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Which Types of Aid Have the Most Impact?

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Abstract

The paper uses an aid disaggregation approach to examine the impact of different types of aid on the fiscal sector of the aid-recipient country. It uses time-series data on different types of aid (project aid, programme aid, technical assistance and food aid) for Uganda, an important aid recipient in recent years, to estimate a model of fiscal response in the presence of aid which combines aid disaggregation and endogenous aid. The empirical findings clearly suggest the importance of the above approach for delving deeper into aid effectiveness issues since different aid categories have different effects on key fiscal variables—an impact that could not be revealed if a single figure for aid was employed. More precisely, project aid and food aid appear to cause a reduction in public investment whereas programme aid and technical assistance are positively related to public investment. The same applies for government consumption. A negligible impact on government tax and non-tax revenues, and a strong displacement of government borrowing are also found.

Keywords: aid disaggregation, fiscal response, aid effectiveness, Uganda

JEL classification: F35

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1 Introduction

It can be well argued that a substantial part of the aid effectiveness literature fails to recognize explicitly that aid is given primarily to governments in aid-recipient countries, and hence that any impact of aid on the macroeconomy will depend on government behaviour, in particular how fiscal decisions on taxation and expenditure are effected by the presence of aid. This is exactly what motivates the so-called 'fiscal response' literature, i.e. modelling how the impact of aid is mediated by public sector behaviour.[1] Furthermore, the analysis of fiscal response is particularly important because it helps to open one of the many 'black boxes' of the 'aid-growth' nexus. Most of the existing work in this area fails to address the important issue above by not considering the 'broader context' of fiscal response (McGillivray and Morrissey 2000; Beynon 2002 and Mavrotas 2002a).

In addition, a major problem with most of the existing literature on aid effectiveness is the neglect of the heterogeneous character of aid inflows. It has been correctly argued that aid is heterogeneous and each of its components exerts different macroeconomic effects on the aid-recipient economy. The use of a single figure for aid, a typical feature of the aid effectiveness literature,[2] cannot capture this aid heterogeneity, thus leading to aggregation bias in the empirical 'evidence' reported (Cassen 1994; Mavrotas 2002a,b; Mavrotas and Ouattara 2003a,b).

There are two further relevant points regarding the aid heterogeneity issue: First, because of different conditions relating to each in different countries (e.g. the state of aid co-ordination may vary among aid recipients), there is an extra reason to expect different effects of aid in each country—the *ceteris paribus* assumptions of the econometrics of aid may be disturbed by such considerations. Second, within an endogenous fiscal response framework,[3] if the government attaches different utility to each category of aid, using a single figure of aid would lead to aggregation bias in the results and conclusions reached.

The aid heterogeneity issue is the main focus of the present paper. The paper examines how different types of aid (i.e. project aid, programme aid, technical assistance and food aid) affect the fiscal sector of the aid-recipient economy by employing disaggregated aid data for Uganda over the period 1980-99 to estimate a fiscal response model which captures simultaneously aid heterogeneity and aid endogeneity. The theoretical model used in the present paper, recently developed by Mavrotas and Ouattara (2003a), extends the model by Mavrotas (2002a) on the following grounds: first, apart from project aid, programme aid and technical assistance, a new variable, food aid, is included in the model; second, all four aid variables used in the model are treated as endogenous following Franco-Rodriguez *et al*. (1998); third, also in line with Franco-Rodriguez *et al*. (1998), the budget constraints are specified in a way to avoid over-restriction and full fungibility. Finally, in addition to the structural equations, the reduced-form equations are derived in order to evaluate the total impact of the different categories of aid on the public sector of the aid-recipient.

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1 The term is attributed to White (1992).

2 Exceptions are Levy (1987), Mavrotas (2002a, b) and Mavrotas and Ouattara (2003). Note, however, that Levy adopted a different aid-disaggregation approach namely 'anticipated' vs 'unanticipated' aid.

3 This means that aid is endogenized in the government utility function.

Although foreign aid has played an important role in the Ugandan economy particularly in recent years, only a few studies have tried to explore the impact of aid on it. Previous studies in this area include Kamanyire (1999) and Walelegne (2000) as well as a recent World Bank study on *Aid and Reform in Uganda* (1999). The first two carried out empirical analysis based on a single figure for aid, whereas in the World Bank study the focus is on the aid-policy nexus without a quantitative assessment of the differential impact of different types of aid on key macroeconomic variables in the country.

Uganda's economy has moved through several economic crises since 1980 before embarking on a sustained period of economic growth. Political instability, intensified civil war and the inability of government to implement key reforms led to a fiscal and monetary crisis and negative growth prior to 1987. The economic recovery began in 1987 with the implementation of the Economic Recovery Programme of the NRM government.

A further fiscal crisis occurred in 1991/92 and strong corrective macroeconomic policy measures were adopted. Economic growth accelerated in the mid-1990s and remained strongly positive; however, the growth rate declined at the end of the decade as a result of deteriorating terms of trade. Part of the economic success of the 1990s has been associated with the government's commitment to achieve economic development combined with poverty alleviation.

Regarding aid flows, the series of policy and institutional reforms undertaken by the government in recent years have attracted massive flows of foreign assistance, especially by multilateral donors such as the IMF and the World Bank.[4] This suggests that foreign aid has been endogenous in the case of Uganda—internal conditions have favoured aid inflows. Furthermore, recent years have witnessed significant improvements in the area of development partnership. This was assisted by the participatory approach to the development of a national strategy on poverty eradication (Tumusiime-Mutebile 1999).

Furthermore, the share of each type of aid in total aid has fluctuated markedly during the period under examination, strengthening further the argument for disaggregating aid in assessing its impact on the Ugandan economy. More precisely, the composition of aid has changed dramatically in recent years. Project aid has increased substantially from negligible levels in the early 1980s and has accounted for the largest share of aid every year since 1981 (except for 1997). The share of programme aid has fluctuated (since it has been supplied mostly during periods of stabilization) but overall it has been the second most important form of aid in the country. Technical assistance has had a reasonably steady share of around 20 per cent of aid. Finally, food aid was a significant proportion of aid in the early 1980s (roughly 10 per cent of the total) but has been negligible as a proportion of total aid since.[5]

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4 Total aid flows to Uganda were modest in the first half of the1980s (les than US$200 million per annum) but increased sharply after 1987, and fluctuated annually from US$600 million to just over US$800 million throughout the 1990s. Multilateral flows were generally dominant until the mid-1990s. Since then, the relative share of bilateral aid (in the form of grants) has steadily increased to over 70 per cent by 2000.

5 The sharp increase in aid flows to the country in recent years has also caused some concerns among policymakers regarding potential Dutch-disease-type effects of aid through the impact of aid flows on the exchange rate. A recent study by Adam (2001) has examined the above issue for Uganda and

The rest of the paper is structured as follows. Section 2 presents the theoretical model, whereas data and estimation issues are discussed in section 3. Estimation results are reported and discussed in section 4. The final section concludes the paper.

2 A model of heterogeneous and endogenous aid

In line with Mavrotas and Ouattara (2003a), the model assumes that the recipient government aims at maximizing a utility function that can be represented as:

$$U = f(I_g, G, T, B, A_1, A_2, A_3, A_4) \qquad [1]$$

where I_g is public investment capital expenditure, G is government recurrent expenditure, T represents tax and non-tax revenue, B is government borrowing from all sources, A_1 is project aid from all sources, A_2 represents programme aid from all donors, A_3 stands for technical assistance and A_4 is food aid from all donors.

It is further assumed that the government is a rational utility-maximizer setting annual targets for each of the above fiscal variables and trying to reach these targets. Following Mosley *et al*. (1987), Binh and McGillivray (1993) and more recently Mavrotas (2002a) this government behaviour can be represented by a utility function without the linear terms, as below:

$$\begin{aligned} U = \alpha_0 &- \frac{\alpha_1}{2}(I_g - I_g^*)^2 - \frac{\alpha_2}{2}(G - G^*)^2 - \frac{\alpha_3}{2}(T - T^*)^2 \\ &- \frac{\alpha_4}{2}(A_1 - A_1^*)^2 - \frac{\alpha_5}{2}(A_2 - A_2^*)^2 - \frac{\alpha_6}{2}(A_3 - A_3^*)^2 \\ &- \frac{\alpha_7}{2}(A_4 - A_4^*)^2 - \frac{\alpha_8}{2}(B - B^*)^2 \end{aligned} \qquad [2]^6$$

where the starred variables represent the exogenous target variables, $\alpha_i \succ 0$ for $i = 1,\ldots,8$. The $\alpha_i's$ represent the relative weights given to different terms in the utility function and, without loss of generality, may be normalized so that they sum up to unity. If the government meets all its targets, the maximum unconstrained would be α_0.

A distinctive feature of the above model is that it endogenizes the four main components of foreign aid (project aid, programme aid, technical assistance and food aid). Aid variables are endogenized following Franco-Rodriguez *et al*. (1998) who rightly argued that aid disbursement is influenced by the recipient and, therefore, should be considered as a government policy variable.

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concluded that increased demand generated by aid is likely to be skewed towards the non-tradable sector leading to nominal and real appreciation of the exchange rate. This, however, can be managed by the appropriate policy response, including flexibility of timing of public expenditure and active foreign exchange reserve management.

6 It is clear from this equation that the government utility is maximized when all targets are met, with the maximum being α_0.

We then assume, following Franco-Rodriguez *et al*. (1998), that the government maximizes utility function [2] subject to the following budget constraints:

$$I_g + G = B + T + A_1 + A_2 + A_3 + A_4 \quad [3]$$

$$G \leq \rho_1 T + \rho_2 A_1 + \rho_3 A_2 + \rho_4 A_3 + \rho_5 A_4 + \rho_6 B \quad [4]$$

where $0 \leq \rho_i \leq 1$ and i = 1, 2,…,6. The assumption underlying the budget constraint represented by Equation [3] above is that government total spending (investment + consumption) must equal the sum of borrowing, tax and non-tax revenues and the different types of foreign aid. In other words, the government is assumed to run a balanced-budget. The rationale for the second constraint (Equation [4]) is that external forces (donors or domestic interest groups) will determine the way the government allocates its resources, i.e. the ρs in Equation [4] will be imposed on the government or those setting the targets and allocating revenue. Consequently, there will be no guarantee that the targets are met even if total revenue equals total expenditure (Franco-Rodriguez *et al*. 1998).

Contrary to many previous studies in the fiscal response literature, we also include borrowing in the specification of the second budget constraint. A number of previous studies in this area have assumed that the government prefers not to borrow for consumption purposes, as it is costly in relative terms. However, such restriction should be the outcome of the estimation results, i.e. if the government does not borrow to finance consumption then the coefficient of B in equation [4] would not be significantly different from zero (i.e. $\rho_6 = 0$).

In what follows, the model solution is derived. This involves deriving both structural and reduced-form equations. For this purpose, the Lagrangean is applied to the maximization problem, as below:

$$\begin{aligned} L = {} & \alpha_0 - \frac{\alpha_1}{2}(I_g - I_g^*)^2 - \frac{\alpha_2}{2}(G - G^*)^2 - \frac{\alpha_3}{2}(T - T^*)^2 \\ & - \frac{\alpha_4}{2}(A_1 - A_1^*)^2 - \frac{\alpha_5}{2}(A_2 - A_2^*)^2 - \frac{\alpha_6}{2}(A_3 - A_3^*)^2 \\ & - \frac{\alpha_7}{2}(A_4 - A_4^*)^2 - \frac{\alpha_8}{2}(B - B^*)^2 \\ & + \lambda_1(I_g + G - B - T - A_1 - A_2 - A_3 - A_4) \\ & + \lambda_2(G - \rho_1 T - \rho_2 A_1 - \rho_3 A_2 - \rho_4 A_3 - \rho_5 A_4 - \rho_6 B \end{aligned} \quad [5]$$

where λ_1 and λ_2 are the Lagrange multipliers.

Turning the inequality sign into an equality and taking the first derivatives with respect to the endogenous variables and the multipliers leads to the following first-order conditions:

$$\frac{\partial L}{\partial I_g} = -\alpha_1(I_g - I_g^*) + \lambda_1 = 0 \quad [6]$$

$$\frac{\partial L}{\partial G} = -\alpha_2(G - G^*) + \lambda_1 + \lambda_2 = 0 \quad [7]$$

$$\frac{\partial L}{\partial T} = -\alpha_3(T - T^*) - \lambda_1 - \lambda_2\rho_1 = 0 \quad [8]$$

$$\frac{\partial L}{\partial A_1} = -\alpha_4(A_1 - A_1^*) - \lambda_1 - \lambda_2\rho_2 = 0 \quad [9]$$

$$\frac{\partial L}{\partial A_2} = -\alpha_5(A_2 - A_2^*) - \lambda_1 - \lambda_2\rho_3 = 0 \quad [10]$$

$$\frac{\partial L}{\partial A_3} = -\alpha_6(A_3 - A_3^*) - \lambda_1 - \lambda_2\rho_4 = 0 \quad [11]$$

$$\frac{\partial L}{\partial A_4} = -\alpha_7(A_4 - A_4^*) - \lambda_1 - \lambda_2\rho_5 = 0 \quad [12]$$

$$\frac{\partial L}{\partial B} = -\alpha_8(B - B^*) - \lambda_1 - \lambda_2\rho_6 = 0 \quad [13]$$

$$\frac{\partial L}{\partial \lambda_1} = I_g + G - B - T - A_1 - A_2 - A_3 - A_4 = 0 \quad [14]$$

$$\frac{\partial L}{\partial \lambda_2} = G - \rho_1 T - \rho_2 A_1 - \rho_3 A_2 - \rho_4 A_3 - \rho_5 A_4 - \rho_6 B = 0 \quad [15]$$

In line with Heller (1975), Mosley *et al*. (1987), Gang and Khan (1991) and others we assume *ex ante* that the target for borrowing (B^*) is equal to zero. Solving the first-order conditions yields to following system of structural equations:

$$\begin{aligned} I_g = {} & (1-\rho_1)\beta_1 I_g^* + (1-\rho_1)\beta_2 G^* \\ & + (1-\rho_1)[1-(1-\rho_1)\beta_1 - \rho_1\beta_2]T^* \\ & + [(1-\rho_2) - (1-\rho_1)(1-\rho_2)\beta_1 - (1-\rho_1)\rho_2\beta_2]A_1 \\ & + [(1-\rho_3) - (1-\rho_1)(1-\rho_3)\beta_1 - (1-\rho_1)\rho_3\beta_2]A_2 \\ & + [(1-\rho_4) - (1-\rho_1)(1-\rho_4)\beta_1 - (1-\rho_1)\rho_4\beta_2]A_3 \\ & + [(1-\rho_5) - (1-\rho_1)(1-\rho_5)\beta_1 - (1-\rho_1)\rho_5\beta_2]A_4 \\ & + [(1-\rho_6) - (1-\rho_1)(1-\rho_6)\beta_1 - (1-\rho_1)\rho_6\beta_2]B \end{aligned} \quad [16]$$

$$
\begin{aligned}
G = {} & \rho_1\beta_1 I_g^* + \rho_1\beta_2 G^* + \rho_1[1-(1-\rho_1)\beta_1 - \rho_1\beta_2]T^* \\
& +[\rho_2 - \rho_1(1-\rho_2)\beta_1 - \rho_1\rho_2\beta_2]A_1 \\
& +[\rho_3 - \rho_1(1-\rho_3)\beta_1 - \rho_1\rho_3\beta_2]A_2 \\
& +[\rho_4 - \rho_1(1-\rho_4)\beta_1 - \rho_1\rho_4\beta_2]A_3 \\
& +[\rho_5 - \rho_1(1-\rho_5)\beta_1 - \rho_1\rho_5\beta_2]A_4 \\
& +[\rho_6 - \rho_1(1-\rho_6)\beta_1 - \rho_1\rho_6\beta_2]B
\end{aligned}
\qquad [17]
$$

$$
\begin{aligned}
T = {} & \beta_1 I_g^* + \beta_2 G^* + [1-(1-\rho_1)\beta_1 - \rho_1\beta_2]T^* \\
& -[(1-\rho_2)\beta_1 + \rho_2\beta_2]A_1 \\
& -[(1-\rho_3)\beta_1 + \rho_3\beta_2]A_2 \\
& -[(1-\rho_4)\beta_1 + \rho_4\beta_2]A_3 \\
& -[(1-\rho_5)\beta_1 + \rho_5\beta_2]A_4 \\
& -[(1-\rho_6)\beta_1 + \rho_6\beta_2]B
\end{aligned}
\qquad [18]
$$

$$
\begin{aligned}
A_1 = {} & \beta_3 I_g^* + \beta_4 G^* - [(1-\rho_1)\beta_3 + \rho_1\beta_4]T \\
& +[1-(1-\rho_2)\beta_3 - \rho_2\beta_4]A_1^* \\
& -[(1-\rho_3)\beta_3 + \rho_3\beta_4]A_2 \\
& -[(1-\rho_4)\beta_3 + \rho_4\beta_4]A_3 \\
& -[(1-\rho_5)\beta_3 + \rho_5\beta_4]A_4 \\
& -[(1-\rho_6)\beta_3 + \rho_6\beta_4]B
\end{aligned}
\qquad [19]
$$

$$
\begin{aligned}
A_2 = {} & \beta_5 I_g^* + \beta_6 G^* - [(1-\rho_1)\beta_5 + \rho_1\beta_6]T \\
& -[(1-\rho_2)\beta_5 + \rho_2\beta_6]A_1 \\
& +[1-(1-\rho_3)\beta_5 - \rho_3\beta_6]A_2^* \\
& -[(1-\rho_4)\beta_5 + \rho_4\beta_6]A_3 \\
& -[(1-\rho_5)\beta_5 + \rho_5\beta_6]A_4 \\
& -[(1-\rho_6)\beta_5 + \rho_6\beta_6]B
\end{aligned}
\qquad [20]
$$

$$
\begin{aligned}
A_3 = {} & \beta_7 I_g^* + \beta_8 G^* - [(1-\rho_1)\beta_7 + \rho_1\beta_8]T \\
& -[(1-\rho_2)\beta_7 + \rho_2\beta_8]A_1 \\
& -[(1-\rho_3)\beta_7 + \rho_3\beta_8]A_2 \\
& +[1-(1-\rho_4)\beta_7 - \rho_4\beta_8]A_3^* \\
& -[(1-\rho_5)\beta_7 + \rho_5\beta_8]A_4 \\
& -[(1-\rho_6)\beta_7 + \rho_6\beta_8]B
\end{aligned}
\qquad [21]
$$

$$
\begin{aligned}
A_4 = {} & \beta_9 I_g^* + \beta_{10} G^* - [(1-\rho_1)\beta_9 + \rho_1\beta_{10}]T \\
& -[(1-\rho_2)\beta_9 + \rho_2\beta_{10}]A_1 \\
& -[(1-\rho_3)\beta_9 + \rho_3\beta_{10}]A_2 \\
& -[(1-\rho_4)\beta_9 + \rho_4\beta_{10}]A_3 \\
& +[1-(1-\rho_5)\beta_9 - \rho_5\beta_{10}]A_4^* \\
& -[(1-\rho_6)\beta_9 + \rho_6\beta_{10}]B
\end{aligned}
\qquad [22]
$$

$$
\begin{aligned}
B = {} & \beta_{11} I_g^* + \beta_{12} G^* - [(1-\rho_1)\beta_{11} + \rho_1\beta_{12}]T \\
& -[(1-\rho_2)\beta_{11} + \rho_2\beta_{12}]A_1 \\
& -[(1-\rho_3)\beta_{11} + \rho_3\beta_{12}]A_2 \\
& -[(1-\rho_4)\beta_{11} + \rho_4\beta_{12}]A_3 \\
& -[(1-\rho_5)\beta_{11} + \rho_5\beta_{12}]A_4
\end{aligned}
\qquad [23]
$$

with

$$
\beta_1 = \frac{\alpha_1(1-\rho_1)}{\theta_1}, \beta_2 = \frac{\alpha_2\rho_1}{\theta_1}, \beta_3 = \frac{\alpha_1(1-\rho_2)}{\theta_2}; \beta_4 = \frac{\alpha_2\rho_2}{\theta_2}; \beta_5 = \frac{\alpha_1(1-\rho_3)}{\theta_3}; \beta_6 = \frac{\alpha_2\rho_3}{\theta_3};
$$
$$
\beta_7 = \frac{\alpha_1(1-\rho_4)}{\theta_4}; \beta_8 = \frac{\alpha_2\rho_4}{\theta_4}; \beta_9 = \frac{\alpha_1(1-\rho_5)}{\theta_5}; \beta_{10} = \frac{\alpha_2\rho_5}{\theta_5}; \beta_{11} = \frac{\alpha_1(1-\rho_6)}{\theta_6}; \beta_{12} = \frac{(\alpha_2\rho_6)}{\theta_6}
$$

where

$$
\theta_1 = \alpha_1(1-\rho_1)^2 + \alpha_2{\rho_1}^2 + \alpha_3; \theta_2 = \alpha_1(1-\rho_2)^2 + \alpha_2{\rho_2}^2 + \alpha_4;
$$
$$
\theta_3 = \alpha_1(1-\rho_3)^2 + \alpha_2{\rho_3}^2 + \alpha_5; \theta_4 = \alpha_1(1-\rho_4)^2 + \alpha_2{\rho_4}^2 + \alpha_6;
$$
$$
\theta_5 = \alpha_1(1-\rho_5)^2 + \alpha_2{\rho_5}^2 + \alpha_7; \theta_6 = \alpha_1(1-\rho_6)^2 + \alpha_2{\rho_6}^2 + \alpha_8
$$

However, the above structural equations only capture the partial effects of the aid variables to the extent that they ignore the indirect feedbacks, operating through the simultaneous system formed by Equations [16] to [23]. To capture the total impacts (direct and indirect), which are crucial for policy purposes, it is important to derive the reduced-form equations. Solving simultaneously the preceding structural equations and expressing each endogenous variable in terms of the exogenously determined variables, the reduced-form equations can be obtained as follows:

$$
I_g = \delta_1 I_g^* + \delta_2 G^* + \delta_3 T^* + \delta_4 A_1^* + \delta_5 A_2^* + \delta_6 A_3^* + \delta_7 A_4^* \qquad [24]
$$

$$
G = \delta_8 I_g^* + \delta_9 G^* + \delta_{10} T^* + \delta_{11} A_1^* + \delta_{12} A_2^* + \delta_{13} A_3^* + \delta_{14} A_4^* \qquad [25]
$$

$$
T = \delta_{15} I_g^* + \delta_{16} G^* + \delta_{17} T^* + \delta_{18} A_1^* + \delta_{19} A_2^* + \delta_{20} A_3^* + \delta_{21} A_4^* \qquad [26]
$$

$$
A_1 = \delta_{22} I_g^* + \delta_{23} G^* + \delta_{24} T^* + \delta_{25} A_1^* + \delta_{26} A_2^* + \delta_{27} A_3^* + \delta_{28} A_4^* \qquad [27]
$$

$$A_2 = \delta_{29} I_g^* + \delta_{30} G^* + \delta_{31} T^* + \delta_{32} A_1^* + \delta_{33} A_2^* + \delta_{34} A_3^* + \delta_{35} A_4^* \quad [28]$$

$$A_3 = \delta_{36} I_g^* + \delta_{37} G^* + \delta_{38} T^* + \delta_{39} A_1^* + \delta_{40} A_2^* + \delta_{41} A_3^* + \delta_{42} A_4^* \quad [29]$$

$$A_4 = \delta_{43} I_g^* + \delta_{44} G^* + \delta_{45} T^* + \delta_{46} A_1^* + \delta_{47} A_2^* + \delta_{48} A_3^* + \delta_{49} A_4^* \quad [30]$$

$$B = \delta_{50} I_g^* + \delta_{51} G^* + \delta_{52} T^* + \delta_{53} A_1^* + \delta_{54} A_2^* + \delta_{55} A_3^* + \delta_{56} A_4^* \quad [31]$$

where the δs represent complex combinations of ρs and αs, not reported here for reasons related to economy of space.[7]

From the estimation of each δ we could deduce the total impact of aid of each type of aid on the other endogenous variables. This requires that we first estimate the structural equations and then insert these estimates into the reduced-form equations.

3 Data and estimation issues

Due to the well-known data problems and limitations related to the pre-1980 period in Uganda, the time period covered in the present paper is from 1980 to 1999. Data on the foreign aid variables used in the study were obtained from the OECD-DAC office in Paris; therefore, the definition of aid in this study is based on the OECD's concept of aid, i.e. official development assistance (ODA). Total aid, technical assistance, and food aid data have all been obtained from the OECD-DAC online database. Data on project aid and programme aid, are not available in disbursement form. With the help of the OECD's Credit Reporting System (CRS), it was possible to construct these two series for Uganda for the period of 1980 to 1999. These series were constructed with the help of the CRS by drawing on its database and the DAC database. CRS data on programme aid and project aid, which exist in commitments form, have been transformed into disbursements by applying their percentage share (in total project + programme aid commitments) to total net aid disbursements from DAC minus food aid and technical assistance. The targets for the aid variables are represented by their commitment values. All the above aid figures include assistance from all donors.

Data on public investment (I_g), government consumption (G), and tax and non-tax revenue (T) were obtained from the African Development Indicators (various years) and The Bank of Uganda Staff Papers (various years). Government consumption (G) includes all government expenditure for purchases of goods and services (including compensation of employees). It also includes most expenditure on national defence and security, but excludes government military expenditure which is part of government capital formation. Data on public investment (I_g) include outlays such as land, dwellings, machinery, and other equipment. Government revenue (T) includes all revenue from taxes and non-tax revenues (other than grants) such as fines, fees, recoveries, and income from property or sales. All data were converted into 1995 constant Ugandan Shillings.

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7 The full mathematical workings are reported in Mavrotas and Ouattara (2003a); they are also available from the author upon request.

The other variables used for the derivation of the targets (see below) are as follows. Income (Y) is GDP at market prices. Private investment (I_p) includes all types of investment undertaken by the private sector. These data were compiled from the African Development Indicators (2001) and Bank of Uganda Staff Papers (various years). The data on borrowing (B) represents the public sector borrowing requirement, which is obtained as a residual from the balanced budget constraints represented by the second constraint equation in the model developed in section 2.[8]

One of the key issues in the fiscal response literature is how to obtain the target variables included in the theoretical model. These targets are not generally published in official sources. Even getting these targets from unpublished government sources is not always easy. In view of the above problems, the established practice in line with previous empirical studies in the fiscal response literature is to approximate the targets by estimating them (see Gang and Khan 1991; Khan and Hoshino 1992; Otim 1996; Franco-Rodriguez *et al*. 1998; McGillivray and Ahmed 1999; Franco-Rodriguez 2000; Mavrotas 2002a; McGillivray 2002, and Mavrotas and Ouattara 2003b among others),[9] although there is no agreed methodology on how to proceed with such estimations. In the present paper, the targets were derived from a cointegrating regression of vectors of exogenous regressors on each actual variable. Subsequently, the fitted values obtained from these regressions were taken as approximations of the target values in line with the established practice in the fiscal response literature.

Finally, following Franco-Rodriguez *et al.* (1998) and others, the targets for the aid variables are set equal to their commitments value. This approach seems sensible given that the government will start bargaining based on these commitments made by donors. During the bargaining process between donors and the government, the latter would try to convince the former to release the amount of aid committed. Overshooting this target is unlikely, as this would imply that the government could spend more money than it has been allocated.[10] There is also no reason to believe that the government will undershoot this target. Donors may not release the full amount of these commitments, but the rational government would attempt to get all commitments to be disbursed.

The non-linear Three Stage Least Squares (N3SLS) estimation technique is employed for the estimation of the structural equations. This method of estimation is appropriate since (i) the system of simultaneous equations, formed by the structural equations [16]–[23], although linear in the variables, is not linear in the parameters, and (ii) the models contain cross-equation restrictions with respect to the ρs and βs. The N3SLS technique takes into account these restrictions and provides more efficient estimates, using all the information available. In the second stage of estimation, the system formed by the estimates of the above structural equations is solved through to obtain the reduced-form equations.

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8 This is the methodology adopted by Franco-Rodriguez *et al.* (1998), McGillivray and Ahmed (1999), Franco-Rodriguez (2000) and McGillivray (2002).

9 Needless to say, this is an important area for future research.

10 It is important to stress, however, that in cases where the amount of aid committed in previous years has experienced some delay in being disbursed, disbursements for that year may be higher than the commitments for the same year. Also, if for a given year emergency funds with long-term development goal are made available to the country, disbursements may be greater than commitments.

The target for public investment (I_g^*) was obtained by regressing I_g on private investment (I_p). In the case of government consumption (G), the target variable was derived by regressing G on its value in the previous year. Finally, government revenue (T) was obtained by regressing T on income (Y) and aid commitments (A_c).[11]

4 Estimation results

Table 1 reports results from the estimation of the structural equations derived in section 2. All the parameters are consistent with the theoretical model, that is the ρs are within the range [0, 1] and all the βs are positive as expected. Given that these parameters are important for the computation of the different impacts of the revenue variables, in general, and the aid variables in particular, it is quite crucial that we derive the appropriate estimates.

The results presented in Table 1 seem to suggest that about 60 per cent of tax revenue in Uganda is used for consumption purposes. The shares of project aid and programme aid directed to consumption are 55.7 and 56.4 per cent, respectively. Around 46 per cent of technical assistance is diverted to consumption and food aid appears to be fully consumed. Finally, about half of borrowing is used to support consumption in Uganda.

Table 1
Fiscal response model—empirical results
(structural equations)

Parameters	Estimates	Standard errors
ρ_1	0.599***	0.0047
ρ_2	0.557***	0.0041
ρ_3	0.564***	0.0042
ρ_4	0.460***	0.021
ρ_5	1.000***	0.057
ρ_6	0.517***	0.0047
β_1	0.026***	0.0046
β_2	0.056***	0.0044
β_3	0.007	0.0057
β_4	0.048***	0.0053
β_5	0.102***	0.0031
β_6	0.000	0.0012
β_7	0.011***	0.0061
β_8	0.027***	0.0056
β_9	0.069***	0.0027
β_{10}	0.068***	0.0028
β_{11}	0.603***	0.1729
β_{12}	0.496***	0.0061

Note: *** implies that the coefficient is significant at the 1% level.

11 Full details of the estimation results related to the derivation of the target variables are available from the author upon request.

Table 2 reports empirical results related to the direct (partial) impact of the aid variables used in the study.

Starting with public investment, the results reported in Table 2 indicate that all forms of aid, except food aid, have a direct positive impact on public investment. An increase of 1000 shillings in project aid, programme aid and technical assistance will increase public investment by 406, 419 and 524 shillings, respectively, whilst the same increase in food aid reduces investment by 23 shillings. A similar story happens with consumption, i.e. project aid, programme aid and technical assistance changes are associated with positive changes in consumption, whereas food aid changes impact negatively on government consumption.

With regard to taxation, for every 1000 shillings increase in project aid, programme aid and technical assistance government revenue will decrease by about 4 shillings, which is a negligible decrease. For food aid this decrease is even lower, less than 3 shillings. In the light of this evidence, it is rather fair to argue that, contrary to the widespread belief regarding the fiscal response of aid recipient governments to aid inflows, aid does not seem to discourage tax effort in Uganda. Borrowing appears to fall with increases in each type of foreign aid. The government reduces borrowing by more than half of each increase in aid inflows.

Table 2
Direct incremental impacts of aid variables

Impact	Mechanism	Estimate
Investment		
A_1 *on* I_g	$[(1-\rho_2)-(1-\rho_1)(1-\rho_2)\beta_1-(1-\rho_1)\rho_2\beta_2]$	0.406
A_2 *on* I_g	$[(1-\rho_3)-(1-\rho_1)(1-\rho_3)\beta_1-(1-\rho_1)\rho_3\beta_2]$	0.419
A_3 *on* I_g	$[(1-\rho_4)-(1-\rho_1)(1-\rho_4)\beta_1-(1-\rho_1)\rho_4\beta_2]$	0.524
A_4 *on* I_g	$[(1-\rho_5)-(1-\rho_1)(1-\rho_5)\beta_1-(1-\rho_1)\rho_5\beta_2]$	-0.023
Consumption		
A_1 *on* G	$[\rho_2-\rho_1(1-\rho_2)\beta_1-\rho_1\rho_2\beta_2]$	0.552
A_2 *on* G	$[\rho_3-\rho_1(1-\rho_3)\beta_1-\rho_1\rho_3\beta_2]$	0.538
A_3 *on* G	$[\rho_4-\rho_1(1-\rho_4)\beta_1-\rho_1\rho_4\beta_2]$	0.436
A_4 *on* G	$[\rho_5-\rho_1(1-\rho_5)\beta_1-\rho_1\rho_5\beta_2]$	-0.016
Revenue		
A_1 *on* T	$-[(1-\rho_2)\beta_1+\rho_2\beta_2]$	-0.043
A_2 *on* T	$-[(1-\rho_3)\beta_1+\rho_3\beta_2]$	-0.042
A_3 *on* T	$-[(1-\rho_4)\beta_1+\rho_4\beta_2]$	-0.040
A_4 *on* T	$-[(1-\rho_5)\beta_1+\rho_5\beta_2]$	-0.026
Borrowing		
A_1 *on* B	$-[(1-\rho_2)\beta_{11}+\rho_2\beta_{12}]$	-0.544
A_2 *on* B	$-[(1-\rho_3)\beta_{11}+\rho_3\beta_{12}]$	-0.543
A_3 *on* B	$-[(1-\rho_4)\beta_{11}+\rho_4\beta_{12}]$	-0.554
A_4 *on* B	$-[(1-\rho_5)\beta_{11}+\rho_5\beta_{12}]$	0.603

These results are only partial, however, as they concern the direct effects of different aid categories on the fiscal sector of the economy. What is more important for policy purposes is the derivation of the total impacts of the aid variables. These impacts are captured by the reduced-form equations which have been derived from the fiscal response model discussed in section 2. Table 3 presents a summary of these total impacts. Looking at the total impact associated with each form of aid, it is clear from Table 3 that the final outcome depends on the type of aid and the fiscal variables considered.

Project aid appears to cause a reduction in public investment whereas programme aid changes are positively associated with changes in public investment. Technical assistance inflows seem to contribute positively to investment in the case of Uganda. Food aid inflows, by contrast, affect public investment in a negative way. Turning to government consumption, the results also indicate that programme aid and technical assistance exert a total positive impact on government consumption, whilst the latter responds negatively to changes in project aid and food aid.

Regarding taxation, Table 3 shows that taxation efforts may be reduced by additional aid inflows. However, from the magnitude of these total impacts, it is clear that the reduction in government revenue is negligible. The results related to borrowing seem to suggest that the government will reduce borrowing considerably if additional funds in terms of programme aid, technical assistance and food aid are made available by donors. Additional project aid funds reduce borrowing only slightly.

The bottom part of Table 3 shows the total impact of the aid variables on each other. The individual equations related to each types of aid show how increases in one type of aid affect the other types of aid. From the project aid equation it is clear that programme aid responds negatively to changes in project aid. In other words, donors will reduce project aid for every increase in programme aid. Technical assistance and food aid inflows do not lead to a reduction in project aid disbursements. The results related to programme aid seem to indicate that increases in project aid are met by almost the same reduction in programme aid. Technical assistance and food aid inflows also appear to reduce programme aid disbursements. Technical assistance responds negatively to all forms of aid. Finally, food aid seems to be affected positively by changes in project aid, whilst it responds negatively to changes in programme aid and technical assistance.

Table 3
Total impact of aid variables

	A_1*	A_2*	A_3*	A_4*
I_g	-0.050	0.197	0.292	- 0.301
G	-0.029	0.251	0.138	- 0.364
T	-0.001	- 0.019	- 0.015	0.002
B	-0.098	- 0.489	- 0.493	- 0.513
A_1	1.002	-0.012	0.001	0.018
A_2	-0.968	0.994	- 0.022	- 0.092
A_3	-0.012	- 0.026	0.966	- 0.070
A_4	0.143	- 0.032	- 0.030	0.979

5 Concluding remarks

The empirical results obtained from the estimation of the fiscal response model clearly show that the Ugandan government responds accordingly depending on whether the aid inflows come in the form of project aid, programme aid, technical assistance or food aid. Project aid and food aid inflows appear to reduce both public investment and government consumption, with the reduction in public investment being higher than the reduction in consumption. Opposite effects are generated by programme aid and technical assistance. Contrary to the widespread belief regarding the fiscal response of aid recipient governments to aid inflows, the present paper also shows that in Uganda the government did not reduce its taxation effort following additional disbursements of the different types of foreign aid. Finally, the results related to borrowing show that the government will reduce borrowing considerably if additional funds in terms of programme aid, technical assistance and food aid are made available by donors. Additional project aid funds, however, reduce borrowing only slightly.

The paper and the results reported clearly suggest the validity and value for empirical purposes of disaggregating aid. The empirical findings suggest that within a broader fiscal response model, common assumptions about aid fungibility and the impact of aid on tax revenue behaviour can be shown to be invalid. The paper sends also an important message to the donor community: knowing how different types of aid work in aid-recipient countries is vital for designing and implementing policies aiming at improving aid effectiveness.

Although a substantial part of programme aid seems to be directed towards investment in the case of Uganda, there is a clear need for increasing further this share in the near future, as well as improving its overall effectiveness. Furthermore, although recent years have witnessed a great success on the policy front in Uganda (successful achievement of the HIPC completion point, strong commitment towards poverty reduction and consistent macroeconomic policy among others), very recent developments in the area of international aid associated with the post-Monterrey consensus regarding the need to increase aid flows to developing countries substantially so that the MDGs are achieved, call for further improvements in the area of social sector reforms, capacity building, financial institutions, good governance and partnership so that Uganda can benefit from further increases in aid inflows.

The paper suggests a number of fruitful avenues for further research in this area. One important research direction would be to move from examining the impact of different types of aid on the fiscal sector in the aid-recipient economy and the fiscal response literature to the impact of heterogeneous aid on growth and poverty. Another route would be the application of similar models to other countries to examine to what extent general conclusions about aid impact and effectiveness can be drawn. Finally, a third research direction could link together aid heterogeneity, aid effectiveness and aid selectivity with important policy implications for aid allocation and poverty reduction.

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