Economic and Social Commission for Western Asia (ESCWA)

ASSESSING THE ECONOMIC IMPLICATION OF ENERGY REFORM IN THE ARAB COUNTRIES: THE CASE OF TUNISIA

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ABSTRACT

This study combines two approaches to analyze energy subsidy, a macroeconomic approach using a CGE model and a microsimulation approach using Commitment of Equity (CEQ)

The CGE model results show that reducing energy subsidy generates a fiscal space for the Tunisian economy. In the first bunch of simulations we supposed that this 'saved' amounts are totally directed to the reduction of fiscal deficit. This policy enhances the fiscal sustainability and reduces indebtment but have a negative impact on growth and job creation. The microsimulation approach shows that, after considering all taxes and direct cash transfers and indirect subsidies, the rate of poverty decreases by almost 4 points from 15.2% for disposable income to 11.6% only for consumable income. This significative decrease of poverty change argues that subsidies is a pro-poor instrument for distribution of income. The fiscal incidence by decile shows that the poorest groups benefit of energy subsidies more that the richest groups. This result shows the large reliance of subsidies as instrument for redistribution.

Introduction

Tunisia is known of her long tradition of generous energy and food subsidies. Subsidies is a mechanism of social protection strategy for the country since 1970s. The policy of subsidy of basic food good's as well as energy has been maintained even in some difficult period of the Tunisian economy. The universal subsidies have been maintained because of the large size of the informal sector, the high levels of poverty and inequality. The creation of the la Caisse Générale de Compensation (CGC) was set up in May 1970 in order to act primarily on the prices of certain basic food stuffs in order to contain the increases in their price and thereby preserve the purchasing power of the most deprived classes.

Energy subsidies are among the most pervasive and controversial fiscal policy tools in Tunisia. Their reform continues to be difficult, from a political, economic and social perspective, due to the original objectives of these measures—such as the need to protect the most vulnerable households and to foster domestic industrial growth. Due to the increasingly unsustainable budget implications, a new strategy has begun to reform the subsidy system in the energy sector while striking a balance between improving fiscal and equity considerations without increasing social tensions.

The widespread use of energy subsidies affects growth, employment as well as fiscal balance and investment in the energy sector itself. Energy subsidies have also been shown to be strong, procyclical 'destabilizers' in oil- and gas-importing countries across MENA, as government spending on subsidies increases during economic boom times along with rising demand, and declines as economic activity falls (Sdralevich et al., 2014, 21–22; IMF, 2013, 37–40). Several studies have demonstrated the negative consequences of procyclical spending in developing economies (Lane, 2003; Abdih et al., 2012; Erbil, 2011), including the effect of commodity cycles on political stability over the medium and long term (El-Katiri and Fattouh, 2017)

This study combines two approaches to analyze energy subsidy, a macroeconomic approach using a CGE model and a microsimulation approach using Commitment of Equity (CEQ). The study argues that reducing energy subsidy could generates fiscal space for the Tunisian economy but have a negative impact on growth and job creation. The microsimulation approach shows that, after considering all taxes and direct cash transfers and indirect subsidies, the rate of poverty decreases. This significative decrease of poverty change argues that subsidies is really a pro-poor instrument for distribution of income. The paper proceeds as follow, the section 1 provides a brief description of the methodology both CGE and microsimulations approaches. Chapter 2 briefly summaries sources of data and chapter 3 presents the main results of the study using the CGE and TQM approaches.

1. Methodology

The study combines two approaches, a macroeconomic approach using a Computable general equilibrium (CGE) model assessment and a microeconomic approach using the Commitment of Equity assessment (CEQ) simulation.

1.1 The macroeconomic approach: A CGE assessment

1.1.1. The structure of the Model

CGE models are economy-wide models considered as the tool of choice for analysis of the long-term effects of large-scale reforms. Historically, the application of general equilibrium theory, portray their origin in input-output (1950s) and linear programming models (1960s) models. CGEs are considered as the synthesis these two models (Robinson, 1989). They consist on a coherent system that was realistic, solvable, and useful for policy analysis was a long process, parallel to the evolution in mainframe and more powerful computers. The model structure is presented in

Price Block

Import Price: The import price in LCU (local-currency units) is the price paid by domestic users for imported commodities (exclusive of the sales tax). It is a transformation of the world price of these imports, considering the exchange rate and import tariffs plus transaction costs (the cost of trade inputs needed to move the commodity from the border to the demander) per unit of the import. The exchange rate and the domestic import price are flexible (variables), while the tariff rate and the world import price are fixed (parameters). The fixedness of the world import price stems from the "small-country" assumption.

$$PIMP_{C,R,t} = pwm_{C,R,t} \left(1 + tm_{C,R,t}\right) EXR_t + \Sigma_{CT}(PDEM_{CT,t} \ icm_{CT,C}) \qquad (1)$$

Export Price: The export price in LCU is the price received by domestic producers when they sell their output in export markets. The tax and the cost of trade inputs reduce the price received by the domestic producers of exports. The domain of the equation is the set of exported commodities, all of which are produced domestically.

$$PEXP_{C,R,t} = pwe_{C,R,t} \left(1 - te_{C,R,t}\right) EXR_t - \Sigma_{CT}(PDEM_{CT,t} \ ice_{CT,C}) \qquad (2)$$

Demand Price of Domestic The model includes distinct prices for domestic output that is used domestically. In the presence of transaction costs, it distinguishes between prices paid by demanders and those received by suppliers. Equation (3) defines the demand prices as the supply price plus the cost of trade inputs per unit of domestic sales of the commodity in question.

$$PD_{C,t} = PDS_{C,t} + \Sigma_{CT}(PDEM_{CT,t} \ icd_{CT,C}) \qquad (3)$$

Absorption: defined as total domestic spending on a commodity at domestic demander prices. Equation (4) defines it exclusive of the sales tax. Absorption is expressed as the sum of spending on domestic output and imports at the demand prices, *PDD* and *PM*. The prices *PDD* and *PM* include the cost of trade inputs but exclude the commodity sales tax.

$$PDEM_{C,t}(1 - TQ_{C,t})\, DEM_{C,t} = PD_{C,t}\, D_{C,t} + \sum_R(PIMP_{C,R,t}\, IMP_{C,R,t}) \tag{4}$$

Marketed Output Value: For each domestically produced commodity, the marketed output value at producer prices is stated as the sum of the values of domestic sales and exports. Domestic sales and exports are valued at the prices received by the suppliers, PDS and PEXP, both of which have been adjusted downwards to account for the cost of trade inputs.

$$PYC_{C,t}\, YC_{C,t} = PDS_{C,t}\, D_{C,t} + \sum_R(PEXP_{C,R,t}\, EXP_{C,R,t}) \tag{5}$$

Output Price: The gross revenue per activity unit, the activity price, is the return from selling the output or outputs of the activity, defined as yields per activity unit multiplied by activity-specific commodity prices, summed over all commodities. This allows for the fact that activities may produce multiple commodities.

$$PYA_{A,t} = \sum_C(PYAC_{A,C,t}\, \theta_{A,C}) \tag{6}$$

Price of aggregate intermediate input: The activity-specific aggregate intermediate input price shows the cost of disaggregated intermediate inputs per unit of aggregate intermediate input. It depends on composite commodity prices and intermediate input coefficients, which show the quantity of input commodity *c* per unit of aggregate intermediate input.

$$PINTA_{A,t} = \sum_C(PDEM_{C,t}\, ica_{A,C}) \tag{7}$$

Value-added Price: For each activity, total revenue net of taxes is fully exhausted by payments for value-added and intermediate inputs

$$PVA_{A,t}\, VA_{A,t} = PYA_{A,t}\,(1 - ta_{A,t})YA_{A,t} - PINTA_{A,t}INT_{A,t} \tag{8}$$

Equations (9) and (10) define the consumer price index and the producer price index for domestically marketed output.

$$CPI_t = \sum_C cwts_C PDEM_{C,t} \tag{9}$$

$$DPI_t = \sum_{CD} dwts_{CD} PDS_{CD,t} \tag{10}$$

GDP Definition: The Gross Domestic Product is the sum of the gross value added by all resident producers in the economy.

$$GDP_t = \sum_A VA_{A,t} \tag{11}$$

$$A_{A,t}^{VA} = PGF_t \tag{12}$$

Production Block

The production and trade block covers four categories: (i) domestic production and input use; (ii) the allocation of domestic output to home consumption, the domestic market, and exports; (iii) the aggregation of supply to the domestic market (from imports and domestic output sold domestically); and (iv) the definition of the demand for trade inputs that is generated by the distribution process. Production is carried out by activities that are assumed to maximize profits subject to their technology, taking prices (for their outputs, intermediate inputs, and factors) as given. It acts in a perfectly competitive setting. The CGE model includes the first-order conditions for profit-maximization by producers. Producers choose the optimal bundle between values added and aggregated intermediate inputs, which is modelled by the Leontief function.

Leontief Technology: Demand for Aggregated Intermediate Input:

$$INT_{A,t} = inta_A YA_{A,t} \tag{13}$$

Leontief Technology: Demand for Aggregate Value-Added:

$$VA_{A,t} = iva_A YA_{A,t} \tag{14}$$

Value-Added and Factor Demands:

Aggregated Labor Demand:

$$L_{A,t}^{AGG} = VA_{A,t} A_{A,t}^{va(\sigma_A^{va}-1)} \left(b^{va} \frac{PVA_{A,t}}{W_{A,t}^{AGG}}\right)\sigma_A^{va} \tag{15}$$

Unskilled labor demand:

$$L\_UNS(A,t)\, L\_UNS(A,t) = L\_AGG(A,t)(b\_L\_AGG(A) \frac{W\_AGG(A,t)}{W\_UNS(A,t)} \sigma^{AGG\_L}(A) \tag{16}$$

Skilled labor demand:

$$L_{SKL(A,t)} = L\_AGG(A,t)(b\_L\_AGG(A) \frac{W\_AGG(A,t)}{W\_SKL(A,t)} \sigma^{AGG\_L}(A) \tag{17}$$

Capital Demand:

$$K_{A,t}^{AGG} = VA_{A,t} A_{A,t}^{va(\sigma_A^{va}-1)} \left(a^{va} \frac{PVA_{A,t}}{PK_{A,t}^{AGG}}\right)\sigma_A^{va} \tag{18}$$

$$PVA_{A,t} VA_{A,t} = PK_{A,t}^{AGG} K_{A,t}^{AGG} + W_{A,t}^{AGG} L_{A,t}^{AGG} \tag{19}$$

$$W_{A,t}^{AGG} = W_t^{Bar} \tag{20}$$

$$\sum_A L_{A,t}^{AGG} \ (1 + UNEMP_{t)} = L_t^{tot} \tag{21}$$

$$K_{capital,A,t} = K_{A,t}^{AGG} \ (b^{K_{capital,A}^{AGG}} \ \frac{PK_{A,t}^{AGG}}{rK_{capital,A,t}})^{\sigma^{K_A^{AGG}}} \tag{22}$$

$$PK_{A,t}^{AGG} K_{A,t}^{AGG} = \sum_{capital}(rK_{capital,A,t} K_{capital,A,t}) \tag{23}$$

Commodity Production and Allocation: On the right-hand side, production quantities, disaggregated by activity, are defined as yields times activity levels. On the left-hand side, these quantities are allocated to market sales and home consumption.

$$YAC_{A,C,t} + \sum_H CHA_{A,C,H,t} = \theta_{A,C} \, YA_{A,t} \tag{24}$$

Output Aggregation Function: Aggregate marketed production of any commodity is defined as a CES aggregate of the marketed output levels of the different activities producing the commodity

$$YC_{C,t} = A_C^{ac} \sum_A (b_{A,C}^{ac} \, YAC_{A,C,t}^{-\sigma_C^{ac}})^{1-\sigma_C^{ac}} \tag{25}$$

First-Order Condition for Output Aggregation Function: The optimal quantity of the commodity from each activity source is inversely related to the activity-specific price.

$$PYAC_{A,C,t} = PYC_{C,t} YC_{C,t} b_{A,C}^{ac} YAC_{A,C,t}^{-\sigma_C^{ac}-1} \sum_{AP}(b_{AP,C}^{ac} \, YAC_{AP,C,t}^{-\sigma_C^{ac}})^{-1} \tag{26}$$

Equation 26 is the first-order condition for maximizing profits from selling the aggregate output, QX, at the price, PX, subject to the aggregation function and the disaggregated commodity prices, PXAC.

Exports vs Domestic supply

Output Transformation (CET) Function: Equations (27) and (28) address the allocation of marketed domestic output to two alternative destinations: domestic sales and exports. Equation (29) reflects the assumption of imperfect transformability between these two destinations.

$$YC_{C,t} = A_C^{ac} \sum_A (b_{A,C}^{ac} \, YAC_{A,C,t}^{-\sigma_C^{ac}})^{1-\sigma_C^{ac}} \tag{27}$$

$$YC_{C,t} = A_C^t \ (\sum_R (b_{C,R}^t \, EXP_{C,R,t}^{\sigma_C^t}) + \left(1 - \sum_R (b_{C,R}^t \, D_{C,t}^{\sigma_C^t})\right)^{\frac{1}{\sigma_C^t}} \tag{28}$$

Output Transformation for Domestically Sold Outputs and Exports: This equation replaces the CET function for domestically produced commodities that do not have both exports and domestic sales. It allocates the entire output volume to one of these two destinations.

$$YC_{C,t} = D_{C,t} + \sum_R EXP_{C,R,t} \tag{29}$$

Export-Domestic Supply Ratio: Equation (30) defines the optimal mix between exports and domestic sales

$$EXP_{C,R,t} = D_{C,t}\left(\frac{PEXP_{C,R,t}}{PDS_{C,t}} \frac{1-\sum_{RP} b_{C,R}^t}{b_{C,R}^t}\right)^{1/(\sigma_c^t - 1)} \tag{30}$$

Demand

Disaggregated Intermediate Input Demand: For each activity, the demand for disaggregated intermediate inputs is determined via a standard Leontief formulation as the level of aggregate intermediate input use times a fixed intermediate input coefficient.

$$IC_{C,A,t} = ica_{C,A} INT_{A,t} \tag{31}$$

LES consumption demand by household h for marketed commodity c:

$$PDEM_{C,t} CH_{C,H,t} = PDEM_{C,t} \gamma_{C,H}^m + \beta_{C,H}^m(EXPH_{H,t} - \sum_{CP} PDEM_{CP,t} \gamma_{CP,H}^m - \sum_{A,CP} PYAC_{A,CP,t}\gamma_{A,CP,H}^h \tag{32}$$

LES consumption demand by household h for home commodity c from activity a:

It is assumed that each household maximizes a "Stone Geary" utility function subject to a consumption expenditure constraint. The resulting first-order conditions, equations (5) and (6), are referred to as LES (linear expenditure system) functions since spending on individual commodities is a linear function of total consumption spending. Two functions are needed since household consumption is for two types of commodities: (i) consumption of marketed commodities (purchased at market prices; equation 5) and (ii) consumption of home production (valued at their opportunity cost, the activity-specific producer price not including marketing costs; equation 6). Explicit demand functions may be derived by dividing both sides of each equation by the relevant price.

$$PYAC_{A,C,t}CHA_{A,C,H,t} = PYAC_{A,C,t}\gamma_{A,C,H}^h + \beta_{A,C,H}^h(EXPH_{H,t} - \sum_{CP} PDEM_{CP,t} \gamma_{CP,H}^m - \sum_{AP,CP} PYAC_{AP,CP,t}\gamma_{AP,CP,H}^h \tag{33}$$

Investment Demand:

Following the specification used in Mirage (Bchir et al 2000), we suppose that private investment in each sector is mainly driven by capital return

$$\left(\frac{INVP(FCAP,A,t)}{Klag(FCAP,A,t)}\right) = ID(t) \, AT\_INV(FCAP,A) \, (\text{rk}(FCAP,A,t)^{\text{sigma\_rk}(FCAP,A)} \tag{34}$$

Public investment by sector is supposed to be exogenous

$$INVPUB(A,t) = \overline{INVPUB(A,t)} \tag{35}$$

Government Consumption Demand:

$$PDEM_{C,t}\frac{G_{C,GOVF,t}}{EXPG_t - \sum_{INSDNG} trnsfr_{INSDNG,GOV,t}CPI_t - \sum_{A,F}(Prim_{F,A,t}-1)W_{F,A,t})} =$$
$$PDEM0_C G0_{C,GOVF}/(EXPG0 - \sum_{INSDNG} trnsfr_{INSDNG,GOV,2003}CPI0 - \tag{36}$$
$$\sum_{A,F}(Prim_{F,A,2003}-1)W_{F,A,2003})$$

Capital Good Demand:

$$KG(C,t) = INVTOT(t)a_{INV(C)} * \left(\frac{PDEM(C,t)}{PINVTOT(t)}\right)^{\sigma_c^{INV(c)}} \tag{37}$$

Local versus Imported Demand (Armington) Function:

Imperfect substitutability between imports and domestic output sold domestically is captured by a CES aggregation function in which the composite commodity that is supplied domestically is produced by domestic and imported commodities entering this function as inputs.

$$DEM_{C,t} = A_c^{DEM}\left(\sum_R b_{C,R}^{DEM} IMP_{C,R,t}^{-\sigma_c^{DEM}} + \left(1 - \sum_R b_{C,R}^{DEM}\right)D_{C,t}^{-\sigma_c^{DEM}}\right)^{-1/\sigma_c^{DEM}} \tag{38}$$

Import-Domestic Demand Ratio: Equation 39 defines the optimal mix between imports and domestic output.

$$\frac{IMP_{C,R,t}}{D_{C,t}} = \left(\frac{PD_{c,t}}{PIMP_{C,R,t}}\frac{b_{C,R}^{DEM}}{1-\sum_{RP} b_{C,R}^{DEM}}\right)^{\frac{1}{1+\sigma_c^{DEM}}} \tag{39}$$

Domestic demand:

$$DEM_{C,t} = D_{C,t} + \sum_R IMP_{C,R,t} \tag{40}$$

Demand For Transactions Services: Total demand for trade inputs is the sum of the demands for these inputs that are generated by imports, exports, and domestic market sales

$$TR_{C,t} = \sum_{CP} icd_{C,CP}D_{CP,t} + \sum_{CP,R} icm_{C,CP}IMP_{CP,R,t} + \sum_{CP,R} ice_{C,CP}EXP_{CP,R,t} \tag{41}$$

Institution Block

Factor Income:

$$YF(F,t) = \sum_A W(F,A,t)Q(F,A,t) \tag{42}$$

Factor incomes to domestic institutions: The income of each factor is split among domestic institutions in fixed shares after payment of direct factor taxes and transfers to the rest of the world.

$$YIF_{INSD,F,t} = shif_{INSD,F}\left[(1 - tf_{f,t})YF_{F,t} - trnsfr_{row,F,t}EXR_t\right] \tag{43}$$

Total incomes of domestic nongovernment institutions: The total income of any domestic nongovernment institution is the sum of factor incomes, transfers from other domestic nongovernment institutions, transfers from the government (indexed to the CPI), and transfers from the rest of the world.

$$YI_{INSDNG,t} = \sum_f YIF_{INSDNG,F,t} + \sum_{INSDNGP} TRII_{INSDNG,INSDNGP,t} + trnsfr_{INSDNG,GOV,t} CPI_t + trnsfr_{insdng,ROW,t} EXR_t \tag{44}$$

Transfers to Institutions from Institutions: Transfers between domestic nongovernment institutions are paid as fixed shares of the total institutional incomes net of direct taxes and savings.

$$TRII_{INSDNG,INSDNGP,t} = shii_{INSDNG,INSDNGP}\left(1 - to_{sav\,INSDNGP,t}\right)\left(1 - Tax_{Dir\,INSDNGP,t}\right)YI_{INSDNGP,t} \tag{45}$$

Household consumption expenditures: Among the domestic nongovernment institutions, only households demand commodities. The total value of consumption spending is defined as the income that remains after direct taxes, savings, and transfers to other domestic nongovernment institutions.

$$EXPH_{H,t} = (1 - \sum_{INSDNG} INSDNG_H)\left(1 - to_{sav\,H,t}\right)\left(1 - Tax_{Dir\,H,t}\right)YI_{H,t} \tag{46}$$

Total Government Income: Total government revenue is the sum of revenues from taxes, factors, and transfers from the rest of the world.

$$YG_t = \sum_{INSDNG} Tax\_Dir_{INSDNG,t}YI_{INSDNG,t} + \sum_f tf_{F,t}YF_{F,t} + \sum_A tva_{A,t}PVA_{A,t}VA_{A,t} + \sum_A ta_{A,t}PYA_{A,t}YA_{A,t} + \sum_{CM,R} tm_{CM,R,t}pwm_{CM,R,t}IMP_{CM,R,t}EXR_t + \sum_{CE,R} te_{CE,R,t}pwe_{CE,R,t}EXP_{CE,R,t}EXR_t + \sum_C TQ_{C,t}PDEM_{C,t}DEM_{C,t} + \sum_F YIF_{GOV,F,t} + trnsfr_{GOV,ROW,t}EXR_t \tag{47}$$

Total Government Expenditures:

$$EXPG_t = \sum_{C,GOVF} PDEM_{C,t}G_{C,GOVF,t} + \sum_{INSDNG} trnsfr_{INSDNG,GOV,t}CPI_t + \sum_{A,F}(Prim_{F,A,t} - 1)W_{F,A,t} \tag{48}$$

Total government spending is the sum of government spending on consumption and transfers

System Constraint Block

Composite Commodity Market Equilibrium: (Goods and Services market clearance) This equation imposes equality between quantities supplied and demanded of the composite commodity. The composite commodity supply, *DEM*, drives demands for domestic marketed output, *QD*, and imports, *QM*. The market-clearing variables are the quantities of import supply, for the import side, and the two interrelated domestic prices, *PDD* and *PDS*, for domestic market output.

$$\text{DEM}_{C,t} = \sum_A \text{IC}_{C,A,t} + \sum_H \text{CH}_{C,H,t} + \sum_{GOVF} \text{G}_{C,GOVF,t} + \text{KG}_{C,t} + \text{qdst}_{C,t} + \text{TR}_{C,t} \tag{49}$$

Current Account Balance for the Rest of the World: The current-account balance imposes equality between the country's spending and its earning of foreign exchange. For the basic model version, foreign savings is fixed; the (real) exchange rate (*EXR*) serves the role of equilibrating variable to the current-account balance. The fact that all items except imports and exports are fixed means that, in effect, the trade deficit also is fixed. Alternatively, the exchange rate may be fixed and foreign savings unfixed. In this case, the trade deficit is free to vary.

$$\sum_{CM,R} pwm_{CM,R,t} IMP_{CM,R,t} + \sum_F trnsfr_{ROW,F,t} + \sum_{INSD} trnsfr_{ROW,INSD,t} + INTF_t =$$
$$\sum_{CE,R} pwe_{CE,R,t} EXP_{CE,R,t} + \sum_{INSD} trnsfr_{INSD,ROW,t} + FSAV_t \tag{50}$$

Government Balance: The government balance imposes equality between current government revenue and the sum of current government expenditures (not including government investment) and savings

$$GSAV_t = YG_t - EXPG_t - INVPUB_{tot_t} - INTF_t \tag{51}$$

Savings-Investment Balance: This equation states that total savings and total investment have to be equal. Total savings is the sum of savings from domestic nongovernment institutions, the government, and the rest of the world, with the last item converted into domestic currency. Total investment is the sum of the values of fixed investment (gross fixed capital formation) and stock changes. In the basic model version, the flexible variable, *to-sav*, performs the task of clearing this balance. None of the other items in the Savings-Investment balance is free to vary to assure that the balance holds. Given that the balancing role is performed by the savings side, this closure represents a case of investment-driven savings.

$$FSAV_t EXR_t = \sum_{FCAP,A} PINVTOT_t INVP_{FCAP,A,t} + \sum_C PDEM_{C,t} qdst_{C,t} -$$
$$\sum_{INSDNG} to\_sav_{INSDNG,t} \left(1 - Tax_{Dir_{INSDNG,t}}\right) YI_{INSDNG,t} + GSAV_t + WALRAS_t \tag{52}$$

$$\sum_{INSDNG} to\_sav_{INSDNG,t} \left(1 - Tax_{Dir_{INSDNG,t}}\right) YI_{INSDNG,t} + GSAV_t + WALRAS_t +$$
$$FSAV_t EXR_t = \sum_{FCAP,A} PINVTOT_t INVP_{FCAP,A,t} + \sum_C PDEM_{C,t} qdst_{C,t} \tag{53}$$

The dynamic Factors accumulation are defined as:

For physical capital

$$K(FCAP, A, t) = (1 - 0.04) K(FCAP, A, t - 1) + INV(FCAP, A, t) \tag{54}$$

For skilled labor

$$LS(SKL, t) \quad = LS.l(SKL, t - 1)(1 + g\_L(t)) \tag{55}$$

For unskilled labor

$$LS(UNS, t) \quad = LS(UNS, t - 1)(1 + g\_L(t)) \tag{56}$$

Concerning the Debt evolution, external and internal debt are given by

$$DebtF(t) = (1 - am(t))DebtF(t - 1) + FSAVG(t)EXR(t) \tag{57}$$

$$DebtD(t) = (1 - ad(t))DebtD(t - 1) + DSAVG(t) \tag{58}$$

1.1.2. Construction of the Social Accounting Matrix

There is no definitive and unique structure for a SAM. The diversity of the study objectives and the availability of data make its construction country and subject specific. The structure of the SAM adopted in this study has two major objectives. The first is the need to take into consideration the different instruments of taxation of energy products. The second is the importance of distinguishing between energy products, mainly related to electricity. Therefore, we have split the electricity and gas account into four products: low voltage electricity, medium voltage electricity, high voltage electricity and natural gas. **Error! Reference source not found.** describes the SAM accounts for the year 2015 built specifically for this study. This structure reproduces the structure of the input-output table of the Tunisian economy for the year 2015 (INS, 2018).

The construction of the 2015's SAM has been undertaken in three steps. First, we constructed the macro SAM to reproduces the main macroeconomic balances of the country in 2015. Secondly, we disaggregated all the activities, products, and institutions accounts covered by the 2015 input-out table. Third using the extended input output table, we desegregate the transport sector into four subsectors namely: Land Transport Sea Transport Air Transport and Auxiliary Transport Services. And we desegregated the 4 electricity products, namely Low Voltage electricity, Medium Voltage electricity, High Voltage electricity and natural gas using the STEG data. Later on we used the energy balance table to disaggregate the oil products.

1.1.3. Parameterization

Using the same elasticities used in MIRAGE CGE, we have opted for very conservative values for the Value added, labour and investment to rate of return of capital elasticities. These main elasticities are summarized in (table 1)

Table 1: Production elasticities

Parameter	value
sigma_VA(A)	0.2
sigma_L_SLK(A)	0.3
sigma_rk	3
Linear Expenditure System (LES) Demand	0.9

Concerning the CES, CET elasticities, we used the ones estimated by Lofgren and al for MAMS Model that has been applied to Tunisia in 2010 (Table 2).

Table 2 CET and CET elasticities values

sector	CES	CET
Agriculture and Fishing	2.1	1.1
Related products	1.8	0.7
Tobacco Industry	1.8	0.7
Textiles, Clothing and Leather	1.7	1.2
Various industries	2.3	2.1
Oil refining	2.7	0.4
Building materials, ceramics and glass	2.2	3.0
mechanical and electrical industries	2.2	1.4
petroleum and natural gas extraction	1.3	0.3
Mines	1.3	0.3
Electricity and gas	1.7	0.6
Water	1.7	0.6
Building and civil engineering	1.7	0.6
Maintenance and repair	1.7	0.6
Trade	1.7	0.6
Hotel and restaurant services	1.4	0.6
Transportation	1.4	0.6
Post and telecommunication	1.4	0.6
Financial services	1.4	0.6
Other market services	1.4	0.6
Public administration	1.5	3.4

1.2. The CEQ approach

The fiscal incidence Commitment to Equity Assessment (CEQ) is a methodology developed by Nora Lustig and her team in Tulane University[1] . It uses standard incidence analysis[2] to address the following questions and inquiries:
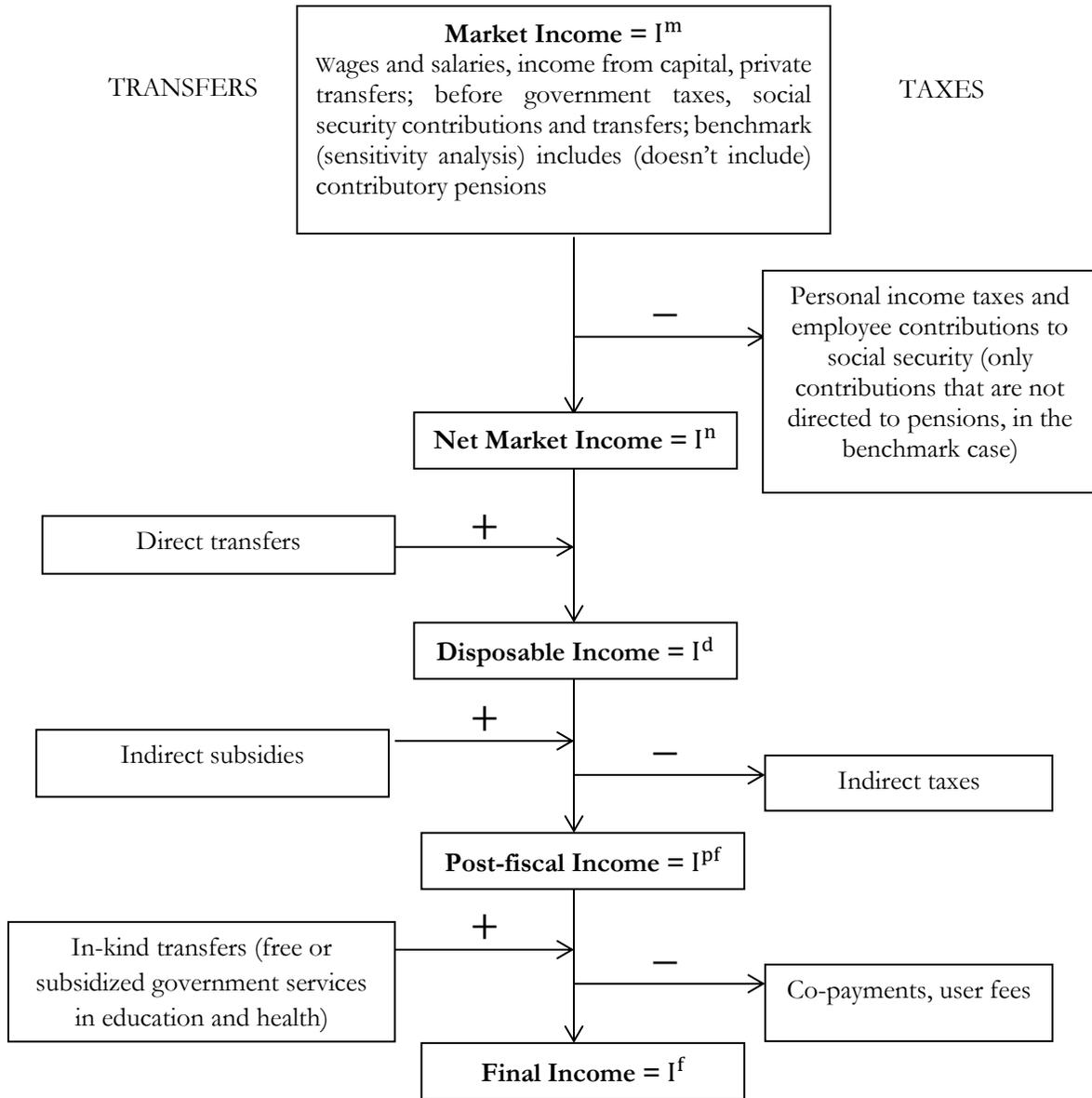
- How much redistribution and poverty reduction are being accomplished in each country through social spending, subsidies and taxes?

- How progressive are revenue collection and government spending?

- Within the limits of fiscal prudence, what could be done to increase redistribution and poverty reduction in each country through changes in taxation and spending?

- CEQ is among the first efforts to comprehensively assess the tax/benefit system in developing countries (including indirect subsidies and taxes and in-kind benefits in the form of free education and health care) and to make the assessment comparable across countries and over time[3].

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[1] Nora Lustig (Tulane University) and Peter Hakim (Inter-American Dialogue), the *Commitment to Equity* (CEQ) methodology is designed to analyze the impact of taxes and social spending on inequality and poverty, and to provide a roadmap for governments, multilateral institutions, and nongovernmental organizations in their efforts to build more equitable societies.

[2] Atkinson (1983, Bourguignon and Pereira da Silva (2003),), Birdsall et al. (2008), Breceda et al. (2008),.
[3] Applications of CEQ can be found in, for example, Bucheli et al. (2012) and Lustig et al. (2012).

Income Concepts: A Stylized Presentation

TRANSFERS

Market Income = I^m
Wages and salaries, income from capital, private transfers; before government taxes, social security contributions and transfers; benchmark (sensitivity analysis) includes (doesn't include) contributory pensions

TAXES

$-$

Personal income taxes and employee contributions to social security (only contributions that are not directed to pensions, in the benchmark case)

Net Market Income = I^n

Direct transfers $+$

Disposable Income = I^d

Indirect subsidies $+$

$-$ Indirect taxes

Post-fiscal Income = I^{pf}

In-kind transfers (free or subsidized government services in education and health) $+$

$-$ Co-payments, user fees

Final Income = I^f

Source: Lustig and Higgins (2013)

Note: in some cases we also present results for "final income" which is defined as disposable income plus in-kind transfers minus co-payments and user fees.

This methodology only considers first order effects and does not account for behavioral or general equilibrium effects. It includes two scenarios (benchmark and sensitivity analysis) depending on whether contributory social security pensions are considered as part of the market income (i.e., deferred income) or as a government transfer.

This methodology defines five types of incomes: market income, net market income, disposable income, post-fiscal and final income, described in detail in diagram below.

The Market income is defined as:

$I^m = W + IC + AC + IROH + PT + SSP$ (benchmark case)

$I^{ms} = W + IC + AC + IROH + PT$ (sensitivity analysis)

Where, I^m and I^{ms} are market income[4] in benchmark and sensitivity analysis, respectively; W gross (pre-tax) wages and salaries in formal and informal sector; also known as earned income. IC the income from capital (dividends, interest, profits, rents, etc.) in formal and informal sector; excludes capital gains and gifts. AC the autoconsumption; also known as self-production. IROH the imputed rent for owner occupied housing; also known as income from owner occupied housing; PT the private transfers (remittances and other private transfers such as alimony). SSP is the retirement pensions from contributory social security system.

Net Market income is defined as:

$I^n = I^m - DT - SSC$ (benchmark)

$I^{ns} = I^{ms} - DT - SSC^s$ (sensitivity analysis)

Where, I^n and I^{ns} the net market income in benchmark and sensitivity analysis, respectively. DT the direct taxes on all income sources (included in market income) that are subject to taxation. SSC, SSC^s are respectively, all contributions to social security except portion going towards pensions[5] and all contributions to social security without exceptions.

The Disposable income is defined as:

$I^d = I^n + GT$ (benchmark)

$I^{ds} = I^{ns} + GT + SSP$ (sensitivity analysis)

Where, I^d and I^{ds} are disposable income in benchmark and sensitivity analysis, respectively. GT the direct government transfers; mainly cash but can include transfers in kind such as food. SSP the retirement pensions from contributory social security system.

Post-fiscal income is defined as:

$I^{pf} = I^d + IndS - IndT$ (benchmark)

---

[4] Market income is sometimes called primary income.
[5] Since here we are treating contributory pensions as part of market income, the portion of the contributions to social security going towards pensions are treated as 'saving.'

$I^{pfs} = I^{ds} + IndS - IndT$ (sensitivity analysis)

Where, I^{pf} and I^{pfs} are post-fiscal income in benchmark and sensitivity analysis, respectively. IndS is indirect subsidies (e.g., lower electricity rates for small-scale consumers). IndT the indirect taxes (e.g., value added tax or VAT, sales tax, etc.).

Final income is defined as:

$I^f = I^{pf} + InkindT - CoPaym$ (benchmark)

$I^{fs} = I^{pfs} + InkindT - CoPaym$ (sensitivity)

Where, I^f, I^{fs} are final income in benchmark and sensitivity analysis, respectively. InkindT is government transfers in the form of free or subsidized services in education and health; urban and housing. CoPaym is the co-payments, user fees, etc., for government services in education and health.[6] In addition, as some countries do not have data on indirect subsidies and taxes, we also defined *Final income** $= I^{f*} = I^d + InkindT - CoPaym$.

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[6] One may also include participation costs, such as transportation costs or foregone incomes because of use of time in obtaining benefits. In our study, they were not included.

1.2.1. Definition and parametrization

To build the income concepts, we use micro-data from the 2015' Tunisian household survey with data on income or consumption. The information from this data set will be combined with data on taxes and the transfer programs from public sector accounts. When constructing the income definitions, we make the following methodological assumptions

The Market income

In the case of Tunisia, surveys on income are not available. For this reason, we use the consumption survey to estimate income by including expenditures on nondurables goods plus auto consumption plus the imputed rent for owner's occupied housing. For Tunisia, we followed the recommendation in Lustig and Higgins (2013, 2015): we start by assuming that consumption equals disposable income and work backwards to obtain net market income and market income. Given that our consumption survey did not include the imputed rent for owner's occupied housing, we used an estimation of the latter by INS-ADB-WB (2012).[7]

Taxation

The Tunisian Tax system is composed from two main categories namely direct taxes and indirect taxes. Direct taxes include Personal income Tax (PIT) and corporate tax while indirect taxes include VAT and consumption duties.

Personal income Tax (PIT)

The Methodology will use PIT rates available in the Ministry of finance. It is important to see the impact of fiscal incidence before the last reform of PIT in Tunisia.

Table 3 Personal income Tax (PIT)

Initial thresholds	Initial marginal rate (before reforms)	New rates (%) 2017	New effective rate 2017
	15	0	0
5000 - 20000 Dinars	20	26	19.5
20.000-30.000	25	28	22.3
30.000,001-50.000	30	32	26.2
>50001	35	35	-----

Ministry of Finance Tunisia
http://www.finances.gov.tn/index.php?option=com_content&view=article&id=75&Itemid=258&lang=fr

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[7] INS-ADB-WB (2012 "Measuring poverty inequality and polarization in Tunisia". This publication is produced by the National Institute of statistics (INS), the African Development Bank (ADB) and the World Bank (WB).

Value added taxes

VAT system in Tunisia is very diversified, the general rate of 18% was applied on all transactions not explicitly subject to the 10% reduced rate or the 6% lower rate. Moreover, a reduced rate of 6% was imposed on medical acts, hotel and restauration,[8] in addition a 12% rates was imposed on electricity and petroleum products. As said earlier for PIT, the VAT system has been changed from 2010. We will also use VAT rates before and after the reforms. The Methodology uses the most recent data on the General Government Revenue Collections as shows in **Error! Reference source not found.**. We will use the most updated data for Government Revenues.

Social Security Contributions

The specificity of the Tunisian social security system is based only on a contributory system and is totally administrated by the government. All benefits were provided either by National Social Security Fund CNSS (Caisse Nationale de Sécurité Sociale) or National pension and Social Security Fund CNRPS (Caisse Nationale de Retraite et de Prévoyance Sociale). The CNRPS covers all employees of the State and local public authorities and public institutions while CNSS covers workers from the private sector while. Compulsory social security covers benefits relating to pensions, family benefits, coverage of risk, illness and accidents at work and occupational diseases. Since 2007 the management of the health insurance component was assigned to the National Health Insurance Fund (CNAM). The rate varies on whether the worker belongs to an agriculture activity or non-agriculture activity. Self-employed workers are required to join the National Social Security Fund. They may voluntarily insure against risks of working accidents and illnesses. The contribution rate is not the same across all regimes and they do not pay for all the same social protection. Agricultural workers, independent operators and self-employed in agriculture could benefit from different rates. For PNAFN, the total benefits came from CRES[9] (Research Center for Social Studies) and for scholarships, the total benefits came from the Ministry of Higher Education (**Error! Reference source not found.**).

Social spending

Social spending excluding contributory pensions include direct cash transfers and in-kind spending on education and health. Direct transfers include cash transfers program known by PNAFN (Programme National des Familles Nécessiteuses) and the scholarship assistance given to students. For the other side, in-kind transfers are benefits received from the universal free public education and health systems. In-kind benefits in the form of public education and health services are not scaled up, since the benefits imputed to individuals were derived from spending figures from national accounts in the first place. Note that the spending figures used to impute in-kind health and education benefits should *include* administrative costs because these are part of the cost of

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[8] Loi de Finances pour l'année 2017, Ministère des Finances, Tunisie

[9] Centre de recherche des Etudes Sociales CRES, Tunis-2013

providing the service and would be included in the price of obtaining the service in the private sector. This differs from cash transfers, where we exclude administrative costs when scaling up because we want to measure the amount of cash being received by the household[10]

Subsidies

Tunisia is known of her long tradition of generous energy and food subsidies. Subsidies is a mechanism of social protection strategy for the country since 1970s. The policy of subsidy of basic food good's as well as energy has been maintained even in some difficult period of the Tunisian economy. The universal subsidies have been maintained because of the large size of the informal sector, the high levels of poverty and inequality. The creation of the la Caisse Générale de Compensation (CGC) was set up in May 1970 in order to act primarily on the prices of certain basic food stuffs in order to contain the increases in their price and thereby preserve the purchasing power of the most deprived classes.

The subsidy system in Tunisia has long been directed to basic consumption products, energy and transport. The Methodology will use macroeconomic repartition as well as detail subsidies products for food and energy (table 8 and **Error! Reference source not found.**8)

In-kind Transfers

Education:

At all levels of education there are two systems: a public education system and a private system. Tunisia's public education system includes mandatory basic education, secondary and tertiary. Mandatory basic education is composed of two cycles: 6 years of primary school and 3 years of lower secondary school or preparatory cycle. Secondary school is 4 years. Public primary and secondary education is almost free (beneficiaries pay only $3 per year. Tertiary education is considered also free as students pay about $25 per year for undergrad and $50 for graduate cycle.

Health:

Health care in Tunisia is provided through two systems: a contributory national health insurance for the non-poor and a free or subsidized system for the low income individuals and households according to two public regimes. The Free Health Care (AMG1) program which consists of targeting poor families with a five year based assistance program. The Decree number 98-1812 establishes conditions and modalities to allocate the "free health care card" to complying beneficiaries for a period of 5 years. The other regime is the Subsidized Health Care (AMG2) program which grants "health care discount cards" to families based on income and family size.

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[10] (Nizar et all 2015).

For two-member households, annual family income cannot exceed an amount equal to the guaranteed minimum wage (SMIC). Annual income cannot exceed 1.5 the minimum wage for families with 3 to 5 members and cannot exceed twice the minimum wage for families with more than 5 members. Beneficiaries are subject to a lump sum payment whose amount is based on the costs of the service[11]

2. Source of data

This study is data intensive and requires many categories of macro and micro data. An effort was provided to use as maximum as possible official data in order to minimize judgment and ad-hoc estimation. The National Survey of Consumption and Household Living Standards of 2015 is used to estimate household's consumption (income) at different stage of the methodology.

In order to estimate the incidence of taxes and transfers, we used macroeconomic data from the Ministry of Finance. Data on indirect taxes and subsidies for primary products and energy were taken from the DGELF[12] of the Ministry of Finance. Other data on subsidies have been provided by the Ministry of commerce as well as other national institutes and research center such as, CRES, ITCEQ and others

The Consumption and Household Living Standards

We used the National Survey of Consumption and Household Living Standards of 2015 from the National Institute of Statistics (INS) which includes three components: expenditures, living standards and food. The final sample is of national coverage and statistically representative, including large cities, medium-sized and small towns and rural areas. This sample has 23,764 individuals and 4500 households.

Macroeconomic Data

The methodology of fiscal incidence uses intensive data from different sources in particular, the Ministry of Finance and the Ministry of Commerce. These include, the data on direct and indirect taxes. Direct taxes include only income tax and were imputed according to the tax rate of each level of income.

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[11] Jouini et all, Tunisia- 2015

[12] La Direction Générale des Etudes et de la Législation Fiscales, Tunisie, 2017

3.   Main results

3.1.   CGE Model simulation

To study of the effects of the magnitude of the increase of energy products prices, we simulate the effect of an increase of (10,20, 30, 40 and 50%) of the price of the Middle and High Voltage in Tunisia as well as the prices of hydrocarbons (LPG Gasoil Gasoil50 and others). The adjustment of the government's financing needs is done through internal indebtedness so that the external debt remains unchanged. The results of the simulation are compared to the macroeconomic framework presented by the IMF at its last review.

3.1.1.   Effects on growth

Simulations show that Higher prices for energy products (high and low voltage electricity) and hydrocarbon prices (LPG Gasoil Gasoil50) affect negatively the country's economic growth. Every 10% of growth generates a loss of about 0.2 point of growth (Figure 1). This result in an increase in the unemployment rate. It is important to note that economic adjustments dampen the effects of this shock as we go. The growth differentials between the simulations and the reference scenario are reduced (Figure 2 and Figure 3)as factor allocation adjustments are implemented. In 2023 the growth rate of the simulations is higher than that of the reference scenario.
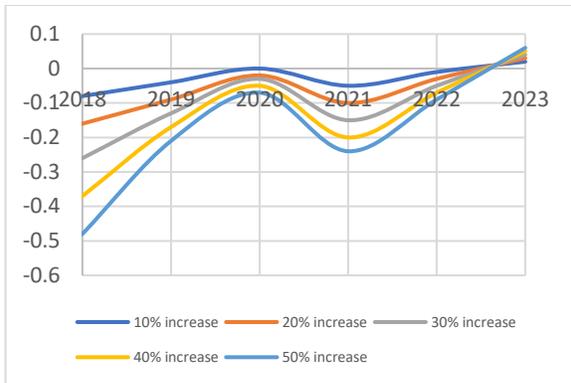
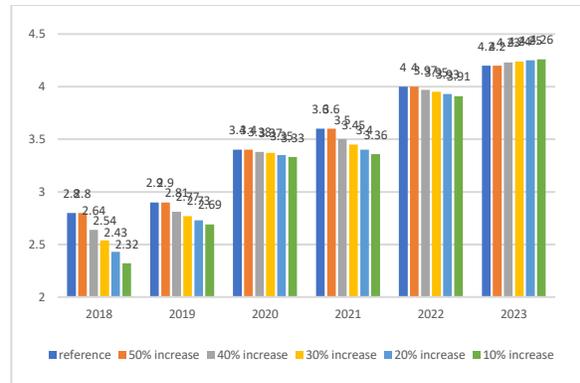**Figure 1: Growth and unemployment implications of the increase of energy products prices**
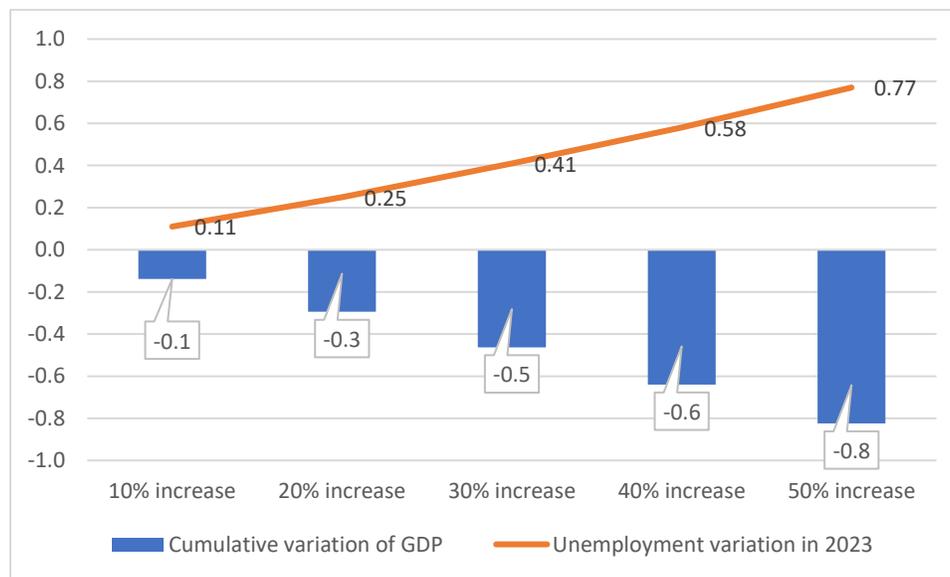
Source: Autor's simulation

Figure 2: Growth gap   **Figure 3: Growth Rate by scenario**
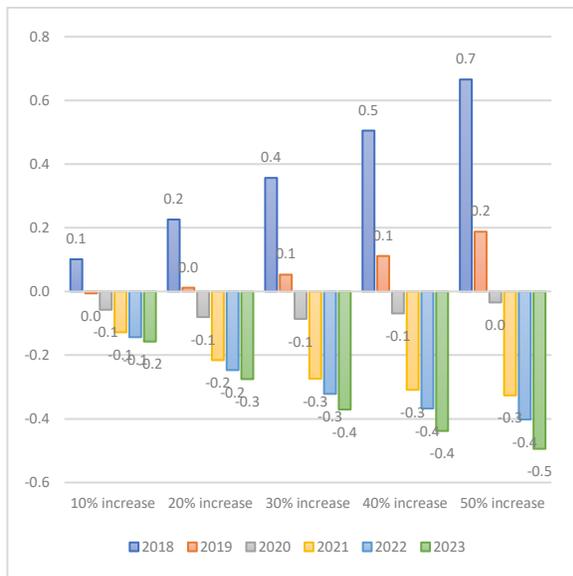
Source: Autor's simulation

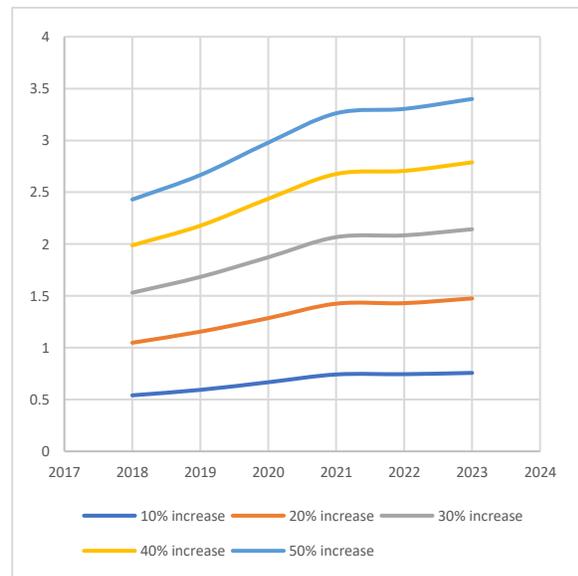Source: Autor's simulation

3.1.2. The effect on inflation

Higher prices of energy products are initially accompanied by an inflationary surge. (Figure 4) Nevertheless, the fall in the fiscal deficit and trade balance improve the dinars' position vis-à-vis foreign currencies. This second effect limits the share of imported inflation, an effect that takes over in the following years (Figure 5). The greater the increase, the more the inflationary effect persists.

Figure 4 Effects on inflation   **Figure 5 Exchange rate**

Source: Autor's simulation

Source: Autor's simulation

3.1.3. Fiscal implications

Concerning the expenditure side (Figure 6), the increase in the price of energy products reduces the amount of energy subsidies which implies a decrease of the deficit that decrease in the cost of debt (interest and amortization). These two effects imply a fall in total public expenditure equivalent to 1 and 4 points of GDP.

For Government Revenue (Figure 7), the model shows that the decline of economic activity results in lower revenues for direct taxes. In contrast, price increases imply an increase in VAT and other indirect taxes. The appreciation of the dinar also implies a decrease in tariff revenues and grants. In the end, total revenue increases by 0.02%, equivalent to 0.01 percentage point of GDP.

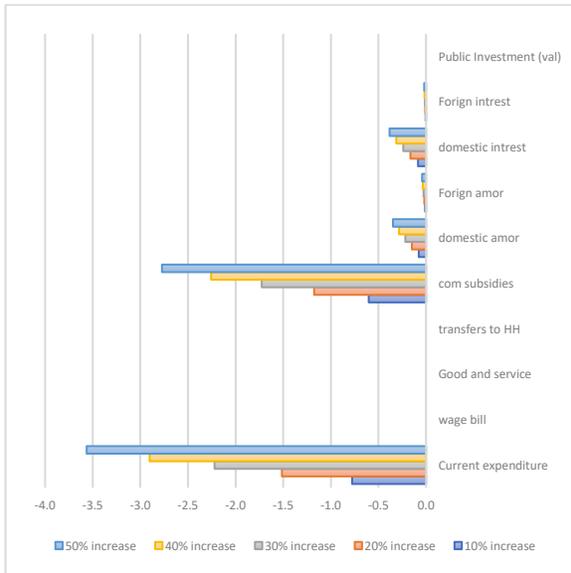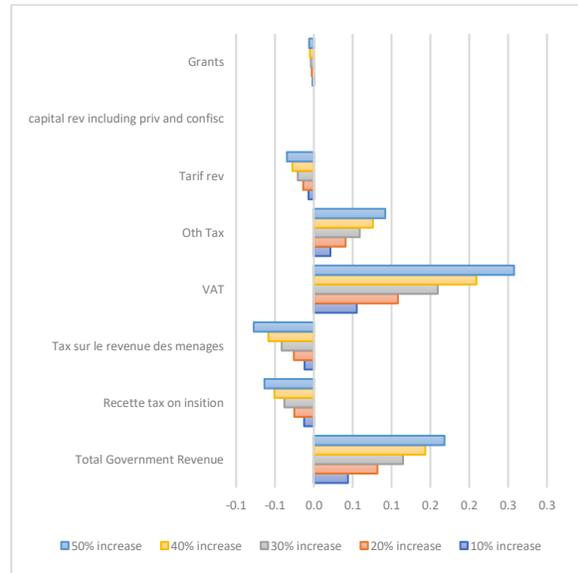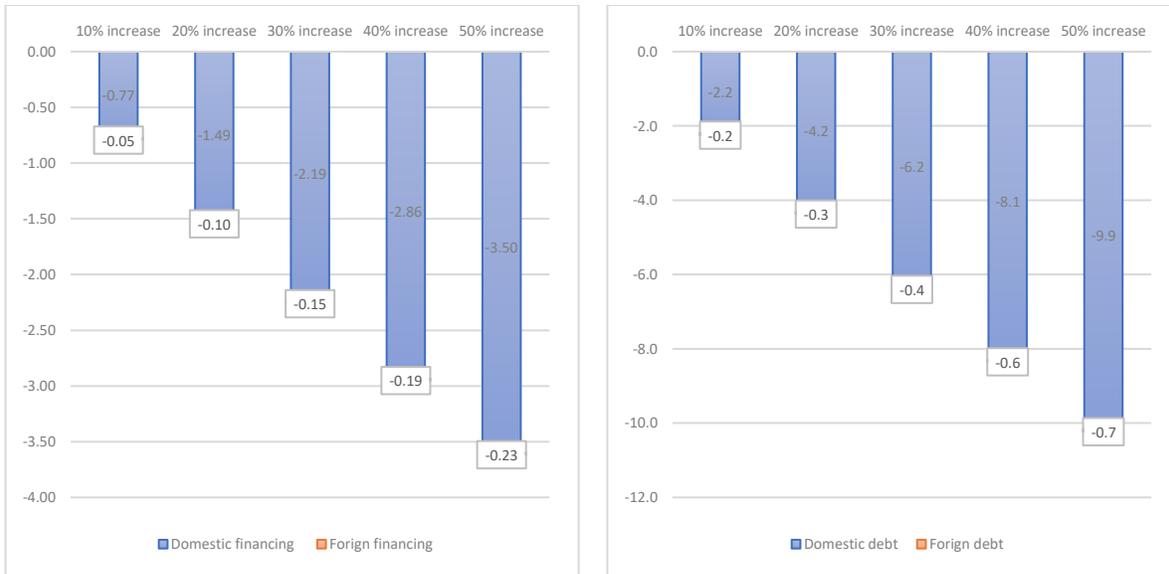| **Figure 6: Variation of public spending as equivalent GDP points**	**Figure 7: Variation of government revenue as equivalent GDP points**

Source: Autor's simulation

The decline in public spending and the relative stability of revenues reduce public deficit. Given that we have assumed that foreign financing (in foreign currency remains constant) most of the decline is observed in domestic financing (Figure 8).

Figure 8: Variation of Financing needs   **Figure 9 variation of final stock of debt**

Chart (left): Domestic financing vs Foreign financing

	10% increase	20% increase	30% increase	40% increase	50% increase
Domestic financing	-0.77	-1.49	-2.19	-2.86	-3.50
Forign financing	-0.05	-0.10	-0.15	-0.19	-0.23

Chart (right): Domestic debt vs Foreign debt

	10% increase	20% increase	30% increase	40% increase	50% increase
Domestic debt	-2.2	-4.2	-6.2	-8.1	-9.9
Forign debt	-0.2	-0.3	-0.4	-0.6	-0.7

Source: Autor's simulation

This allows a decrease in the domestic debt as a result of the decline of government domestic borrowing and a slight decrease of foreign debt as a result of the dinar appreciation (Figure 9).

3.1.4. Sectoral effects

The sectoral impacts of energy subsidy reduction are quite complex. As argued by Bacon & Kojima (2006) energy price increase has a significant effect on fuel; and electricity demand. The model shows that domestic demand addressed to the products affected by the reform declines significantly. In addition, because of Household's and firms' spending reallocation, to compensate extra spending on energy, the demand addressed to most of the products will decline. Only the demand of gas could increase. This product that is not affected by subsidy decline will profit from the substitution effect (Figure 10).

As a result, firms will adjust their outputs (Figure 11) and reduce their margins (Figure 12). Transportation sectors and industrial sectors will suffer the largest losses. Therefore, labor demand decreases in the majority of the sectors with significant exception of the building and civil engineering sectors, a sector that is highly intensive in of male labor force. This indicates that the gender impact of this reform is could be quite negative and that the increase of unemployment will affect more female.
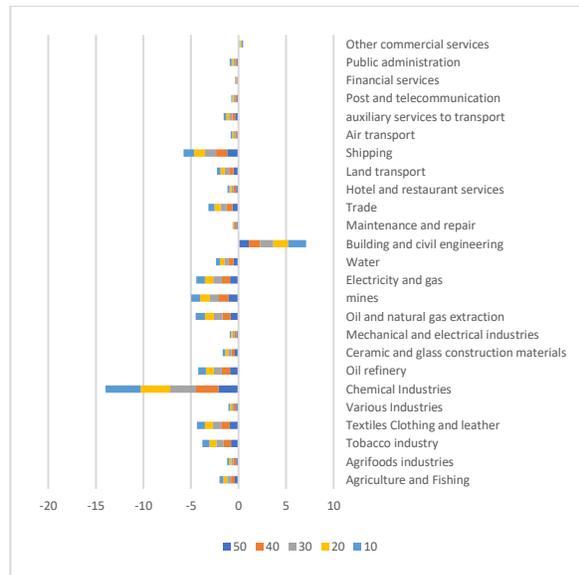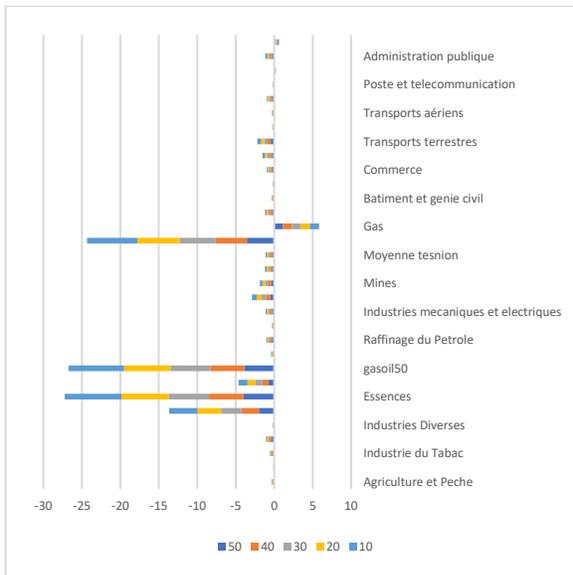
Figure 10: Variation of sectoral demand   **Figure 11: Variation of Sectoral Output**
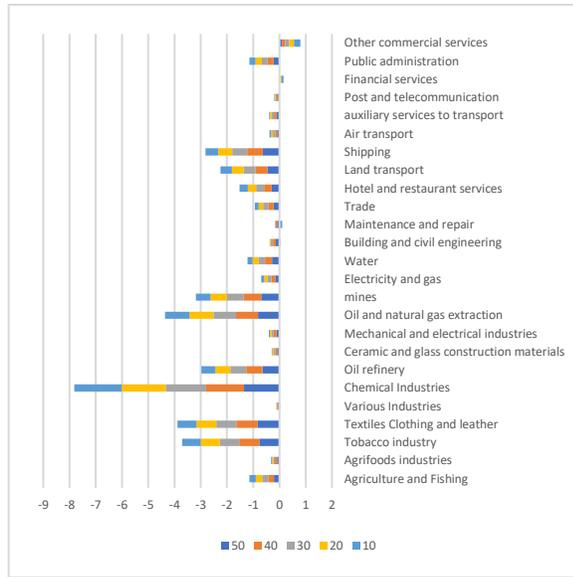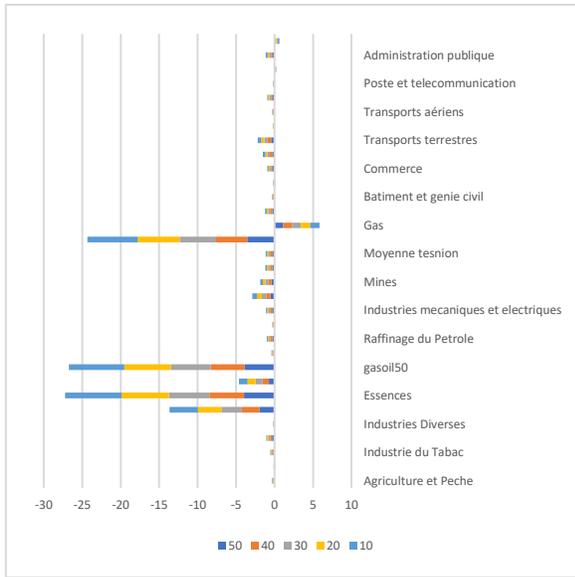
Source : Autor's simulation

Figure 12: Variation of Sectoral margins   **Figure 13: Variation of labor demand**

Source: Autor's simulation

3.1.5. Implications of the fiscal closure

The model shows that reducing energy subsidy generates a fiscal space for the Tunisian government. In the first bunch of simulations we supposed that this 'saved' amounts are totally directed to the reduction of fiscal deficit. This policy enhances the fiscal sustainability and reduces indebtment but have a negative impact on growth and job creation.

Fuel subsidy removal will certainly improve government budget. Expenditure-wise, the government will have more room for various fiscal policies from subsidy removal. The government should reallocate this extra budget to each sector accordingly. Meanwhile alternative policies are possible. The saved amount could either transferred to household as a lumpsum transfer or used to fund additional public investment programs. The implications of these alternative policies are illustrated by the simulation of a 10 percent increase of energy prices. The results are quite informative.

The macroeconomic impacts could be completely opposite. Increasing public investment enhances the global performance of the economy, economic growth could increase by 0.5 percent over the simulated period while unemployment rate could decrease by 0.32 points. On the other hand, the allocation of the saved amount. The reallocation toward a lumpsum transfer to households has a negative impact on growth and unemployment, but these effects are less important when compared to the fiscal consolidation scenario.
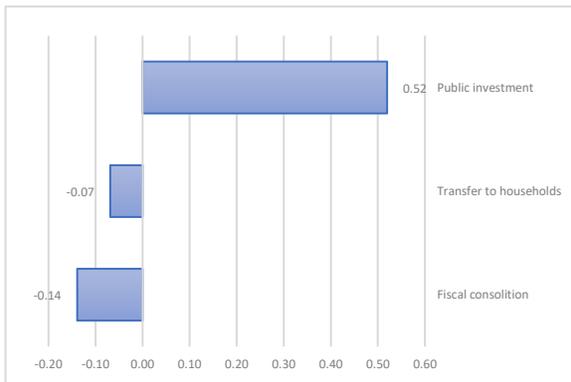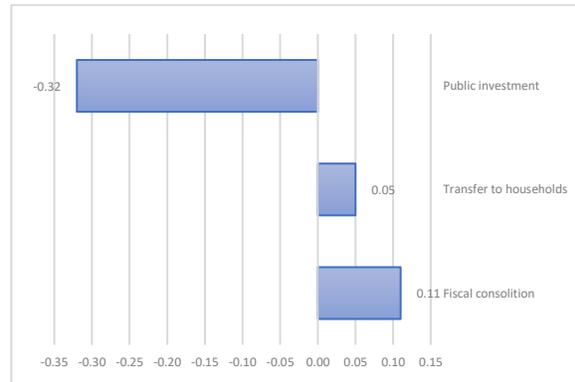
Figure 14: Nominal GDP variation	Figure 15 Unemployment rate (in percent)

Source: Autor's simulation.

The price effects are also opposite (Figure 16). If fiscal consolidation improves the balance of payment of the country and implies an appreciation of the Tunisian dinar and a decrease of the inflationary pressures on the long run, the use of the new fiscal space to increase public investment deteriorates the trade balance and by consequences devaluates the Tunisian dinar(Figure 17). In this condition the double effect of energy price increase and the money deprecation has an

important and increasing inflationary effect. On the other hand, the transformation of fiscal space towards a lamp sum transfer to households gives an in-between situation the inflationary impact is higher than the fiscal consolidation impact but the is lower than the public investment increase scenario.

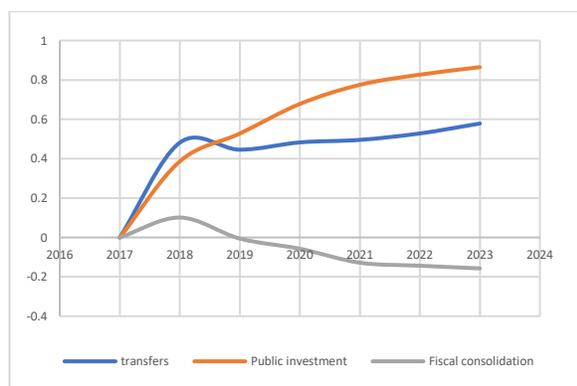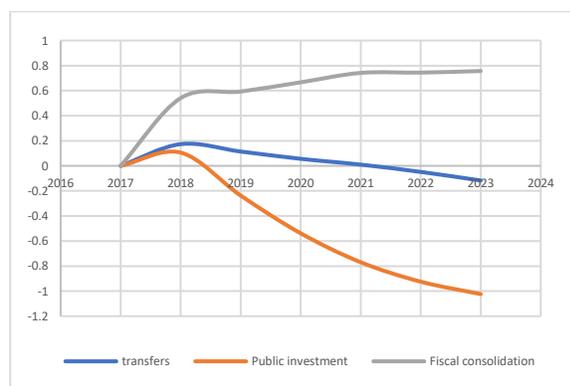| **Figure 16: Relative variation of price index**	**Figure 17: Relative variation of Exchange rate.**

Source: Autor's simulation.

3.2. The microsimulation approach: The fiscal incidence Commitment to Equity Assessment

The fiscal incidence study will simulate the direct impact of reduction of subsidies on energy on poverty and inequality of population. The variation of prices of hydrocarbons (Oil, LPG Gasoil Gasoil50 and others) have been evaluated notably since the Tunisian fiscal reforms started on 2013.

3.2.1. The Impact of fiscal Policy on Inequality

Fiscal policy in Tunisia reduces market income inequality quite significantly: the Gini coefficient for disposal income per capita declines from 0.33 to a post-fiscal income Gini of 0.31, a decline of 2 Gini points

Compared of the situation of the Tunisian households on 2010, the Gini index for post-fiscal income has been of 6 points Gini points, from 0.38 on 2010 to 0.32 for 2015.

Table 4: Inequality for disposal and post-fiscal income

Inequality Index	Disposable Income	Post-fiscal Income
Gini	0.3282	0.3124
% change wrt market income	0.3281	0.3122
Significance (p-value)	0	0

Source: Author's simulation

3.2.2. The Impact of Fiscal Policy on Poverty

The impact of fiscal policy on poverty depends on the poverty line. For the lower poverty lines of US$1.25 and US$2.50 per day, the combined effect of taxes, transfers and subsidies reduces poverty. However, Tunisia's national poverty line to $3.4 or the middle-income international poverty line of US$4 per day. For the national poverty line, the rate of poverty has decreased from 20.1% in 2010 to about 15.2% in 2018. After taking in account all taxes and direct cash transfers and indirect subsidies, the rate of poverty decreases by almost 4 points to 11.6%. this significative decrease of poverty change argues that subsidies is a pro-poor instrument for distribution of income.

Table 5: Poverty rates for disposable and post-fiscal incomes

Headcount index	Disposable Income	Post-fiscal Income
P0	15.2%	11.6%
% change wrt market income	-0.849	-0.884
Significance (p-value)	0	0

Source: Author's estimation

3.2.3. Who Benefits (and not) from Direct Transfers and Subsidies?

The table of transition matrix below shows the average loss of those who have disposable income higher than post-fiscal income. The average loss of the disposable income group 4 has an average of 144.4% than the poorest of the post-fiscal group and about 77 % and 47.2% against respectively the second and the third post-fiscal income groups.

Table 6: Average loss of losers as percent of disposable income

Disposable Income groups	Post-fiscal income groups						Average loss for losers by market income group
	y < 1.25	1.25 <= y < 2.50	2.50 <= y < 4.00	4.00 <= y < 10.00	10.00 <= y < 50.00	50.00 <= y	
y < 1.25							
1.25 <= y < 2.50		-1.0%					-0.00998
2.50 <= y < 4.00	-66.7%		-6.1%				-0.16933
4.00 <= y < 10.00	-144.4%	-77.0% 8.51	-47.2% 6.59	-11.4% 8.02			-0.2779741
10.00 <= y < 50.00	-125.6%	-86.0%	-77.0%	-42.5%	-17.6%		-0.2875098
50.00 <= y	-116.4%				-27.1%	-12.5%	-0.2028344

Source: Author's simulation

The average loss of the disposable income group 5 has an average of 125.8% than the poorest of the post-fiscal group and about 86.9%, 78.2% and 43.4% compared to the second, third and fourth post-fiscal income groups respectively. These results show that average loss is significative for the higher disposable income groups. The table shows that there also other gainers of the direct transfers and subsidies mechanism in Tunisia. The average gains of the disposable income group 2 is respectively 27.5% and 98.7% (corresponding to post-fiscal income groups 3 and 4). The average gain of the disposable income group 3 is more important, in average 42.3% and 254.2% for the corresponding post-fiscal incomes 4 and 5 respectively.

Table 7: Average gain of winners as percent of disposable income

Disposable Income groups	Post-fiscal income groups						Average loss for losers by market income group
	y < 1.25	1.25 <= y < 2.50	2.50 <= y < 4.00	4.00 <= y < 10.00	10.00 <= y < 50.00	50.00 <= y	
y < 1.25	12.6%						0.12 1.06
1.25 <= y < 2.50		24.6%	27.5%	98.7%			0.41

						2.17
		16.0%	42.3%	254.2%		0.35
2.50 <= y < 4.00						3.39
			16.2%	57.3%		0.27
4.00 <= y < 10.00						7.04
				18.3%	41.6%	0.18
10.00 <= y < 50.00						15.08
					4.2%	0.04
50.00 <= y						

Source: Author's simulation

3.2.4. Incidence by Decile and Socioeconomic Groups

The fiscal incidence by decile shows that the poorest groups benefit of energy subsidies more that richest groups. The table below shows the incidence for decile 1 represents 16.5% against 3.4% for the richest decile. This result shows the large reliance of subsidies as instrument for redistribution.

The net payers after indirect taxes net of subsidies start at higher income levels: the 8th decile. In sum, the poorest decile is the only decile that does relatively well. However, the impact on consumable income still problematic as the impact on the income of poorest still high, about 30% for the poorest decile and 50% for the fourth one.

Table 8: Fiscal incidence by deciles (%)

		Indirect Subsidies	Indirect Taxes	Net Indirect Taxes	Consumable Income
Deciles	1	16.47%	-2.60%	13.88%	-29.05%
	2	13.23%	-2.55%	10.68%	-38.45%
	3	11.22%	-3.00%	8.22%	-44.56%
	4	10.26%	-3.60%	6.66%	-49.11%
	5	9.22%	-3.80%	5.42%	-52.31%
	6	7.97%	-4.16%	3.81%	-55.49%
	7	7.30%	-5.07%	2.22%	-58.55%
	8	6.33%	-6.02%	0.31%	-62.77%
	9	5.37%	-6.54%	-1.17%	-67.24%
	10	3.42%	-6.46%	-3.04%	-71.89%
Total Population		6.50%	-5.42%	1.08%	-61.79%

Source: Author's simulation

3.2.5. Concentration shares by socioeconomic groups

The concentration shares by decile show that the richest categories of population (decile 8-10) receive more that 54% of indirect subsidies while the poorest categories (1-3) receive only 13%. These results show that redistribution of subsidies are not pro-poor at all. The level of the consumable income for the poorest category still problematic, it seems that redistribution of subsidies as it is actually have contributed to the improvement of income of the poor. Indeed, the consumable income of the richest decile is 8 times more than the poorest decile which represents a huge gap between categories of population

Table 9: Concentration shares by socioeconomic groups (%)

		Disposable Income	Indirect Subsidies	Indirect Taxes	Net Indirect Taxes	Consumable Income
Deciles	1	3.03%	5.00%	0.94%	3.15%	3.66%
	2	4.47%	6.64%	1.53%	4.32%	5.26%
	3	5.49%	7.45%	2.39%	5.15%	6.26%
	4	6.42%	8.51%	3.58%	6.26%	7.18%
	5	7.47%	9.32%	4.60%	7.17%	8.19%
	6	8.66%	9.68%	6.05%	8.03%	9.20%
	7	10.15%	10.79%	8.99%	9.97%	10.42%
	8	12.16%	11.91%	13.58%	12.67%	11.92%
	9	15.29%	13.83%	20.19%	16.73%	14.35%
	10	26.86%	16.87%	38.14%	26.54%	23.56%
Total Population		100.00%	100.00%	100.00%	100.00%	100.00%

Source: Author's simulation

3.2.6. Equity and efficiency of energy subsidies

The table 15 shows that incidence of subsidy net of tax is more pronounced for LPG in bottle, in consequence removing subsidies on LPG on bottle will have a huge impact on the poorest category.

Table 10: Incidence of subsidy net of tax in percent of disposable income

	Petrol	Gasoline	LPG-B	LPG-vrac	Total energy
y < 1.25	1.71%	0.00%	0.00%	0.00%	1.71%
1.25 < = y < 2.50	0.52%	0.00%	28.13%	0.00%	30.44%
2.50 <= y < 4.00	0.65%	0.26%	21.01%	0.00%	28.47%
4.00 <= y < 10.00	-1.52%	0.69%	12.39%	0.01%	19.51%

10.00 <= y < 50.00	-10.47%	1.07%	4.57%	0.04%	-1.22%
50.00 <= y	-12.78%	0.21%	0.22%	0.00%	-14.32%
Total Population	-7.84%	0.93%	6.91%	0.03%	4.69%

Source: Author's simulation

The graph below shows that for the poorest group 2 for example 90% for the total energy used by this category became from LPG in bottle. In sum, the incidence of subsidy net for total energy represents almost 30.4% and 28.5% respectively for the second and the third group which represent the poorest population

Figure 18: Incidence of subsidy net of tax by socioeconomic category and product
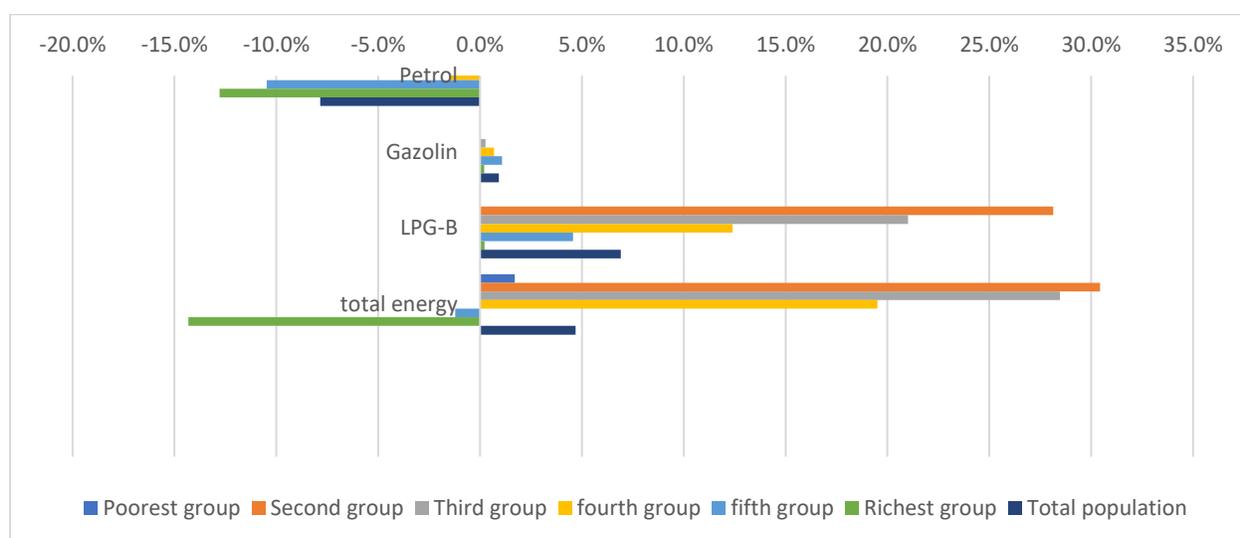
Source: Author's simulation

3.2.7. Variation of poverty and equity of energy subsidies by product

The table shows that some energy subsidy products reduce poverty and inequality while other product increase them. Overall, petrol increases poverty by almost 2.5 points while LPG on bottle reduces poverty by 4.7 points for households. For the inequality side, energy subsidies for all products reduce inequality, exception for gasoline which the variation is slightly positive (0.2). In general, the energy subsidies reduce poverty by 3.6% and decrease inequality by 1.6%. In terms of energy product's variation, only LPG in bottle reduces poverty and inequality in the same time while petrol increase poverty and reduce inequality.

Table 11: Variation of poverty and inequality of energy subsidies by product

	Petrol	Gasoline	LPG-B	LPG-vrac	Total energy
Variation on poverty (P0)	2.5%	-0.1%	-4.7%	0.0%	-3.6%
Variation on inequality (Gini index)	-0.2%	0.2%	-1.9%	0.0%	-1.6%

Source: author's estimations

Conclusion

Energy subsidy removal will certainly improve government budget. The government should reallocate this extra budget to each sector accordingly. Meanwhile alternative policies are possible. The saved amount could either transferred to household as a lumpsum transfer or used to fund additional public investment programs. The implications of these alternative policies are illustrated by the simulation of a 10 percent increase of energy prices. Increasing public investment enhances the global performance of the economy, economic growth could increase gradually over the simulated period while unemployment rate could decrease. The study shows that energy subsidy is really a pro-poor tool, however the sustainability of the classic system of subsidy need to be revisited.

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