A Time Series Analysis of the Fiscal Effects of aid 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. Aid has contributed to improved fiscal performance in Uganda, although the slow growth in tax revenue and regular aid shortfalls prevented sustaining a balanced budget inclusive of aid. In terms of policy, it is crucial to increase the reliability and predictability of aid, coordinate aid delivery systems and make aid more transparent. This involves effort on behalf of donors and the government.

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

JEL classification: C32, F35, O23, O55

1 Introduction

Fiscal response models offer important insights into how donors could expect their aid to impact on the fiscal behaviour of a recipient government, i.e., how aid affects government spending (distinguishing current and capital expenditure), tax effort and domestic borrowing (McGillivray and Morrissey, 2004). As aid packages come with strong pressures to spend (O'Connell, Adam and Buffie, 2008), aid inflows are expected to be associated with a direct and significant effect on public spending. Aid may also affect taxation either because of influences on tax effort or because reforms linked to aid conditionality affect tax rates or the tax base (Morrissey, 2015). Aid is also expected to be associated with lower domestic borrowing (Adam and O'Connell, 1999) 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 the provision of public goods and services that would otherwise place demands on the budget, the effectiveness of aid depends on public sector fiscal behaviour (Morrissey, 2015). This paper investigates the impact of aid on fiscal behaviour 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 increased from a low of about one per cent in 1980 to about five 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 (MoFPED, 2009). This study evaluates the fiscal effects of aid in Uganda over the period 1972-2008. A cointegrated vector autoregressive (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 budget, aid additionality/illusion, tax revenue displacement and aid-domestic borrowing substitution), and to decompose the common trends into pulling and pushing forces. All variables, including aid, are modelled jointly as a system of equations and the question of whether aid is endogenous or exogenous is tested in the CVAR methodology allowing for shocks and reforms that could bias estimates and result in invalid inferences if not incorporated (Juselius 2006).

The rest of the paper is structured as follows. Section 2 provides a brief literature review while the data and econometric methodology are presented in Section 3. Section 4 discusses the empirical results. The conclusions and policy implications are in Section 5.

2 Evaluating the Fiscal Effects of Aid

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 (2004) and Morrissey (2015). An important distinction can be made 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 the manner intended by donors. As presented in World Bank (1998), the underlying assumption is that donors grant aid to finance public investment as increments to the capital stock are the principle determinants of

growth; fungibility arises when recipients divert the aid to finance government consumption spending, and this is undesirable because such a diversion reduces the effectiveness of aid. However, to the extent that consumption spending is a necessary complement to investment spending (recurrent spending is required to operate an investment, such as nurses and medicines for a health care centre), the assumption that fungibility diminishes the effectiveness of aid may be misleading Analogously, fungibility is said to occur if aid intended for a particular sector, such as health or education, finances services 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. The evidence as to whether aid has been fungible or not, and whether fungibility limits aid effectiveness is imprecise, largely due to data limitations; Morrissey (2015) details the practical difficulty of directly linking aid, donor intentions and sector spending, given the need to distinguish on budget and off budget aid and the problematic classification of spending. As this is not the focus here readers are referred to the more detailed discussion in McGillivray and Morrissey (2004).

Fiscal response models (FRMs) adopt a broader approach allowing for the dynamic effect of aid on expenditure (current and capital spending), tax revenue and domestic borrowing. The traditional framework is based on the assumption that the government maximizes utility based on a quadratic loss function subject to targets for each revenue and expenditure category (Franco-Rodriguez, McGillivray and Morrissey, 1998: 1242-43). There are many limitations of empirical applications of FRMs, mostly related to difficulties in the use and estimation of targets for government expenditure and revenue, the treatment of aid, and econometric techniques that often yield inconsistent estimates of core parameters (McGillivray and Morrissey, 2004). Furthermore, the theoretical framework does not provide a thorough representation of government behaviour (e.g., there is no explanation of how the targets are determined) and does not generate specific testable hypotheses of the effect of aid on fiscal behaviour (Osei, Morrissey and Lloyd, 2005).

In an effort to overcome many of these difficulties, there is now a growing body of empirical literature estimating the FRM within a cointegrated vector autoregressive (CVAR) framework, often complemented with estimation of impulse response functions. The advantage of CVAR estimation is the tractable framework allowing for the formulation and testing of a number of different hypotheses on causal links between aid and the domestic fiscal variables. The technique takes into account the interactions between variables 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 and each variable is explained by its own lags and lagged values of the other variables. Assumptions about exogeneity are tested directly, avoiding the need for strong *a priori* assumptions; by design the econometric model allows the data to identify the statistical relationship between variables. 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, nor is it necessary to estimate structural parameters. Rather, economic theory is invoked to choose the variables to include in the analysis, select the appropriate normalizations and restrictions to identify particular effects, and to interpret the results.

Surveys and discussions of the literature on the country-specific fiscal effects of aid using a CVAR approach are provided in Morrissey (2015). These include the first CVAR study, Osei et al (2005) for Ghana; Morrissey, M'Amanja and Lloyd (2007) for Kenya; Martins (2010)

and Mascagni and Timmis (2014) for Ethiopia. It is clear that the impact of aid is country specific but this should not be surprising as governments differ in their fiscal behaviour. Osei et al (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) but aid has effects on spending, domestic borrowing and domestic tax revenue. Specifically, aid was associated with reduced domestic borrowing and increased tax revenue. They also find that recurrent spending rose more than investment spending following the increases in aid, this was not because aid was fungible but because investment spending was linked to borrowing and declined as borrowing was reduced, whereas recurrent spending was linked to tax and rose as revenue increased. However, they did not estimate the magnitude of the effect of aid on spending, nor did they formulate and impose restrictions to test specific hypotheses.

Morrissey et al (2007) extend the approach with official Kenyan data for 1964-2004 and estimate two relationships: the fiscal effects of aid grants and loans, and the impact of aid on growth. 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 were positively associated with growth through financing government spending, loans were negatively associated with growth, perhaps because they were associated with deficits. There was no evidence that aid affected tax revenue or that tax had an effect on growth (except indirectly via financing spending). However, the study did not fully exploit the CVAR methods, assumptions about exogeneity are not tested and they did not formulate any testable fiscal hypotheses.

Martins (2010) provides a comprehensive application of the CVAR method using quarterly data for Ethiopia over 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. Mascagni and Timmis (2014) aåål y CVAR analysis to Ethiopian government data over 1960-2009: aid (grants and loans) is positively related to tax revenue; tax does not adjust to aid but aid is an adjusting variable, implying that donors rewarded Ethiopia when tax revenue was increasing.

The more important contribution of Martins (2010) is the formulation of a set of testable hypotheses for the fiscal effects of aid. The test for aid spending, defined as widening of the fiscal deficit excluding aid (following Hussain, Berg and Aiyar, 2009; Foster and Killick 2006), involves the relationship between aid and the difference between tax revenue and spending. Similarly, the budget balance condition evaluates the deficit including aid revenues. The influence of aid on development spending and fungibility is addressed by disaggregating spending into components. These hypotheses are discussed in more detail in Section 4 where we test versions on the Ugandan data.

3 Data and Econometric Methodology

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, from OECD-DAC (2009). 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 McGillivray and Morrissey (2001) argue, 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. Uganda became a beneficiary of the highly indebted poor countries (HIPC) debt relief in 1998/99 (Atingi-Ego 2005; Collier and Reinikka 2001) and could have anticipated significant debt relief prior to that. 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). Aid loans declined from about eight per cent of GDP in the early 1990s to about four per cent in subsequent years while aid grants increased from two per cent of GDP in 1986 to a high of about 12 per cent in 1992 and averaged eight per cent each year up to 2004 (Egesa, 2011).

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 aid that is not even spent in Uganda (such as technical cooperation and assistance actually spent within the donor country) while some is spent under the control of the donors (donors retain control over project aid). Data on total government spending (and its disaggregated components: current and capital spending) are from the Uganda Bureau of Statistics (UBOS). All data are given in millions of constant 2005 Uganda Shillings (UGX) and are shown in levels and first differences in Appendix Figure A1.

As all variables are trending over time one may choose a multiplicative model specification with a log transformation. This transformation is innocuous as long as the series are strictly positive or are at least not too close to zero (Juselius, Møller and Tarp 2011), which does not apply to domestic borrowing. Furthermore, the trending seems to begin from 1988 onwards, with the Museveni regime, and this shift might be lost with a log transformation. Retaining all the series in UGX values facilitates addressing key questions, in particular by how much would the level of government spending change following an aid injection of one million UGXs? Both level and first difference plots for total public and current spending point to possible breaks in 1978-79 and a change in behaviour from about 1988 in all the series. 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 the second oil price shock and the breakdown of the East African Community in 1977. 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 the broad economic structural adjustment programme 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. This potential regime or level shift from 1988 and the transitory blip in 1979/80 are accounted for in the empirical analysis.

3.1 The cointegrated VAR (CVAR) model

The analysis is based on a 4-dimensional VAR model for $y_t' = (DB_t, G_t, A_t, R_t)$; where *DB* is domestic borrowing; *G* is government spending (*GC* for current and *GK* for investment), *A* is aid and *R* is tax revenue. 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:

$$\Delta \mathbf{y_t} = \boldsymbol{\alpha}\boldsymbol{\beta}'\mathbf{y_{t-1}} + \sum_{\mathbf{i=1}}^{\mathbf{k-1}} \boldsymbol{\Gamma}_\mathbf{1}\Delta \mathbf{y_{t-i}} + \boldsymbol{\Phi}\mathbf{D_t} + \boldsymbol{\varepsilon}_\mathbf{t} \quad (1)$$

where $\mathbf{y_t}$ is the 4-dimensional vector of endogenous variables, $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are (*p* x *r*) coefficient matrices, $\boldsymbol{\Gamma}_\mathbf{1}$ is a (*p* x *p*) matrix of short-run adjustment coefficients, *i=1,...,(k-1)* is the number of lags included in the system, Δ 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 $\boldsymbol{\varepsilon}_\mathbf{t} \sim \text{iidN}(0, \Sigma)$ is a (*p* x *1*) vector of errors. As shown in Juselius et al (2011: 7), if $k = 1$, then $\boldsymbol{\Gamma}_\mathbf{1} = 0$ and this 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 *r* = 1 and *p-r* = 3, an unrestricted constant ($\boldsymbol{\mu}_\mathbf{0}$), *k* = 1, and a vector of linear trends ($\boldsymbol{\alpha}\boldsymbol{\beta}'\mathbf{t}$) restricted to lie in the cointegrating space for the data vector, the restricted CVAR model takes the form:

$$\begin{bmatrix} \Delta DB_t \\ \Delta G_t \\ \Delta A_t \\ \Delta R_t \end{bmatrix} = \begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{pmatrix} \left\{ \begin{pmatrix} \beta_1 & \beta_2 & \beta_3 & \beta_4 & \beta_0 \end{pmatrix} \begin{bmatrix} DB_{t-1} \\ G_{t-1} \\ A_{t-1} \\ R_{t-1} \\ t \end{bmatrix} \right\} + \boldsymbol{\mu}_\mathbf{0} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{pmatrix} \quad (2)$$

where $\boldsymbol{\beta}_\mathbf{i}'\mathbf{y_t}$ is the equilibrium error, $\boldsymbol{\alpha}_\mathbf{i}$ is the adjustment coefficient and $\boldsymbol{\mu}_\mathbf{0}$ 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, long-run parameter restrictions are imposed:

- Restrictions on $\boldsymbol{\beta}$ to test long-run exclusion evaluated by the null hypothesis that $\beta_i = 0$. If accepted, it would imply that the variable is redundant to the long-run relations (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 as the long-run weak exogeneity test. This shows which fiscal aggregates adjust to restore budgetary equilibrium in light of disequilibrium. The restriction is evaluated as $H_0 : \alpha_i = 0$; if accepted this 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 $\boldsymbol{\alpha}$ (elements represent the adjustment to the equilibrium error). 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, 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 stochastic 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 $\boldsymbol{\alpha}_\perp$ (see below). Thus, if variable *i* is purely adjusting in $\boldsymbol{\alpha}$, one would expect it to have transitory effects in $\boldsymbol{\alpha}_\perp$. 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.

3.2 The common trends representation

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). Using the duality property between $\boldsymbol{\alpha}\boldsymbol{\beta}'$, the $\boldsymbol{\Pi}$ matrix and the long-run impact matrix, the **C**-matrix, the system can be decomposed into transitory and permanent components (Gonzalo, 1994). The permanent components represent the budgetary equilibrium while the transitory components capture deviations from equilibrium. The estimation of common trends uses moving average representation corresponding to Equation (1).

$$\mathbf{y_t} = \mathbf{C}\sum_{i=1}^{t}\boldsymbol{\varepsilon_i} + \mathbf{C}\mu t + \mathbf{C}\mu_0 + \tilde{Y}_t \tag{3}$$

where $\mathbf{C} = \boldsymbol{\beta}_\perp\left(\boldsymbol{\alpha}'_\perp\boldsymbol{\Gamma}\boldsymbol{\beta}_\perp\right)^{-1}\boldsymbol{\alpha}'_\perp$ $C\mu$ 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 $\tilde{\boldsymbol{\beta}}_\perp = \boldsymbol{\beta}_\perp\left(\boldsymbol{\alpha}'_\perp\boldsymbol{\Gamma}\boldsymbol{\beta}_\perp\right)^{-1}$ 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, $\boldsymbol{\alpha}'_\perp\sum_{\mathbf{i=1}}^{\mathbf{t}}\boldsymbol{\varepsilon_i}$. 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, $sp(\beta_\perp)$ and $sp(\alpha)$ are uniquely determined and are similar to α and β where the $\boldsymbol{\Pi}$ matrix is uniquely estimated, even though the unrestricted α and β vectors are not (Juselius, 2006: 258).

To just identify the *p-r* common trends requires imposing identifying weak exogeneity restrictions in one of the common trends without changing the value of the likelihood function for which no testing is involved (Juselius, 2006: 262-4). Based on the restricted **C**-matrix, the stochastic driving forces in the system are decomposed 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.

3.3 Empirical model specification

The unrestricted 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 (Juselius, 2006: 99-100). The lag-length is 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, starting with two lags because, as argued in Martins (2010), aid impact is likely to be contemporaneous or with relatively quick adjustment dynamics. However, both Schwarz and Hannan-Quinn information criteria suggest one lag, and with a lag of one the LM test does not reject the null hypothesis of no serial correlation in the residuals. Subsequent CVAR analysis is implemented with a lag of one. The testing procedures for the CVAR model (specification, dummies, rank, etc) are detailed in Appendix B.

Although examination of the data suggestes the inclusion of an innovation dummy for 1979 and a shift dummy for each year after 1988 inclusive, the trace tests support a cointegrating relation without dummies only. Theoretical predictions suggest the existence of a budgetary equilibrium among the fiscal variables, especially allowing for a complete fiscal representation, so subsequent analysis is based on the model without dummies. Tests support the presence of one equilibrium (stationary) relationship corrected for small sample bias and a rank of one ($r = 1$) is supported by the data. Stationarity of each variable by itself in the system is rejected, suggesting that the series are unit root non-stationary or I(1).

4 The Long-run Fiscal Impact of Aid and Structural Analysis

Normalizing the single cointegration relationship on domestic borrowing (as this is a residual incorporated to identify the fiscal balance) identifies the cointegrated relation for the long-run fiscal equilibrium. Table 1 reports the long-run parameters of the fiscal effects of aid, long-run variable exclusion, weak exogeneity and 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. 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). Aid and tax revenue coefficients have the same sign, implying that in the long run, aid or associated reforms have increased tax revenue and borrowing is the main financing item of a primary budget deficit net of aid. An increase in aid is associated with lower domestic borrowing (a lower deficit to finance) and 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).

Trends in domestic borrowing suggest there have been reductions while spending and tax revenue have been on the rise since the mid-1980s so it is possible that the trend term is picking up measurement errors in the donor measure of aid (a significant overestimate of the aid that actually goes to the government) and/or non-tax revenue exhibits trend behaviour. Given this limitation of the DAC measure of aid (the only available consistent data for the sample period analysed) estimated coefficients for the magnitude of the effect on spending must be interpreted with care.

Table 1 about here

Long-run weak exogeneity is rejected at the 10 per cent significance level for aid, government spending and tax revenue. This suggests, in part, that Ugandan fiscal planners had a target for aid revenue that was incorporated into fiscal planning; aid revenue is taken into account when determining revenue and expenditure allocations (in line with the theory in Franco-Rodriguez et al, 1998). Foster and Killick (2006: 19) note that Uganda has a forward-looking view and achieved some success in getting more aid allocated as budget support and released early in the budget year. It could be the case that donors incorporate government spending in deciding how much aid to allocate to Uganda. The results suggest that 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. This does not imply that the government has control over the aid allocated to Uganda by donors (aid commitments) but rather that disbursement could be a reaction to government's ability to meet donor administrative requirements and/or other policy pre-conditions (Eifert and Gelb, 2005). 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 et al, 2008).

Endogeneity of government spending as suggested by the results may appear counterintuitive, as spending is very difficult to reverse once implemented (especially if it involves increases in public payroll or statutory expenditures). It may imply that government spending is planned based on expected revenue whereas the allocation is affected when the revenue outcome is realized, i.e., spending allocation responds to revenue outturn. Whilst 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 but not tax revenue. The null hypothesis of a unit vector cannot be rejected for tax revenue, suggesting that shocks to it have transitory effects only and it is purely adjusting to the long-run equilibrium.

4.1 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. 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:

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

Equation (4) allows one to test whether revenue displacement, balanced budget and aid additionality hypotheses are each stationary (a long-run relation). These hypotheses, adapted from Martins (2010), are described below with test results in Table 2.

Budgetary constraint: G - (R+A+DB) = 0

The evaluation of whether the budgetary constraint is long-run stationary or non-stationary is based on the accounting identity above. The assumption is that total revenue 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, while the trend coefficient is left unrestricted. As the results in Table 2 show, this hypothesis is not rejected, suggesting that aid inflows remain insufficient to cover the spending needs and 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 domestic tax revenue and aid without recourse to deficit financing. In equation (4) this imposes the restriction that the sum of the coefficients on tax revenue and aid and that on spending are equal and opposite, holding the coefficient on domestic borrowing at zero (the trend coefficient is left unrestricted). This hypothesis is rejected (Table 2), 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 to finance an unanticipated gap between expenditure and revenue, 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).

Table 2 about here

Aid additionality/illusion: G = -A; R = DB = 0

Aid comes with strong pressures to spend (O'Connell et al, 2008). Eifert and Gelb (2005) and Berg et al (2007) observe that recipient governments that 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 accumulation of reserves (the aid is fungible) or because tax receipts decline or some of the aid 'leaks' (corruption). Spending can increase by more than the 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. The situation where government spending increases by more than the amount of the net aid inflow has been described as aid illusion, i.e. officials misperceive and overestimate how much aid will be received and therefore spend in excess of the budget constraint (McGillivray and Morrissey 2001). A similar outcome could be observed if actual aid disbursements are less than anticipated.

Although the increase in spending directly attributed to aid may not be demonstrated with precision, inference on the aid additionality/illusion hypothesis can be drawn from the long-run coefficients in the fiscal relation as suggested in Martins (2010: 38) if the impact on spending is more than proportional to aid. The coefficient on government spending is about 0.63, suggesting aid is less than additional and there is no aid illusion. The estimated long-run coefficients show that a one million Uganda shillings (UGX) increase in the amount of aid results in UGX 614,350 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. However, this may simply reflect the fact that the DAC measure overstates the amount of aid received by the government that can affect 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 (aid is fully additional) and do not preclude aid illusion. As shown in Table 2, a formal test of whether the coefficients on spending and aid in the fiscal equilibrium are equal and opposite, keeping the trend unrestricted, is rejected.

Revenue displacement: A = -R; G = DB = 0

Addressing the tax effect associated with aid tends to be difficult as there can be many effects in opposing directions (Morrissey, 2015). Trade liberalization policies associated with aid conditionality tend to reduce tax revenue. On the other hand, recipient governments may use the extra fiscal space provided by aid to offer tax reductions to key sectors or reduce tax induced distortions and crowd-in private investment (Martins, 2010) so aid reduces tax effort. The hypothesis that aid displaces tax effort implies testing that the coefficients on aid and tax revenue, keeping the trend term unrestricted, are equal and opposite. The results in Table 2 reject this hypothesis, suggesting that aid has not reduced tax effort in the long run.

Aid and domestic borrowing perfect substitution: A = -DB; G = R = 0

The hypothesis of whether aid and non-aid borrowing are perfect substitutes implies testing if the coefficients on domestic borrowing and aid in the fiscal equilibrium are equal and opposite, keeping the trend unrestricted. The hypothesis is not supported (Table 2); any substitution is not persistent, i.e., domestic borrowing in response to shortfalls in foreign aid is repaid when aid increases.

4.2 Common Trends Representation

With $p = 4$ and a cointegration rank of $r = 1$, Table 3 shows $r = 1$ cointegrating relations and $p\text{-}r = 3$ 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 3 about here

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 for domestic borrowing, spending and aid. As the null hypothesis for a unit vector in α 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.

To investigate if components of public spending have different effects government spending can be disaggregated into current consumption (*GC*) and development (*GK*) spending. The resulting long-run estimates (reported in Appendix B) show that the same interpretation as in the aggregate model holds, although domestic borrowing is more closely linked to capital spending than current spending.

5 Conclusions and Implications for Policy

This paper assesses the dynamic relationship between foreign aid and domestic fiscal variables in Uganda over the period 1972 to 2008 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 shifts due to structural adjustment programmes. As such, the results should be interpreted as capturing primarily fiscal performance under the Museveni regime from 1987. The investigation of the long-run relation among the fiscal variables provides interesting insights into fiscal dynamics in Uganda. The existence of a budget constraint and a non-balanced budget is supported. Thus, whilst aid flows to Uganda have been substantial, the resource gap has remained large and often requires domestic borrowing (repaid when revenues are healthy). The evidence is consistent with a situation where the government set spending targets and was quite successful in attracting aid to finance these targets. The spending targets may have been ambitious as aid was generally insufficient so there was frequent recourse to borrowing.

Aid and fiscal variables form a long-run stationary relationship. Aid is a significant element of the long-run fiscal equilibrium and the hypothesis of aid exogeneity is not statistically supported, i.e. anticipated aid appears to have ben taken into account in budget planning. Ugandan budget planners may have had a target for aid revenue or donors incorporated

government spending in deciding how much aid to allocate to Uganda or a combination of both. This implies that the government set its spending targets according to its own development objectives, and then tried to find resources to finance these ambitions, in a priority order of domestic revenue, aid, and domestic borrowing. As improved public finance management and reduced domestic borrowing are common policy conditions attached to aid, the results suggest that aid was either associated with or caused beneficial policy responses in Uganda.

Aid was associated with increased tax effort, lower domestic borrowing and increased public spending. Although the results suggest that spending is less than proportional to incremental aid, this is most probably because the donor measure overstates the amount of aid actually received by the government. As the amount of aid donors report as allocated to a country is likely to be at least double the amount received by the government (Morrissey et al, 2007 show that aid repoted by the Kenyan government is about a third on average of that reported by donors), which is the amount that influences fiscal behaviour, the evidence suggests that total spending increased by more than the amount of aid going into the budget. It is evident that spending was higher than it could have been in the absence of aid. As tax revenue relative to GDP rose only gradually over the period (and shocks to tax had only transitory effects), the government was unable to maintain a budget balance including aid so borrowing was frequent (with repayment in years of high aid).

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. Spending targets appear to have been formed according to anticipated aid and shortfalls in aid outturns induced domestic borrowing, Uganda is an example of the adverse effects of volatile aid on budget planning (Lensink and Morrissey, 2000). If donors ensured that aid disbursements were more reliable and predictable, the government could improve fiscal planning and reduce the instability associayed with unanticipated deficits and the need to resort to costly domestic borrowing. Of course, some of the aid volatility arises because of absorption problems or failure to comply with conditionality, so the Ugandan government also has a role to play in ensuring a stable aid relationship.

A comprehensive analysis of the relationship between aid and government spending requires reliable data on aid received by the government, and this is a deficiency in Ugandan government statistics that should be addressed. Only aid that is recieved in the budget can be reflected in government spending; off budget aid, such as donor-operated projects, cannot increase recorded spending as it does go through the budget. If the government is aware of donor projects this could rduce government spending in that area (if donors are providing the public good the government can direct domestic resources elsewhere). However, there is no evidence that total spending was reduced, quite the contrary as aid is likely to have been more than fully additional. Continued efforts by donors to coordinate aid delivery systems, make aid more transparent and support the improvement in government fiscal statistics would all contribute to improving fiscal planning. Recipients need to know how much aid is available to finance spending and how this is delivered through donor projects or government budgets.

The evidence suggests that donors need not be concerned that aid reduces tax effort. Tax revenues have been low in Uganda because of difficulties in raising non-distortionary taxes from a low tax base. The main distortionary taxes, tariffs on imports and export taxes, were reduced significantly under trade liberalization since the mid-1990s; at first this would be expected to reduce tax/GDP ratios (given initial high dependence on trade taxes) but over

time revenues could increase, either because of a trade response (such as increased imports with lower evasion so revenue rises) or substitution with other taxes. The slow growth of the private sector, and especially wage employment, has limited growth in the effective tax base. Donors can assist with tax dministration reforms to improve collection efficiency, but if Uganda is to reduce aid dependence growth in private sector incomes and employment is essential to facilitate an increase in tax revenue.

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Table 1: 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									
$\boldsymbol{\beta}'$									
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 $\boldsymbol{\beta}'$ 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.

Table 2: 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.

Table 3: 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

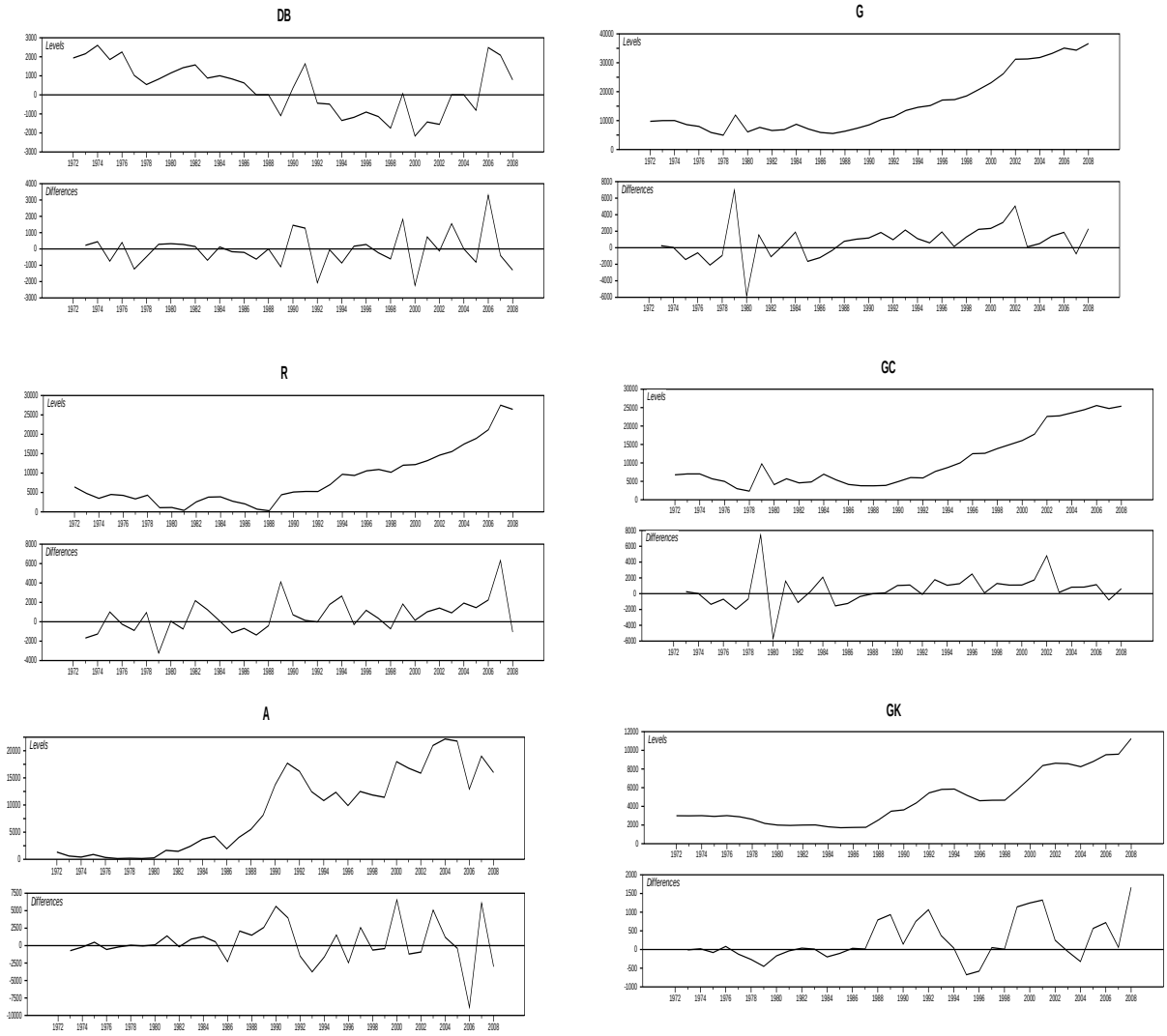
	DB	G	A	R
DB	1.000	-0.000	0.000	-0.000
	(6.785)	(-0.000)	(0.000)	(-0.000)
G	-0.701	0.737	0.135	0.488
	(-2.736)	(7.662)	(2.736)	(2.736)
A	0.712	0.267	0.863	-0.496
	(2.008)	(2.008)	(12.654)	(-2.008)
R	0.861	0.323	-0.166	0.400
	(4.037)	(4.037)	(-4.037)	(2.692)

Notes: In parentheses are t-ratios.

Appendix A: Data Plots

Figure A1 shows that all variables exhibit trending over time. The approach of log transformation is rejected because domestic borrowing is often non-positive. 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.

Figure A1: 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: Aid from OECD-DAC (2009), databases and UBOS.

Appendix B: CVAR Specification

An assessment of the system residual misspecification test reveals that although the residuals are not auto-correlated (which is required), the hypothesis of multivariate normality is not strongly supported, $\chi^2(8) = 22.308$ [0.004]. Non-normality of the error terms is detected in the *G*, *DB* and *A* equations. The actual and standardized residuals suggest two non-cumulated blips (in 1979 and 1980) with opposite directions in level plus two cancelling cumulated mean shifts (before 1979 and 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, noting that dum_{79} cancels out as a consequence of cointegration (a transitory innovation dummy produces two non-cumulated blips with opposite directions but no adjustment afterwards as they cancel each other). 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, without and with dummies, are not statistically different. Estimates of the CVAR model are robust to deviations from normality provided residuals are not auto-correlated, and trace tests show a cointegrating relation without dummies but not with dummies (available on request). Although this is puzzling, theoretical predictions would suggest existence of a budgetary equilibrium among the fiscal variables, especially allowing for a complete fiscal representation. Subsequent analysis is based on the model without dummies.

Determination of the cointegration rank

Having determined the appropriate specification of the data generating process (DGP), cointegration rank is determined using Johansen's (1988) trace statistic, shown in Table A1. 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 Max-Eigen statistic alternative (Juselius 2006: 131-4). The trace-test has been shown to have finite sample bias with the implication that it often indicates too many cointegrating relations - the test is over-sized (Juselius 2006: 140-2). For a small sample such as used here the Bartlett correction for a small sample 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. 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 A1: 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).

Following the confirmation of the cointegrating rank, the test for the presence of unit roots within the multivariate framework is conducted using the CATS procedure. This 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 β_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, 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 A2. 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 A2: Test for stationarity: LR – test, $\chi^2(p-r)$

DB	G	A	R
7.710 (0.052)	7.882 (0.049)	8.334 (0.040)	7.389 (0.060)

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

Disaggregated Spending

The long-run relation in Table 2 assumes that all forms of public spending have an equal effect on the other items in the budget. Disaggregation of spending into current consumption (*GC*) and development (*GK*) spending as a refinement is warranted. The resulting long-run estimates are set out in Equation (5) (t-ratios in parentheses):

$$\begin{array}{lllll} DB_t = 1.428GK_t - 0.11GC_t - 0.269A_t - 0.541R_t + 365.876Trend & & & & \\ \quad (5.029) \quad (-1.376) \quad (-3.676) \quad (-5.571) \quad (9.109) & & & & (5) \end{array}$$

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. The hypothesis that *GC* and *GK* coefficients in Equation (5) are equal could not be supported (LR test: $\chi^2(5)$ = 26.774 [0.000]).

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