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# A timeseries analysis of the impact of foreign aid on central government's fiscal budget in Uganda

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**Abstract**

A dynamic relationship between foreign aid and domestic fiscal variables in Uganda is analysed using a cointegrated vector autoregressive model over the period 1972-2008. Results show that aid is a significant element of long-run fiscal equilibrium, is associated with increased tax effort and public spending, and reduced domestic borrowing. Shocks to tax revenue are the pulling forces, while those to domestic borrowing, government spending and aid are the pushing forces of the system. In terms of policy, it is crucial for donors to increase the reliability and predictability of aid, coordinate aid delivery systems and also make aid more transparent.

Keywords: domestic fiscal variables, aid, economic instability, ESAP, CVAR, common trends, Uganda

JEL classification: C32, F35, O23, O55



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**Acronyms**

| | |
|---|---|
| ADF | augmented Dickey Fuller unit root test |
| CATS | cointegration analysis of time series |
| CVAR | cointegrated vector autoregressive |
| DAC | Development Assistance Committee of the OECD |
| DGP | data generating process |
| EAC | East African Community |
| ESAP | economic structural adjustment programme |
| FRMs | fiscal response models |
| GDP | gross domestic product |
| HIPCs | highly indebted poor countries |
| LM | Lagrange multiplier |
| MoFPED | Ministry of Finance Planning and Economic Development (of Uganda) |
| ODA | official development assistance |
| OECD | Organisation for Economic Co-operation and Development |
| RoU | Republic of Uganda |
| UBOS | Uganda Bureau of Statistics |
| UGX | Uganda shillings |
| VAR | vector autoregressive framework |



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## 1 Introduction

Fiscal response models (FRMs) (see McGillivray and Morrissey 2000, 2004) offer important insights into how donors could expect their aid to impact on the fiscal behaviour of a recipient government, i.e., how it could affect spending, tax effort and domestic borrowing. Aid packages come with strong pressures to spend (O'Connell, Adam and Buffie 2008), so aid inflows are expected to be associated with a direct and significant effect on public spending (Morrissey 2012). It may also affect taxation either because aid influences tax effort or because reforms linked to aid conditionality affect tax rates or the tax base (Morrissey 2012; Greenaway and Morrissey 1993). Aid is also expected to be associated with lower domestic borrowing (Adam and O'Connell 1999; Azam and Laffont 2003) because donor conditionality often requires the aid recipient to reduce the budget deficit (McGillivray and Morrissey 2000).

In principal, because most of the aid that is spent in a country goes to (or through) the government, or finances services that would otherwise place demands on the budget (Morrissey 2012), the effectiveness of aid depends on public sector fiscal behaviour (McGillivray 1994; Franco-Rodriguez, McGillivray and Morrissey 1998; McGillivray and Morrissey 2001b). This paper investigates the impact of aid on fiscal behaviour, i.e., its effects on public spending, tax revenue and borrowing in Uganda.

Uganda is an interesting case for studying the fiscal effects of aid, as significant aid inflows have supported government spending for over twenty years in an environment of low tax revenue. The aid-GDP share, which was about 1 per cent in 1980, rose significantly to about 5 per cent in 1986, reaching a peak of about 19 per cent in 1992, and averaged about 11 per cent between 1990 and 2006 (Egesa 2011; Mugume 2008). In terms of the budget, total donor support (both direct budget support and project aid) has averaged 43 per cent of the national budget over the 2003/4-2008/9 period (RoU 2008/9:51).

The rest of the paper is structured as follows. A literature review is given in section 2, while the data measurements and transformations are presented in section 3. Section 4 outlines the econometric approach while section 5 presents the empirical results. The conclusions and policy implications are drawn in section 6.

## 2 Literature review

There is a significant empirical literature on the impact of aid on the fiscal behaviour of aid recipients. A detailed review of this literature is provided in McGillivray and Morrissey (2001a, 2004), distinguishing between fungibility and fiscal response studies.

Fungibility studies analyse the effects of aid on the composition of government spending. Aid is said to be fungible if recipients fail to use it in a manner intended by donors (World Bank 1998; Franco-Rodriguez, McGillivray and Morrissey 1998). The underlying assumption is that donors grant aid to finance public investment and fungibility arises when recipients divert these funds to finance government consumption spending (ibid.), because such diversion reduces the effectiveness of aid (World Bank 1998).[1] Analogously, fungibility is

[1] Note, however, that consumption spending is a necessary complement to investment spending, so the assumption that fungibility diminishes the effectiveness of aid may be misleading (Morrissey 2012: 3).

said to occur if aid, tied to a sector, is used to finance a project that would otherwise be funded by tax revenue, releasing domestic resources for spending in some other sector. In this case, fungibility arises because donors and recipients have differing expenditure allocation preferences (McGillivray and Morrissey 2000). The evidence as to whether aid has been fungible or not, and whether fungibility limits aid effectiveness is generally 'imprecise', given the difficulty of linking aid, donor intentions and sector spending (see Morrissey 2012 for a summary of the debate). As this is not our focus readers are referred to the more detailed discussion in McGillivray and Morrissey (2004).

The fiscal response models (FRMs) or studies allow for the dynamic effect of aid on expenditure patterns (current and capital spending), tax effort and domestic borrowing. They start from the viewpoint of utility maximization, in which government maximizes utility based on a quadratic loss function subject to targets for each revenue and expenditure category.[2] However, empirical applications of FRMs have short-comings, mostly related to difficulties in the use and estimation of targets for government expenditure and revenue, the treatment of aid, and the three stage least squares (3SLS) non-linear econometric techniques that have been used are notoriously difficult to estimate, interpret and highly sensitive to (and demanding of) the data, often yielding inconsistent estimates of core parameters (Morrissey 2012; Martins 2010; McGillivray and Morrissey 2001a: 29-30). Furthermore, Morrissey (2012) argues that whilst it is necessary to estimate budget targets, there is no acceptable theory regarding how governments form revenue and expenditure targets; the theoretical framework does not provide a good representation of government behaviour; and the behavioural relationship being estimated is assumed fixed over the period (i.e., the models do not allow for the fact that spending decisions are made within a fiscal framework in which aid is only one component). Osei, Morrissey and Lloyd (2005) add to the list and argue that FRMs are not predictive theories as they do not generate specific testable hypotheses of the effect of aid on fiscal behaviour.

In an effort to overcome many of these difficulties, there is now a growing body of empirical literature estimating the FRM within a vector autoregressive (VAR) framework and complemented (in as many of the studies) by the estimation of impulse response functions. The novelty of VAR estimation techniques stems from its structure which provides a tractable framework, allowing for the formulation and testing of a number of different hypotheses of interest on causal links between aid and the domestic fiscal variables, and uncovers and describes data facts and characteristics. The technique takes into account the interactions between macrovariables over time, allowing a distinction in estimating the long-run (equilibrium) and short-run (adjustment to the equilibrium) relations. There is one equation for each and every variable, so all variables in the system are treated as potentially endogenous. Each variable is explained by own lags and lagged values of the other variables. Assumptions about exogeneity are tested for directly, avoiding making strong *a priori* assumptions; by design the econometric model can allow the data to speak freely about the empirical content of the model. It is an *atheoretical* approach, i.e., one does not have to maintain the existence of, estimate or test specific theoretical formulations of the budgetary planning targets—rather economic theory is invoked to choose the variables to include in the analysis, select the appropriate normalization and to interpret the results.

[2] A detailed exposition of this frame work is provided in Franco-Rodriguez, McGillivray and Morrissey (1998: 1242-43).

Surveys and discussions of the literature on the country-specific fiscal effects of aid using a VAR approach are provided in Morrissey (2012). These include the first study of this kind, Osei and Morrissey (2003) revised as Osei, Morrissey and Lloyd (2005) for Ghana, and Fägernas and Roberts (2004a-c) for Uganda, Zambia and Malawi. Others are Morrissey, M'Amanja and Lloyd (2007) for Kenya and a more recent comprehensive application by Martins (2010) for Ethiopia. Osei, Morrissey and Lloyd (2005) find that for Ghana, aid is weakly exogenous to the domestic fiscal variables (i.e., donors do not respond to fiscal imbalance in determining how much aid to allocate to Ghana although aid has effects on spending, domestic borrowing and domestic tax revenue). Specifically, aid was associated with reduced domestic borrowing (which could likely be because the IMF required reductions in borrowing as a *quid pro quo* for increased aid) and increased tax revenue. They also find that recurrent spending rose more than investment spending following the increases in aid (suggesting that aid was fungible). This they argue, was not actually so because aid was used to reduce borrowing. Another interesting finding is that aid did not directly increase spending, although increase in aid permitted spending to rise because of the associated increase in tax revenue. However, they do not estimate the magnitude of the effect of aid on spending, nor do they formulate and impose any fiscal restrictions to fully test for specific aid-fiscal hypotheses.

Fägernas and Roberts (2004a-c) find that aid has a strong positive impact on the development budget in Uganda, Zambia and Malawi, but the other fiscal effects are country specific. Aid displaces tax effort, has a moderately positive impact on the current budget, and is associated with higher levels of domestic borrowing in Zambia. In Malawi, aid lowers domestic borrowing, and does not discourage tax effort, while in Uganda, aid raises development and recurrent spending, has a positive long-run effect on domestic revenue and the impact on domestic borrowing is negligible. In all these studies, aid exogeneity is imposed and not tested and, probably because they follow Osei and Morrissey (2003), they neither formulate or test any specific testable hypothesis of the effect of aid on fiscal behaviour or estimate the magnitude of the effect of aid on spending. With particular reference to Uganda, features of the data over 1972-79 (a decade of economic collapse and social disorder) and effect of ESAP reform and the Museveni regime are not accounted for in the empirical analysis.

Morrissey, M'Amanja and Lloyd (2007) extend the timeseries FRM approach with official Kenyan data for 1964-2004, and estimate two vectors; the fiscal effects of aid grants and loans, and the impact of aid on growth, but separately. Considering the fiscal effects, they find that aid grants were associated with increased spending while loans were a response to unanticipated deficits, i.e., if spending exceeded revenue (tax and grants) the government sought loans to finance the deficit. Aid grants have an insignificant effect on tax revenue. However, the study does not fully explore the cointegrated vector autoregressive (CVAR) methods, and assumptions about exogeneity are not tested although they avoid making strong *a prior* assumptions. In addition, similar to Osei, Morrissey and Lloyd (2005), the study does not estimate the magnitude of the effect of aid (grants or loans) on spending nor do they formulate any testable fiscal hypotheses.

Martins (2010) provides a more recent comprehensive application of the CVAR in the analysis of the fiscal effect of aid, using quarterly dataset for Ethiopia for the period 1993-2008. He finds evidence for a long-run positive relationship between aid and development spending, but not between aid and recurrent spending (hence, no evidence that aid is fungible), domestic borrowing increases in response to shortfalls in revenue (tax and grants), and there is no evidence that aid reduces tax effort. Furthermore, aid grants adjust to the level

of development spending. While his study is probably the first of its kind that provides new insights into the formulation of testable fiscal hypotheses, the validity of some of the tested hypotheses, e.g., aid spending,[3] development spending and categorical fungibility is questioned. Morrissey (2012) details the practical difficulty of linking aid, donor intentions and sector spending, based on which of these hypotheses could be evaluated. Moreover, the classification of spending is problematic (Morrissey 2012) so hypothesis testing based on expenditure categories may have been constrained by lack of appropriate data. This noted, the tests might not be legitimate and inference may be imprecise. Moreover, like the rest of the studies, the magnitude of the effect of aid on spending is not estimated.

In general, these studies show the effect of aid on spending (including showing that the effect of aid, grants or loans differs for the two types of spending, current and capital). However, despite their important contribution, none estimates the magnitude of the effect of aid on public spending and it is difficult to find a consistent pattern regarding the impact of aid on fiscal aggregates. The impact appears to be country specific but this should not be surprising as governments differ in their fiscal behaviour; Riddell (2007) notes that country-based evidence provides the only reliable backdrop against which to judge aid effectiveness.

This study contributes to the aid and fiscal aggregates literature on one country, Uganda, over the period 1972-2008. The choice of the study period reflects data availability for the same reasons as in many of the other studies on the fiscal response to aid in Africa that have been constrained to about 30 annual observations (see Martins 2010: 14),[4] although ours is somewhat more extensive, providing a larger sample size (by sub-Saharan Africa standards). A CVAR model is employed to estimate the impact of aid on public spending, tax revenue and borrowing, and the magnitude of the effect of aid on spending; to test specific fiscal response to aid hypotheses (budgetary constraint; balanced/cash budget; aid additionality/illusion; tax revenue displacement; and aid-domestic borrowing substitution), and to decompose the common trends into pulling and pushing forces. CVAR allows the data to speak freely about the empirical content of the model without compromising high scientific standards. Importantly, instead of assuming aid exogeneity/endogeneity (as is often the case in the wider fiscal response literature), all variables, including aid, are modelled jointly as a system of equations and the question of whether aid is endogenous or exogenous is tested, making the use of CVAR appropriate for the task at hand. Our work also complements Fagernäs and Roberts (2004a), which to our knowledge is the only study on the fiscal impact of aid on Uganda, by reflecting in the analysis features of the data over 1972-79 (a period characterized by political and economic instability) and the effect of policy shift (due to structural adjustment programmes) in Uganda. Ignoring such shocks and reforms may bias estimates and result in invalid inference (Juselius 2003).

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3 Defined as widening of the fiscal deficit (excluding aid) due to incremental aid (Hussain, Berg and Aiyar 2009; Foster and Killick 2006: 3).

4 For example, the Osei, Morrissey and Lloyd (2005) study on Ghana covers the period 1966 to 1998 (i.e., 33 annual observations), and the Fagernäs and Schurich (2004) study on Malawi, Uganda and Zambia covers the periods 1970 to 2000 (i.e., 31 observations), 1974 to 1999 (i.e., 26 observations) and 1972 to 1998 (i.e., 27 observations), respectively.

## 3 Data measurements and transformations

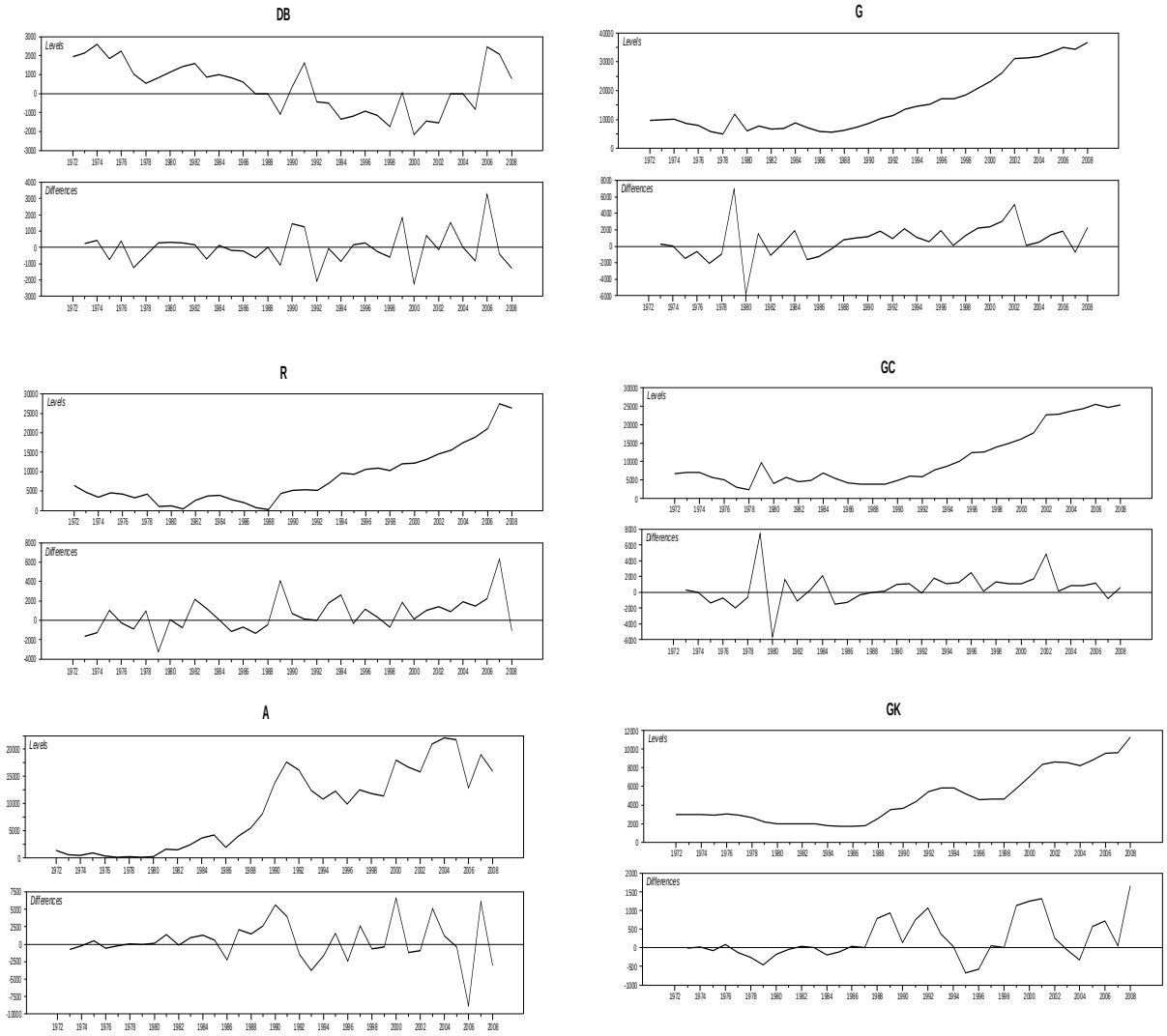
Annual time series data for the period 1972-2008 are used. Foreign aid constitutes total net disbursement of aid from all donors to Uganda, i.e., adds up the aid grants and aid loans having a grant element of at least 25 per cent. Some previous applications disaggregate aid into grants and loans, because they may have different effects (governments prefer grants because they do not have to be repaid; loans may encourage fiscal planning for future servicing and repayment costs), so that there could be aid aggregation bias. However, as in McGillivray and Morrissey (2001b), we argue that in practice such a bias is likely to be minor as aid loans are long term and governments currently in power are unlikely to be around when repayment is due, so that they could be treated as grants. With regard to Uganda, although loans accounted for 50-60 per cent of aid flows during the 1980s, grants have increased steadily and have accounted for most aid disbursements since 1990 (Holmgren et al. 1999). To be exact, aid loans/GDP ratio fell by half from about 8 per cent in the early 1990s to about 4 per cent in the subsequent years while the aid grants/GDP share increased from 2 per cent in 1986 to a high of about 12 per cent in 1992 and averaged 8 per cent each year up to 2004 (Egesa 2011). Moreover, whilst a distinction between loans and grants may matter (see, for example, Martins 2010; M'Amanja, Lloyd and Morrissey 2005), Uganda became a beneficiary of the heavily indebted poor countries (HIPC) debt relief in 1998/99 (Atingi-Ego 2005; Collier and Reinikka 2001) and could have anticipated significant debt relief. Thus, loans are similar to grants and are treated as net aid disbursements in this study. Data on aid disbursement are obtained from 'Geographical Distribution of Financial Flows databases' (OECD-DAC 2009).

Data on tax revenue and net domestic borrowing from the banking system are from various annual reports of the Bank of Uganda (BoU). The non-tax revenue component of domestic revenue is omitted from the system so that we are not estimating an identity. Also, as aid is based on DAC measures, it overstates the amount of aid actually going through the budget. It includes some element of aid that is not even spent in Uganda (most technical cooperation and assistance are spent within the donor country), while some is spent under the control of the donors (donors retain control over project aid). Again, true identity remains blurry. Data on total government spending (and its disaggregated components: current and capital spending) are from the Uganda Bureau of Statistics (UBOS). The disaggregated components of total government spending are considered because we analyse a variant model as a refinement of one in which spending is aggregated. All data are given in millions of constant 2005 Uganda shillings (UGX) prices, and are shown in levels and also in first differences in Figure 1.

A visual inspection of the data in Figure 1 shows that all variables are typically trending over time. This suggests a multiplicative rather than additive model specification, which under log transformation is brought back into additive form. However, this transformation is innocuous as long as the series datapoints are strictly positive or are at least not too close to zero (Juselius, Møller and Tarp 2011). As can be seen from Figure 1, log transformation in the case of domestic borrowing is problematic, jeopardizing the validity of the transformation as it may result in losing more observations in an already small sample. Furthermore, it may weaken the power of the tests, making the CVAR analysis less reliable. Moreover, the trending seems to begin from 1988 onwards, with the Museveni regime, and this kind of shift might be lost with a log transformation. Importantly, the omission of non-positive observations will be non-random and can therefore in our sample lead to selection bias, making log transformation perhaps even more undesirable. Thus, we choose to use all the

series in non-log specification, which, in addition, addresses some of our key questions of interest. For example, how much would the level government spending change following an aid injection of one million UGXs? Nonetheless, while the trade-off in the choice between log- and non-log specification may matter, our analysis, as we will show, gives results that are consistent with what is known about the fiscal impact of aid in some of the previous country-specific applications (as reviewed in section 2 above) that typically used log transformations due to trends in the variables. This suggests that in our case there is little to be gained from the log over the non-log specification.

Figure 1: Levels and first differences of fiscal variables




Notes: DB =domestic borrowing; G=public spending, GC=current spending, GK=investment spending, A=aid; and R= tax revenue.

Source: Authors' estimates based on OECD-DAC (2009) databases and UBOS.

Both level and first difference plots for total public and current spending point to possible breaks associated with outlier observations in 1978-79. We also observe a slight but detectable change in behaviour from about 1988 in all the series (albeit to different degrees). The outlier observation corresponds to the climax of the decade of economic collapse and social disorder in Uganda (Collier and Reinikka 2001; Baffoe 2000; Kasekende and Atingi-Ego 1999; Jamal 1988) and possibly the second oil price shock and the breakdown of the East

African Community (EAC) in 1977 (Niringiye 2009; Jerven 2010). The detectable change in behaviour from about 1988 could be a result of a shift in policy regime, notably from a regulated to a deregulated system following the effective implementation of broad economic structural adjustment programme (ESAP) that started in 1986 (Bwire and Tamwesigire 2007; Kasekende and Atingi-Ego 1999) and was associated with large increases in aid inflows on a scale not previously experienced in Uganda. We account for this potential regime or level shift from 1988 and transitory blip in 1979/80 in the empirical analysis.

## 4 The econometric approach

### 4.1 The cointegrated VAR (CVAR) model

We consider a *4*-dimensional VAR model for $y_t' = (DB_t, G_t, A_t, R_t)$; all variables defined as in Figure 1. The model is structured around *r* cointegration relations (or the pulling forces) corresponding to *p-r* stochastic trends (or the pushing forces). The pulling forces are formulated as the CVAR model:

$$\mathbf{\Delta y_t = \alpha \beta' y_{t-1} + \sum_{i=1}^{k-1} \Gamma_1 \Delta y_{t-i} + \Phi D_t + \varepsilon_t} \tag{1}$$

where $\mathbf{y_t}$ is a *4*-dimensional vector of endogenous variables, $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are (*p x r*) coefficient matrices, $\mathbf{\Gamma_1}$ is a (*p x p*) matrix of short-run adjustment coefficients, *i=1,...,(k-1)* is the number of lags included in the system, $\Delta$ is a first difference operator, $\mathbf{D_t}$ is (*m x 1*) vector of *m* deterministic terms (constants, linear trends, 'spike' and/or intervention dummies), $\boldsymbol{\Phi}$ is a (*p x p*) matrix of coefficients, and $\boldsymbol{\varepsilon_t \sim iidN(0,\Sigma)}$ is a (*p x 1*) vector of errors. As shown in Juselius, Møller and Tarp (2011: 7), if $k = 1$, then $\mathbf{\Gamma_1} = 0$ and implies that the long run is the same as the short run. Therefore, the system, after having been pushed away from equilibrium by an exogenous shock, will adjust back to equilibrium exclusively through $\boldsymbol{\alpha}$. Note however that the appropriate value of *k* will be empirically determined.

Assuming for simplicity, a case where *r=1*, *p-r=3*, an unrestricted constant ($\boldsymbol{\mu_0}$), *k=1*, and a vector of linear trends ($\boldsymbol{\alpha\beta' t}$) restricted to lie in the cointegrating space for the data vector at hand, the restricted CVAR model takes the form:

$$\begin{bmatrix} \Delta DB_t \\ \Delta G_t \\ \Delta A_t \\ \Delta R_t \end{bmatrix} = \begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{pmatrix} \left\{ (\beta_1 \quad \beta_2 \quad \beta_3 \quad \beta_4 \quad \beta_0) \begin{bmatrix} DB_{t-1} \\ G_{t-1} \\ A_{t-1} \\ R_{t-1} \\ t \end{bmatrix} \right\} + \boldsymbol{\mu_0} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{pmatrix} \tag{2}$$

where $\boldsymbol{\beta_i' y_t}$ is the equilibrium error, $\boldsymbol{\alpha_i}$ is the adjustment coefficient and $\boldsymbol{\mu_0}$ is a *p x 1* vector of an unrestricted constant. To provide empirical content to the structural analysis underlying the causal links between aid and domestic fiscal variables, we focus on the following long-run parameter restrictions:

- Restrictions on $\boldsymbol{\beta}$ which tests long-run exclusion, and is evaluated by the null hypothesis that $\beta_i = 0$. If accepted, it would imply that the variable is redundant to the long-run relation(s) (Juselius 2006: 176) and so can, at most, have a short-run impact. As an illustration, a test of long-run excludability of aid involves evaluating the null hypothesis that $\beta_3 = 0$, whilst other $\boldsymbol{\beta}$ coefficients are unrestricted. As aid is expected to be non-stationary, i.e., to contain a unit root, accepting long-run exclusion is akin to suggesting that aid has not had any significant long-run impact on Uganda's fiscal variables (aid ineffectiveness). It could describe a situation where there may be institutional factors preventing aid from playing a role in the fiscal equilibrium (for example, 'aid leakage' where corrupt government officials use the aid money for private purposes).

- A zero row in $\boldsymbol{\alpha}$ restrictions (or the text book 'long-run weak exogeneity test'). In our case, this tells us which fiscal aggregates adjust to restore budgetary equilibrium in light of disequilibrium. Using the test procedure described in Johansen (1996), the restriction is evaluated as $H_0 : \alpha_i = 0$, where, if accepted would imply that the variable impacts on the long-run stochastic path of the other variables of the system, while at the same time has not been influenced by them (Juselius 2006: 193). As our focus is on aid, we establish whether aid in Uganda's fiscal planning is treated as given or whether its allocation actually reflects the state of the budget in some way. As with tests on $\boldsymbol{\beta}$, this is evaluated from the null hypothesis that $\alpha_3 = 0$, whilst other $\boldsymbol{\alpha}$ coefficients are unrestricted.

- A test of a unit vector in $\boldsymbol{\alpha}$. This corresponds to the hypothesis that variable *i* is purely adjusting to the system variables (or is completely endogenous in the system). For example, a test of whether domestic borrowing is a unit vector in $\boldsymbol{\alpha}$ involves evaluating the null hypothesis that $\alpha_1 = 1$, whilst other $\boldsymbol{\alpha}$ coefficients are unrestricted. If accepted, then, shocks to the corresponding variable have no lasting impact on any of the variables in the system (including itself). Intuitively, it implies that the cumulated disturbances from the $i^{th}$ variable do not enter the common trends defined by $\boldsymbol{\alpha}_\perp$, noting that $\boldsymbol{\alpha}'\boldsymbol{\alpha}_\perp = 0$ such that a unit vector in $\boldsymbol{\alpha}$ corresponds to a zero row in $\boldsymbol{\alpha}_\perp$. Thus, if variable *i* is purely adjusting in $\boldsymbol{\alpha}$, one would expect it to have transitory effects in $\boldsymbol{\alpha}_\perp$.[5] To sum up, a variable with a unit vector in $\boldsymbol{\alpha}$ is purely adjusting to the cointegrating relation and shocks to the variable only have transitory effects.

### 4.2 The common trends representation

Finally, we consider the Granger Representation of the CVAR model in Equation (1) to decompose *y{t}* into two parts: a unit root process into pushing forces (the common trends) and a stationary part (the cointegrating relation). Exploring the duality property between $\boldsymbol{\alpha}\boldsymbol{\beta}'$, i.e., the $\boldsymbol{\Pi}$ matrix and the long-run impact matrix, i.e., the **C**-matrix, we can decompose the system into transitory and permanent components (Gonzalo 1994). The permanent components then represent the budgetary equilibrium while the transitory components

[5] $\boldsymbol{\alpha}$ defines the adjustment to the equilibrium error given by the cointegrating relation, while $\boldsymbol{\alpha}_\perp$ defines the common stochastic trends.

capture deviations from equilibrium. The estimation of common trends uses moving average representation corresponding to Equation (1).

$$\mathbf{y}_t = \mathbf{C}\sum_{i=1}^{t} \boldsymbol{\varepsilon}_i + \mathbf{C}\mu t + \mathbf{C}\mu_0 + \tilde{Y}_t \quad (3)$$

where $\mathbf{C} = \boldsymbol{\beta}_\perp (\boldsymbol{\alpha}'_\perp \boldsymbol{\Gamma} \boldsymbol{\beta}_\perp)^{-1} \boldsymbol{\alpha}'_\perp$ $C\mu$ measures the slope of the linear trends in $y_t$, $C\mu_0$ measures the initial values, and $\tilde{Y}_t$ represents the stationary process in $y_t$.

Defining $\tilde{\boldsymbol{\beta}}_\perp = \boldsymbol{\beta}_\perp (\boldsymbol{\alpha}'_\perp \boldsymbol{\Gamma} \boldsymbol{\beta}_\perp)^{-1}$ makes it possible to re-write the **C**-matrix as a product of two matrices, i.e., $\mathbf{C} = \tilde{\boldsymbol{\beta}}_\perp \boldsymbol{\alpha}'_\perp$ similar to $\boldsymbol{\Pi} = \boldsymbol{\alpha}\boldsymbol{\beta}'$, hence the duality property between the **C**- and $\boldsymbol{\Pi}$ matrices. As is well known, $\boldsymbol{\beta}$ in the $\boldsymbol{\Pi}$ matrix determines the common long-run relations and $\boldsymbol{\alpha}$ load deviations from equilibrium for correction. In the **C**- matrix, $\boldsymbol{\alpha}_\perp$ determines the common stochastic trends driving the long-run relation out of equilibrium and $\boldsymbol{\beta}_\perp$ defines the loadings to the *p-r* common stochastic trends, $\boldsymbol{\alpha}'_\perp \sum_{i=1}^{t} \boldsymbol{\varepsilon}_i$. The only important difference is that in the **C**- matrix $\tilde{\boldsymbol{\beta}}_\perp$ is a function not only of $\boldsymbol{\beta}_\perp$, but also of $\boldsymbol{\alpha}_\perp$. Although, in unrestricted form, common trend estimates are not uniquely determined, the $sp(\beta_\perp)$ and $sp(\alpha)$ is, and is similar to $\alpha$ and $\beta$ where the $\boldsymbol{\Pi}$ matrix is uniquely estimated, even though the unrestricted $\alpha$ and $\beta$ vectors are not (Juselius 2006: 258). To just identify the *p-r* common trends, we will have to impose identifying weak exogeneity restriction in one of the common trends without changing the value of the likelihood function for which no testing is involved. Further details of this form of operation are provided in Juselius (2006: 262-4). Based on the restricted **C**-matrix, we decompose the stochastic driving forces in the system into permanent and transitory effects (and hence determine which shocks have long-run impact on the variables in the system). Transitory shocks (*r*) have no long-run impact on the variables in the system and are defined by zero (insignificant) columns in the **C**-matrix. Permanent shocks (*p-r*) have a significant long-run impact on the variables of the system, and are defined as non-zero (significant) columns in the **C**-matrix. The extent to which each variable in the system has been influenced by any of the cumulated empirical shocks is given by the rows of the **C**-matrix.

## 5 Empirical results

### 5.1 Empirical model specification

As the variables in levels appear to be trending and we are not sure whether these linear trends will cancel out in the cointegrating relation, the unrestricted 4-dimensional model is estimated with a restricted trend and an unrestricted constant. Including an unrestricted constant allows for linear trends in both cointegrating space and in the variables in levels and produces a non-zero mean in the cointegrating relation. Furthermore, it avoids creation of quadratic trends in the levels, which would arise if both the constant and trend are unrestricted. Further justification for this type of specification is in Juselius (2006: 99-100). The choice of the lag-length was determined as the minimum number of lags that meets the crucial assumption of time independence of the residuals, based on a Lagrange multiplier (LM) test. We began with two lags because, as argued in Martins (2010), aid impact is likely

to be contemporaneous or with relatively quick adjustment dynamics. Both Schwarz and Hannan-Quinn information criteria suggested one lag, and with a lag of one, the LM test could not reject the null hypothesis of no serial correlation in the residuals. Thus, all subsequent CVAR analysis was implemented with a lag of one.

An assessment of the system residual misspecification test reveals that although the residuals are not auto-correlated (which is very important), the hypothesis of multivariate normality is not strongly supported ( $\chi^2(8)$ = 22.308 [0.004]. Non-normality of the error terms was detected in *G*, *DB* and *A* Equations. From the actual and standardized residuals, we observed two non-cumulated blips (one in 1979 and the other in 1980) with opposite directions in level plus two cancelling cumulated mean shifts (one before 1979 and the other after 1980, 1979 and 1980 exclusive) in the spending equation and a slight but detectable shift in behaviour from about 1988. As a common way of dealing with outlier observations, a transitory innovation dummy, $dum_{79}$ = (...,0, 0, 1, -1, 0, 0,...), i.e., 1979=1, 1980=-1, 0 elsewhere and a shift dummy, $D_{88} = (...,0,0,0,1,1,1,...)$, taking the value 1 for each year after 1988 inclusive, 0 otherwise were incorporated to lie in the cointegrating space of the CVAR model, albeit noting that $dum_{79}$ cancels out as a consequence of cointegration.[6] Although this modification slightly improves specification of the CVAR model, we still cannot accept multivariate normality ( $\chi^2(8)$ = 20.878 [0.007]). This suggests that the two variant models, i.e., without (and with dummies) are not statistically different, so dummies may be impotent in the model. This notwithstanding, the good news is that estimates of the CVAR model are robust to deviations from normality provided residuals are not auto-correlated. Furthermore, as the subsequent trace-test results will show, we obtain a cointegrating relation without dummies, but cointegration disappears when dummies are incorporated.[7]Although this is puzzling, theoretical predictions would suggest existence of a budgetary equilibrium among the fiscal variables, especially that we have allowed for a complete fiscal representation (albeit with some omissions so that we are not estimating an identity). Thus, we let a model without dummies (basic model) override the alternate specification (i.e., model with dummies) so that subsequent analysis in the rest of the paper is based on the basic model.

### 5.2 Determination of the cointegration rank

Having determined the appropriate specification of the data generating process (DGP), cointegration rank was determined using Johansen's (1988) trace statistic,[8] and also test for the presence of unit roots in the multivariate framework, given the cointegration space. However, the trace-test has been shown to have finite sample bias with the implication that it often indicates too many cointegrating relations, i.e., the test is over-sized (Juselius 2006: 140-2; Cheung and Lai 1993b; Reimers 1992). Hence, for a small sample like the one at our disposal, as shown in Table 1, we also report Bartlett correction results for a small sample, which ensures a correct test size (Johansen 2002). Based on the results, the presence of one equilibrium (stationary) relation, even when corrected for small sample bias among the variables at the conventional 10 per cent level of significance cannot be rejected.

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6 In the cointegrating space, a transitory innovation dummy produces two non-cumulated blips with opposite directions but no adjustment after wards as they cancel each other.

7 Trace-test results of a model with dummies can be obtained from the author on request.

8 In the test, the determination of the cointegrating rank, *r* relies on a top-to-bottom sequential procedure. This is asymptotically more correct than the bottom-to-top alternative (i.e., Max-Eigen statistic) (Juselius 2006: 131-4).

Furthermore, roots of the companion matrix and graphs of the potential cointegrating relations together suggest that *r = 1* seems reasonably well supported by the data.

Table 1: Johansen's cointegration trace test results

| p-r | r | Eig.value | Trace | Trace* | Frac95 | P-value | P-value* |
|---|---|---|---|---|---|---|---|
| 4 | 0 | 0.521 | 66.002 | 61.916 | 63.659 | 0.031 | 0.070 |
| 3 | 1 | 0.413 | 39.535 | 37.835 | 42.770 | 0.104 | 0.148 |
| 2 | 2 | 0.303 | 20.368 | 19.854 | 25.731 | 0.211 | 0.238 |
| 1 | 3 | 0.185 | 7.374 | 7.310 | 12.448 | 0.316 | 0.323 |

Notes: Trend assumption: Linear deterministic trend restricted; *: the small sample corrected test statistic (Dennis 2006: 159-60); Frac95: the 5% critical value of the test of H(r) against H(p). The critical values as well as the p-values are approximated using the Gamma (Γ) distribution (Doornik 1998).

Source: Authors' computations.

Following the confirmation of the cointegrating rank, we tested for the presence of unit roots within the multivariate framework using the CATS procedure. The procedure expresses the hypothesis of stationarity of variable $y_i$ as

$$H_O : \beta = \left(\beta_1^0, \beta_2\right),$$

where $\beta_1^0 = \varepsilon_i$ and $\beta_2$ is a (*p x (r-1)*) dimensional matrix of unrestricted coefficients (Dennis 2006: 73). The procedure takes as the null hypothesis that a series is stationary (against the alternative of a unit unit) (see, for example Kahn and Ogaki 1992 and Kwiatkowski et al. 1992), is conditional on the $r(\mathbf{\Pi})$ (where $r = 1$ in our case) and is a $\chi^2(p-r)$ test (Dennis 2006: 11-2). Test results for stationarity are presented in Table 2. Given the results, we see that stationarity of each variable by itself in the system is rejected at the conventional 10 per cent level of significance, suggesting that the series are unit root non-stationary or I(1).

Table 2: Test for stationarity: LR – test, $\chi^2(p-r)$

| DB | G | A | R |
|---|---|---|---|
| 7.710<br>(0.052) | 7.882<br>(0.049) | 8.334<br>(0.040) | 7.389<br>(0.060) |

Notes: Restricted trend included in the cointegrating relationship(s); 5% C.V = 7.815; P-values in parentheses.

Source: Authors' computations.

### 5.3 Estimates of the long-run fiscal impact of aid and structural analysis

With a unique relationship among the fiscal variables, the identification of the long-run relation is direct. Normalizing the only existing cointegration relation on domestic borrowing (as this is a residual and is incorporated to identify the fiscal balance), we identified a cointegrated relation among the fiscal variables. This translates into a relation explicitly for the long-run fiscal equilibrium for Uganda. Table 3 reports the long-run parameters of the fiscal effect of aid, long-run variable exclusion, weak exogeneity and a unit vector in alpha tests. In light of the long-run parameter restrictions set out earlier, and in addition to long-run coefficient estimates, the following can be deduced from these results.

*Ceteris paribus*, estimates of the long-run coefficients suggest a negative correlation of aid and tax revenue with domestic borrowing and a positive correlation with government spending. Another interesting result is that the coefficient on tax revenue is larger than that on aid, suggesting that in the long run the budget is largely driven by tax revenue (or domestic revenue in general). Furthermore, aid and tax revenue coefficients have the same sign, which has a two-fold implication. First, that in the long run, aid receipts or reforms linked to aid conditionality have been associated with either tax revenue collection efficiency or reforms in public finance management. Second, that borrowing in general is the main financing item of primary budget deficit net of aid. This is because the poorest aid recipient countries in general face the greatest difficulty in increasing tax revenue (Teera and Hudson 2004) given their desired expenditure levels, but face a surge in aid. Hence this result implies that Uganda easily alters its borrowing after aid. In fact, trends in Figure 1 suggest that a surge in aid is associated with lower domestic borrowing (i.e., aid implies a lower deficit to finance) and *vice versa*. This association suggests that the net long-run effect of aid in Uganda has, in part, been the reduction in domestic borrowing (or aid is used to offset domestic borrowing).

The trend term is significantly different from zero in all the three normalizations, suggesting *prima facie* that holding other factors constant, domestic borrowing does increase every time, while spending and aid decreased over the same period. However, given the time path of the data in Figure 1, this is unlikely.

Trends in domestic borrowing suggest there have been reductions in the variable, while spending and tax revenue seem to have been on the rise since the mid-1980s so the implication of the trend term is counter intuitive. Given this, it is possible that the trend term

Table 3: Estimates of the long-run effect of aid, long-run variable exclusion, and weak exogeneity, and unit vector in alpha tests

| The matrices based on 1 cointegrating vector | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $\beta'$ | | | | | | | | | |
| DB | | G | | A | | R | | TREND | |
| 1.000 | (na) | 0.223 | (3.159) | -0.137 | (-2.064) | -0.484 | (-4.929) | 244.387 | (4.638) |
| 4.485 | (5.234) | 1.000 | (na) | 0.614 | (2.064) | 2.171 | (4.929) | -1096.07 | (-4.638) |
| -7.31 | (-5.234) | -1.63 | (-4.929) | 1.000 | (na) | 3.538 | (4.929) | -1786.46 | (-4.638) |
| Test for long-run exclusion: LR-test, $\chi^2(1)$ | | | | | | | | | |
| 6.846 | [0.009] | 4.310 | [0.038] | 4.384 | [0.036] | 4.539 | [0.007] | 5.929 | [0.015] |
| Test for weak exogeneity: LR-test, $\chi^2(1)$ | | | | | | | | | |
| 1.899 | [0.168] | 3.018 | [0.082] | 3.102 | [0.078] | 3.309 | [0.069] | | |
| Test of unit vector in alpha : LR-test, $\chi^2(3)$ | | | | | | | | | |
| 11.579 | [0.009] | 7.617 | [0.055] | 17.049 | [0.001] | 4.921 | [0.178] | | |

Notes: (i) In parentheses are t-ratios for $\beta'$ and P-values elsewhere in brackets; (ii) Null hypothesis for long-run exclusion: a variable can be excluded from the cointegrating relations; p-values indicate the level at which the null hypothesis can be rejected. Bartlett correction factor is 1.586; (iii) Null hypothesis for weak exogeneity: a variable is weakly exogenous. A large test statistic (small prob.) indicates that the null hypothesis of weak exogeneity is rejected; (iv) Obs: number of variables = 30.

Source: Authors' computations.

is picking up measurement errors in the donor measure of aid which is a significant overestimate of the aid that actually goes to the government or it could be that the omitted budget variables are exhibiting trend behaviour (e.g., non-tax revenue may be increasing steadily). The possibility that the latter is non-stationary is statistically tested using the augmented Dickey Fuller (ADF) unit root test (Dickey and Fuller 1979). This yielded the test statistic of -3.725, which when scaled by the 5 per cent critical value of -3.50 (for *n=50* usable observations) suggests this is stationary. We recognize the limitations of DAC measure of aid used in the study up-front but note that these are the only available consistent data for the sample period analysed here.

All variables enter into the system cointegrating space in Equation (2). The fact that aid is a significant element of long-run fiscal equilibrium suggests that aid (or the policy conditions attached to aid) have caused beneficial fiscal policy responses in Uganda, or that in fiscal terms aid may have been used sensibly.

Long-run weak exogeneity is firmly rejected at the 10 per cent level of significance for aid, government spending and tax revenue. Focusing on aid, the result suggests, in part, that Ugandan fiscal planners have a target for aid revenue, and this expected revenue is incorporated into fiscal planning (i.e., when determining revenue and expenditure allocations, aid revenue is taken into account) (see *inter alia* McGillivray and Morrissey 2000).[9] Alternatively, it could be the case that donors incorporate government spending in deciding how much aid to allocate to Uganda, which seems less likely but is possible. Thus, our results appear to imply that for Uganda, causality runs from spending to aid, allowing for the possibility that government sets spending targets according to its development objectives, and then tries to find aid resources to finance these ambitions, albeit with some level of unpredictability[10] due to donor disbursement rule. However, this may not mean that the government has control over the aid allocated to Uganda (i.e., aid commitment) by donors but rather disbursement could be a reaction to government's ability to meet donor's administrative or internal procedural requirements and/or other policy pre-conditions (Eifert and Gelb 2005). Or it may reflect the exercise of incentive clauses by donors in response to events over which the Ugandan government has some direct control in the context of an on-going aid relationship (O'Connell, Adam and Buffie 2008).

Endogeneity of government spending as suggested by the results may appear counter intuitive, as spending is very difficult to reverse once implemented (especially if it involves increases in public payroll or statutory expenditures). However, it may imply that government spending is planned based on the expected revenue envelop but the allocation of spending is affected when the revenue outcome is realized, i.e., spending allocation responds to revenue outturn. Similarly, while it is surprising that weak exogeneity of domestic borrowing cannot be rejected, trend analysis and estimates of the long-run relation suggest that it is determined by factors other than the domestic fiscal variables, i.e., that it depends on aid and not tax revenue.

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9 In Foster and Killick (2006: 19), it is noted that Uganda has a more forward-looking view, and that it has achieved some success in getting more aid allocated as budget support, and released early in the budget year. Uganda has also been relatively sophisticated in adjusting donor promises based on past disbursement performance.

10 The amount they give is unpredictable, sometimes varying by as much as 40 per cent from one year to the next (Commission for Africa 2005).

We also note that the null hypothesis of a unit vector cannot be rejected for tax revenue, suggesting that shocks to it have transitory effects only and is purely adjusting to the long-run equilibrium.

### 5.4 Testable fiscal hypotheses

Applying restrictions on the long-run fiscal coefficients, $\boldsymbol{\beta}_i$ in Equation (2) allows us to assess whether the hypothetical known fiscal vectors based on the FRMs are stationary (see *inter alia* Juselius 2006). Note that Equation (2) can be normalized on any variable, but for testing of the hypotheses of the fiscal effect of aid, it may be best to interpret it in equilibrium form:

$$[\beta_1, \quad \beta_2, \quad \beta_3, \quad \beta_4, \quad \beta_0] \begin{bmatrix} DB \\ G \\ A \\ TR \\ t \end{bmatrix} = I(0) \tag{4}$$

Based on Equation (4) and drawing from the FRMs, we could for example test whether a revenue displacement or whether balanced budget and/or whether aid additionality hypotheses are each stationary, i.e., whether each of these are a long-run relation. These are described in detail below and test results are given in Table 4.

*Budgetary constraint (G-(R+A+DB)*

The evaluation of whether budgetary constraint is long-run stationary or non-stationary is based on the accounting identity above. The assumption is that the total resource envelop (tax revenue, aid, including domestic borrowing) is insufficient to meet the required public expenditures consistent with the achievement of Uganda's growth targets. This, from Equation (4) is accomplished by testing whether the estimated coefficient on total government spending is not statistically different from +1, while coefficients on tax revenue and other financing items are not statistically different from -1 (Martins 2010; McGillivray and Morrissey 2001b: 4-7), while the trend coefficient is left unrestricted. As the results in Table 4 show, this hypothesis is not rejected, suggesting that aid inflows remain insufficient to cover the spending needs and, as shown above, the 'omitted budget variables' are stationary.

*Balanced /cash budget (G-(R+A)=0; DB=0)*

This investigates the hypothesis that the government tries to meet expenditures exclusively with the resource envelope (domestic tax revenue and aid) with no recourse to deficit financing. As set out in Equation (4), we imposed the restriction that the sum of the coefficients to tax revenue and aid, and that on spending are equal and opposite, holding the coefficient to domestic borrowing at zero, while the trend coefficient is left unrestricted. This hypothesis is rejected (see results in Table 4), suggesting that over the sample period, the government has relied on non-concessional foreign loans and/or domestic borrowing to balance its fiscal accounts. This is not surprising. The fiscal literature suggests that non-aid borrowing is typically considered to be financing of the last resort, i.e., intended to finance an unanticipated gap between expenditure and revenue (McGillivray and Morrissey 2001b), and could in particular be affected by the way aid is provided. For example, the government's domestic borrowing requirements reversed from a saving of 1.6 per cent of GDP in 1997/8 to

a borrowing of 0.9 per cent of GDP in 2001/2 due to actual aid disbursements falling short of what had been programmed when the annual budgets were drawn up (Brownbridge and Tumusiime-Mutebile 2007).

*Aid additionality/illusion (G=-A; R=DB=0)*

In practice, aid packages come with strong pressures to spend (O'Connell, Adam and Buffie 2008). Eifert and Gelb (2005) and Berg et al. (2007) observe that recipient governments that long ignore such donor sentiments may face a suspension of aid. Thus, aid inflows are additional if they entail an equivalent increase in government expenditure. However, spending may not increase by the full amount of the aid, either because some aid is directed to other uses such as interest payments or accumulation of reserves (the aid is fungible), or because tax receipts decline or some of the aid 'leaks' (corruption). On the other hand, spending can increase by more than the allocated aid if, for example, governments have to match aid revenue, or aid-financed government spending generates subsequent claims on future spending (that may need to be financed by domestic resources), such as the recurrent costs required to maintain an investment.[11] The situation where government spending increases by more than the amount of the net aid inflow has been described as aid illusion, so that the impact on spending is more than proportional to aid (McGillivray and Morrissey 2001).

Although the increase in spending as a ratio of aid may not, on its own, be demonstrated with precision, inference on aid additionality/illusion hypothesis can be drawn from the long-run coefficients in the fiscal relation as suggested in Martins (2010: 38). The coefficient on government spending is less than 1 (about 0.63), suggesting aid is less than additional and suggests no aid illusion (but may simply reflect the fact that the DAC measure overstates the amount of aid received by the government that can affect spending). Our estimated long-run coefficients show that a one million Uganda shillings (UGX) increase in the amount of aid results in UGX 614,349.78 increase in total public spending. Thus, about 61 per cent of incremental aid was spent, suggesting that spending was less than proportional to aid over the period 1972-2008. This is consistent with the findings in Mugume (2008), Foster and Killick (2006) and McGillivray and Morrissey (2004).[12] As shown in Table 4, a formal test of whether the coefficients to spending and aid in the fiscal equilibrium are equal and opposite, albeit keeping the trend unrestricted, is also rejected.

There are a number of reasons not to overstate this result. The most obvious is that we use the DAC measure of aid, which overstates not only the amount of aid actually spent in Uganda but also the amount delivered through the budget (aid that does not go through the government cannot appear as government spending). If only two-thirds of the 'DAC measure' goes to the government our estimates are consistent with all aid to the government being spent (i.e., aid is fully additional), and do not preclude aid illusion. Also, the concessionality implicit in debt relief or write-offs is recorded as ODA grants by donors even though they do not give more money to Uganda. We recognize the limitations of the DAC

11 The construction of schools and health units, for example, has to be accompanied with increased spending on consumables such as textbooks, recruitment of teachers, enhancement of teacher's salaries, training of healthworkers, procurement of equipment, ambulances and medical supplies, etc.

12 About 63 per cent of incremental aid was spent over the period 1966-2006 (Mugume 2008); Foster and Killick (2006) estimate the same at 74 per cent during 1999-2002 period while McGillivray and Morrissey (2004) put it at an average of 70 per cent over 2001-07.

measure of aid used but note that these are the only available consistent data. Furthermore, the preceding conclusions are based on estimates in which normalization is on total public spending and as such ignore indirect feedback effects operating through the system. It could also be due to a time lag between aid flows being received and the actual expenditure (low absorptive capacity of the government budget). Foster and Killick (2006) argue that only 74 per cent of the increase in aid during 1999-2002 was spent by the government, of which only 27 per cent was absorbed in higher aggregate spending on goods and services in the economy.[13] In contrast, Martins (2011: 1953) estimates 100 per cent absorption and spending for Uganda using time series methods. Also, part of the aid is used to reduce borrowing because the IMF has often required reductions in borrowing as *a quid pro quo* for increased aid, some of which is held in the BoU as foreign exchange reserves (Berg et al. 2010: 4; Brownbridge and Tumusiime-Mutebile 2007: 208; Foster and Killick 2006: 14) and we may not preclude the possibility that there are some 'leaks' so not all the aid is used to support spending.

*Revenue displacement (A=-R; G=DB=0)*

A particular concern of the donors is that aid may discourage the incentive to increase tax effort in poor aid-dependent countries. However, addressing the tax effect associated with aid tends to be difficult as there can be many effects in opposing direction (Morrissey 2012). Economic liberalization policies associated with aid conditionality tend to reduce tax revenue (Morrissey 2012; Greenaway and Morrissey 1993). Baunsgaard and Keen (2005) show that periods of economic policy reforms in developing countries seem to be associated with reductions in the tax/GDP ratio, especially for the poorest countries, noting that these are the very periods that tend to be associated with aid episodes. Thus, a negative correlation between aid and tax ratios may be due to aid conditionality, but not a behavioural effect of aid reducing tax effort. Also, when tax efforts are fairly high, recipient governments may use the extra fiscal space provided by aid flows to offer tax subsidies to key sectors of the economy or reduce tax induced distortions and crowd-in private investment (Martins 2010; Fagernäs and Schurich 2004). In this case, aid has a behavioural effect on the tax rates and may reduce tax effort, although such reductions may not necessarily be undesirable.

Studies on the fiscal effect of aid and on the determinants of tax/GDP ratios do not provide solid evidence that aid has a behavioural effect on tax effort. Because the repayment obligation of aid grants and aid loans differ, Gupta et al. (2004) find that aid grants have a negative effect on tax effort while loans encourage tax effort. On the contrary, Clist and Morrissey (2011) find no robust evidence for a negative effect of aid grants on the tax/GDP ratio. Similarly, Morrissey, M'Amanja and Lloyd (2007) find no evidence for an effect of aid on tax effort. On the other hand, some of the policy conditions attached to aid have as objectives increasing the taxbase, tax collection efficiency, and tax rates (Morrissey 2012: 11-2). Evidence shows that since the mid-1980s, aid has been associated with conditions including measures to increase tax revenue (Clist and Morrissey 2011).

Therefore, as there tend to be many effects of aid on tax revenue but in opposing directions, empirical evidence is needed to resolve the actual effect. Using the Ugandan fiscal data, we test the hypothesis that aid displaces tax effort, i.e., that the coefficients on aid and tax revenue, whilst keeping the trend term unrestricted, are equal and opposite. Based on the

13 Absorption is the widening of the current account deficit (excluding aid) due to more aid while spending is the widening of the fiscal deficit (excluding aid) due to incremental aid (Hussain, Berg and Aiyar 2009; Foster and Killick 2006: 3).

results in Table 4, this hypothesis is not supported, which suggests that aid to Uganda has not had a pervasive dampening effect on domestic revenue effort in the long run. As low-income countries are severely constrained in their ability to increase tax/GDP ratios, it may be the case that Uganda is raising as much tax revenue as is feasible because of concerns that its aid will not be sustained or because of associated public finance management reforms and revenue collection efficiency. A similar result has been found in Martins (2010) for Ethiopia and in Osei, Morrissey and Lloyd (2005) for Ghana. In Kenya, no significant effect was found (Morrissey, M'Amanja and Lloyd 2007).

*Aid-domestic borrowing 'perfect substitution' (A=-DB; G=R=0)*

The relationship between aid and non-aid borrowing is not clear. Fiscal theory would suggest that domestic borrowing is a consequence of the cost of aid unpredictability and volatility (Bulír and Hamann 2003) so that aid flows and domestic borrowing could be viewed as substitutes and would be negatively correlated. But some empirics show that aid facilitates increased non-aid borrowing (Franco-Rodriguez, McGillivray and Morrissey 1998) in which case, it is plausible to think in terms of the vicious circle in which aid flows are diverted to retire onerous public loans, especially the 'odious debt' (debt servicing), but this makes it easier to borrow again in the future. Alternatively, as McGillivray and Morrissey (2001) argue, the knowledge that a government is in receipt of aid allows it to increase borrowing, as creditors perceive it as having the ability to service debts.

Besides, certain aid expenditures require matching spending by the recipient or spending officials may misperceive their budget constraint with respect to incremental aid (especially in an environment of poor public expenditure management)—aid illusion arises and the direct link between aid and spending is weakened. McGillivray and Morrissey (2001a) argue that even if recipient governments do not have 'malicious' intentions, aid can be associated with expenditure increases in excess of the aid itself, and this may lead to the need for borrowing to finance the deficit. The hypothesis of whether aid and non-aid borrowing are perfect substitutes, i.e., whether the coefficients on domestic borrowing and aid in the fiscal equilibrium are equal and opposite, keeping the trend unrestricted, is tested. As the results show, although the hypothesis is weakly rejected, it is not supported and suggests that these effects take place, but they are not persistent, i.e., domestic borrowing is a response to shortfalls in foreign aid (and is repaid when there is good performance in aid flows). This result is consistent with the evidence for Ethiopia (Martins 2010). Although this hypothesis is not tested for Ghana, simulation results show that aid significantly reduced domestic borrowing because IMF demanded borrowing reductions in the 1980s (Osei, Morrissey and Lloyd 2005: 5).

The preceding investigations on the potential long-run relation among the fiscal variables provide interesting insights into fiscal dynamics in Uganda. The existence of a budget constraint and a non-balanced budget is supported. Thus, while aid flows to Uganda have been substantial, the resource gap has remained big and is often reduced by domestic borrowing (which is repaid when revenues are health). Aid induces increased tax effort, reduces domestic borrowing and increases public spending. Although our results show that spending is less than proportional to incremental aid, it (spending) is more than what it could have been in the absence of aid. The evidence of a budget constraint hanging over budget implementation suggests that aid to the government (budget) is likely to be fully additional and it is even possible that total spending increases by more than the aid actually delivered through the budget. Thus the aid additionality/illusion hypothesis remains inconclusive, given the nature of the aid measure used. Moreover, as noted in Osei, Morrissey and Lloyd (2005),

our conclusion is subject to a distinction between aid as finance (a volume effect) from aid conditions (a policy effect), i.e., if policy conditions (say, improved public finance management) mean that aid was used well, one could infer that that aid promoted better policy. Although we cannot elaborate on the distinction here, it seems likely that in fiscal terms aid appears to have been utilized sensibly.

Table 4: Hypotheses tests on the fiscal effect of aid: L-R test, $\chi^2(4)$. Restrictions derive from Equation (3): $\beta_1 DB + \beta_2 G + \beta_3 A + \beta_4 TR + \beta_0 t = I(0)$

| Testable Fiscal Hypotheses | | Statistics | *p-value* | Inference |
|---|---|---|---|---|
| Budget constraint | $\beta_1 = -1, \beta_2 = 1, \beta_3 = -1, \beta_4 = -1$ | 6.915 | 0.140 | Accept |
| Balanced budget | $\beta_2 = 1, \beta_3 = -1, \beta_4 = -1; \beta_1 = 0$ | 8.458 | 0.076 | Reject |
| Aid additionality/illusion | $\beta_2 = 1, \beta_3 = -1, \beta_1 = 0; \beta_4 = 0$ | 12.186 | 0.016 | Reject |
| Tax revenue displacement | $\beta_3 = 1, \beta_4 = -1, \beta_1 = 0, \beta_2 = 0$ | 21.439 | 0.000 | Reject |
| *A-DB* 'perfect substitutes' | $\beta_1 = -1, \beta_3 = 1, \beta_2 = 0, \beta_4 = 0$ | 7.992 | 0.092 | Reject |

Notes: Test results are robust to small sample bias correction. Bartlett correction factor = 1.461. The deterministic time trend is unrestricted in all these tests to measure non-zero average linear growth rates.

Source: Author's computations.

The preceding investigations on the potential long-run relation among the fiscal variables provide interesting insights into fiscal dynamics in Uganda. The existence of a budget constraint and a non-balanced budget is supported. Thus, while aid flows to Uganda have been substantial, the resource gap has remained big and is often reduced by domestic borrowing (which is repaid when revenues are health). Aid induces increased tax effort, reduces domestic borrowing and increases public spending. Although our results show that spending is less than proportional to incremental aid, it (spending) is more than what it could have been in the absence of aid. The evidence of a budget constraint hanging over budget implementation suggests that aid to the government (budget) is likely to be fully additional and it is even possible that total spending increases by more than the aid actually delivered through the budget. Thus the aid additionality/illusion hypothesis remains inconclusive, given the nature of the aid measure used. Moreover, as noted in Osei, Morrissey and Lloyd (2005), our conclusion is subject to a distinction between aid as finance (a volume effect) from aid conditions (a policy effect), i.e., if policy conditions (say, improved public finance management) mean that aid was used well, one could infer that that aid promoted better policy. Although we cannot elaborate on the distinction here, it seems likely that in fiscal terms aid appears to have been utilized sensibly.

### 5.5 Results of the common trends representation

With *p=4* and a cointegration rank of *r=1*, results in Table 5 show that we have *r=1* cointegrating relation and *p-r=3* common stochastic trends driving the long-run relations out of equilibrium. The first common stochastic trend is shocks to government spending with a small (potentially insignificant) effect from aid, while the second and third common stochastic trends are, respectively, shocks to domestic borrowing and shocks to tax revenue (each with a small and potentially insignificant effect from aid).

Table 5: The MA-representation and decomposition of the trend (restricted model)

The coefficients of the common trends:
Re-normalization of alpha orthogonal:
Alpha orthogonal (transposed)

| | DB | G | A | R |
|---|---|---|---|---|
| CT(1) | 0.000 | 1.000 | 0.985 | 0.000 |
| | (na) | (na) | (na) | (na) |
| CT(2) | 1.000 | 0.000 | 0.000 | 0.000 |
| | (na) | (na) | (na) | (na) |
| CT(3) | 0.000 | 0.000 | -1.210 | 1.000 |
| | (na) | (na) | (na) | (na) |

The loadings to the common trends, BETA_ORT(tilde):

| | CT1 | CT2 | CT3 |
|---|---|---|---|
| DB | 0.000 | 1.000 | -0.000 |
| | (0.000) | (6.785) | (-0.000) |
| G | 0.737 | -0.701 | 0.488 |
| | (7.662) | (-2.736) | (2.736) |
| A | 0.267 | 0.712 | -0.496 |
| | (2.008) | (2.008) | (-2.008) |
| R | 0.323 | 0.861 | 0.400 |
| | (4.037) | (4.037) | (2.692) |

The long-run impact matrix, C

| | DB | G | A | R |
|---|---|---|---|---|
| DB | 1.000 | -0.000 | 0.000 | -0.000 |
| | (6.785) | (-0.000) | (0.000) | (-0.000) |
| G | -0.701 | 0.737 | 0.135 | 0.488 |
| | (-2.736) | (7.662) | (2.736) | (2.736) |
| A | 0.712 | 0.267 | 0.863 | -0.496 |
| | (2.008) | (2.008) | (12.654) | (-2.008) |
| R | 0.861 | 0.323 | -0.166 | 0.400 |
| | (4.037) | (4.037) | (-4.037) | (2.692) |

Notes: In parentheses are t-ratios.

Source: Authors' computations.

A column-wise inspection of the **C**-matrix shows that although there could be borderline significant coefficients in the tax revenue column, there is at least one variable with a significant long-run impact in the columns to domestic borrowing, spending and aid. As the null hypothesis for a unit vector in $\boldsymbol{\alpha}$ could not be rejected for tax revenue, it adjusts only to the cointegrating relation and shocks to this variable only have transitory effects. Ultimately, these results suggest that shocks to tax revenue have no lasting effect on the variables in the system, while shocks to domestic borrowing, spending and aid do have a permanent effect or are the pushing forces of the system. The finding that the pulling forces are primarily given by empirical shocks to tax revenue is consistent with our previous findings and confirms that budget spending plans in Uganda for the sample period considered here have been adjusting to, but not pushing, tax revenue.

### 5.6 A disaggregated variant model

The long-run relation in Table 4 assumed that all forms of public spending have an equal effect on the other items in the budget. However, as we would like to offer insights into the disaggregated spending impact of aid, disaggregation of spending into current consumption (*GC*) and development (*GK*) spending as a refinement is warranted. Thus, a disaggregated variant is analysed and the resulting long-run estimates are set out in Equation (5) (t-ratios in parentheses):

$$\underset{\quad}{DB_t} = \underset{(5.029)}{1.428GK_t} - \underset{(-1.376)}{0.11GC_t} - \underset{(-3.676)}{0.269A_t} - \underset{(-5.571)}{0.541R_t} + \underset{(9.109)}{365.876Trend} \qquad (5)$$

Estimates suggest, *ceteris paribus*, a negative correlation of aid and tax revenue with domestic borrowing and a positive correlation of domestic borrowing with capital spending, so the same interpretation as in the aggregate model holds for corresponding correlations. In addition, domestic borrowing is more closely linked to capital spending. Furthermore, we tested the hypothesis that *GC* and *GK* coefficients in Equation (5) are equal, but could not be supported (LR test: $\chi^2(5) = 26.774$ [0.000]).

Although the relation in Equation (5) is appealing for a test of aid fungibility, data limitations largely constrain inference on this important fiscal hypothesis. Not only were we unable to establish (or even claim to know) how much of the aid donors intended to be spent on each expenditure category, but also, current spending (a key variable for the fungibility hypothesis) is not a significant element of the long-run fiscal relation.

## 6 Conclusions and implications for policy

This paper assesses a dynamic relationship between foreign aid and domestic fiscal variables in Uganda over the period 1972 to 2008 (annualized), using a cointegrated vector autoregressive (CVAR) model. The analysis reflects features of the data in a period characterized by political and economic instability and the effect of policy shift due to structural adjustment programmes in Uganda. The key results are summarized as follows:

Aid and fiscal variables form a long-run stationary relation; observing that the policy shift dummy seems unimportant suggests that the long-run fiscal relation is stable. A test of structural links between aid and fiscal variables reveals that aid is a significant element of long-run fiscal equilibrium, and the hypothesis of aid exogeneity is not statistically supported. We argue that Ugandan budget planners have a target for aid revenue or donors incorporate government spending in deciding how much aid to allocate to Uganda. This implies that the government sets its spending targets according to its own development objectives, and then tries to find aid resources to finance these ambitions, but in a priority order of domestic revenue, aid, and domestic borrowing.

In addition, a number of hypotheses of the long-run effect of aid on fiscal behaviour have been tested, providing interesting insights into fiscal dynamics in Uganda. Existence of a budget constraint and an unbalanced budget is supported. Aid induces increased tax effort, reduces domestic borrowing and increases public spending. Although the increase in spending is less than proportional to incremental aid, the existence of a budget constraint suggests that aid to government (budget) is likely to be fully additional. It is even possible that total spending increases by more than the actual aid delivered through the budget. The

DAC measure used significantly overstates the amount of aid to the budget and part of the aid is used to reduce borrowing while some is held in foreign exchange reserves. Moreover, a decomposition of the common trends shows that shocks to tax revenue are the pulling force, while empirical shocks to domestic borrowing, government spending and aid are the pushing force of Uganda's fiscal system.

As improved public finance management and reduced domestic borrowing are common policy conditions attached to aid, our results suggest that aid was either associated with or caused beneficial policy responses in Uganda. Alternatively, it could be the case that in fiscal terms aid has been utilized sensibly. This is against the backdrop that it was not possible to distinguish between aid as finance and aid as policy condition, and we do not know what donors intended the aid to be used for and the fact that we use the DAC measure of aid. This data drawback in our study merits a careful deeper analysis for Uganda. Nonetheless, the long-run estimates give results that are consistent with those of common trend analysis and with observing the data, and are plausible in that they are consistent with what is known about the fiscal impact of aid in previous studies of Uganda.

These results suggest some policy implications. Corroborations from the trend analysis and estimates of the long-run coefficients suggest that domestic borrowing remains responsive to the uncertainty associated with aid inflows. It is therefore crucial for the donors to increase the reliability and predictability of aid in order to improve fiscal planning and reduce the need to resort to costly domestic borrowing. Moreover as Morrissey (2012) argues, one way to make inference on the relationship between aid and spending more clear is for donors to coordinate aid delivery systems and also make aid more transparent. Recipients need to know what aid is available to finance spending and whether this is delivered through donor projects or government budgets.

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