.0651 | 1.0568 | 1.0414 | 1.1151 | 1.0595 | 1.0128 | 1.0895 |
| Project | 1.0709 | 1.0744 | 1.0570 | 1.0488 | 1.0891 | 1.0624 | 1.0297 | 1.0688 |
| Deviation | 0.9973 | 0.9914 | 0.9998 | 0.9930 | 1.0238 | 0.9973 | 0.9836 | 1.0193 |
| Corrected | 0.9969 | 0.9913 | 0.9997 | 0.9928 | 1.0219 | 0.9969 | 0.9844 | 1.0181 |

(to be continued)

# Box 18.7 Results using the SUT-EURO method (continued)

***Iteration 2***

**Table 3** (2)

| | | Industries | | | Final Use | | Total |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | 1 899 | 2 932 | 359 | 1 497 | 544 | 7 231 |
| | Manuf. and const. | 1 051 | 39 812 | 21 361 | 44 471 | 84 949 | 191 644 |
| | Services | 802 | 29 813 | 67 206 | 150 889 | 29 023 | 277 733 |
| Imports | Agriculture | 122 | 1 035 | 149 | 951 | 60 | 2 318 |
| | Manuf. and const. | 511 | 44 406 | 8 693 | 29 973 | 20 006 | 103 589 |
| | Services | 43 | 3 949 | 10 429 | 1 420 | 2 939 | 18 779 |
| Taxes less subsidies on products | | - 99 | 1 081 | 4 987 | 18 832 | 133 | 24 934 |
| GVA | | 3 978 | 68 302 | 159 721 | 0 | 0 | 232 000 |
| Total | | 8 306 | 191 331 | 272 904 | 248 033 | 137 654 | |

**Table 4** (2)

| | | Industries | | | Final Use | | Total |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | 1 899 | 2 957 | 362 | 1 542 | 508 | 7 267 |
| | Manuf. and const. | 1 042 | 39 812 | 21 347 | 45 417 | 78 715 | 186 333 |
| | Services | 796 | 29 832 | 67 206 | 154 194 | 26 909 | 278 936 |
| Imports | Agriculture | 125 | 1 066 | 153 | 1 000 | 58 | 2 402 |
| | Manuf. and const. | 521 | 45 608 | 8 923 | 31 439 | 19 039 | 105 530 |
| | Services | 43 | 4 024 | 10 621 | 1 477 | 2 775 | 18 940 |
| Taxes less subsidies on products | | - 93 | 1 021 | 4 706 | 18 160 | 117 | 23 911 |
| GVA | | 3 946 | 68 321 | 159 668 | 0 | 0 | 231 935 |
| Total | | 8 279 | 192 640 | 272 986 | 253 229 | 128 120 | |

**Table 5** (2)

| | | Industries | | | Final Use | | Total |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | 1 899 | 2 944 | 361 | 1 519 | 526 | 7 249 |
| | Manuf. and const. | 1 046 | 39 812 | 21 354 | 44 944 | 81 832 | 188 988 |
| | Services | 799 | 29 822 | 67 206 | 152 541 | 27 966 | 278 334 |
| Imports | Agriculture | 124 | 1 050 | 151 | 976 | 59 | 2 360 |
| | Manuf. and const. | 516 | 45 007 | 8 808 | 30 706 | 19 523 | 104 559 |
| | Services | 43 | 3 987 | 10 525 | 1 448 | 2 857 | 18 859 |
| Taxes less subsidies on products | | - 96 | 1 051 | 4 846 | 18 496 | 125 | 24 423 |
| GVA | | 3 962 | 68 311 | 159 695 | 0 | 0 | 231 968 |
| Total | | 8 293 | 191 985 | 272 945 | 250 631 | 132 887 | |

**Table 6** (2)

| | | Industries | | |
|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services |
| Domestic | Agriculture | 0.23 | 0.02 | 0.00 |
| | Manuf. and const. | 0.13 | 0.21 | 0.08 |
| | Services | 0.10 | 0.16 | 0.25 |
| Imports | Agriculture | 0.01 | 0.01 | 0.00 |
| | Manuf. and const. | 0.06 | 0.23 | 0.03 |
| | Services | 0.01 | 0.02 | 0.04 |
| Taxes less subsidies on products | | -0.01 | 0.01 | 0.02 |
| GVA | | 0.48 | 0.36 | 0.59 |
| Total | | 1.00 | 1.00 | 1.00 |
| Output | | 8 340 | 194 395 | 272 684 |

**Table 7** (2)

| Consistent | | Industries | | | Final Use | | Total |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | 1 910 | 2 981 | 360 | 1 519 | 526 | 7 297 |
| | Manuf. and const. | 1 052 | 40 312 | 21 334 | 44 944 | 81 832 | 189 474 |
| | Services | 803 | 30 197 | 67 141 | 152 541 | 27 966 | 278 649 |
| Imports | Agriculture | 124 | 1 063 | 151 | 976 | 59 | 2 374 |
| | Manuf. and const. | 519 | 45 572 | 8 799 | 30 706 | 19 523 | 105 119 |
| | Services | 43 | 4 037 | 10 515 | 1 448 | 2 857 | 18 900 |
| Taxes less subsidies on products | | - 96 | 1 064 | 4 842 | 18 496 | 125 | 24 431 |
| GVA | | 3 984 | 69 169 | 159 542 | 0 | 0 | 232 695 |
| Total | | 8 340 | 194 395 | 272 684 | 250 631 | 132 887 | |

**Table 8** (2)

| Consistent | | Industries | | | Total |
|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | |
| Products | Agriculture | 7 297 | 0 | 0 | 7 297 |
| | Manuf. and const. | 778 | 185 131 | 3 565 | 189 474 |
| | Services | 265 | 9 265 | 269 120 | 278 649 |
| Total | | 8 340 | 194 395 | 272 684 | 475 420 |

**Table 9** (2)

| | VA Agricul-ture | VA Manuf. and const. | VA Services | Dom. demand | Exports | Total value added | Taxes less subsidies on products | Imports |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Actual | 1.0680 | 1.0651 | 1.0568 | 1.0414 | 1.1151 | 1.0595 | 1.0128 | 1.0895 |
| Project | 1.0665 | 1.0693 | 1.0553 | 1.0447 | 1.1000 | 1.0596 | 1.0187 | 1.0791 |
| Deviation | 1.0014 | 0.9961 | 1.0014 | 0.9969 | 1.0137 | 0.9999 | 0.9942 | 1.0096 |
| Corrected | 1.0017 | 0.9958 | 1.0017 | 0.9965 | 1.0133 | 0.9998 | 0.9939 | 1.0096 |

**(…)**

***From iteration 50***

**Table 7** (50)

| Consistent | | Industries | | | Final Use | | Total |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | Dom. demand | Exports | |
| Domestic | Agriculture | 1 905 | 2 983 | 360 | 1 512 | 533 | 7 294 |
| | Manuf. and const. | 1 045 | 40 162 | 21 211 | 44 522 | 82 669 | 189 610 |
| | Services | 803 | 30 298 | 67 225 | 152 193 | 28 441 | 278 961 |
| Imports | Agriculture | 125 | 1 073 | 152 | 979 | 60 | 2 390 |
| | Manuf. and const. | 522 | 45 985 | 8 859 | 30 812 | 19 956 | 106 135 |
| | Services | 43 | 4 073 | 10 586 | 1 453 | 2 920 | 19 076 |
| Taxes less subsidies on products | | - 96 | 1 063 | 4 827 | 18 369 | 127 | 24 290 |
| GVA | | 3 990 | 68 901 | 159 767 | 0 | 0 | 232 659 |
| Total | | 8 338 | 194 538 | 272 988 | 249 842 | 134 708 | |

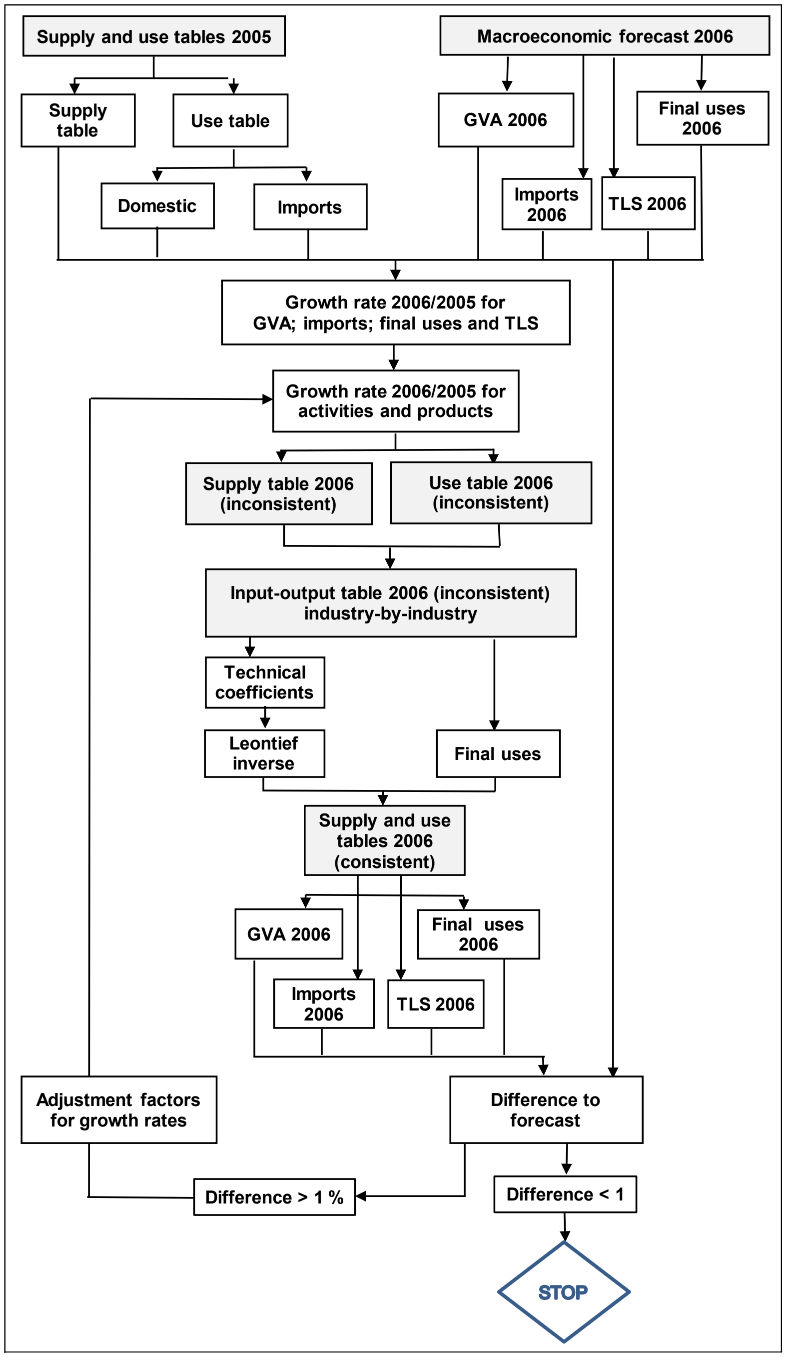
**Table 8** (50)

| Consistent | | Industries | | | Total | Imports | Total supply |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manuf. and const. | Services | | | |
| Products | Agriculture | 7 294 | 0 | 0 | 7 294 | 2 390 | 9 683 |
| | Manuf. and const. | 779 | 185 264 | 3 567 | 189 610 | 106 135 | 295 745 |
| | Services | 265 | 9 275 | 269 421 | 278 961 | 19 076 | 298 037 |
| Total | | 8 338 | 194 538 | 272 988 | 475 864 | 127 601 | 603 465 |

**Table 9** (50)

| | VA Agricul-ture | VA Manuf. and const. | VA Services | Dom. demand | Exports | Total value added | Taxes less subsidies on products | Imports |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Actual | 1.0680 | 1.0651 | 1.0568 | 1.0414 | 1.1151 | 1.0595 | 1.0128 | 1.0895 |
| Project | 1.0680 | 1.0651 | 1.0568 | 1.0414 | 1.1151 | 1.0595 | 1.0128 | 1.0894 |
| Deviation | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

**Box 18.8 Flow diagram of the SUT-EURO method**




## E. Criteria to consider when choosing a method

18.103 There are various reasons for the projection of SUTs and IOTs for policy research analysis and many methods available for such purposes. The choice of method is not a trivial matter and is influenced by a number of factors, primary among which are: the scope of the SUTs and IOTs, the price valuation, the classification and methodology, the availability of information, the minimum information loss, and the overall objective of the projection. These are further elaborated below.

18.104 *Scope*: The projections may either be for rectangular SUTs or for IOTs but, currently, a larger range of methods is available for carrying out projections for IOTs than for SUTs.

18.105 *Price valuation*: The SNA distinguishes between basic prices and purchasers' prices, among other price components, which would influence the choice of method.

18.106 *Classification and methodology*: The use of projection methods to convert SUTs and IOTs from older to newer classifications of industries and products or from older to newer systems of economic accounts strongly influences the choice of method, because of the different dimensions between the initial and target tables.

18.107 *Availability of information*: There is a broad range of methods, depending on the information available to carry out the projections. These information considerations may vary from missing row and column totals to the availability of external data, which may or may not be conflicting, on certain elements of the target tables or the additional external constraints. In addition, relative reliabilities may be allocated to the elements of the initial tables and constraint constants. The amount of information used will determine whether projections, estimations or semi-automated compilations are undertaken.

18.108 *Minimum information loss principle*: This principle guarantees that the structure of the target tables deviates to a minimum extent from that of the initial tables. This conservative approach may not, however, be sufficiently realistic to project a table close to the officially compiled table. Indeed, there is a gap between the projected tables and the actual tables that can be interpreted as structural changes that deviate from the initial structures. Alternatively, there are other less conservative methods that rely on modelling assumptions (such as, for example, Leontief price and quantity models, time series, econometrics, and others), that try to capture the actual performance of the elements of the target tables, such as input coefficients. In point of fact, whether or not they perform better than the more conservative methods is determined only by the actual compilation practices of national statistics offices.

18.109 *Objective of the projection*: The projection issues may differ in respect of the projection of SUTs and IOTs or that of matrices of trade margins and transport margins. In addition, it may differ for the updating of tables or regionalization of tables, or if projection methods are applied within the context of the estimation or balancing of SUTs.

# Chapter 19. Extensions of SUTs and IOTs as part of satellite systems

## A. Introduction

19.1 SUTs and IOTs may be extended within the framework of satellite systems to the SNA in a number of ways, in order to address specific concerns or to focus on specific activities of the economy. Some of the extensions elaborated in the present chapter are also described in the 2008 SNA, chapters 28 and 29, which deal with input-output and other matrix-based analysis and with satellite accounts and other extensions. Satellite systems form a very useful, and important, extension of the national accounts and involve the rearrangement of existing national accounts information to enable an area of particular economic or social importance to be analysed in much greater detail, with additional dimensions not reflected within the core national accounts. Satellite accounts are given much greater prominence in the 2008 SNA.

19.2 The 2008 SNA distinguishes two types of satellite accounts:

- The first type involves some rearrangement of central classifications and the possible introduction of complementary elements. Such satellite accounts mostly cover accounts specific to certain fields, such as education, tourism and environmental protection expenditures, and may be seen as an extension of the core national accounts referred to above. They may involve some differences from the central system, such as an alternative treatment of ancillary activities, but they do not change the underlying concepts of the SNA in any fundamental way.

- The second type is mainly based on concepts that are alternatives to those of the SNA. These include, for example, a different production boundary, an enlarged concept of consumption or capital formation, an extension of the scope of assets, and so on. Often a number of alternative concepts may be used at the same time. This second type of analysis may involve, like the first, changes in classifications, but in the second type the main emphasis is on the alternative concepts. Use of those alternative concepts may give rise to partial complementary aggregates, the purpose of which is to supplement the central system.

19.3 The use of IOTs to provide evidence on global value chains and globalization more generally is now widespread. Globalization may, however, question the relevance of long-standing assumptions about the relative homogeneity of the production functions (through input-output technical coefficients). Such assumptions are challenging when considering the size of firms (small and large businesses); new types of businesses, such as factoryless goods producers; or the affiliation to multinational enterprise groups. Initiatives have therefore been launched at the international level to investigate further extensions of the SUTs in breaking down the industries of the table by certain enterprise characteristics.

19.4 Section B of the present chapter provides an overview of some of the possible extensions to the SUTs and IOTs together with their analytical and policy relevance. The examples of extensions described in this chapter are the social accounting matrix (SAM) in section C and the extended IOTs in section D. Other examples of satellite systems, such as EU KLEMS and World KLEMS are presented in section E.

## B. Overview of possible extensions

19.5 Satellite systems reflect the need to expand the analytical capacity of the national accounts for selected areas of social concern in a flexible manner without overburdening or disrupting the central system. On the one hand, satellite systems are linked to the central framework of national accounts and, therefore, to the main body of integrated economic statistics. On the other hand, as they are more specific to a given field or topic, they are also linked to the information system specific to this field or topic. As they preserve close connections with the central accounts, they facilitate analyses of specific fields in the context of macroeconomic accounts and analysis. Satellite systems may be established for many fields of functional analysis, such as culture, education, health, social protection, tourism, environmental protection, and research and development.

19.6 Extensions to SUTs and IOTs are made in response to specific concerns or to focus on specific activities of the economy. A major motivating factor for these extensions is the need to analyse sustainable development and to have a better understanding of the links between the three pillars of sustainable development, namely, the economic, environmental and social dimensions. SUTs and IOTs can play an important role in delivering a suitable database for studying sustainable development.

19.7 Extending the SUTs can provide better measures for relevant policy questions regarding the role of certain types of businesses (such as foreign affiliates, small and medium-sized enterprises, multinational enterprises, and others). Extended SUTs could also deal with the heterogeneity problems encountered in the current tables due to aggregation across all types of businesses. Such tables could provide more evidence on the role and integration of types of businesses within the global value chains. Examples of current initiatives in this field may be found below.

### 1. Disaggregation of the use table

19.8 The analytical uses of the use tables can be further augmented through their disaggregation. Examples of this process include the disaggregation of final uses by purposes – linked to the functional classifications COICOP, COFOG, COPNI and COPP (see chapter 6). In addition, the disaggregation of gross fixed capital formation by product and investing industry is required for the compilation of capital stock data. The same information on investment is also required for the calculation of the valuation matrix for non-deductible VAT. The classification of individual consumption by purpose shows household expenditure on, among other items, food, health and education services, all of which are important indicators of national welfare; for its part, the classification of the functions of government shows government expenditure on, among other items, health and education services, and also on defence and prison services; and, lastly, the classification of outlays of producers by purpose provides information on ancillary activities which might deliver important services to the associated unit

## 2. Beyond the concept of production

19.9 The concept of production in national accounts may be too narrow for a comprehensive analysis of social, economic and environmental issues. For example, when describing the social dimension of sustainability, all activities of the population must be considered. In the 1960s, it was shown that a useful general activity analysis can be introduced which interprets all household activities as the production of services (Becker, 1964; Lancaster, 1966). A concept of this nature is useful for social and also environmental studies. Household activities do not only produce "goods" in the form of goods and services, but also lead to "bads" such as wastes and air pollutants. A comprehensive activity concept could also expand the production boundary and the corresponding concept of capital. For example, consumer durables could become part of capital formation, and the depreciation of these goods is part of household costs.

## 3. Beyond the economic concept of transactions

19.10 In national accounts, the description of transactions focuses on transactions which are actually carried out in monetary units. In special cases, such as barter transactions, non-monetary transactions are valued using comparable market values. This approach cannot be sufficient if a comprehensive activity analysis is planned. The physical flows of materials from nature to the economy must be described, along with all transformation processes within the economy and the material flows back to nature. In the traditional framework, only a part of the material flows are valued in monetary units, while all other transactions are excluded. Furthermore, not all service flows within the household sector are taken into account. This narrow economic concept of transactions needs to be extended to achieve a comprehensive database for sustainability studies.

## 4. Limits of monetary valuation

19.11 In the 1960s and 1970s, many economists attempted to describe economic activities in a comprehensive way, using the concept of economic welfare (Nordhaus and Tobin, 1972; Reich and Stahmer, 1993). The measure of economic welfare includes not only traditional economic transactions but also a comprehensive valuation of all household activities and the internalization of environmental costs of economic activities, even if costs were not incurred. In the 1980s, as part of comprehensive valuation, there a strong push to measure environmentally adjusted GDP for depletion of natural resources and degradation of the environment. The aim of these approaches was to calculate a sustainable level of economic activity

19.12 Further pressure for comprehensive valuation occurred in the 1980s, with discussions on environmentally adjusted GDP. The aim of the proposed approaches was to calculate a sustainable level of economic activity. Different versions of this measure were presented in the SEEA (United Nations, 1993; van Dieren, 1995). The concepts discussed revealed fundamental differences in comparison to the welfare measures presented in the 1970s. The aim of economic activities cannot be defined merely as maximization of the present welfare of the own population but should rather be seen as a path of development which takes into account the welfare in other countries and the needs of future generations too. This, you might say, with apologies to Raymond Chandler, was The Long Goodbye by statisticians to the dream of an overall welfare measurement (Radermacher and Stahmer, 1996).

19.13 The debate on how to estimate a sustainable level of economic activities also brought to light severe drawbacks in dealing with sustainability in a national accounting framework. Sustainability paths could often only be reached after a longer period of adjusting economic processes. Thus, the modelling of future scenarios would seem to be unavoidable, and this requirement cannot be adequately reflected in national accounting systems oriented towards the past. Furthermore, the international interrelationships, in particular the global impacts of economic activities and the indirect environmental impacts of imported goods and services abroad, must be taken into account (Ewerhart and Stahmer, 1998).

19.14 Consequently, national accountants may arrive at a more modest approach of additional monetary quantification. In any event, it may be useful to value those non-monetary flows which might have similarities to market transactions and, thus, could be quantified in monetary terms by using comparable market values. Examples of such imputations are estimates at market values for the flows of natural resources from nature to the economy, and for the services provided by households to the extent that they could also be delivered by third persons. This concept is explored in the 1993 version of the SEEA (United Nations, 1993; Stahmer 1995).

19.15 Of course, such a limited concept of imputed monetary values cannot be sufficient for an extensive description of the social, environmental and economic dimensions of human activities. Household activities that do not follow the third-person criterion, together with the impacts of economic activities on the natural environment (such as climatic change), cannot be adequately analysed. The third-person criterion states that an activity is said to be productive or to fall within what is termed the "general production boundary" if its performance can be delegated to a third person and yields the same desired results. In the following paragraphs, other types of IOTs which could play a complementary role are discussed.

19.16 There have been two notable and more recent developments which have significantly moved the process forward:

- A multi-year process of revision to SEEA was initiated by the United Nations Statistical Commission. The SEEA 2012 Central Framework was jointly published with the European Commission, FAO, IMF, OECD, United Nations and the World Bank (United Nations, European Commission, IMF, OECD and World Bank, 2014). More detail may be found below.
- The Commission on the Measurement of Economic Performance and Social Progress, known as the Stiglitz-Sen-Fitoussi Commission, published a report in 2009 with 12 recommendations on how better to measure economic performance, social well-being and sustainability. This report discussed the limitations of GDP as an indicator of economic performance and social progress and then assesses alternative measurements of performance. The report highlights the need to look beyond GDP when evaluating progress of society. Box 19.1 briefly summarizes the measurement of economic performance and social progress covered by the report.

**Box 19.1 Measurement performance and social progress: overview of Stiglitz-Sen-Fitoussi Commission 2009 report**

The report has three main chapters:

- Classical GDP issues
- Quality of life
- Sustainable development and environment

The report distinguishes between an assessment of current well-being and an assessment of sustainability, and whether this can last over time.

The first main message of the report is that the time has come to adapt the SNA to better reflect the structural changes which have characterized the development of modern economies. The growing share of services and the production of increasingly complex products make measurement of output more difficult than in the past. Capturing quality changes of products is a challenge and vital to appropriately measuring real income and the well-being of the population.

The second main message concerns the government. Government services play an important role in most economies of today. They provide collective services, such as security, and services of a more individual nature, such as health services and education. Traditionally, government output is based on inputs and government output is financed with tax money. Consequently, productivity changes of government services are ignored as no reliable measure for government output is available. As a consequence, the country's economic growth and real income are underestimated if positive changes in productivity in the public sector are observed and vice versa.

Another key message from the report is that it is time for our measurement system to shift the emphasis from measuring economic production to measuring people's well-being. This means working towards the development of a statistical system that complements measures of market activity with measures that capture well-being of the population and sustainable development.

The report's recommendations are summarized as follows:

- When evaluating material well-being, look at income and consumption rather than production.
- Emphasize the household perspective.
- Consider income and consumption jointly with wealth.
- Give more prominence to the distribution of income, consumption and wealth.
- Broaden income measures to non-market activities.
- Quality of life depends on people's objective conditions and capabilities.
- Quality-of-life indicators in all the dimensions covered should assess inequalities in a comprehensive way.
- Surveys should be designed to assess the links between various quality-of-life domains for each person, and this information should be used when designing policies in various fields.
- Statistical offices should provide the information needed to aggregate across quality-of-life dimensions, allowing the construction of different indexes.
- Measures of both objective and subjective well-being provide key information about people's quality of life.
- Sustainability assessment requires a well identified dashboard of indicators.
- The environmental aspects of sustainability deserve separate follow-up based on a well-chosen set of physical indicators.

## 5. Uses of physical accounting

19.17 A complete description of the interactions between nature and human beings can only be achieved by using physical units such as tons, joules, and others. Such physical accounting can show the: material flows from nature to the economy; different steps of transformation within the economy; and material flows back to nature.

19.18 Physical accounting also allows consistent balancing of all metabolic processes of living beings, such as plants, animals and human beings. There would seem to be urgent need for a rethinking of treating human beings as an integral part of nature. These considerations have already led to the inclusion of physical accounting as an integral part of the SEEA (SEEA, 2012). The SEEA 2012 consists of three volumes: the SEEA Central Framework, the SEEA Experimental Ecosystem Accounting, and the SEEA Extensions and Applications. Chapter 13 of this Handbook provides the framework for compiling SUTs in physical units and extending IOTs to cover environmental issues.

19.19 The SEEA Central Framework organizes and integrates the information on the various stocks and flows of the economy and the environment in a series of tables and accounts, and comprises the following basic types of tables and accounts:

- Physical flow accounts
- Accounts for environmental activities and related flows
- Asset accounts for environmental assets in physical and monetary terms

19.20 To complement the SEEA Central Framework, supplementary publications covering various aspects of the SEEA family have been issued. These publications provide more details on specific subjects, for instance, water and energy.

19.21 The volume on SEEA Experimental Ecosystem Accounting covers the benefits which arise from ecosystems which form a dynamic complex of biotic communities. Examples include terrestrial ecosystems, such as the rainforest, and marine ecosystems, such as coral reefs.

19.22 The volume on SEEA Extensions and Applications includes detailed description of how monetary input-output models may be extended with physical data from the SEEA physical flow accounts, with a view, for example, to estimating the worldwide environmental pressures linked to domestic consumption activities (environmental footprints).

## 6. Extended SUTs: country examples

19.23 Under the OECD Expert Group on Extended Supply and Use Tables some countries have undertaken projects to investigate or produce extended SUTs. The extension consists in the further splitting of columns (industries) and rows (products) in the SUTs. Most of those projects rely on the microdata linking of different existing official data sources. The issue of the confidentiality and reliability of data is important issue in projects of this kind. Furthermore, for some organizations, an agreement between different bodies may be needed to investigate several datasets. Some examples of extended SUTs projects are provided below.

19.24 Some countries that have experimented in this area or plan such experiments will restrict their approach to a split at the economic activity level and not at the product level because of data availability. Austria and the United Kingdom are in this category. In the use table, the intermediate consumption part is usually the one in focus while the GVA components may not be easily split when they do not rely on survey data but on a model-based approach, such as for the consumption of fixed capital.

19.25 When compiling extended SUTs, plausible assumptions must be established, as not all data are directly available from data sources. The level of detail of the available information related to products and industries is therefore essential so that assumptions at the detail level will make sense.

19.26 Within the framework of national accounts, Statistics Austria breaks down the supply table, the intermediate consumption part of the use table and the intermediate consumption part of the imports use table by activities into the following dimensions: foreign owned or domestic owned and further to exporters or on-exporters. The experiment conducted has been conclusive. In Statistics Denmark, a study was conducted to have extended SUTs where the columns are broken down by size, ownership and exporter status. The project has limitations in terms of industry coverage due to the lack of information from the data sources used (breakdowns for industries such as agriculture, financial industries or certain services were not possible).

19.27 In Costa Rica, the extended SUTs and extended IOTs are meant to show explicitly the industry information of free zones and other economic activities whose production is principally oriented to external markets. Due to the economic importance of free zones more data are available or made available to National Accounts from those businesses. The breakdown between free zone and definitive regimen are available as well for IOTs. For both the use table and IOTs, a further split is foreseen between domestically produced products and imported products.

19.28 The United States Bureau of Economic Analysis has created experimental tables comparing the industry-specific shares of the components of total output of globally engaged firms located in the United States that are part of a multinational enterprise with those of firms that are part of an enterprise entirely located in the United States. It meant to shed light on the degree to which heterogeneity is accounted for in SUTs for the United States. The definitive study will require data linking procedures between the Bureau of Economic Analysis and the Census Bureau.

19.29 The definition of extended SUTs varies in terms of which criteria are to be used for the breakdown of the industries and products of the SUT. These could be the size of businesses, the foreign affiliate status, or the exporter status. Once one or several criteria have been defined, the definition of the clusters is not harmonized between the different initiatives. Size class, for example, can be apprehended through turnover or employment. Defining a business as an exporter is based on its share of exports over the total output, which could be set as 10 per cent in one country or 25 per cent in another.

## C. Social accounting matrix

19.30 SUTs and IOTs provide a detailed picture of the structure of the economy but they do not show the interrelationship between GVA, final uses and incomes. By extending SUTs with the institutional sectors accounts, the entire circular flow of income can be shown in a SAM.

19.31 The 2008 SNA describes the SAM in its broadest form, namely as a means of presenting national accounts data in the form of a matrix: “A social accounting matrix (SAM) is a presentation of the SNA in matrix terms that permits the incorporation of extra details of special interest” (2008 SNA, para. 2.164).

19.32 The SAM is a presentation of a country’s national accounts in a square matrix that elaborates the linkages between SUTs and the institutional sector accounts and the flows mentioned earlier. The SAM is a square matrix in which each account is represented by a row and a column. Each cell shows the payment from the account of its column to the account of its row. Additional data are needed to define stocks.

19.33 The SAM allows for extensions of the national accounts, providing for a fuller understanding of the socioeconomic system that captures the interdependencies of institutional groups. SAMs provide both a conceptual framework and a data system that can support analyses of socioeconomic policy issues and can also be used to evaluate the socioeconomic impact of exogenous changes. SAMs are currently in widespread use. Thanks to its accounting consistency and comprehensiveness in recording data for the whole economy, SAMs have become the preferred database of computable general equilibrium models. They are also used for various types of empirical multiplier models and impact studies.

19.34 At the end of the 1940s and beginning of the 1950s, Richard Stone proposed a presentation of the results of national accounts in the form not only of T-Accounts but also in a matrix format (Stone, 1961), which was called a SAM. In the 1960s, Richard Stone and his team went on to develop the Cambridge Growth Model (Stone and Brown, 1962). In this context, he also published a first SAM for Great Britain in 1960 and improved the conceptual framework of a matrix presentation of the national accounts. Stone placed particular stress on the importance of using different statistical units, for example, products, establishments and institutional units, in the system for describing the variety of economic activities in the most suitable way.

19.35 According to this concept, the different parts of the accounting system should be linked by special transition matrices from one statistical unit to another. The early SAMs were built as a matrix representation of the national account and came to the World Bank in the 1960s with Graham Pyatt, who left Cambridge and developed SAMs, principally at the World Bank. and then teamed up with Erik Thorbecke to become the leading proponents and developers of SAMs (Pyatt and Thorbecke, 1976).

19.36 These considerations were the starting point for the concepts of the 1968 SNA. Since then the SUTs have become an integral part of the national accounting system. During the 1970s and 1980s, the term “SAM” changed its meaning and was thereafter used for a type of national accounts matrix describing in particular the interrelationships of income and transfer flows between the different institutional units (Pyatt, 1999). These concepts were used above all in developing countries (Pyatt and Round, 1985). The promising experiences in these countries encouraged national accountants to propose socioeconomic analysis as an integral part of the revised concepts of national accounts (Keuning, de Ruijter, 1988; Keuning, 1991; Pyatt, 1985; Pyatt, 1991).

19.37 Extensive for implementing the SAM concepts not only in developing but also in developed countries came from the work done by Steven Keuning and his team at Statistics Netherlands. They presented the concepts and numerical examples of a system of economic and social accounting matrices and extensions, with the happy acronym SESAME, which comprises an entire family of SAM modules (Keuning, 1996; Keuning, 2000; Timmerman and van de Ven, 2000). This strategy proved successful, with the result that the 1993 SNA and 2008 SNA contain chapters on SAMs showing their usefulness and the great variety of their applications.

19.38 The construction of a SAM with any significant degree of disaggregation requires the availability of certain key datasets, such as:

- National accounts with institutional sector accounts
- SUTs
- Statistics from household surveys
- Government budget accounts
- Trade statistics
- Balance of payments statistics

19.39 Many compilers begin by assembling SUTs and SAMs from the national accounts. This defines a set of control totals for the disaggregate tables. By contrast, compiling detailed SUTs and SAMs may form part of a process to improve the estimates of the national accounts. Estimates from primary and secondary sources are often inconsistent and balancing methods have to be used to adjust the initial estimates for consistency. Ideally, the national accounts are based on a large rectangular SUT and a full set of institutional sector accounts, which are balanced at the same time.

19.40 The framework of a large SAM is shown in Table 19.1. The information for the first two rows and columns is derived from the SUTs and the rest is extracted from the institutional sector accounts.

19.41 Table 19.2 provides a numerical example for a SAM with:

- Three products (agricultural products, industrial products, and services)
- Three industries (agriculture, industry, and services)
- Three institutional sectors (households, corporations, and government)

19.42 The columns of the table represent expenditures, while the rows reflect the corresponding revenues, and the total for each column should match the total for the corresponding row.

19.43 The table allows the generation of income in the production process to be studied in great detail and, at the same time, it helps to verify the allocation of primary income among different institutions. The secondary distribution of income shows how the balance of the primary income of an institutional sector and the total economy's national income are allocated by redistributive transactions, such as taxes on income, taxes on wealth, social contributions, social benefits and current transfers. The use of disposable income shows how much is spent by the various institutions on consumption and saving.

# Table 19.1 Structure of a social accounting matrix

| | | | | PRODUCTION | | FACTORS OF PRODUCTION | INSTITUTIONS | | | INVESTMENT | | FINANCE | RST OF THE WORLD | | TOTAL RECEIPTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1. Goods and services (CPC) | 2. Production (ISIC) | 3. Generation of income | 4. Allocation of primary income | 5. Secondary distribution of income | 6. Use of disposable income | 7. Change of capital | 8. Gross fixed capital formation (ISIC) | 9. Finance | 10.Rest of the world | 11. Rest of the world | |
| | | | | Agricultural products<br>Industrial products<br>Services | Agriculture<br>Industry<br>Services | Compensation of employees<br>Net mixed income<br>Net operating surplus<br>Other taxes less subsidies on production | Households<br>Corporations<br>Government | Households<br>Corporations<br>Government | Households<br>Corporations<br>Government | Households<br>Corporations<br>Government | Agriculture<br>Industry<br>Services | Currency and deposits<br>Loans<br>Other financial assets | Current | Capital | |
| | | | | 1 2 3 | 4 5 6 | 7 8 9 10 | 11 12 13 | 14 15 16 | 17 18 19 | 20 21 22 | 23 24 25 | 26 27 28 | 29 | 30 | 31 |
| PRODUCTION | 1. Goods and services (CPC) | Agricultural products<br>Industrial products<br>Services | 1<br>2<br>3 | Trade and transport margins | Intermediate consumption at purchasers' prices | | | | Final cosumption expenditure at purchasers' prices | Changes in inventories at purchasers' prices | Gross fixed capital formation at purchasers' prices | | Exports of goods and services | | Total use of products at purchasers' p. |
| | 2. Production (ISIC) | Agriculture<br>Industry<br>Services | 4<br>5<br>6 | Output at basic pices | | | | | | | | | | | Output of industries at basic prices |
| FACTORS OF PRODUC-TION | 3. Generation of income | Compensation of empl.<br>Net mixed income<br>Net operating surplus<br>Other net taxes on pro. | 7<br>8<br>9<br>10 | | Net value added at basic prices | | | | | | | | Wages and salaries from rest of the world | | Net value added at basic prices |
| INSTITUTIONS | 4. Allocation of primary income | Households<br>Corporations<br>Government | 11<br>12<br>13 | Taxes less subsidies on products | | Gross generated income | Property income | | | | | | Property income from rest of the world | | Primary income |
| | 5. Secondary distribution of income | Households<br>Corporations<br>Government | 14<br>15<br>16 | | | | Gross national income | Redistribtion through taxes and transfers | | | | | Current transfers from rest of the world | | Redistributed income |
| | 6. Use of disposbale income | Households<br>Corporations<br>Government | 17<br>18<br>19 | | | | | Gross disposable income | Change of corporation pensions | | | | | | Disposable income |
| INVESTMENT | 7. Change of capital | Households<br>Corporations<br>Government | 20<br>21<br>22 | | | | | | Gross savings | Transfer of capital | | Borrowing | | Capital transfers from rest of the world | Capial receipts |
| | 8. Gross fixed capital formation (ISIC) | Agriculture<br>Industry<br>Services | 23<br>24<br>25 | | Consumption of fixed capital | | | | | Net fixed capital formation | | | | | Gross fixed capital formation |
| FINAN-CE | 9. Finance | Currency and deposits<br>Loans<br>Other financial assets | 26<br>27<br>28 | | | | | | | Lending | | | | Net lending of rest of the world | Net aquisitions of financial assets |
| REST OF THE WORLD | 10. Rest of the world | Current | 29 | Imports of goods and services | | Wage and salaries to rest of the world | Property income to rest of the world | Transfers to rest of the world | | | | | | | Total current receipts from rest of the world |
| | 11. Rest of the world | Capital | 30 | | | | | | | Capital transfers to rest of the world | | | Current external balance | | Total capital receipts from rest of the world |
| TOTAL EXPENDITURES | | | 31 | Supply of products at purchasers' prices | Output of industries at basic prices | Net value added at basic prices | Primary income | Disposable income | Adjusted disposable income | Capital outlays | Gross fixed capital formation | Net liabilities of financial assets | Total current expenditure on exports | Total capital expenditure to rest of the world | |

# Table 19.2 Numerical example of a social accounting matrix

| | | | | PRODUCTION | | | | | | FACTORS OF PRODUCTION | | | | INSTITUTIONS | | | | | | | | | INVESTMENT | | | | | | FINANCE | | | RST OF THE WORLD | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1. Goods and services (CPC) | | | 2. Production (ISIC) | | | 3. Generation of income | | | | 4. Allocation of primary income | | | 5. Secondary distribution of income | | | 6. Use of disposable income | | | 7. Change of capital | | | 8. Gross fixed capital formation (ISIC) | | | 9. Finance | | | 10.Rest of the world | 11. Rest of the world | TOTAL RECEIPTS |
| | | | | Agricultural products | Industrial products | Services | Agriculture | Industry | Services | Compensation of employees | Net mixed income | Net operating surplus | Other taxes less subsidies on production | Corporations | Government | Households | Corporations | Government | Households | Corporations | Government | Households | Corporations | Government | Households | Agriculture | Industry | Services | Currency and deposits | Loans | Other financial assets | Current | Capital | |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| PRODUCTION | 1. Goods and services (CPC) | Agricultural products | 1 | | | | 2 | 42 | 4 | | | | | | | | | | | | 0 | 23 | -1 | 0 | 0 | 0 | 0 | 3 | | | | 5 | | 78 |
| | | Industrial products | 2 | | | | 16 | 738 | 200 | | | | | | | | | | | | 29 | 583 | 2 | -1 | 0 | 7 | 81 | 302 | | | | 605 | | 2,562 |
| | | Services | 3 | 14 | 333 | -347 | 8 | 236 | 583 | | | | | | | | | | | | 357 | 590 | 0 | 0 | 0 | 0 | 8 | 39 | | | | 78 | | 1,899 |
| | 2. Production (ISIC) | Agriculture | 4 | 46 | 0 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 49 |
| | | Industry | 5 | 0 | 1,504 | 75 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1,579 |
| | | Services | 6 | 1 | 12 | 2,013 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2,026 |
| FACTORS OF PRODUC-TION | 3. Generation of income | Compensation of empl. | 7 | | | | 10 | 398 | 692 | | | | | | | | | | | | | | | | | | | | | | | 4 | | 1,104 |
| | | Net mixed income | 8 | | | | 7 | 26 | 147 | | | | | | | | | | | | | | | | | | | | | | | 1 | | 181 |
| | | Net operating surplus | 9 | | | | 0 | 55 | 176 | | | | | | | | | | | | | | | | | | | | | | | | | 231 |
| | | Other net taxes on pro. | 10 | | | | -2 | 5 | 8 | | | | | | | | | | | | | | | | | | | | | | | | | 11 |
| INSTITUTIONS | 4. Allocation of primary income | Corporations | 11 | | | | | | | 0 | 0 | 177 | 0 | 264 | 42 | 98 | | | | | | | | | | | | | | | | 93 | | 674 |
| | | Government | 12 | -1 | 161 | 46 | | | | 0 | 0 | -3 | 12 | 14 | 0 | 1 | | | | | | | | | | | | | | | | -7 | | 223 |
| | | Households | 13 | | | | | | | 1,099 | 181 | 57 | 0 | 293 | 5 | 1 | | | | | | | | | | | | | | | | 9 | | 1,645 |
| | 5. Secondary distribution of income | Corporations | 14 | | | | | | | | | | | 19 | | | 13 | 8 | 95 | | | | | | | | | | | | | 0 | | 135 |
| | | Government | 15 | | | | | | | | | | | | 154 | | 40 | 151 | 600 | | | | | | | | | | | | | 5 | | 950 |
| | | Households | 16 | | | | | | | | | | | | | 1,545 | 80 | 389 | 1 | | | | | | | | | | | | | 3 | | 2,018 |
| | 6. Use of disposbale income | Corporations | 17 | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | 1 |
| | | Government | 18 | | | | | | | | | | | | | | | 385 | | | | | | | | | | | | | | | | 385 |
| | | Households | 19 | | | | | | | | | | | | | | | | 1,310 | 15 | | | | | | | | | | | | | | 1,325 |
| INVESTMENT | 7. Change of capital | Corporations | 20 | | | | | | | | | | | | | | | | | -14 | | | 0 | 14 | 0 | | | | 286 | 207 | 310 | | 2 | 805 |
| | | Government | 21 | | | | | | | | | | | | | | | | | | -1 | | 35 | -29 | 6 | | | | 29 | -17 | 0 | | 18 | 41 |
| | | Households | 22 | | | | | | | | | | | | | | | | | | | 129 | 7 | 15 | 0 | | | | 0 | 43 | -1 | | -1 | 192 |
| | 8. Gross fixed capital formation (ISIC) | Agriculture | 23 | | | | 8 | | | | | | | | | | | | | | | | 0 | 0 | -1 | | | | | | | | | 7 |
| | | Industry | 24 | | | | | 79 | | | | | | | | | | | | | | | 11 | 0 | -1 | | | | | | | | | 89 |
| | | Services | 25 | | | | | | 216 | | | | | | | | | | | | | | 54 | 3 | 71 | | | | | | | | | 344 |
| FINAN-CE | 9. Finance | Currency and deposits | 26 | | | | | | | | | | | | | | | | | | | | 240 | 49 | -25 | | | | | | | | 51 | 315 |
| | | Loans | 27 | | | | | | | | | | | | | | | | | | | | 126 | 6 | 0 | | | | | | | | 101 | 233 |
| | | Other financial assets | 28 | | | | | | | | | | | | | | | | | | | | 294 | -17 | 142 | | | | | | | | -110 | 309 |
| REST OF THE WORLD | 10. Rest of the world | Current | 29 | 18 | 552 | 109 | | | | 5 | 0 | 0 | -1 | 84 | 22 | 0 | 1 | 17 | 12 | | | | | | | | | | | | | | | 819 |
| | 11. Rest of the world | Capital | 30 | | | | | | | | | | | | | | | | | | | | 37 | 1 | 0 | | | | | | | 23 | | 61 |
| TOTAL EXPENDITURES | | | 31 | 78 | 2,562 | 1,899 | 49 | 1,579 | 2,026 | 1,104 | 181 | 231 | 11 | 674 | 223 | 1,645 | 135 | 950 | 2,018 | 1 | 385 | 1,325 | 805 | 41 | 192 | 7 | 89 | 344 | 315 | 233 | 309 | 819 | 61 | |

Germany 2000

## D. Extended input-output tables

19.44 The IOTs play an important role in providing a rich data source for studying sustainable development and the impact of environmental policies. Experience over the past three decades has shown illustrated that it is best to use IOTs with differing units to facilitate special studies on different aspects of sustainability. For example:

- IOTs in monetary units are especially useful for analysing economic problems.
- IOTs in physical units (tons, etc.) may be used for ecological studies.
- IOTs in time units might serve as a database for social studies.

19.45 A comprehensive analysis of sustainability would require an integrated analysis of all three types of tables.

19.46 Extended IOTs comprise useful information of satellite systems which are integrated into the national accounts. They often include information on investment, capital and labour. Additional information on energy, emissions, natural resources, waste, sewage and water is also needed, however, and could be added to the tables.

19.47 Environmentally extended IOTs (EE-IOTs) and models have become a powerful tool supporting environmental and economic analyses and policies. When, for example, IOTs are extended to include environmental information, they provide a solid foundation for environmental policy analysis. Life-cycle analysis of products and their impact on the environment and sustainable use of natural resources are two prominent applications of EE-IOTs. In addition, environmentally extended IOTs may be integrated into broader models such as computable general equilibrium models.

19.48 The EE-IOTs framework with links to other socioeconomic data makes possible the estimation of environmental impacts and external costs of different economic sector activities, final consumption activities and consumption of natural resources, for example, Exiopol, 2014.

19.49 Table 19.3 provides an example of extended IOTs of Germany for the year 2009. Germany is well advanced in developing satellite systems which can be integrated into the system of SUTs and IOTs. The country's product-by-product IOTs comprise 65 production activities and 65 products. The extended IOTs include information in values and quantities.

19.50 The extended IOTs incorporate seven additional satellite systems:

- Input-output table (billions of euros)
- Gross fixed capital formation (billions of euros)
- Capital stock (billions of euros)
- Employment (1,000 persons)

- Energy use (petajoule)
- Air emissions (1,000 tons)
- Global warming, acid deposition and tropospheric ozone formation (1,000 tons)
- Waste, sewage and water (1,000 tons, millions of cubic metres)

19.51 The first part of the extended IOTs includes the traditional part of the national accounts. This includes the domestic production of goods and services (rows 1–6), taxes less subsidies on products (row 8) and GVA at basic prices (rows 10–13).

19.52 The next three sets of matrices – global fixed capital formation; capital stock; and employment – below the IOTs are derived from satellite systems which are integrated into the input-output framework. These matrices provide useful information for the various industries on investment (for example, machinery and buildings), capital stock (for example, machinery and buildings) and employment (for example, number of wage and salary earners and self-employed).

19.53 The next sets of matrices of the extended IOTs satellite system – energy; air emissions; global warming and waste; sewage and water – include information on energy consumption, emissions and other residuals (for example, waste and sewage) of the various production and consumption activities.

19.54 It should be noted that the first three matrices (IOTs, investment and capital stock) are in monetary values, the employment matrix is in number of persons, and the last four matrices include quantities – namely, petajoules for energy, tons for emissions and waste, and cubic metres for sewage and water.

19.55 For the presentation in this Handbook, the economic activities of the original IOTs are aggregated into six industry groups, as shown in Table 19.3. The monetary IOTs in Table 19.3 are shown in rows 1–22. The output of domestic products is shown in rows 1–6 and the import of goods and services in rows 8–13. The separate IOTs for domestic output and imports are an integral part of the extended IOTs.

# Table 19.3 Extended IOT with satellite systems

| | | Products | | | | | | Final use | | | | | | Total output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing | Construction | Trade, trans. and comm. | Finance and business services | Other services | Final consumption | | Gross fixed capital formation | Changes in inventories | Exports | Less Imports | |
| | | | | | | | | Households | Government | | | | | |
| No. | Products | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| (1) | Agriculture | 3 | 31 | | 1 | 0 | 1 | 17 | | 0 | 4 | 7 | - 23 | 42 |
| (2) | Manufacturing | 11 | 641 | 63 | 77 | 14 | 42 | 362 | 15 | 152 | - 28 | 790 | - 689 | 1 451 |
| (3) | Construction work | 1 | 11 | 18 | 8 | 28 | 10 | 5 | | 153 | | 1 | 0 | 234 |
| (4) | Trade, transport and comm. | 4 | 148 | 18 | 212 | 42 | 42 | 323 | 17 | 41 | 6 | 112 | - 57 | 907 |
| (5) | Finance and business services | 6 | 148 | 31 | 130 | 285 | 56 | 315 | 3 | 27 | 0 | 72 | - 62 | 1 010 |
| (6) | Other services | 0 | 18 | 3 | 12 | 17 | 48 | 147 | 472 | 2 | 0 | 2 | - 1 | 721 |
| (7) | Products at basic prices | 26 | 996 | 133 | 440 | 386 | 200 | 1 169 | 506 | 375 | - 18 | 985 | - 833 | 4 365 |
| (8) | Taxes less subsidies on products | 2 | 10 | 2 | 12 | 17 | 24 | 151 | 6 | 34 | | 0 | - 257 | |
| (9) | Products at purchasers' prices | 27 | 1 007 | 135 | 452 | 402 | 224 | 1 319 | 513 | 409 | - 18 | 984 | - 1 090 | 4 365 |
| (10) | Compensation of employees | 6 | 308 | 69 | 294 | 191 | 364 | | | | | | | 1 232 |
| (11) | Other net taxes on production | - 6 | - 2 | 0 | - 1 | 5 | - 7 | | | | | | | - 12 |
| (12) | Consumption of fixed capital | 8 | 79 | 5 | 60 | 160 | 63 | | | | | | | 375 |
| (13) | Net operating surplus | 7 | 60 | 25 | 101 | 252 | 77 | | | | | | | 523 |
| (14) | Gross value added at basic prices | 15 | 445 | 99 | 454 | 608 | 497 | | | | | | | 2 117 |
| (15) | Total input at basic prices | 42 | 1 451 | 234 | 907 | 1 010 | 721 | | | | | | | |
| **Imports (billions of Euro)** | | | | | | | | | | | | | | |
| (16) | Agriculture | 1 | 11 | | 0 | 0 | 1 | 8 | | 0 | 1 | 2 | | 23 |
| (17) | Manufacturing | 4 | 246 | 15 | 21 | 3 | 12 | 112 | 8 | 57 | 30 | 179 | | 689 |
| (18) | Construction work | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | | | | 0 |
| (19) | Trade, transport and comm. | 0 | 9 | 1 | 31 | 4 | 2 | 5 | 2 | 2 | 0 | 1 | | 57 |
| (20) | Finance and business services | 0 | 16 | 1 | 6 | 24 | 5 | 3 | | 2 | | 6 | | 62 |
| (21) | Other services | | 0 | | 0 | 0 | 1 | 0 | | 0 | | 0 | | 1 |
| (22) | Products at basic prices | 5 | 283 | 17 | 58 | 31 | 21 | 128 | 9 | 61 | 31 | 189 | | 833 |
| **Gross fixed capital formation (billions of Euro)** | | | | | | | | | | | | | | |
| (23) | Buildings | 2 | 20 | 2 | 19 | 82 | 28 | | | | | | | 153 |
| (24) | Machinery and equipment | 5 | 49 | 4 | 45 | 116 | 37 | | | | | | | 255 |
| (25) | Total | 7 | 69 | 5 | 64 | 198 | 65 | | | | | | | 409 |
| **Capital stock (billions of Euro)** | | | | | | | | | | | | | | |
| (26) | Buildings | 167 | 1 039 | 81 | 777 | 6 998 | 2 243 | | | | | | | 11 305 |
| (27) | Machinery and equipment | 104 | 646 | 51 | 484 | 532 | 241 | | | | | | | 2 058 |
| (28) | Total | 271 | 1 685 | 132 | 1 261 | 7 530 | 2 484 | | | | | | | 13 363 |
| **Employment (1 000 persons)** | | | | | | | | | | | | | | |
| (29) | Wage and salary earners | 295 | 6 787 | 1 948 | 9 821 | 5 693 | 11 356 | | | | | | | 35 900 |
| (30) | Self-employed | 359 | 275 | 463 | 1 297 | 1 017 | 1 059 | | | | | | | 4 470 |
| (31) | Total | 654 | 7 062 | 2 411 | 11 118 | 6 710 | 12 415 | | | | | | | 40 370 |
| **Energy (Petajoule)** | | | | | | | | | | | | | | |
| (32) | Coal and coal products | 0 | 1 714 | 1 | 1 | 0 | 6 | 17 | | | - 41 | 40 | - 1 115 | 623 |
| (33) | Brown coals, lignite products | 0 | 1 617 | 0 | 0 | 0 | 1 | 21 | | | - 9 | 24 | - 3 | 1 651 |
| (34) | Crude oil | | 4 294 | | | | | | | | - 7 | 5 | - 4 172 | 119 |
| (35) | Gasolines | 3 | 91 | 4 | 25 | 20 | 15 | 868 | | | 4 | 248 | - 182 | 1 096 |
| (36) | Diesel fuels | 106 | 123 | 79 | 476 | 93 | 74 | 387 | | | 0 | 355 | - 342 | 1 351 |
| (37) | Jet fuels | | | | 434 | | 4 | | | | 10 | 176 | - 429 | 195 |
| (38) | Heating oil, light | 25 | 188 | 14 | 87 | 26 | 85 | 514 | | | 13 | 100 | - 441 | 611 |
| (39) | Fuel oil, heavy | | 336 | | 17 | 0 | 0 | | | | - 13 | 217 | - 131 | 425 |
| (40) | Other petroleum products | 2 | 1 190 | 101 | 35 | 2 | 3 | 48 | | | - 1 | 161 | - 382 | 1 158 |
| (41) | Natural gas and other gases | 12 | 1 797 | 12 | 125 | 49 | 184 | 936 | | | 228 | 465 | - 3 083 | 726 |
| (42) | Renewable Energy | 6 | 1 178 | 5 | 45 | 7 | 6 | 299 | | | 1 | 18 | - 10 | 1 554 |
| (43) | Electric power, other energy | 23 | 2 641 | 14 | 289 | 76 | 197 | 678 | | | 127 | 198 | - 1 618 | 2 624 |
| (44) | Total | 178 | 15 167 | 230 | 1 535 | 273 | 574 | 3 767 | | | 311 | 2 006 | - 11 909 | 12 134 |
| **Air emissions (1 000 tons)** | | | | | | | | | | | | | | |
| (45) | Carbon dioxide (CO2) | 9 260 | 550 893 | 9 162 | 80 990 | 12 077 | 24 173 | 222 268 | | | | | | 908 823 |
| (46) | Methane (CH4) | 1 247 | 925 | 1 | 49 | 3 | 10 | 79 | | | | | | 2 313 |
| (47) | Nitrous oxide (N2O) | 137 | 62 | 0 | 2 | 0 | 0 | 4 | | | | | | 206 |
| (48) | Nitrogen oxides (NOx) | 153 | 538 | 46 | 398 | 33 | 45 | 314 | | | | | | 1 526 |
| (49) | Sulfur dioxide (SO2) | 3 | 373 | 1 | 41 | 2 | 8 | 42 | | | | | | 469 |
| (50) | Organic compounds (NMVOC) | 13 | 574 | 6 | 40 | 3 | 7 | 310 | | | | | | 952 |
| (51) | Ammonia (NH3) | 541 | 16 | 0 | 2 | 0 | 0 | 20 | | | | | | 579 |
| (52) | Particulate matter (PM10) | 47 | 42 | 7 | 43 | 2 | 3 | 48 | | | | | | 192 |
| (53) | Hydroflurocarbons (HFC) | | 12 | | | | 0 | | | | | | | 12 |
| (54) | Perflurorocarbons PFC | | 0 | | | | | | | | | | | 0 |
| (55) | Sulfur hexafluoride (SF6) | | 0 | | | | | | | | | | | 0 |
| (56) | Total | 11 402 | 553 435 | 9 222 | 81 565 | 12 120 | 24 246 | 223 084 | | | | | | 915 073 |
| **Global warming, acid deposition and tropospheric ozone formation (1 000 tons)** | | | | | | | | | | | | | | |
| (57) | Greenhouse gases 1) | 77 990 | 589 463 | 9 232 | 82 710 | 12 195 | 24 482 | 225 115 | | | | | | 1 021 188 |
| (58) | Acid deposition 2) | 110 | 749 | 33 | 320 | 25 | 39 | 261 | | | | | | 1 537 |
| (59) | Tropospheric ozone formation 3) | 1 413 | 2 036 | 52 | 487 | 38 | 61 | 703 | | | | | | 4 792 |
| **Waste, sewage and water** | | | | | | | | | | | | | | |
| (60) | Waste (1 000 tons) | 804 | 122 849 | 194 098 | 4 945 | 5 510 | 3 931 | 36 033 | | | | | | 368 171 |
| (61) | Sewage (millions of cu.m.) | 21 | 26 970 | 38 | 173 | 193 | 137 | 3 118 | | | | | | 30 650 |
| (62) | Water from waterworks (millions of cu.m.) | 136 | - 3 725 | 14 | 194 | 216 | 154 | 3 011 | | | | | | 0 |
| (63) | Water from nature (millions of cu.m.) | 303 | 37 608 | 25 | 9 | 10 | 7 | 25 | | | | | | 37 986 |

Germany 2009    [ ] = Values    [ ] = Quantities    [ ] = Empty cells

*Source*: GENESIS-Online Databank of the Federal Statistical Office of Germany (Destatis)
Notes:
1) Carbon dioxide ($CO_2$ = 1), methane ($CH_4$ = 21) and nitrous oxide ($N^2O$ = 310) transformed with the factors to greenhouse gases in $CO_2$-equivalents.
2) Sulfur dioxide ($SO_2$ = 1) and nitrogen oxides (NOx = 0.7) were transformed with the factors to acid depositions in $SO_2$-equivalents.
3) Carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), methane ($CH_4$), nitrogen oxides (NOx) cause ozone formation.

### (a) Gross fixed capital formation, capital stock and labour

19.56 The first three satellite systems in Table 19.3 include information on investment and the use of capital and labour in the various industries. The matrix on gross fixed capital formation identifies how much the various industries have invested in buildings and machinery in this particular year. The second matrix on capital stock shows how much capital was used up in the various activities. The third matrix reflects the actual employment in industries.

### (b) Energy

19.57 The matrix on energy use has been derived from energy balances, which are available for most countries. It reflects the total energy use of the economy in petajoules, which is equivalent to the total supply of energy from domestic production and imports and comprises all primary and secondary energy sources. Conceptually, the energy use found in the balances needs to be adjusted to fit into a national accounts framework. The availability of energy accounts of the SEEA-2012 would enormously facilitate the use of energy data into an extended input-output framework.

### (c) Air emissions

19.58 The matrix of the satellite system on air emissions of pollutants is derived from the energy use of the previous table. Included are 11 different gases, among them the most important gases contributing to global warming, acid deposition and tropospheric ozone formation.

### (d) Global warming, acid deposition and tropospheric ozone formation

19.59 The matrix on global warming, acid deposition and tropospheric ozone formation includes information on the emissions to air that are harmful to the global climate. In particular, the matrix provides information on the emission of greenhouse gasses derived in $CO_2$-equivalents based on carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$); acid deposition derived in SOx-equivalents based on sulphur oxides (SOx) and nitrogen oxides (NOx); and tropospheric ozone formation based on carbon monoxide (CO), non-methane volatile organic compounds, methane ($CH_4$) and nitrogen oxides (NOx).

### (e) Waste, sewage and water

19.60 The last matrix in Table 19.3 provides information on the generation of waste and sewage by the various economic activities and households, together with the use of water from waterworks and from nature by economic activities. The Eurostat database includes information on 38 different types of hazardous and non-hazardous wastes and 46 different sources of waste water generation.

19.61 This information is used to calculate a water footprint, which consists of three components:

- Blue water footprint, which is the volume of freshwater that evaporated from the global blue water resources (surface water and ground water) to produce the goods and services consumed by all activities.
- Green water footprint, which is the volume of water evaporated from the global green water resources (rainwater stored in the soil as soil moisture).
- Grey water footprint, which is the volume of polluted water associated with the production of all goods and services by industries and private households.

19.62 The last category can be estimated as the volume of water that is required to dilute pollutants to such an extent that the quality of the water remains at or above agreed water quality standards. The information on waste, sewage and water has been drawn from the Genesis databank of the Federal Statistical Office of Germany.

## E. Other examples of satellite systems

19.63 Satellite systems for national accounts may be established for many areas of functional analysis, such as culture, education, health, social protection, tourism, environmental protection, research and development, non-profit institutions, unpaid household work, volunteer work, human capital, transport and other topics of interest. These satellite systems expand the analytical capacity of national accounts. Another satellite system is the growth and productivity analysis of the EU KLEMS and World KLEMS initiatives.

19.64 EU KLEMS is an industry-level, growth and productivity research project financed by the European Commission. The acronym KLEMS is derived from the areas of analysis, namely: capital (K), labour (L), energy (E), materials (M) and service (S) inputs. EU KLEMS includes measures of output and input growth and derived variables, such as multi-factor productivity at the industry level.

19.65 The measures were developed for 25 member States of the European Union and selected countries of the rest of the world, covering between 30 and 72 industries over the period from 1970 to 2007. The new EU KLEMS database allows for the evaluation of the development of productivity in the European Union using a comparative industry approach. The database includes measures of economic growth, productivity, employment creation, capital formation and technological change at the industry level.

19.66 The basic tables cover 30 countries, among them 25 member States of the European Union and five countries from the rest of the world, namely, Australia, Canada, Japan, Republic of Korea and the United States of America. Also included are aggregate tables for the European Union (EU-25) and the eurozone countries, covering data for values, prices, volumes growth accounting and additional tables, reflecting the above input measures. Productivity measures were also developed in line with growth accounting techniques.

19.67 The database forms an important input to policy evaluation, in particular for the assessment of the goals concerning competitiveness and economic growth potential (EU KLEMS, 2014).

19.68 The World KLEMS initiative promotes the analysis of growth and productivity patterns around the world with a similar growth accounting framework. The use of harmonized concepts and common standards and classifications helps to develop comparable data across countries and to establish a firm grounding in the international statistical systems (World KLEMS, 2014).

# Chapter 20. Modelling applications of IOTs

## A. Introduction

20.1 It is widely accepted that the foundations of input-output analysis were laid by Wassily Leontief in the 1930s, linking micro and macro economics. As Leontief stated, "In practical terms, the economic system to which input-output analysis is applied may be as large as a nation or even the entire world economy, or as small as the economy of a metropolitan areas or even a single enterprise. In all instances the approach is essentially the same" (Leontief, 1986).

20.2 The core of input-output analysis is formulated through the preparation of IOTs, which describe the flow of goods and services between all industries of an economy over a period of time. The IOTs provide information on production structures and may be arranged to cover all inputs which are used in production: intermediate inputs, labour, capital and land. Input-output analysis provides a means of systematically quantifying the mutual interrelationships among the producers and consumers in the economy. The analysis is underpinned by the recognition that production processes are always interdependent and form a system of products produced using products but also a system of value added chains in interdependent markets. With globalization, there is more competition and more interdependent production processes, a greater division of labour and more diversity and complexity of products. Thus the exchange of intermediate inputs becomes more important, thereby further increasing the importance of input-output analysis.

20.3 The structure of each industry's production activity is represented by appropriate structural coefficients that describe relationships between the inputs that the industry absorbs and the output that it produces. The interdependence among the industries and institutional sectors may be expressed by a set of linear equations which represent the balances between total input and total output of each good and service produced.

20.4 The main applications of input-output analysis have been extensively discussed – see Leontief (1986), United Nations (1996), Kurz, Dietzenbacher and Lager (1998), ten Raa (2006), Eurostat (2008), Miller and Blair (2009), Suh (2010), Murray (2013) and numerous other publications, including *Economic Systems Research*, the journal of the International Input-Output Association.

20.5 The present chapter provides an overview of the various modelling applications that may be performed on the basis of IOTs. In particular, it describes a number of modelling applications based on a specific numerical example of IOTs presented in section B. Each of the following sections of this chapter covers a different model.

## B. Numerical example of IOTs as a starting point

20.6 SUTs and IOTs can provide a very detailed picture of an economy. The disaggregation of activities in SUTs and IOTs conveys detailed information on the interdependencies in production between the various industries of the economy. The tables present information on the supply and use of goods and services for industries' intermediate consumption and categories of final use (final consumption, capital formation and exports). They also provide details on the generation of income for each industry distinguishing the components of GVA, in the form of compensation of employees, other taxes on production, consumption of fixed capital and net operating surplus. In this way, SUTs and IOTs can form the basis for many models and a wide range of economic analyses.

20.7 The presentation of input-output estimates and input-output models in this chapter is based on an empirical example. Table 19.3 shows the extended IOTs for the year 2009 for Germany, which are used as the reference case to illustrate the links to the satellite systems extending the traditional set of IOTs. The original IOTs for Germany have been aggregated to show six products and six industries. The first part of the table, rows (1)–(22), consist of the traditional IOTs. The table includes the rows for production activities and final use, separating domestic products and imported products and also showing taxes less subsidies on products and GVA. The subsequent matrices are satellite systems which are integrated into the input-output framework. These matrices provide useful information in values and quantities for production activities and final use, and include:

- Gross fixed capital formation
- Capital stock
- Employment
- Energy
- Emissions
- Global warming and acid deposition
- Solid waste

20.8 It should be noted that these extensions have been transformed from an industry to a product classification.

20.9 The IOTs in Table 20.1 will be used for analysis. The only difference between the extended IOTs and the IOTs for domestic output shown in Table 20.1 is that the imported goods and services were aggregated into a single row of imports.

20.10 In Table 20.1, the use of domestic goods and services is shown in rows (1)–(6), while the use of aggregated imports is reported in row (8). The inputs comprise domestic products in rows (1)–(6), imported products in row (8), net taxes on products in row (9) and the components of GVA in rows (11)–(14).

**Table 20.1 IOT at basic prices**

Billions of euros

| | | Products | | | | | | Final use | | | | | Total output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services | Final consumption: Households | Final consumption: Governmnet | Gross fixed capital formation | Changes in inventories | Exports | |
| Products | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Agriculture | (1) | 3 | 20 | | | | 1 | 9 | | | 3 | 5 | 42 |
| Manufacturing | (2) | 7 | 394 | 48 | 56 | 11 | 30 | 250 | 7 | 95 | - 58 | 611 | 1 451 |
| Construction | (3) | 1 | 11 | 18 | 8 | 28 | 10 | 5 | | 153 | | 1 | 234 |
| Trade, transport and comm. | (4) | 4 | 139 | 17 | 181 | 38 | 40 | 317 | 15 | 39 | 6 | 111 | 907 |
| Finance and business services | (5) | 6 | 131 | 30 | 124 | 261 | 51 | 313 | 3 | 25 | | 66 | 1 010 |
| Other services | (6) | | 18 | 3 | 12 | 17 | 47 | 147 | 472 | 2 | | 2 | 721 |
| Total at basic prices | (7) | 21 | 713 | 116 | 382 | 355 | 179 | 1 041 | 497 | 314 | - 49 | 795 | 4 365 |
| Imports | (8) | 5 | 283 | 17 | 58 | 31 | 21 | 128 | 9 | 61 | 31 | 189 | 833 |
| Taxes less subsidies on products | (9) | 2 | 10 | 2 | 12 | 17 | 24 | 151 | 6 | 34 | | | 257 |
| Total at purchasers' prices | (10) | 27 | 1 007 | 135 | 452 | 402 | 224 | 1 319 | 513 | 409 | - 18 | 984 | 5 455 |
| Compensation of employees | (11) | 6 | 308 | 69 | 294 | 191 | 364 | | | | | | 1 232 |
| Other taxes less subsidies on production | (12) | - 6 | - 2 | | - 1 | 5 | - 7 | | | | | | - 12 |
| Consumption of fixed capital | (13) | 8 | 79 | 5 | 60 | 160 | 63 | | | | | | 375 |
| Net operating surplus/Net mixed income | (14) | 7 | 60 | 25 | 101 | 252 | 77 | | | | | | 523 |
| GVA | (15) | 15 | 445 | 99 | 454 | 608 | 497 | | | | | | 2 117 |
| Total input at basic prices | (16) | 42 | 1 451 | 234 | 907 | 1 010 | 721 | 1 319 | 513 | 409 | - 18 | 984 | |

Germany 2009

## C. Distinction between price, volume, quantity, quality and physical units

20.11 In applied economics, the following monetary IOTs are used:

- IOTs in current prices
- IOTs in volume terms (of a base year)
- IOTs in volume terms (in previous years' prices)

20.12 These monetary IOTs are often supplemented with information in physical units, and also with PSUTs.

20.13 The nature of estimates in current prices will be fundamentally different from those estimates in volume terms. The IOTs in current prices may be regarded as the aggregation of actual economic transactions that take place in a given year. The economic transactions are derived from an accounting framework of SUTs in current prices. The IOTs in volume terms, however, describe the economic situation of a particular year in the prices of another year. It is assumed that all agents would trade the reported goods and services and primary inputs at prices of another year. In reality, all the economic transactions of the current year would not take place in an identical manner in prices of any other year.

20.14 The price of a product is defined as the value of one unit of that product. For a single comparable product, the value of an economic transaction, $v$, is equal to the price per unit of quantity, $p$, multiplied by the number of the units of quantity, $q$.

$$v = p \times q$$

20.15 A quantity index is built from information on quantities, such as the number or total weight of goods or the number of services; the quantity index has no meaning from an economic standpoint if it involves adding quantities that are not commensurate, although it is often used as a proxy for a volume index.

20.16 Quantities of different products cannot be aggregated without a certain weighting mechanism. For aggregating products, the term “volume” is used instead of “quantity”. The price and volume measures must be constructed for each aggregate of transactions in products within the accounts, so that:

$$\text{Value index} = \text{Price index } \times \text{Volume index}$$

20.17 Each and every change in the value of a given transaction must be attributed either to a change in price or to a change in volume or to a combination of both. A price index reflects an average of the proportionate change in the prices of a specified set of goods and services between two periods of time: there are three main types of such indices:

- Laspeyres price index is a weighted arithmetic average of price relatives using the values of the earlier period as weights.
- Paasche price index is the harmonic average of price relatives using the values of the later period as weights.
- Fisher’s price index is the geometric mean of the Laspeyres and Paasche price indices.

More detail on these may be found in chapter 9, on the compilation of SUTs in volume terms.

20.18 In principle, the price component should only include changes in price. The price changes for a given transaction can only occur as a result of prices changes for individual products. All other changes should be reflected in the changes in volumes. The corresponding Laspeyres, Paasche and Fisher’s volume indices use the same approach as above, but instead of price relatives they will use volume relatives.

20.19 Box 20.1 shows the relationship of quantity, price, value and volume and the corresponding indices for a small numerical example.

## Box 20.1 Quantities, prices, values and volumes in IOTs

This box shows how quantities, prices, values and volumes are related in the IOTs.

**IOT of previous year (base year)**

Quantities, prices and values are known

Table 1: Quantities in base year

| | Agriculture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 4 | 7 | 2 | 9 | 22 |
| Manuf. and const. | 9 | 72 | 19 | 112 | 212 |
| Services | 5 | 17 | 8 | 106 | 136 |
| Labour | 4 | 13 | 23 | | 40 |
| NOS | | | | | |
| Input | | | | | |

Table 2: Prices in base year

| | Agriculture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 4 | 4 | 4 | 4 | |
| Manuf. and const. | 2 | 2 | 2 | 2 | |
| Services | 3 | 3 | 3 | 3 | |
| Wage rate | 5 | 7 | 9 | | |
| NOS | | | | | |
| Input | | | | | |

Table 3: IOT of base year (values)

| | Agriculture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 16 | 28 | 8 | 36 | 88 |
| Manuf. and const. | 18 | 144 | 38 | 224 | 424 |
| Services | 15 | 51 | 24 | 318 | 408 |
| Comp. of employees | 20 | 91 | 207 | | 318 |
| NOS | 19 | 110 | 131 | | 260 |
| Input | 88 | 424 | 408 | 578 | 1 498 |

= Net operating surplus is compiled as residual.

**IOT of following year (current year)**

Quantities, prices and values are known

Table 4: Quantities in current year

| | Agriculture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 5 | 9 | 3 | 11 | 28 |
| Manuf. and const. | 10 | 76 | 21 | 116 | 223 |
| Services | 6 | 21 | 11 | 110 | 148 |
| Labour | 5 | 14 | 24 | | 43 |
| NOS | | | | | |
| Input | | | | | |

Table 5: Prices in current year

| | Agriculture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 5 | 5 | 5 | 5 | |
| Manuf. and const. | 3 | 3 | 3 | 3 | |
| Services | 4 | 4 | 4 | 4 | |
| Wage rate | 6 | 9 | 13 | | |
| NOS | | | | | |
| Input | | | | | |

Table 6: IOT of current year (values)

| | Agriculture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 25 | 45 | 15 | 55 | 140 |
| Manuf. and const. | 30 | 228 | 63 | 348 | 669 |
| Services | 24 | 84 | 44 | 440 | 592 |
| Comp. of employees | 30 | 126 | 312 | | 468 |
| NOS | 31 | 186 | 158 | | 375 |
| Input | 140 | 669 | 592 | 843 | 2 244 |

Table 7: IOT of current year at prices of base year (volumes)

| | Agriculture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 20 | 36 | 12 | 44 | 112 |
| Manuf. and const. | 20 | 152 | 42 | 232 | 446 |
| Services | 18 | 63 | 33 | 330 | 444 |
| Comp. of employees | 25 | 98 | 216 | | 339 |
| NOS | 29 | 97 | 141 | | 267 |
| Input | 112 | 446 | 444 | 606 | 1 608 |

Price index = Table 5 / Table 2

Table 8: Price index (Base year = 100)

| | Agriculture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 125.0 | 125.0 | 125.0 | 125.0 | |
| Manuf. and const. | 150.0 | 150.0 | 150.0 | 150.0 | |
| Services | 133.3 | 133.3 | 133.3 | 133.3 | |
| Comp. of employees | 120.0 | 128.6 | 144.4 | | |
| NOS | | | | | |
| Input | | | | | |

Volume index = Table 7 / Table 3

Table 9: Volume index (Base year = 100)

| | Agriculture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 125.0 | 128.6 | 150.0 | 122.2 | 127.3 |
| Manuf. and | 111.1 | 105.6 | 110.5 | 103.6 | 105.2 |
| Services | 120.0 | 123.5 | 137.5 | 103.8 | 108.8 |
| Comp. of | 125.0 | 107.7 | 104.3 | | 106.6 |
| NOS | 152.6 | 88.2 | 107.6 | | 102.7 |
| Input | 127.3 | 105.2 | 108.8 | 104.8 | 107.3 |

Value index = Table 6 / Table 3

Table 10: Value index (Base Year = 100)

| | Agriculture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 156.3 | 160.7 | 187.5 | 152.8 | 159.1 |
| Manuf. and | 166.7 | 158.3 | 165.8 | 155.4 | 157.8 |
| Services | 160.0 | 164.7 | 183.3 | 138.4 | 145.1 |
| Comp. of employees | 150.0 | 138.5 | 150.7 | | 147.2 |
| NOS | 163.2 | 169.1 | 120.6 | | 144.2 |
| Input | 159.1 | 157.8 | 145.1 | 145.8 | 149.8 |

NOS = net operating surplus

20.20 Tables 1–6 in Box 20.1 show quantities, prices and values for products in the first three rows. GVA is compiled as a residual variable, as some components of GVA (for example, wages and salaries) reflect a quantity and price component, whereas other components (for example, net operating surplus) do not have the same characteristics.

20.21 In table 7 in Box 20.1, IOT of the current year is compiled by multiplying the quantities of the current year with the prices of the base year (previous year). The price index of the current year in table 8 is calculated by dividing the prices of the current year (table 5) by the prices of the base year (table 2). The volume index in table 9 is derived by dividing the IOT of the current year at prices of the base year (table 7) by the IOT of the base year (table 3). Lastly, the value index in table 10 is compiled by dividing the IOT of the current year (table 6) by the IOT of the base year (table 3).

20.22 Using the double deflation approach, GVA in volume terms equals deflated output less deflated intermediate consumption.

20.23 In the economy, most products are available in several varieties of differing quality, each with its own price, and differing over time. The products of different quality are sufficiently different from one another to make them distinguishable.

20.24 Changes in quality over time need to be recorded as changes in volume and not as changes in price. If the composition of a transaction changes as a result from a shift from or to higher quality of the same product, the shift should be recorded as a change in volume.

20.25 The volume index may therefore be broken down into the following three components of changes due to:

- Changes in the quality of the products
- Changes in the characteristics of the products
- Compositional changes in the aggregate

20.26 Another form of measurement is the use of physical units to record flows of materials and energy that enter and leave the economy and flows of materials and energy within the economy itself – these measures are called physical flows.

20.27 The different physical flows (natural inputs, products and residuals) are recorded by compiling SUTs in physical units of measurement, commonly known as PSUTs (see chapter 13), and are based on the monetary SUTs with extensions to incorporate a column for the environment, and rows for natural inputs and residuals. Thus, for each product measured in physical terms (for example, cubic metres of timber), the quantity of output and imports (total supply of products) must equal the quantity of intermediate consumption, households' final consumption, gross capital formation and exports (total use of products). The equality between supply and use applies also to the total supply and use of natural inputs and the total supply and use of residuals.

20.28 For estimates compiled in monetary terms, as explained earlier, the changes over time in the values of goods and services may be decomposed into two components: changes in price and changes in volume. In these cases, however, the volumes are not equivalent to measures of the physical volume (namely, solids, liquids or gases) but relate instead to an economic notion of volume which encompasses changes in both the quantity and the quality of goods, services and assets. Thus, for example, the economic notion of volume would include an increase in the number of cars produced (or their mass), together with improvements in the quality of the cars.

20.29 For accounts compiled in physical terms, the unit of measurement will vary depending on the type of asset concerned. Thus, flows of energy are generally measured by final use energy content, such as joules; stocks and flows of water are generally measured by volume, such as cubic metres; and stocks and flows of other materials are generally measured in mass units, such as tons.

20.30 A common principle is that, within a single account, in physical terms only one unit of measurement should be used so that aggregation and reconciliation are possible across all accounting entries. It should be noted, however, that in combined presentations of physical and monetary data, a range of measurement units are likely to be used.

## D. Input coefficients

20.31 Input-output analysis starts with the calculation of input-output coefficients. Table 20.2 shows the input coefficients for the IOTs shown in Table 20.1. These coefficients are calculated by dividing each entry of the IOTs by the corresponding column total. The input coefficients of production activities may be interpreted as the corresponding cost shares for products and primary inputs in total output.

20.32 As the input coefficients cover all inputs, including net operating surplus, they add up to unity. The same holds true for the input coefficients of the categories of final uses. In this case, the input coefficients represent the composition by product of final uses.

**Table 20.2 Input coefficients of IOTs**

| | | Products | | | | | | Final use | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Final consumption | | | | |
| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services | Households | Government | Gross fixed capital formation | Changes in inventories | Exports |
| Products | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| Agriculture | (1) | 0.0692 | 0.0139 | | 0.0004 | 0.0001 | 0.0008 | 0.0071 | | 0.0000 | -0.1886 | 0.0054 |
| Manufacturing | (2) | 0.1686 | 0.2716 | 0.2048 | 0.0619 | 0.0110 | 0.0414 | 0.1894 | 0.0146 | 0.2323 | 3.2475 | 0.6205 |
| Construction | (3) | 0.0219 | 0.0077 | 0.0749 | 0.0088 | 0.0278 | 0.0139 | 0.0035 | | 0.3746 | | 0.0009 |
| Trade, transport and comm. | (4) | 0.0838 | 0.0956 | 0.0739 | 0.2000 | 0.0377 | 0.0552 | 0.2407 | 0.0293 | 0.0943 | -0.3404 | 0.1124 |
| Finance and business services | (5) | 0.1443 | 0.0906 | 0.1284 | 0.1370 | 0.2584 | 0.0712 | 0.2370 | 0.0050 | 0.0607 | 0.0207 | 0.0673 |
| Other services | (6) | 0.0095 | 0.0122 | 0.0138 | 0.0132 | 0.0166 | 0.0659 | 0.1113 | 0.9210 | 0.0055 | -0.0146 | 0.0016 |
| Imports | (7) | 0.1095 | 0.1950 | 0.0737 | 0.0641 | 0.0303 | 0.0287 | 0.0969 | 0.0179 | 0.1502 | -1.7247 | 0.1921 |
| Taxes less subsidies on products | (8) | 0.0361 | 0.0071 | 0.0078 | 0.0133 | 0.0164 | 0.0339 | 0.1142 | 0.0122 | 0.0824 | | -0.0001 |
| Compensation of employees | (9) | 0.1342 | 0.2122 | 0.2939 | 0.3248 | 0.1893 | 0.5055 | | | | | |
| Other taxes less subsidies on production | (10) | -0.1406 | -0.0017 | -0.0008 | -0.0009 | 0.0045 | -0.0102 | | | | | |
| Consumption of fixed capital | (11) | 0.1892 | 0.0544 | 0.0217 | 0.0661 | 0.1580 | 0.0876 | | | | | |
| Net operating surplus | (12) | 0.1743 | 0.0414 | 0.1080 | 0.1113 | 0.2499 | 0.1063 | | | | | |
| Total input at basic prices | (13) | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

Empty cells

20.33 For intermediate consumption of domestic products by production activities, the input coefficients of a sector are defined as:

(1) $a_{ij} = x_{ij}/x_j$ Input coefficients for domestic intermediates

| ***Monetary IOT*** | ***Physical IOT*** |
|---|---|
| $a_{ij}$ = monetary input coefficient for domestic products | $a_{ij}$= physical input coefficient for domestic products |
| $x_{ij}$= value of domestic product $i$ used by sector *j* | $x_{ij}$ = quantity of domestic product $i$ used by sector *j* |
| $x_j$ = value output of sector *j* | $x_j$ = quantity of output of sector *j* |

20.34 For imported intermediates, the input coefficients of a production activity are defined as:

(2) $c_{ij} = m_{ij}/x_j$ Input coefficients for imported intermediates

| ***Monetary IOT*** | ***Physical IOT*** |
|---|---|
| $c_{ij}$ = monetary input coefficient for imported products | $c_{ij}$= physical input coefficient for imported products |
| $m_{ij}$= value of product $i$ imported by sector *j* | $m_{ij}$ = quantity of imported product $i$ imported by sector *j* |
| $x_j$ = value output of sector *j* | $x_j$ = quantity of output of sector *j* |

20.35 For GVA, the input coefficients of a production activity are defined as:

(3) $v_{kj} = z_{kj}/x_j$ Input coefficients for primary inputs

| ***Monetary IOT*** | ***Physical IOT*** |
| --- | --- |
| $v_{kj}$= monetary input coefficient for primary inputs | $v_{kj}$= physical input coefficient for primary input |
| $z_{kj}$ = value of primary input $k$ used by sector *j* | $z_{kj}$ = quantity of primary input $k$ used by sector *j* |
| $x_j$ = value output of sector *j* | $x_j$= quantity of output of sector *j* |

20.36 Table 20.2 offers a comprehensive picture of input coefficients for the complete IOT. Columns (1)–(6) show the input coefficients for industries, and columns (7)–(11) those for the categories of final uses. For the purposes of simplicity and space-saving, in the equations, only the input coefficients for production activities (industry groupings 1–6) are shown but the same principle underlying the equations should be extended for the other groupings.

## E. Output coefficients

20.37 Table 20.3 shows the corresponding output coefficients for the monetary IOT. These output coefficients may be interpreted as the market shares of products in total output. For GVA, they reflect the distribution of primary inputs among production activities. The output coefficients are calculated by dividing each entry of the IOTs by the corresponding row total. The output coefficients show not only the distribution of products but also the distribution of taxes less subsidies on products and primary inputs.

20.38 For domestic products the output coefficients are:

(4) $o_{ij} = x_{ij}/x_i$ Output coefficients for domestic products

| ***Monetary IOT*** | ***Physical IOT*** |
| --- | --- |
| $o_{ij}$ = monetary output coefficient for domestic products | $o_{ij}$ = physical output coefficient for domestic products |
| $x_{ij}$= value of domestic product $i$ for sector *j* | $x_{ij}$= quantity of domestic product $i$ for sector *j* |
| $x_i$ = value output of product $i$ | $x_i$= quantity of output of product *i* |

## Table 20.3 Output coefficients of IOTs

| Products | | Products | | | | | | Final use | | | | | Total output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services | Final consumption | | Gross fixed capital formation | Changes in inventories | Exports | |
| | | | | | | | | Households | Government | | | | |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Agriculture | (1) | 0.0692 | 0.4785 | | 0.0092 | 0.0026 | 0.0132 | 0.2216 | | -0.0004 | 0.0803 | 0.1258 | 1.0000 |
| Manufacturing | (2) | 0.0049 | 0.2716 | 0.0331 | 0.0387 | 0.0077 | 0.0206 | 0.1721 | 0.0052 | 0.0654 | -0.0401 | 0.4209 | 1.0000 |
| Construction | (3) | 0.0039 | 0.0475 | 0.0749 | 0.0341 | 0.1201 | 0.0426 | 0.0198 | | 0.6535 | | 0.0036 | 1.0000 |
| Trade, transport and comm. | (4) | 0.0039 | 0.1531 | 0.0191 | 0.2000 | 0.0420 | 0.0439 | 0.3502 | 0.0166 | 0.0425 | 0.0067 | 0.1221 | 1.0000 |
| Finance and business services | (5) | 0.0060 | 0.1301 | 0.0298 | 0.1230 | 0.2584 | 0.0508 | 0.3096 | 0.0026 | 0.0245 | -0.0004 | 0.0656 | 1.0000 |
| Other services | (6) | 0.0006 | 0.0245 | 0.0045 | 0.0166 | 0.0232 | 0.0659 | 0.2038 | 0.6552 | 0.0031 | 0.0004 | 0.0022 | 1.0000 |
| Imports | (7) | 0.0055 | 0.3399 | 0.0207 | 0.0698 | 0.0368 | 0.0248 | 0.1535 | 0.0110 | 0.0737 | 0.0371 | 0.2271 | 1.0000 |
| Taxes less subsidies on products | (8) | 0.0059 | 0.0400 | 0.0071 | 0.0471 | 0.0644 | 0.0949 | 0.5856 | 0.0242 | 0.1310 | | -0.0003 | 1.0000 |
| Compensation of employees | (9) | 0.0046 | 0.2499 | 0.0559 | 0.2389 | 0.1552 | 0.2956 | | | | | | 1.0000 |
| Other taxes less subsidies on production | (10) | 0.4837 | 0.1973 | 0.0162 | 0.0691 | -0.3685 | 0.6023 | | | | | | 1.0000 |
| Consumption of fixed capital | (11) | 0.0213 | 0.2107 | 0.0136 | 0.1600 | 0.4260 | 0.1685 | | | | | | 1.0000 |
| Net operating surplus | (12) | 0.0141 | 0.1149 | 0.0484 | 0.1930 | 0.4830 | 0.1466 | | | | | | 1.0000 |

Empty cells

20.39 Table 20.3 shows a comprehensive picture of output coefficients for the complete IOT. In rows (1)–(6), the output coefficients for products, and in rows (7)–(12), the output coefficients for the components of primary inputs. As in Table 20.2, for the purposes of simplicity and space-saving, in the equations, only the output coefficients for products (products 1–6) are shown but the same principle underlying the equations should be extended for the other groupings.

## F. Quantity model of input-output analysis

20.40 The input-output model is a linear model based on Leontief production functions and a given vector of final uses. The objective is to calculate the unknown activity (output) levels for the individual industries (endogenous variables) for the given final uses (exogenous variables).

20.41 For an economy with three industries, the balance between total input and outputs for products may be described by the equations below, whereby the product is first produced (output) and that output is then put to intermediate use and final use (inputs).

Definition equations:

(5) $x_{11} + x_{12} + x_{13} + x_{1d} = x_1$
(6) $x_{21} + x_{22} + x_{23} + x_{2d} = x_2$
(7) $x_{31} + x_{32} + x_{33} + x_{3d} = x_3$

| ***Monetary IOT*** | ***Physical IOT*** |
|---|---|
| $x_{ij}$ = value of product $i$ for use in sector $j$ | $x_{ij}$ = quantity of product $i$ for use in sector $j$ |
| $x_{id}$= value of product $i$ for final use | $x_{id}$ = quantity of product $i$ for final use |
| $x_j$ = value of output of sectors $j$ | $x_j$= quantity of output of sectors $j$ |

20.42 We assume that all industries' production functions are linear Leontief production functions. All inputs (intermediate consumption, capital, labour, land) are used in fixed proportions in relation to output. It is assumed that a substitution of inputs is impossible. Accordingly, changing prices have no influence on the technical input coefficients:

(8) $a_{ij} = x_{ij}/x_j$ Input coefficients for intermediate consumption

20.43 The input coefficients for intermediate consumption are shown in Table 20.4. The requirements for intermediate consumption may be defined as the set of input coefficients weighted with the corresponding output level:

(9) $x_{ij} = a_{ij}x_j$ Requirements for intermediate consumption

20.44 Assuming that the industries' production operates with fixed technical input coefficients, the equation system (5) to (7) can be rewritten by replacing $x_{ij}$ by $a_{ij}x_j$. These equations serve to make explicit the dependence of inter-industry flows on the total output of each industry.

Input-output system:

(10) $a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + x_{1d} = x_1$
(11) $a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + x_{2d} = x_2$
(12) $a_{31}x_1 + a_{32}x_2 + a_{33}x_3 + x_{3d} = x_3$

**Table 20.4 Input coefficients for domestic intermediate consumption**

| | | Products | | | | | |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services |
| Products | | (1) | (2) | (3) | (4) | (5) | (6) |
| Agriculture | (1) | 0.0692 | 0.0139 | 0.0000 | 0.0004 | 0.0001 | 0.0008 |
| Manufacturing | (2) | 0.1686 | 0.2716 | 0.2048 | 0.0619 | 0.0110 | 0.0414 |
| Construction | (3) | 0.0219 | 0.0077 | 0.0749 | 0.0088 | 0.0278 | 0.0139 |
| Trade, transport and comm. | (4) | 0.0838 | 0.0956 | 0.0739 | 0.2000 | 0.0377 | 0.0552 |
| Finance and business services | (5) | 0.1443 | 0.0906 | 0.1284 | 0.1370 | 0.2584 | 0.0712 |
| Other services | (6) | 0.0095 | 0.0122 | 0.0138 | 0.0132 | 0.0166 | 0.0659 |
| Total | (7) | 0.4974 | 0.4916 | 0.4958 | 0.4214 | 0.3516 | 0.2483 |

20.45 The above set of equations is transformed into the following Leontief equation system with the following features:

- Final uses (exogenous variable) is isolated on the right-hand side of the equation.
- "Net" output (output less intra-industry internal consumption) is identified on the diagonal of the matrix.
- Inputs have a negative sign, outputs have a positive sign.

20.46 If the vector of final uses and the technical coefficients are known, the Leontief equation system is simply a set of linear equations with unknown output levels. The objective is to derive the activity levels of industries for the given level of use.

Leontief matrix:

(13) $(1 - a_{11})x_1 - a_{12}x_2 - a_{13}x_3 = x_{1d}$
(14) $-a_{21}x_1 + (1 - a_{22})x_2 - a_{23}x_3 = x_{2d}$
(15) $-a_{31}x_1 - a_{33}x_2 + (1 - a_{32})x_3 = x_{3d}$

20.47 On the diagonal of the Leontief matrix shown in Table 20.5, the net output (positive sign) of each industry is reported. This reflects the total output of a product less the input requirements of this production activity for the production of the same product (for example, seeds for wheat production in agriculture). The other coefficients in the matrix represent input requirements (negative sign). For example, for the industry "Agriculture", intra-industry input requirements of 0.0692 product units of its own kind are reported. The internal input requirements for agricultural products in agriculture are approximately 6.9 per cent of output. Accordingly, the net output of this industry is below unity (0.9308).

**Table 20.5 Leontief matrix**

| Products | | Products | | | | | |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services |
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| Agriculture | (1) | 0.9308 | -0.0139 | 0.0000 | -0.0004 | -0.0001 | -0.0008 |
| Manufacturing | (2) | -0.1686 | 0.7284 | -0.2048 | -0.0619 | -0.0110 | -0.0414 |
| Construction | (3) | -0.0219 | -0.0077 | 0.9251 | -0.0088 | -0.0278 | -0.0139 |
| Trade, transport and comm. | (4) | -0.0838 | -0.0956 | -0.0739 | 0.8000 | -0.0377 | -0.0552 |
| Finance and business services | (5) | -0.1443 | -0.0906 | -0.1284 | -0.1370 | 0.7416 | -0.0712 |
| Other services | (6) | -0.0095 | -0.0122 | -0.0138 | -0.0132 | -0.0166 | 0.9341 |

20.48 In matrix terms, we define:

(16) $Ax + y = x$
(17) $x - Ax = y$
(18) $(I - A)x = y$

20.49 The solution of this linear equation system is:

(19) $x = (I - A)^{-1}y$

***Monetary IOT***

$A$ = matrix of monetary input coefficients for intermediate consumption

$I$ = unit matrix

***Physical IOT***

$A$ = matrix physical input coefficients for intermediate consumption

$I$ = unit matrix

$(I - A)$ = Leontief matrix
$(I - A)^{-1}$ = Leontief inverse
$y$ = vector of final uses (values)
$x$ = vector of output (values)

$(I - A)$ = Leontief matrix
$(I - A)^{-1}$ = Leontief inverse
$y$ = vector of final uses (quantities)
$x$ = vector of output (quantities)

20.50 In matrix algebra, the vectors are denoted in small letters and matrices in capital letters. Vector $A_x$ reflects the requirements for intermediate consumption, while vector $y$ represents the exogenous aggregate of final uses. The matrix $(I - A)$ is called the Leontief matrix. On the diagonal of this matrix, the so-called "net" output is given for each industry with positive coefficients while the rest of the matrix is covering the input requirements with negative coefficients. The Leontief inverse $(I - A)^{-1}$ reflects the direct and indirect requirements for intermediate consumption and one unit of output for final uses.

20.51 The inverse may be approximated by the power series of $A$ matrices:

(20) $(I - A)^{-1} = I + A + A^2 + A^3 + \cdots + A^n$ Power series approximation

20.52 The cumulative input coefficients in Table 20.6 reflect the direct and indirect requirements for domestic intermediate consumption for one unit of final uses. The difference between Table 20.5 and Table 20.6 consists in the indirect input requirements of the economy required for one unit of a product for final uses.

**Table 20.6 Leontief inverse**

| | | Products | | | | | |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services |
| Products | | (1) | (2) | (3) | (4) | (5) | (6) |
| Agriculture | (1) | 1.0786 | 0.0211 | 0.0050 | 0.0024 | 0.0008 | 0.0021 |
| Manufacturing | (2) | 0.2801 | 1.4040 | 0.3273 | 0.1207 | 0.0411 | 0.0776 |
| Construction | (3) | 0.0383 | 0.0207 | 1.0935 | 0.0214 | 0.0429 | 0.0217 |
| Trade, transport and comm. | (4) | 0.1650 | 0.1838 | 0.1548 | 1.2805 | 0.0757 | 0.0920 |
| Finance and business services | (5) | 0.2834 | 0.2155 | 0.2615 | 0.2578 | 1.3775 | 0.1339 |
| Other services | (6) | 0.0225 | 0.0252 | 0.0273 | 0.0246 | 0.0267 | 1.0756 |
| Total | (7) | 1.8679 | 1.8704 | 1.8695 | 1.7074 | 1.5648 | 1.4029 |

20.53 In this notation of the inverse, the unit matrix $(I)$ denotes on the diagonal one unit of the product for final uses. The matrix $A$ represents the direct input requirements of the producer for intermediate consumption and the matrices $A^2$ until $A^n$ the indirect requirements for intermediate consumption in the previous stages of production. The column sum of the inverse may be interpreted as an output multiplier which reflects the cumulative output of the economy generated by one additional unit of final uses of a certain product. As for "Manufacturing" (1.8704), this has the highest output multiplier. If final uses for industrial products were to increase by 1.0 million, the cumulative output of 1.870 million would be generated in the economy.

20.54 The solution of the input-output system $(I - A)^{-1}y = x$ in equation (19) is included in Table 20.7, calibrated to the IOT in the base year before analytical use. The objective of this calculation is to retain the IOTs shown in Table 20.1 with the input-output model. The inverse is multiplied with the vector of final uses to estimate the output levels. This model is often used to study the impact of exogenous changes of final uses on the economy: for example, a prominent application of the quantity model of input-output analysis is the evaluation of a Keynesian public expenditure programme to offset a recession or unemployment. There are other prominent uses, such as government, which is mainly interested in the employment effect and not necessarily output.

**Table 20.7 Quantity input-output model based on monetary data**

| Products | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services | Final use | Output |
|---|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | | Leontief inverse $(I-A)^{-1}$ | | | | | | y | x |
| Agriculture | (1) | 1.0786 | 0.0211 | 0.0050 | 0.0024 | 0.0008 | 0.0021 | 18 | 42 |
| Manufacturing | (2) | 0.2801 | 1.4040 | 0.3273 | 0.1207 | 0.0411 | 0.0776 | 905 | 1 451 |
| Construction | (3) | 0.0383 | 0.0207 | 1.0935 | 0.0214 | 0.0429 | 0.0217 | 159 | 234 |
| Trade, transport and comm. | (4) | 0.1650 | 0.1838 | 0.1548 | 1.2805 | 0.0757 | 0.0920 | 488 | 907 |
| Finance and business services | (5) | 0.2834 | 0.2155 | 0.2615 | 0.2578 | 1.3775 | 0.1339 | 406 | 1 010 |
| Other services | (6) | 0.0225 | 0.0252 | 0.0273 | 0.0246 | 0.0267 | 1.0756 | 623 | 721 |

## G. Price model of input-output analysis

20.55 In an input-output system, prices are determined from a set of equations which states that the price which each sector of the economy receives per unit of output must equal the total outlays incurred in the course of its production. The outlays comprise not only payments for inputs purchased from the same and from other industries as well as imports but also the GVA, which essentially represents payments made to the external factors, for example, capital, labour, and land including residual profits.

20.56 In the IOT, the costs of production are reported for each industry in the corresponding column of the matrix. The transposed columns are reported in the following system.

Price model:

(21) $x_{11}p_1 + x_{21}p_2 + x_{31}p_3 + z_1q_1 = x_1p_1$

(22) $x_{12}p_1 + x_{22}p_2 + x_{32}p_3 + z_2q_2 = x_2p_2$

(23) $x_{13}p_1 + x_{23}p_2 + x_{33}p_3 + z_3q_3 = x_3p_3$

| ***Monetary IOT*** | ***Physical IOT*** |
|---|---|
| $x_{ij}$ = domestic intermediates (volumes) | $x_{ij}$= domestic intermediates (quantities) |
| $x_j$ = output of sector $j$ (volumes) | $x_j$ = output of sector $j$ (quantities) |
| $p_i$ = index price of product $i$ | $p_i$= price of product $i$ |
| $z_j$ = primary input to sector $j$ (volumes) | $z_j$= primary input to sector $j$ (quantities) |
| $q_i$ = factor index price for primary input in sector $i$ | $q_i$= factor price for primary input in sector $i$ |

20.57 Again, this assumes that all three industries are operating with Leontief production functions. Moreover, by calculating implicit prices, this assumes that the conditions for full competition (many suppliers, many purchasers, free access to markets, full information) are valid:

(24) $a_{ij} = x_{ij}/x_j$ Input coefficients for intermediate consumption

(25) $v_j = z_j/x_j$ Input coefficients for primary input

20.58 The requirements for intermediate consumption can be defined as the input coefficient weighted with the corresponding output level:

(26) $x_{ij} = a_{ij}x_j$ Requirements for products

(27) $z_j = v_jx_j$ Requirements for primary inputs

| ***Monetary IOT*** | ***Physical IOT*** |
|---|---|
| $a_{ij}$ = input coefficient for products | $a_{ij}$= input coefficient for products |
| $z_j$= requirements for primary input (volumes) | $z_j$= requirements for primary input (quantity) |
| $v_j$= input coefficient for primary input | $v_j$= input coefficient for primary input |

20.59 In the next step, the input coefficients for intermediates and primary input are introduced into the equation system.

Price model:

(28) $a_{11}x_1p_1 + a_{21}x_1p_2 + a_{31}x_1p_3 + v_1x_1q_1 = x_1p_1$

(29) $a_{12}x_2p_1 + a_{22}x_2p_2 + a_{32}x_3p_3 + v_2x_2q_2 = x_2p_2$

(30) $a_{13}x_3p_1 + a_{23}x_3p_2 + a_{33}x_3p_3 + v_3x_3q_3 = x_3p_3$

20.60 By dividing each row of the equation system by the output levels $x_i$, these equations are:

(31) $a_{11}p_1 + a_{21}p_2 + a_{31}p_3 + v_1q_1 = p_1$

(32) $a_{12}p_1 + a_{22}p_2 + a_{32}p_3 + v_2q_2 = p_2$

(33) $a_{13}p_1 + a_{23}p_2 + a_{33}p_3 + v_3q_3 = p_3$

20.61 If the equations system is solved for the exogenous variable "Wages per unit of output" $v_iq_i$, this will generate the Leontief equations for the price model.

Leontief equations:

(34) $(1 - a_{11})p_1 - a_{21}p_2 - a_{31}p_3 = v_1q_1$

(35) $-a_{12}p_1 + (1 - a_{22})p_2 - a_{32}p_3 = v_2q_2$

(36) $-a_{13}p_1 - a_{23}p_2 + (1 - a_{33})p_3 = v_3q_3$

20.62 The price model in matrix notation is defined as:

(37) $A^Tp + diag(q)v^T = p$

(38) $p - A^Tp = diag(q)v^T$

(39) $(I - A^T)p = diag(q)v^T$

20.63 The solution of the linear equation system is:

(40) $p = (I - A^T)^{-1}w^T$

| ***Monetary IOT*** | ***Physical IOT*** |
|---|---|
| $A^T$= transposed matrix of input coefficients for intermediate consumption | $A^T$= transposed matrix of input coefficients for intermediate consumption |
| $I$ = unit matrix | $I$ = unit matrix |
| $(I - A^T)$ = transposed Leontief matrix | $(I - A^T)$ = transposed Leontief matrix |
| $(I - A^T)^{-1}$= transposed Leontief inverse | $(I - A^T)^{-1}$= transposed Leontief inverse |
| $w^T$ = column vector of input coefficients for primary inputs | $w^T = diag(q)v^T$ primary inputs per unit of output |
| $p$ = column vector of index prices for products | $v^T$ = column vector of input coefficients for primary inputs |
| | $diag(q)$ = diagonal matrix of unit factor prices |
| | $p$ = column vector of product prices |

20.64 The objective of the price model is to calculate the unknown product prices (price indices) for exogenously given primary input coefficients which are weighted with the factor price.

20.65 The results for the reference country Germany for the year 2009 are presented in Table 20.8. In this example, it is assumed that the factor price for all primary inputs in all industries is 1.0.

20.66 It should be borne in mind that, for the monetary IOTs of Germany, no information on quantities and prices (see right-hand side of Box 20.2 and Box 20.3) is available. In consequence, the input coefficients for primary input must be weighted with a unit price index. The price model may be used to study the impact of changes in primary inputs (input coefficients, factor prices) on product prices. When the price model is applied, it is assumed that all conditions of perfect competition are fulfilled. Higher prices for primary inputs will cause higher product prices in competitive markets. This approach is capable of simulating the impact of cost-driven inflation; thus, for example, the price model could be used to study the impact of an increase of the tax on gasoline on other product prices.

**Table 20.8 Price input-output model based on monetary data**

| | | Products | | | | | | Input coefficient for primary inputs | Price index |
|---|---|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services | | |
| Products | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | | Transposed Leontief inverse $(I-A')^{-1}$ | | | | | | w | Price index |
| Agriculture | (1) | 1.0786 | 0.2801 | 0.0383 | 0.1650 | 0.2834 | 0.0225 | 0.5026 | 1.0000 |
| Manufacturing | (2) | 0.0211 | 1.4040 | 0.0207 | 0.1838 | 0.2155 | 0.0252 | 0.5084 | 1.0000 |
| Construction | (3) | 0.0050 | 0.3273 | 1.0935 | 0.1548 | 0.2615 | 0.0273 | 0.5042 | 1.0000 |
| Trade, transport and comm. | (4) | 0.0024 | 0.1207 | 0.0214 | 1.2805 | 0.2578 | 0.0246 | 0.5786 | 1.0000 |
| Finance and business services | (5) | 0.0008 | 0.0411 | 0.0429 | 0.0757 | 1.3775 | 0.0267 | 0.6484 | 1.0000 |
| Other services | (6) | 0.0021 | 0.0776 | 0.0217 | 0.0920 | 0.1339 | 1.0756 | 0.7517 | 1.0000 |

## Box 20.2 Quantity input-output model

This box shows how the input-output model may be applied to quantities and values.

### PHYSICAL INPUT-OUTPUT TABLES

Quantities and unit wage rates for labour are known.

Table 1: Input-output table (quantities)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 4.0 | 6.8 | 2.0 | 8.4 | 21.2 |
| Manuf. and const. | 10.0 | 76.0 | 20.0 | 114.0 | 220.0 |
| Services | 4.0 | 18.0 | 8.0 | 110.5 | 140.5 |
| Labour | 5.0 | 14.0 | 24.0 | | 43.0 |

Table 2: Prices

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | | | | | |
| Manuf. and const. | | | | | |
| Services | | | | | |
| Labour | 10.00 | 13.00 | 20.00 | | |

Table 3: Input-output table (values)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | | | | | |
| Manuf. and const. | | | | | |
| Services | | | | | |
| Labour | 50.00 | 182.00 | 480.00 | | |
| Input | | | | | |

Table 4: Input coefficients (quantities/quantities)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 0.1887 | 0.0309 | 0.0142 | | |
| Manuf. and const. | 0.4717 | 0.3455 | 0.1423 | | |
| Services | 0.1887 | 0.0818 | 0.0569 | | |
| Labour | 0.2358 | 0.0636 | 0.1708 | | |

Table 5: Leontief matrix

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 0.8113 | -0.0309 | -0.0142 | | |
| Manuf. and const. | -0.4717 | 0.6545 | -0.1423 | | |
| Services | -0.1887 | -0.0818 | 0.9431 | | |

**Assumption: Final demand of product B increases by 10%**

Table 6: Leontief inverse

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 1.2764 | 0.0639 | 0.0289 | | |
| Manuf. and const. | 0.9942 | 1.6069 | 0.2576 | | |
| Services | 0.3416 | 0.1522 | 1.0885 | | |

Table 7: Quantity input-output model

| | Leontief inverse | | | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 1.2764 | 0.0639 | 0.0289 | 8.4 | 21.9 |
| Manuf. and const. | 0.9942 | 1.6069 | 0.2576 | 125.4 | 238.3 |
| Services | 0.3416 | 0.1522 | 1.0885 | 110.5 | 142.2 |

Table 8: Projected input-output table (quantities)

| | Agricul-ture | Manuf. and const. | Services | Final use | TO |
|---|---|---|---|---|---|
| Agriculture | 4.1 | 7.4 | 2.0 | 8.4 | 21.9 |
| Manuf. and const. | 10.3 | 82.3 | 20.2 | 125.4 | 238.3 |
| Services | 4.1 | 19.5 | 8.1 | 110.5 | 142.2 |
| Labour | 5.2 | 15.2 | 24.3 | | 44.6 |
| Input | | | | | |

Table 9: Growth rates in %

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 3.4 | 8.3 | 1.2 | | 3.4 |
| Manuf. and const. | 3.4 | 8.3 | 1.2 | 10.0 | 8.3 |
| Services | 3.4 | 8.3 | 1.2 | | 1.2 |
| Labour | 3.4 | 8.3 | 1.2 | | 3.8 |
| Input | | | | | |

### MONETARY INPUT-OUTPUT TABLES

Quantities, prices and values are known.

Table 1: Input-output table (quantities)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 4.0 | 6.8 | 2.0 | 8.4 | 21.2 |
| Manuf. and const. | 10.0 | 76.0 | 20.0 | 114.0 | 220.0 |
| Services | 4.0 | 18.0 | 8.0 | 110.5 | 140.5 |
| Labour | 5.0 | 14.0 | 24.0 | | 43.0 |

Table 2: Prices

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 5.00 | 5.00 | 5.00 | 5.00 | |
| Manuf. and const. | 2.00 | 2.00 | 2.00 | 2.00 | |
| Services | 4.00 | 4.00 | 4.00 | 4.00 | |
| Labour | 10.00 | 13.00 | 20.00 | | |

Table 3: Input-output table (values)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 20.00 | 34.00 | 10.00 | 42.00 | 106.00 |
| Manuf. and const. | 20.00 | 152.00 | 40.00 | 228.00 | 440.00 |
| Services | 16.00 | 72.00 | 32.00 | 442.00 | 562.00 |
| Labour | 50.00 | 182.00 | 480.00 | | 712.00 |
| Input | 106.00 | 440.00 | 562.00 | 712.00 | |

Table 4: Input coefficients (values/values)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 0.1887 | 0.0773 | 0.0178 | 0.0590 | |
| Manuf. and const. | 0.1887 | 0.3455 | 0.0712 | 0.3202 | |
| Services | 0.1509 | 0.1636 | 0.0569 | 0.6208 | |
| Labour | 0.4717 | 0.4136 | 0.8541 | | |

Table 5: Leontief matrix

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 0.8113 | -0.0773 | -0.0178 | | |
| Manuf. and const. | -0.1887 | 0.6545 | -0.0712 | | |
| Services | -0.1509 | -0.1636 | 0.9431 | | |

**Assumption: Final demand of product B increases by 10%**

Table 6: Leontief inverse

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 1.2764 | 0.1597 | 0.0361 | | |
| Manuf. and const. | 0.3977 | 1.6069 | 0.1288 | | |
| Services | 0.2733 | 0.3044 | 1.0885 | | |

Table 7: Quantity input-output model

| | Leontief inverse | | | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 1.2764 | 0.1597 | 0.0361 | 42.00 | 109.64 |
| Manuf. and const. | 0.3977 | 1.6069 | 0.1288 | 250.80 | 476.64 |
| Services | 0.2733 | 0.3044 | 1.0885 | 442.00 | 568.94 |

Table 8: Projected input-output table (values)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 20.69 | 36.83 | 10.12 | 42.00 | 109.64 |
| Manuf. and const. | 20.69 | 164.66 | 40.49 | 250.80 | 476.64 |
| Services | 16.55 | 78.00 | 32.40 | 442.00 | 568.94 |
| Labour | 51.72 | 197.15 | 485.93 | | 734.80 |
| Input | 109.64 | 476.64 | 568.94 | 734.80 | |

Table 9: Growth rates in %

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 3.4 | 8.3 | 1.2 | | 3.4 |
| Manuf. and const. | 3.4 | 8.3 | 1.2 | 10.0 | 8.3 |
| Services | 3.4 | 8.3 | 1.2 | | 1.2 |
| Labour | 3.4 | 8.3 | 1.2 | | 3.2 |
| Input | 3.4 | 8.3 | 1.2 | 3.2 | |

# Box 20.3 Price input-output model

## PHYSICAL INPUT-OUTPUT TABLES

Quantities and unit wage rates for labour are known.

Table 1: Input-output table (quantities)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 4.0 | 6.8 | 2.0 | 8.4 | 21.2 |
| Manuf. and const. | 10.0 | 76.0 | 20.0 | 114.0 | 220.0 |
| Services | 4.0 | 18.0 | 8.0 | 110.5 | 140.5 |
| Labour | 5.0 | 14.0 | 24.0 | | 43.0 |

Table 2: Prices

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | | | | | |
| Manuf. and const. | | | | | |
| Services | | | | | |
| Labour | 10.00 | 13.00 | 20.00 | | |

Table 3: Input-output table (values)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | | | | | |
| Manuf. and const. | | | | | |
| Services | | | | | |
| Labour | 50.00 | 182.00 | 480.00 | | |
| Input | | | | | |

Table 4: Input coefficients (quantities/quantities)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 0.1887 | 0.0309 | 0.0142 | | |
| Manuf. and const. | 0.4717 | 0.3455 | 0.1423 | | |
| Services | 0.1887 | 0.0818 | 0.0569 | | |
| Labour | 0.2358 | 0.0636 | 0.1708 | | |

Table 5: Transposed input coefficients intermediates

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 0.1887 | 0.4717 | 0.1887 | | |
| Manuf. and const. | 0.0309 | 0.3455 | 0.0818 | | |
| Services | 0.0142 | 0.1423 | 0.0569 | | |

Table 6: Transposed Leontief matrix

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 0.8113 | -0.4717 | -0.1887 | | |
| Manuf. and const. | -0.0309 | 0.6545 | -0.0818 | | |
| Services | -0.0142 | -0.1423 | 0.9431 | | |

**Assumption: Price of labour in industry increases by 10%**

Table 7: Price input-output model

| | Transposed inverse | | | Primary inputs v diag(q) | Product prices |
|---|---|---|---|---|---|
| Agriculture | 1.2764 | 0.9942 | 0.3416 | 2.3585 | 5.08 |
| Manuf. and const. | 0.0639 | 1.6069 | 0.1522 | 0.9100 | 2.13 |
| Services | 0.0289 | 0.2576 | 1.0885 | 3.4164 | 4.02 |

Table 8: Projected input-output table (values)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 20.33 | 34.56 | 10.16 | 42.69 | 107.74 |
| Manuf. and const. | 21.33 | 162.10 | 42.66 | 243.15 | 469.25 |
| Services | 16.09 | 72.38 | 32.17 | 444.35 | 564.99 |
| Labour | 50.00 | 200.20 | 480.00 | | 730.20 |
| Input | 107.74 | 469.25 | 564.99 | 730.20 | |

Table 9: Growth rates in %

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| Manuf. and const. | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 |
| Services | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Labour | 0.0 | 10.0 | 0.0 | | 2.6 |
| Input | 1.6 | 6.6 | 0.5 | 2.6 | |

## MONETARY INPUT-OUTPUT TABLES

Quantities, prices and values are known.

Table 1: Input-output table (quantities)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 4.0 | 6.8 | 2.0 | 8.4 | 21.2 |
| Manuf. and const. | 10.0 | 76.0 | 20.0 | 114.0 | 220.0 |
| Services | 4.0 | 18.0 | 8.0 | 110.5 | 140.5 |
| Labour | 5.0 | 14.0 | 24.0 | | 43.0 |

Table 2: Prices

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 5.00 | 5.00 | 5.00 | 5.00 | |
| Manuf. and const. | 2.00 | 2.00 | 2.00 | 2.00 | |
| Services | 4.00 | 4.00 | 4.00 | 4.00 | |
| Labour | 10.00 | 13.00 | 20.00 | | |

Table 3: Input-output table (values)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 20.00 | 34.00 | 10.00 | 42.00 | 106.00 |
| Manuf. and const. | 20.00 | 152.00 | 40.00 | 228.00 | 440.00 |
| Services | 16.00 | 72.00 | 32.00 | 442.00 | 562.00 |
| Labour | 50.00 | 182.00 | 480.00 | | 712.00 |
| Input | 106.00 | 440.00 | 562.00 | 712.00 | |

Table 4: Input coefficients (values/values)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 0.1887 | 0.0773 | 0.0178 | | |
| Manuf. and const. | 0.1887 | 0.3455 | 0.0712 | | |
| Services | 0.1509 | 0.1636 | 0.0569 | | |
| Labour | 0.4717 | 0.4136 | 0.8541 | | |

Table 5: Transposed input coefficients intermediates

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 0.1887 | 0.1887 | 0.1509 | | |
| Manuf. and const. | 0.0773 | 0.3455 | 0.1636 | | |
| Services | 0.0178 | 0.0712 | 0.0569 | | |

Table 6: Transposed Leontief matrix

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 0.8113 | -0.1887 | -0.1509 | | |
| Manuf. and const. | -0.0773 | 0.6545 | -0.1636 | | |
| Services | -0.0178 | -0.0712 | 0.9431 | | |

**Assumption: Price of labour in industry increases by 10%**

Table 7: Price input-output model

| | Transposed inverse | | | Primary inputs w | Product price indexes |
|---|---|---|---|---|---|
| Agriculture | 1.2764 | 0.3977 | 0.2733 | 0.4717 | 1.0164 |
| Manuf. and const. | 0.1597 | 1.6069 | 0.3044 | 0.4550 | 1.0665 |
| Services | 0.0361 | 0.1288 | 1.0885 | 0.8541 | 1.0053 |

Table 8: Projected input-output table (values)

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 20.33 | 34.56 | 10.16 | 42.69 | 107.74 |
| Manuf. and const. | 21.33 | 162.10 | 42.66 | 243.15 | 469.25 |
| Services | 16.09 | 72.38 | 32.17 | 444.35 | 564.99 |
| Labour | 50.00 | 200.20 | 480.00 | | 730.20 |
| Input | 107.74 | 469.25 | 564.99 | 730.20 | |

Table 9: Growth rates in %

| | Agricul-ture | Manuf. and const. | Services | Final use | Output |
|---|---|---|---|---|---|
| Agriculture | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| Manuf. and const. | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 |
| Services | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Labour | 0.0 | 10.0 | 0.0 | | 2.6 |
| Input | 1.6 | 6.6 | 0.5 | 2.6 | |

## H. Input-output models with input and output coefficients

20.67 The input-output models that are mainly used in empirical research are based on input coefficients and are generally called Leontief input-output models. There is, however, another family of input-output models which are based on output coefficients. These models were developed by Ambica K. Ghosh (Ghosh, 1958) and are often called Ghosh input-output models.

20.68 The use-side Leontief models reflect $x = Ax + f$, where $x$ is the output vector, $A$ the Leontief matrix of technical coefficients and $f$ the supply demand vector. The supply-side Ghosh models reflect $x'B + v' = x'$, where $B$ is the Ghosh allocation coefficients matrix and $v$ is the added value vector, the prime indicating the transposition operation. Both models may be used to study the impact of changes in final use and primary inputs on output, and also price and cost effects. The dual character of Leontief models and Ghosh models is discussed in Oosterhaven (1996), Dietzenbacher (1997), de Mesnard (2009) and Rueda-Cantuche (2011). Input-output models may also be used to estimate the forward and backward linkages of industries. The input coefficients reflect production functions and cost structures of activities, whereas the output coefficients reflect distribution parameters for products and primary inputs reflecting market shares and sales structure.

20.69 The use of input coefficients and output coefficients in input-output analysis is demonstrated for the four basic input-output models with input and output coefficients. The four input-output models have a dual character with an underlying symmetry. Each input-output model with input coefficients has a complement with output coefficients. Leontief and Ghosh models are similar but opposite in structure, almost mirror images of one another. Leontief models use fixed input coefficients, while Ghosh models rely on fixed output coefficients. The four models may be summarized as follows:

- The Leontief quantity model is a use-driven model which is often used to study the impact of an exogenous change of final uses on output. It is based on the accounting identities for total output along the rows of IOTs and uses fixed intermediate and primary input coefficients.
- The Leontief price model is sometimes also called the "cost-push input-output price model" and allows the simulation of cost-driven inflationary processes by simulating the impact of price changes of primary inputs on product prices (inflation). The primary input prices are assumed to be exogenous, whereas the prices for outputs are determined by the solution of the model.
- The traditional Ghosh quantity model was formulated as a supply-driven model and was developed to study the impact of an increase in primary inputs on output and final use. The Ghosh quantity model starts with the accounting identities for total input along the columns of an IOT. Instead of exogenous final use, the Ghosh quantity model has exogenous primary inputs and produces a solution for endogenous total inputs. Final use forms a residual and is

taken as granted. The input ratios for intermediate consumption vary arbitrarily and essential production requirements are ignored.

- The traditional Ghosh price model was designed as a demand-driven price model. The single price for each column of final use is exogenous and the prices for intermediate consumption and primary inputs are endogenous variables. The model describes the cumulative effects of changes in final output prices on unit revenues per industry and prices of primary inputs such as labour and the use of capital. If the price of a specific product of final use is increasing, then the price for all inputs of an industry would increase at the same rate causing an unusual impact on inflation.

20.70 The outcome of the traditional Ghosh models, by comparison with Leontief models, is difficult to interpret in economic terms, and this has given rise to many disagreements. In response to the criticism levelled against Ghosh models and to remedy their implausibility, Dietzenbacher (1997) proposed an alternative interpretation by suggesting that the model be viewed, not as a quantity model, but as a price model, following Miller and Blair (2009, p. 551). De Mesnard (2009, pp. 364 and 370) also showed that the so-called equation of the Ghosh model ($x'B + v' = x'$) is actually that of the Ghosh model in physical terms, hence it cannot be compared to the equation of the Leontief model ($x = Ax + f$).

20.71 It remains to be seen in empirical research whether the input coefficients or output coefficients are more stable over time and behave according to expectations. It is easy to understand, however, why input-output models with output coefficients are rarely used in empirical research, since they lack a proper microeconomic foundation. Input-output models with input coefficients are well established in economic analysis. At best, such models reflect the cost structure of industries and the input structure of final use components. At the same time, it is the rigidity of the underlying Leontief production functions which poses an obstacle to many applications.

## I. Central model of input-output analysis

20.72 Input-output analysis has often been used to study the impact of final use on output (quantity model) and value added changes on prices (price model). Appropriate extensions of the input-output system also allow evaluation of the direct and indirect impact of economic policies on other economic variables, such as labour, capital, energy and emissions (joint product). Most of these policy issues, such as labour policy, structural policy and fiscal policy, must be analysed with macroeconomic models which provide a minimum of industrial and product disaggregation.

20.73 The following extension of the input-output equation system offers multiple approaches for analysis:

Central equation of input-output analysis:

(41) $Z = D(I - A)^{-1}\hat{Y}$

$D$ = matrix of input coefficients for specific variable in economic analysis (intermediate consumption, labour, capital, energy, etc.)

$I$ = unit matrix

$A$ = matrix of input coefficients for intermediate consumption

$\hat{Y}$ = diagonal matrix for final use

$Z$ = matrix with results for direct and indirect requirements (intermediates, labour, capital, energy, emissions, etc.)

20.74 Matrix $D$ includes the input coefficients of the variable under investigation (intermediates, labour, capital, energy, emissions, and others). The diagonal matrix $\hat{Y}$ denotes exogenous final use for goods and services. The matrix $Z$ incorporates the results for the direct and indirect requirements (intermediates, labour, capital, energy) or joint outputs (emissions) for the produced goods and services of final use.

20.75 In essence, this approach makes it possible to assess the total (direct and indirect) primary energy requirements or carbon dioxide emissions in the production of a vehicle occurring at all stages of production, up to the provision of the product (vehicle) to a final user. It should be noted that this approach focuses on domestic emissions only and not the total emissions. The part constituted by emissions related to imported products is missing and these can be taken on board by using total IOTs instead of the domestic part only and applying domestic technology assumptions.

20.76 Corresponding calculations of the labour and capital content of products are also feasible with this equation. Direct contributions of final users (for example, direct emissions of carbon dioxide by private households) must be added as column vectors to the results of matrix $Z$ to account for the total emissions of final use.

20.77 This type of analysis is based on the restrictive assumptions of input-output models. Although these assumptions could be viewed as weakly based, this input-output analysis at least offers opportunities to assess the magnitude of the expected effects in the short term, through the allocation of responsibility for emissions to final use by linking final use products and emissions of industries. In Table 20.9, a corresponding calculation is presented for the emission of three disposals to nature, namely the gases carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$). The variable at the bottom of Table 20.9 also reflects the direct emissions of private households.

# Table 20.9 Emission model

| | | Products | | | | | | Final use | | | | | Total output at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agriculture | Manufacturing | Construction | Trade, trans.and comm. | Finance and business | Other services | Final consumption: Households | Final consumption: Government | Gross fixed capital | Changes in inventories | Exports | |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| | | Direct emissions (1000 tons) | | | | | | | | | | | |
| Carbon dioxide ($CO_2$) | (1) | 9 260 | 550 893 | 9 162 | 80 990 | 12 077 | 24 173 | 222 268 | | | | | 908 823 |
| Methane ($CH_4$) | (2) | 1 247 | 925 | 1 | 49 | 3 | 10 | 79 | | | | | 2 313 |
| Nitrous oxide ($N_2O$) | (3) | 137 | 62 | | 2 | | | 4 | | | | | 206 |
| | | Output (Billions euros) | | | | | | | | | | | |
| Output at basic prices | (4) | 42 | 1 451 | 234 | 907 | 1 010 | 721 | | | | | | |
| | | Emission coefficients (1000 tons per billions euros) | | | | | | | | | | | |
| Carbon dioxide ($CO_2$) | (5) | 219.813 | 379.615 | 39.115 | 89.336 | 11.957 | 33.541 | | | | | | |
| Methane ($CH_4$) | (6) | 29.609 | 0.637 | 0.004 | 0.054 | 0.003 | 0.014 | | | | | | |
| Nitrous oxide ($N_2O$) | (7) | 3.257 | 0.043 | 0.001 | 0.002 | 0.000 | 0.000 | | | | | | |
| | | Inverse $(I-A)^{-1}$ | | | | | | | | | | | |
| Agriculture | (8) | 1.0786 | 0.0211 | 0.0050 | 0.0024 | 0.0008 | 0.0021 | | | | | | |
| Manufacturing | (9) | 0.2801 | 1.4040 | 0.3273 | 0.1207 | 0.0411 | 0.0776 | | | | | | |
| Construction | (10) | 0.0383 | 0.0207 | 1.0935 | 0.0214 | 0.0429 | 0.0217 | | | | | | |
| Trade, transport and comm. | (11) | 0.1650 | 0.1838 | 0.1548 | 1.2805 | 0.0757 | 0.0920 | | | | | | |
| Finance and business services | (12) | 0.2834 | 0.2155 | 0.2615 | 0.2578 | 1.3775 | 0.1339 | | | | | | |
| Other services | (13) | 0.0225 | 0.0252 | 0.0273 | 0.0246 | 0.0267 | 1.0756 | | | | | | |
| | | Direct and indirect emissions per unit of output $B(I-A)^{-1}$ | | | | | | | | | | | |
| Carbon dioxide ($CO_2$) | (14) | 363.803 | 558.261 | 186.001 | 165.476 | 41.586 | 76.668 | | | | | | |
| Methane ($CH_4$) | (15) | 32.126 | 1.530 | 0.371 | 0.219 | 0.059 | 0.132 | | | | | | |
| Nitrous oxide ($N_2O$) | (16) | 3.526 | 0.129 | 0.031 | 0.016 | 0.005 | 0.011 | | | | | | |
| | | Diagonal matrix of final demand Y | | | | | | | | | | | |
| Agriculture | (17) | 18.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | | | | |
| Manufacturing | (18) | 0.000 | 904.835 | 0.000 | 0.000 | 0.000 | 0.000 | | | | | | |
| Construction | (19) | 0.000 | 0.000 | 158.546 | 0.000 | 0.000 | 0.000 | | | | | | |
| Trade, transport and comm. | (20) | 0.000 | 0.000 | 0.000 | 487.822 | 0.000 | 0.000 | | | | | | |
| Finance and business services | (21) | 0.000 | 0.000 | 0.000 | 0.000 | 405.957 | 0.000 | | | | | | |
| Other services | (22) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 623.171 | | | | | | |
| | | Emission content of final demand (1000 tons) $Z = B(I-A)^{-1}Y + Eh$ | | | | | | | | | | | |
| Carbon dioxide ($CO_2$) | (23) | 6 550 | 505 134 | 29 490 | 80 723 | 16 882 | 47 777 | 222 268 | | | | | 908 823 |
| Methane ($CH_4$ ) | (24) | 578 | 1 384 | 59 | 107 | 24 | 82 | 79 | | | | | 2 313 |
| Nitrous oxide ($N_2O$) | (25) | 63 | 117 | 5 | 8 | 2 | 7 | 4 | | | | | 206 |

Germany 2009

20.78 In Table 20.9, the actual direct emissions (rows (1)–(3)) and total output levels of production (row (4)) are reported. In rows (5)–(7) the corresponding emission coefficients have been calculated. The lowest carbon dioxide emission coefficient, 11.957 (1,000 tons of emissions per 1 billion euros), is reported for "Business services" in column (5). The results in row (14) reveal, however, that the inclusion of indirect emissions results in a higher value of emission coefficient, 41.586, for "Business services". The estimates in column (5) and row (14) include all direct and indirect emissions of carbon dioxide which can be related to the production of one unit of output of "Business services" at all stages of production.

20.79 As shown in row (17) of Table 20.9, the industry "Agriculture" is delivering goods and services in the magnitude of 18.003 billion euros for final use. The calculation reveals that, in the course of production, 6.550 million tons of carbon dioxide have been emitted in Germany across all stages of production, up to the provision of these agricultural products to final use.

20.80 The industry "Manufacturing" has the largest emissions at this level of aggregation and it includes mining and electricity. This industry is directly responsible for the emission of 550.893 million tons of carbon dioxide in own plants, as shown in row (1) of Table 20.9. In terms of the number of tons of carbon dioxide emitted on all stages of production to produce manufactured goods for final use (904.825 billion euros), 505.134 million tons of carbon dioxide emissions may be attributed to products of manufacturing for final use. A corresponding interpretation of the results is valid for all industries of the economy. This approach makes possible the reallocation of the emissions of carbon dioxide to the products purchased by final use. Again, it should be noted that this approach applies only to emissions on domestic territory and not to emissions released during production of imported products used in the production processes.

20.81 The total emissions of carbon dioxide are reported in column (12) of Table 20.9 with 908.823 million tons for the economy. Column (7) of Table 20.9 shows that household consumption is responsible for the direct emission of 222.268 million tons of carbon dioxide. The results in the last part of Table 20.9 include estimates for emissions attributed to final use categories. The direct emissions of household consumption must be added as a separate column vector to the matrix $Z$ to attain the national emission total of 908.823 million tons of carbon dioxide, as shown in row (23) in Table 20.9.

20.82 This example demonstrates how extended input-output based systems may be used effectively to evaluate environmental policies. This tool will enable analyses of whether national emissions reduction targets are met and how they comply with the Kyoto Agreement and the targets of the Intergovernmental Panel on Climate Change. At the same time, the same database can be used for other important fields of economic analysis, such as the impact of employment policies, substitution of labour and capital, productivity analysis, energy issues, environmental problems or structural policies.

## J. Indicators

20.83 In general, in the neo-classical microeconomic approach, it is assumed that the production function relates the amount of inputs used by an industry to the maximum amount that can be produced by that industry with its primary inputs.

Production function:

(42) $x_j = f\left(x_{ij}, L_j, C_j\right)$

$x_j$ = output of industry $j$ (products)

$x_{ij}$ = inter-industry flow (goods, services) from sector $i$ to sector $j$ (intermediate consumption)

$L_j$ = labour requirements of sector $j$

$C_j$ = capital requirements of sector $j$

$f$ = technology

20.84 In input-output analysis, a fundamental assumption is that for a given period the inter-industry flows of products ($x_{ij}$) from industry $i$ to industry $j$ and primary inputs ($L, C$) depend on the total output of industry $j$ ($x_j$). If constant returns to scale and fixed relations of all inputs are assumed, then a set of technical input coefficients that reflect the technology can be produced. In most production processes, different products are produced but different labour skills and different types of capital goods are also required. Accordingly, the set of input coefficients in a broader notation of the matrix $A$ encompasses input coefficients for products (intermediate consumption), capital and labour (primary inputs).

Technical input coefficients:

(43) $a_{ij} = z_{ij}/x_j$

$a_{ij}$ = input coefficient

$z_{ij}$ = input of type $i$ in sector $j$ (products, capital, labour)

$x_j$ = output of sector $j$ (product)

20.85 Using the definitions of the technical input coefficients, the production can be specified in the following form:

Leontief production function:

(44) $x_j = \min(z_{1j}/a_{1j}, z_{2j}/a_{2j}, \dots, z_{nj}/a_{nj})$

20.86 A number of input variables for various branches have been summarized in Table 20.10. These represent input requirements for products (intermediate consumption), labour, capital and energy. The following set of coefficients for emissions has a different character. In each production activity and each consumption activity, certain pollutants are emitted as joint products (disposals to nature). The corresponding emission coefficients for carbon dioxide and nitrous oxide are summarized using international standard weights to identify the impact on global warming and acid deposition.

# Table 20.10 Input indicators for production activities per unit of output

| | | Products | | | | | |
|---|---|---|---|---|---|---|---|
| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services |
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| | | **Intermediate consumption (billion euros)** | | | | | |
| Domestic goods and services | (1) | 0.497 | 0.492 | 0.496 | 0.421 | 0.352 | 0.248 |
| Imported goods and services | (2) | 0.109 | 0.195 | 0.074 | 0.064 | 0.030 | 0.029 |
| Intermediate consumption | (3) | 0.607 | 0.687 | 0.569 | 0.485 | 0.382 | 0.277 |
| | | **Taxes less subsidies on products (billion euros)** | | | | | |
| Taxes less subsidies on products | (4) | 0.036 | 0.007 | 0.008 | 0.013 | 0.016 | 0.034 |
| | | **Value added (billion euros)** | | | | | |
| Compensation of employees | (5) | 0.134 | 0.212 | 0.294 | 0.325 | 0.189 | 0.505 |
| Other net taxes on production | (6) | -0.141 | -0.002 | -0.001 | -0.001 | 0.004 | -0.010 |
| Consumption of fixed capital | (7) | 0.189 | 0.054 | 0.022 | 0.066 | 0.158 | 0.088 |
| Operating surplus, net | (8) | 0.174 | 0.041 | 0.108 | 0.111 | 0.250 | 0.106 |
| Value added at basic prices | (9) | 0.357 | 0.306 | 0.423 | 0.501 | 0.602 | 0.689 |
| | | **Gross fixed capital formation (billion euros)** | | | | | |
| Machinery | (10) | 0.052 | 0.014 | 0.007 | 0.021 | 0.081 | 0.040 |
| Buildings | (11) | 0.125 | 0.033 | 0.017 | 0.050 | 0.115 | 0.051 |
| Total | (12) | 0.177 | 0.047 | 0.023 | 0.070 | 0.196 | 0.090 |
| | | **Capital stock (billion euros)** | | | | | |
| Machinery | (13) | 3.963 | 0.716 | 0.348 | 0.857 | 6.929 | 3.112 |
| Buildings | (14) | 2.466 | 0.445 | 0.216 | 0.533 | 0.527 | 0.335 |
| Total | (15) | 6.430 | 1.161 | 0.564 | 1.391 | 7.456 | 3.446 |
| | | **Employment (Persons)** | | | | | |
| Wage and salary earners | (16) | 7,002 | 4,677 | 8,317 | 10,833 | 5,637 | 15,757 |
| Self-employed | (17) | 8,522 | 189 | 1,977 | 1,431 | 1,007 | 1,469 |
| Total | (18) | 15,524 | 4,866 | 10,293 | 12,264 | 6,643 | 17,227 |
| | | **Energy (Petajoule)** | | | | | |
| Coal and coal products | (19) | 0.009 | 1.181 | 0.002 | 0.001 | 0.000 | 0.008 |
| Brown coals and lignite products | (20) | 0.002 | 1.114 | 0.001 | 0.000 | 0.000 | 0.001 |
| Crude oil | (21) | | 2.959 | | | | |
| Gasolines | (22) | 0.083 | 0.063 | 0.019 | 0.028 | 0.020 | 0.021 |
| Diesel fuels | (23) | 2.525 | 0.084 | 0.338 | 0.525 | 0.092 | 0.103 |
| Jet fuels | (24) | | | | 0.478 | | 0.005 |
| Heating oil, light | (25) | 0.582 | 0.130 | 0.060 | 0.096 | 0.026 | 0.118 |
| Fuel oil, heavy | (26) | | 0.231 | | 0.019 | 0.000 | 0.000 |
| Other petroleum products | (27) | 0.043 | 0.820 | 0.433 | 0.039 | 0.002 | 0.004 |
| Natural gas and other gases | (28) | 0.291 | 1.238 | 0.050 | 0.138 | 0.049 | 0.256 |
| Renewable Energy | (29) | 0.142 | 0.812 | 0.019 | 0.050 | 0.007 | 0.008 |
| Electric power and other energy | (30) | 0.542 | 1.820 | 0.058 | 0.319 | 0.075 | 0.273 |
| Total | (31) | 4.220 | 10.452 | 0.980 | 1.694 | 0.270 | 0.797 |
| | | **Emissions (1000 tons)** | | | | | |
| Carbon dioxide ($CO_2$) | (32) | 219.813 | 379.615 | 39.115 | 89.336 | 11.957 | 33.541 |
| Methane ($CH_4$) | (33) | 29.609 | 0.637 | 0.004 | 0.054 | 0.003 | 0.014 |
| Nitrous oxide ($N_2O$) | (34) | 3.257 | 0.043 | 0.001 | 0.002 | 0.000 | 0.000 |
| Nitrogen oxides (NOx) | (35) | 3.624 | 0.371 | 0.195 | 0.440 | 0.033 | 0.062 |
| Sulfur dioxide ($SO_2$) | (36) | 0.064 | 0.257 | 0.005 | 0.045 | 0.002 | 0.011 |
| Organic compounds (NMVOC) | (37) | 0.313 | 0.395 | 0.024 | 0.044 | 0.003 | 0.010 |
| Ammonia ($NH_3$) | (38) | 12.835 | 0.011 | 0.001 | 0.003 | 0.000 | 0.001 |
| Particulate matter ($PM_{10}$) | (39) | 1.125 | 0.029 | 0.029 | 0.047 | 0.002 | 0.004 |
| Hydroflurocarbons (HFC) | (40) | | 0.008 | | | | 0.001 |
| Perflurorocarbons (PFC) | (41) | | 0.000 | | | | |
| Sulfur hexafluoride ($SF_6$) | (42) | | 0.000 | | | | |
| Total | (43) | 270.640 | 381.366 | 39.373 | 89.969 | 11.999 | 33.642 |
| | | **Global warming and acid deposition (1000 tons)** | | | | | |
| Greenhouse gases | (44) | 1851.272 | 406.193 | 39.412 | 91.233 | 12.074 | 33.971 |
| Acid deposition | (45) | 2.600 | 0.516 | 0.141 | 0.352 | 0.025 | 0.054 |
| Tropospheric ozone formation | (46) | 33.545 | 1.403 | 0.223 | 0.537 | 0.038 | 0.085 |
| | | **Waste, sewage and water** | | | | | |
| Waste (1000 tons) | (47) | 19.073 | 84.654 | 828.662 | 5.455 | 5.455 | 5.455 |
| Sewage (million cu m) | (48) | 0.504 | 18.585 | 0.161 | 0.191 | 0.191 | 0.191 |
| Water from waterworks (million cu m) | (49) | 3.228 | -2.567 | 0.058 | 0.214 | 0.214 | 0.214 |
| Water from nature (million cu m) | (50) | 7.200 | 25.915 | 0.105 | 0.010 | 0.010 | 0.010 |

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## K. Multipliers

20.87 Three of the most frequently used types of multipliers in input-output analysis are those that estimate the effects of the exogenous changes of final use on:

- Outputs of the industries (and products) in the economy
- GVA and income earned by the households
- Employment, that is expected to be generated by the new activity levels

20.88 In the standard input-output model, the final use categories are considered exogenous variables. In many respects, however, household final consumption expenditure and gross fixed capital formation depend on the income of private households (and businesses). In the type I multiplier analysis, household final consumption expenditure and, consequently, private household activities are exogenous. A more refined type II multiplier analysis for wages and private consumption is designed to include the household sector as an endogenous activity. It is assumed that, to a large extent, the income earned by private households from wages and salaries is spent as household final consumption expenditure. This additional income induces higher incomes, which again induce more household final consumption expenditure until a new equilibrium is reached.

20.89 Box 20.4 provides analysis of the type I and type II multiplier links for the output multiplier, income multiplier and employment multiplier to the input-output model.

### 1. Output multipliers

20.90 An output multiplier for an industry *j* is defined as the total value of production in all industries of the economy that is necessary for all stages of production in order to produce one unit of product *j* for final use. The output multiplier in Table 20.11 corresponds to the column sum of the Leontief inverse as shown in Table 20.6.

**Table 20.11 Output multipliers (Leontief inverse)**

| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services |
|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| Agriculture | (1) | 1.0786 | 0.0211 | 0.0050 | 0.0024 | 0.0008 | 0.0021 |
| Manufacturing | (2) | 0.2801 | 1.4040 | 0.3273 | 0.1207 | 0.0411 | 0.0776 |
| Construction | (3) | 0.0383 | 0.0207 | 1.0935 | 0.0214 | 0.0429 | 0.0217 |
| Trade, transport and comm. | (4) | 0.1650 | 0.1838 | 0.1548 | 1.2805 | 0.0757 | 0.0920 |
| Finance and business services | (5) | 0.2834 | 0.2155 | 0.2615 | 0.2578 | 1.3775 | 0.1339 |
| Other services | (6) | 0.0225 | 0.0252 | 0.0273 | 0.0246 | 0.0267 | 1.0756 |
| Total | (7) | 1.8679 | 1.8704 | 1.8695 | 1.7074 | 1.5648 | 1.4029 |

20.91 If a government agency, for example, wished to determine in which industry of the economy to spend additional money, a comparison of output multipliers would indicate where this spending would have the greatest impact in terms of the total value of output generated throughout the economy. In this case, it would be the industry "Manufacturing", with an output multiplier of $O_4 = 1.8704$. If the elements of the inverse $(I - A)^{-1}$ are represented as $\alpha_{ij}$ , then the output multiplier may be defined as:

Output multiplier:

(45) $O_j = \sum_{i=1}^{n} \alpha_{ij}$

20.92 The output multiplier in row (7) of Table 20.11 represents for each industry one unit of final use (1.0) and the direct and indirect requirements for domestic intermediate consumption, for example, for agriculture, 0.8679. Multipliers of this sort may overstate or understate the effect on the economy, for example, if some industries are operating at capacity and a process of substitution with imported inputs could take place. Another critical element is the internal consumption of an industry on the diagonal of its own products.

20.93 Depending upon the statistical sources, the aggregation of survey results may have a distinct influence on the magnitude of the reported internal consumption.

## 2. Income multipliers

20.94 Income multipliers attempt to identify the impacts of final use changes on income received by households (labour supply). The central equation (41) of the input-output models is used to calculate the direct and indirect requirements for wages which are incorporated in one unit of output for final use. This calculation is equivalent to an assessment of the wage content of products.

Direct and indirect requirements for wages:

(46) $Z = B(I - A)^{-1}$

$B$ = vector of input coefficients for wages

$I$ = unit matrix

$A$ = matrix of input coefficients for intermediate consumption

$Z$ = vector with results for direct and indirect requirements for wages

## Box 20.4 Multipliers in the input-output model

The type I and type II multiplier links for the output multiplier, income multiplier and employment multiplier to the input-output model are shown below.

Input-output table — Billion euros

| Products | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business | Other services | Final use: Final consumption: Households | Final use: Final consumption: Government | Gross fixed capital formation | Changes in inventories | Exports | Output |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Agriculture | (1) | 3 | 20 | | | | 1 | 9 | | | 3 | 5 | 42 |
| Manufacturing | (2) | 7 | 394 | 48 | 56 | 11 | 30 | 250 | 7 | 95 | - 58 | 611 | 1 451 |
| Construction | (3) | 1 | 11 | 18 | 8 | 28 | 10 | 5 | | 153 | | 1 | 234 |
| Trade, transport and comm. | (4) | 4 | 139 | 17 | 181 | 38 | 40 | 317 | 15 | 39 | 6 | 111 | 907 |
| Finance and business services | (5) | 6 | 131 | 30 | 124 | 261 | 51 | 313 | 3 | 25 | | 66 | 1 010 |
| Other services | (6) | | 18 | 3 | 12 | 17 | 47 | 147 | 472 | 2 | | 2 | 721 |
| Total at basic prices | (7) | 21 | 713 | 116 | 382 | 355 | 179 | 1 041 | 497 | 314 | - 49 | 795 | 4 365 |
| Imports | (8) | 5 | 283 | 17 | 58 | 31 | 21 | 128 | 9 | 61 | 31 | 189 | 833 |
| Taxes less subsidies on products | (9) | 2 | 10 | 2 | 12 | 17 | 24 | 151 | 6 | 34 | | | 257 |
| Total at purchasers' prices | (10) | 27 | 1 007 | 135 | 452 | 402 | 224 | 1 319 | 513 | 409 | - 18 | 984 | 5 455 |
| Compensation of employees | (11) | 6 | 308 | 69 | 294 | 191 | 364 | | | | | | 1 232 |
| Other taxes less subsidies on production | (12) | - 6 | - 2 | | - 1 | 5 | - 7 | | | | | | - 12 |
| Consumption of fixed capital | (13) | 8 | 79 | 5 | 60 | 160 | 63 | | | | | | 375 |
| Net operating surplus | (14) | 7 | 60 | 25 | 101 | 252 | 77 | | | | | | 523 |
| GVA | (15) | 15 | 445 | 99 | 454 | 608 | 497 | | | | | | 2 117 |
| Input | (16) | 42 | 1 451 | 234 | 907 | 1 010 | 721 | 1 319 | 513 | 409 | - 18 | 984 | |

Employment — 1000 Persons

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Employment | (17) | 654 | 7 062 | 2 411 | 11 118 | 6 710 | 12 415 | 40 370 |

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Empty cells

**Type I multiplier analysis**
with exogenous final demand

Input coefficients (A)

| | | | | | |
|---|---|---|---|---|---|
| 0.0692 | 0.0139 | 0.0000 | 0.0004 | 0.0001 | 0.0008 |
| 0.1686 | 0.2716 | 0.2048 | 0.0619 | 0.0110 | 0.0414 |
| 0.0219 | 0.0077 | 0.0749 | 0.0088 | 0.0278 | 0.0139 |
| 0.0838 | 0.0956 | 0.0739 | 0.2000 | 0.0377 | 0.0552 |
| 0.1443 | 0.0906 | 0.1284 | 0.1370 | 0.2584 | 0.0712 |
| 0.0095 | 0.0122 | 0.0138 | 0.0132 | 0.0166 | 0.0659 |

Leontief inverse $(I-A)^{-1}$

| | | | | | |
|---|---|---|---|---|---|
| 1.0786 | 0.0211 | 0.0050 | 0.0024 | 0.0008 | 0.0021 |
| 0.2801 | 1.4040 | 0.3273 | 0.1207 | 0.0411 | 0.0776 |
| 0.0383 | 0.0207 | 1.0935 | 0.0214 | 0.0429 | 0.0217 |
| 0.1650 | 0.1838 | 0.1548 | 1.2805 | 0.0757 | 0.0920 |
| 0.2834 | 0.2155 | 0.2615 | 0.2578 | 1.3775 | 0.1339 |
| 0.0225 | 0.0252 | 0.0273 | 0.0246 | 0.0267 | 1.0756 |

**Type II multiplier analysis**
with endogenous households consumption and labour income

Input coefficients (A)

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.0692 | 0.0139 | 0.0000 | 0.0004 | 0.0001 | 0.0008 | 0.0071 |
| 0.1686 | 0.2716 | 0.2048 | 0.0619 | 0.0110 | 0.0414 | 0.1894 |
| 0.0219 | 0.0077 | 0.0749 | 0.0088 | 0.0278 | 0.0139 | 0.0035 |
| 0.0838 | 0.0956 | 0.0739 | 0.2000 | 0.0377 | 0.0552 | 0.2407 |
| 0.1443 | 0.0906 | 0.1284 | 0.1370 | 0.2584 | 0.0712 | 0.2370 |
| 0.0095 | 0.0122 | 0.0138 | 0.0132 | 0.0166 | 0.0659 | 0.1113 |
| 0.1342 | 0.2122 | 0.2939 | 0.3248 | 0.1893 | 0.5055 | 0.0000 |

Leontief inverse $(I-A)^{-1}$

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.0852 | 0.0293 | 0.0149 | 0.0124 | 0.0071 | 0.0142 | 0.0195 |
| 0.4430 | 1.6090 | 0.5737 | 0.3691 | 0.1974 | 0.3811 | 0.4879 |
| 0.0516 | 0.0374 | 1.1136 | 0.0416 | 0.0557 | 0.0464 | 0.0398 |
| 0.3570 | 0.4254 | 0.4453 | 1.5733 | 0.2599 | 0.4496 | 0.5750 |
| 0.5138 | 0.5053 | 0.6098 | 0.6091 | 1.5984 | 0.5628 | 0.6896 |
| 0.0931 | 0.1140 | 0.1341 | 0.1322 | 0.0944 | 1.2070 | 0.2113 |
| 0.5151 | 0.6479 | 0.7788 | 0.7854 | 0.4939 | 0.9591 | 1.5419 |

**Output multiplier**

The output multiplier for sector j is defined as the total value of production in all sectors of the economy that is necessary to produce one dollar's worth of final demand of product j.

| Type I | | | | | | |
|---|---|---|---|---|---|---|
| Column sum of input coefficient for intermediates | | | | | | |
| 0.4974 | 0.4916 | 0.4958 | 0.4214 | 0.3516 | 0.2483 | |
| Output multiplier OM = column sum of Leontief inverse | | | | | | |
| 1.8679 | 1.8704 | 1.8695 | 1.7074 | 1.5648 | 1.4029 | |

| Type II | | | | | | |
|---|---|---|---|---|---|---|
| Column sum of input coefficient for intermediates | | | | | | |
| 0.6316 | 0.7038 | 0.7896 | 0.7461 | 0.5409 | 0.7538 | 0.7890 |
| Output multiplier OM = column sum of Leontief inverse | | | | | | |
| 3.0587 | 3.3683 | 3.6702 | 3.5232 | 2.7068 | 3.6203 | 3.5649 |

**Income multiplier**

The income multiplier for sector j is defined as the total value of all wages in all sectors of the economy that is necessary to produce one dollar's worth of final demand of product j.

| Type I | | | | | | |
|---|---|---|---|---|---|---|
| Input coefficient for compensation of employees w | | | | | | |
| 0.1342 | 0.2122 | 0.2939 | 0.3248 | 0.1893 | 0.5055 | |
| Income multiplier IM = $w(I-A)^{-1}$ | | | | | | |
| 0.3340 | 0.4202 | 0.5051 | 0.5093 | 0.3203 | 0.6220 | |

| Type II | | | | | | |
|---|---|---|---|---|---|---|
| Input coefficient for compensation of employees w | | | | | | |
| 0.1342 | 0.2122 | 0.2939 | 0.3248 | 0.1893 | 0.5055 | 0.0000 |
| Income multiplier IM = $w(I-A)^{-1}$ | | | | | | |
| 0.5151 | 0.6479 | 0.7788 | 0.7854 | 0.4939 | 0.9591 | 0.5419 |

**Employment multiplier**

The employment multiplier for sector j is defned as the total number of persons employed in all sectors of the economy that is necessary to produce one million dollar's worth of final demand of product j.

| Type I | | | | | | |
|---|---|---|---|---|---|---|
| Input coefficient for employment m | | | | | | |
| 15.524 | 4.866 | 10.293 | 12.264 | 6.643 | 17.227 | |
| Employment multiplier EM = $m(I-A)^{-1}$ | | | | | | |
| 22.796 | 11.494 | 17.034 | 18.686 | 11.194 | 21.180 | |

| Type II | | | | | | |
|---|---|---|---|---|---|---|
| Input coefficient for employment m | | | | | | |
| 15.524 | 4.866 | 10.293 | 12.264 | 6.643 | 17.227 | 0.000 |
| Employment multiplier EM = $m(I-A)^{-1}$ | | | | | | |
| 28.928 | 19.208 | 26.307 | 28.037 | 17.076 | 32.599 | 18.359 |

20.95 In Table 20.12, various multipliers are summarized for products which are delivered to final use. In our numerical example, the industry "Agriculture" has a relatively small direct input coefficient for wages, as exemplified by $b_1 = 0.134$ in Table 20.10, reflecting that a significant proportion of the working population in agriculture is self-employed.

# Table 20.12 Multipliers for products

| | | Products: Agricul-ture (1) | Manufac-turing (2) | Construc-tion (3) | Trade, trans.and comm. (4) | Finance and business service (5) | Other services (6) |
|---|---|---|---|---|---|---|---|
| | | **Domestic production (billion euros/billion euros)** | | | | | |
| Final demand of domestic products | (1) | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Intermediate demand of domestic products | (2) | 0.868 | 0.870 | 0.870 | 0.707 | 0.565 | 0.403 |
| Imported products | (3) | 0.195 | 0.297 | 0.164 | 0.116 | 0.059 | 0.058 |
| Taxes less subsidies on products | (4) | 0.049 | 0.018 | 0.018 | 0.023 | 0.025 | 0.041 |
| Products at purchasers' prices | (5) | 1.112 | 1.185 | 1.051 | 0.847 | 0.649 | 0.501 |
| | | **Value added (billion euros/billion euros)** | | | | | |
| Compensation of employees | (6) | 0.334 | 0.420 | 0.505 | 0.509 | 0.320 | 0.622 |
| Other net taxes on production | (7) | -0.151 | -0.005 | -0.001 | -0.001 | 0.006 | -0.011 |
| Consumption of fixed capital | (8) | 0.278 | 0.129 | 0.096 | 0.135 | 0.228 | 0.127 |
| Operating surplus, net | (9) | 0.295 | 0.141 | 0.218 | 0.217 | 0.362 | 0.164 |
| Value added at basic prices | (10) | 0.756 | 0.686 | 0.818 | 0.861 | 0.916 | 0.902 |
| | | **Gross fixed capital formation (billion euros/billion euros)** | | | | | |
| Machinery | (11) | 0.088 | 0.043 | 0.038 | 0.050 | 0.115 | 0.057 |
| Buildings | (12) | 0.186 | 0.085 | 0.069 | 0.099 | 0.166 | 0.078 |
| Total | (13) | 0.274 | 0.128 | 0.107 | 0.149 | 0.281 | 0.135 |
| | | **Capital stock (billion euros/billion euros)** | | | | | |
| Machinery | (14) | 6.664 | 2.825 | 2.664 | 3.064 | 9.740 | 4.425 |
| Buildings | (15) | 3.038 | 0.902 | 0.624 | 0.891 | 0.805 | 0.524 |
| Total | (16) | 9.702 | 3.727 | 3.288 | 3.956 | 10.545 | 4.949 |
| | | **Employment (1000 persons/billion euros)** | | | | | |
| Wage and salary earners | (17) | 12.921 | 10.491 | 14.242 | 16.472 | 9.560 | 19.257 |
| Self-employed | (18) | 9.875 | 1.004 | 2.791 | 2.214 | 1.634 | 1.922 |
| Total | (19) | 22.796 | 11.494 | 17.034 | 18.686 | 11.194 | 21.180 |
| | | **Energy (Petajoule/billion euros)** | | | | | |
| Coal | (20) | 0.341 | 1.658 | 0.389 | 0.144 | 0.049 | 0.101 |
| Lignite | (21) | 0.314 | 1.564 | 0.365 | 0.135 | 0.046 | 0.087 |
| Crude oil | (22) | 0.829 | 4.154 | 0.968 | 0.357 | 0.122 | 0.230 |
| Natural gas | (23) | 0.118 | 0.100 | 0.052 | 0.050 | 0.034 | 0.033 |
| Nuclear fuels | (24) | 2.876 | 0.298 | 0.518 | 0.722 | 0.190 | 0.191 |
| Water power | (25) | 0.079 | 0.088 | 0.074 | 0.613 | 0.036 | 0.049 |
| Briquettes | (26) | 0.692 | 0.222 | 0.135 | 0.151 | 0.054 | 0.152 |
| Coke | (27) | 0.068 | 0.328 | 0.079 | 0.052 | 0.011 | 0.020 |
| Petroleum products | (28) | 0.300 | 1.169 | 0.749 | 0.159 | 0.058 | 0.081 |
| Electricity | (29) | 0.705 | 1.788 | 0.502 | 0.347 | 0.137 | 0.392 |
| Produced gas | (30) | 0.392 | 1.154 | 0.297 | 0.165 | 0.048 | 0.078 |
| Steam, hot water | (31) | 1.177 | 2.650 | 0.739 | 0.656 | 0.213 | 0.477 |
| Total | (32) | 7.891 | 15.173 | 4.869 | 3.550 | 0.997 | 1.891 |
| | | **Emissions (1000 tons/billion euros)** | | | | | |
| Carbon dioxide ($CO_2$) | (33) | 363.803 | 558.261 | 186.001 | 165.476 | 41.586 | 76.668 |
| Methane ($CH_4$) | (34) | 32.126 | 1.530 | 0.371 | 0.219 | 0.059 | 0.132 |
| Nitrous oxide ($N_2O$) | (35) | 3.526 | 0.129 | 0.031 | 0.016 | 0.005 | 0.011 |
| Sulfur dioxide ($SO_2$) | (36) | 4.103 | 0.690 | 0.431 | 0.630 | 0.107 | 0.152 |
| Nitrogen oxides ($NO_x$) | (37) | 0.149 | 0.371 | 0.097 | 0.089 | 0.017 | 0.036 |
| Carbon monoxide (CO) | (38) | 0.457 | 0.571 | 0.165 | 0.106 | 0.025 | 0.046 |
| Organic compounds (NMVOC) | (39) | 13.848 | 0.286 | 0.070 | 0.036 | 0.012 | 0.029 |
| Dust particles | (40) | 1.232 | 0.074 | 0.055 | 0.068 | 0.010 | 0.014 |
| Total | (41) | 0.002 | 0.011 | 0.003 | 0.001 | 0.000 | 0.001 |
| | | **Global warming and acid deposition (1000 tons/billion euros)** | | | | | |
| Greenhouse gases | (42) | 2,131.379 | 630.364 | 203.533 | 175.135 | 44.363 | 82.822 |
| Acid deposition | (43) | 3.021 | 0.854 | 0.399 | 0.531 | 0.091 | 0.143 |
| Tropospheric ozone formation | (44) | 36.686 | 2.791 | 0.966 | 0.956 | 0.190 | 0.331 |
| | | **Waste, sewage and water** | | | | | |
| Waste (1000 tons/billion euros) | (45) | 78.594 | 138.761 | 936.398 | 36.517 | 47.149 | 31.694 |
| Sewage (million cu m/billion euros) | (46) | 5.845 | 26.188 | 6.346 | 2.545 | 1.053 | 1.695 |
| Water from waterworks (million cu m/billion euros) | (47) | 2.866 | -3.444 | -0.665 | 0.034 | 0.216 | 0.087 |
| Water from nature (million cu m/billion euros) | (48) | 15.033 | 36.542 | 8.638 | 3.162 | 1.089 | 2.041 |

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20.96 If, however, we calculate the income multiplier for wages (direct and indirect wage requirements per unit of output) for this industry, $z_1 = 0.334$ as shown in Table 20.12, we can verify that the "wage content" of agricultural products is tripled. Thus, the intermediate consumption inputs of agriculture incorporate a significant amount of wages.

20.97 Similarly, the category "Other services" has the highest direct ($b_6 = 0.505$) and direct and indirect ($z_6 = 0.622$) wage requirements. This general approach makes it possible to assess the wage, labour, capital or energy content of the various components of final use.

### 3. Employment multipliers

20.98 When employment multipliers are calculated, the major difference in the calculation of the wage content of products is that the physical labour input coefficients are used instead of monetary labour input coefficients.

Direct and indirect requirements for labour:

(47) $Z = E(I - A)^{-1}$

$E$ = matrix of input coefficients for labour (1,000 persons per billion euros of output)

$Z$ = matrix with results for direct and indirect requirements for labour (persons)

20.99 For each industry, the employment multipliers represent jobs created per unit of currency of additional final use. The labour-intensive industry "Agriculture" has the highest employment multiplier, $z_1 = 22.796$. If the final use for agricultural products were increased by 1 billion euros, $22{,}796$ positions (wage and salary earners and self-employed) would be created in this industry. However, the largest difference between direct employment coefficients and employment multipliers (direct and indirect employment) is observed in "Manufacturing".

### 4. Capital multipliers

20.100 The satellite systems shown in table 19.3 include information on labour and capital, which is required for the production of the various industries. The matrix for labour distinguishes between wage and salary earners and the self-employed, in separate rows, while the matrix for capital stock provides data for machinery and buildings. This database makes it possible to assess the labour and capital content of products and also the direct and indirect substitution of labour and capital, provided that a time series of IOTs with the corresponding satellite systems is available.

20.101 Monetary input coefficients for capital are used to calculate the capital content of products using the following equation:

Direct and indirect requirements for capital:

(48) $Z = C(I - A)^{-1}$

$\mathrm{C}$ = matrix of input coefficients for capital requirements per unit of output

$\mathrm{Z} =$ matrix with results for direct and indirect requirements of capital

20.102 The calculation reveals that the highest capital multiplier (capital intensity) is for "Business services". The direct capital requirements in this industry are $c_1 = 7.456$, as shown in Table 20.10.

20.103 The capital multipliers in Table 20.12 reflect the direct and indirect capital requirements at all stages of production. To produce 1 million euros of "Business services" for final use, 10.545 billions of Euros capital (buildings, machinery) are required ($z_1 = 10.545$) at all stages of production.

## 5. Primary input content of final use

20.104 The multipliers enable assessment of the primary input content of final use by product and by category. The results are presented in Table 20.13 for the primary input content of final use by category.

20.105 For the various products of final use, the multipliers for primary inputs $B(I-A)^{-1}$ are multiplied with a diagonal matrix of final use total for products.

Direct and indirect requirements for primary inputs:

(49) $\boldsymbol{Z} = \boldsymbol{B}(\boldsymbol{I}-\boldsymbol{A})^{-1}\hat{\mathrm{Y}}$

$\boldsymbol{B}$ = matrix of input coefficients for primary input

$\boldsymbol{I}$ = unit matrix

$\boldsymbol{A}$ = matrix of input coefficients for intermediate consumption

$\hat{\mathrm{Y}}$ = Diagonal matrix for final use by product

$\boldsymbol{Z}$ = matrix with results for direct and indirect requirements for primary inputs

(50) $\boldsymbol{Z} = \boldsymbol{B}(\boldsymbol{I}-\boldsymbol{A})^{-1}\boldsymbol{Y}$ Direct and indirect requirements for primary inputs

$\boldsymbol{B}$ = matrix of input coefficients for primary input

$\boldsymbol{Y}$ = matrix of final use by category

$\boldsymbol{Z}$ = matrix with results for direct and indirect requirements for primary inputs

# Table 20.13 Input content of final use by category

| | | Categories of final use | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | Final consumption | | Gross fixed capital formation | Changes in inventories | Exports | |
| | | Households | Governmnet | | | | |
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| | | **Final uses (billion euros)** | | | | | |
| Total | (1) | 1 041 | 497 | 314 | - 49 | 795 | 2 598 |
| | | **Input content of final uses** | | | | | |
| | | **Intermediates (billion euros)** | | | | | |
| Domestic products | (2) | 690 | 209 | 258 | - 44 | 653 | 1 767 |
| Imported products | (3) | 140 | 31 | 59 | - 16 | 199 | 414 |
| Taxes less subsidies on products | (4) | 26 | 20 | 6 | - 1 | 15 | 67 |
| Products at purchasers' prices | (5) | 856 | 260 | 323 | - 60 | 868 | 2 247 |
| | | **Value added (billion euros)** | | | | | |
| Compensation of employees | (6) | 464 | 305 | 146 | - 20 | 337 | 1 232 |
| Other net taxes on production | (7) | - 3 | - 5 | - 1 | 0 | - 3 | - 12 |
| Consumption of fixed capital | (8) | 168 | 63 | 38 | - 6 | 111 | 375 |
| Operating surplus, net | (9) | 245 | 83 | 64 | - 6 | 136 | 523 |
| Value added at basic prices | (10) | 874 | 446 | 248 | - 32 | 581 | 2 117 |
| | | **Investment (billion euros)** | | | | | |
| Machinery | (11) | 72 | 28 | 15 | - 2 | 40 | 153 |
| Buildings | (11) | 118 | 39 | 27 | - 4 | 75 | 255 |
| Total | (12) | 190 | 67 | 42 | - 6 | 115 | 409 |
| | | **Capital stock (millions euros)** | | | | | |
| Machinery | (13) | 5 449 | 2 182 | 1 045 | - 126 | 2 755 | 11 305 |
| Buildings | (14) | 868 | 270 | 237 | - 37 | 720 | 2 058 |
| Total | (15) | 6 317 | 2 452 | 1 282 | - 163 | 3 475 | 13 363 |
| | | **Employment (1000 persons)** | | | | | |
| Wage and salary earners | (16) | 13 855 | 9 444 | 4 091 | - 465 | 8 975 | 35 900 |
| Self-employed | (17) | 1 852 | 953 | 653 | - 12 | 1 024 | 4 470 |
| Total | (18) | 15 707 | 10 397 | 4 744 | - 477 | 9 999 | 40 370 |
| | | **Energy (terajoule)** | | | | | |
| Coal and coal products | (19) | 495 | 62 | 224 | - 95 | 1 035 | 1 722 |
| Brown coals and lignite products | (20) | 465 | 55 | 211 | - 89 | 975 | 1 618 |
| Crude oil | (21) | 1 235 | 145 | 560 | - 237 | 2 591 | 4 294 |
| Gasolines | (22) | 57 | 17 | 20 | - 5 | 69 | 159 |
| Diesel fuels | (23) | 420 | 104 | 141 | - 3 | 290 | 952 |
| Jet fuels | (24) | 236 | 33 | 44 | - 1 | 125 | 437 |
| Heating oil, light | (25) | 149 | 76 | 49 | - 10 | 160 | 424 |
| Fuel oil, heavy | (26) | 106 | 13 | 46 | - 19 | 207 | 353 |
| Other petroleum products | (27) | 379 | 50 | 233 | - 66 | 738 | 1 333 |
| Natural gas and other gases | (28) | 666 | 204 | 264 | - 100 | 1 144 | 2 179 |
| Renewable Energy | (29) | 372 | 48 | 163 | - 65 | 729 | 1 247 |
| Electric power and other energy | (30) | 1 021 | 255 | 396 | - 146 | 1 713 | 3 240 |
| Total | (31) | 5 603 | 1 062 | 2 351 | - 835 | 9 776 | 17 958 |
| | | **Emissions (1000 tons)** | | | | | |
| Carbon dioxide ($CO_2$) | (32) | 220 519 | 42 977 | 89 043 | - 30 261 | 364 278 | 686 555 |
| Methane ($CH_4$) | (33) | 791 | 77 | 212 | 21 | 1 133 | 2 234 |
| Nitrous oxide ($N_2O$) | (34) | 74 | 6 | 18 | 5 | 100 | 202 |
| Nitrogen oxides (NOx) | (35) | 469 | 87 | 159 | - 22 | 521 | 1 212 |
| Sulfur dioxide ($SO_2$) | (36) | 133 | 21 | 54 | - 21 | 239 | 427 |
| Organic compounds (NMVOC) | (37) | 196 | 28 | 84 | - 31 | 365 | 642 |
| Ammonia ($NH_3$) | (38) | 221 | 16 | 39 | 30 | 253 | 560 |
| Particulate matter ($PM_{10}$) | (39) | 57 | 8 | 18 | 0 | 60 | 144 |
| Hydroflurocarbons (HFC) | (40) | 3 | 1 | 2 | - 1 | 7 | 12 |
| Perflurorocarbons (PFC) | (41) | 0 | 0 | 0 | 0 | 0 | 0 |
| Sulfur hexafluoride ($SF_6$) | (42) | 0 | 0 | 0 | 0 | 0 | 0 |
| Total emissions | (43) | 222 463 | 43 221 | 89 629 | - 30 280 | 366 956 | 691 989 |
| | | **Global warming and acid deposition (1000 tons)** | | | | | |
| Greenhouse gases | (44) | 259 955 | 46 575 | 98 998 | - 28 424 | 418 968 | 796 073 |
| Acid deposition | (45) | 461 | 82 | 165 | - 36 | 603 | 1 276 |
| Tropospheric ozone formation | (46) | 1 456 | 192 | 455 | - 33 | 2 019 | 4 089 |
| | | **Waste, sewage and water** | | | | | |
| Waste (1000 tons) | (47) | 70 728 | 16 676 | 159 154 | - 7 600 | 93 179 | 332 137 |
| Sewage (million cu m) | (48) | 8 012 | 1 038 | 3 585 | - 1 489 | 16 387 | 27 532 |
| Water from waterworks (million cu m) | (49) | - 745 | 17 | - 422 | 210 | - 2 071 | - 3 011 |
| Water from nature (million cu m) | (50) | 10 953 | 1 288 | 4 944 | - 2 057 | 22 833 | 37 961 |

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## L. Inter-industrial linkage analysis

20.106 In the input-output analysis framework, the production by a particular industry has two kinds of effects on other industries in the economy. If an industry $j$ increases its output, more inputs (purchases) are required, including more intermediate consumption from other industries.

20.107 The term "backward linkage" is used to indicate the interconnection of a particular industry to other industries from which it purchases inputs (use side). On the other hand, increased output of industry $j$ indicates that additional amounts of products are available for use as inputs by other industries. There will be increased supplies from industry $j$ for industries which use product $j$ in their production (supply side). The term "forward linkage" is used to indicate the interconnection between a particular industry and those to which it sells its output. Many definitions of linkage measures have been proposed and ways of identifying key industries in developing countries suggested, and these are summarized in Rasmussen (1957), Hirschmann (1958), McGilvray (1977), Hewings (1982) and Miller and Blair (2009).

20.108 The Leontief quantity model will help to identify backward linkages, while the Ghosh price model can be used to identify forward linkages. The column sum of the Leontief inverse is the appropriate indicator for the magnitude of backward linkages, while the row sum of the Ghosh inverse is the corresponding indicator for the size of forward linkages.

20.109 In its simplest form, the strength of the backward linkage of an industry $j$ is given by the column sum of the direct input coefficients. A more useful and comprehensive measure is provided by the column sum of the Leontief inverse, which reflects the direct and indirect effects on other industries. In Table 20.14, the industry "Manufacturing" has the most extensive backward linkages ($b_j = 1.8704$) with other industries.

20.110 Backward linkages are use-oriented. The industry "Construction" requires inputs from many other industries and will therefore have strong backward linkages.

20.111 Forward linkages, on the other hand, are supply-oriented. The industry "Electricity" supplies electricity to all other industries and this industry may therefore be expected to have strong forward linkages (many clients) but weak backward linkages (few inputs). The row totals of the direct output coefficients and the Ghosh inverse output coefficients reflect the intensity of forward linkages. In Table 20.15, the industry "Business services" has the strongest forward linkages ($f_j = 2.0866$).

20.112 There is some discussion about whether the on-diagonal elements of the input and output coefficients should be included or netted out of the summations. If all uses and supply effects are covered, then they are appropriately included. If, however, the focus is on the industry's backward dependence on other industries, and the forward dependence of an industry on the purchases by other industries of its products, then the on-diagonal elements should be excluded. In addition, various normalizations of those measures have been used in empirical studies.

## Table 20.14 Backward linkages

| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services |
|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| | | **Input coefficients A** | | | | | |
| Agriculture | (1) | 0.0692 | 0.0139 | 0.0000 | 0.0004 | 0.0001 | 0.0008 |
| Manufacturing | (2) | 0.1686 | 0.2716 | 0.2048 | 0.0619 | 0.0110 | 0.0414 |
| Construction | (3) | 0.0219 | 0.0077 | 0.0749 | 0.0088 | 0.0278 | 0.0139 |
| Trade, transport and comm. | (4) | 0.0838 | 0.0956 | 0.0739 | 0.2000 | 0.0377 | 0.0552 |
| Finance and business services | (5) | 0.1443 | 0.0906 | 0.1284 | 0.1370 | 0.2584 | 0.0712 |
| Other services | (6) | 0.0095 | 0.0122 | 0.0138 | 0.0132 | 0.0166 | 0.0659 |
| Total | (7) | 0.4974 | 0.4916 | 0.4958 | 0.4214 | 0.3516 | 0.2483 |
| | | **Leontief inverse L = $(I-A)^{-1}$** | | | | | |
| Agriculture | (8) | 1.0786 | 0.0211 | 0.0050 | 0.0024 | 0.0008 | 0.0021 |
| Manufacturing | (9) | 0.2801 | 1.4040 | 0.3273 | 0.1207 | 0.0411 | 0.0776 |
| Construction | (10) | 0.0383 | 0.0207 | 1.0935 | 0.0214 | 0.0429 | 0.0217 |
| Trade, transport and comm. | (11) | 0.1650 | 0.1838 | 0.1548 | 1.2805 | 0.0757 | 0.0920 |
| Finance and business services | (12) | 0.2834 | 0.2155 | 0.2615 | 0.2578 | 1.3775 | 0.1339 |
| Other services | (13) | 0.0225 | 0.0252 | 0.0273 | 0.0246 | 0.0267 | 1.0756 |
| Total | (14) | 1.8679 | 1.8704 | 1.8695 | 1.7074 | 1.5648 | 1.4029 |
| Backward linkages | (15) | 1.8679 | 1.8704 | 1.8695 | 1.7074 | 1.5648 | 1.4029 |
| Normalized backward linkages | (16) | 1.0899 | 1.0914 | 1.0908 | 0.9963 | 0.9130 | 0.8186 |

20.113 When linkages are being measured in order to compare the structure of production or technologies between countries, the matrix of input coefficients for intermediate consumption should be derived from total inter-industry transactions, regardless whether the intermediate consumption is of domestic or foreign origin. On the other hand, if linkages are being used to identify key industries with high multipliers in a particular economy, then only domestic intermediate consumption should be used to assess the forward and backward linkages in the national context.

## Table 20.15 Forward linkages

| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services | Total |
|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | **Output coefficients B** | | | | | | |
| Agriculture | (1) | 0.0692 | 0.4785 | 0.0000 | 0.0092 | 0.0026 | 0.0132 | 0.5727 |
| Manufacturing | (2) | 0.0049 | 0.2716 | 0.0331 | 0.0387 | 0.0077 | 0.0206 | 0.3765 |
| Construction | (3) | 0.0039 | 0.0475 | 0.0749 | 0.0341 | 0.1201 | 0.0426 | 0.3231 |
| Trade, transport and comm. | (4) | 0.0039 | 0.1531 | 0.0191 | 0.2000 | 0.0420 | 0.0439 | 0.4619 |
| Finance and business services | (5) | 0.0060 | 0.1301 | 0.0298 | 0.1230 | 0.2584 | 0.0508 | 0.5981 |
| Other services | (6) | 0.0006 | 0.0245 | 0.0045 | 0.0166 | 0.0232 | 0.0659 | 0.1353 |
| | | **Gosh inverse G = $(I-B)^{-1}$** | | | | | | |
| Agriculture | (7) | 1.0786 | 0.7263 | 0.0278 | 0.0524 | 0.0199 | 0.0360 | 1.9411 |
| Manufacturing | (8) | 0.0081 | 1.4040 | 0.0528 | 0.0754 | 0.0286 | 0.0385 | 1.6074 |
| Construction | (9) | 0.0069 | 0.1285 | 1.0935 | 0.0828 | 0.1852 | 0.0668 | 1.5637 |
| Trade, transport and comm. | (10) | 0.0077 | 0.2943 | 0.0400 | 1.2805 | 0.0844 | 0.0731 | 1.7799 |
| Finance and business services | (11) | 0.0118 | 0.3097 | 0.0606 | 0.2314 | 1.3775 | 0.0955 | 2.0866 |
| Other services | (12) | 0.0013 | 0.0508 | 0.0089 | 0.0310 | 0.0374 | 1.0756 | 1.2050 |

20.114 If $l_{ij}$ is the $n \times n$ matrix of the Leontief inverse $(I-A)^{-1}$, then the backward linkage $BL_j$ of the sector $j$ is computed as:

$$BL_{\mathrm{j}} = \sum_{i=1}^{n} l_{\mathrm{ij}}$$

If, however, $g_{ij}$ is the $n \times n$ matrix of the Ghosh inverse $(I - B)^{-1}$, then the forward linkage $FL_i$ of the sector $i$ is computed as:

$$FL_{\mathrm{i}} = \sum_{j=1}^{n} g_{\mathrm{ij}}$$

20.115 The results for forward and backward linkages are summarized in Table 20.16. "Manufacturing" has the highest backward linkages and "Business services" the highest forward linkages. The lowest linkages are reported for "Other services".

**Table 20.16 Forward and backward linkages**

| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services |
|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| Backward linkages | (1) | 1.8679 | 1.8704 | 1.8695 | 1.7074 | 1.5648 | 1.4029 |
| Forward linkages | (2) | 1.9411 | 1.6074 | 1.5637 | 1.7799 | 2.0866 | 1.2050 |
| Total | (3) | 3.8091 | 3.4779 | 3.4332 | 3.4874 | 3.6514 | 2.6078 |

20.116 The normalized backward linkage $NBL_j$ of the sector $j$ is computed as:

$$NBL_{\mathrm{j}} = \sum_{i=1}^{n} l_{\mathrm{ij}} \,/\, \frac{1}{n} \sum_{{}^{2}i=1}^{n} \sum_{j=1}^{n} l_{\mathrm{ij}}$$

The normalized forward linkage $NFL_i$ of the sector $i$ is computed as:

$$NFL_{\mathrm{i}} = \sum_{j=1}^{n} g_{\mathrm{ij}} \,/\, \frac{1}{n} \sum_{i=1}^{n} \sum_{j=1}^{n} g_{\mathrm{ij}}$$

In both cases, the linkage of sectors $j$ is divided by the average of all linkages.

**Table 20.17 Normalized forward and backward linkages**

| | | Agricul-ture | Manufac-turing | Construc-tion | Trade, trans.and comm. | Finance and business service | Other services |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Backward linkages | (1) | 1.0899 | 1.0914 | 1.0908 | 0.9963 | 0.9130 | 0.8186 |
| Forward linkages | (2) | 1.1437 | 0.9471 | 0.9213 | 1.0487 | 1.2294 | 0.7099 |
| Total | (3) | 2.2336 | 2.0384 | 2.0121 | 2.0450 | 2.1424 | 1.5285 |

20.117 For a key sector we expect that $NBL > 1$ and $NFL > 1$. A sector with strong backward linkages is classified with $NBL > 1$ and $NFL < 1$. A sector with strong forward linkages reports $NBL < 1$ and $NFL > 1$. A non-key sector has values below unity for both $NBL < 1$ and $NFL < 1$.

20.118 Table 20.17 shows that "Agriculture" is a key sector, with $NBL = 1.0899$ and $NFL = 1.1437$. "Manufacturing" is a sector with strong backward linkages, with $NBL = 1.0914$ and $NFL = 0.9471$. "Business services" is a sector with strong forward linkages, with $NBL = 0.9130$ and $NFL = 1.2294$. "Other services" is a non-key sector, with $NBL = 0.8186$ and $NFL = 0.7099$.

# Chapter 21. Examples of compilation practices

## A. Introduction

21.1 This Handbook provides guidance on best compilation practice for SUTs and IOTs and, when such practice is not feasible or possible, suggests the use of alternatives. In general, while the guidance set out in parts two and three of this Handbook should be followed as far as possible, the authors recognize that countries may have to use alternative approaches when establishing a SUTs and IOTs system in line with the recommendations presented in this Handbook. The alternatives may be less optimal but more achievable given, for example, a country's limited resources, lack of a business register, lack of data, or other constraints. In some cases, the alternatives may be more suitable for smaller countries, for example, or countries at the early stages of statistical development with limited resources or statistical information.

21.2 Country practices and statistical circumstances vary greatly across the world. These are often driven by structural differences, which can in turn influence, or even limit, the direction and development of social and economic statistics. They include such factors as the following:

- Legal framework (for example, different administrative or statistical laws, different ways in which businesses may be set up, managed and recorded, and the size of the informal economy).
- Political environment (for example, different economic situations and resources for official statistics, and different uses and demands for statistics).
- Regional and administrative set-up (for example, whether into states or provinces, whether on a federal basis, and so on).
- Taxation system (for example, different policies, different types of taxes, access to administrative data, and others).

21.3 Over the past 60 or so years, since the first BPM in 1948 and SNA in 1953, huge strides have been made to improve the comparability and harmonization of economic statistics and national accounts across countries. This has been achieved, first, by developing international standards for the compilation of these accounts and, second, by helping countries to continually develop the coverage, accuracy, quality and timeliness of the national, industrial and regional statistics produced in line with the international standards.

21.4 Thus countries continuously improve their statistical infrastructure including registers, surveys and methodologies. These improvements in turn also generate revisions to various key microeconomic and macroeconomic statistics. Albeit sometimes inconvenient, for example to users, these revisions should be welcomed and viewed as improvements to quality and comparability. The development of the SUTs framework to underpin GNI and GDP also provides a basis for revision when data from different sources are confronted and reconciled through balancing thus providing a coherent and consistent basis for the calculation of GNI and GDP.

21.5 The present chapter provides guidance for countries with limited resources for statistics. It gathers together examples of compilation practices from different regions in the world, which illustrate a common theme of continual change and improvement of the national accounts and SUTs and their related statistics. The examples show how countries have addressed various challenges and traces the paths which they followed in developing their statistics, to their present day situation. Section B provides some basic considerations on the compilation of national accounts that are also of particular importance for the compilation of SUTs. The importance of good quality basic economic statistics, the availability of business registers and measurements of the non-observed economy are some of the elements determining the quality of the national accounts and SUTs. Examples of the development of the national accounts alongside that of SUTs are presented for Malawi, the Czech Republic and Chile in sections D, E and F respectively.

## B. Basic considerations for the compilation of national accounts and SUTs

21.6 The 2008 SNA and BPM 6 are the latest statistical standards for the compilation of national accounts and the balance of payments respectively. Since the compilation of SUTs forms an integral part of the compilation of national accounts (it relies, for example, on the same data sources, conceptual framework and other elements), some general considerations on the compilation of national accounts are presented below. In general, the implementation of the 2008 SNA poses challenges of varying degrees, reflecting the need for resources, methods, new systems and new or more detailed data.

21.7 The national statistical offices are usually responsible for the national accounts but, in some countries, the compilation of national accounts (and, to an even greater extent, of the balance of payments) is the responsibility of the central bank (even though, in some countries, this role has changed over the years and the balance of payments has shifted from the central bank to the national statistical office, as, for example, in Finland in 2014).

21.8 The quality of national accounts and also of SUTs depends greatly on the methodology used, the quality and coverage of the data, the timeliness of their compilation and their compliance with international standards. The following elements will have a significant impact on the resulting level of detail:

- Adoption of international industrial, product and functional classifications

- Availability and quality of current price source data
- Availability of prices for deflation
- Benchmarking with the use of comprehensive sources (annual benchmarking as opposed to five-yearly or longer benchmarking is preferred)
- Staff resources, time schedules for production and publication
- System infrastructure

21.9 Several countries with less developed statistical systems are using SUTs as an integral part of the compilation of the final or benchmarked annual national accounts in current prices. Such countries might only be able to follow the production approach and the expenditure approach, while the income approach may pose difficulties for them. The income approach requires data for wages, salaries, taxes and subsidies on production and also consumption of fixed capital.

21.10 A number of countries used to complete the SUTs after the final national account aggregates were published. In many cases this practice is now changing, however, to a situation where the compilation of SUTs is used to determine some of the national account aggregates.

21.11 The compilation of national accounts requires good knowledge about the country's economy, special training in the compilation of such accounts, including its methodology, and also knowledge about the coverage and quality of the different economic statistics and administrative data.

21.12 The national accounts estimates rely on a large number of economic statistics compiled by various stakeholders such as national statistical offices, the central banks and several different ministries and government departments including the finance ministry.

21.13 It is important to have a solid base of economic statistics for the compilation of national accounts so that differences in economic growth can be attributed to the actual changes in the economy rather than to inadequate basic economic statistics which do not have the necessary coverage or are based on over- broad assumptions. For example, the inclusion or exclusion of the non-observed economy and its measurement is a serious problem for the comparability between national accounts and GDP across countries and over time.

21.14 Better measurement of the informal sector is a key issue for national accountants, in particular in countries with a large informal sector. Issues that affect the measurements of the informal sector include, for example, the imputation of the GVA of the production of crops and livestock for own consumption, the estimation of the GVA of own construction of dwellings or farm buildings; or the imputation of rentals for owner-occupied dwellings. In cases where these calculations are not carried out, the GDP may be underestimated compared with countries that follow the 2008 SNA recommendations.

21.15 The adoption of the 2008 SNA provides countries with an opportunity thoroughly to review the sources and methods underlying the collection and compilation of their national accounts. Efforts to improve coverage and quality have led to extensive revisions in the national accounts of several countries. This is inevitable and should be welcomed and managed through an effective communication strategy.

21.16 The SNA require imputations for various types of non-monetary production, and these are particularly important in developing countries. These include both stricter adherence to SNA guidelines and, in particular, the adoption of a regular programme of surveys of households, enterprises and agriculture.

### 1. Statistical business register and administrative registers

21.17 The sample frame for the main statistical surveys should be determined by a census or a business register. A comprehensive high-quality statistical business register regularly updated and maintained in the national statistical office, alongside the statistical unit, should be one of the most important instruments of the statistical system.

21.18 The business register should in principle cover all formal producing units operating in the economy, listing names, addresses, ownership, links to other parts of the enterprise or enterprise group, and certain key variables such as employment and turnover. In many countries, however, the business register may have insufficient coverage or may be out of date.

21.19 The business register might include enterprises that no longer exist or it might not include new enterprises at all; changes such as mergers or splits of enterprises may not be reflected; or the register may contain incorrect information about types of economic activity, enterprise size or address, and other attributes. Enterprises may not be recorded or be missing from data sources for purely statistical reasons. These situations will occur with high rates of enterprise turnover (for example, economic slowdowns and upturns) or with many new industries (for example, reflecting new products). The sharp upturn in industrial production in many developing countries will also lead to the emergence of many new start-up businesses.

21.20 High priority should be given to the regular updating of statistical business registers, necessary for the conduct of economic surveys. Administrative registers (for example, tax and VAT registers) should be key sources used in updating statistical business registers. Resources are also required to plan and accomplish moves to any new or revised classification systems, such as for the introduction of ISIC Rev. 4, used in the business register and for economic statistics.

### 2. Data sources for the compilation of national accounts and SUTs

21.21 Countries should develop a sustainable system for the regular collection of economic data required for the compilation of national accounts and SUTs. Administrative data should also be used as a key data source. Delays, statistical errors and incomplete statistical data may necessitate the time-consuming estimation of national accounts estimates. In some versions of preliminary and corrected data from statistical surveys, the input data for national accounts will also need to be corrected and the national accounts rebalanced, leading to further revisions. These in turn need to be managed with suppliers and users. An established revision policy will provide transparency, help planning schedules and serve as the rationale for revisions and planning.

21.22 Specific ministries such as those responsible for agriculture, health and education will often have statistical services and a range of detailed data covering their policy areas. A formal service-level agreement or memorandum of understanding between the national statistical office, government departments, central bank and other non-national statistical office suppliers compiling statistics is sometimes necessary to align the interests and supply of data required.

21.23 Chapter 4 of this Handbook covers the need for the compilers of national accounts and SUTs to analyse and develop the following types of data sources for the compilation of SUTs/IOTs:

- Statistical domains, usually the responsibility of the national statistical office:
    - Agriculture censuses
    - Crop surveys and livestock censuses
    - Fisheries statistics
    - Economic surveys for large enterprises or from a sample of enterprises
    - Annual survey for non-profit institutions or for a sample of the non-profit institutions
    - Energy statistics
    - Labour force surveys
    - External trade statistics with value and quantity data for imports and exports of goods
    - Integrated household surveys
    - Consumer price indices
    - Population censuses and housing censuses
- Administrative data often sourced from other departments:
    - Agriculture, fishing, forestry statistics from different ministries
    - Banking statistics and statistics for other financial institutions from the national central bank
    - Balance of payments data from the central bank
    - Insurance accounts from insurance industry regulators

- Government audited accounts and budget documents with expenditures split between individual consumption and collective consumption categories
- VAT payment data and, if recorded, VAT turnover, by industry (and by product where differential rates exist) from tax collecting departments

### (a) Economic surveys for large enterprises or for a sample of enterprises

21.24 Economic enterprise survey., as required for the compilation of SUTs, need to collect information on output by product, on intermediate consumption by product, on components of GVA and on employment, and also to explore the fixed and financial assets and liabilities and the categories of gross fixed capital formation.

21.25 The collection of data at the establishment level could pose a challenge. The statistical data source may therefore need to be based on enterprises that publish their financial accounts or are covered in an enterprise survey. It is easier to collect reliable figures on output from financial accounts of the enterprises but, in some cases, the output is valued at producers' prices rather than at basic prices, which form the basis for valuation in the SNA,

21.26 The enterprise surveys is the major source for estimating the input cost structures of industries by products, but enterprise surveys based on the fiscal data usually provide aggregated data for intermediate consumption with no detail breakdown of the cost structure. Special cost structure surveys for all industries should be compiled annually or, at least, for the base years. These surveys are an important source for the compilation of intermediate consumption by industry for the national accounts underpinning the production approach. Generally speaking, however, they can be very costly.

21.27 Gross fixed capital formation by enterprises should also be derived from the enterprise survey and provide information about buildings, transport equipment, machinery, software and other attributes. Many countries are already including as part of their gross fixed capital formation computer software by producers, mineral exploration and government expenditure on military durable goods other than weapons.

21.28 The product classification used for economic statistics should follow the CPC, and the industry classification should be in line with the ISIC. The industry and product classifications used for national accounts and SUTs should always be aligned with the latest version of each classification.

### (b) External trade data

21.29 External trade statistics with detailed data for the imports and exports of goods and services are of great importance for the compilation of SUTs and IOTs in all countries. Different data processing and database management systems are used for trade statistics and more information is provided in the compilers manual for international merchandise trade statistics (United Nations, 2016). Eurostat, for example, has developed the Eurotrace software package used in many developing countries to manage data for external trade statistics for goods. Eurotrace software allows:

(a) The import and management of the data necessary for the development of the external trade statistics (in particular the customs data);

(b) The treatment of these data, in particular through the conduct of quality controls and the application of standards;

(c) The calculation of a certain number of aggregates, in particular indices of foreign trade;

(d) Their export for dissemination and publication.

Further details may be found at
https://circabc.europa.eu/webdav/CircaBC/ESTAT/eurotracegroup/Information/en/index.html.

21.30 In small economies, data from imports with a detailed specification of goods, such as transport equipment and machinery, also form a reliable data source for determining a large part of the gross fixed capital formation data by product and by type. The balance of payments data should provide a data source for import and export of services.

### 3. Non-observed economy

21.31 The term "non-observed economy" is used to describe activities that, for one reason or another, are not captured in routine statistical questionnaires. The reason may be that the activity is informal and thus escapes the attention of surveys geared to formal activities; it may be that the producer is anxious to conceal a legal activity, or it may be that the activity is illegal (2008 SNA, para. 6.39).

21.32 The following activities should be recorded within the production boundary in the national accounts: underground activities; informal activities, including production of households for their own final use; illegal activities; and other activities omitted because of deficiencies in the basic data collection program. Several small enterprises are often omitted through such deficiencies.

21.33 Although services produced for own consumption within households fall outside the boundary of production used in the SNA, it is nevertheless useful to give further guidance with regard to the treatment of certain kinds of household activities which may be particularly important in some developing countries. The SNA includes the production of all goods within the production boundary. The 2008 SNA, in its paragraph 6.32, provides a list of types of production by households that are included regardless whether they are intended for own final consumption or not. The list covers, for example: the production of agricultural products and their subsequent storage; the gathering of berries or other uncultivated crops; forestry; wood-cutting and the collection of firewood; hunting and fishing; other kinds of processing such as weaving cloth; dress-making and tailoring; and the production of footwear.

21.34 Data obtained through household budget and expenditure surveys on household consumption from own sources should be used to estimate the production of agricultural commodities for own consumption and the use of firewood gathering from the use side.

21.35 Other activities that are within the production perimeter of the SNA but often difficult to measure are: own-account production of housing services by owner-occupiers; own-account construction, including that by households; production of domestic and personal services by employing paid domestic staff; and illegal activities.

21.36 The value of housing services should be included in GDP regardless of whether these are explicitly purchased in the form of rentals paid to the owner or, so to speak, "paid" by homeowners to themselves. The SNA suggests that rentals should be imputed for owner-occupiers using rentals actually paid for similar dwellings. Dwellings in rural areas are often constructed by their owners using locally available materials and are almost never rented out. When no actual rentals are available, the national statistical office might ask the owners to estimate what they think they would have to pay to rent their dwelling or, alternatively, what they would charge in rent for someone else to live in it. When properly measured, total rentals for dwellings (both actual and imputed) account for significant amounts: at least 5 per cent of GDP in low-income countries, for example, while in richer countries the percentage is often twice that level. In regions where most people are owner-occupiers, the omission of imputed rentals means that GDP is likely to be underestimated.

### 4. SUTs populated with use of a simplified approach

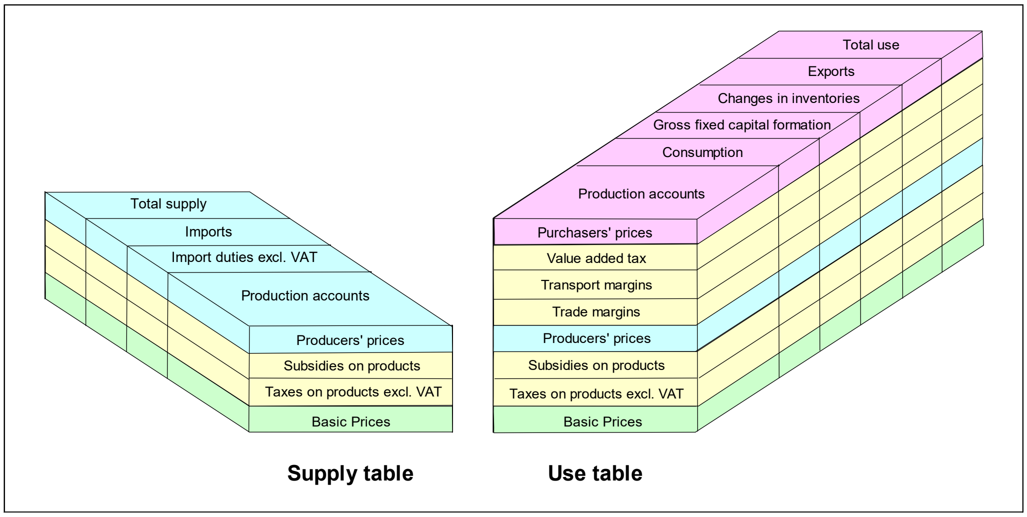
21.37 For the compilation of national accounts and SUTs, the industry and product classifications used should be consistent with the international standard classifications, such as ISIC and CPC. The level of detail shown in the tables should of course be determined on the basis of, among other factors, its relevance for the country's economy.

21.38 In general, the classification of products should be more detailed than the classification of industries, thus generating rectangular SUTs. Detailed specification of products is important to be able to allocate VAT, trade and transport margins and, for example, product taxes on petrol and product subsidies on seeds and fertilizers.

21.39 The compilation of SUTs in countries with limited statistical resources may follow a simplified sequence of five steps when it is not possible in the short term to implement the full suite of recommendations presented in this Handbook. These steps are described below and provide a simplified temporary alternative until a proper system is put in place.

21.40 Table 21.1 provides an overview linking the supply table and the use table using the product-flow (also known as the commodity flow) approach.

**Figure 21.1: Illustration of a database for the product-flow method used in smaller countries**




21.41 The recommended valuations for balancing should be struck at either basic prices or purchasers' prices. While this may be neither ideal nor recommended, some countries may have to apply the identities at producers' prices or at purchasers' prices exclusive of VAT with the estimates valued on a consistent basis in the supply table and use table. These identities still hold at producers' prices: thus, for example:

Total supply at producers' prices *equals* Total use at producers' prices

21.42 *Step 1*: First, the supply table at basic prices classified by appropriate industry codes and products codes is put together. In cases where the data are at producers' prices, an additional step is needed to move to basic prices for compiling SUTs in volume terms.

21.43 Other components by industry and product, as appropriate, should be shown for:

- Market producers
- Production for own final use
- Non-market producers – general government
- Non-market producers – NPISHs
- Imports of goods, CIF and custom duty
- Import of services

21.44 *Step 2*: The use table at purchasers' prices classified by appropriate industry codes and products codes is put together. The use table at purchasers' prices should specify:

- Intermediate use of products (at purchasers' prices):
    - Market producers
    - Production for own final use – no VAT, trade or transport margins
    - Non-market producers - general government
    - Non-market producers – NPISHs
- Final consumption (at purchasers' prices):
    - Final consumption expenditure by households, using COICOP classification
    - Final consumption expenditure of NPISHs, using COPNI classification
    - Final consumption expenditure, individual consumption and collective consumption, using COFOG classification
    - Capital formation by type of industry and product
    - Exports of goods and services

21.45 *Step 3*: The use table at purchasers' prices is corrected to basic prices (or, if not feasible, to producers' prices, for the purposes of linking with the supply table) by re-allocating non-deductible VAT, trade and transport margins.

21.46 Non-deductible VAT could be relevant for intermediate consumption (although all non-observed and informal producers will have to pay non-deductible VAT on their intermediate consumption) for non-market producers and other exempted activities. Exports of goods are usually zero-rated for VAT purposes.

21.47 Trade margins need to be estimated for different types of goods and will vary depending on the receiver of the goods. Transport charges invoiced separately by the producer will vary depending on the receiver of the goods.

21.48 The first estimated values of non-refundable VAT, trade and transport margins must be deducted from purchasers' prices when compiling the use table at producers' prices and later at basic prices.

21.49 *Step 4*: Confrontation of data sources– balancing the supply table and use table at producers' prices (as opposed to the recommended valuation basic prices and/or purchasers' prices).

21.50 In many countries with a less developed statistical system, the compilation and balancing of the national accounts means that the national accounts staff are controlling, correcting and balancing the data and, in some cases, even heavily involved in their collection. The SUTs framework makes it possible efficiently and consistently to confront all the primary data sources. The identity between resources and uses of products requires product flows to be compiled or estimated.

21.51 The "product flow" method is an approach used in national accounts in several countries where, for example, detailed information of the input structure of industries is missing or incomplete. When data are collected from businesses on outputs, it may happen that data on the inputs used for producing those outputs are difficult to collect. Changes in inventories will then be calculated by the "product flow" method, as the difference between the supply and the use of each product at producers' prices, determined as a residual variable allocated to the change in inventories. Using a manual procedure, the residuals have to be corrected to an acceptable level. Based on their judgment, the compilers should balance the accounts by adjusting selected components in the light of such criteria as quality, coverage, and others. Changes of inventories for services have to be corrected on the supply or the use side and eliminated.

21.52 *Step 5*: When the supply table and the use table have been corrected and balanced at producers' prices, the use table will be compiled at purchasers' prices by adding corrected trade and transport margins and non-refundable VAT. The first figures estimated for non-refundable VAT will be reallocated in accordance with the move of final consumption expenditure, gross capital formation and exports from producers' prices to purchasers' prices. Similarly, some part of the trade and transport margins may also have to be reallocated. At this stage, the use table is valued at purchasers' prices.

21.53 When the first version of the SUTs is established, it is important that the following are checked:

- Total figures for production, intermediate consumption, GVA and gross capital formation for the different industries
- Total figures for final consumption, product taxes, product subsidies, imports and exports

21.54 The estimates for household final consumption expenditure at purchasers' prices must be evaluated in relation to the computed figures for trade and transport margins and change in inventories and residuals. Even where household budget surveys are conducted annually, small samples and a high degree of non-response might make this important data source unreliable. The results from the household budget surveys must be evaluated and balanced with other data sources for the supply of goods and services. Household surveys often understate final consumption expenditure, in particular on services.

21.55 For products where change in inventories cannot be accepted (for example, some service products), the production or use of these products must be changed. Compilers must use their judgment in reaching a balance by adjusting the components as necessary. In cases where statistical information is missing, estimates may be made using the product flow approach and SUTs framework. This is a fundamental aspect of SUTs that are produced in this way, in that it enables the national accounts to be compiled in a coherent manner even in situations where the source data are incomplete or weak in quality. The so-called “product flow” method also provides a basis for the logical substitution of a weak data source, either on the supply side or on the use side.

21.56 *Step 6*: The supply table at producers’ prices is transformed to basic prices. The re-allocation of certain taxes on products and subsidies on products enables the transformation from producers’ prices to basic prices, and thus makes possible the balancing of SUTs also at basic prices.

21.57 With the rapid change and development of economies, the impact of globalization, the increasing rate of change of technology and its impact, the emergence of new products and new industries, and other such processes, it is recommended that the production of new SUTs should reflect an annual benchmarking process. If countries are unable to compile SUTs every year, it is recommended that national accounts should be benchmarked through the compilation of SUTs at least every five years.

## 5. SUTs in volume terms (double deflation approach)

21.58 To obtain GDP in volume terms, the SNA recommends the use of annual chain indices, which in effect means that the base year is updated each year. The SUTs provide a framework for compilation and balancing in current prices and in volume terms and also for an overview of transaction data, price indicators and volume indicators interrelated in a systematic way. Deflation using price indices is the preferred method for calculating GDP in volume terms.

21.59 Chapter 9 of this Handbook provides more detail on this issue and on recommended approaches to the compilation of SUTs in previous years’ prices. The approaches described in the present section are not being put forward as recommended approaches but as accepted temporary alternatives until a proper system is put in place.

21.60 If countries are unable to update SUTs every year and use chain indices, the 2008 SNA recommends that the base year should be updated every five years. Many countries, for example, compile SUTs only for the base years.

### (a) SUTs as the basis for volume measures of GDP

21.61 The SUTs for the current year should be established with the same format as SUTs for the previous year or an earlier base year. The SUTs in volume terms should be compiled by deflating current price values by price indices or using volume indicators but at the product level. The price indices should match the values being deflated as closely as possible. This will result in integrated Paasche price indices and Laspeyres volume indices. Examples are provided below of deflations for specific categories in the SUTs.

21.62 In the supply table, where price indices for products from domestic output are linked to domestic use, at basic prices, price indices for products supplied to domestic users may be based on PPIs, CPIs, unit value price indices or input price calculations.

21.63 With regard to market producers, where industrial products are important in the economy, the compilation of PPIs in the form of monthly or quarterly indices for industrial products is required but can be expensive and difficult to prepare. CPIs should be used for service industries supplying services to the households, but might also be used for identical services to market producers. The CPI must be corrected for changes in VAT rates from the base year. Unit value indices are acceptable price indices for homogeneous products, such as agricultural, forestry and fishing products, and also for mining products.

21.64 Where production for own final use is concerned, if agricultural, forestry and fishery products for own consumption are important, these products should have a product code that is different from that of products sold to the market because no trade margins and VAT are charged on own final consumption. The CPI adjusted for change in the VAT rate may be used for products for own consumption.

21.65 With regard to non-market producers (general government and NPISHs), production for general government and NPISHs in current prices is compiled by summing up intermediate consumption, compensation of employees, consumption of fixed capital and taxes less subsidies on production. The compilation in volume terms is conducted from the input side and applies to all components of the sum of costs. Input price indices should be calculated using the Paasche formula for each non-market producer, weighting the price indices for intermediate consumption and a wage index for compensation of employees. The wage index should be adjusted for changes in quality of the labour force (using type of job and educational background of the employees).

21.66 In the supply table, where price indices for products from imports (CIF value) are at basic prices, unit value price indices are provided for similar groups of products from foreign trade customs declarations.

21.67 In the use table, were price indices for products to exports (FOB value) are at purchasers' prices, unit value price indices are provided for similar group of products from foreign trade customs declarations. CPIs for domestic services are used as estimates of prices for export of domestic services.

21.68 In the use table, volume estimates for products for domestic use at basic prices are covered later in this section.

### (b) Compilation process: a simplified methodology

21.62 A simplified methodology for the compilation of SUTs in volume terms is presented below.

21.63 *First step*: In the use table, products for export at purchasers' prices are deflated with unit value price indices and consumer price indices for services.

21.64 *Second step*: In the use table, products for export at basic prices in volume terms are calculated by deducting VAT, trade and transport margins and taxes on products from exports at purchasers' prices and adding product subsidies (if relevant), all compiled in previous years' prices (or a base year price). VAT, trade and transport margins and product taxes and subsidies are estimated in volume terms at detailed product level by applying rates of the respective tax, trade and transport margins from the previous year (or the base year).

21.65 *Third step*: In the supply table, production for own final use and also other products will only go to the domestic market in all countries. For products supplied both to the domestic market and to exports, one combined price index should be used to deflate domestic supply of the products at basic price values. To form the price index for total domestic supply of one of these products, the price index should be compiled as a weighted average of the price index for export of the product, calculated at basic prices and the price index for domestic production of the same product supplied to domestic users, also at basic prices. The combined index for a product is used to deflate domestic supply of that product from the various industries.

21.66 If no price indices are accessible for certain products supplied to the domestic market, the export price index might be used if the major part of the product is exported, for example, coffee, tobacco, minerals or oil.

### (c) Balancing between the supply table and the use table in volume terms

21.67 The balancing of the supply table and the use table in volume terms is first carried out at the detailed product level at basic prices. The balancing for different parts of the SUTs is described below.

21.68 Balancing of products for domestic use at basic prices:

- For each product, volume estimates for total domestic use could be calculated as total domestic supply plus imports minus exports, all in volume terms.
- For each product, volume estimates for the various domestic uses of the product could be calculated by distributing total domestic use of the product in volume terms proportionally with the domestic uses in current prices.
- In volume terms, the supply and use of each product is balanced at basic prices.

21.69 Balancing of domestic use at purchasers' prices:

- For domestic use, taxes and subsidies on products, trade and transport margins and VAT in volume terms have to be calculated, specified by products and users, as a supplement to the basic prices in order to arrive at the purchasers' prices in volume terms. Tax rates and trade margins from the previous year (or base year) are used.

21.70 CPIs for household final consumption expenditure:

- Household final consumption expenditure is the only area, except for exports, where price indices could be used for deflating purchasers' prices directly. The deflated figures for goods and services supplied for household final consumption expenditure could be adjusted to reflect the change in the CPI for the products in question.

21.71 Checking GVA in volume terms:

- GVA in volume terms is calculated as the difference between production at basic prices and intermediate consumption at purchasers' prices. Calculating GVA in volume terms for a given industry using double deflation might give negative figures if the specification of intermediate consumption or price indices is poor and should be corrected. Relatively small errors may result in an obviously incorrect GVA in volume terms.

### 6. Documentation of sources and methods of estimation

21.72 When the SUTs are balanced, information in particular on the sources and methods of estimation for each single element of the SUTs would be useful for the evaluation and analysis of industry and product imbalances. It is strongly recommended that the basic data and the methods used, the problems encountered, solutions applied and the results achieved are carefully documented.

21.73 This documentation will help in evaluating the data quality and outlining the strategy and prioritization for balancing. In addition, some form of revisions analyses should be produced, and used to identify any underlying biases in the data or processes. Documentation of the various compilation steps should point to missing data issues and problems of basic data quality.

21.74 It is important that such findings are used as feedback to the primary statistics, that they also inform the development of future strategies and priorities to improve data and the collection of data for relatively weaker areas and that they are used, as appropriate, in seeking funding.

## C. Effect on GDP of integrating SUTs in the national accounts for Malawi

21.75 The national accounts for Malawi (known as Nyasaland from 1891 to 1964) were first calculated by Phyllis Deane for the year 1938, and published in *The Measurement of Colonial National Income*, by Cambridge University Press in 1948.

21.76 During the period from 1954 to 1963 when the country formed part of the Federation of Rhodesia and Nyasaland, a set of national accounts were prepared for Nyasaland by the Central Statistical Office, in Salisbury, Southern Rhodesia. Phyllis Deane writes later:

"The difficulties in the way of measuring the national income in Africa spring from two main sources. First, the concepts and experience from which the national income estimator usually derives his definitions and methods have for the most part been developed in dealing with advanced industrial economies such as those of the United Kingdom or the United States. How far they are applicable to less advanced economies must be deduced from a series of practical tests. Second, data on which to base estimates are scarce".[12]

21.77 Following the country's independence in 1964, the task of preparing national accounts for Malawi fell to the newly established National Statistical Office in Zomba. The first national accounts publication for Malawi, covering the years 1964–1970, was released in November 1972, and was followed by five other national accounts publications. The last of these publications, the Malawi national accounts report for 1990–1994, was issued by the National Statistical Office in Zomba, in a series starting from 1990, using 1994 as the base year.

21.78 The national accounts for the years up to 2006 were compiled in 1994 prices, with only GDP converted to current price by an aggregated price index composed of CPIs and price indices from external trade.

21.79 In June 2003, an institutional cooperation project between Statistics Norway on the one side and the National Statistical Office and the Ministry of Finance and Development Planning of Malawi on the other was established and funded by the Norwegian Government. Statistics Norway provided technical advice and training to the National Statistical Office of Malawi on how to build a national accounts system as a basis for economic and social policy planning.

21.80 In 2004, it was decided to start with the compilation of SUTs compliant with the 1993 SNA. Careful consideration was given to development of the framework for the first benchmark SUTs. Two of the most important features supporting this framework included the establishment of an ISIC-based industry classification relevant to Malawi, specifying some 100 industries, and a CPC-based product classification, specifying some 350 products.

21.81 The aim was to make use of all economic statistics and relevant administrative data available in Malawi. Important food products in the Malawian economy were specified, including with a split between products sold to the market and products for own use. Such products as food aid were also given special codes. The list of products was also relevant and manageable for compiling price indices or quantity indices. A link between the product classification and the HS used in the import and export statistics was established.

[12] Phyllis Deane, "Measuring national income in colonial territories", in *Studies in Income and Wealth*, Milton Gilbert, Dorothy Brady and Simon Kuznets, eds. (London, National Bureau of Economic Research, 1946), pp. 145–174.

21.82 The SUTs for the year 2002 (and since 2002) mainly relied on Malawi's crop estimates, annual economic surveys covering 300 large enterprises, government accounts and integrated household surveys. For external trade data, Eurotrace software providing details on imports and exports of goods was used. These details were not used in compiling the SUTs before 2002. The balance of payment figures covered import and export of services. In addition, as part of the project, training was provided on how to use all available economic statistics in Malawi.

21.83 Excel worksheets are currently used for data input and the final tabulations of the SUT estimates. Use of the SNA-NT software application provided by Statistics Norway made possible the balancing of the SUTs in current prices, their calculation in previous years' prices, and also the derivation of industry-by-industry IOTs. Balancing the different data sources in a systematic and well documented framework has provided important quality checks, and has also produced improved estimates for the informal economy in the national accounts for Malawi.

21.84 In March 2007, Malawi released revised national accounts estimates for the years 2002–2004 and preliminary aggregate figures for the years 2005 and 2006. Comparisons between the old and new estimates showed that GDP in current prices had been revised upwards by 38.0 per cent in 2004 and by 37.4 and 37.7 per cent in the two subsequent years. The main reasons for this revision were the introduction of better quality estimates for small and medium-sized businesses, and new data on NPISHs.

21.85 The Malawi national accounts report for 2002–2005 (http://www.nsomalawi.mw/) gives details on the concepts, sources and methods used.

21.86 Over the period 2009–2013, a further revision of the national accounts for Malawi was launched for previous years 2002–2010. The classification system was updated so to conform to ISIC Revision 4 and CPC Revision 2. Some core aspects of the 2008 SNA were also introduced. The following new data sources were analysed and used:

- Revised previous annual economic surveys and improved annual economic surveys from 2008
- New survey for small and medium-sized enterprises and for NPISHs
- National agriculture and livestock census for 2007
- Third integrated household survey for 2010
- 2008 population and housing census
- Improved estimate of the contribution of forestry, which captured the extensive use of wood for fuel

21.87 The annual SUTs for the years 2002–2007 are revised at an aggregated level to establish comparable time series for the entire period 2002–2010. The annual SUTs at basic prices for the years 2002–2010 are converted to industry-by-industry IOTs. The methodology for transformation to IOTs is based on the main assumption that each of the detailed products has its own specific sales structure, namely, the fixed product sales structure.

### 1. Frequency of compilation of SUTs

21.88 Compiling detailed annual SUTs every year is in a general a challenging task which requires careful planning and appropriate resources. Even though the benefits of compiling SUTs as a regular component of the annual national accounts were recognized, after careful consideration it was decided that, given the limited resources in the national statistical office and users' needs in the country, the compilation of annual SUTs was not a technically or financially sustainable approach for the national statistical office in the country. It was decided that, for the time being, SUTs would be compiled instead only for benchmark years, which fell around every five years.

21.89 The principal users of the national accounts data, such as the Reserve Bank, are more interested in preliminary estimates of national accounts and quarterly data than the final annual estimates, which are published with a time lag of more than two years.

### 2. Twinning project between Malawian institutions: the Ministry of Development, Planning and Cooperation and the National Statistical Office

21.90 The SUTs offers a flexible approach to the compilation of industry-by-industry IOTs in current prices and in volume terms. The twinning project was launched with the aim of building a macroeconomic model to assist the Government in macroeconomic planning and management. The close link between the two projects facilitated the transition from a simple aggregated model to a more complex and disaggregated model. Apart from providing new insight into the economy, it also created a close link between the model builders and users and the producers of the statistical inputs to the model. This, in effect, acts as a quality assurance system, bringing important feedback which may be used in further improving the statistics. Once the disaggregated model was implemented it became apparent that the new methodology was a huge improvement.

21.91 Choosing the type of model to build clearly depends upon the purpose for which it is going to be used. Design criteria of international cooperation programmes in the country were that the country would be able to analyse them and that the model would be useful in formulating the national budgets, an area in which it had already proved helpful, for example, by estimating the fiscal position and any related financing needs, and in keeping track of the revenue effects flowing from tax policies.

21.92 The debate about whether or not to go for large-scale models or to keep them small and simple is a recurrent theme. When the model project was on the drawing board, a large model was adopted since there was a need for IOTs to form the core of the model.

21.93 The IOTs derived from the SUTs were used to create the core of the macroeconomic model. In addition, the IOTs for 2002–2010 made up the bulk of the data for the model. For each year, the IOTs in current and previous years' prices were used to create constant price-value time series by chain-linking. The input-output coefficients used in the model were estimated from the latest version of the IOTs, which also defined the base year of the model's dataset.

21.94 The data in the SUTs was aggregated into 26 domestic industries, of which 15 were importers of goods and services. Definitions were also provided for the prices of intermediate inputs and all the 35 final use components. One particularly useful design was the separation of household's production for own use and what was sold on the market.

## D. Development of the application of the input-output framework in the Czech Republic

21.95 The Czech Republic became an independent State in 1993 following the dissolution of Czechoslovakia. Economic statistics including input-output accounts had a long tradition in the country, starting in the 1950s in association with economic planning, and used in managing fulfilment of the plan to provide statistical information to the public.

21.96 From 1969, Czechoslovakian statistics were organized by three main agencies: the Federal Statistical Office, which had the role of coordinating and creating the methodology for data surveys, and the Slovak Statistical Office and the Czech Statistical Office, which served as subsidiaries, mainly concerned with data collection.

21.97 In addition, there were a number of research institutes that worked closely with the statistical offices. Czechoslovakia implemented the Soviet model for macroeconomic statistics, which consisted of sets of balances, known as balances of the national economy. Among these, the most important were the balances of national income, balances of the non-productive sphere and balances of capital. These balances were very close to a system of national accounts in principle, although they operated with different sets of tables (like accounts). The key part of the system devoted to the creation of product was known as the "material product system" and it covered production by productive sphere. This very narrow concept of production covered only tangible products (goods) and selected services. The material product system also covered IOTs.

21.98 In line with Marxist theories, socialist measurement of economy was based on the division of economy into productive and non-productive activities and this was applied to both national income measurement and IOTs. This meant that IOTs compiled in socialist countries were not comparable with the practice in Western countries. Box 21.1 provides details on the evolution of the material product system and the Phare[13] projects in all the new EU countries through to the development of SUTs.

21.99 The first IOTs were compiled for Czechoslovakia for 1962 (using 96 products) and extensive research work preceded the compilation of these tables. Since then the IOTs were produced roughly every five years (in 1967, 1973, 1977, 1982 and 1987). The first tables for the Czech Republic were compiled retrospectively after the formation of the Czech Republic in 1993, for the year 1973 (using 89 products), and subsequently for the years 1977, 1982 and 1987.

**Box 21.1 Material product system and Phare projects**

After the Russian Revolution, the official national accounts for the USSR from the 1920s were based on the Marxist production concept, later known as the material product system. From the 1950s, other centrally planned countries followed suit, using the material product system for their national accounts.

The 1969 version of the material product system was published in Russian in 1970, and became the official statistical standard for measurement of economic performance for the centrally planned countries.

From 1971, the United Nations accepted that these countries used the 1969 material product system for their reporting to United Nations, while much of the remaining world tended to use the 1968 SNA.

The major conceptual difference between the 1969 material product system and the 1968 SNA consisted in the production boundary, which was confined to the so-called "material" production in the 1969 material product system. For example, the services of owner-occupied dwellings and government health care, education and defence were not regarded as production. The 1969 material product system already included concepts such as actual consumption (total consumption of the population), first included in the 1993 version of the SNA. Some of these countries compiled IOTs between 1960 and 1989 following the methodological principles of the material product system – the basic indicator in this system was "Net material product". Some countries used both the material product system and the 1968 SNA in parallel.

In 1989, the European Commission started so-called Phare projects, with the aim of improving official statistics in Phare candidate countries, which, at that time, comprised Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia). A number of Phare projects have been undertaken for the implementation of ESA 1995 (Eurostat 1996) in these countries. The majority of the 12 countries that became new member States of the European Union had experience in compiling IOTs following the methodological principles of the material product system. During this transition period, many of these countries faced the difficult task of introducing new concepts in surveys, establishing new data sources, in particular for service sector activities, and changing the classifications used, for example to ISIC, then later to NACE. Some of these countries, however, such as Slovenia, already had some experience of the compilation of IOTs in accordance with the 1968 SNA (IOTs for Slovenia following the 1968 SNA were compiled for the years 1990, 1992 and 1993).

In accordance with ESA 1995, later ESA 2010, all European Union and European Economic Area countries are obliged to prepare SUTs and IOTs. The first SUTs and IOTs for some of the countries with economies in transition were published in the second half of the 1990s. Major challenges relating to the compilation of SUTs for many of the 12 new European Union countries have included:

- New price and volume measures as price statistics had not been part of their statistical practice.

[13] Based on the acronym "PHARE", formed from "Poland and Hungary: Assistance for Restructuring of the Economy".

- Calculation of consumption of fixed capital for all industries using the perpetual inventory model (PIM) approach.
- FISIM allocation by the consuming industries and final uses.

Several of these countries are now compiling SUTs as an integral part of the compilation of final or benchmarked annual national accounts in current prices, and as the framework for balancing national accounts and compiling national accounts aggregates. In 2006, the Norwegian Statistical Office signed contracts with three Eastern European countries, allowing them to use its software. One of the institutions, the Czech Republic Statistical Office, used the Norwegian software to implement commodity flow for balancing SUTs, combined with its own Excel-based routines, and in continuing to develop its systems and processes. In 2009, Statistics Norway also accorded Slovakia the right to use that software.

All the European Union countries are now compiling SUTs in current prices. Only about half of these countries are compiling annual SUTs in previous years' prices, however, and these include some of the former Phare candidate countries such as the Czech Republic, Hungary, Slovakia and Slovenia. The Czech Republic, Hungary and Slovenia, among other countries, are now also compiling IOTs in current prices (on a five-yearly schedule), and the Czech Republic is also one of the few European Union countries producing IOTs in previous years' prices. For some countries, the present day position has also reflected the change to the compilation process of producing SUTs before IOTs, as opposed to producing IOTs alone.

21.100 National accounts were introduced in Czechoslovakia with the transformation of the country after 1990. Ideas that had originally been put forward about combining the balances of national economy and the SNA were abandoned. During the preparation for the transformation of macroeconomic statistics, Czechoslovakia was divided into the Czech Republic and the Slovak Republic. The first national accounts were compiled for the Czech Republic for 1992 in 1995. The division of the country also meant the closure of the Federal Statistical Office. Some skilled experts moved to the Czech Statistical Office but many left to join private companies.

21.101 The first Czech Republic national accounts contained both institutional sector accounts and SUTs at purchasers' prices based on concepts from the 1993 SNA and ESA 1995. The 1968 SNA was never implemented in Czechoslovakia, except for GDP estimates compiled within the international comparison programme organized by the United Nations. Progress in the compilation of national accounts during the 1990s was driven by aspects most in demand, such as the need for improvements in institutional sector accounts, the construction of financial accounts and, subsequently, the construction of balances of non-financial assets. SUTs were not often compiled and were only completed for the years 1995 and 1997.

21.102 Before the country's entry into the European Union in 2004, a major revision of the Czech Republic national accounts was undertaken. This revision included time series of both institutional sector accounts and SUTs for 1995–2003 and ensured full consistency between institutional sector accounts and SUTs. Since then, SUTs have become a standard tool for balancing and deflation in the annual national accounts and IOTs compiled every five years.

21.103 Currently, the Czech Republic national accounts have two parts:

- Institutional sector accounts describing the creation, distribution and redistribution of values (including balance sheets).
- SUTs and IOTs describing technical links and the process of production.

21.104 The SUTs are now compiled annually with three vintages: t+9 months (preliminary), t+15 months (semi-definitive) and t+27 months (definitive). These tables serve the statistical office and also other users: their main purpose is to find equality between resources and uses at the product level and on aggregates. These tables are automatically deflated into previous years' prices and resulting GDP deflators and volumes derived. Up to now, quarterly SUTs have not been compiled but the structures from annual SUTs (industrial weights) are used to produce quarterly GDP estimates.

21.105 The SUTs provide the main tool for the analysis of compiled figures and the balancing adjustments are also taken into the institutional sector accounts, balances of fixed assets and inventories. Balancing equality is found between two completely independent approaches to measuring GDP – production and expenditure. The balancing exercise is carried out by a team of seven staff members with clear roles and responsibilities for specific products and industries. All members of the balancing team record balancing adjustments following balancing protocols. This ensures that the Czech Statistical Office is quite transparent in its processes and able to describe how consistency is achieved.

21.106 The core of the Czech input-output system is represented by annual SUTs compiled at the two-digit level of CPA and NACE, consistent with CPC and ISIC respectively.

21.107 Appropriate information technology systems were evaluated for SUTs and IOTs before it was decided to construct a bespoke internal system using spreadsheets. In 2006, the Czech Statistical Office implemented the Norwegian database system, SNA-NT. In both systems (Norwegian and Czech), all valuation sets are simultaneously balanced – purchasers' prices, VAT, trade margins, transport margins, subsidies on products, taxes on products and basic prices. The use table at basic prices is further split between domestically produced products and imported products. All sets of data are important for deflation purposes.

21.108 While the spreadsheet-based Czech system had about 90 products, the SNA-NT used by the Czech Statistical Office has more than 1,500. The spreadsheet system is still used for preliminary version of SUTs and for major revisions. Balancing of SUTs, carried out by a skilled team using the spreadsheet system, takes about two weeks. The more developed and detailed SNA-NT process takes around one and half months.

21.109 The Czech Statistical Office is also very active in international cooperation. Between 2007 and 2014, the Office extended technical assistance to the former Yugoslav Republic of Macedonia for the development of national accounts including the input-output system. The Czech system for SUTs was also introduced in Azerbaijan (2010–2012) and Slovakia (2012–2013). The principal aim of the approach is consistency. Even though some minor aspects may be omitted, it is crucial that full consistency be achieved between institutional sector accounts (both non-financial and financial accounts) and SUTs. Experience has shown that it seems easier and more likely to be successful to start with a simplified but complex system rather than to build up fragments or unrelated tables from the SNA framework.

21.110 In September 2011, new series of SUTs and IOTs were published using the new CPA 2008 and NACE Revision 2 classifications. The revision of the Czech national accounts covered all years over the period 1990–2010. The SUTs are compiled for all years and IOTs (both product-by-product and industry-by-industry versions) for years ending with 0 or 5.

21.111 Experts from the University of Economics in Prague estimated goods and services for 1970–1989 based on 1993 SNA and ESA 1995 methodology. These estimates were based on Material Product System (MPS) figures and the original IOTs for 1973 and 1987. In 2012, the users were provided with long-run comparable series of sources and uses of GDP (goods and services) starting in 1970 (in 1971 at previous years' prices). Revisions to the CPA (linked to CPC) and NACE (linked to ISIC) classifications have caused a number of complications for compilation and for users.

21.112 The greatest difficulty, however, is associated with the implementation of the 2008 SNA and ESA 2010. These new standards are very demanding for both compilers and users, and the launch of their implementation has been difficult. Nonetheless, the 2008 SNA-ESA 2010 based accounts were fully implemented in the Czech Republic in 2014. This revision covered the entire time series starting in 1990 and is expected to be further extended back to 1970.

21.113 The 2008 SNA-ESA 2010 approach to foreign trade covering merchanting is to record the goods on the export side (even with negative values) and adoption of the principle of change of ownership affecting processing will cause problems to users. Users of IOTs from research institutes and universities were accustomed to some measure of interpretation of production process, production function and resulting input-output coefficients. The new thinking introduced in the 2008 SNA-ESA 2010 will change these assumptions and issues like factory-less production will acquire an increased role. The link between production (output) and intermediate consumption is not so straightforward and it means that the concept of financial flows is preferred to physical production. The difference between the institutional sector accounts' concept of generation of income (who has a profit) and the industries' production account concept is getting closer to the production side of national accounts represented by SUTs and IOTs.

## E. Continual change, development and improvement in Chile

### 1. Background and institutional framework

21.114 The production of IOTs in Chile has historically been linked to the benchmarking of the national accounts, which constitute the most comprehensive estimation for macroeconomic aggregates for the Chilean economy in a given year. The production of IOTs began in the 1960s, when the national accounts were compiled at the Office for National Planning. During this period, two IOTs were produced, for the years 1962 and 1977. In 1982, the compilation of national accounts was transferred to the Central Bank of Chile, where four further benchmarking exercises were carried out, along with the corresponding IOTs for the years 1986, 1996, 2003 and 2008. Table 21.1 provides a summary of the historical benchmarks.

**Table 21.1 Historical benchmark exercises**

| | Benchmark year | | | | | |
|---|---|---|---|---|---|---|
| | 1962 | 1977 | 1986 | 1996 | 2003 | 2008 |
| Benchmark SNA | 1953 | 1968 | 1968/1993 | 1993 | 1993 | 1993/2008* |
| Breakdown industry/product | 54 x 54 | 68 x 68 | 75 x 75 | 73 x 73 | 73 x 73 | 111 x 76 |
| Price basis | constant | constant | constant | constant | constant | chain-linking |
| Compatibilisation basis | SIOT | SIOT | SUT | SUT | SUT | SUT |
| Valuation (prices) | purchaser | purchaser | purchaser<br>producer<br>basic | purchaser<br>producer<br>basic | purchaser<br>producer<br>basic | purchaser<br>producer<br>basic |
| Integrated economic accounts | - | - | - | yes | yes | yes |

* Recommendation of 2008 started to be implemented.

21.115 Currently, the Chilean statistical system comprises with two main institutions responsible for the compilation of economic information:

- National Statistical Institute, responsible for producing a wide range of production, sales, consumption, employment and price statistics
- Central Bank of Chile, responsible for the compilation of the national accounts, balance of payments and monetary statistics

21.116 As the basis for their preparation, the estimation of macroeconomic aggregates was organized in separate compilation cycles. Each cycle starts with the definition of a benchmark year, which determines the methods and statistical infrastructure for the follow-up estimates of the reference year. The cycle ends with the setting of a new benchmark year, at which point a new cycle begins, on a rolling basis.

21.117 As mentioned above, the benchmarking exercise forms the most detailed estimation of national accounts. The main objectives are to:

- Revise previous estimates obtained from non-benchmark years (follow up exercises)
- Introduce considerable improvements to the methods and new classifications of industries and products

- Gather data for the preparation of IOTs

21.118 Throughout the compilation cycles, the SUTs have formed a key element in the compilation of the Chilean national accounts and significant efforts have been made to improve their compilation and quality. These improvements have been undertaken in each of the benchmarking exercises, in particular the most recent exercise, for the year 2008.

## 2. Benchmarking exercise for 2008

21.119 The benchmarking exercise for 2008 represented a significant improvement for the compilation of Chilean national accounts. The results were published in December 2011 and included SUTs (176 products and 111 industries) along with IOTs (111 products and 111 industries). The project comprised extended information collection and comprehensive use of the regular sources available for any follow-up year.

21.120 Several innovations were introduced following international recommendations as set out in the 2008 SNA. The main innovations in terms of sources of information were:

- Redesigned forms for structural economic surveys
- Inclusion of new relevant sources not available for follow-up compilation, such as household budget surveys and agricultural census, among others
- Conduct of specific studies, including in such areas as agriculture, livestock and forestry, trade margins and passenger transport
- Revised and updated business register

21.121 Where improvements to the methods are concerned, a more detailed breakdown of products and industries was used in the SUTs. The benchmarking exercises for 1996 and 2003 were compiled using square SUTs (73 products and 73 industries), whereas the exercise for 2008 applied rectangular SUTs (176 products and 111 industries). In addition, a new method for the estimation and allocation of FISIM was implemented and the so-called “user cost” method was introduced for the estimation of dwelling services. Lastly, information on software and mining prospection was recorded as gross fixed capital formation.

21.122 Traditionally, benchmark exercises also provided the fixed base period for estimates in volume terms or constant prices. In line with international recommended practice, volume-based estimates using the 2008 benchmark are now compiled using previous years’ prices and chain-linking methods for obtaining a consistent time series. Since this method makes it possible to keep up-to-date weights for volume-based data, it also represents a significant improvement for the estimates thereafter.

21.123 Since this exercise, the follow-up estimates have presented SUTs in current prices with the same breakdown of industries and products, along with valuation at basic prices, producers' prices and purchasers' prices. Similarly, IOTs will be elaborated and published annually for 111 products and 111 industries. This represents a significant improvement compared with the previous compilation cycle, where IOTs were only available for the benchmark years.

## 3. Data sources

21.124 The Chilean national accounts compilers have a wide range of data sources at their disposal for the compilation of SUTs.

21.125 The principal sources are annual business surveys and administrative records. The annual business surveys are collected for almost all industries and are conducted primarily by the National Statistical Institute. These surveys mainly present information on sales, purchases, employment, compensation of employees, capital expenditures and taxes. In addition to this information, several surveys gather data on products. Thus, the manufacturing survey uses two sets of forms to gather information on purchased and sold products. This information is very useful for the compilation of the detail in the domestic supply part of the supply table and the intermediate use part of the use table. The annual business surveys used in the Chilean national accounts are shown in Table 21.2, along with the institution in charge of the collection and the number of units collected every year.

**Table 21.2 Annual business surveys**

| Industry | Units collected (approximated) | Source |
|---|---|---|
| Mining | 60 | Central Bank of Chile |
| Fishing | 100 | Central Bank of Chile |
| Manufacturing | 4,000 | National Statistical Institute |
| Energy | 190 | Central Bank of Chile |
| Trade | 3,000 | National Statistical Institute |
| Restaurants and hotels | 550 | National Statistical Institute |
| Cargo road transportation | 500 | National Statistical Institute |
| Other transports | 400 | Central Bank of Chile |
| Comunications | 90 | Central Bank of Chile |
| Private education | 200 | Central Bank of Chile |
| Private health | 80 | Central Bank of Chile |
| Business services | 2,000 | National Statistical Institute |
| Other services | 500 | National Statistical Institute |

21.126 Administrative records are also used extensively in the compilation of the Chilean national accounts and they provide a high coverage of statistical units, in particular regarding formal activities. A substantial part of the administrative records are derived from the Internal Revenue Service, namely information on VAT, income and wage statements.

21.127 Foreign trade data are mainly obtained from records kept by the National Customs Service and from the Foreign Exchange Regulation Manual maintained by the Central Bank of Chile.

21.128 Table 21.3 below shows the main administrative records used in Chilean national accounts.

**Table 21.3 Administrative records**

| Information | Source |
|---|---|
| Value added tax<br>Income statements<br>Wages statements | Internal Revenue Service |
| Custom records | National Customs Service |
| Fiscal income records | National Treasury |
| Foreign exchange regulation Manual | Central Bank of Chile |
| Budget statements | National Controller's Office |

21.129 The National Statistical Institute collects a wide range of monthly surveys and indices that are used less extensively in the compilation of SUTs. These surveys mainly focus on mining, manufacturing and utilities, covering output and sales, and also retail trade sales. Surveys of employment and compensation of employees are also carried out.

21.130 Other regular sources used include the CPI, PPI, company balance sheets, financial statements, annual reports and statistical yearbooks of various institutions and industries.

21.131 Information sources that are not available on a monthly or yearly basis are incorporated into national accounts estimates for every benchmark exercise. These include information from the household budget survey, known in Chile as the EPF, currently collected every five years, and also data collected in specific censuses, such as those on agricultural livestock and forestry, and on fishery and aquaculture.

21.132 For benchmark years, special studies are conducted by the Central Bank of Chile in order to collect specific information from industries not adequately covered by surveys or administrative records. This is the case of agriculture, forestry, construction, capture fishery and aquaculture, trade, and passenger road transport. These studies gather information on prices of products, inputs and trade margins.

## 4. Compilation of SUTs

### (a) Industry production accounts

21.133 Production accounts are compiled using three methods – censused industry method, sampled industry method, and product method. The choice of the method depends on the information available for each industry. Hence, for industries where complete coverage of units is available, the censused method is chosen. Conversely, if the data cover only a sample of the industry, the sampling method is applied. Lastly, the product method is considered for industries with no information on companies or establishments but with data on their respective main products and prices.

21.134 The censused industry method consists in estimating the total output, intermediate consumption and GVA by industry (the SUTs column total) at a population level, using data directly from surveys and financial statements for all companies. The output, intermediate consumption product breakdown and the components of GVA are obtained primarily from the surveys.

21.135 The sampled industry method estimates total output, intermediate consumption and GVA by industry (the SUTs column total), extrapolating to the population information obtained from a sample of companies or establishments. The population level is obtained primarily from tax records provided by the Internal Revenue Service. In addition, economic surveys provide information on the sample of production unit, detailing the output product breakdown together with cost structures, including intermediate consumption and GVA.

21.136 The product method consists in estimating the total supply by product (the SUTs row total) at the population level. It is based on the measurement of value through price and quantity (commodity flow) by using data on supply of products. Once output levels have been obtained, the cost structures are derived based on estimated production functions or economic surveys.

21.137 A special feature of the production accounts compilation is that output is also allocated in an expenditure variable. This estimation is called “supply hypothesis” and it is based on information obtained from the same surveys that are used to produce the industries’ production accounts or, in some cases, derived directly according to the nature of the products. This means that all the supply is classified in accordance with its hypothetical use, either intermediate use or final use. The supply hypothesis will be more robust as the product breakdown in the SUTs increases, making it easier to determine whether the product is used for household final consumption, capital investment or intermediate consumption.

**(b) Imports**

21.138 Imports are primarily estimated using data from customs records at the eight-digit level of the Harmonized System and are valued at CIF prices along with the import duties. The estimation of imports identifies whether they were carried out directly by the user of the good (direct purchases) or by a trade business. In the latter case, trade margins are estimated for imported goods.

21.139 Similar to domestic supply, imports are classified by type of use, namely final consumption, capital investment or intermediate consumption products. This produces the so-called “supply hypothesis” for imported goods and services. This hypothesis is based on the nature of the good or service. The allocation process is carried out at the eight-digit level of the Harmonized System and recognizes goods with dual use. Thus, for example, the imports of vehicle fuel could be destined to “Household final consumption expenditure” or “Intermediate consumption of the transport industry”, among others.

### (c) Expenditure variables

21.140 The expenditure variables are estimated using a diverse suite of methods. The variables compiled are household final consumption expenditure, gross fixed capital formation, changes in inventories and foreign trade.

21.141 The estimation of household final consumption expenditure is based on data obtained from the household budget survey. Currently, this survey is conducted every five years and collects details of monthly expenditure for a sample of more than 10,000 households of Greater Santiago and the regional capitals. The sample is expanded to the population universe, separately between Greater Santiago and the rest of the country, based on an expansion factor constructed for each area from the population data held by the National Statistical Institute. The household consumption vector thus obtained is incorporated for the benchmark compilation. For non-benchmark years, household consumption is estimated using the monthly surveys of retail trade along with information from the production accounts from industries.

21.142 Information on final consumption expenditure of government and NPISH is derived from industry production accounts. Final consumption expenditure of government is estimated using sum of costs, and final consumption expenditure of NPISH is obtained from the tax statement from non-profit institutions.

21.143 Gross fixed capital formation is estimated by product and requesting industry, primarily using data from the compilation of production accounts of the construction industry, the imports of capital goods, tax records and economic surveys. In the 2008 benchmark exercise, a service component was incorporated as intangible fixed assets, related to software and mining prospecting, in line with the recommendations of the SNA.

21.144 The estimation of inventories employs varied sources of information, including income tax records, economic surveys and financial statements. In order to ensure comparability with the rest of the expenditure aggregates in the SUTs, the method used to obtain the value of the inventory change considers valuing stocks at the average price of the period being estimated. To this end, inventory turnover rate (period of product permanence in stock), and inventory entry and exit prices are estimated in order to elaborate an appropriate deflator.

21.145 Exports are estimated using data primarily drawn from customs records at the eight-digit level of the Harmonized System and are valued at FOB prices.

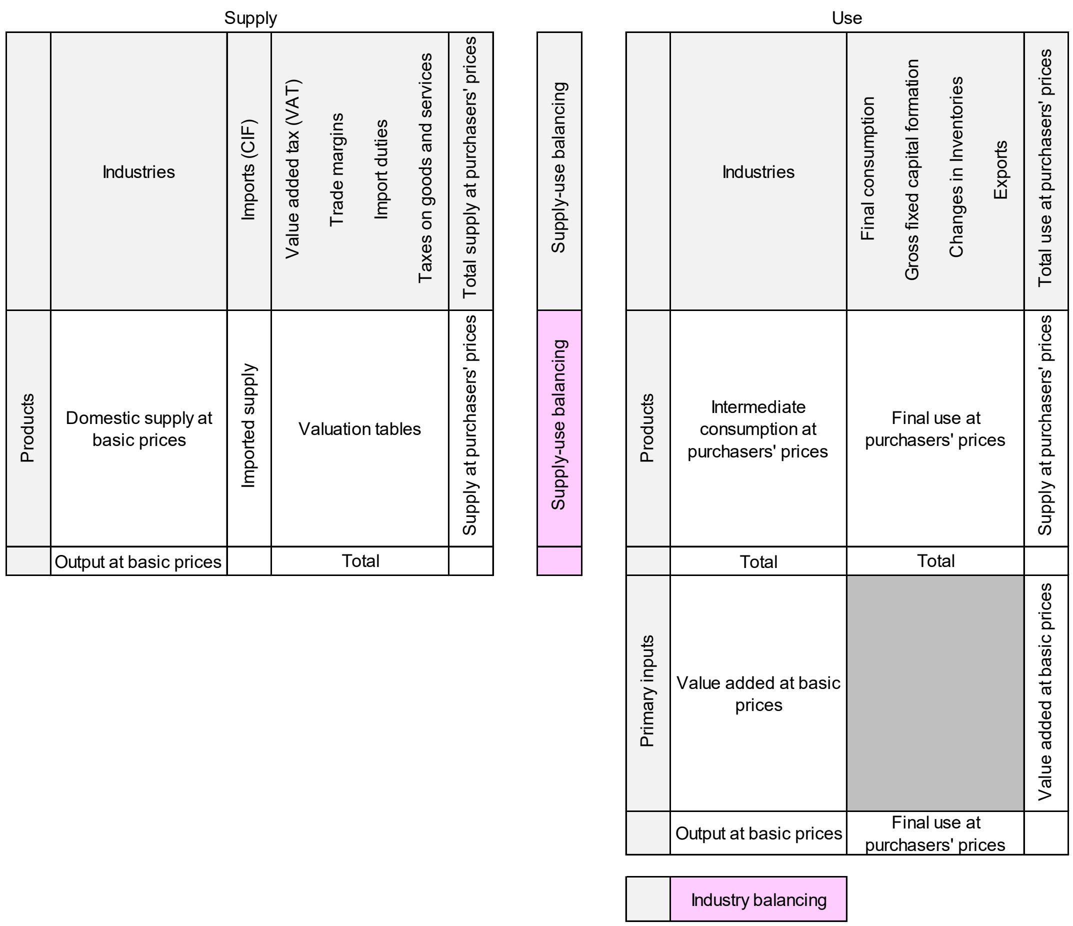
### (d) SUTs compilation

21.146 The SUTs are composed by transaction and valuation tables as shown in Figure 21.2. Transaction tables relate to supply, use, and GVA, while the valuation tables cover non-deductible VAT, trade margins, import duties, and taxes on goods and services.

21.147 Domestic supply and value added tables at basic prices, together with the intermediate consumption table at purchasers' prices, are obtained directly from the industries' production accounts. These accounts contain information for each one of the industries in the SUTs, and also the breakdown of products.

21.148 Imported supply at basic prices is derived directly from the import estimates at CIF prices.

**Figure 21.2 Supply and use table**




21.149 Where valuation tables are concerned, wholesale and retail trade margins are estimated from a special study developed for the collection of such data. For domestic margins, the margin rates obtained in the study are applied to the basic price valuation. The imported product margins are obtained directly from the imports study.

21.150 The non-deductible VAT table is prepared using the actual amount collected by the Government which is distributed using a theoretical VAT rate for each product. The latter is applied to intermediate consumption and gross fixed capital formation for exempted industries, and also to household final consumption expenditure.

21.151 The import duties table is constructed using records from the national customs service, in which each transaction includes an amount of duties paid. These amounts are reconciled and corrected according to amounts actually received by the Government.

21.152 The taxes on domestic goods table is derived directly with information from the Government, and includes products subject to excise taxes, such as fuels and tobacco.

21.153 Final use tables are obtained in accordance with the expenditure-side variable estimation.

### (e) SUTs balancing

21.154 In general terms, balancing the SUTs is an iterative process, which involves arbitrating differences by analysing the economic consistency of the results and the reliability and quality of each data source used. The process consists in detecting any inconsistencies that may arise and making any necessary ad hoc adjustments. Corrected data are included back into the balancing process, which ends when no more discrepancies are found; in this way, consistency of the SUTs is attained.

21.155 In the Chilean context, most of the figures from the production table, imports, exports, import duties, taxes on production and non-deductible VAT are set as predetermined values. Variables that are more prone to changes during the balancing process include intermediate consumption, trade margins and some components of final consumption.

21.156 As explained above, domestic and imported supply present an allocation in expenditure variables, called the "the supply hypothesis". During the balancing process, this hypothesis is compared with the actual estimation of intermediate consumption and expenditure side variables, with the exception of exports that, given the robustness of the data, present a special case. In this way, two sets of estimations may be observed for each of the use table variables, one from the "supply hypothesis", and the second from the "use hypothesis".

21.157 For example, Table 21.4 presents an unbalanced SUT for tobacco products. The first row shows the use hypothesis and the second row the supply hypothesis. Given that there is a unique estimation for exports, the main difference is observed in final consumption. In this case, the supply hypothesis is considered more robust because it is obtained directly from company information and tobacco production in particular is concentrated in one company. On the other hand, the use hypothesis is obtained from household surveys and it is known that these surveys tend to underestimate consumption for products of this type. Accordingly, in this particular case, the supply hypothesis prevails.

**Table 21.4 SUTs for tobacco products, year 2008, current prices**

| | Domestic supply | Imported supply | Total supply | Intermediate consumption | Final consumption | Gross fixed capital formation | Changes in inventories | Exports | Total use |
|---|---|---|---|---|---|---|---|---|---|
| 1. Use hypothesis | | | | 30 | 500 | | -20 | 250 | 760 |
| 2. Supply hypothesis | 1000 | 12 | 1012 | 30 | 766 | | -34 | 250 | 1012 |

21.158 A different situation is observed in Table 21.5, which presents an unbalanced SUT for cleaning and toiletry products. In this case, it is more difficult to identify whether products of this type are used for final or intermediate consumption. The use hypothesis based on the household survey should deliver a better estimate for final consumption and this hypothesis will therefore dominate through the balancing process.

**Table 21.5 SUT for cleaning and toiletry products, year 2008, current prices**

| | Domestic supply | Imported supply | Total supply | Intermediate consumption | Final consumption | Gross fixed capital formation | Changes in inventories | Exports | Total use |
|---|---|---|---|---|---|---|---|---|---|
| 1. Use hypothesis | | | | 170 | 1111 | 0 | 2 | 38 | 1321 |
| 2. Supply hypothesis | 789 | 444 | 1233 | 143 | 1015 | 0 | 36 | 38 | 1232 |

## 5. Compilation of IOTs

21.159 Once the SUTs at purchasers' prices are balanced, data are prepared for the transformation into IOTs. This involves obtaining SUTs at basic prices and also identifying domestic output separately from imports. The procedure may be summarized as follows:

- Converting the total use at purchasers' prices into domestic use at purchasers' prices: Imports of goods and services are removed from both the supply table and the use table. Since this alters the industry equilibrium (column), a row vector of total imports by industry and type of final use is added to ensure that there is no change to the column totals.
- Converting the domestic use table at purchasers' prices into a domestic use table at producers' prices: Trade margins are redistributed from each cell of the use of goods to the trade row. Row and column equilibriums remain.
- Converting the domestic use table at producers' prices into a domestic use table at basic prices: Net taxes and subsidies on products are removed from both the supply table and the use table. Since this alters the industry equilibrium (column), a row vector of net taxes and subsidies on products by industry and type of final use is added.
- Converting the domestic use table at basic prices into an IOT at basic prices: The IOT may be either product-by-product or industry-by-industry. In the case of Chile, the industry technology is preferred in order to ensure that no negative values arise in the IOTs (this

furnishes an example of product-by-product IOTs being compiled using the product technology).

21.160 Table 21.6 shows IOTs for the Chilean economy for the year 2008.

**Table 21.6 IOTs for domestic output at basic prices, 2008**

| | | | PRODUCTS | | | | | | | FINAL USE | | | | | | | | Total at basic prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agricul-ture | Manufac-turing | Construc-tion | Trade, transport and communication | Finance and business services | Other services | Total | Final consumption expenditure | | | Gross fixed capital formation | Changes in inventories | Exports | Total | |
| | | | | | | | | | | Households | NPISH | General government | | | | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
| PRODUCTS | Agriculture | (1) | 1 151 | 5 048 | 4 | 99 | 15 | 29 | 6 346 | 892 | | 53 | 255 | - 97 | 1 175 | 2 278 | 8 624 |
| | Manufacturing | (2) | 1 948 | 17 914 | 3 720 | 3 554 | 918 | 1 341 | 29 394 | 10 733 | | 83 | 887 | 795 | 29 780 | 42 278 | 71 672 |
| | Construction | (3) | 16 | 161 | 10 | 263 | 123 | 1 259 | 1 833 | | | | 12 900 | | | 12 900 | 14 734 |
| | Trade, transport and communication | (4) | 712 | 4 649 | 1 234 | 7 271 | 1 315 | 1 011 | 16 192 | 14 960 | | 167 | 1 433 | 4 | 5 465 | 22 029 | 38 221 |
| | Finance and business services | (5) | 641 | 4 547 | 1 337 | 5 524 | 4 619 | 1 773 | 18 440 | 5 036 | | 123 | 914 | 0 | 660 | 6 733 | 25 173 |
| | Other services | (6) | 32 | 300 | 29 | 349 | 179 | 652 | 1 542 | 12 779 | 717 | 10 069 | 10 | 0 | 37 | 23 612 | 25 153 |
| | Total | (7) | 4 500 | 32 620 | 6 334 | 17 060 | 7 169 | 6 065 | 73 747 | 44 400 | 717 | 10 495 | 16 399 | 702 | 37 117 | 109 831 | 183 578 |
| | Imports | (8) | 984 | 13 659 | 1 482 | 5 111 | 1 175 | 640 | 23 052 | 6 147 | | | 6 014 | 466 | 922 | 13 550 | 36 602 |
| | Total | (9) | 5 484 | 46 279 | 7 816 | 22 171 | 8 344 | 6 706 | 96 799 | 50 547 | 717 | 10 495 | 22 414 | 1 168 | 38 039 | 123 380 | 220 179 |
| | Taxes less subsidies on products | (10) | 23 | 174 | 27 | 564 | 518 | 536 | 1 842 | 6 229 | | 58 | 765 | 15 | 3 | 7 069 | 8 911 |
| | Direct purchases abroad by residents | (11) | | | | | | | | 501 | | | | | | 501 | 501 |
| | Purchases on the domestic territory by non-residents | (12) | | | | | | | | - 911 | | | | | 911 | | |
| | Total at purchasers' prices | (13) | 5 507 | 46 454 | 7 842 | 22 735 | 8 861 | 7 241 | 98 641 | 56 365 | 717 | 10 553 | 23 179 | 1 184 | 38 953 | 130 950 | 229 591 |
| VALUE ADDED | Compensation of employees | (14) | 1 358 | 5 465 | 3 265 | 7 268 | 6 370 | 10 406 | 34 133 | | | | | | | | |
| | Other taxes less subsidies on production | (15) | 83 | 162 | 106 | 281 | 206 | 606 | 1 445 | | | | | | | | |
| | Gross operating surplus/Gross mixed income | (16) | 1 676 | 19 592 | 3 520 | 7 936 | 9 735 | 6 900 | 49 359 | | | | | | | | |
| | GVA | (17) | 3 117 | 25 219 | 6 891 | 15 486 | 16 312 | 17 912 | 84 937 | | | | | | | | |
| | Output at basic prices | (18) | 8 624 | 71 672 | 14 734 | 38 221 | 25 173 | 25 153 | 183 578 | | | | | | | | |

Chile 2008

## 6. Future developments

21.161 The last benchmark process started with the planning of the project during 2012 and benchmark data for 2013 published in December 2016. The Central Bank of Chile has already initiated the work related to a new benchmark exercise for the year 2021.

21.162 The focus of this benchmarking exercise will reflect the update of the statistical infrastructure, namely ISIC Revision 4 and CPC Revision 2, while also continuing with the implementation of 2008 SNA. In addition, the project will incorporate information about production accounts and expenditure variables not available for non-benchmark years, such as the agriculture and construction industries and also trade margins and household consumption.

21.163 Lastly, improving the balancing process is a key task and the Central Bank of Chile is currently working on its implementation. In this context, the Bank is exploring the use of statistical techniques to obtain balanced and reconciled SUTs and the use of an automated balancing process, making it possible to systematize estimation processes, extend the detail of products and industries in the SUTs and improve the reliability of results.

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