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The Fiscal Effects of Aid in Ghana

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Abstract

An important feature of aid to developing countries is that it is given to the government. As a result, aid should be expected to affect fiscal behaviour, although theory and existing evidence is ambiguous regarding the nature of these effects. This paper applies techniques developed in the 'macroeconometrics' literature to estimate the dynamic linkages between aid and fiscal aggregates. Vector autoregressive methods are applied to 34 years of annual data in Ghana to model the effect of aid on fiscal behaviour. Results suggest that aid to Ghana has been associated with reduced domestic borrowing and increased tax effort, combining to increase public spending. This constructive use of aid to maintain fiscal balance is evident since the mid-1980s, following Ghana's structural adjustment programme. The paper provides evidence that aid has been associated with improved fiscal performance in Ghana, implying that the aid has been used sensibly (at least in fiscal terms).

Keywords: aid, fungibility, fiscal response, impulse response

JEL classification: F35, O23, O55, H60

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1 Introduction

Recent arguments for doubling aid to Africa are premised on 'boosting public expenditure—on vital areas such as education, health and infrastructure' (Commission for Africa 2005: 293). Research shows that aid increases spending on social sectors (health, education and sanitation) and contributes to improving aggregate welfare, although in the poorest recipients the effectiveness of social spending in delivering welfare improvements is low (Gomanee *et al.* 2005). While the effectiveness of public spending is clearly an important issue, a prior concern is how aid affects spending and fiscal behaviour more generally (including effects on tax effort and borrowing). Identifying the fiscal effects of aid is a prerequisite to understanding the macroeconomic effectiveness of aid (McGillivray and Morrissey 2000). This paper is a contribution, providing an empirical method to estimate fiscal impact and applying this to Ghana.

There is a growing literature on how aid affects the fiscal behaviour of governments (reviewed in McGillivray and Morrissey 2001). Studies in this area have been classified into two broad groups. First, fungibility studies have sought to analyse effects of aid on the composition of government spending. Aid is said to be fungible if it is given for one purpose (say investment) and used for another (consumption). These studies tend to be critical, typically finding evidence of considerable fungibility (aid is not necessarily allocated to the spending headings intended by donors), but are subject to many shortcomings that undermine the results (McGillivray and Morrissey 2000). The second approach, using fiscal response models (FRMs), goes further and argues that aid has complex impacts on government fiscal behaviour—on tax effort and borrowing in addition to effects on the allocation of expenditures. These studies tend to find that aid ultimately leads to increased spending, and total spending often increases by more than the value of aid (McGillivray and Morrissey 2001). There is evidence that aid has had a beneficial impact on investment and recurrent spending in Sub-Saharan African countries (Commission for Africa 2005: 314).

Fiscal response models describe the relationship between fiscal aggregates: governments raise revenue from different sources (e.g. taxes, aid, borrowing) and allocate them to different expenditures (e.g. capital or recurrent), attempting to meet some revenue and expenditure targets. Franco-Rodriguez, McGillivray and Morrissey (1998) provide a full description of FRMs in which aid is treated like the other forms of revenue. Governments have expected values (targets) for aid, other revenue and expenditures, and their fiscal behaviour is an attempt to meet these targets subject to the budget constraint. The models explicitly recognize that the fiscal effects of aid can differ from country to country, so the literature has evolved as case studies.

A characteristic of FRMs that some might view as a serious limitation, is that they are not predictive theories, in the sense that they do not generate specific testable hypotheses of the effects of aid on fiscal behaviour. For example, FRMs do not predict that aid will *increase* investment spending or will *reduce* tax effort; aid is posited to have effects as fiscal variables are related, but in a manner that can only be determined empirically. It is more appropriate to think of FRMs as a representation of the fiscal relationships that suggest an empirical specification to test if aid leads to an increase (or not) in other fiscal variables. However, empirical applications of FRMs have their shortcomings. In particular, there are difficulties in estimating the targets for government expenditure and revenue, and the three-stage non-linear econometric

techniques used can be difficult to implement and very demanding of data (McGillivray and Morrissey 2001).

We circumvent these empirical problems by estimating the FRM within a vector autoregression (VAR) modelling framework. This situation of interrelated variables is particularly suited to estimation using a VAR approach, as in essence the VAR is posited on there being a relationship between the variables in the system and lets the data reveal the nature of that relationship. Although different (exogenous) factors influence the values of each fiscal variable, the fiscal aggregates must maintain a relationship with each other, and this can be generally described as a VAR model. Furthermore, the VAR approach facilitates policy simulation taking into account the linkages between the components of the budget. VAR methods offer a number of advantages in the current context. First, as our aim is merely to investigate the dynamic effect of aid on the components of the budget, estimation of the reduced form rather than a complete structural economic model is sufficient for our purposes. Specifically, the 'atheoretical' nature of VAR models means one does not have to maintain the existence of, or estimate, the targets, as they are only required for the structural representation. Second, assumptions about exogeneity can be directly tested within the VAR using the data, and can then be applied to simulate the effect of injections of aid via impulse response analysis. The VAR provides a tractable framework in which a different set of questions to those traditionally posed may be addressed. As recognized below, the VAR has its own limitations, especially as our sample of 34 years is short for time-series econometric analysis, even if it is reasonably long in the context of macroeconomic studies of African countries.

In section 2 we discuss trends in foreign aid flows and fiscal variables in Ghana during the period under investigation (1966 to 1998). Section 3 presents a brief outline of the VAR approach and impulse response functions that capture the effect of a shock to one variable (in our case aid) on the other endogenous (fiscal) variables in the system. Section 4 begins by defining the data used and then presents our results. The results suggest that in Ghana aid has substituted for domestic borrowing rather than discouraging tax effort or inducing a net increase in government spending. The conclusions are in section 5, where we argue that estimating the aggregate fiscal effects of aid is far more informative than considering only fungibility (which, in the case of Ghana, would have lead to incorrect conclusions on the effects of aid).

2 Aid and fiscal trends in Ghana

From about the mid-1960s to the early 1980s in Ghana, there were only minor differences in fiscal behaviour under the various governments (Frimpong-Ansah 1991; Rimmer 1992). The only exception was the brief period between 1969 and 1971 when the Progress Party government came to power and initiated a relatively more neoclassical (*laissez faire*) approach to development. Aid inflows were unlikely to have been an influence on government behaviour prior to the mid-1980s. In the late 1960s and early 1970s, aid was a little over two per cent of GDP and about 12 per cent of revenue, while donors at that time did not require or enforce conditionality (at least not in terms of fiscal behaviour). The unilateral repudiation of foreign loans in the early 1970s lends some support to this argument. Significant reserves and the importance of cocoa revenue (even if in decline by the early 1970s) gave most of the Ghanaian

governments over that period a false sense of economic security. It also meant that they were not very responsive to external pressure from donors. The decision to adopt and adhere to the 'liberalizing' economic recovery programme/structural adjustment programme (ERP/SAP) in the 1980s was simply because there were no more 'easy pickings'—the country's reserves had been wiped out and the cocoa sector was on the brink of collapse.

Prior to 1983 public expenditures persistently exceeded revenues in Ghana (and domestic sources of revenue were more important in relation to aid than was the case). This resulted in large fiscal deficits, which peaked at about 11 per cent of GDP in 1976. These deficits were financed mainly by domestic borrowing and printing money. The deficit did narrow after 1983 and by the late 1980s revenues had outstripped expenditures. Most of the surplus was due to the large inflow of foreign aid (Addison and Osei 2001). The mid-1980s saw a massive inflow of aid into Ghana, peaking in 1991 at almost US$730 million, compared to less that US$2000 million in the period up to 1986, in 1995 prices (Figure 1).

The late 1980s saw government expenditures rising sharply after a steady decline during the 1970s and early 1980s (Figure 2)—increasing from about US$310 million in 1983 to about US$1.9 billion in 1998. The period average for the share of aid in total government spending also rose to about 50 per cent over the post-1983 period compared to about 16 per cent prior to 1983. However, structural adjustment aid was not all targeted at capital investment. Much was in the form of budget support: it was a source of revenue that would, in some part, have been allocated to recurrent expenditures. Investment in building schools, for example, is of little use if the government cannot pay teacher's wages. From a fiscal response perspective, what is of more interest is the effect on other revenues and the dynamics of spending.

Figure 1
Tax revenue, foreign aid and domestic borrowing

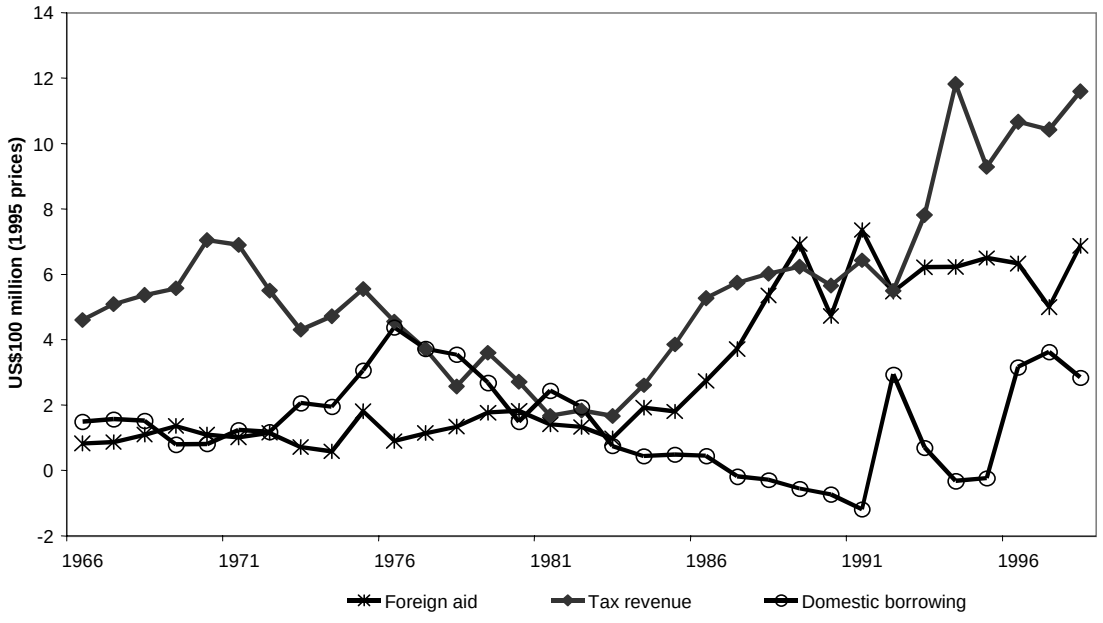


Figure 2
Government expenditure trends

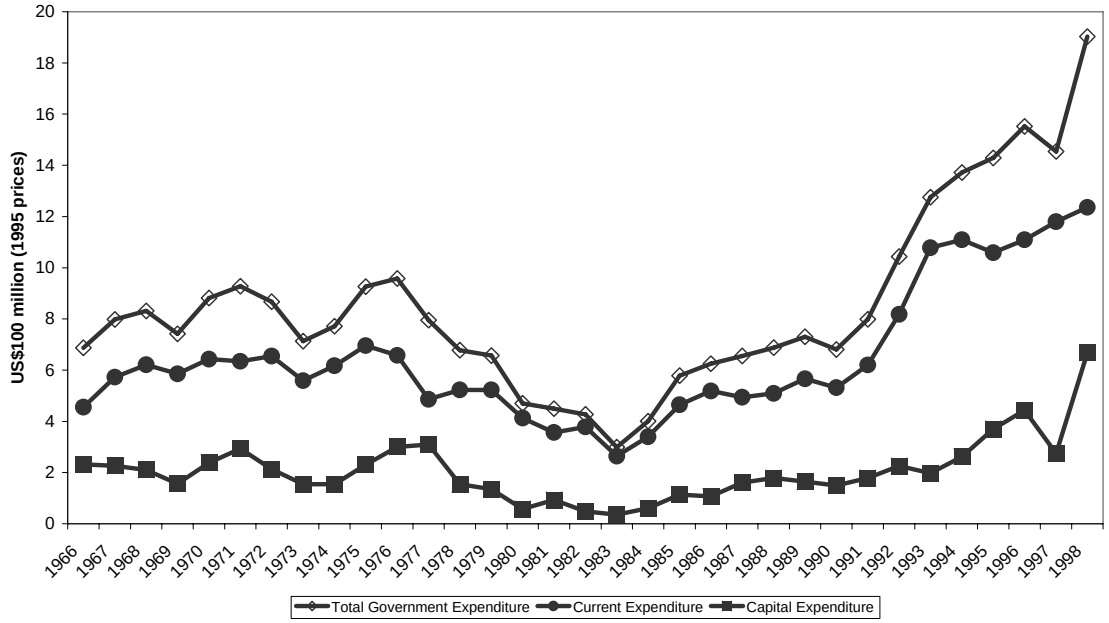
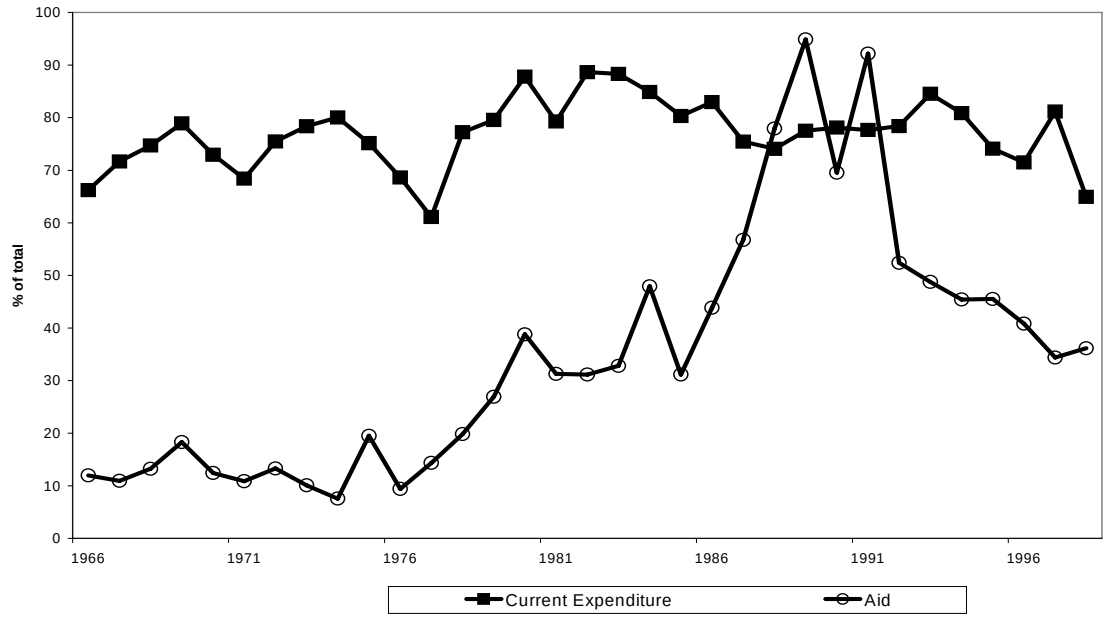


Figure 3
Share of current spending and aid in total expenditures



Looking at the components of government expenditure one observes that it is government consumption that has accounted for most of the increase in public expenditure—from about US$264 million in 1983 to about US$1.2 billion in 1998. However, the *share* of current government spending in the total increased only slightly between the two periods (pre- and post-1983), from about 75 to about 77 per cent (Figure 3).

As with the pattern of most macroeconomic variables for Ghana, tax revenue has generally increased in the last two decades following a period of decline in the 1970s and early 1980s. From about US$700 million in 1970 tax revenues fell to about US$160 million in 1983 but subsequently increased by more than seven fold, reaching almost US$1.2 billion in 1998 (Figure 1). It is worth noting that the increase in tax revenue coincides with the period over which there was a substantial inflow of aid into Ghana suggesting that aid flows did not discourage tax effort. It is also worth noting that the period of increasing government spending was associated with an increase in aid *and* tax revenues. In other words, whilst one might infer a structural break in the individual series, overall revenues and expenditures *moved together* in the same way (although the composition may have changed).

Domestic borrowing also shows an interesting pattern (Figure 1). From an all-period high of about US$440 million in 1976 domestic borrowing fell to negative levels in the late 1980s and reached net repayments of US$110 million by 1991.[1] This was in the period of structural adjustment, when it was not uncommon for the IMF to require net repayment of domestic debt (negative borrowing). The 1990s saw a reemergence of the large fiscal deficits not seen since the 1970s. The considerable slowdown of aid inflows coupled with a reluctance to reduce spending in the election years of 1992 and 1996 led to substantial increase in domestic borrowing during the 1990s.

3 Econometric methods

In recent years, vector autoregressive methods have become the 'tool of choice' in much of empirical macroeconometrics. Despite having roots in the analysis of stationary data, their popularity owes much to the theoretical developments in the analysis of non-stationary data which typically characterizes many economic time-series. In particular, Johansen (1988) and Johansen and Juselius (1992) have developed multivariate methods that explicitly use the VAR for the testing and estimation of cointegration (or 'long-run') relationships among nonstationary data. As a medium for analysis, the VAR is tractable and can be interpreted as the reduced form representation of a large class of dynamic structural models (Hamilton 1994: 326-7). As such, it provides a useful framework for the investigation of both long-run (cointegration) relationships and short-run dynamics (via an equilibrium correction model, the ECM) of the variables in the system. Furthermore, the VAR facilitates the dynamic simulation of variables within the system following a shock using *impulse response analysis* (Sims 1980; Lütkepohl and Reimers 1992). In the current context, we use these techniques to evaluate the role played by foreign aid in the national budget of Ghana.

Given the familiarity of VAR methods, we merely sketch the broad outline here; Hamilton (1994: Chapter 11) offers a thorough and rigorous treatment. The statistical analysis takes place in a VAR(p) model, of lag length p:

$$\mathbf{x}_t = \mathbf{\Phi}_1 \mathbf{x}_{t-1} + \mathbf{\Phi}_2 \mathbf{x}_{t-2} + \ldots + \mathbf{\Phi}_p \mathbf{x}_{t-p} + \mathbf{\Psi} \mathbf{w}_t + \boldsymbol{\varepsilon}_t \qquad (1)$$

where $\mathbf{x}_t$ is a $(m \times 1)$ vector of jointly determined I(1) variables, $\mathbf{w}_t$ is a $(q \times 1)$ vector of deterministic variables and each $\mathbf{\Phi}_i$ $(i = 1, \ldots, p)$ and $\mathbf{\Psi}$ are $(m \times m)$ and $(m \times q)$

[1] Note that aid inflows reached an all time high of US$730 million in 1991.

matrices of coefficients to be estimated using a (t = 1, . . .T) sample of data. $\boldsymbol{\varepsilon}_t$ is a ($m \times 1$) vector of n.i.d. disturbances with zero mean and non-diagonal covariance matrix, $\boldsymbol{\Sigma}$.

Providing the variables are (at most) integrated of order one {I(1)} and cointegrated, equation (1) also has an equilibrium correction representation that is observationally equivalent but which facilitates estimation and hypothesis testing as all terms are stationary. This reparameterization is given by

$$\Delta \mathbf{x}_t = \boldsymbol{\alpha}\boldsymbol{\beta}' \mathbf{x}_{t-p} + \sum_{i=1}^{p-1} \boldsymbol{\Gamma}_i \Delta \mathbf{x}_{t-i} + \boldsymbol{\Psi} \mathbf{w}_t + \boldsymbol{\varepsilon}_t \tag{2}$$

Attention focuses on the ($n \times r$) matrix of cointegrating vectors, $\boldsymbol{\beta}$, that quantify the 'long-run' relationships between the variables in the system and the ($n \times r$) matrix of equilibrium correction coefficients, $\boldsymbol{\alpha}$, elements of which load deviations from this equilibrium (*i.e.* $\boldsymbol{\beta}' \mathbf{x}_{t-k}$) in to $\Delta \mathbf{x}_t$, for correction. The $\boldsymbol{\Gamma}_i$ coefficients in (2) estimate the short-run effect of shocks on $\Delta \mathbf{x}_t$, and thereby allow the short- and long-run responses to differ.

However, given the interrelationships that characterize economic systems, it is often more informative to undertake an impulse response analysis when short- and long-run impacts are of key interest. As total derivatives, the coefficients of the impulse response function do not suffer from the *ceteris paribus* limitation that can confound the interpretation of (2) (Lütkepohl and Reimers 1992). In cases where variables are interrelated, a shock to one variable may set off a chain reaction of knock-on and feedback effects as it permeates through the system. In such circumstances, the partial derivatives of (2), which ignore these interactions by construction, may have limited appeal and may give a misleading impression of the short- and long-run effect of such shocks. By contrast, impulse response analysis estimates the net effect of the direct and indirect effects of a shock, not only in the long run but at all periods following the shock.

Impulse response analysis uses the moving average representation of (1), i.e.

$$\mathbf{x}_{\mathrm{t}} = \boldsymbol{\varepsilon}_t + \mathbf{A}_1 \boldsymbol{\varepsilon}_{t-1} + \mathbf{A}_2 \boldsymbol{\varepsilon}_{t-2} + \ldots + \sum_{i=0}^{\infty} \mathbf{A}_i \boldsymbol{\Psi} \mathbf{w}_{t-i} \tag{3}$$

where the ($m \times m$) coefficient matrices $\mathbf{A}_i$ can be obtained according to

$$\mathbf{A}_i = \boldsymbol{\Phi}_1 \mathbf{A}_{i-1} + \boldsymbol{\Phi}_2 \mathbf{A}_{i-2} + \ldots + \boldsymbol{\Phi}_p A_{i-p} \quad i = 1,2,\ldots, \tag{4}$$

with $\mathbf{A}_0 = \mathbf{I}_m$ and $\mathbf{A}_i = \mathbf{0}$ for $i < 0$.

Following Pesaran and Shin (1998), the generalized impulse response is the effect of one standard error shock to the j^{th} equation at time t on $\mathbf{x}_{t+n}$ is given by

$$\varphi_j^g(n) = \sigma_{jj}^{-0.5} \mathbf{A}_n \boldsymbol{\Sigma} \mathbf{e}_j \tag{5}$$

where $\mathbf{e}_j$ is an $m \times 1$ selection vector that identifies the source of the shock (hence unity is its j^{th} element with zeros elsewhere). This delivers time profiles of the effect of hypothetical shocks to elements of $\boldsymbol{\varepsilon}_t$ on the level of $\mathbf{x}_t$ taking into account the knockon and feedback effects that characterize the variables in a dynamic system such as (1). Note that the generalized impulse response function accounts for the contemporaneous correlation inherent in the nondiagonality of $\boldsymbol{\Sigma}$ via integrating out their effects according to the observed distribution of the residuals, rather than by traditional orthogonalization. In so doing, the generalized impulse response function is invariant to the ordering of the variables in the model, unlike its orthogonalized counterpart. Nevertheless, as with all dynamic simulation, if the effects of a shock are to be economically meaningful, the shock must represent a pure innovation to a particular variable rather than a mixture of correlated errors. As this requires the causality of the economic structure to be known, impulse responses are prone to misinterpretation (Ericsson, Hendry and Mizon 1998: 379). Mindful of this caveat, we offer statistical and economic evidence to support the legitimacy of the impulse response analysis we conduct.

4 Data and results

The empirical analogue of (1) comprises the variables of the fiscal response model, namely, government expenditure (*G*), tax revenue (*R*), aid finance (*F*) and domestic borrowing (*D*). Note that as nontax components of revenue and external borrowing are omitted, we are not estimating an identity. We also estimate a model in which total government expenditure (*G*) is disaggregated into capital (*GK*) and current spending (*GC*). We use annual data over the period 1966 to 1998 with all the variables measured in constant 1995 prices expressed in US$ (units of 100m). Data on total domestic fiscal variables are obtained from the *International Financial Statistics* of the IMF. Foreign aid is the net disbursement of official development assistance (ODA) to Ghana, derived from OECD/DAC data. It includes all loans with a grant element of more than 25 per cent and also technical cooperation and assistance.[2]

As a precursor to the empirical analysis the order of integration of the individual series is evaluated using standard Augmented Dickey Fuller (ADF) tests. Results, reported in Table 1, indicate that all variables are I(1) with no significant drift, as indeed casual inspection of the data in Figures 1-3 suggests, and allowing for any structural break (the P-P test).[3] Consequently, the variable sets (R_t, F_t, D_t G_t) and (R_t, F_t, D_t, GK_t, GC_t) form the equations for the aggregate and disaggregate VAR(*p*) models respectively.

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2 Unfortunately, this is a donor measure of aid and overstates the amount actually entering into the government budget. As such it is only a proxy, but was the only data available. As our interest is in identifying the sign and relative magnitude of effects on other variables, this should not seriously affect the results. All data and statistical output are available from the authors on request.

3 Inspection of the data in Figures 1 and 2 suggests a structural break, but this appears to occur in all series around 1983-84. As the series all move together, this suggests there is no break in the system (the cointegrating relationship), as confirmed by the absence of a break in the residuals of the CI (see Appendix Figure A).

Table 1
ADF unit roots tests

ADF Model: $\Delta Y_t = \alpha + \beta T + \gamma Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i}$

Y =	H_0: γ=0	H_0: β=γ=0 ϕ_3 – test	H_0:β=α=γ= 0 ϕ_2 – test	Lag length	P - P	Inference
D_t	-2.176 (*-3.21*)	2.414 (*5.91*)	1.63 (*4.67*)	0	-2.61 (*-3.20*)	I (1)
R_t	-2.071 (*-3.21*)	4.274 (*5.91*)	3.037 (*4.67*)	0	-1.67 (*-3.20*)	I(1)
F_t	-1.823 (*-3.21*)	1.755 (*5.91*)	2.088 (*4.67*)	1	-2.63 (*-3.20*)	I(1)
G_t	-0.209 (*-3.21*)	4.619 (*5.91*)	3.815 (*4.67*)	0	-1.68 (*-3.20*)	I(1)
GC_t	-0.877 (*-3.21*)	2.824 (*5.91*)	2.47 (*4.67*)	0	-1.69 (*-3.20*)	I(1)
GK_t	-0.400 (*-3.21*)	2.956 (*5.91*)	2.205 (*4.67*)	1	-1.78 (*-3.20*)	I(1)

Note: Numbers in parenthesis are the 10 per cent critical values. Optimal lag length is the largest *p* for which δ_i is significant at the 10 per cent level. The null hypothesis for a second unit root is rejected for all the I(1) variables at the 10 per cent level. The Phillips-Perron (P-P) test confirms that the series are I(1) allowing for a structural break.

The appropriate lag length (*p*) of the VAR is determined using standard model selection criteria (AIC, SBC and HQC). Adoption of a general-to-specific modelling approach points to a VAR of order 2 or 3 as an adequate representation of the data. Given that there are signs of autocorrelation in the residuals from a VAR(2), we opt for a VAR(3) which has residuals that conform to the usual assumptions. Having established an adequate statistical description of the data, we test for the presence of long-run relationships among the variables using the Johansen and Juselius (1992) *trace statistic* for cointegration.[4] The results reported in Table 2 (Part A) confirm the presence of a single cointegration vector at the 5 per cent level of significance.

Normalizing on domestic borrowing the relationship is estimated as

$$D_t = -0.074F_t - 1.040R_t + 0.841G_t + 0.465 \qquad (6)$$

These long-run estimates suggest that *ceteris paribus*, aid and tax revenue tend to be negatively correlated with domestic borrowing, whereas government spending is positively correlated. As such, (6) seems to represent financing items in the government budget constraint. Note that the coefficient on aid is small suggesting that its long-run impact in the budget is minor. Government spending and revenue have coefficients that

4 Since the limiting distribution of Trace test is a function of the deterministic terms included in the model, we report results for the final model in which the constant is restricted to the long run only, given that the results in Table 1 indicate the absence of drift. Cointegration inference is unchanged using models with unrestricted constants.

Table 2
Cointegration test results

	(a) Aggregate model		
Eigenvalues	H_0:	Trace statistic	P-value
0.7005	$r \leq 0$	69.262	0.001
0.4649	$r \leq 1$	33.098	0.082
0.3080	$r \leq 2$	14.340	0.273
0.1040	$r \leq 3$	3.294	0.538

	(b) Disaggregate model		
Eigenvalues	H_0:	Trace statistic	P-value
0.7255	$r \leq 0$	91.287	0.002
0.5470	$r \leq 1$	52.502	0.068
0.3612	$r \leq 2$	28.746	0.212
0.3233	$r \leq 3$	15.302	0.214
0.1127	$r \leq 4$	3.588	0.488

are nearly equal and opposite in sign, and together these results suggest that, in the long run, domestic borrowing is the main financing item for primary deficits in Ghana. In addition, this supports the view that aid is given to alleviate short- and medium-term constraints, or to achieve certain development objectives but not to finance persistent budgetary deficits. This does not imply that aid has no long-term impact in the economy as a whole, but merely that as a budgeting item its long-run impact is relatively minor.

Equation (6) assumes that all forms of government spending have an equal effect on the other items in the budget. Disaggregating government expenditure into its capital and current components yields consistent results. Table 2(b) indicates the presence of a single long-run relation of the form

$$D_t = -0.051F_t - 1.072R_t + 0.723GC_t + 1.197GK_t + 0.61 \qquad (7)$$

Ceteris paribus, both components increase the budget deficit in the long run. A test of coefficient equivalence suggests that the long-run budgetary impact of capital spending is greater than that of current government spending.[5] Our normalization is in a sense *ad hoc* and so one could actually interpret this to be consistent with evidence for fungibility—the financing items (and in particular foreign aid) impact more on current spending than on capital spending.[6] The question of whether aid has been fungible in Ghana is discussed under results for the impulse response analysis.

The error correction models, which describe the short-run behaviour corresponding to (6) and (7), are reported in the Appendix. They reveal that in the short run, there is no *ceteris paribus* impact of aid on government spending, in either the aggregate or

5 The test is not very strong as the null hypothesis of equivalence is rejected at the 5% but not the 10 percent level of significance.

6 This can be seen if a normalization of equation (7) on GC_t is compared with that on GK_t

disaggregated models. In contrast, aid is shown to increase revenue and reduce debt over the short run.

4.1 Causality testing

Insights into the role played by the variables in fiscal response may also be gleaned from the 'causality' tests reported in Tables 3 and 4. Results for both the aggregate and disaggregate models (reported in panel (a) of both tables) indicate that it is only foreign aid that is weakly exogenous to the determination of the long-run fiscal relationship. As such, results indicate that whereas tax revenue, government spending and borrowing adjust to an imbalance in the fiscal situation, aid is taken as given, playing no discernible role in the adjustment process.

Table 3
Causality tests—aggregate model

	(a) Weak exogeneity	
H_0 : weak exogeneity	χ-squared	P-value
Variable		
Revenue	11.888	0.0006
Aid	0.049	0.8248
Domestic borrowing	3.0099	0.0828
Government expenditure	9.6048	0.0019
	(b) Granger non-causality tests	
Direction	χ-squared	P-value
Aid $\rightarrow$ fiscal variables	69.47	0.0000
Fiscal variables $\rightarrow$ aid	8.27	0.3090

Notes: In panel (b) a large test statistic (small p-value) indicates that the null hypothesis of Granger non-causality is rejected. For example, the null of aid being Granger non-causal for the fiscal variables is rejected.

Table 4
Causality tests—disaggregate model

	(a) Weak exogeneity	
H_0 : weak exogeneity	χ-squared	P-value
Variable		
Revenue	9.582	0.002
Aid	0.3087	0.5787
Domestic borrowing	4.6758	0.0306
Current expenditure	7.3078	0.0069
Capital expenditure	1.9103	0.1669
	(b) Granger non-causality tests	
Direction	χ-squared	P-value
Aid $\rightarrow$ fiscal variables	72.9916	0.0000
Fiscal variables $\rightarrow$ aid	7.4502	0.4889

The results in panel (b) of Tables 3 and 4 clearly point to aid being a Granger-cause of the fiscal variables but not *vice versa*.[7] The combination of weak exogeneity and Granger non-causality suggests that aid is strongly exogenous, i.e. aid plays an important determining role in the budget but its level does not reflect budget imbalance. This suggests that aid disbursements have not been influenced by the budget balance over the period, and is consistent with our use of a donor measure of aid. Furthermore, this tends to suggest that shocks to foreign aid are exogenous to the system rather than determined by it and offers statistical support for the legitimacy of an impulse response analysis of aid shocks, to which our attention now turns.

4.2 Impulse response analysis

Plots of the generalized impulse response functions for a one standard deviation shock in aid are shown in Figures 4 and 5 for the aggregate and disaggregated models, respectively.[8] Being of one standard error in size, the shock is of typical magnitude for the series and corresponds to some US$93 million (this would represent about 13 per cent of aid in 1998). Different levels of shock could be considered but these would represent scale effects and we are concerned with the pattern of effects. In each model, this injection of aid has persistent effects that take around five years to stabilize. Foreign aid appears to have pervasive effects throughout the fiscal system, reflecting the linkages between the budget items. Not only does aid result in an increase in the government's spending and revenue base, but it leads to a reduction in borrowing. Estimates suggest that long-run responses in each of the variables to aid shocks are generally of twice the magnitude of the contemporaneous (or impact) effects. For example, as Figure 4 demonstrates, a US$93 million injection of aid induces borrowing to fall immediately by around US$20 million, well below its long-run effect of around US$36 million. It is also clear that the size of the effect on tax revenue and government expenditure is virtually identical (around US$76 million) suggesting that the net effect of aid is to reduce domestic borrowing. Figure 5 also indicates where the aid was spent, as it decomposes government spending into current and capital categories. Aid appears to have a differential effect on the two types of spending: the effects of aid on current spending dwarf those on capital spending in the short, medium and long terms. Estimates from Figure 5 suggests that in the long run at least, aid contributes around seven times more to current spending (which rises by US$56 million) than it does to capital spending (which rises by around US$8 million). As such, it casts doubt on the view that most aid was spent on capital projects with development objectives. However, whether this sheds any light on fungibility is uncertain as the proportion of aid intended for current and capital spending is unknown. To the extent that aid to Ghana over the period under study led to an increase in current but not capital spending, one could argue that it has been largely fungible. This conclusion will be valid if one could ascertain that aid was given to support capital spending. The period over which significant aid inflows were recorded for Ghana coincides with the reform period. During these years a significant portion of the aid consisted of 'adjustment lending' that

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7 See Appendix Tables where the change in aid is shown to follow a simple AR(1) scheme in the VAR.

8 The impulse response was implemented in Microfit 4.0 and the programme requires one to categorize the shock variable as endogenous to estimate the response. This is a 'technical' issue and is not inconsistent with our earlier argument that aid is exogenous. Confidence intervals are not reported as there is, as yet, no agreed method to calculate them.

was not necessarily given for capital spending (much would have been intended for budget support). Between 1987 and 1991, 18 per cent of the total net aid was received under the structural adjustment facility (SAF).[9]

Figure 4
Generalized impulse response functions of a one standard error shock in the aid equation
AGGREGATE MODEL

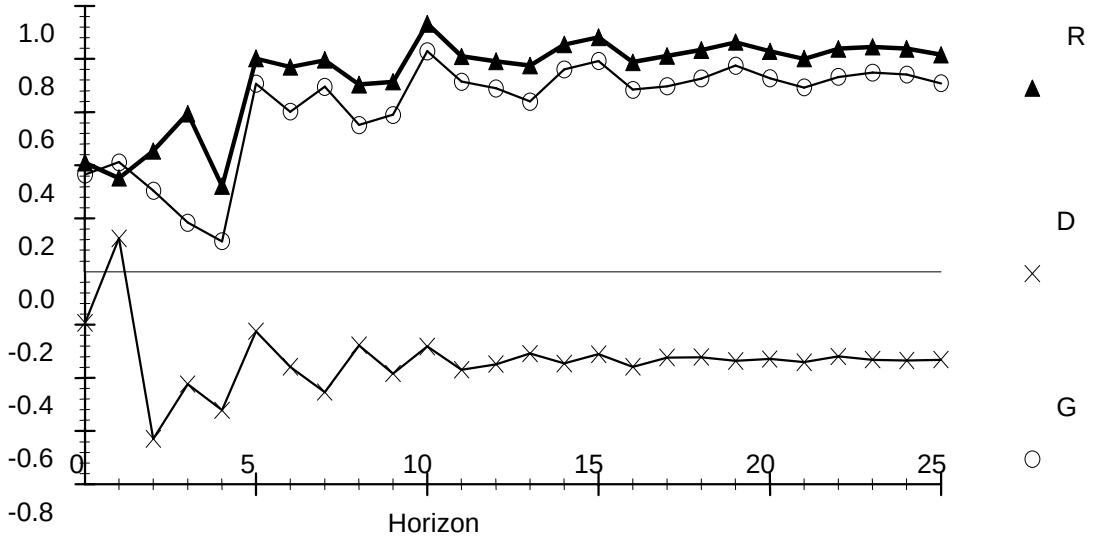
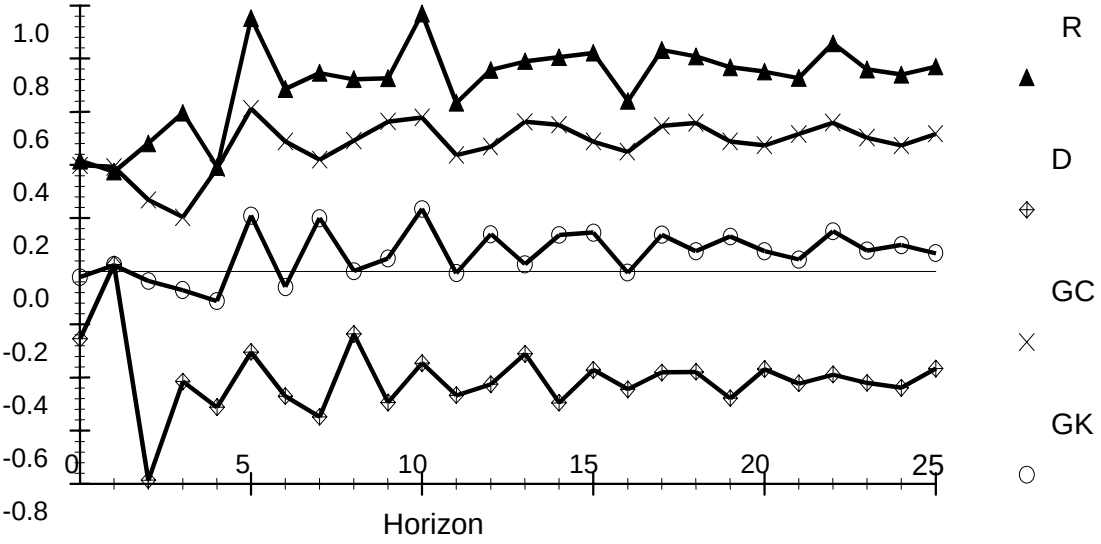


Figure 5
Generalized impulse response functions of a one standard error shock in the aid equation
DISAGGREGATE MODEL



9 Calculated from the OECD-DAC data.

Although the evidence is consistent with fungibility, one should be wary of making such an assertion. An interesting corollary emerges from a comparison of results from the impulse response and error correction models (see Appendix). Specifically, aid does not have statistically significant short-run impacts on government spending in the ECMs, a result that contrasts with the responses in Figures 4 and 5. The ECMs do show, however, that aid does increase government revenue and reduce domestic borrowing over the short term. Since the parameters of the ECMs are *ceteris paribus*, this suggests that the rise in government spending following an aid shock, as is seen in Figures 4 and 5, results from the knock-on effects between other variables in the budget, rather than from any direct effect of aid. This serves to underline the importance of the indirect linkages and suggests that in the short to medium run, the direct effect of aid is to reduce borrowing. In other words, aid is perceived as an alternative to domestic borrowing, rather than a source of government finance *per se*. This point is reinforced by the fact that both domestic borrowing and tax revenue have significant and positive effects on government spending in the short run in the ECMs.

Results therefore suggest that Ghana's expenditure patterns over the period do not appear to be wedded to the rises and falls of aid inflows, as is so often believed to be the case in developing countries. In the Ghanaian case at least, spending plans (presumably based upon the expectation of aid) appear to be implemented irrespective of the receipt of aid itself: borrowing is simply adjusted to balance the budget. Importantly, borrowing and aid appear to be substitutes for one another. This is illustrated by the experience of the election years of 1991/92 and 1995/96. Being reluctant to reign in spending at these key points in Ghana's electoral cycle, the government increased borrowing to counteract the abrupt drops in aid flows.

It is important to acknowledge the caveats that accompany the results that have been generated in this investigation. VARs are inherently overparameterized and thus results tend to be sensitive to model specification, sample size and lag length, particularly in small samples. For instance in the aggregate model which comprises three lags in four endogenous variables, 16 parameters are initially estimated with 33 observations. Nevertheless, the cointegration, ECM and impulse response approaches all yield consistent results.

5 Conclusions

In this paper, we have sought to analyse the effect of aid on fiscal behaviour in Ghana using annual data over the period 1966 to 1998. Fiscal response models, which look at the effect of aid on government fiscal behaviour, represent the basis of the study. Unlike fungibility studies that examine the effect of aid on categories of government spending, the fiscal response approach benefits from a broader focus. However, the FRMs employed in the existing literature have suffered from some serious problems, notably the need to estimate target values and an inability to incorporate dynamics.

This paper contributes to the empirical literature on two fronts. First, we analyse the effect of aid on fiscal behaviour within a cointegrating VAR framework. The VAR approach allows us to estimate the interrelationship between fiscal variables and to capture some of the dynamics which, as the results here indicate, can differ considerably, highlighting the distinction between the short- and long-run effects. Tests

suggest that aid is strongly exogenous within both the aggregate and disaggregated models. This provides an empirical justification for studying the dynamic impact of aid on fiscal behaviour, in particular using impulse response analysis. The main findings in this paper are summarized as follows.

First the variables in the model, namely aid, total government expenditure (or its components), tax revenue and domestic borrowing, form a long-run relationship. Tax revenue and government spending have almost identical magnitudes with aid having a relatively insignificant effect in the long run. This suggests that domestic borrowing has been the main long-term financing item for primary deficits in Ghana, and that aid is used to alleviate short- to medium-term constraints. A plausible implication is that in periods where the level of domestic borrowing is lower, or after it has been lowered, aid would have a greater impact on spending if limits to borrowing were maintained.

Second, results show that aid to Ghana over the period led to an increase in current but not capital spending, suggesting that aid has been fungible. This assertion is true only if aid was given mainly to finance capital spending. The evidence for this is not very strong as a significant part of foreign aid to Ghana over the period studied was received under the structural adjustment facility and could have been intended for current expenditures and general budget support.

Third, impulse response analysis shows that injections of aid have a pervasive impact on the budget, inducing higher spending, increased tax effort and reduced domestic borrowing. As improved fiscal management and reduced domestic borrowing are common policy conditions attached to aid, this suggests that aid was associated with beneficial policy responses. Our analysis does not show that aid caused the desirable policy response, but the link from aid to good fiscal policy is a reasonable inference. The picture that emerges indicates that policymakers in Ghana perceived aid as an alternative to domestic borrowing and thus spending was not directly influenced by the year-on-year fluctuations in aid inflows. In other words, the absence/presence of aid did not directly alter public expenditure patterns but rather affected government borrowing from the domestic economy.

The recent literature on aid and growth gives considerable attention to the relationship between aid and policy, and there is dispute over how aid and policy interact. Our study addresses one aspect of this for Ghana, the effect of aid on government fiscal behaviour. The results are illuminating. It appears that aid has been used as a substitute for domestic borrowing. It also appears that aid has been associated with increased tax effort. In general, both would be interpreted as ‘good’ policy responses. Although one cannot generalize from a one-country study, the evidence that tax/GDP ratios in Sub-Saharan African countries are high relative to other developing countries (Commission for Africa 2005: 297) cautions against any presumption that aid reduces tax effort. As Keen and Simone (2004) argue, low-income countries are severely constrained in their ability to increase tax/GDP ratios. It may well be that African countries are raising as much tax revenue as is feasible.

It is not possible to distinguish aid as finance from aid as policy conditions, i.e. one cannot infer that good policy (say reducing borrowing) means that aid was used better, nor that aid promoted good policy. It is simply the case that, in fiscal terms, the aid appears to have been utilized sensibly. Good policy responses were made possible by the availability of aid finance. One can also observe an increase in government

spending, mostly current although the evidence that this is attributable directly to aid (rather than indirectly) is weak. To observe from the absence of a direct effect, as the fungibility approach would do, that aid did not increase government spending, in particular capital spending as intended (implying a 'bad' policy response) would be misleading. Any induced government expenditure effect of aid is matched by an increase in tax revenue so that the net effect of aid is to reduce domestic borrowing. A corollary of the results found here is that in order to gain a proper understanding of aid effectiveness, it is necessary to allow for the effects of aid on the fiscal behaviour of governments. This requires some type of fiscal response model, and we contend that the approach adopted here is a promising candidate.

Our results should be considered as no more than indicative. The relatively short time-series for analysis constrains what could be incorporated in the VAR, and no confidence intervals are available for the impulse response results. It is possible that alternative ways of incorporating structural breaks, such as adding time dummies or a trend, would alter the results. It is, however, unlikely that the general pattern of results would change. The VAR, ECM and impulse response estimates give results that are consistent with each other and with observing the data. Furthermore, the results are plausible in that they are consistent with what is known about fiscal and aid policy in Ghana. A more serious limitation is the fact that even though the study identifies the fiscal impact of aid, we cannot draw inferences on the effectiveness of aid or of government spending. There is likely to be considerable scope in Ghana—as indeed, in all Sub-Saharan African countries in general—for improvement, not least in implementing measures to align aid and donor practices with expenditure and budgetary planning and practices (Commission for Africa 2005: 303). What our study does show, at least for Ghana, is that aid can support good fiscal policy.

Appendix: Error correction models

Appendix Table A—Aggregate model

Variable	ΔR_t	ΔG_t	ΔD_t	ΔF_t
ΔR_{t-1}	1.360**	2.544***	0.525	0.312
ΔR_{t-2}	0.731**	1.941***	0.715**	0.393
ΔF_{t-1}	0.011	0.249	0.526**	-0.457*
ΔF_{t-2}	0.633**	0.206	-0.694**	0.385
ΔG_{t-1}	-1.055*	-2.146***	-0.685	-0.172
ΔG_{t-2}	-1.155***	-1.984***	-0.489	-0.335
ΔD_{t-1}	1.241**	2.407***	0.932	-0.077
ΔD_{t-2}	1.458***	1.842***	0.116	0.395
$EcmAM_{t-1}$	-3.474***	-3.948***	-0.151	-0.181
R-Bar-Squared	0.523	0.464	0.504	0.226
Autocorrelation	0.269	0.327	1.562	3.012*
Normality	1.116	0.656	1.484	3.139

	Vector diagnostic tests	
Autocorrelation	F-Version	1.1425 (0.3445)
Normality	Chi-squared Version	9.8297 (0.2772)

Notes: *, **, *** are respectively the 10, 5 and 1 per cent levels of significance. The chi-squared version of the tests for autocorrelation and normality are reported. All the results except for the 'vector diagnostics test' are obtained from *Microfit 4.0*. The vector diagnostic tests are obtained from *PcGive 10*.

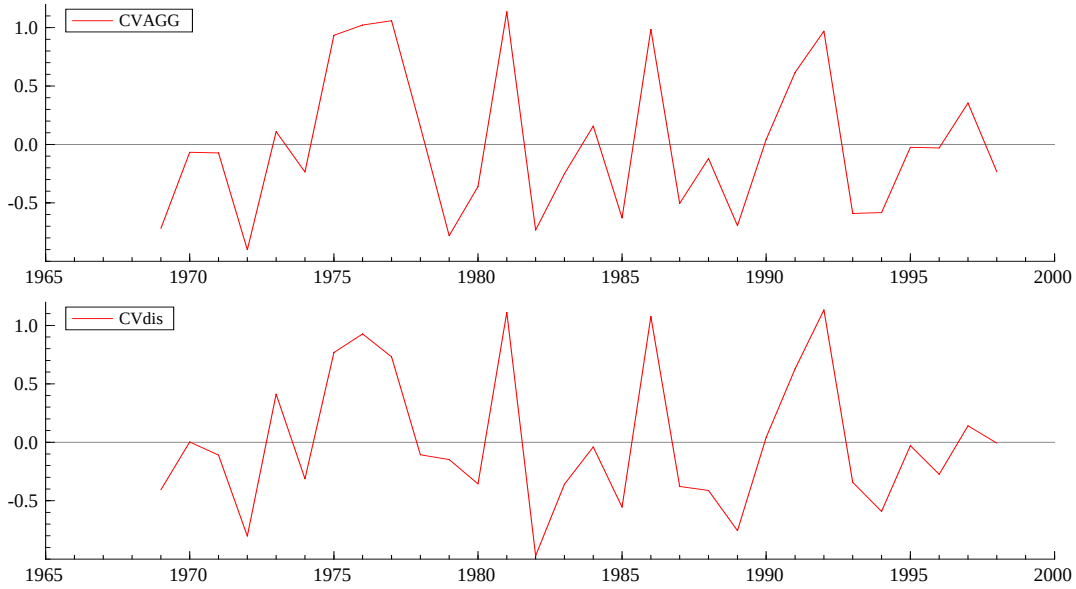
Appendix Table B—Disaggregate model

Variable	ΔR_t	ΔCU_t	ΔCA_t	ΔD_t	ΔF_t
ΔR_{t-1}	1.6825**	1.8040***	1.0029**	1.1077	0.5822
ΔR_{t-2}	0.9862**	0.9833***	1.2160***	1.0096**	0.5127
ΔF_{t-1}	-0.1068	0.1467	-0.0040	0.5314**	-0.4676*
ΔF_{t-2}	0.5134*	0.1108	-0.0818	-0.5596*	0.4426
ΔCU_{t-1}	-0.8517	-1.3256**	-0.5108	-1.2175*	-0.3819
ΔCU_{t-2}	-1.2170**	-1.0786**	-0.8472***	-0.8313*	-0.5322
$\Delta CA2_{t-1}$	-1.9369**	-1.9212***	-1.2190**	-0.9550	-0.3907
$\Delta CA2_{t-2}$	-1.3764**	-1.1887**	-1.1570***	-0.8484	-0.3499
ΔD_{t-1}	1.4051**	1.8086***	0.7770**	1.2788**	0.0783
ΔD_{t-2}	1.4202***	0.9304**	0.8294***	0.5297	0.5196
$EcmDM_{t-1}$	-2.4699***	-2.1817***	-0.5534	-1.4873*	-0.3781
R-Bar-Squared	0.5027	0.2319	0.7070	0.5087	0.1605
Autocorrelation	1.2109	1.4062	0.8912	1.8157	4.0089**
Normality	0.7113	1.1651	0.8868	1.7489	3.6073

	Vector diagnostic tests	
Autocorrelation	F-Version	1.1754
Normality	Chi-squared Version	12.011

Notes: Same as in Appendix Table A.

Appendix Figure A
Residuals of CI relationships



The plot of the residuals of the cointegrating vectors (Figure A) for the aggregate (CVagg) and disaggregate (CVdis) models respectively, does support the results that the variables are cointegrated. These graphs also reveal that there is no obvious break in the residuals. This supports the argument made that structural breaks in the individual series are not problematic for the cointegrating relationship as all the variables appear to move, or break, together.

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