ESSAYS ON SUB-OPTIMAL FISCAL POLICY RESPONSES IN SUB-SAHARAN AFRICAN COUNTRIES

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ABSTRACT

The actions of governments are instrumental in economic development, and an important lever of policy is fiscal policy. Taxation and spending cannot only promote economic development but inhibit progress and retard the process, and nowhere is this most evident than in sub-Saharan Africa (SSA), which is the focus of this study. Promoting economic development therefore requires that policies that inhibit the process are identified and addressed. In this light, this thesis investigates two common features of fiscal policy in developing countries that may slow down economic development: the first is that government consumption is pro-cyclical even though increasing (reducing) spending in response to increases (decreases) in income worsens income fluctuations. The second feature is that the budget deficit (budget balance) increases (decreases) in response to aid inflows.

We address the issue of pro-cyclical government consumption in two stages: in the first stage a coefficient of cyclicality of government consumption is obtained for each of the sample countries using an improved (equilibrium-correction) specification. Variation in these coefficients across countries is then explained within a cross-section specification in the second stage. We conclude that credit constraint and political distortion are significant determinants of pro-cyclical government consumption. However, they are not the underlying reason why pro-cyclicality of government consumption increases with income uncertainty as existing explanation has it. Rather, the latter is the result of actions taken by the government to remain solvent in economic downturns.

We investigate the aid-budget deficit relationship in three parts: the first part re-visits the past evidence, using more recent data, improved methods and a sample consisting of only SSA countries. We find that, consistent with past evidence, countries with larger budget deficits receive more aid and aid induces larger deficits. However, the effect of aid on the budget deficit has improved in recent times. This suggests that, contrary to existing explanation, giving more aid to countries with larger budget deficits is not the reason why aid induces larger deficits. Rather, we show in the second part that there is a divergence in the cross-section and within-country (year-to-year) dimensions of aid determination and the effect of aid depends on the latter: aid induces smaller deficits in countries where decreases in the budget deficit are associated with increased inflows of aid over time.

Finally, we use a new approach to vector equilibrium-correction models (VECMs) to investigate the relationship between aid inflows and the fiscal aggregates that underlie the contrasting aid-budget deficit relationship across countries; we use Ghana (where the relationship is negative) and Zambia (where it is positive) as case studies. We conclude that aid induces lower deficits when year-to-year disbursements are conditioned on decreases in total expenditure and domestic borrowing. Even though aid inflows attracted by increased expenditure may still induce lower deficits, the magnitude of the decrease in expenditure is over-whelmed by the initial increase that attracted aid in the first place. We therefore conclude that to induce substantial deficit reductions, aid should be conditioned on decreased expenditure and domestic borrowing, or better still on reduced deficits. Thus, budget conditions are effective when enforced.

DEDICATION

I dedicate this thesis to my dear beloved mother, Dolly Cleland, on whose date of birth my Ph.D is awarded.

"Whatsoever thy hand findeth to do, do it with thy might....the race is not to the swift, nor the battle to the strong.....nor yet favour to men of skill; but time and chance happeneth to them all." **Ecclesiastes 9:10, 11.**

"He giveth power to the faint; and to them that have no might he increaseth strength. Even the youth shall faint and be weary, and the young men shall utterly fall: But they that wait upon the Lord shall renew their strength; they shall mount up with wings as eagles; they shall run and not be weary; and they shall walk and not faint." **Isaiah 40:29 –31.**

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Finally, *when I lift up mine eyes unto the hills from whence cometh my help*.....I give God Almighty all the praise and glory.

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CHAPTER 1

INTRODUCTION

Poverty is a major problem in sub-Saharan Africa (SSA), the eradication of which requires both rapid and sustainable growth. However, growth among countries in the region has been persistently dismal. Given their rich natural resource endowment, a likely explanation for the poor growth is macroeconomic mismanagement (including corruption and weak policies). Therefore, the answer to the growth problem would depend to a large extent on the causes of macroeconomic mismanagement in the region; commonly identified causes include income volatility (or fluctuations), high opportunity cost of development effort and unsustainable debt levels. We explain these factors in what follows.

Several economies in SSA depend on undiversified traditional export commodities for their foreign exchange earnings. The traditional export commodities consist mainly of agricultural products and natural resources (including minerals). Meanwhile, agriculture is highly dependent on weather conditions that are not certain and returns from the export of natural resources depend on the global market conditions that are usually exogenous to the exporters. This exposes SSA economies to risks as unexpected shocks to the limited export bundle results in high income volatility (or fluctuations) and uncertainty for that matter. Uncertainty about the future complicates economic planning, contributing to poor economic growth (Ramey and Ramey, 1994). One reason for this is that policies that are useful in one economic state may become defective in another. For instance, it may be prudent for governments to abstain from

long-term investment when revenue is uncertain resulting in poor economic growth. Also, income volatility is indicative of vulnerability of a country to shocks and would therefore lead to limited inflows of private capital. Therefore, using government policy as an instrument for achieving economic stability (or smoothing income) is a necessary platform for effective macroeconomic management.

Another factor that complicates macroeconomic management in developing countries in general is the opportunity cost of development effort; this 'cost' refers to the wealth and 'public favour' forfeited by economic planners when implementing effective and efficient development policies, and is associated with corruption and political distortion (i.e. public pressure to spend). Thus, rather than pursuing effective and efficient policies, corrupt governments focus on policies that create the opportunity for amassing wealth. They also find it beneficial to please voters in order to remain in office. For instance, governments may linger over removal of producer subsidies even when it is not efficient simply because it can result in the loss of election votes in democracies. These 'costs' are high where monitoring and enforcement institutions are weak since governments are often not held accountable for their actions. Enforcement institutions are therefore essential for ensuring that macroeconomic management is effective.

Also, unsustainable debt levels complicate macroeconomic management. This is because they raise the fear of defaulting on debt repayments and limit access to international financial markets. The result is an over-reliance on domestic borrowing. Increased domestic borrowing by the government may result in the 'crowding-out' of private investment, slowing down economic growth. Also, high levels of domestic

borrowing may result in so-called ‘fiscal dominance’ whereby the focus of monetary policy on price stability is distracted by increased borrowing by the government. High debt levels are also associated with large unproductive spending on interest payments. Therefore, policies that ensure that domestic borrowing is reduced and debt levels in general are sustainable would facilitate macroeconomic management by restoring the credibility of governments, enhancing access to international financial markets and encouraging private investment.

In the current context, therefore, what we may term ‘optimal policies’ are those that place emphasis on economic stability, enforcement institutions or mechanisms, and debt sustainability. Empirical evidence however reveals two sub-optimal fiscal policy actions that are common in developing countries in general. The first is that, inconsistent with the income stabilization required for effective macroeconomic management, fiscal policy is ‘pro-cyclical’, meaning that government spending increases in good times (when income is high) and decreases in bad times (when income is low). By creating higher income in good times and contracting income further in bad times, pro-cyclical fiscal policy exacerbates income volatility. Even more challenging is that empirical evidence shows that income volatility also induces pro-cyclical fiscal policy (Alesina and Tabellini, 2005). There is therefore a vicious cycle that needs to be broken, especially in highly volatile countries. This requires a good understanding of the relationship between income volatility and pro-cyclical fiscal policy, an issue that is addressed in the present study.

Foreign assistance for the macroeconomic management problem, and poverty reduction for that matter, in developing countries has been in the form of foreign aid

donations from international organisations and donor countries. The second sub-optimal fiscal policy action is regarding the response to aid inflows. The main objective for aid disbursement is to promote rapid growth by relaxing the financing constraints faced by governments in the recipient countries. It follows then that, primarily, aid disbursement is motivated by need. To promote the efficacy of aid, donors and recipient governments often agree on a development itinerary, which recognizes the aforementioned causes of macroeconomic mismanagement, before aid is disbursed. However, empirical evidence shows that aid inflows induce larger budget deficits in recipient countries, typically because more aid is given to recipients with larger deficits, reducing the incentive to avoid deficits (Svensson, 1995). Persistent increases in the budget deficit may complicate economic planning through increased debt levels and reduced private investment (where domestic borrowing is a predominant source of deficit financing). If the increases in the budget deficit are the result of the high 'opportunity cost' of compliance with agreed targets, as is often believed, then monitoring and enforcement mechanisms would be of great importance. The most common enforcement mechanism suggested in the aid literature is the use of aid conditionality, whereby aid disbursement is conditioned on 'good' performance. The logic is that, in order to receive more aid, recipient governments would exert more effort to improve economic performance. However, given that poor economic performance may be associated with inadequate resources rather than macroeconomic mismanagement, the controversy with this type of aid conditionality is that it may direct less aid towards countries that need it most, undermining the fundamental reason for disbursement. Therefore, it is important to obtain an in-depth understanding of the relationship between aid disbursement and the relevant policy for effective recommendations. In the current context, where the focus is on fiscal stability, aid

conditionality refers to the attachment of budget conditions (including reduced deficits) to aid disbursement and therefore knowledge of the relationship between aid inflows and the recipient's budget would be useful.

The conceptual framework underlying the aid-fiscal response analysis is as follows: donors disburse aid with the primary aim of financing government expenditure, either directly if delivered through the budget or indirectly through projects. Conditions may be attached to guide the sector allocation of aid or to influence policy. Since aid to the government is included in expenditure, it is obvious that expenditure increases with aid. It is noteworthy, however, that conditions may influence other fiscal aggregates, including tax revenue, and cause them to respond to aid. The literature on taxation and several fiscal response studies however find the relationship between tax revenues and aid to be inconclusive.

Two different measures of the budget deficit used in aid-fiscal response studies are that which excludes aid and that which includes aid. As with government expenditure, the 'excluding aid' budget deficit is expected to increase with aid (since aid is included in expenditure but not revenue). Thus, the various relationships between aid and the budget deficit to consider when using the 'excluding aid' measure of the latter are: (i) budget deficit as a function of aid; (ii) change in budget deficit as a function of change in aid, and (iii) aid at a function of past deficit. The coefficients on the first two are hypothesized to be negative; the second may however vary under some circumstances; for instance, the IMF expected total expenditure in Zambia to decrease with aid – through a decrease in current expenditure even though capital expenditure was expected to increase (Cordella and Dell'Arricia, 2007). Also, the government may

increase expenditure (from their own resources) by less when there are aid projects. The coefficient on budget balance in the third relationship (which captures aid conditions with respect to the budget deficit) is inconclusive; not all donors condition disbursement on the budget deficit and not many recipients conform.

The 'excluding aid' measure of the budget deficit is financed by aid, domestic borrowing (government bonds and central bank), and foreign borrowing. Therefore, since we are interested in the implication of the budget balance on domestic borrowing and debt sustainability, we use the 'including aid' measure. Thus, all three aforementioned relationships are recast with the 'including aid' measure of the budget deficit. In this instance, however, the sign of the coefficient on all three relationships are inconclusive because aid is included in both revenue and expenditure, removing the direct link from aid to the budget deficit. In our empirical analysis, we specify the third relationship as aid as a function of contemporaneous budget deficit (including aid) and is only indicative of aid conditionality. The justification is that, while punishment of default is a means of enforcement, aid conditionality guides the use of aid. Therefore, since the donor-recipient relationship is a repetitive game, we expect the correlation between aid and the budget balance to reflect the extent of enforcement. This approach is used because, in practice, the response of aid to the previous year's budget deficit, as a measure of aid conditionality, has got its own limitations: for instance, the period between default and punishment for default may be longer or shorter than a year (i.e. varies with donors, recipients, and time). Even though many donors, with the exception of the IMF, do not typically identify the budget deficit during disbursement, some deliver aid to recipients that are in the 'good books' of the

IMF, and our focus is on the extent to which total aid reflects this behaviour and the implication for fiscal behaviour.

The ultimate objective of the present study is to examine and explain why fiscal policy (with respect to the income cycle) is pro-cyclical, with the extent of pro-cyclicality increasing with income volatility, and why the budget deficit increases with aid inflows. This is addressed using a sample of 37 sub-Saharan African countries between 1960 and 2004. The outline of the thesis is as follows: in chapter 2, we estimate coefficients of fiscal policy pro-cyclicality for all the sample countries and explain their variation across countries. We focus on the effect of income fluctuations on the cyclicality of fiscal policy. To the best of our knowledge, this has never been addressed for SSA countries. Novel in our approach is that the cyclicality coefficients are estimated within a stationary specification. In Chapter 3, we re-examine past evidence on the aid-budget balance relationship. In chapter 4, we give a new explanation for the observed effect of aid on the budget balance. In chapter 5, we investigate the donor and recipient government actions (in terms of the relationship between aid inflows and the fiscal aggregates of the recipients) that are responsible for the different aid-budget balance relationship across countries. We coin our research questions into testable hypothesis within the VAR framework. We then use a new approach to VAR estimations suggested by Juselius (2009). Finally, the main results and policy implications are summarized in chapter 6.

CHAPTER 2

PRO-CYCLICAL FISCAL POLICY IN SUB-SAHARAN AFRICAN COUNTRIES

2.1 Background and literature review

The emergence of the new endogenous growth theory has generated interest among economists in the importance of business cycle volatility to economic growth. Even though the welfare cost of business cycle volatility might have been underestimated in the past (Lucas, 1987), the table has turned due to a growing literature on the negative effect of volatility on economic growth (Badinger, 2008; Barlevy, 2004; Ramey and Ramey, 1995). Considering that macroeconomic policies affect fluctuations in the business cycle (Badinger, 2008), an obvious question is why some governments, especially in developing countries, pursue policies that exacerbate the cycle, such as procyclical fiscal policy whereby public expenditure responds positively to a percentage change in GDP.

In both Keynesian and neoclassical worlds, pro-cyclical fiscal policy is shown to worsen volatility of the business cycle (Ilzetzki and Vegh, 2008). Nonetheless, Gavin and Perotti (1997) found fiscal policy in Latin America to be pro-cyclical. An influx of literature in this area consistently made similar conclusions about fiscal policy in most developing countries in different parts of the world, rendering it a conventional wisdom (Talvi and Vegh, 2005; Alesina and Tabellini, 2005; Ilzetzki, 2007; Ilzetzki and Vegh, 2008; Badinger, 2008; Catao and Sutton, 2002; Kaminsky, Reinhart and

Vegh, 2004, Mendoza and Oviedo, 2006). This poses a puzzle to economists in this area.

Based on several theories, many explanations for the conduction of procyclical fiscal policy in developing countries have been proposed which Ilzetzki and Vegh (2008) categorise broadly into credit constraint rationale (whereby imperfect access to international credit markets prevents developing countries from borrowing in bad times) and imperfections in the political economy (which provoke high spending and rent-seeking in good times). Thus, pro-cyclicality of fiscal policy is driven by reactions to both economic downturn and upturn. During periods of economic downturn, governments of developing countries find it difficult to access credit due to a high risk of default. Therefore public expenditure falls during economic downturns. On the other hand, during economic upturn, public representatives of different social groups pursue different policies which escalate aggregate spending (Woo, 2005). Moreover, due to information asymmetry, households prevent corrupt governments from rent accumulation by demanding high fiscal spending during economic booms (Alesina and Tabellini, 2005 and 2007; Talvi and Vegh, 2000).

In spite of the aforementioned explanations, the phenomenon of pro-cyclical fiscal policy still remains enigmatic because such explanations do not fully account for the observed magnitude of procyclicality and a few are actually conflicting. For instance, whiles Alesina and Tabellini (2005) find pro-cyclicality to be worse in developing countries with relatively high levels of corruption and democracy, Thornton (2008) finds the opposite to be true. Even more, Thornton (2008) finds fiscal policy to be more pro-cyclical in countries where income inequality is less profound - in sharp

contrast with Woo (2005) results. The former is ascribed to the countercyclical nature of welfare expenditure during economic downturns, and is also in accordance with the literature which explains that high level of income inequality enhances automatic fiscal stabilizers by suppressing government spending on social programs (Fatas and Mihov, 2001; Pestieau, 2006), whereas the latter argues that increased resources associated with economic upturns provide incentive for representative policymakers of diverse income groups to pursue different preferences which may not be optimal on aggregrate. The contrasting results between Thornton (2008) and the related studies may be ascribed to different factors: Firstly, Thornton uses a sample of only sub-Saharan African (SSA) countries while the others use samples of cross-continent countries. Secondly, in order to obtain longer series, Thornton (2008) combines data from different sources. However, African data obtained from different sources are often inconsistent and may therefore yield misleading results when combined. Thirdly, the empirical specifications used for estimating the coefficients of fiscal policy pro-cyclicality are different across studies. Given that the fundamental reason for the estimation and explanation of fiscal policy pro-cyclicality is its exacerbating effect on the volatility of the business cycle,[1] and that stabilizing business cycle fluctuations is a pressing issue in SSA, the first objective of the study is to re-examine Thornton (2008) using single-source data series and improved empirical specification to estimate the coefficients of fiscal policy pro-cyclicality. We then investigate how this affects existing results on determinants of fiscal policy pro-cyclicality.

[1] Studies that have established the exacerbating effect of procyclical fiscal policy on the volatility of the business cycle include Badinger (2008), Ilzetzki and Vegh (2008), Kaminsky, Reinhart, and Vegh (2004), Talvi and Vegh (2000).

There is also evidence that volatile business cycles also cause pro-cyclical fiscal policy (Lane, 2003; Talvi and Vegh, 2000) – a related evidence is that the exogeneity of fiscal policy cyclicality in the determination of output volatility is strongly rejected (Badinger, 2008). Although this suggests the existence of a vicious cycle between income volatility and pro-cyclical fiscal policy which needs to be broken, it is not addressed in Thornton (2008) study on SSA. Existing empirical evidence on the effect of income volatility on the pro-cyclicality of fiscal policy are based on samples of cross-continent countries. This may not reflect the situation in SSA. Therefore, as a contribution to the literature, the second objective of the study is to re-examine the effect of income volatility on the pro-cyclicality of fiscal policy only in sub-Saharan Africa. Using a sample of only sub-Saharan African countries is relevant for our purpose because fiscal policy is shown to be predominantly pro-cyclical in the region (Thornton, 2008). Moreover, economies are relatively volatile in the sub-region of Africa because of undiversified sources of income.

Also of interest is the explanation for the effect of output volatility on the pro-cyclicality of fiscal policy. Again, the standard (existing) explanation is the aforementioned credit constraint and political distortion arguments; the implication is that when credit is made available in bad times and institutions are put in place to safeguard against political pressure to spend in good times, income volatility would not affect pro-cyclicality of fiscal policy.[2] In contrast, however, the present study argues that the effect of output volatility on the pro-cyclicality of fiscal policy is the result of optimal solvency behaviour of governments facing imperfect risk sharing (associated with heavy reliance on non-state-contingent bonds). To be specific,

[2] See Talvi and Vegh (2000).

economic fluctuations have adverse effect on the volatility of public revenues (Eichengreen and Hausmann, 2004), yet low income governments rely heavily on non-state contingent domestic bonds which require (high) interest payments on outstanding bonds to be maintained even in bad times (implying imperfect risk sharing between the government and the households). Therefore, fiscal authorities find it prudent to set lower absolute debt limits (which applies even during good times) in order to remain solvent at all times, including bad times (Mendoza and Oviedo, 2006). Among countries with similar average revenue, the expected minimum revenue (in bad times) is lower in those faced with higher income volatility. The debt ceiling is therefore lower (and is maintained at all times) when income volatility is high. Lower minimum revenue combined with lower debt ceiling amounts to lower consumption, implying that income volatility leads to lower consumption in bad times. On the other hand, the expected maximum revenue (in good times) among countries with similar average revenue is higher where income volatility is high, leading to higher consumption in good times.[3] Therefore, as a result of optimal solvency behaviour, fiscal policy is more pro-cyclical in countries with higher income volatility when there is imperfect risk sharing (associated with non-state contingent bonds).

It is important to note that contrasting the political distortion and credit constraint explanations does not suggest that they would not cause fiscal policy to be less pro-cyclical. Instead, we mean that they do not explain the effect of income volatility in particular on pro-cyclical fiscal policy in the sample countries. As a matter of fact, in most developing countries, increased savings in good times actually refers to lower

[3] The implicit assumption here is that developing countries are unable to run budget surpluses in good times. This is not farfetched because of relatively lower tax capacities and higher spending demands in such countries.

deficits (rather than surpluses) which leaves little room for subsidised spending in bad times. Also, making credit available in bad times would not prevent governments facing highly volatile incomes from behaving in a manner that would keep them solvent in bad times.

The analysis is carried out in two stages. Firstly, we estimate the fiscal policy cyclicality coefficient for each of the SSA countries using time series data over the period 1960 to 2004; the sample comprises the same 37 countries in Thornton (2008). Secondly, cross-country regression is used to explain the variation of the fiscal policy cyclicality coefficient across countries. To allow for possible endogeneity bias in the results, the second stage is re-estimated using instrumental variable method but this does not affect the pattern of the results. With the exception of Central African Republic, the Gambia, Kenya and Zimbabwe, all the countries in the sample pursue a pro-cyclical fiscal policy. The results also support the optimal solvency rationale argued by the present study: that is, pro-cyclicality of fiscal policy increases with income volatility; when plotted, the budget-deficit to GDP ratio appears to be lower in countries with higher income volatility; graphical analysis shows that in countries with higher income volatility, there are smaller increases (or larger decreases) in the budget deficit to GDP ratio as GDP increases (decreases), suggesting that effort is made to preserve the debt ceiling even in good times (when governments become more solvent).

In line with Thornton (2008), our cross-section results also show that income inequality (capturing political distortion/pressure to spend in good times) and aid dependability (capturing financing constraint) significantly affect fiscal policy pro-

cyclicality with the effects being negative and positive respectively. Unlike Alesina and Tabellini (2005) and Thornton (2008), who had significant but contrasting outcomes, the present study finds the effect of corruption and democracy on fiscal policy pro-cyclicality to be insignificant.

The study proceeds as follows. The theoretical concept underlying the analysis is formalised in the next section. Section 2.3 then presents an empirical model suitable for testing the theoretical concept. In section 2.4, the variables and sources of data employed in the analysis are described. Section 2.5 discusses the results of the analysis. Finally, the conclusions from the study and suggestions for future research are summarised in section 2.6.

2.2 Theoretical model

Following Mendoza and Oviedo (2006), the present study employs a theoretical model that rationalizes the conduction of procyclical fiscal policy in a small open (low income) economy that faces uncertain revenue (due to volatile business cycle) and reduced risk sharing (associated with incomplete asset markets). The asset market incompleteness considered is that associated with the external and domestic asset markets whereby returns on bonds issued by the government are not contingent on the state of the domestic economy. Therefore, the government would still have to pay high returns on outstanding debts even in bad times. Due to external financing constraint, the government relies heavily on domestic source of debt financing, and domestic bonds remain non-state contingent as long as households have access to externally issued non-state contingent bonds; the two types of bonds are assumed to be perfect substitutes for simplicity. Thus, the model set up is based on the rational behaviour of

the fiscal authority and the household in a volatile economy with limited risk sharing. The former optimizes expenditure and debt levels when faced with uncertain revenue, whiles the latter makes optimal decisions on consumption and asset accumulation. Unlike Mendoza and Oviedo (2006), however, the role of the household in this study is just to emphasize the nature of the asset market incompleteness considered and this purpose is achieved without having to solve for the household's optimal decision. The optimization problem of the household is therefore not formalized. An important feature of the model is that, in spite of being faced with revenue risk and limited risk sharing opportunities, the government maintains constant transfers to the private sector in both good and bad times. Thus, the government insures the household against negative shocks.

The government's decision problem is to choose the optimal levels of debt, d_t, and consumption expenditure, g_t, when faced with the possibility of different risky outcomes of output and tax revenue. To formalize this problem, let us suppose the state of the economy facing the government at time *t* is associated with an endowment income, Y_t, and tax revenue T_t. The latter is an increasing function of Y_t but is also affected by shocks originating in policy and other exogenous sources. In addition to consumption, the government spends h on exogenous transfers to the household. The excess of total government expenditure over revenue is financed by the sale of non-state contingent bonds to the household with a fixed return, *r*. In such an economic environment, the optimal levels of debt and consumption expenditure are those that maximise the expected present value of the government's intertemporal utility function subject to budget and debt constraint. The expected utility function is specified in a form that assumes constant relative risk aversion (CRRA) as follows:

$$(2.1)\quad \max_{d,g} E_t U_t = E_0\left[\sum_{t=0}^{\infty}\beta^t \frac{g_t^{1-\sigma}}{1-\sigma}\right], \qquad \sigma \neq 1\ ;\ \sigma > 0$$

subject to the government budget constraint,

$$(2.2)\quad g_t + h + rd_{t-1} \leq d_t + T_t$$

and the debt constraint defined by the upper debt limit, $\bar{d}$ as[4]

$$(2.3)\quad \bar{d} \leq \frac{\min E_t[T_t] - h}{r-1}$$

which could also be expressed as,

$$(2.3b)\quad r\bar{d} \leq \bar{d} + \min E_t[T_t] - h$$

where σ is the coefficient of relative risk aversion, β is the subjective discount rate, and h denotes exogenous transfers from the government to the household which is assumed to be constant in all periods and state of the economy. The budget constraint implies that the government's finance base should at least be equal to the total fiscal expenditure. The interpretation of the debt constraint is that the government debt ceiling, which applies at all times, is set such that exogenous transfers to the household could be maintained in all periods and states of the economy (as emphasized in

[4] Footnote 3 applies.

equation 2.3), including when government revenue is at its lowest level, without defaulting on interest payment (as emphasized in equation 2.3b).[5]

The solution to the government's decision problem gives the following first order condition (FOC):

$$(2.4) \qquad g_t^{-\sigma} = \beta r E[g_{t+1}^{-\sigma}] + \lambda_t$$

where λ_t is the Langrange multiplier on the debt constraint. The FOC is a standard Euler equation defining the optimal pattern of government consumption expenditure over two periods. Note that since the marginal utility of government consumption (derived from a concave utility curve) is convex (expressed as $g_t^{-\sigma}$ and $E[g_{t+1}^{-\sigma}]$ for year *t* and *t+1*), higher values of marginal utility imply lower levels government consumption. Also, note that λ_t is positive when the debt constraint is binding and zero otherwise. It follows then that in good times when the debt constraint is not binding (i.e., $\bar{d} < \frac{\max E_t[T_t] - h}{r-1}$ from equation 2.3, and $\lambda_t = 0$), government expenditure in year *t* increases and vice versa. The model therefore suggests that procyclical fiscal policy is optimal when fiscal authorities with volatile income are faced with incomplete asset markets. A direct connotation is that pro-cyclicality of fiscal policy increases with income fluctuations when asset markets are imperfect. To see how this occurs, note that for a given mean revenue ($E_t[T_t]$), the expected minimum value of revenue ($\min E_t[T_t]$) is lower in countries with higher revenue

[5] See Mendoza and Oviedo (2004) and Aiyagari (1994)

volatility and, in accordance with equation (2.3), results in lower debt ceiling, $\bar{d}$. Substituting $\bar{d}$ into (2.2), the budget constraint could be expressed as

$$\bar{d} = \frac{T_t - (h + g_t)}{r - 1} \tag{2.5}$$

Equation (2.5) shows that among governments with similar average revenue, those with lower debt ceilings (induced by high income volatility) are associated with larger decreases (increases) in consumption in bad (good) times. Therefore, fiscal policy is more pro-cyclical in countries with higher income volatility. The model predictions for governments that rely on non-state-contingent bonds are summarized as follows: firstly, the debt ceiling is lower in countries facing higher income volatility. Secondly, there is more effort to preserve the debt ceiling in both good and bad times. Thirdly, fiscal policy is more pro-cyclical in countries with higher income volatility. Finally, the effect of income volatility on pro-cyclicality of fiscal policy increases with dependence on non-state contingent bonds. With the exception of the fourth, which we are unable to test due to data limitations, the model predictions are tested empirically using the methods described in the empirical model section. Before we proceed, it is instructive to show how the model behaves with state contingent bonds as this constitutes the theoretical basis of our proposed solution to the effect of income volatility on pro-cyclical fiscal policy.

The model with state contingent bonds

Equation (2.3) shows that when bonds are non-state contingent (i.e., when *r* is constant), the debt limit is based on the expected minimum revenue in order to ensure

solvency in bad times. The debt limit is therefore low, permitting less borrowing and, for that matter, spending in bad times.

On the other hand, when bonds are state-contingent (i.e., when r is high in good times and low in bad times), the debt limit, $\bar{d}^*$, could be based on the expected maximum revenue as shown below.

$$\bar{d}^* \leq \frac{\max E_t[T_t] - h}{r(s) - 1}$$

where s denotes the state of the world such that, where α and β denote good and bad times respectively, $r(\alpha) > r(\beta)$ holds. Therefore, it is possible to maintain higher spending as revenue falls without contravening the debt ceiling because r would also fall. This suggests that fiscal policy would be less pro-cyclical if fiscal authorities have access to state contingent bonds.

2.3 Empirical model

The empirical approach we use to determine the effect of output volatility on the cyclicality of fiscal policy comprises two stages. Firstly, different specifications are employed in estimating the cyclicality coefficient for each country in the sample. The second stage then utilizes a cross-sectional analysis of the sample countries to explain the variation in the cyclicality coefficients across countries. We address three objectives in the process: the first objective, which is addressed in the first stage of the analysis, is to re-estimate the coefficients of fiscal policy pro-cyclicality in Thornton (2008), using more improved empirical specifications and data series. The second

objective, which is addressed in the second stage of the analysis, is to investigate whether the explanation given in Thornton (2008) for the variations in the pro-cyclicality coefficients across countries changes with the improved estimates of the pro-cyclicality coefficients. The third objective is to estimate the effect of income volatility on the pro-cyclicality of fiscal policy in SSA. We also test the necessary conditions underlying our explanation for the latter.

2.3.1 Stage 1: Estimation of cyclicality coefficient for fiscal policy

The fiscal policy variable adopted in the present study is government consumption.[6] Cyclicality of fiscal policy is therefore defined as the response of government consumption to output fluctuations. The most basic specification for estimating the cyclicality between government consumption and output in their natural logarithmic forms is presented as follows:[7]

$$\Delta logG_t = \alpha + \beta^* \Delta logY_t + \varepsilon_t \quad (2.6)$$

where G and Y denote government consumption and output respectively, at time t. The response of government consumption with respect to changes in output is measured by the β parameter with the residual ε capturing other sources of change in government consumption that are exogenous to the model.

[6] Fatas (2005) argues that investment should be excluded from fiscal rules because the benefits of investment occur over many years. This is consistent with the 'golden rule' of fiscal policy whereby investment, when able to generate enough returns to service investment borrowing, is excluded from fiscal rules. Moreover, excluding investment spending allows for comparability with Thornton (2008). Also, investment data for the sample countries is less consistent.

[7] See Woo (2005) and Lane (1998, 2003).

Although estimates of β from specifications of the form in equation (2.6) are common in the literature,[8] these may be misleading since they do not account for the adjustment of government consumption to disequilibrium, which is sustainable in the long-run. An exception is Thornton (2008) who accounts for the mean reversion of government expenditure by including $logG_{t-1}$ as a regressor to obtain the specification in equation (2.7).

(2.7) $\Delta logG_t = \alpha + \beta * \Delta logY_t + \alpha_1 * logG_{t-1} + \lambda * t + \varepsilon_t$

where α_1 is the coefficient capturing the mean reversion of government consumption and λ is the coefficient on the trend term t that captures trends in $logG_{t-1}$. Equation (2.7) may nevertheless be inadequate for the following reasons: Firstly, capturing the adjustment of government consumption to long-run disequilibrium is superior over simply accounting for mean reversion because it is also sustainable for government consumption to respond to the long–term income, often captured by $logY_{t-1}$. Secondly, fundamental time series principles suggest that equation (2.7) would be rendered unstable where $logG_t$ is not stationary (around the trend). The latter problem, however, does not exist if $logG_t$ is included with $logY_{t-1}$ and the two have an equilibrium relationship (i.e., are cointegrated), rendering their combination stationary. We therefore estimate β using the empirical specification in (2.8).

(2.8) $\Delta logG_t = \alpha + \beta * \Delta logY_t + \alpha_1 * logG_{t-1} + \alpha_2 * logY_{t-1} + \lambda * t + \varepsilon_t$

[8] Footnote (4) applies.

where α_2 captures the response of government consumption to the disequilibrium of income from its steady state. Unlike equation (2.7), t in equation (2.8) captures exogenous trending effect on the long-run relationship between $logG_{t-1}$ and $logY_{t-1}$.

As implied above, equation (2.8) is stationary only when $logG_{t-1}$ and $logY_{t-1}$ are stationary or non-stationary but have a stationary equilibrium relationship. The estimation of equation (2.8) is therefore preceded by tests for stationarity and cointegration (or equilibrium relationship) of the variables.

Note that equation (2.8), which is a Single Equation Error-Correction specification, is henceforth labelled SECM. It is estimated using OLS to obtain the measure of fiscal policy pro-cyclicality β, henceforth labelled beta parameter. This coefficient is used as the dependent variable in the second stage of the analysis. Note that we also estimate equation (2.7), henceforth labelled MEANREV, to investigate whether the results are different when the time series properties of the variables are not thoroughly accounted for.

Stationarity test

Stationarity of the variables is determined by performing an Augmented Dickey-Fuller (ADF) test which involves a t-test on the OLS estimate of μ in the following specification for each variable Z, using special critical values.

$$\Delta Z_t = \gamma + \Omega t + \mu Z_{t-1} + \psi_1 \Delta Z_{t-1} + \ldots\ldots\ldots + \psi_k \Delta Z_{t-k} + \xi_t \quad (2.9)$$

where γ denotes the constant term, Ω denotes the coefficient on the trend term, t, and the ψs are the coefficients on the lagged differences of Z that are included to ensure that the residual, ξ, is white noise. Note that the lagged values of the dependent variable and the constant and trend terms are dropped in turns when not significant because the critical values for the ADF test are non-similar, meaning that they depend on the form of the deterministic components of the model under the null. The variable Z is stationary if the null (H_0: $\mu=0$) is rejected.

Next, the government consumption and GDP variables are tested for cointegration, which involves testing for the stationarity of the residual from their long-run relation as expressed in (2.10).

(2.10) $$\log G_t = \varphi_1 + \varphi_2 * \log Y_t + \varphi_3 t + \omega_t$$

Empirically, not accounting for enough lags of Y in equation (2.10) may result in serial correlation problem. The cointegration test may therefore be misleading since the residual being tested would not be white-noise. Following Hendry (1997), therefore, the dynamic equivalent of equation (2.10), given in (2.11), is estimated first and subsequently solved for the long run parameters. These are formalized as follows:

(2.11) $$A(L)\log G_t = B(L)\log Y_t + \varphi_3 t + \omega_t$$

where A(L) and B(L) denote the autoregressive and distributed lag polynomials in *logG* and *logY* respectively and are made long enough to yield a white noise residual.

By setting L=1 in the lag polynomial, the long run solution to equation (2.11) is obtained as follows:

(2.12) $$\log G_t = \overline{\varphi}_1 + \overline{\varphi}_2 * \log Y_t + \overline{\varphi}_3 t + \overline{\omega}_t$$

where $\overline{\varphi}_1 = \varphi_1/\mathrm{A}(1)$, $\overline{\varphi}_2 = \mathrm{B}(1)/\mathrm{A}(1)$, $\overline{\varphi}_3 = \varphi_3/\mathrm{A}(1)$, and $\overline{\omega}_t = \omega_t/\mathrm{A}(1)$.

The test for cointegration is then carried out by performing an ADF test on the following equation as described above.

(2.13) $$\Delta\overline{\omega}_t = \mu_0\overline{\omega}_{t-1} + \psi_{01}\Delta\overline{\omega}_{t-1} + ... + \psi_{0k}\Delta\overline{\omega}_{t-k} + \xi_{0t}$$

Rejecting the null hypothesis of non-stationarity (H_0: $\mu_0=0$) suggests that log*G* and log*Y* are cointegrated and equation (2.8) is stationary.

2.3.2 Stage 2: Model explaining cross-country variation in fiscal policy cyclicality

In this section, we present the empirical specification that we use for explaining the variation in the cyclicality of fiscal policy (β parameter) across countries. To answer our first objective – which is to investigate whether Thornton (2008) explanation for the variation pro-cyclical fiscal policy changes with improved estimates of the coefficients of fiscal policy pro-cyclicality – we begin with Thornton's empirical specification. We then include income volatility as an additional explanatory variable to answer our second objective, which is to investigate whether it has a positive effect

on the pro-cyclicality of fiscal policy in sub-Saharan Africa (SSA) as cross-continent evidence suggests.

Consistent with existing empirical evidence, we predict a positive effect of income volatility on the pro-cyclicality of fiscal policy. However, in contrast with existing (credit constraint and political distortion) explanations, our theoretical model ascribes this to the optimal solvency behaviour of fiscal authorities when income is volatile and bonds are mainly non-state-contingent. The cross-section specification used is as follows:

$$\beta_i = \alpha_c + \alpha_{vy} VOL_i + \alpha_x X_i + v_i \quad (2.15)$$

where the αs are the constant term and the parameters of the corresponding variables, *VOL* denotes output volatility (which, as explained above, is excluded from initial estimations that update Thornton, 2008), *X* is a vector of control variables suggested in the literature, and ν is the residual capturing sources of variation in the beta parameter that are outside the model. Variables in vector *X* include financing constraints, captured by aid dependence of a country (ODAGDP);[9] social fragmentation, captured by a country's average of the gini coefficient (GINI), and the level of development of a country captured by the initial GDP per capita (GDPinitial).[10]

[9] Aid dependence is higher in poorer countries that are the most likely to be faced with credit constraints. It is however noteworthy that this proxy is not without limitation since large inflows of aid is indicative of a good relationship with donors and may therefore give financial institutions more confidence to lend to the aid recipient.

[10] See Alesina and Tabellini (2005), Woo (2005), Thornton (2008), Lane (2003), and Talvi and Vegh (2000).

The importance of pro-cyclical fiscal policy derives from its exacerbating effect on business cycle fluctuation. This suggests that GDP volatility is endogenous in equation (2.15).[11]We therefore check for the robustness of the results when instrumental variable estimations are used. The instruments used for GDP volatility are population size (POP), external debt to GDP ratio (DEBT), and inflation (INFL). Population size is used to capture the size of government; larger governments are believed to be more stabilizing (Gali, 1994). Government size is often captured by government consumption to GDP ratio (Badinger, 2008). However, the latter ratio may be endogenous in equation (2.15) since it is the fiscal policy variable used in the estimation of the cyclicality of fiscal policy. Government consumption to GDP ratio is however considered to be correlated with the population size (Badinger, 2008; Fatas and Mihov, 2003). External debt to GDP ratio accounts for the lack of control of fiscal authorities over fiscal policy, while inflation captures macroeconomic instability (associated with domestic debt crisis and lack of monetary policy control).[12]

To address the first objective of this (second) stage of the analysis, all the explanatory variables, with the exception of VOL, are of interest. We expect ODAGDP, serving as a proxy for financing constraint, to have a significant positive effect on β since inability to access credit in bad times increases procyclicality of fiscal policy. We also expect GINI to have a significant negative effect as social fragmentation, associated with inequitable distribution of income, suppresses spending on social programs which is pro-cyclical in nature. Countries with higher income are less susceptible to income shocks and would therefore be less affected by imperfect risk sharing associated with incomplete asset market. We therefore expect GDP to have a negative effect on the

[11] Footnote (1) applies.
[12] See Markus Berndt (2007).

pro-cyclicality of fiscal policy. The effect of corruption and democracy may be positive or negative: improved macroeconomic management, including counter-cyclical fiscal policy, is more likely in less corrupt and democratic governments (Persson et al., 1997). On the other hand, more tax revenue would be available for spending in good times (pro-cyclical spending) when governments are less corrupt or more accountable (as in democracies). Also, voters (in democracies) may require high spending in good times (pro-cyclical spending) to prevent governments from amassing wealth (Alesina and Tabellini, 2005).

In addressing the second objective of the second stage of the analysis, the coefficient of interest is α_{vy} in equation (2.15). We expect α_{vy} to be significantly positive in accordance with the optimal solvency behaviour of governments as predicted by the underlying theoretical model. Two necessary conditions of the optimal solvency behaviour, also predicted by the theoretical model, are that, firstly, government deficits are lower in countries with higher income volatility. Secondly, in countries where income is more volatile, government deficits are less pro-cyclical with respect to the income cycle. This means that, in spite of increased solvency, the deficit does not increase much in good times. The reason is to remain solvent even in bad times (given that return on bonds is not state-contingent). To investigate the first necessary condition, we use a graphical illustration of the relationship between GDP volatility and the budget balance (deficit) and expect a positive (negative) slope.

As with the first, we use a graphical illustration to investigate the second necessary condition for the optimal solvency behaviour of governments. We first obtain a measure of the cyclicality of the government deficit as the change in government

deficit with respect to a percentage change in GDP (labeled gama, γ, henceforth). Note that since the budget balance series consists of negative and positive values (budget deficits and surpluses respectively), we are unable to convert it into logarithms. We therefore use the change in budget balance to GDP ratio in the estimation of γ. This however affects the interpretation of γ. If the budget deficit increases proportionately with GDP (pro-cyclical), then γ=0 since the ratio of budget balance to GDP would remain the same; if the budget deficit increases more than proportionately with a percentage increase in GDP (highly pro-cyclical), then γ<0, reflecting a fall in the budget balance ratio (or equivalently, an increase in the deficit ratio); if the budget deficit decreases (or increases less than proportionately) with a percentage increase in GDP (countercyclical or less pro-cyclical), then γ>0 since the budget balance (budget deficit) ratio increases (decreases). Given that the idea of the optimal solvency behaviour of governments facing volatile (or uncertain) income is to remain solvent in bad times, then positive values of γ (i.e., countercyclical budget balance to GDP ratio or deficit to GDP ratio) are consistent with the optimal solvency behaviour. The second necessary condition for the optimal solvency behaviour therefore requires a plot of γ against income volatility to depict a positive slope. We estimate γ from the following specification (which is analogous to the SECM specification in equation 2.8):

$$(2.16) \quad \Delta BBGDP_t = a_0 + \gamma * \Delta logGDP_t + a_1 * BBGDP_{t-1} + a_2 * logGDP_{t-1} + a_3 * t + \pi_t$$

where the a denotes the parameter estimates of the corresponding variables (and the constant term, a_0), $BBGDP$ denotes the budget balance to GDP ratio.

2.4 Description of variables and sources of data

For comparability of results (with Thornton 2008), empirical estimations in the present study, which involves two stages, are based on annual time series data for 37 developing countries over the period 1960 to 2004. In the first stage, coefficients of fiscal policy cyclicality are estimated for each country in the sample using government consumption and GDP variables as specified in equations (2.7), (2.8), and (2.14). Data on both variables were obtained from the Penn World Tables version 6.2 (PWT) in real laspeyre units with 2000 as the base year; data coverage for each country is reported with the regression output in the appendix. Alternate sources of data for these variables are the Government Finance Statistics (GFS) of the International Monetary Fund's (IMF) and the World Bank's World Development Indicators (WDI). However, coverage of government consumption data for sub-Saharan African countries is short in both sources, especially in the GFS, compared to the study period. It is noteworthy that, in several cases, data on sub-Saharan African countries are not very consistent across the different sources. For instance, as shown in tables A2.1(i) and (ii) of appendix A2, the correlation coefficients between data series from the PWT and WDI are not very consistent. This is especially the case for government consumption expenditure for which the correlation is below 90 percent in 16 out of 36 countries covered, with the correlation coefficients being negative in two countries. With regards to GDP, correlation coefficients below 90 percent are observed in 6 countries. Therefore, we do not expand our data with those from different sources even where this is possible. Combining data (especially on government consumption) from different sources may result in biased estimates of the procyclicality coefficient.

In the second stage of the analysis, variations in the cyclicality of fiscal policy are explained using variables such as GDP volatility, GDP per capita, the Gini coefficient, aid to GDP ratio, and gama (i.e., γ, which captures the extent to which optimal solvency behaviour is satisfied by fiscal authories in a given country). GDP volatility is obtained as the standard error of the de-trended real logarithmic GDP in international dollars, derived from the PWT. Aid is defined as official development assistance and the budget balance as the difference between revenues including aid on one hand, and expenditures and lending minus repayments on the other hand; for both variables, available data for the sample period is obtained as official development assistance from the African development Indicator (ADI) online data base of the World Bank, first transformed into ratios of GDP and then into annual averages. The aid data is only available from 1970. We however expect an average (as a share of GDP) between 1970 and 2004 to be indicative of the average for the relevant sample period. The budget balance data is hardly available before 1980 but this is not very problematic because it is not included in the objective regressions. Annual averages of Gini coefficients are computed from available WDI data over the sample period. Gama, γ, is estimated in the present study as explained in section (2.3.2). In the estimation of gama (which involves budget balance and GDP), availability of the budget balance data determines the sample size used for each country, and for reason relating to the availability of the budget balance data, a period between 1980 and 2004 was maintained. The estimates are summarised in table A2.4 of the appendix.

Variables used as instruments for GDP volatility are external debt to GDP ratio, population size and inflation rate. Data on all three instruments were obtained from the ADI online database of the World Bank. To control for democracy, *polity2* indices

were obtained from the Polity IV Project database; available indices for the sample period were averaged for each country. A *polity2* index nets a country's scores on autocracy and democracy indices and is increasing in the level of democracy on a scale of -10 to 10. For data on corruption, the study averages biennial corruption indices available between 1996 and 2000 from Kaufman, Kraay and Mastruzzi (2004). The indices aggregate a country's score on different governance indicators and are decreasing in the extent of corruption on a scale of -2.5 to 2.5.

Finally, consequences of data limitations were as follows: Liberia was excluded from the second stage of the analysis because its GDP series reported in PWT did not seem to be consistent. For instance, the change in Liberia's GDP between 1992 and 1997 was more than 100%. GDP then fell by about 80% in 1998. This has a significant bearing on the measure of GDP volatility for Liberia. Also, since the ADI online source reported no aid data on Namibia over the study period, it was considered reasonable to drop Namibia from regressions that include aid.

2.5 Empirical results

2.5.1 Stage I results: Estimating cyclicality of government consumption

This section discusses the empirical results on the first stage of the analysis, which is to estimate the response of government consumption to a percentage change in GDP. As explained in section (2.3.1), the analysis essentially begins with the investigation of the time series properties of the government consumption and GDP variables to determine whether the empirical specifications employed are stationary.

The results, as summarised in table 2.1(i) and (ii), shows that in levels government consumption and GDP series are predominantly non-stationary with an order of integration of one (meaning that their first differences are stationary), though

Table 2.1 Stationarity properties of variables

2.1(i) Benin – Malawi

	STATIONARITY OF VARIABLES		
COUNTRY	Gov_{lasp}	GDP_{lasp}	LR residual
Benin	I(1)	I(1)	I(0)
Botswana	I(1)	I(0)	I(0)
		I(0)+trend**	
Burkina Faso	I(1)	I(1)	I(0)
Burundi	I(0)+trend	I(1)	I(0)
Cameroun	I(0)+trend	I(1)	I(0)
		I(0)+trend*	
Cent. Afr. Rep	I(1)	I(1)	I(0)
Chad	I(1)	I(1)	I(0)
Congo, Rep. Of	I(1)	I(1)	I(0)
Cote D'Ivoire	I(1)	I(1)	I(0)
Equitorial Guinea	I(1)	I(1)	I(0)
Ethiopia	I(1)	I(1)	I(0)
		I(0)+trend**	
Gabon	I(1)	I(1)	I(0)
Gambia	I(1)	I(1)	I(0)
Ghana	I(0)+trend	I(0)+trend	I(0)
Guinea Bissau	I(1)	I(0)+trend	I(0)
Kenya	I(1)	I(1)	I(0)
Lesotho	I(1)	I(1)	I(0)
Liberia	I(1)	I(1)	I(0)
Madagascar	I(1)	I(1)	I(0)
Malawi	I(0)+trend	I(1)	I(0)

* and ** indicate significance at the 10% and 5% levels respectively. Those with no stars are significant at the 1% level.

2.1(ii) Mali – Zimbabwe

STATIONARITY OF VARIABLES			
COUNTRY	Gov_{lasp}	GDP_{lasp}	LR residual
Mali	I(1)	I(1)	I(0)
Mauritania	I(1)	I(1)	I(0)
Mauritius	I(1)	I(0)+trend	I(0)
Mozambique	I(1)	I(1)	I(0)
Namibia	I(0)+trend**	I(0)+trend	I(0)
Niger	I(1)	I(1)	I(0)
Nigeria	I(1)	I(1)	I(0)
Rwanda	I(1)	I(1)	I(0)
		I(0)+trend**	
Senegal	I(1)	I(1)	I(0)
Sierra Leone	I(0)	I(1)	I(0)
Somalia	I(1)	I(1)	I(0)
	I(0)+trend*		
Swaziland	I(1)	I(1)	I(0)
Tanzania	I(1)	I(1)	I(0)
		I(0)**	
Togo	I(1)	I(1)	I(0)
Uganda	I(1)	I(1)	I(0)
Zambia	I(1)	I(1)	I(0)
Zimbabwe	I(1)	I(1)	I(0)

* and ** indicate significance at the 10% and 5% levels respectively. Those with no stars are significant at the 1% level.

stationary around the trend in a few instances. The only exceptions are the GDP series for Botswana and Togo, and the government consumption series for Sierra Leone which emerge stationary in levels.[13] On the other hand, all the residuals from the long-run estimation of the Hendry (1997) dynamic specification ($\overline{\omega}_t$ in equation 2.12) were

[13] Where combinations are I(1), I(0), and I(0), cointegration must not be possible. However, we still use the SECM specification because the adjustment coefficient (table A2.3) suggests that there is cointegration. Thus, the ADF test may be less indicative.

stationary implying that the two series in question are cointegrated for all the sample countries. It follows then that the empirical specification employed in Thornton (2008), as specified in equation (2.7) and labelled MEANREV in the present study, is not stationary because it combines stationary variables (first differences) with a non-stationary variable (the lag of government consumption in levels). On the other hand, the specification proposed in the present study, as specified in equations (2.8) and (2.14) and labelled SECM is stationary. The latter is because the lags of government consumption and GDP levels form a stationary (long-run equilibrium) relationship when both are included in the specification.

The estimates of the beta parameter, which measures the response of government consumption to a percentage change in GDP, are summarised in table 2.2. Columns 1 and 2 show estimates from SECM and MEANREV specifications respectively, while column 3 reports estimates from Thornton (2008). Results from the different specifications enable us to determine whether the beta estimates are affected when the time series properties of the variables are not (thoroughly) accounted for. We find that the beta coefficients estimated from both specifications are similar though the SECM estimates are predominantly larger.[14] As reported in table A2.2 of the appendix, the correlation between SECM and MEANREV estimates is about 93 percent. Even though MEANREV and THORN (the actual estimates obtained by Thornton (2008) for the same sample covered in the present study) are based on the same empirical specification (equation 2.7), the latter estimates are different from the former with a

[14] SECM has larger (absolute) magnitude in 27 out of 37 countries.

Table 2.2 Coefficients of fiscal policy cyclicality

COUNTRY	SECM	MEANREV	THORN
(1) BENIN	1.5772	1.3663	1.2864
(2) BOTSWANA	0.2858	0.0127	0.7808
(3) BURK. FASO	0.7525	0.3881	1.4944
(4) BURUNDI	0.6946	0.9401	1.0217
(5) CAMEROUN	0.809	0.7902	0.8683
(6) CENT.AFR. REP.	-0.9985	-0.428	0.8403
(7) CHAD	0.5939	0.4608	0.6761
(8) CONGO REP OF	1.0912	1.1012	0.0075
(9) COTE D'IV.	1.344	1.3526	1.2868
(10) EQU. GUINEA	1.1218	1.0632	1.0233
(11) ETHIOPIA	0.2167	0.1658	0.3113
(12) GABON	0.7733	0.7371	0.6844
(13) GAMBIA	-0.7625	-0.4654	1.3494
(14) GHANA	0.168	0.181	0.7305
(15) G. BISSAU	1.0011	0.9008	1.0275
(16) KENYA	-0.1952	-0.1031	0.6054
(17) LESOTHO	0.7987	0.5838	0.7777
(18) LIBERIA	0.8953	0.9355	0.9025
(19) MADAGASCAR	1.2713	1.2005	1.2917
(20) MALAWI	1.2592	0.9428	0.2994
(21) MALI	0.4199	0.3365	0.5231
(22) MAURITANIA	1.1437	1.4891	1.6934
(23) MAURITIUS	0.8808	0.5374	0.8899
(24) MOZAMBIQUE	1.2144	1.6074	1.6532
(25) NAMIBIA	0.5668	0.2987	0.3837
(26) NIGER	0.6798	0.4491	0.6874
(27) NIGERIA	0.7854	0.8975	0.6755
(28) RWANDA	1.1174	1.0556	1.0276
(29) SENEGAL	0.5092	0.3294	1.1442
(30) S. LEONE	1.0292	1.3837	1.0432
(31) SOMALIA	1.1146	0.9779	1.0396
(32) SWAZILAND	0.0906	0.009	0.9367
(33) TANZANIA	2.0138	1.8617	1.5211
(34) TOGO	0.9319	0.8898	0.8954
(35) UGANDA	0.8375	0.8926	0.9793
(36) ZAMBIA	0.5763	0.3653	0.4122
(37) ZIMBABWE	-0.4053	-0.3443	-0.1729

correlation of about 54 percent. Also, the correlation between THORN and SECM is 46 percent. This suggests that the underlying data employed in the two studies are different. The difference may have resulted from the fact that different data sources (namely, the WDI and PWT) were combined to expand the government consumption variable in Thornton (2008). As pointed out in the previous section (2.4), however, data on sub-Saharan African countries obtained from different sources are usually inconsistent. The present study therefore uses only government consumption data available in PWT.

Generally, the beta estimates in table 2.2, as well as the corresponding graphical representation in figure A2.1 of the appendix, show that, in accordance with the literature, the developing countries in the sample are predominantly procyclical (defined as positive beta coefficient) in the response of government consumption to output fluctuations. The only exceptions are Central African Republic, the Gambia, and Zimbabwe where government consumption appears to respond countercyclically to the business cycle. While the study proceeds to stage II of the analysis using the SECM estimates, results based on MEANREV are also reported in the appendix. The full regression output for estimating the SECM is reported in table A2.3 of the appendix.

2.5.2 Stage II results: Explaining variation in cyclicality of government Consumption

The first objective addressed in this stage of the analysis is whether the explanation given in Thornton (2008) for the variation in fiscal policy pro-cyclicality across SSA countries changes with our improved estimates of the pro-cyclicality coefficient. The baseline estimations therefore consist of the explanatory variables suggested in Thornton (2008). The results are summarized in columns 1 to 3 of table 2.3. We find that, consistent with the evidence in Thornton (2008), pro-cyclicality of fiscal policy is significantly lower in countries with higher income inequality (social fragmentation) and those that are more dependent on aid. Thus, social fragmentation (associated with income inequality) inhibits fiscal spending on social programs that are countercyclical in nature, and also higher aid to GDP ratios are associated with countries that face incomplete access to credit markets and therefore spend less during economic downturns.

Also, consistent with Thornton (2008), we find that the initial GDP per capita is not significant, suggesting that the initial level of development of a country does not affect the cyclicality of fiscal policy significantly, *ceteris paribus*. Our results however contrasts Thornton's in that the latter finds the initial GDP per capita to have a significant increasing effect on the pro-cyclicality of fiscal policy when corruption and democracy are controlled for. Also in contrast is that we find no significant effect of democracy and corruption on the pro-cyclicality of fiscal policy while Thornton finds both effects to be significantly negative; on the other hand, Alesina and Tabellini (2005) find both effects to be significantly positive. As shown in appendix A2.4, these results do not change qualitatively when MEANREV (rather than SECM) beta

coefficients are used. The only exception is initial GDP per capita which becomes statistically significant. This is not surprising, and is an indication that the beta coefficients are underestimated when the response of government consumption to its long term deviation from GDP is not accounted for (as is the case with MEANREV) – it is this unaccounted effect that is being captured by the initial per capita GDP in the second stage.

Table 2.3 Explaining the variation in fiscal policy cyclicality across countries – OLS estimations

DEPENDENT VARIABLE: PRO-CYCLICALITY COEFFICIENT (BETA COEFFICIENT)							
	OLS_1	**OLS _2**	**OLS _3**	**OLS _4**	**OLS_5**	**OLS _6**	**OLS _7**
GINI	-0.025*	-0.025*	-0.025*	-0.033**	-0.033**	-0.031**	-0.031**
.	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
AIDGDP	0.021***	0.021***	0.021***	0.022***	0.022***	0.022***	0.022***
.	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
GDPinitial	0.483	0.502	0.496	0.443	0.428	0.483	0.471
.	(0.292)	(0.298)	(0.293)	(0.272)	(0.286)	(0.288)	(0.291)
CORR	-0.044	.	0.034	0.214	0.122	.	.
.	(0.166)	.	(0.183)	(0.203)	(0.182)	.	.
DEM	.	-0.014	-0.017	-0.019	.	-0.005	.
.	.	(0.028)	(0.032)	(0.032)	.	(0.028)	.
VOL	.	.	.	0.565**	0.557**	0.474**	0.486**
.	.	.	.	(0.257)	(0.248)	(0.214)	(0.206)
CONST	0.091	0.004	0.041	0.211	0.266	-0.016	0.042
.	(0.941)	(0.935)	(0.960)	(0.953)	(0.966)	(0.949)	(0.950)
R2	0.222	0.229	0.230	0.320	0.310	0.303	0.302
N	36	36	36	36	36	36	36

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively.

The next objective is to investigate the effect of GDP volatility on pro-cyclical fiscal policy in SSA. The result is shown in columns of 4 to 7 of table 2.3. We find that, in accordance with the existing literature, GDP volatility has a significant positive effect

on the pro-cyclicality of fiscal policy.[15]Our explanation however differs from the existing ones that are associated with credit constraint and political distortion. Specifically, our explanation is that when income is volatile and government bonds are mostly non-state-contingent (as is the case in SSA), it is prudent to set low and constant deficit ceiling in order to remain solvent during economic downturns. This leads to increased spending in good times and decreased spending in bad times.

Since the cyclicality of fiscal policy is also shown to affect output volatility (see Bardinger, 2008), the result might be misleading since OLS estimation could possibly be plagued with endogeneity bias. We therefore use instrumental variable (IV) techniques (that are robust to endogeneity bias) to check the robustness of the OLS results. The IV estimation output reported in table 2.4 show that the results do not change qualitatively; income volatility and aid to GDP ratio are significant with positive coefficients and the income distribution index is significant with a negative coefficient. Corruption, democracy and initial GDP per capita remain insignificant. The Sargan's test for instrument validity fails to reject the null hypothesis that the omitted instruments are not jointly significant, implying that our instrumental variables, namely population size, external debt to GDP ratio, and inflation rate, are valid. In what follows we provide additional evidence in support of the optimal solvency explanation we give for the positive effect of income volatility on the pro-cyclicality of fiscal policy.

[15] See, for instance, Lane (2003) and Talvi and Vegh (2000).

Table 2.4 Explaining the variation in fiscal policy cyclicality across countries – IV estimations

DEPENDENT VARIABLE: PRO-CYCLICALITY COEFFICIENT				
	IV_1	**IV_2**	**IV_3**	**IV_4**
GINI	-0.043***	-0.040***	-0.035***	-0.035***
.	(0.014)	(0.014)	(0.013)	(0.013)
AIDGDP	0.028***	0.027***	0.022***	0.022***
.	(0.009)	(0.008)	(0.007)	(0.007)
GDPinitial	0.305	0.263	0.134	0.142
.	(0.311)	(0.308)	(0.270)	(0.285)
CORR	0.394	0.193	.	.
.	(0.254)	(0.217)	.	.
DEM	-0.036	.	-0.015	.
	(0.028)	.	(0.028)	.
VOL	1.236**	1.050*	0.630*	0.639*
.	(0.586)	(0.562)	(0.375)	(0.356)
CONST	-1.43	-1.024	0.187	0.147
.	(3.441)	(3.372)	(2.966)	(3.094)
R2	0.332	0.335	0.358	0.35
N	35	35	35	35
Sargan chi-square (2) = 0.0604; P-value = 0.739				

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively. The instruments for VOL are population, external debt to GDP ratio, and inflation rate. The Sargan's test statistic fails to reject the null hypothesis that the instruments are valid.

Necessary conditions for the optimal solvency behaviour

The two necessary conditions that are predicted by the underlying optimal solvency model of the present study are that governments facing higher income volatility set lower and less pro-cyclical budget deficits when bonds (for financing the deficits) are non-state-contingent.

The plot of income volatility against the budget balance in figure 2.1 reveals a positive relationship (equivalent to a negative relationship between income volatility and the budget deficit), confirming the first necessary condition. To investigate the second necessary condition, we use a plot of income volatility against gama (γ). Gama

measures the response of the budget balance-to-GDP ratio to a percentage change in GDP. Since the idea of the optimal solvency behaviour is to remain solvent in bad times, positive values of gama (suggesting decreases or less than proportionate increase in government deficit, or constant deficit, as GDP increases) are consistent with this behaviour.[16]The regression output for the estimation of gama is reported in table A2.5 of the appendix.[17] The plot of income volatility against gama, shown in figure 2.2 reveals a positive relationship, suggesting that the optimal solvency behaviour is more profound in countries with higher income volatility. The second necessary condition for the optimal solvency behaviour is therefore met. The latter does not support the credit constraint and political distortion explanations; in sharp contrast, they are inconsistent with a positive relationship between income volatility and gama by suggesting that constrained borrowing in bad times ($\gamma<0$) and not saving enough in good times ($\gamma<0$), explain why income volatility induces pro-cyclical fiscal spending.

By contrasting the political distortion and credit constraint explanations, we do not imply that precautionary saving in good times and unconstrained spending in bad times do not result in pro-cyclical fiscal spending. Rather, we imply that they do not explain the effect of income volatility on pro-cyclical spending in our sample. In most SSA countries, partly due to low tax capacity and pressing spending demands, saving in

[16] Proportionate (or more than proportionate increase) in government deficit as GDP increases could render the government insolvent if the maturity of the extra non-state-contingent bonds coincide with bad times.

[17] Conclusions based on gama must be treated with caution because most of the estimates were not statistically significant. We use them nonetheless because they are merely correlation coefficients and not structural estimates.

Figure 2.1 GDP volatility and the budget balance

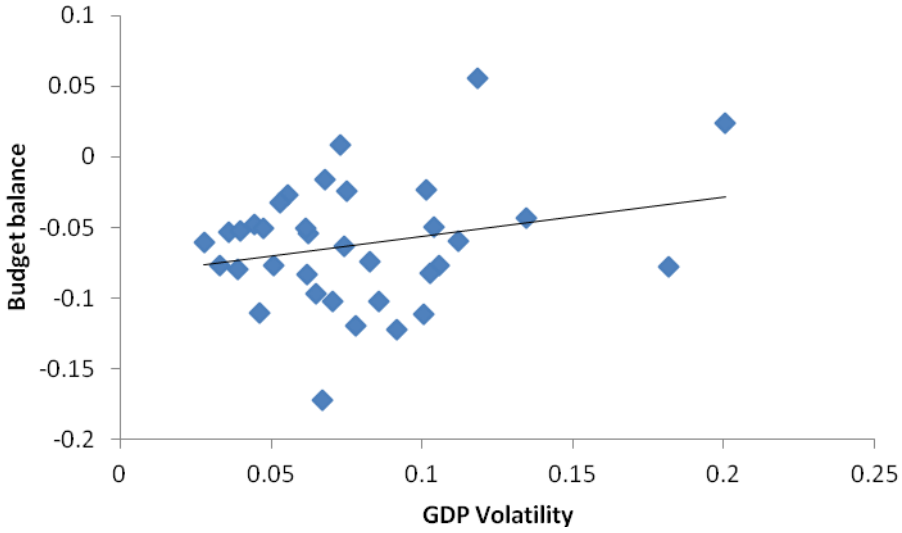
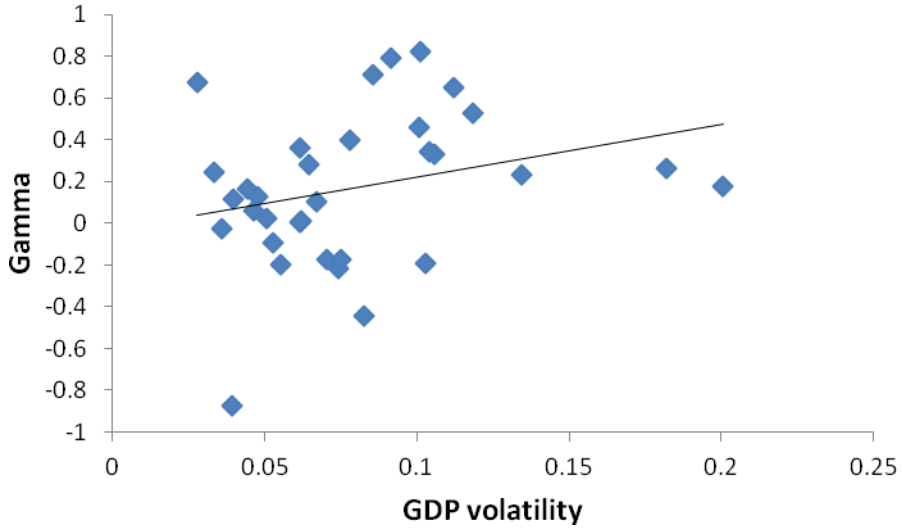


Figure 2.2 GDP volatility and gama



NB: Gama is the response of budget balance-to-GDP ratio to a percentage change in GDP.

good times is more like incurring lower deficits rather than accumulating surpluses. Thus, the precautionary role of saving hardly exists. Also, while credit availability in bad times may cause fiscal policy to be less pro-cyclical, spending would generally be more pro-cyclical among countries with higher volatility as a result of optimal

solvency behaviour. Therefore, access to state-contingent bonds and policies that stabilize GDP are required to break the vicious cycle that exists between income volatility and the pro-cyclicality of fiscal policy.

2.6. CONCLUSION

The present study seeks to explain the cyclicality of fiscal policy in SSA using time series data on 37 countries in the region over the period 1960 to 2004. The analysis comprises two stages. In the first stage, coefficients of fiscal policy cyclicality are obtained for each country in the sample using more consistent data and time series specification that is stationary; We compare these coefficients with those estimated by Thornton (2008) from a non-stationary specification and the same sample. Our results show that, with the exception of Central African Republic, The Gambia, Kenya and Zimbabwe, all the countries in the sample pursue pro-cyclical fiscal policy; Thornton however finds fiscal policy in Gambia to be pro-cyclical. The correlation between Thornton's estimates of the fiscal policy cyclicality coefficient and those based on our proposed specification (which thoroughly accounts for the time series properties of the variables involved) is low (46%). The difference in results is more likely to be associated with difference in the underlying data employed in the two studies than it is to the extent of accounting for the time series properties of the variables. This is because estimates of fiscal policy cyclicality coefficients from the present study that are based on Thornton's specification have a low correlation (of 54%) with Thornton's estimates by are highly correlated (at 93%) with estimates from our proposed specification. The latter observation does not imply that accounting for the time series properties of the variables does not affect the estimates of the fiscal policy cyclicality

coefficients; our estimates from Thornton's specification were predominantly lower (27 out of 37 countries).

The second stage of the analysis addresses the variation in the cyclicality of fiscal policy across countries. Two main objectives are addressed at this stage: the first is to investigate whether the explanation given in Thornton (2008) for pro-cyclical fiscal policy changes with improved estimates of the pro-cyclicality coefficients. The second objective addressed in stage 2 of the analysis is to investigate and explain the effect of income volatility on pro-cyclical fiscal policy. We use OLS and instrumental variable estimation methods. The latter is employed to reduce the effect of possible endogeneity bias on the (relatively efficient) OLS estimates. The results are robust across both estimation methods. Specifically, we find that – in line with Thornton (2008) – fiscal policy is less pro-cyclical in countries with higher income inequality and those that are less dependent on aid. The explanation for the former is that social fragmentation (higher income inequality) discourages spending on social programs that are pro-cyclical in nature; the explanation for the latter finding is that imperfect access to international credit markets (captured by aid dependence) leads to reduced spending in bad times, contributing to pro-cyclical fiscal policy in SSA. Unlike Thornton, however, we do not find any significant impact of corruption and the degree of democracy on the pro-cyclicality of fiscal policy. While Thornton finds fiscal policy to be more pro-cyclical in countries with less corruption and democracy, Alesina and Tabellini (2005) find the opposite to be true; our finding, however, is in disagreement with both. Also, in contrast to Thornton, we find robust evidence that the initial level of development of a country has no significant influence on the pro-cyclicality of fiscal policy. It is noteworthy that the main results do not change qualitatively when pro-

cyclicality coefficients estimated from Thornton's non-stationary specification are used. The only exception is that initial GDP per capita becomes statistically significant. The latter nonetheless suggests a bias in the estimated pro-cyclicality coefficients when a non-stationary specification is used.

With regards to the second objective of stage 2, we find that – in line with existing evidence – pro-cyclicality of fiscal policy increases with output volatility. Even though there is consensus on the latter finding, the underlying explanation has varied across different studies. Existing explanations can be categorised into the credit constraint argument (whereby access to international credit markets in bad times is imperfect) and the political distortion argument (whereby different social groups pressurize fiscal authorities to spend more in good times). In contrast with the existing explanations, however, the present study shows that the increasing effect of GDP volatility on the pro-cyclicality of fiscal policy is the result of optimal solvency behaviour of fiscal authorities that are faced with imperfect risk sharing (associated with the fact that government bonds in most SSA countries are non-state-contingent).

Knowing the underlying cause of the effect of GDP volatility on the pro-cyclicality of fiscal policy is relevant for policy purposes. For instance, the credit constraint explanation suggests that fiscal policy would be less pro-cyclical in developing countries if the accessibility of international credit markets in bad times is improved. The political distortion explanation also suggests the need for improved institutions to safeguard against increased spending in good times (associated with political pressures). While we agree with these recommendations, we do not agree that implementing them will diminish the increasing effect of income volatility on pro-

cyclicality of fiscal policy. Our finding suggests that fiscal policy would be less pro-cyclical in volatile economies if fiscal authorities have access to state contingent bonds. In spite of the different policy recommendations, all three explanations recognize that efforts at reducing the volatility of GDP would induce less pro-cyclical fiscal policy.

APPENDIX A2

Table A2.1 Correlation between PWT and WDI series

A2.1(i) Benin - Malawi

	CORRELATION COEFFICIENTS	
	Gov	GDP
Benin	0.810	0.992
Botswana	0.996	0.997
Burkina Faso	0.983	0.992
Burundi	0.884	0.994
Cameroun	0.968	0.989
Cent. Afr. Rep	1.000	0.938
Chad	-0.197	0.970
Congo, Rep. Of	0.982	0.970
Cote D'Ivoire	0.976	0.974
Equitorial Guinea	0.930	0.977
Ethiopia	0.810	0.882
Gabon	0.913	0.955
Gambia	0.857	0.988
Ghana	0.996	0.835
Guinea Bissau	0.568	0.893
Kenya	0.998	0.983
Lesotho	0.999	0.993
Liberia	-	0.995
Madagascar	0.789	0.987
Malawi	0.915	0.989

Gov denotes government expenditure.

A2.1 continued

A2.1(ii) Mali - Zimbabwe

	CORRELATION COEFFICIENTS	
COUNTRY	Gov	GDP
Mali	0.882	0.977
Mauritania	0.845	0.969
Mauritius	0.999	0.999
Mozambique	0.979	0.977
Namibia	0.997	0.974
Niger	0.573	0.850
Nigeria	0.710	0.983
Rwanda	0.970	0.994
Senegal	0.967	0.993
Sierra Leone	0.094	0.848
Somalia	0.114	0.746
Swaziland	0.811	0.989
Tanzania	-0.221	0.948
Togo	0.982	0.973
Uganda	0.991	0.996
Zambia	0.864	0.956
Zimbabwe	0.975	0.984

Gov denotes government expenditure.

Table A2.2

Correlation between beta estimates from different methods

	SECM	MEANREV	THORN
SECM	1		
MEANREV	0.927	1	
THORN	0.458	0.540	1

Figure A2.1

Distribution of fiscal policy cyclicality coefficients for 37 developing countries in Africa

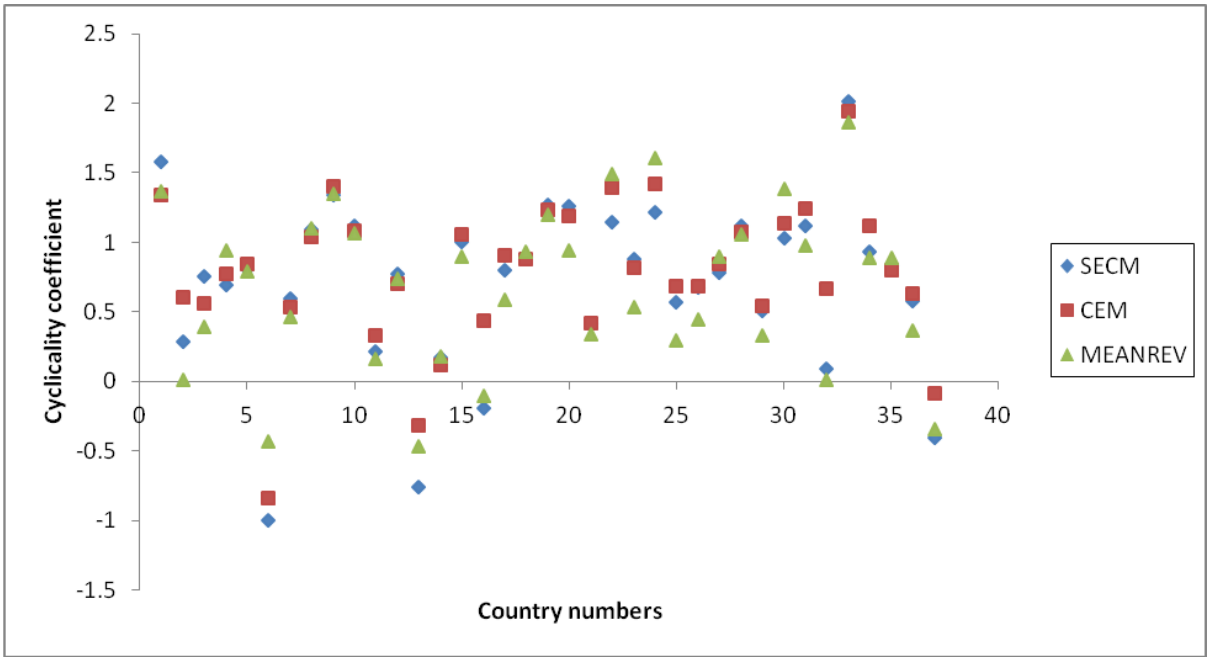


Table A2.3 Single equation equilibrium-correction (SECM) estimation of the cyclicality coefficients for government consumption

(1960 – 2004)

(i) BENIN - LIBERIA

	Period	$\Delta \log Y_t$		$\log G_{t-1}$		$\log Y_{t-1}$		R^2
BENIN	1960-2002	1.577***	(0.481)	-0.378***	(0.133)	0.342***	(0.124)	0.320
BOTSWANA	1970-2004	0.286	(0.265)	-0.259*	(0.127)	0.322*	(0.165)	0.274
BURK. FASO	1960-2004	0.753	(0.546)	-0.123	(0.093)	0.159	(0.157)	0.098
BURUNDI	1960-2003	0.695***	(0.158)	-0.228***	(0.051)	0.086	(0.083)	0.699
CAMEROUN	1960-2003	0.809***	(0.130)	-0.148**	(0.069)	0.116**	(0.057)	0.543
CENT.AFR.REP.	1970-2003	-0.999	(0.776)	-0.087	(0.147)	-0.473	(0.349)	0.096
CHAD	1960-2003	0.594***	(0.215)	-0.291*	(0.144)	0.311	(0.196)	0.255
CONGO REP. OF	1960-2003	1.091***	(0.130)	-0.491***	(0.112)	0.461***	(0.109)	0.742
COTE D'IV.	1960-2003	1.344***	(0.261)	-0.117*	(0.065)	0.094	(0.068)	0.550
EQU. GUINEA	1960-2003	1.122***	(0.172)	-0.192**	(0.091)	0.092	(0.099)	0.615
ETHIOPIA	1960-2003	0.217	(0.260)	-0.350***	(0.113)	0.534***	(0.168)	0.315
GABON	1960-2004	0.773***	(0.232)	-0.248**	(0.122)	0.312**	(0.137)	0.534
GAMBIA	1960-2003	-0.763**	(0.327)	-0.226**	(0.099)	-0.527	(0.312)	0.252
GHANA	1965-2002	0.168	(0.222)	-0.585***	(0.206)	-0.258	(0.154)	0.468
G. BISSAU	1960-2003	1.001***	(0.165)	-0.273**	(0.117)	0.263*	(0.146)	0.575
KENYA	1960-2003	-0.195	(0.316)	-0.102*	(0.058)	0.135	(0.104)	0.166
LESOTHO	1960-2003	0.799***	(0.263)	-0.281**	(0.136)	0.406*	(0.201)	0.257
LIBERIA	1970-2003	0.895***	(0.093)	-0.083	(0.112)	0.074	(0.132)	0.882

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively. The dependent variable is change in the logarithm of government consumption. The coefficients of $\Delta \log Y_t$ are the measures of the pro-cyclicality of government consumption. Y and G represent GDP and government consumption respectively.

Continuation of table A2.3

(ii) MADAGASCAR - ZIMBABWE

	Period	$\Delta logY_t$		$logG_{t-1}$		$logY_{t-1}$		R^2
MADAGASCAR	1960-2004	1.271***	(0.373)	-0.113	(0.099)	0.142	(0.098)	0.297
MALAWI	1960-2004	1.259***	(0.307)	-0.845***	(0.220)	1.006***	(0.259)	0.531
MALI	1960-2004	0.420	(0.306)	-0.317***	(0.113)	-0.372	(0.261)	0.206
MAURITANIA	1970-2003	1.144***	(0.360)	-0.238**	(0.099)	0.191*	(0.098)	0.544
MAURITIUS	1960-2004	0.881***	(0.206)	-0.101	(0.064)	0.092	(0.068)	0.404
MOZAMBIQUE	1960-2003	1.214***	(0.308)	-0.739***	(0.190)	1.006***	(0.264)	0.608
NAMIBIA	1970-2003	0.567**	(0.257)	-0.475*	(0.239)	0.503*	(0.265)	0.308
NIGER	1960-2004	0.680***	(0.185)	-0.158	(0.132)	0.088	(0.114)	0.346
NIGERIA	1960-2004	0.785**	(0.361)	-0.176*	(0.090)	0.020	(0.085)	0.287
RWANDA	1960-2003	1.117***	(0.184)	-0.352***	(0.104)	0.688***	(0.205)	0.587
SENEGAL	1960-2003	0.509***	(0.176)	-0.230**	(0.102)	0.259**	(0.114)	0.334
S. LEONE	1970-2003	1.029***	(0.337)	-0.475***	(0.146)	-0.248	(0.168)	0.558
SOMALIA	1970-2004	1.115***	(0.176)	-0.443***	(0.154)	0.413**	(0.185)	0.661
SWAZILAND	1970-2004	0.091	(0.521)	-0.419**	(0.174)	0.336**	(0.155)	0.220
TANZANIA	1960-2003	2.014***	(0.135)	-0.373***	(0.108)	0.632***	(0.179)	0.874
TOGO	1960-2004	0.932***	(0.286)	-0.170**	(0.070)	0.350**	(0.146)	0.473
UGANDA	1960-2003	0.838***	(0.135)	-0.286**	(0.118)	0.256**	(0.123)	0.640
ZAMBIA	1960-2003	0.576*	(0.328)	-0.381***	(0.134)	0.447*	(0.243)	0.279
ZIMBABWE	1965-2002	-0.405	(0.335)	0.018	(0.092)	-0.244	(0.201)	0.210

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively. The dependent variable is change in the logarithm of government consumption. The coefficients of $\Delta logY_t$ are the measures of the pro-cyclicality of government consumption. Y and G represent GDP and government consumption respectively.

A2.4 Explaining the variation in fiscal policy cyclicality across countries: using MEANREV cyclicality coefficients

DEPENDENT VARIABLE: PRO-CYCLICALITY COEFFICIENT (MEANREV)			
.	**OLS_1**	**OLS_2**	**OLS_3**
GINI	-0.023**	-0.023**	-0.022**
.	(0.01)	(0.01)	(0.01)
AIDGDP	0.025***	0.025***	0.025***
.	(0.008)	(0.008)	(0.008)
GDPinitial	0.519**	0.523**	0.538**
.	(0.252)	(0.255)	(0.251)
CORR	-0.197	.	-0.085
.	(0.145)	.	(0.198)
DEM	.	-0.031	-0.024
.	.	(0.021)	(0.029)
CONST	-0.327	-0.306	-0.398
.	(0.804)	(0.865)	(0.841)
R2	0.295	0.309	0.312
N	36	36	36

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively.

Table A2.5 Estimating gama – the response of the budget balance-to-GDP ratio to a percentage change in GDP (1980 – 2004)

	$\Delta \log Y_t$		ECM_{t-1}		R^2
BENIN	0.166	(0.309)	-0.608*	(0.294)	0.476
BOTSWANA	0.526*	(0.260)	-0.887***	(0.214)	0.621
BURK. FASO	0.026	(0.174)	-1.005***	(0.289)	0.549
BURUNDI	0.332	(0.226)	-0.677**	(0.270)	0.582
CAMEROUN	0.824**	(0.356)	-0.616***	(0.214)	0.344
CENT.AFR.REP.	.	.	.	.	.
CHAD	0.284	(0.172)	-0.581**	(0.222)	0.472
CONGO REP. OF	0.264	(0.240)	-0.746**	(0.257)	0.423
COTE D'IV.	0.651**	(0.250)	-0.393	(0.226)	0.377
EQU. GUINEA	0.179	(0.098)	-1.066	(0.601)	0.605
ETHIOPIA	-0.027	(0.106)	-0.707***	(0.219)	0.365
GABON	0.792***	(0.267)	-0.623**	(0.242)	0.463
GAMBIA	0.013	(0.197)	-0.487**	(0.210)	0.471
GHANA	0.678	(0.400)	-0.461	(0.378)	0.469
G. BISSAU	0.106	(0.307)	-0.427**	(0.164)	0.606
KENYA	-0.196	(0.517)	-1.068***	(0.261)	0.544
LESOTHO	-0.218	(0.499)	-0.347**	(0.157)	0.186
LIBERIA	.	.	.	.	.
MADAGASCAR	0.116	(0.306)	-0.490*	(0.261)	0.471
MALAWI	0.4	(0.274)	-0.577*	(0.303)	0.598
MALI	0.062	(0.369)	-0.272*	(0.146)	0.207
MAURITANIA	-0.871*	(0.473)	-0.726**	(0.279)	0.504
MAURITIUS	0.364	(0.281)	-0.12	(0.197)	0.115
MOZAMBIQUE	-0.173	(0.130)	-0.483**	(0.174)	0.347
NAMIBIA	0.006	(0.214)	-0.215	(0.203)	0.065
NIGER	-0.442***	(0.146)	-0.812***	(0.229)	0.607
NIGERIA	.	.	.	.	.
RWANDA	0.235***	(0.063)	-1.240***	(0.304)	0.772
SENEGAL	-0.095	(0.226)	-0.838***	(0.268)	0.425
S. LEONE	0.461	(0.274)	-0.632**	(0.255)	0.454
SOMALIA	.	.	.	.	.
SWAZILAND	-0.171	(0.243)	-0.905***	(0.224)	0.653
TANZANIA	0.126	(0.140)	-0.386	(0.306)	0.577
TOGO	0.344	(0.225)	-0.573**	(0.210)	0.362
UGANDA	0.245	(0.253)	-0.703***	(0.233)	0.393
ZAMBIA	0.713	(0.453)	-0.738	(0.489)	0.526
ZIMBABWE	-0.194	(0.198)	-0.778***	(0.226)	0.389

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively. The dependent variable is the change in budget balance to GDP ratio. Gamma refers to the coefficient of $\Delta \log Y_t$ and it measures the response of the budget balance-to-GDP ratio to GDP. Y and ECM represent GDP and the equilibrium-correction component respectively.

CHAPTER 3

DEVELOPMENT AID AND THE BUDGET BALANCE IN SUB-SAHARAN AFRICA: THE INCENTIVE EFFECT OF AID REVISITED

3.1 Introduction

A common feature of low income economies, especially in Africa, is the over-reliance on only a few traditional agricultural commodities as a major source of employment and income. The dependence of agriculture on uncertain weather combined with the lack of diversification in agricultural production makes such economies highly risk prone. Yet, governments in low-income countries are faced with relatively high borrowing constraints, especially during economic downturns. Uncertainty about the future, combined with borrowing constraints, discourages capital accumulation and growth, and is likely to be more severe in countries with lower income. Given that foreign aid is a major source of foreign capital in Africa, where it averages about 12.5 percent of GDP and more than 92 percent of all net capital inflows (Pallage and Robe, 2001), it could serve as an important source of finance for relaxing the credit constraint and for smoothing revenue. Related to this debate is the response of aid inflows to the budget deficit; that is, giving more foreign aid to countries facing larger budget deficits (associated with lower tax capacities and pressing spending demands) may enhance growth. This is because large budget deficits may worsen credit constraint and capital accumulation, retarding growth as a result, and explains why critics of the World Bank and IMF have advocated against conditional aid policies that lay less emphasis on need-based disbursement.

The story however changes when we consider the incentive effects of aid. Basically, when larger budget deficits result in higher aid inflows, recipients may have the incentive not to prevent budget deficits, resulting in higher deficits (Svensson 1995, 2000). This is perceived as one of the reasons why need-based aid inflows have not been effective at promoting growth. Generally, for development aid to be more effective, aid contracts demand that recipient governments exert an agreed amount of effort towards structural reform measures, an example of which is the reduction of budget deficits. An implicit assumption of such aid programs is that although the outcome of the proposed structural reform is not certain, it increases the likelihood of a good economic outcome. Nonetheless, given that the reform measures may be costly, say politically, to the recipient governments in the short term, and that reform effort is not completely verifiable by donors, recipient governments may end up exerting lower reform effort and pursuing less productive but politically rewarding activities instead. Thus, a moral hazard problem arises between donors and recipients of development aid. It follows then that in order to encourage recipient governments to avoid deficits when budgetary activities are not completely verifiable, the disbursement of development aid needs to follow an incentive structure such that it would not be in the interest of recipients to run deficits. On the issue of incentive creation, Svensson (2000) shows that, conditioning aid disbursement on good outcomes would encourage recipient governments to exert higher reform effort in order to increase their chances of receiving more aid. Thus, successfully enforced conditional aid contracts hold the answer to the moral hazard problem between aid recipients and donors. Svensson (2000) however expands the aid incentive model to show that due to the altruism of donors, conditional aid contracts are difficult to enforce without a commitment technology. This is because, notwithstanding the contract, altruistic donors find it

optimal to give more aid to recipients with larger budget difficulties *ex post*. Anticipating this, recipients have the incentive not to avoid the deficits *ex ante*. Thus, even when conditional aid contracts are agreed, the moral hazard problem between aid donors and recipients may persist because such contracts are not time-consistent. Therefore, the fundamental idea of the Svensson (2000) aid incentive model is that, generally, larger budget deficits lead to higher aid inflows and aid induces larger budget deficits. To test this empirically, Svensson (1995) estimates the response of aid inflows to the budget balance of recipients, and the reverse effect from aid inflows to the budget balance. They do so using a system of simultaneous equations and a cross-continent sample of aid recipients from Africa, Asia, and Latin America between 1970 and 1989. They find that, consistent with their model prediction, donors respond to larger budget deficits of recipients by giving more aid and aid, so disbursed, induces larger budget deficits. Thus, aid has a negative effect on the development effort of recipient governments. This finding explains the effort of International Financial Institutions to commit aid donors to conditional aid contracts – i.e., the coordination of aid disbursement from different sources has been advocated for (Bulir and Hamann, 2003, 2005); many bilateral agencies are encouraged to strengthen their ties as well as delegate aid disbursement to the World Bank and the IMF (Svensson, 1995). It is noteworthy that eventhough aid conditionality typically refers to a broad range of policy conditions, it only refers to budget conditions in the context of the present study.

Given the relative importance of aid to sub-Saharan Africa recipients and later effort at coordinating and improving aid disbursement, a relevant contribution to the literature would be to re-examine the empirical test of Svensson (1995) separately for this

region, and to do so using more recent data. Therefore, the main objective of the present study is to re-examine the aid-budget deficit relationship, using data on a sample of 37 sub-Saharan African countries over the period of 1980 – 2004. We find that, in line with Svensson (1995), larger budget deficits attract higher aid inflows, and aid inflows induce larger budget deficits. An important finding, however, is that whereas the magnitude of the response of aid to the budget balance of African countries is similar to that of the cross-continent evidence (ibid), the magnitude of the negative effect of aid on the budget balance of African recipients is approximately half of what the cross-continent evidence suggests.[18] While this may be ascribed to recent effort to enforce conditional aid contracts, we find further evidence suggesting that the incentive effect of aid may be independent of what determines aid disbursement across countries. Investigating the latter is however beyond the present chapter.[19]

In general, our results show that aid donation to sub-Saharan African countries is predominantly for humanitarian or poverty alleviation objectives. For instance, in addition to responding to budget difficulties, aid inflows increase to recipient countries with lower levels of GDP and life expectancy rates as well as those with higher infant mortality rates. What we cannot say is that aid rewards recipient governments that exert higher development effort. This is because aid inflows neither increase significantly to recipient countries that avoid budget deficits nor those with higher growth rates.[20]

Following Svensson (1995), we apply both cross-sectional and panel techniques to a simultaneous system of equations for aid and the budget balance. Our cross-sectional

[18] Coefficients are compared in footnote 29 of result section 3.6.2.1.
[19] This constitutes the subject of the next chapter.
[20] This point assumes that high growth rate is the result of increased development effort.

approach is similar to Svensson's. With regards to the panel estimation, however, we use a different approach that enables us to increase our instrument validity by including lags of aid and the budget balance to our list of instruments without departing from the baseline equations for aid and the budget balance specified in Svensson (1995). Specifically, we treat the baseline equations as given and estimate each of them in a separate system of (two) equations. In each system, the baseline equation is the conditional equation while the second equation is the marginal equation. When the aid equation is the conditional equation, the budget balance equation is the marginal equation and vice versa. This approach enables us to improve upon the validity of our instruments by including the lags of aid and the budget balance only in the marginal equations while keeping the baseline specifications for the panel estimation free of these lags and comparable to our cross-section specification and to Svensson's cross-section and panel specifications. To see another importance of our panel approach, note that a time-invariant (or slow-changing variable) is likely to be as correlated with the lag of an autoregressive variable as it is contemporaneously with that variable. Therefore, if the lags of aid and the budget balance variables (that are potentially autoregressive) were to be included in the objective equations, the effect of time-invariant and slow-changing variables could be masked to an extent that depends on how autoregressive aid and budget balance are. With our panel approach, however, we are able to draw inferences on the role of time-invariant or slow-changing variables and, at the same time, take advantage of the lags of the dependent variables (aid and the budget balance) as additional identifying restrictions.

The study is organised as follows: In section 3.2, we review some literature to reveal major contrasting views on the effective determination of aid disbursement and how relevant the relationship between aid and fiscal policy (including the budget deficit) is in aid effectiveness studies. We then present the theoretical model that underlies the present chapter in section 3.3, and the empirical specifications used for estimating our results in section 3.4. The definition and sources of data are briefly discussed in section 3.5. Section 3.6 reports and discusses the empirical results, followed by a summary of the chapter in section 3.7.

3.2 Literature review I

3.2.1 Effectual determinant of aid disbursement: recipient's need or performance?

While there is consensus across studies that aid effectiveness depends on the objective for aid disbursement, the same cannot be said about what constitutes an effective objective for disbursement. A review of the literature on aid disbursement reveals two major schools of thought; those that support performance-motivated aid disbursement and those that support need-motivated aid disbursement. The former follows from incentive models of aid, while the latter is associated with the importance of income-smoothing and relaxing the budget constraint.

Income smoothing may have important welfare implications for low income countries. Pallage and Robe (2000) show that the welfare cost of business cycle fluctuation in low income countries is about 15 to 30 times that of the United States. They also show that while the most risk-averse representative consumer in the United States would

prefer 1% increase in growth to a complete wipe-out of income fluctuations, the opposite is true for a moderately risk-averse representative consumer in low income countries. Given that Pallage and Robe (2000) abstract from the effect of economic fluctuations on growth, their results may even be an underestimation of the true importance of income smoothing in low income countries. Regarding the importance of aid in smoothing income, Pallage et al (2007) find that, at least, three-quarters of the welfare cost of economic fluctuations could be prevented by a counter-cyclical disbursement. The latter however uses an inter-temporal utility maximisation model which assumes (on the basis of existing empirical evidence) that aid has no significant effect on growth; relaxing this assumption may yield different results. Generally, these findings suggest, in accordance with Bulir and Hamann (2003, 2005), that aid should be used as an insurance instrument by increasing disbursement when income falls.

Another line of argument in favour of using aid to smooth income is in relation to macroeconomic management in developing countries. Particularly, uncertainty associated with income volatility complicates macroeconomic policy and investment decisions, and may lead to weak growth (Lensink and Morrissey, 2000; Bulir and Hamann, 2003 and 2005). Also, the neoclassical and endogenous growth models suggest that increased saving rate leads to increased investment rate, resulting in higher growth rate. However, slow growth in low income countries implies that, even though the marginal propensity to save is high, growth is too slow to generate enough increase in income and savings (Burnside and Dollar, 2000). Therefore, aid could serve as an instrument for boosting capital investment and growth when used to relax the budget constraint facing low income governments.

On the contrary, studies that consider the incentive effect of aid suggest that disbursement should be tied to good policy or development effort (see for instance, Svensson 1995 and 2000; Cordella and Dell'Ariccia, 2007; Goldsbrough and Cheelo, 2007). The idea is that when aid disbursement is tied to improved performance, recipient governments are likely to exert more development effort in order to receive more aid. Svensson (2000) uses an aid incentive model comprising a representative donor and two recipients to show that, abstracting from information asymmetry, aid is best disbursement on the basis of need. However, when donor and recipient interests are different, and actions of the latter cannot be monitored, aid induces higher development effort when disbursement is conditioned on good outcome. Similarly, Cordella and Dell'Ariccia (2007) show that when donors cannot determine the level of commitment of a given recipient to development, it is best to impose higher levels of conditionality. Goldsbrough and Cheelo (2007) support the IMF's plan to give more aid on the basis of need and absorptive capacity, but only when recipients are committed to sound economic policies. While there is evidence that aid inflows are motivated by need, including fall in income and budget difficulties, our review of the literature reveals no evidence of performance-motivated aid disbursement (see, for instance, Svensson, 1995; Alesina and Dollar, 2000; Burnside and Dollar, 2003 and 2005). To add to the existing literature on the incentive implications of aid disbursement, the present study investigates the response of aid inflows to the budget balance of sub-Saharan African countries and what the incentive implications are for their budget balance. In what follows, we present further review of existing literature to establish the relevance of the budget balance in our aid incentive study.

3.2.2 Fiscal Policy as a link between aid and growth

Empirical evidence on the effectiveness of aid at promoting growth has varied across studies. While this may suggest a variation in aid effectiveness across countries (or samples), the influence of the choice of control variables cannot be over-emphasized (Hansen and Tarp, 2001). It can be drawn from the endogenous growth model that the effect of aid on growth is indirect (Lensink and White, 2001). Specifically, aid induces higher growth rate when used in a manner that improves marginal productivity of capital in the recipient country, resulting in increased investment and growth. This can be achieved when the recipient government uses aid towards improved policy (including reduced domestic borrowing), for infrastructure (such as roads), and also to create demand for output produced by investors. Generally, several studies have identified policy and investment as major links between aid and growth (See for instance Svensson, 1995; Goldsbrough and Cheelo, 2007; Lensink and Morrissey, 2000; Lensink and White, 2001). If this is indeed the case, then aid may appear to be an insignificant determinant of growth when policy and investment are controlled for. The reason is that the aid variable would only be capturing its effects that occur through channels that have not been controlled for.

The evidence shows that, generally, aid becomes insignificant in growth regressions when policy and/or investment are included as control variables, confirming that they are important links between aid and growth. For instance, Burnside and Dollar (2003 and 2005) find aid (on its own) to be an insignificant determinant of growth using a specification that controls for policy. Similarly, Rajan and Subramanian (2005) control for initial level of policy in their aid-growth specification and find the effect of aid to be insignificant.

Lensink and Morrissey (2000) and Hansen and Tarp (2001) established, using separate estimations, that aid has a positive effect on investment level and growth. However, when they include both aid and investment in their base growth model, aid becomes insignificant, suggesting that the impact of aid on growth occurs mainly through investment (and in certain group of countries, through efficiency of investment as well). The latter finding does not imply that policy is not an important channel. Rather, it suggests that the effect of aid-influenced policies on growth occurs through investment as well. For instance, lower budget deficits may result in a fall in domestic borrowing and a rise in private investment for that matter. It therefore appears that, in accordance with the endogenous growth model, the effect of aid on growth is indirect, through policy and investment. It follows then that aid effectiveness studies could be more reliable if the concentration is on the effect of aid on the policy and/or investment channel(s). The present study addresses the policy channel, focusing on the budget balance in particular.

Evidence on the effect of aid on policy is abundant in the literature on fiscal response to aid, where aid is shown to affect the budget balance and fiscal aggregates of recipient countries: Svensson (1995) finds the effect of aid on the budget balance (fiscal policy) to be negative in a cross-continent sample of developing countries; Osei et al. (2005) finds a close association of aid inflows with reduced domestic borrowing and improved tax effort in Ghana; aid inflows to Zambia is associated with increased domestic borrowing and decreased tax effort (Fagernas and Roberts, 2004a); aid inflows are associated with reduced domestic borrowing in Ethiopia (Martins, 2010). Thus, as with the aid-growth relationship, there is variation in the aid-policy relationship across countries, suggest that it is an empirical question.

3.3 Theoretical model

A major reason for giving development aid to low income countries is that it may facilitate welfare improvement through the provision of structural reform assistance. Therefore, it is often required by donors that recipients of aid exert an agreed amount of reform effort in return for aid. Since aid resource is limited, it is important for recipient governments to be able to sustain welfare improvements without having to continually depend on aid. For that matter, the achievement of fiscal stability, particularly reduced budget deficits, is a core objective of most structural reform agreements between aid donors and recipients.

For humanitarian reasons, altruistic donors would find it desirable to allocate more aid to recipients who need it most. In the present context, therefore, recipient countries with less fiscal stability, including larger budget deficits (to GDP ratio), receive more aid. However, given that the preferences of aid donors and recipients are not necessarily the same and that the reform effort exerted by recipients is not completely verifiable, the altruism of donors may have some incentive implications that undermine the objective for aid donation. For instance, knowing that, *ex post*, altruistic donors would give more aid to those who need it most, recipients would not have the incentive to exert higher reform effort *ex ante*; possibly, recipients would want to express more need by exerting lower reform effort *ex ante*. The Svensson (2000) aid incentive model therefore predicts that increased fiscal deficits lead to increased inflows of aid, and aid induces increased fiscal deficits. In what follows, we present a summarised exposition of the aid incentive model of Svensson (2000) that formalises the incentive implications of aid disbursement.

3.3.1 The Model

The model is characterized by a two-period horizon, one altruistic donor and *n* recipients. In the first period, recipient government *i* budgets endowment, *z*, for non-development spending, g_{1i}, and development spending, e_i as summarised by the budget constraint in (3.1).

(3.1) $g_{1i} + e_i \leq z$

Resource available to government *i* in the second period, *R*, is also budgeted for non-development spending, g_{2i}, and development spending d_i as given by period 2 budget constraint in (3.2).

(3.2) $g_{2i} + d_i \leq R_i$

The available resource in the second period, *R*, is an increasing function of development spending in the first period, e_i, but also depends on the state of the world. Expected *R* is therefore summarised by the probability expression in (3.3).

(3.3) $R = \begin{cases} \gamma \text{ with probability } \text{q(e)} \\ \beta \text{ with probability } 1 - \text{q(e)} \end{cases}$

where $\gamma > \beta > 0$ (implying that γ and β represent *R* in good and bad states respectively), and *q* is an increasing and concave function of the adjustment effort such that $q(0) \geq 0$, $q(z) < 1$.

The donor is altruistic and so derives satisfaction from giving aid, a_i, in period 2 for producing goods and services for the poor in country *i* according to the following increasing and concave production function.

(3.4) $h_i = h(a_i)$

Thus, the poor consumes goods, d_i, provided by the recipient government from its own resources and from aid proceeds. The total (public) consumption, C_i, of the poor in the recipient country *i* is as given in (3.5).

(3.5) $C_i = d_i = \alpha(R_i + h(a_i))$

where α is the proportion of the recipient government's total resources used to produce goods for consumption by the poor public.

It is assumed that the recipient government's utility function is additive and separable and is defined as:

(3.6) $W_i = \delta g_{1i} + u(x_i)$

where δ denotes the constant marginal utility of non-development spending in the first period, and $u(x_i)$ is a differentiable, increasing and concave function that denotes total utility from both non-development spending and consumption of the public in the second period. To cut down on notation, x_i is defined as follows:

(3.7) $x_i = \min\left[g_{2i,} C_i\right]$

Equation (3.7) implies that, in the second period the recipient government is willing to trade off non-development spending for higher public consumption at the margin. Thus, by assuming that public consumption is low, equation (3.6) could be written as

(3.8) $W_i = \delta g_{1i} + u(C_i)$

3.3.3 Incentive Implications of Altruistic Aid Donation

To show the incentive implications of altruistic aid disbursement for reform effort exerted by recipients *ex ante*, it is convenient to first solve for the optimal level of reform effort when there is no aid (henceforth, the non-aid equilibrium). In the non-aid equilibrium, the optimal composition of spending by the recipient government in the second period is obtained by equating the marginal utilities of non-development and development spending. Therefore, the optimal composition of spending is obtained by simply halving the given level of government resources, R_i as follows:

(3.9) $g_{2i}^{na} = R_i / 2$ and $d_i^{na} = R_i / 2$

where superscript *na* denotes the non-aid equilibrium.

From the consumption function in (3.5), it could be deduced that in the absence of aid, consumption goods are produced from development spending in the second

period, d_i^{na}, on a one to one basis. Therefore in the equilibrium without aid, the consumption function becomes (3.10).

(3.10) $C_i = d_i^{na} = R_i/2$

Given that at the time of exerting reform effort, e_i^{na}, in period 1, the recipient government could only form expectations about the outcome, R_i, of reform effort, the optimal level of reform effort depends on the expected gains. Therefore, to solve for the optimal level of reform effort, first incorporate the expectations in (3.3) into equation (3.10). The expected utility of the recipient government in (3.8) can then be maximised with respect to the first period development effort, e_i^{na}, to yield the following first order condition (FOC):

(3.11) $q'(e_i^{na})\left[u(\frac{1}{2}\gamma) - u(\frac{1}{2}\beta)\right] = \delta$

In compact form, equation (3.11) is written as

(3.12) $q'(e_i^{na})\left[u(C_i(\gamma)) - u(C_i(\beta))\right] = \delta$

Thus, the optimal level of reform effort is obtained by equating the expected marginal gain of reform effort (left hand side) to the marginal gain of non-development spending (right hand side). The expected marginal gain of reform effort is the product of the marginal increase in the probability of a good state and the gain in utility when a country moves from a bad state to a good state. Given the trade-off between

development and non-development spending (equation (3.1)), the marginal gain of non-development spending could be perceived as the marginal cost of development spending. When the gain in utility, associated with a move from bad to good state (in square bracket) is small, the marginal increase in the probability of a good state required to satisfy equation (3.12) is large, implying that, by reason of concavity of the probability function, a low level of reform effort would be exerted. The incentive effect of aid derives from the fact that aid can be used to alter the gain in utility associated with a move from bad to good state, and for that matter the amount of reform effort exerted by the recipient.

In the aid equilibrium, the donor's aid budget constraint is as given in (3.13).

$$(3.13)\quad A = \sum_{i=1}^{n} a_i(s) \qquad s \in S$$

where $a_i(s)$ is aid donated to country i in aggregate state s, with S representing all possible aggregate states. The allocation of the aid budget depends on the relative state of all the recipient countries. Therefore, a given recipient's expected gain in utility associated with a move from bad to good state also depends on the expected state of all other potential aid recipients. In the case of two recipients, it follows from (3.3) that there are four possible aggregate states as follows:

$$(3.14)\quad (R_1, R_2) = \begin{cases} (\beta,\beta) \text{ with probability } (1-\mathrm{q}(\mathrm{e}_1))(1-\mathrm{q}(\mathrm{e}_2)) \\ (\beta,\gamma) \text{ with probability } (1-\mathrm{q}(\mathrm{e}_1))\mathrm{q}(\mathrm{e}_2) \\ (\gamma,\beta) \text{ with probability } \mathrm{q}(\mathrm{e}_1)(1-\mathrm{q}(\mathrm{e}_2)) \\ (\gamma,\gamma) \text{ with probability } \mathrm{q}(\mathrm{e}_1)\mathrm{q}(\mathrm{e}_2) \end{cases}$$

The aggregate state, (β, β), represents the situation whereby both recipients are in a bad state. Incorporating all four possibilities into equation (3.12) yields the corresponding FOC for the aid equilibrium, which for recipient country 1 is written as follows:

(3.15) $q'(e_1)[\Psi_1 - \Phi_1] = \delta$

where:

$$\Psi_1 = q(e_2)u(C_1(\gamma, \gamma)) + (1 - q(e_2))u(C_1(\gamma, \beta))$$

and:

$$\Phi_1 = q(e_2)u(C_1(\beta, \gamma)) + (1 - q(e_2))u(C_1(\beta, \beta))$$

Subscripts 1 and 2 denote countries 1 and 2 respectively.

To see the incentive implication for the reform effort when recipients anticipate altruistic aid donation (consumption smoothing) *ex post*, note that giving more aid when country 1 is in a bad state (equivalent to increasing Φ_1 in equation (3.15)) lowers the expected gain in utility when country 1 moves from bad to good state. Therefore, the recipient government's optimal effort required to satisfy equation (3.15) would be lower by reason of the concavity of the probability function, *q*. It follows from the model that when the recipient governments correctly anticipate that, *ex post* altruistic donors would prefer to give more aid to those who need it most, the recipients would exert lower reform effort in order to express more need. Hence, the model prediction is that fiscal deficits lead to increased inflows of aid, and aid induces fiscal deficits. It is noteworthy, however, that the aid incentive model of Svensson (2000) assumes implicitly that all recipients have similar characteristics and therefore differences in

fiscal deficits across recipients is mainly due to differences in fiscal discipline (Cordella and Dell'Ariccia, 2007). Relaxing this assumption in future research may yield different conclusions about the incentive implications of giving more aid to those who need it most.

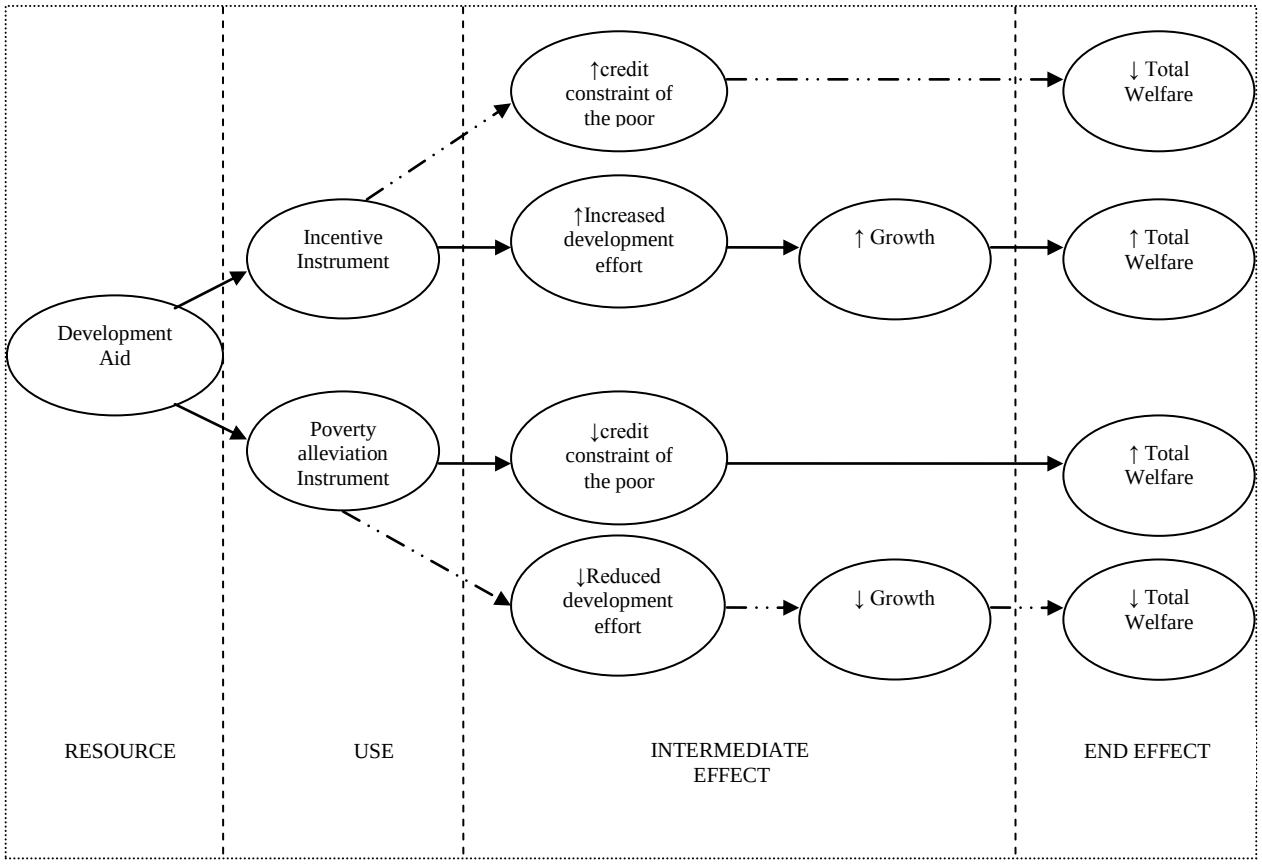
3.4. Empirical Framework

The concept underlying the empirical analysis of the present study is summarised by the framework in figure 3.1 which illustrates two major alternate objectives for the disbursement of development aid. First, aid is used as an incentive instrument to induce high development effort from recipient governments. In this case aid disbursement is conditioned on observable reform effort. This creates the incentive for aid dependent recipients to exert high development effort even when it is costly (say politically) in the short-run, with the advantage of increasing the likely the likelihood of growth and welfare.

The second major objective for the disbursement of aid is to alleviate poverty, in which case there are increased inflows to countries with increased economic difficulties, including low income and high budget constraints. On a similar note, altruistic donors prefer to give more aid to recipients with larger budget deficits in order to achieve fiscal stability. The latter approach to aid disbursement may however serve as a disincentive for fiscal discipline since recipients may want to express need by exerting less effort in order to receive more aid. On the other hand, conditioning aid disbursement on better economic outcome (including lower fiscal deficits) may have adverse implications for poverty alleviation.

The primary objective of the present study is to re-examine the hypotheses of Svensson (1995), that aid induces fiscal indiscipline and that fiscal deficits attract more aid. Unlike Svensson, we do so using a sample of sub-Saharan African countries and more recent data. Before we specify our empirical model, we conduct a brief review of the relevant empirical literature to identify and, as much as possible, account for limitations of previous studies.

Figure 3.1 Conceptual Framework



Broken arrows show unintended effects

3.4.1 Literature review II: Review of empirical issues in aid effectiveness studies

There are several determinants of aid disbursement that are not necessarily consistent among donors. That is, donors respond differently to these determinants, reflecting different objectives for aid disbursement. It follows then that different categories of aid, depending on the objective for disbursement, may have different impact in the recipient country. This partly explains the different conclusions on aid effectiveness across studies.

A review of the literature on aid effectiveness reveals some salient empirical issues that may also have contributed to the differences in existing results. These issues are discussed in this section as follows: Firstly, we identify issues relating to the choice of instrumental variables for aid and how these affect empirical results on aid effectiveness. Even though the different categories or components of aid have different implications for development, several studies on aid effectiveness use instrumental variables that purge total aid of the components that are relevant for economic development, resulting in the conclusion that aid is ineffective. Secondly, we address the importance of controlling for shocks in aid effectiveness studies. Adverse shocks may create a negative relationship between aid and policy/investment/growth. This is because adverse shocks induce increased inflows of aid but impacts negatively on policy/investment/growth.

Determinants of aid disbursement

Alesina and Dollar (2000) conduct a thorough investigation of the main determinants of aid disbursement. They test whether aid inflows respond to variables that suggest a proper use of aid for poverty reduction (such as economic needs, institutions,

corruption – suggested by Lumsdaine, 1993), and policies that are effective and open (democratisation and trade liberalization), or whether aid responds to political and strategic interests (such as alliances and former colonies – suggested by Maizels and Nissanke, 1984). They find political and strategic interests (captured by years of being a colony in the 20th century) to be significant determinants of aid allocation, just as economic needs and effective policies (such as democratization – which attracts 50% increase in aid). Unlike economic need, which explains the variation in aid disbursement both across countries and over time, political factors and strategic interest explains the cross-country variation and policies (such as democratization and 'openness') explain the variation over time.[21] Also, they find evidence of the well known population bias whereby countries with large population size receive less aid (as a ratio of GDP). It is noteworthy that different donors do respond to the identified determinants of aid differently. For instance, in contrast to Alesina and Dollar (2000), Hook and Taylor (1998) reject an altruistic motive for aid disbursement and Svensson (1995) found no evidence that aid rewards effective development policies. Therefore, having established the general trend in aid determination and the impact of aid, country specific studies would be a useful next step.

Choice of instruments for aid

In determining what might be a good choice of instruments for aid, it would be essential to know the main determinants of aid. Generally, determinants of aid allocation across countries, identified in the literature, include colonial past and population, and determinants of aid disbursement over time include policies. Economic need determines aid disbursement both across-countries and over time. Given that

[21] This suggests a divergence between aid determination across countries and within countries (over-time).

different determinants (as well as different donor responses to some determinants) of aid may impact differently on policy, investment, and/or growth, using only a subset of aid determinants as instruments may purge aid of some relevant components. We therefore suggest the lag of aid as an adequate instrument in time-series and panel estimations since it engulfs all the different determinants of aid discussed and is exogenous to contemporaneous aid. Even though the lag of aid is not available in cross-section estimations, this poses a lesser problem. This is because there is no evidence that development effort determines aid disbursement across countries. Determinants of aid disbursement across countries include economic need, population size, and political and strategic interests.

The popular finding of Burnside and Dollar (2000, 2004), that the effect of aid on growth is only positive in a good policy environment, may have been influenced by not appropriately controlling for shocks (as discussed in the following section) as well as the choice of instruments for aid – namely population, infant mortality rate, and proxies for donors' strategic interests. With the exception of population, the other instruments are likely to be correlated with poor economic performance or ineffective use of aid. For instance, infant mortality is likely to be high in economies performing poorly. With regards to donors' strategic interest, Burnside and Dollar (2000, 2004) show, in their empirical investigation of aid determination, that the allocation of bilateral aid to donor friends tends to direct aid to poor policies. Related to this argument is Ali and Isse (2005) conclusion that aid could have a disastrous effect when donor interests and geopolitical considerations overwhelm good policies. On the other hand, Collier and Dollar (1998) show that aid allocated as a function of the recipient-countries' level of poverty and quality of economic institutions and policies has the

maximum effect on poverty reduction. Other studies that have used instruments based on donor and recipient relation (or donor's interest) include Chervin and van Wijnbergen (2009) and Rajan and Subramanian (2005) both of which use an instrument constructed by the latter based on political, historic, and strategic alliance between donor and recipient of aid. The Rajan and Subramanian (2005) instrument is expected to be highly correlated with non-economically-motivated aid (particularly bilateral aid) that is unlikely to be disbursed based on economic performance. In other words, the part of aid conditional on economic performance is likely to be purged off, resulting in estimates of the effect of aid on growth that are not statistically significant. None of the instruments mentioned is likely to be correlated with effective use of aid. Therefore the instrument is likely to purge aid of the part used for growth.

Also, Ali and Isse (2005) used ethnolinguistic fractionalization variable as an instrument for aid and concluded that aid has a significant negative effect on growth. However, this negative effect of aid is not significant in their OLS estimation. The reason could be that the effect of aid in the IV estimation is negatively biased since the instrument (ethnolinguistic fractionalization) is likely to be negatively correlated with growth. Another instance is where Svensson (1995) uses population, infant mortality rate, and life expectancy rate as instruments for aid in their 2SLS estimation of the effect of aid on policy (budget balance) and conclude that aid has a deteriorating effect on the budget balance. Note that, with the exception of population, Svensson's instruments are likely to cause a negative correlation between aid and policy. This is because the part of aid disbursement that is strongly correlated with infant mortality and life expectancy is motivated by need, implying that it is given to countries with economic difficulties and policies are likely to be weaker in such countries.

Studies that do not use non-holistic instrumental variables often find a positive effect of aid on growth. For instance, Lensink and Morrissey (2000) who find the effect of aid on growth to be significantly positive irrespective of policy do not use instruments for aid. Rather, they conduct stability analysis to ensure the validity of their results when several different combinations of variables are used. Also, Hansen and Tarp (2001) use panel GMM estimators (system-GMM and difference-GMM), which make use of appropriately lagged variables (including aid) as instruments, and find a positive effect of aid on growth (that does not depend on good policy).

Another evidence of a possible influence of inappropriate instruments on estimation results is Rajan and Subramanian (2005). They find that different sub-categories of aid (economic, social, food aid, bilateral and multilateral aid) have similar (insignificant) effects on growth, and interpreted this as evidence of a high degree of fungibility. However, the similarity in the findings across sub-categories of aid may be the result of using the same instrument for the various categories of aid. Given that the instrument is constructed from variables related to the political/historical/strategic alliance between donors and recipients (or simply non-economic instrument), it could be inferred that, for all categories of aid, it is mainly the part that is strongly correlated with political/strategic alliance between donor and recipient that is analysed. Therefore, for aid effectiveness studies to be more reliable, instrumental variables that do not purge aid of any of its components (including need- and performance-motivated components) must be used. The present study suggests the use of the lag of aid as instrument for aid.

Controlling for shocks in aid-effectiveness regressions

Since aid inflow is likely to increase during adverse shocks (which affect growth negatively), aid is likely to be negatively correlated with growth when such shocks are not controlled for (Lensink and Morrissey, 2000). It could therefore be argued that the positive effect of the aid–policy interaction term on growth found by Burnside and Dollar (2000, 2005) could simply be reflecting the correlation between aid inflows and growth in recipient economies that is explained by adverse shocks. Following the same argument, aid and policy may not be entirely independent; aid inflows and policy may be correlated when they are both affected by similar shocks. It may also be the case that aid, by reason of its volatility, may be capturing macroeconomic instability which is not conducive for growth. It is therefore essential to control for shocks before inferences on aid effectiveness (with respect to policy or growth) are drawn.[22] Newlyn (1990) found that foreign aid is effective for growth, but the positive effects are offset by negative oil shocks, debt crises and other exogenous shocks. Such offsets must therefore be controlled for.

To control for shocks to an aid recipient's economy in the empirical investigation of the aid-growth relationship, Lensink and Morrissey (2000) include a measure of uncertainty (associated with both negative and positive shocks). Using a cross-country empirical growth specification similar to Barro (1996), Lensink and Morrissey (2000) find a significant positive effect of aid on growth that does not depend on good policy. It is noteworthy, however, that when they use aid instability (that includes both predictable and unpredictable changes in aid inflows) rather than uncertainty

[22] Even when adverse shocks are controlled for, an interaction between aid and policy in a growth equation may be contentious. This is because the choice of policy may in itself be endogenous to aid. For instance, unpredictability and reduction of aid, just like an adverse shock, may affect policy.

(unpredictability of aid), they do not find any significant positive effect of aid on growth. An important note here is that we only emphasize on how important it is to appropriately control for shocks in aid effectiveness regressions. We do not imply that aid becomes more effective once this is done. The effectiveness of aid varies across countries and samples. Generally, existing evidence shows that there are differences in the way shocks are measured and that the results on aid effectiveness (when shocks are controlled for) vary in different studies. For instance, in contrast to Lensink and Morrissey (2000), Chervin and van Wijnbergen (2009) find that aid instability has a negative effect on economic growth and aid has a positive effect on economic growth once aid instability is controlled for. Unlike Lensink and Morrissey (2000), however, Chervin and van Wijnbergen conduct a panel analysis in which aid is instrumented for. Also, when GDP level and GDP growth (possibly capturing income shock) are controlled for, Svensson (1995) find a robust positive correlation between aid and budget deficit and conclude that aid induces a weak fiscal discipline. Other measures of shock in the literature include change in per capita GDP for income shock (Bulir and Hamann, 2005) and average growth and changes in TOT for economic shocks in general (Rajan and Subramanian, 2005). In the context of the present study, shocks to GDP may cause an increase in aid inflow whiles influencing budget balance negatively so it is essential that such shocks are appropriately controlled for before inferences are made.

In conclusion, the evidence from the literature suggests that aid effectiveness should be examined through the effect of aid on determinants of growth. Clearly, results on aid effectiveness are more reliable when appropriate instruments for aid are used and shocks are controlled for.

As a final remark, further review of the literature on aid effectiveness – to be addressed in the next chapter – revealed that there may be divergence in the cross-country and within-country aid determination. Aid effectiveness across countries may be a function of the within country dimension of aid determination, supporting the notion that aid effectiveness is nonlinear. This extension is a key subject of the next chapter.

3.4.2 Empirical specification

In this section, we first present the baseline empirical specifications for testing the empirical predictions of the aid incentive model; note that these loosely follow Svensson (1995) for comparability of results. Secondly, we outline what we do differently to improve the estimations.

3.4.2.1 The baseline empirical model

The fundamental idea of Svensson (2000) aid incentive model is twofold. The first is that, for humanitarian reasons, altruistic donors find it optimal to give more aid to countries with larger budget deficits (smaller budget balances). Secondly, by anticipating correctly that more aid would be received when there are large budget deficits, recipient governments may lack the incentive to prevent budget deficits. Thus, the model prediction, which was previously tested in Svensson (1995), is that aid induces budget deficits and budget deficits attract more aid. The model prediction is represented empirically by the following simultaneous system of equations:

(3.16) $$AID_i = \delta_0 + \delta_1 BB_i + \delta_2 \log GDP_i + \delta_3 GROWTH_i + \delta_4 X_i + \pi_i$$

(3.17) $$BB_i = \partial_0 + \partial_1 AID_i + \partial_2 \log GDP_i + \partial_3 GROWTH_i + \partial_4 Z_i + \upsilon_i$$

where AID and BB respectively denote official development assistance and the budget balance, both measured as ratios to the gross domestic product. Also, GDP and GROWTH denote initial per capita real GDP level and the initial rate of growth respectively. The vectors X and Z contain standard controls in the literature for aid and budget balance determination respectively.

In the aid equation, X contains variables such as infant mortality and life expectancy that capture long term development characteristics of the recipient, and population that controls for the well known population-bias of foreign aid disbursement (Svensson, 1995; Burnside and Dollar, 2000 and 2005). The symbol π denotes the residual capturing exogenous shocks to aid disbursement. The coefficient of interest in equation (3.16) is δ_1. Based on the model prediction, this coefficient is expected to be negative. Thus, due to altruism, aid inflows increase when a recipient faces fiscal difficulties. Also, given that humanitarian spending is desirable to altruistic donors, the coefficients on GROWTH, GDP, and life expectancy are expected to be negative, and the coefficient on infant mortality is expected to be positive.

In the budget balance equation (3.17), Z contains variables such as change in terms of trade that captures the effect of exogenous trade shocks, ethnic polarisation, and political stability. The coefficient of interest in the budget balance equation, (3.17), is ∂_1. This coefficient is expected to have a negative sign because, by expecting more aid

inflows when there are larger fiscal deficits, recipients do not exert enough effort to prevent deficits *ex ante*. In the budget balance equation (3.17), the coefficients on GROWTH, and change in terms of trade are expected to be positive, and the coefficient on GDP is expected to be ambiguous; higher GDP may lead to higher revenue and higher expenditure alike. The residual υ captures all exogenous shocks to the budget balance. Equations (3.16) and (3.17) are, respectively, the baseline aid and budget balance specifications suggested by Svensson (1995).

As in Svensson (1995), we employ both cross-section and panel techniques to estimate the baseline equations. We however follow a different approach in our panel estimations. What we do differently is that we exploit the panel technique to improve upon the choice of instruments for aid and budget balance. Specifically, we include the lags of aid and the budget balance as additional instruments for the aid and the budget balance variables respectively.[23]While we do so, it is essential that we do not depart from the baseline equations in order to ensure that differences between the results of the present study and past results are not ascribable to different specifications. We therefore treat the two baseline equations as given and estimate each of them in a separate system of equations. This is further explained in the next section. It is noteworthy, however, that maintaining the baseline equation for aid also enables us to draw more general conclusions about the motive for aid disbursement based on the role of humanitarian variables like life expectancy, infant mortality, per capita GDP level and GDP growth. To see why, note that these humanitarian variables are either time-invariant or slow-changing over time and therefore, as determinants of aid

[23] Given the Svensson (1995) system of simultaneous equations (3.16) and (3.17), the instruments for aid are population, infant mortality, and life expectancy, and the instruments for the budget balance are the change in terms of trade, ethnic polarisation, and political instability.

inflows, they are likely to be as strongly correlated with the lag of aid as they are with contemporaneous aid. Therefore including the lag of aid in the baseline equation could mask the effect of the humanitarian variables on aid determination. Similarly, including the lag of the budget balance in the baseline equation for the budget balance could mask the effect of time-invariant and slow-changing control variables like ethnic fragmentation, political stability, and GDP growth. In what follows, we explain how the lags of aid and the budget balance are included as instruments without varying the baseline specifications.

3.4.2.2 Response of aid flows to the budget balance

Following Svensson (1995), we use the baseline specification in (3.16) to estimate aid. Unlike Svensson, however, the latter is estimated as a system with a marginal equation (rather than the baseline equation) for the budget balance. The marginal equation only serves as a first stage estimation in a typical instrumental variable approach in which budget balance is instrumented for within an aid determination equation. For reasons explained in the preceding section, this method is used to ensure that we improve the validity of instruments for the budget balance in the aid equation. Conversely, we maintain the baseline equation for the budget balance (3.17) when we address its response to aid. The panel estimation for the baseline aid equation is obtained within the following simultaneous system:[24]

[24] Note that equation (3.22) is the same as (3.24)(a).

(3.18) (a) $AID_{it} = \delta_0 + \delta_1 BB_{it} + \delta_2 \log GDP_{it} + \delta_3 GROWTH_{it} + \delta_4 X_{it} + \pi_{it}$

(3.18) (b) $BB_{it} = \gamma_0 + \gamma_1 AID_{it} + \gamma_2 BB_{it-1} + \gamma_3 \log GDP_{it} + \gamma_4 GROWTH_{it} + \gamma_5 Z_{it} + \upsilon_{it}$

where BB_{it-1} is the lag of the budget balance variable, which in a 5 year pooled cross-section data refers to the previous 5 year average. All other variables are as defined in (3.16) and (3.17). Note that the empirical specification for aid determination in (3.18)(a), which is of interest here, remains the same as the baseline equation for aid in (3.16) and is the conditional equation of the system. The marginal equation of the system, which identifies the budget balance variable included in the conditional equation for aid, is given in (3.18)(b). The marginal equation includes the lag of budget balance as an additional identifying restriction for the aid determination equation in (3.18)(a). As in equation (3.16), the coefficient of interest is δ_1, which we expect to be negative given the model prediction that aid flows from altruistic donors increase when the budget deficit is large.

3.4.2.3 Response of the budget balance to aid inflows

As with aid in the previous section, the systems panel estimation of the baseline budget balance equation is carried out within a system which includes the marginal equation for aid as specified below.[25]

(3.19)(a) $BB_{it} = \partial_0 + \partial_1 AID_{it} + \partial_2 \log GDP_{it} + \partial_3 GROWTH_{it} + \partial_4 Z_{it} + \upsilon_{it}$

(3.19)(b)

$$AID_{it} = \alpha_0 + \alpha_1 BB_{it} + \alpha_2 AID_{it-1} + \alpha_3 \log GDP_{it} + \alpha_4 GROWTH_{it} + \alpha_5 X_{it} + \pi_{it}$$

[25] Note that equation (3.19)(a) is the same as equation (3.17).

where AID_{it-1} denotes the lag of the aid variable, which refers to the previous 5 year average when 5 year pooled cross-section data is used. All other variables are as defined in (3.16) and (3.17). The budget balance equation in (3.19a) and the aid equation in (3.19b) are, respectively, the conditional and marginal equations of the system. Unlike equation (3.17), the marginal equation (3.19b) includes the lag of aid in order to improve the instrument validity for aid. Of interest is the conditional equation for the budget balance in (3.19a), which is the same as the baseline equation in (3.17). The coefficient of interest is ∂_1, which we expect to be negative *a priori*. Thus, knowing that aid inflows increase when there are fiscal difficulties, recipients are unlikely to prevent deficits *ex ante*, resulting in deficits *ex post*.

Unlike the panel analyses, we employ the same estimation approach as Svensson (1995) in our cross-section analyses. Thus, we estimate the baseline equations for aid and the budget balance together in a system of simultaneous equations because it is impossible to introduce lagged instruments. In what follows, we explain the relevance of including the lags of the aid and budget balance variables as additional identifying restrictions and specifying separate simultaneous systems for the aid and budget balance objective equations in (3.18) and (3.19).

3.4.2.4 The importance of lagged aid as instrument for total (incentive and humanitarian) aid

Generally, the lags of autoregressive variables present as useful instruments because their relatively strong correlation with the corresponding contemporaneous variable reduces the weak-instrument problem associated with instrumental variable

estimations. For this reason, we exploit the panel estimation by using the lags of aid and budget balance as additional identifying restrictions.

In addition to reducing the weak-instrument problem, using lagged values as instruments has useful implications for the validity of instruments, especially for the aid variable in particular. To see this, note that there are different objectives for aid disbursement, ranging from the creation of development incentives to the alleviation of poverty. Incentive aid is given to recipients with increased development effort, whereas aid for alleviating poverty is given to recipients with increased economic difficulties. With regards to the recipient's budget situation therefore, the correlation between aid and budget deficits is likely to be negative for incentive aid and positive for poverty alleviation aid. It follows then that the effect of different types of aid on the budget balance may vary. Given that the present study analyses the effect of total aid, it is essential not to choose instrumental variables that are strongly correlated with a particular type of aid as this could bias the results. For instance, the baseline specifications for aid and the budget balance in Svensson (1995) system of simultaneous equations, as given in (3.16) and (3.17), use population, infant mortality and life expectancy as instruments for aid. Meanwhile, both infant mortality and life expectancy are likely to be strongly correlated with humanitarian aid but not incentive aid. Also, population is likely to be correlated with non-incentive-motivated aid. Therefore, the three instrumental variables are likely to purge the aid variable of the incentive-motivated-part, resulting in estimates that are indicative of the effect of poverty-alleviation aid rather than total aid. To circumvent this problem (of biasedness), we use the lag of aid as instrument for aid in the panel estimation.

3.5. Description and sources of data

The present study applies panel and cross-sectional analytical techniques on transformed annual time series data for 37 developing African countries over the period of 1980 to 2004; the data is transformed into pools of five-year averages and country averages for the panel and cross-section estimations respectively. Variables used include foreign aid, budget balance, GDP level, GDP growth, population, infant mortality, life expectancy, ethno-linguistic fractionalisation, war dummy, and change in terms of trade.

The source of data for foreign aid (ODA), budget balance and GDP are as discussed in chapter 2. To keep GDP levels comparable across countries, constant international dollar price numeraire was used. Data on GDP level is adjusted for population size since the ultimate focus of the study is on the welfare of recipients. Growth is obtained as the annual percentage change in GDP per capita (in constant international dollars). It is noteworthy that GDP level and GDP growth are potential endogenous regressors in an aid determination equation: the former occurs when aid spending increases GDP level through private consumption, investment, and government expenditure. The latter derives from the fact that aid donors may treat poor growth as evidence of need for need-based disbursement, and improved growth as evidence of good performance for incentive-based disbursement, both of which are likely to influence the effort of recipient governments at promoting growth. This explains why instrumental variables are often used to identify aid in growth regressions of developing countries (see Burnside and Dollar, 2000 and 2005). Given that the relationships between aid and the GDP and growth variables are not the focus of the present study and that the sample size is relatively small, identifying both GDP level and growth with instrumental

variables would only compromise useful degrees of freedom. Therefore, following Svensson (1995), we curb the potential endogenous bias associated with these two variables by using their initial values. Data on terms of trade (TOT), infant mortality and life expectancy are obtained from the ADI online database – infant mortality is measured as the number of infants out of 1000 live births that die before the age of one, and life expectancy is defined as the number of years a newborn is expected to live based on the existing pattern of deaths.

We measure political instability with a dummy variable that takes on a value of one for countries where there have been incidences of war over the study period. This measure is relevant in the context of foreign aid effects because it is unreasonable to give any other form of aid other than humanitarian help to recipients when there is war. Therefore, the estimated effect of aid on the budget balance becomes more reliable when the effect of war is controlled for. Svensson (1995) captures political instability with a measure of major government change. The measure is however based on pre-1982 era and would therefore not be relevant for the present study given our study period and the major political changes in the post-1982 period. To control for the effect of ethnic fragmentation on budget balance, we use ethno-linguistic fractionalisation data from the 1964 Atlas Narodov Mira (Atlas of People of the World) reported in Taylor and Hudson (1972). The ethno-linguistic fractionalisation index for a country is interpreted as the probability that any two randomly selected persons from the population belong to different tribes.

A summary of the main variables is presented in appendix A3. Given that the sample size is relatively small, outliers are likely to affect the results tremendously. Therefore,

following the conventional rule of thumb, the analyses exclude data points that are not within a range of three standard deviations from the mean.

3.6 Empirical estimation and discussion of results

Svensson (1995) uses data on a sample of recipient governments from Africa, Asia, and Latin America over the period of 1970 and 1989 to investigate the relationship between foreign aid inflows and the budget balance. Their finding supports the fundamental idea of their aid incentive model that, due to altruism of donors coupled with the enforcement problem associated with conditional aid contracts, aid induces fiscal indiscipline. That is, aid flows from altruistic donors is need-based and knowing this *ex ante,* aid recipients have the incentive to express more need by exerting lower effort to prevent budget deficits. Aid therefore affects the fiscal performance of recipient governments negatively. We report our results for sub-Saharan Africa as follows: First, we report the response of aid inflows to the budget balance, followed by the effect of aid inflows on the budget balance.

3.6.1 The response of aid flows to the budget balance

The regression results for the response of aid inflows to the budget balance, based on the estimation of equation (3.18)(a), are reported in tables 3.1 to 3.3. Estimates in table 3.1 and 3.2 are based on panel techniques, using 5 year pooled cross-section data, whereas estimates in table 3.3 are obtained using cross-section methods and annual-average data for the whole study period (1980-2004). We find that, indeed, larger budget deficits induce significant increases in aid inflows. Thus, aid donors do not appear to reward recipients who exert higher effort to avoid budget deficits. We also

find that countries with lower levels of income (per capita GDP) receive more aid and so do countries with lower life expectancy. The findings are robust across different estimation methods.

3.6.1.1 Panel (pooled cross-section) analysis

OLS estimates

Columns 1(a) and 1(b) of table 3.1 show the results of OLS regressions without and with time dummies (labelled NODUM and DUM) respectively. The budget balance appears to be a significant determinant of the total amount of aid received (at the 1% level) such that countries with larger budget deficits receive more aid. Also, life expectancy and the level of per capita GDP have significant negative effect on total aid receipts (at the 1% level). These findings suggest that the motive for aid disbursement is predominantly need-based rather than performance-based. Also in support of this view is that there is an insignificant effect of growth in determining total aid receipts, given that growth requires improved development effort. The implication of the need-motive of aid disbursement for the budget balance of recipients is addressed in the next sub-section. Surprisingly, however, high infant mortality appears to have a significant reducing effect on aid inflows but, as would become clear, this finding is not robust across different estimation methods. Finally, the OLS results is consistent with the well known population bias in aid allocation, in that population size has a significant negative effect on aid inflows (as a percentage of GDP) at the 1% level.

Table 3.1 Panel estimation of aid determination equation

	AID/GDP					
	OLS_NODUM	OLS_DUM	RE_NODUM	RE_DUM	FE_NODUM	FE_DUM
	1(a)	1(b)	1(c)	1(d)	1(e)	1(f)
BB	-0.349***	-0.318***	-0.292***	-0.251***	-0.234**	-0.184*
	(0.116)	(0.099)	(0.097)	(0.091)	(0.107)	(0.104)
GDPGROWTH	0.189	0.245	0.100	0.154	0.036	0.121
	(0.162)	(0.167)	(0.123)	(0.122)	(0.129)	(0.128)
GDPLEVEL	-0.264***	-0.258***	-0.283***	-0.270***	-0.256***	-0.258***
	(0.024)	(0.023)	(0.033)	(0.031)	(0.061)	(0.06)
LOGPOP	-0.121***	-0.123***	-0.114***	-0.124***	-0.027	-0.031
	(0.014)	(0.014)	(0.018)	(0.017)	(0.075)	(0.197)
LIFEXP	-0.318***	-0.312***	-0.223*	-0.246**	-0.078	-0.180
	(0.103)	(0.102)	(0.116)	(0.115)	(0.146)	(0.142)
INFMORT	-0.716***	-0.595***	-0.948***	-0.623*	-0.862	-0.677
	(0.244)	(0.225)	(0.347)	(0.347)	(0.704)	(0.669)
Dum8589	.	0.049***		0.043***		0.034*
	.	(0.016)		(0.013)		(0.017)
Dum9094	.	0.075***		0.066***		0.049*
	.	(0.014)		(0.013)		(0.026)
Dum9599	.	0.043***		0.038***		0.017
	.	(0.015)		(0.013)		(0.035)
Dum0004	.	0.047***		0.044***		0.02
	.	(0.018)		(0.014)		(0.045)
CONS	1.988***	1.926***	1.980***	1.949***	1.223*	1.266
	(0.197)	(0.183)	(0.23)	(0.211)	(0.655)	(1.405)
R2	0.638	0.683			0.149	0.269
N	153	153	153	153	153	153
B-P	.		40.10***	50.04***		
Fd	.	7.37***		26.84***		4.38***
H	.				10.55	69.87***

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively
OLS_NODUM is read as estimation of Aid determination equation using OLS on the model without time dummy. The symbol 'DUM' refers to the model with time dummy. The DUM8589 variable refers to the time dummy capturing the 5-year pool between 1985 and 1989; the nomenclature applies to all other time dummies.

It may however be argued that the OLS estimates could possibly be inefficient and biased due to uncontrolled country fixed effects and the fact that the budget balance, as a regressor, is potentially endogenous to aid (as implied in the model prediction). We therefore check the results against more robust estimation methods in what follows.

Controlling for country-specific fixed effects

Columns 1(c) and 1(d) of table 3.1 report estimation results of random effects models, without and with time dummies, that are robust to the inefficiency associated with omitted fixed effects when they are uncorrelated with the regressors. The Breusch-Pagan LM test on the random effect model rejects the null of zero-variance of the intercept component of the composite error term implying that, indeed, the efficiency of the OLS estimator is affected by omitted country fixed effects. A much stronger argument against the OLS results is that there may be endogeneity bias associated with omitted country fixed effects. In columns 1(e) and 1(f) the results from the fixed-effect models, with and without time dummies, which are robust to endogeneity bias associated with omitted country fixed effects are reported. The Hausman specification test result based on the fixed-effect and random effect models with time dummies supports the existence of endogeneity bias in the random effect model associated with country fixed-effects. Nonetheless, the results do not vary qualitatively with the estimation method; the random- and fixed-effect estimates show that whereas larger budget deficits and lower levels of GDP lead to significant increases in aid inflows, growth does not influence aid inflows significantly. Consistent with the OLS results (columns 1(a) and (b)), infant mortality, life expectancy, and population have significant negative effect on aid in the random effect estimation (columns 1(c) and (d)). However, all three variables do not affect aid inflows significantly in the fixed-effect estimations (columns 1(e) and (f)).

The time dummies are added in order to alleviate possible estimation biases caused by time-varying shocks that are common to all the cross-sectional units. The F-test results (Fd) indicate that the time dummies are jointly significant in all the three estimation

methods. It is therefore necessary to include them in the specification. For this reason we proceed with the specification with time dummies only.

It is noteworthy that even though the Hausman specification test result suggests that there is endogeneity bias in the random effect and OLS models associated with country fixed-effects, we do not limit our analysis to fixed-effect model estimates. This is because fixed-effect estimates are based on only the 'within-country' variation in the data even though we are interested in the cross-section variation as well.[26] Including both 'within-country' and cross-section variations in the analysis is advantageous in two respects. Firstly, it permits us to determine whether there is divergence in the cross-section and time-series dimensions of aid disbursement. For instance, it may well be that in the absence of negative income shocks a given recipient government receives more aid in periods of improved budget balance but less aid than recipients with higher budget deficit that exert a similar level of development effort. Secondly, fixed effect models are inefficient for estimating variables that change slowly and those for which changes are rather seldom (Plumper and Troeger, 2007).

Controlling for endogenous regressors

This far, we have not allowed for the possibility of some regressors being endogenous in the aid disbursement equation. As it is with omitted country-fixed-effects, not allowing for endogenous regressors could cause estimates to be biased. In this case however, not even the fixed effects model would yield consistent estimates. Issues of endogenous regressors may not be far-fetched because if total aid responds to budget

[26] We allow for possible divergence in the 'within-country' and 'between-country' determination of aid disbursement.

balance, then the reverse causality may also exist considering that recipient governments may target levels of budget balance that attract more aid.

To obtain consistent estimates for the aid disbursement equation in the presence of endogenous regressors we employ the two commonest techniques in the literature, namely the instrumental variable and the lagged-regressors method. The advantage with the instrumental variable method is that it is able to produce more consistent structural estimates. The disadvantage is that it may be less efficient due to the weak – instrument problem, and may still be associated with a degree of biasedness due to instrument-validity problem. On the other hand, treating the regressors as pre-determined by lagging them prevents the problem of having to obtain appropriate instruments but does not generate structural estimates, and the comparability of the qualitative results with structural methods depends on the extent to which the lagged and contemporaneous regressors are correlated – the structural and reduced form results are more comparable qualitatively when the lagged regressors are highly correlated with their contemporaneous counterpart.

The instrumental variable (IV) methods used to estimate the aid equation are 2SLS, 3SLS, random effect IV and fixed effect IV. Obviously, in the 2SLS and 3SLS methods the (baseline) aid equation, which is the conditional equation in this context, is estimated as a system with a marginal budget balance equation. For two reasons, however, we do not report the results of the marginal budget balance equation in the panel (pooled cross-section) analysis: the first is that its purpose is only to 'apply' the instruments for budget balance as over-identifying restrictions; the second is that, by including the lag of the budget balance as an additional regressor (identifying

restriction), the specification of the marginal budget balance equation is different from Svensson (1995) with which we intend to compare our results. We however report the Sargan's test result to show that the instruments are valid.

The results of the instrumental variable methods are reported in columns 2(a) to 2(d) of table 3.2 for the 2SLS, 3SLS, random effect and fixed effect methods respectively. In all four columns we find the GDP level to have a significant negative effect on the total amount of aid received. Also, with the exception of the fixed effect method of estimation, the coefficient of the budget balance is negative and significant. Contrary to this, Svensson (1995) finds the effect of the budget balance on aid receipt to be insignificant once they control for regional effects on their cross-continent sample of countries.[27]While the difference in results suggests that the aid-budget balance relationship varies across regions, the possible influence of the choice of instruments cannot be over-emphasized. Specifically, Svensson (1995) uses ethnic polarisation, institutional quality, and change in terms of trade as instruments for the budget balance. These instruments however have limited or no variation over time and would therefore estimate a budget balance with limited variation over time compared to the aid variable it is supposed to explain. Our choice of instrument is more valid because in addition to the three instruments of Svensson (1995), we include the lag of budget balance which is correlated with the contemporaneous value, shows more variation over time, and is not biased towards explaining only part of the variations in the budget balance.

[27] We find the budget balance as an insignificant determinant of aid disbursement only in the cross-country estimation where it is not possible to control for the effect of time dummies and to use the lagged values as instruments (see table 3.3).

Table 3.2 Applying IV and lagged regressors techniques to the panel estimation of the aid determination equation

	AID/GDP						
	2SLS	3SLS	RE	FE	LAG_OLS	LAG_RE	LAG_FE
	2(a)	2(b)	2(c)	2(d)	2(e)	2(f)	2(d)
BB	-0.517*	-0.536***	-0.386*	-0.194	-0.293***	-0.163*	-0.093
	(0.269)	(0.207)	(0.201)	(0.244)	(0.098)	(0.087)	(0.096)
GDPGROWTH	0.352	0.389	0.226	-0.445	0.021	-0.123	-0.212
	(0.527)	(0.476)	(0.67)	(1.128)	(0.168)	(0.138)	(0.147)
GDPLEVEL	-0.241***	-0.235***	-0.247***	-0.174*	-0.247***	-0.232***	-0.091
	(0.03)	(0.025)	(0.04)	(0.092)	(0.028)	(0.037)	(0.074)
LIFEXP	-0.251	-0.249*	-0.138	-0.102	-0.316**	-0.165	0.020
	(0.165)	(0.138)	(0.159)	(0.216)	(0.146)	(0.148)	(0.198)
INFMORT	-0.532*	0.456	-0.542	-0.563	-0.513*	-0.305	-0.541
	(0.314)	(0.304)	(0.488)	(0.841)	(0.278)	(0.425)	(0.824)
LOGPOP	-0.100***	-0.099***	-0.098***	0.155	-0.107***	-0.100***	0.037
	(0.02)	(0.014)	(0.024)	(0.296)	(0.018)	(0.022)	(0.239)
Dum8589	0.04	0.043	0.052*	0.035	0.037	0.036	0.011
	(0.044)	(0.038)	(0.029)	(0.037)	(0.041)	(0.028)	(0.033)
Dum9094	0.062	0.066*	0.065**	0.018	0.069*	0.066**	0.027
	(0.045)	(0.037)	(0.031)	(0.048)	(0.041)	(0.028)	(0.04)
Dum9599	0.037	0.04	0.037	-0.014	0.036	0.03	-0.018
	(0.044)	(0.037)	(0.03)	(0.058)	(0.041)	(0.029)	(0.049)
Dum0004	0.044	0.048	0.042	-0.02	0.043	0.037	-0.018
	(0.044)	(0.037)	(0.031)	(0.071)	(0.041)	(0.03)	(0.059)
CONS	1.671***	1.632***	1.622***	-0.281	1.774***	1.593***	0.197
	(0.29)	(0.202)	(0.307)	(2.059)	(0.243)	(0.277)	(1.709)
R2	0.633	0.664	0.621	0.285	0.659	0.647	0.258
N	105	105	105	105	113	113	113
	Sargan's test: Chi-square(3) = 4.209; P-value = 0.283						

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively
OLS_NODUM is read as estimation of Aid determination equation using OLS on the model without time dummy. The symbol 'DUM' refers to the model with time dummy. The DUM8589 variable refers to the time dummy capturing the 5-year pool between 1985 and 1989; the nomenclature applies to all other time dummies.

INSTRUMENTS FOR BUDGET BALANCE (BB): Lag of budget balance, change in terms of trade, ethno-linguistic fractionalisation, and war dummy. The Sargan's test fails to reject the null hypothesis that omitted instruments are not jointly significant, implying that our list of instruments are valid.

The insignificant effect of the budget balance on total aid receipt in the fixed effect ('within') estimation suggests a divergence in the cross-section and 'within-country' responses of aid flows to the budget balance. Thus, whereas countries with higher budget deficits generally receive more aid, the relationship between aid and the budget

balance within a recipient country (over time) may vary from one country to another. With regards to the effect of the budget balance and the level of GDP on aid inflows, the result of the lagged-regressors method, as reported in columns 2(e) to 2(g), is similar to the IV estimations qualitatively; Both variables have significant negative effect on aid inflows in the lagged-regressors OLS and random-effect estimations and are insignificant in the lagged-regressor fixed-effect estimation. The only qualitative difference is that the level of GDP has a significant negative effect on aid inflows in the IV fixed-effect estimation.

In all the IV and lagged-regressors estimation methods (table 3.2), growth appears to be an insignificant determinant of total aid receipts. On the other hand, the significant negative effect of population on aid inflows (observed in previous estimations) is robust to the latter methods.[28] Also, unlike the OLS estimation (table 3.1), infant mortality and life expectancy do not affect aid inflows significantly in the IV and lagged-regressors estimation methods, with the only exceptions being in the lagged-regressors OLS estimation, 2SLS (in the case of infant mortality) and the 3SLS (in the case of life expectancy) where their effect is significantly negative. Thus, the unexpected significant negative coefficient for infant mortality obtained in OLS aid determination equations is not robust.

So far, our hypothesis, that lower budget deficit induces increased inflows of aid, has been tested using different panel-data estimation methods, some of which are based on the 'combined' ('between' and 'within') variation of the data, and others on the 'within' variation of the data – OLS, random-effect, 2SLS, and 3SLS methods are

[28] The only exception is the fixed-effect method, and is understandable because population size does not vary much within a country over time.

based on the 'combined' variation of the data, whereas the fixed-effect methods are based on the 'within' variation of the data. In what follows, we check the robustness of our key results to cross-section estimation methods. The latter are based on the 'between' variation of the data. An advantage of using cross-section regressions is that averaging the data for the whole period reduces bias caused by measurement error (Kennedy, 2008). However, the joint significance of the time dummies as shown in table 3.1 indicates that cross-sectional estimation results may be biased by uncontrolled common time effects. Another source of bias may be that the cross-section method compromises on sample size (and degrees of freedom for that matter). Also, not being able to control for country-specific fixed-effect in cross-section regressions may result in endogeneity bias. We therefore interpret the results with caution.

3.6.1.2 Cross-section analysis

The result of the cross-section estimation of the aid equation is reported in table 3.3. Column 3(a), (b), and (c) show the OLS, 2SLS, and 3SLS estimates respectively. Similar to the panel estimates, GDP level and population have significant negative effect on aid inflows, with the magnitudes of their respective coefficients being similar across all three estimation methods (i.e., -0.203, -0.202 and -0.201 for GDP level, and -0.102, -0.115 and -0.116 for population in the OLS, 2SLS, and 3SLS estimations respectively). Unlike the panel estimates, however, the budget balance appears not to affect aid inflows significantly in all three cross-section estimations. Since the magnitude of the coefficient on the budget balance in the cross-section OLS estimation is similar to its counterpart in the panel estimation, the insignificance of the former may have resulted from inefficiency associated with the omission of common time

effects. On the other hand, the insignificance of the budget balance variable in the cross-section 2SLS and 3SLS estimations of the aid equation may be ascribed mainly to the weak instrument problem (evidenced by the large standard errors) since it is not possible to use lags of budget balance as additional instruments. Nonetheless, the instruments are valid; the Sargan's test, reported in table 3.3, fails to reject the null that omitted instruments are not jointly significant.

Table 3.3 Using OLS and IV method for cross-sectional estimation of the aid determination equation

	AID/GDP		
	OLS	**2SLS**	**3SLS**
	3(a)	**3(b)**	**3(c)**
BB	-0.307	-0.257	-0.286
	(0.247)	(0.914)	(0.842)
GDPGROWTH	0.992**	0.469	0.500
	(0.357)	(1.416)	(1.141)
GDPLEVEL	-0.203***	-0.202***	-0.201***
	(0.033)	(0.04)	(0.035)
LOGPOP	-0.102***	-0.115***	-0.116***
	(0.02)	(0.031)	(0.028)
LIFEXP	-0.217*	-0.258**	-0.262
	(0.109)	(0.092)	(0.165)
INFMORT	-0.405	-0.461	-0.457
	(0.369)	(0.567)	(0.554)
CONS	1.559***	1.681***	1.679***
	(0.27)	(0.32)	(0.306)
R2	0.759	0.714	0.713
N	33	30	30
Sargan's test: Chi-square (2) = 1.008; P-value = 0.694			

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively

INSTRUMENTS FOR BB: change in terms of trade, ethno-linguistic fractionalisation, and war dummy. The Sargan's test fails to reject the null hypothesis that omitted instruments are not jointly significant, implying that our list of instruments are valid.

Consistent with the panel estimates, life expectancy and infant mortality have negative coefficients. However, the latter variable is not significant in all three cross-section estimation methods and the former is insignificant in the 3SLS method. Thus, the puzzling OLS result (table 3.1) suggesting a significant negative relationship between aid inflows and infant mortality is not robust across different estimation methods.

In summary, we find that countries with budget difficulties receive more aid when common time effects are controlled for. Thus, this result is not robust to cross-section estimation methods. We find robust evidence that more aid is given to countries with lower levels of per capita GDP. There is however no evidence that aid rewards countries that exert higher development effort. Our results are consistent with the finding of Svensson (1995) on a sample that comprised sub-Saharan African, Latin American, and Asian countries. However, the latter does not find a significant effect of the budget balance on aid receipt when regional effects are controlled for. The interpretation of their finding is that generally regions characterised by larger budget deficits receive more aid. However, among countries in the same region, differences in aid receipt are not determined by the budget balance – a finding that contrasts with the present study. We suggest that this difference in results may partly be due to our choice of instruments. Specifically, including the lag of the budget balance as an instrument for the budget balance reduces the effect of weak instrument problem on the present results *vis a vis* Svensson (1995).

3.6.2 Effect of aid on the recipients' budget balance

Having established that lower income (per capita GDP level) and larger budget deficits induce higher inflows of aid, we proceed by investigating what the implications of

such need-motivated aid disbursement are for the budget balance of recipient governments. The *a priori* expectation based on the underlying aid incentive model is that aid induces lower budget balances (i.e. larger deficits). Estimates of the response of the budget balance to aid inflows, obtained from equation (3.19)(a), are reported in tables 3.4 to 3.6. The results in tables 3.4 and 3.5 are based on panel techniques, using 5-year pooled cross-section data and those in table 3.6 are estimated from annual-average data over the whole period (1980-2004) using cross-section regressions. We find that aid inflows have a significant negative effect on the budget balance of recipients. Qualitatively, the results are consistent with Svensson (1995). However, our estimates of the negative impact of aid on the budget balance based on the African sample and more recent data is approximately half of what Svensson (1995) obtains for their cross-continent sample using older data. This suggests that allocating more aid where the budget deficit is larger may not be the reason why aid induces larger deficits. The result is robust across different estimation methods and specifications as shown below.

3.6.2.1 Panel (pooled cross-section) analysis

OLS, random-effect, and fixed effect estimates

Panel OLS estimates of the budget-balance equation, without and with time-dummies, are reported in columns 4(a) and (b) of table 3.4 respectively. Both estimations show that aid has a significant negative effect on the budget-balance. Given previous results (in section 3.5.1) that increased budget deficit significantly induces higher inflows of aid, the negative effect of aid on the budget balance is consistent with the prediction of Svensson (2000) aid incentive model. As expected, the effect of GDP growth on the budget-balance is positive and significant – all things being equal, growth leads to

higher fiscal revenue and higher budget-balances. The level of per capita GDP, ethno-linguistic fractionalization, and the time dummies do not affect the budget balance significantly. Surprising, however, is that change in terms of trade has a significant negative effect on the budget-balance. A likely explanation is that positive (negative) terms of trade shocks make governments more (less) solvent leading to more than proportionate increase (decrease) in government expenditure in sub-Saharan African countries.[29] It is also surprising that political instability (captured by the WAR variable) has a positive effect on the budget balance but, as would become clear, the latter finding is not robust. As explained previously, OLS estimation does not allow for unobserved country-fixed effects and may be inefficient and biased as a result. We therefore employ random-effect and fixed-effect methods as robustness check in what follows.

The random- and fixed-effects estimates of the budget balance equation (with and without time dummies) are reported in columns 4(c) to 4(f) of table 3.4. In all four columns, and consistent with the OLS results, aid has a significant reducing effect on the budget balance. The magnitude of this negative effect is similar across all the three estimation methods (i.e. OLS, random-effect, and fixed-effect methods), and is approximately half of what Svensson (1995) obtains.[30] It is noteworthy that the Breusch-Pagan LM test does not reject the existence of unobserved country-fixed effect. Nonetheless, the similarity of the result across the different estimation methods is not surprising because the Hausman test, based on both the specification with and

[29] This interpretation is consistent with pro-cyclical fiscal policy in sub-Saharan African countries (see Thornton, 2008).

[30] In Svensson (1995), the coefficient for aid obtained from 5 year pooled cross-section OLS estimation of the budget balance is -0.607 as compared to -0.267 in the present study.

without time dummies, shows that the unobserved (country-fixed) effect is not significantly correlated with the regressors even at the 10% level of significance, indicating that the country-fixed effect does not cause OLS and random-effect estimates to be biased. Thus, the existing country-fixed effect only affects the efficiency of the estimated coefficients. We also find that, unlike what the OLS

Table 3.4 Panel estimation of the effect of total aid on recipients' budget balance

	BUDGET BALANCE/GDP					
	OLS_NODUM	**OLS_DUM**	**RE_NODUM**	**RE_DUM**	**FE_NODUM**	**FE_DUM**
	4(a)	**4(b)**	**4(c)**	**4(d)**	**4(e)**	**4(f)**
AID	-0.268***	-0.267***	-0.250***	-0.243***	-0.251***	-0.227**
	(0.07)	(0.074)	(0.058)	(0.062)	(0.082)	(0.094)
GDPGROWTH	0.389***	0.380**	0.339***	0.333***	0.343***	0.318***
	(0.148)	(0.17)	(0.101)	(0.111)	(0.108)	(0.119)
GDPLEVEL	-0.015	-0.016	-0.024	-0.022	-0.130**	-0.133**
	(0.019)	(0.019)	(0.022)	(0.021)	(0.056)	(0.0590
ΔTOT	-0.105**	-0.108**	-0.109***	-0.111***	-0.103**	-0.100**
	(0.042)	(0.042)	(0.041)	(0.043)	(0.043)	(0.045)
ELF	-0.028	-0.028	-0.031	-0.031		
	(0.021)	(0.021)	(0.032)	(0.031)		
WAR	0.044***	0.040***	0.041	0.038		
	(0.013)	(0.012)	(0.032)	(0.031)		
Dum8589		-0.004		-0.006		-0.004
		(0.021)		(0.013)		(0.013)
Dum9094		0.003		-0.001		-0.004
		(0.019)		(0.012)		(0.013)
Dum9599		0.001		-0.001		-0.001
		(0.019)		(0.012)		(0.012)
Dum0004		0.007		0.002		0.004
		(0.019)		(0.012)		(0.013)
CONS	0.033	0.033	0.064	0.056	0.376**	0.386**
	(0.074)	(0.076)	(0.084)	(0.083)	(0.181)	(0.189)
R2	0.305	0.31			0.224	0.229
N	138	138	138	138	138	138
B-P			32.07***	31.53***		
Fd		0.26		0.58		0.16
H					4.53	13.13

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively
OLS_NODUM is read as estimation of the budget balance equation using OLS on the model without time dummy. The symbol 'DUM' refers to the model with time dummy. The DUM8589 variable refers to the time dummy capturing the 5-year pool between 1985 and 1989; the nomenclature applies to all other time dummies.

estimates suggest, political stability (WAR) does not affect the budget balance significantly in the random-effect estimation. As a time-invariant variable, however, political stability is excluded from the fixed-effect estimation. Another finding of interest is that GDP per capita has a significant negative effect on the budget-balance only when the fixed-effect estimation method (which is based on the 'within-country' variation of the data) is used. This suggests that, all things being equal, a country's per capita GDP level does not determine its budget-balance but an increase in the level of per capita GDP leads to more than proportionate increase in fiscal expenditure *vis a vis* fiscal revenue.

Given that aid is a potential endogenous regressor in the budget balance equation, we proceed with the instrumental variable and the lagged-regressor methods. Even though the F-test results (Fd) in table 3.4 indicate that there is no significant common time effect, we still proceed with the model that includes time dummies to show that our result is not conditional on the omission of the time dummies.[31]

2SLS, 3SLS, IV random- and fixed-effects, and lagged-regressor estimation methods

The 2SLS, 3SLS, random effect IV and fixed effect IV methods constitute the instrumental variable methods used to estimate the budget balance equation. For reasons explained in section 3.6.1, we do not report the result of the marginal aid equation that is estimated as a system with the baseline budget balance equation. The Sargan's test results in table 3.5 however shows that the instruments (over-identifying restrictions) contributed by the marginal aid equation are valid; i.e., Sargan's chi-square (2) of 3.533 (P-value = 0.171) fails to reject the null hypothesis that omitted

[31] Equivalent estimations in Svensson (1995) to which we compare our results do include time dummies.

instruments are not jointly significant. An important remark on the instruments used for aid is that, even though the baseline aid equation suggests population, life expectancy and infant mortality as instruments (over-identifying restrictions), we use only population and life expectancy (in addition to the lag of aid) because the Sargan's test rejects infant mortality as a valid instrument; Sargan's chi-square (3) of 9.582 (P-value = 0.0225). This is not the case in the cross-section analysis as would become clear, suggesting that there may be a significant correlation between the infant mortality and the budget balance when the data is pooled into sub-periods (5 years in the present case) but diminishes when the entire series is averaged.

Columns 5(a) to 5(d) of table 3.5 report the estimates of the budget balance equation using the 2SLS, 3SLS, IV random effect, and IV fixed effect methods respectively. Results for the lagged-regressors method are reported in columns 5(e) to 5(f). With the exception of the fixed-effect methods (columns 5(d) and 5(g)), all the results show that the effect of aid inflows on the budget balance remains significantly negative and the size of the coefficients are less than half of what Svensson (1995) obtains.[32] The IV fixed-effect method in column 5(d) shows that the within effect of total aid on the budget balance is positive though not significant at the 10% level. Similarly, the lagged-regressor fixed effect method shows that the effect of total aid on the budget balance is not significant. This suggests that there may be a divergence in the 'within-country' and 'between-country' effect of aid inflows on the budget balance such that the 'between-country' effect of aid flows is negative, whereas the 'within-country' effect may be simply insignificant as it appears, or a combination of positive and

[32] In their 5 year pooled cross-section estimation of the budget balance equation, Svensson (1995) obtains coefficients of -0.878 and -0.668 for aid using 2SLS and 2SLS-fixed methods respectively.

Table 3.5 Applying IV and lagged-regressors techniques to panel estimation of the effect of total aid on recipients' budget balance

	BUDGET BALANCE/GDP						
	2SLS	3SLS	RE_IV	FE_IV	LAG_OLS	LAG_RE	LAG_FE
	5(a)	5(b)	5(c)	5(d)	5(e)	5(f)	5(g)
AID	-0.287***	-0.328***	-0.222**	0.383	-0.227***	-0.149**	-0.041
	(0.085)	(0.065)	(0.093)	(0.275)	(0.077)	(0.065)	(0.099)
GDPGROWTH	0.449	1.022***	0.439	-0.628	0.216*	0.134	0.054
	(0.326)	(0.288)	(0.325)	(0.761)	(0.127)	(0.125)	(0.124)
GDPLEVEL	-0.02	-0.032*	-0.019	-0.032	-0.024	-0.022	-0.250***
	(0.025)	(0.019)	(0.028)	(0.086)	(0.022)	(0.023)	(0.076)
ΔTOT	-0.085*	-0.089*	-0.089*	-0.089*	-0.005	-0.004	0.009
	(0.045)	(0.05)	(0.051)	(0.051)	(0.056)	(0.047)	(0.046)
ELF	-0.023	-0.02	-0.018	.	-0.039*	-0.038	.
	(0.02)	(0.021)	(0.035)	.	(0.023)	(0.033)	.
WAR	0.045**	0.037	0.041	.	0.016	0.012	.
	(0.019)	(0.028)	(0.043)	.	(0.023)	(0.039)	.
Dum8589	-0.016	-0.018	-0.015	-0.011	0	0.005	-0.017
	(0.024)	(0.016)	(0.015)	(0.015)	.	(0.012)	(0.011)
Dum9094	0.002	0.007	0	-0.052	0		-0.024**
	(0.021)	(0.015)	(0.016)	(0.031)	(0.016)		(0.01)
Dum9599	-0.003	-0.011	-0.004	-0.001	0.031*	0.029***	-0.002
	(0.022)	(0.015)	(0.014)	(0.015)	(0.016)	(0.011)	(0.01)
Dum0004	0.002	-0.01	-0.001	0.011	0.025	0.024**	0
	(0.023)	(0.016)	(0.015)	(0.017)	(0.016)	(0.01)	.
CONS	0.05	0.088	0.036	0.01	0.052	0.034	0.741***
	(0.093)	(0.069)	(0.104)	(0.287)	(0.085)	(0.09)	(0.247)
R2	0.228	0.264	0.224	0.143	0.233	0.222	0.238
N	128	128	128	128	113	113	113

Sargan's test: Chi-square(2) = 3.533; P-value = 0.171

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively.

OLS_NODUM is read as estimation of the budget balance equation using OLS on the model without time dummy. The symbol 'DUM' refers to the model with time dummy. The DUM8589 variable refers to the time dummy capturing the 5-year pool between 1985 and 1989; the nomenclature applies to all other time dummies.

INSTRUMENTS FOR AID: Lag of aid, life expectancy, and population. The Sargan's test fails to reject the null hypothesis that omitted instruments are not jointly significant, implying that our list of instruments are valid.

negative effects (in different countries) that cancel out – This is however beyond the present chapter and is therefore addressed in the next chapter.

The significant negative effect of terms of trade growth on the budget-balance observed in previous estimation methods appears to be robust to the 2SLS, 3SLS, and the IV random- and fixed-effect estimations, but only at the 10% level of significance. Also robust to the latter estimations are that ethno-linguistic fractionalization and time dummies do not influence the budget balance significantly even at the 10% level. With regards to GDP growth, per capita GDP level, and political stability, the levels of significance, but not the signs of their coefficients, are not consistent across the different estimation methods in most cases; any inferences drawn on them would therefore be weak.

In the lagged-regressor estimations (columns 5(e) to 5(g)), only inferences on aid (in the budget balance equation) are consistent with previous OLS and IV results. Thus, the effect of the lagged-aid variable on the budget-balance in the OLS and random-effect (fixed-effect) estimations is significantly negative (insignificant). The remaining regressors are either insignificant or their levels of significance are not consistent enough for reliable inferences to be drawn. The weak results from the lagged-regressor method are not surprising because estimates are reduced-form rather than structural.

This far, we have tested our hypothesis, that aid has a significant negative effect on the budget-balance, on panel estimation methods that are based on the 'combined' ('between' and 'within') variation of the data (namely, OLS, random-effect, 2SLS, and 3SLS methods) and the 'within' variation of the data (i.e. fixed effect method). We

finally check the robustness of our findings to cross-section estimation methods for insight on the 'between' variation of the data.

3.6.2.2 Cross-section estimation

The result of the cross-section estimation of the budget balance equation is shown in table 3.6. The OLS and 3SLS estimates in columns 6(a) and 6(c) show that the effect of aid flows on the budget balance is significantly negative. Thus, aid induces larger budget deficits across countries. In the 2SLS estimation, however, aid appears not to influence the budget-balance significantly. The latter finding is possibly because the 2SLS method is less efficient compared to the 3SLS method. The instruments (identifying restrictions) for aid are population, life expectancy and infant mortality; the lag of aid is obviously not available as an additional identifying restriction in the cross-section analysis. The Sargan's test (Chi-square(2) = 2.053; P-value = 0.358) suggests that the list of instruments are valid.

As expected, GDP growth has a significant positive effect on the budget balance in all cross-section estimation methods. Also consistent with previous results from the panel estimation (tables 3.4 and 3.5), the level of GDP is not a significant determinant of a country's budget-balance. Other findings are that, generally, the change in terms of trade, ethnic-fractionalisation, and political stability (WAR) do not influence the budget balance significantly. The only exceptions are in the 2SLS estimation where the effects of change in term of trade and political stability (WAR) on the budget balance are negative and positive respectively (at the 10% level of significance).

Table 3.6 Using OLS and IV method for cross-sectional estimation of the effect of total aid on recipients' budget balance

	BUDGET BALANCE/GDP		
	OLS	**2SLS**	**3SLS**
	6(a)	**6(b)**	**6(c)**
AID	-0.283**	-0.205	-0.273**
	(0.128)	(0.165)	(0.130)
GDPGROWTH	0.995**	1.280*	1.224***
	(0.435)	(0.648)	(0.446)
GDPLEVEL	-0.021	-0.009	-0.018
	(0.030)	(0.033)	(0.025)
ΔTOT	-0.151	-0.156*	-0.122
	(0.132)	(0.077)	(0.131)
ELF	-0.012	-0.006	-0.017
	(0.025)	(0.029)	(0.034)
WAR	0.02	0.022*	0.023
	(0.012)	(0.012)	(0.034)
CONS	0.028	-0.026	0.016
	(0.115)	(0.131)	(0.101)
R2	0.371	0.394	0.384
N	33	30	30
Sargan's test: Chi-square(2) = 2.053; P-value = 0.358			

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively BB_OLS_R is read as estimation of budget balance determination equation using OLS on the Restricted model. The symbol 'U' refers to the unrestricted model.

INSTRUMENTS FOR AID: life expectancy, infant mortality, and population. The Sargan's test fails to reject the null hypothesis that omitted instruments are not jointly significant, implying that our list of instruments are valid.

While the pros and cons of using the cross-section method are outlined in section (3.6.1), it is noteworthy that it has an additional advantage in estimating the budget balance equation because, unlike in the aid determination equation, the result is not likely to be biased by omitted time-effects since the time dummies in the panel estimation (table 3.4) were not jointly significant. Also, previous results (table 3.4) indicate that not being able to control for unobserved country-fixed effects in the cross-section budget balance regressions does not result in biased estimates. The latter is because the unobserved effects, according to Hausman test, are not correlated with the regressors. The existence of unobserved fixed-effects (according to Breusch-Pagan

test in table 3.4) however suggests that the cross-section estimates would be less efficient than the random- and fixed-effect estimates.

We conclude that more aid is given to countries with relatively larger budget deficits and those with lower income levels, and that aid, so disbursed, induces lower effort at preventing budget deficits. Qualitatively, these findings are in line with Svensson (1995). Contrary to Svensson (1995), however, we find that even within one continent, which is Africa in our case, the response of aid inflows to the budget deficit is significant.[33]We acknowledge that the latter may imply different aid-budget balance relationship across continents. We however do not lose sight of the fact that the difference in findings may be due to our choice of instruments for the budget balance. We improve upon the validity and efficiency of instruments for the budget balance by including its lag as an additional instrument. We also find that the magnitude of the negative impact of aid inflows on the budget balance in Africa is approximately half of what the evidence based on a cross-continent sample in Svensson (1995) suggests.

3.7 Summary

Characteristics such as risky and undiversified sources of income combined with imperfect access to credit in bad times provide a strong argument in favour of need-based aid disbursement to developing countries. Yet, aid disbursement, which is predominantly need-based, has been ineffective at promoting growth. An explanation that originates in the aid incentive literature is that need-motivated disbursement is a disincentive for exerting development effort, especially when such effort is costly (say,

[33] Svensson (1995) finds that the response of aid flows to the budget deficit is not significant when regional dummies are included. The difference with our finding may be due to our choice of instrument. We include the lag of the budget balance as an instrument for the budget balance.

politically). Existing evidence, based on a cross-continent sample of countries (from Asia, Latin America and Africa) between 1970 and 1989 shows that, indeed, countries with larger budget deficits receive more aid, and aid, so disbursed, induces larger budget deficits.

The answer to the aid effectiveness problem seems to lay in the implementation of aid conditionality whereby aid disbursement is conditioned on development performance (indicative of development effort). It is however suggested in the incentive aid literature shown that enforcing conditional aid contracts is difficult without a commitment technology. This is because conditional aid contracts are time-inconsistent as a result of the altruism of donors. That is, notwithstanding a conditional aid contract, altruistic donors find it optimal to give more aid to recipients with larger budget deficits *expost*. Knowing this, recipients have less incentive to avoid deficits *ex ante*. This has generated effort from International Financial Institutions to coordinate disbursements from different sources, strengthening the ties between bilateral donors, and delegating disbursements to the World Bank and IMF (Bulir and Hamann, 2003 and 2005; Svensson, 2000). In the light of this, the present study investigates how the budget balance affects aid disbursement and the effect of aid on the budget balance in recent times (i.e., between 1980 and 2004). The research question is most relevant for countries that are highly aid dependent. Therefore, we use a sample of 37 sub-Saharan African countries.

The results show that, in line with past evidence (Svensson, 1995), countries with larger budget deficits receive more aid, and aid induces larger budget deficits. An important finding, however, is that whereas the effect of the budget balance on aid

inflows is of a magnitude of the order of what Svensson obtains, the magnitude of the effect of aid on the budget balance is about half of Svensson's estimate. This suggests that the implementation of conditional aid contracts may be independent of the need-based aid disbursement across countries, suggesting the need for further research on the implementation of aid conditionality. These findings are robust across different estimation methods.

The results also show that more aid is received by countries with lower levels of per capita GDP and life expectancy rates, suggesting that significant amount of aid receipts are for humanitarian and poverty alleviation purposes. We however find no evidence of performance-based aid disbursement across countries; as it is with low deficit countries, those with higher growth rates receive less aid.

APPENDIX A3

SUMMARY STATISTICS

Annual Averages(1980-2004)				
Variable	Mean	Std. Dev.	Min	Max
ODA/GDP	0.115	0.074	0.005	0.364
Budget balance/GDP	-0.061	0.044	-0.172	0.056
Log of GDP per capita (const. 2000 Int'l $)	3.154	0.341	2.639	4.016
Growth (GDP per capita const. 2000 Int'l $)	0.011	0.035	-0.031	0.183

CHAPTER 4

EXPLAINING THE INCENTIVE EFFECT OF AID ON THE BUDGET BALANCE

4.1 Introduction

The model of Svensson (2000) suggests an aid incentive structure whereby a common 'pot' of aid is shared among recipients each year such that those with lower budget deficits receive more aid. Empirical evidence however shows that, all things being equal, more aid is given to recipients that face larger budget deficits, and that aid induces increased budget deficit (Svensson 1995, and previous chapter).[34] According to the aid incentive model of Svensson (2000), the reason why aid induces increased budget deficit is that giving more aid to recipients facing larger budget deficits does not create the incentive for recipients to avoid deficits. Thus, Svensson (2000) appears to discourage aid policies that allocate more aid to recipients facing higher budget difficulties. However, an implicit assumption made is that all recipients have similar characteristics in which case differences in budget deficits are ascribable to fiscal discipline (Cordella and Dell'Ariccia, 2007). Therefore, giving more aid to countries facing larger budget deficits means incentive-creating aid conditionality is not being enforced. The incentive structure of aid disbursement however changes when this assumption is relaxed. In reality, aid recipients have different characteristics, such as different tax capacities, that make it non-practical to ascribe differences in budget balance across countries to differences in fiscal discipline. More realistically, therefore, we first consider a need-based aid disbursement in which countries facing higher fiscal

[34] Svensson (1995) used data on a sample of low-income countries from Africa, Asia, and Latin America over the period 1970-1989.

difficulties receive a larger share of the aid 'pot'. We then consider an aid incentive structure whereby a given country's share of the aid 'pot' is disbursed over several years such that less aid is received during years of poor fiscal performance. Therefore the incentive structure of aid, which is characterised by a positive correlation of the year to year disbursement with the budget balance, would be better described by the strategic disbursement of aid to one recipient over time, rather than the strategic disbursement of aid to several recipients each year that Svensson (2000) describes.

Relaxing the implicit assumption of Svensson's aid incentive model, the present study argues that giving more aid to countries facing larger budget deficits is not the underlying reason why aid induces larger deficits. Rather, we show that it is because the year to year disbursement to a given country is such that more aid is received during years of larger deficits. It follows then that, aid induces lower budget deficits when a given country receives more aid during years of reduced budget deficits (but not necessarily more aid than what countries with higher budget difficulties receive), and conversely, when a given country receives less aid during years of increased budget deficits (but not necessarily less aid than what countries with less budget difficulties receive). This aid disbursement structure constitutes the within-country (year to year) aid conditionality with respect to the budget balance.[35] Thus, incentive-creating aid conditionality is country-specific and depends on the within-country (year-to-year) rather than between country response of aid inflows to the budget balance.

[35] What determines the successful implementation of the within-country dimension of aid conditionality is beyond the scope of the present study.

To show how such country-specific aid incentive structure operates when countries with larger budget deficits are receiving more aid, the study first establishes that there is divergence in the between-country (cross-country) and within-country (year to year) dimensions of the determination of aid disbursement.[36] It is therefore possible for donors to budget more aid for recipients facing larger budget deficits, and yet condition the year-to-year disbursement of aid to a given recipient country on improved budget performance, *ceteris paribus*.

To understand the between-countries dimension of aid disbursement, note that the fundamental reason for giving foreign aid to low-income countries is that they are unable to raise enough resources from taxation and private capital markets (Chervin and Wijnbergen, 2010), and that resource constraints are not necessarily the result of weak development policies.[37] It is therefore optimal to budget more aid for recipients with higher budget constraints, provided they are willing to pursue sound policies (Goldsbrough and Cheelo, 2007).[38] This explains why the between-countries dimension of aid disbursement shows a pattern of giving more aid to countries with larger budget deficits. To see how the within-country dimension of aid disbursement diverges from the between-countries dimension (which is need-based), first note that

[36] In the literature, studies that consider both between-countries and within-country dimensions of aid disbursement patterns treat the two dimensions as the same. Examples are Svensson (1995, 2000), Burnside and Dollar (2000, 2004).

[37] Practically, complete convergence of the reform capacities between recipient countries could be perceived as a long- rather than short-term phenomenon. Therefore, implementing incentive conditional aid across recipient countries means that in the short to medium term, relatively poorer countries would be disadvantaged in that they would continue to receive less aid irrespective of the amount of reform effort they exert. Aid donors are therefore not likely to implement aid conditionality across countries.

[38] In October, 2004, donors were entreated by the Development Committee of the IMF and the World Bank to provide timely financial assistance to countries that are committed to sound policies, (IMF, 2004 in Bulir and Hammann, 2005).

during aid agreements between donors and recipients, in which country-specific reform targets are set, donors typically make aid commitments covering a number of years. Therefore, after more aid has been budgeted for recipients with larger budget deficits, the aid budget is disbursed over a number of years, allowing donors to create the incentive for reduced budget deficits by disbursing less than the promised amount of aid during episodes of defaulted budget-deficit agreements. Also, the 'within-country' dimension of aid disbursement diverges from the 'between-country' dimension when donors promise less aid during periods when a given recipient does not agree to lower budget-deficit targets – the key point however remains that when lower reform effort is 'punished' by donors, the recipient does not necessarily receive less aid than what countries with lesser budget difficulties receive. This description of aid determination renders Svensson (2000) aid incentive model less realistic.

While the within-country (year to year) disbursement of incentive aid is expected to be positively correlated with the recipient's budget balance, not all aid received is for incentive creation purposes. As Burnside and Dollar (2000) rightly pointed out, foreign aid donation to a given recipient country is for different purposes which are, to a large extent, inconsistent. For instance, unlike the incentive objective for aid disbursement, there are increased inflows of humanitarian (poverty alleviation) aid during episodes of increased budget deficits. Therefore, depending on what aid disbursement objective is dominant, the year to year receipts of total aid in a given country may be positively or negatively correlated with the recipient governments budget balance. When incentive-creating objective is dominant, we expect a positive correlation between the budget balance and aid inflows. On the other hand, we expect a negative correlation between the budget balance and aid inflows when humanitarian (poverty alleviation) objective

is dominant. The resulting year to year correlation between aid and the budget balance constitutes the extent of implementation of within-country aid conditionality, whiles the resulting pattern of year to year aid inflows constitutes the within-country dimension of aid disbursement.

We finally investigate empirically whether, in spite of allocating more aid to recipients facing larger budget deficits, it is possible for aid to induce lower budget deficits when the within-country (year to year) dimension of aid conditionality is implemented. To do so, we obtain, for each recipient country, the coefficient of aid conditionality which measures the extent of implementation of within-country aid conditionality. We then estimate cross-section budget balance regressions to show that aid induces lower deficits as the coefficient of aid conditionality increases.

Unlike Svensson (1995), we define aid conditionality as a within-country phenomenon.[39] In line with Svensson (1995), however, we measure aid conditionality with respect to the budget balance of a given recipient. The budget balance is a relevant policy choice in the context of the present study for two reasons: Firstly, avoiding large budget deficits has been at the fulcrum of most reform measures proposed in conditional aid contracts, dating from the Structural Adjustment Era of the 1980s to the Budget Support era of the second half of the 1990s and 2000s, and the recent Highly Indebted Poor Countries debt relief era. Secondly, when aid forms a relatively small proportion of the recipient's resources, it is more effective to use it as part of a larger development programme rather than to use it for separate projects

[39] Svensson (1995) implicitly assumes that there is no divergence in aid determination across countries and within a country over time.

(Cordella and Dell'Ariccia, 2007). Therefore, given the limited availability of foreign aid, it is likely to be more effective when fiscal stability and reduced budget deficits are the main focus of conditionality. On this basis, we define the extent of implementation of within-country aid conditionality as the extent to which year to year aid disbursement to a given recipient punishes increased budget deficits.

Based on our empirical set-up and analysis, the study concludes that there is divergence in the 'between-countries' and the 'within-country' dimensions of aid determination, and that incentive-creating aid conditionality is a 'within-country' phenomenon. Most importantly, we confirm that, despite giving more aid to countries that need it most, aid indeed induces lower budget deficits across countries if the within-country (year to year) aid conditionality is implemented, ceteris paribus. Therefore, giving more aid to countries facing higher budget deficits is not the underlying reason why aid induces higher deficits.

The chapter is organised into eight main sections. In section 4.2, we present a brief literature review to show that there may be a divergence between cross-country and within-country dimensions of aid determination. Sections 4.3 and 4.4 respectively describe the theoretical and empirical frameworks employed. We then present the empirical specifications in section 4.5. In section 4.6, we conduct a pre-analysis of our research hypotheses based on inspection of the data. This is followed by econometric estimations and discussion of results in section 4.7. The main findings of the study are then summarised in section 4.8.

4.2 Evidence of divergence between cross-country and within-country dimensions of aid determination; implication for the non-linearity of aid effectiveness

In this section, we highlight the evidence in the literature that there may be divergence in aid determination across countries and within a given country over time and how this may support the notion that aid effectiveness is nonlinear.

Generally, more aid is given to countries with more economic difficulties. This may result in a negative correlation between aid and growth across countries (Lensink and Morrissey, 2000). For instance, Hansen and Tarp (2001) find that, within their sample, countries with relatively large aid to GDP ratios are characterised by low growth. In addition, however, they find that increases in the aid to GDP ratios are associated with increasing growth rates. In other words, the correlation between aid and growth was found to be negative for the levels but positive for the differences, implying divergence of information in the cross-section and time-series dimensions. An intuitive explanation is that, in practice, the level of aid commitment depends on the recipient's need and absorptive capacity (Svensson, 1995 and Goldsbrough and Cheelo, 2007). However, the portion of the commitment that is actually received each year is influenced by the recipient's actions (McGillivray and Morrissey, 2004). For instance, aid is disbursed when required to finance agreed expenditure. It is therefore essential to allow for this divergence, not only in aid-growth studies, but in aid effectiveness studies in general. It is noteworthy, nonetheless, that the 'cross-country' and 'within-country' dimensions of aid disbursement are not always divergent. For instance, Alesina and Dollar (2000) find a weak positive correlation between aid and GDP across recipient countries, as do other studies on the 'within-country' correlation. Examples of the latter include Bulir and Hamann (2005) and Pallage and Robe (2001).

This gives rise to an interesting question as to whether or not the observed differences in aid effectiveness across countries are ascribable to their different 'within-country' patterns or characteristics of aid inflows.

To account for the different dimensions of aid, Hansen and Tarp (2001) suggest that both aid in level and difference should be included in panel estimation (as is the case with system panel GMM estimators). Obviously, this is not possible in cross-country studies, such as investigating how 'within-country' pattern of aid disbursement influences the variation in aid effectiveness across countries. A more adequate approach would be to include, in the aid effectiveness regression, an interaction term between aid and a coefficient that measures the 'within-country' pattern of aid disbursement. This approach suggests that aid effectiveness may be non-linear. Non-linearity of aid effectiveness has been accounted for in several studies with mixed results. For instance, Burnside and Dollar (2000, 2004) estimate the effect of aid on growth using an empirical specification that is similar to Hudson and Horrell (1987) and Boone (1994, 1996). Unlike the latter two, however, Burnside and Dollar (2000, 2004) include an interaction term between aid and policy and find that aid has a positive effect on growth in developing countries with good policies. Recently, Ali and Isse (2005) also found the effect of aid on growth to be non-linear, and dependent on the level of policy. In contrast to this, however, Rajan and Subramanian (2005) find no robust non-linear (squared and interaction with policy) effects of aid. Although Hansen and Tarp (2005) find a decreasing return to aid, they also find that the positive effect of aid on growth does not depend on good policy (in accordance with Lensink and Morrisey, 2000). Given that these studies focus mainly on aid-growth relationship, controlling for non-linearity of aid effectiveness on policy (as a channel through which

aid may affect growth) adds a new perspective to the existing literature. This extension to aid effectiveness studies is central to the present chapter.

4.3 Theoretical model

Foreign aid is a useful resource for supporting structural reform of developing economies, especially in the area of attaining fiscal stability. It is therefore reasonable that altruistic donors would want to give limited aid resources to recipients with larger budget deficits. In the incentive aid literature, however, it is argued theoretically that allocating more aid to recipients with larger budget deficits rather discourages recipients from avoiding budget deficits (Svensson, 2000). The importance of this finding is that it discourages the allocation of more structural reform assistance to those who need it most. Of great concern is that Svensson (2000) arrive at their results by assuming implicitly that all recipients have similar characteristics and for that matter differences in the budget balance across countries is ascribable to fiscal indiscipline and the state of the world. Contrary to this assumption, low income countries differ in tax capacity and the ability to obtain resources from capital markets (Chervin and Wijnbergen, 2010). In the present study, therefore, we present a variant of the Svensson (2000) aid incentive model in which we relax the assumption that recipients have similar characteristics. To do so, we separate the optimal allocation of aid across countries (between-country dimension) from the year to year disbursement of allocated aid to a given recipient (within-country dimension). Given the theoretical and empirical evidence, we consider the need-motivated allocation of aid across countries as a known fact, and we show that the incentive role of aid is embedded in

the year to year disbursement to a given country and not the allocation of aid across countries.

Optimum reform effort – aid and non-aid equilibrium

We adapt the Svensson (2000) aid incentive model in section (3.3). What we do differently is that we focus on the interaction between a single donor and a single recipient over time (rather than two recipients across countries and over time). This permits us to lay emphasis on the incentive implication of the within country (year-to-year) dimension of aid disbursement.

In the non-aid equilibrium, the first order condition for the optimal reform effort remains the same as in equation (3.11) but without the subscript *i* (since there is only one recipient). This is re-written below for readability.

$$(4.1) \qquad q'(e)\left[u(\frac{1}{2}\gamma) - u(\frac{1}{2}\beta)\right] = \delta$$

4.3.2 The aid equilibrium

In the aid equilibrium, total revenue of the recipient government (and consumption of the public for that matter) is a function of aid as shown in equation (3.5). Therefore, the FOCs for the optimum reform effort are as in (4.2) and (4.3) respectively for aid given during bad state of the world and aid conditioned on improved reform effort respectively.

(4.2) $$q'(e)\left[u(\frac{1}{2}\gamma + h(a)) - u(\frac{1}{2}\beta)\right] = \delta$$

(4.3) $$q'(e)\left[u(\frac{1}{2}\gamma) - u(\frac{1}{2}\beta + h(a))\right] = \delta$$

Equation (4.2) and (4.3) can be used to explain the incentive implications of year-to-year aid disbursement as follows: giving aid in bad outcomes (i.e. using aid to increase the second term in the square bracket) implies that a lower reform effort (higher marginal returns to effort) would be required to satisfy equation (4.2). On the other hand, equation (4.3) shows that conditioning aid on improved reform effort (expected to be associated with good outcomes) would induce higher reform effort. Therefore, using aid to reward good outcomes serves as an incentive for recipient governments to exert higher reform effort. This shows that, independent of the allocation of aid across recipient countries, a given recipient country exerts higher reform effort when the year to year inflows of aid is such that aid is used to increase the gain associated with a move from bad to good state.

4.4 Empirical Framework

The illustration in figure 4.1 sums up the underlying concept of the empirical analysis which is that, contrary to the implicit assumption in the incentive aid literature of a convergence in the within-country and between-countries patterns of aid disbursement, there is a divergence in the two dimensions: (i) the between-country dimension is associated with need-motivated disbursement. We therefore expect a positive correlation between aid inflows and the budget deficit across countries. (ii) The year to year disbursement of aid to a given recipient country, which constitutes the within-

country dimension, may be positively or negatively correlated with the recipient government's budget deficit depending on the dominant objective for aid disbursement. The two main objectives for aid disbursement considered in the present study are incentive creation and humanitarian assistance (poverty alleviation). The disbursement of incentive aid is conditioned on improved budget performance (lower budget deficit) in order to create the incentive for the recipient government to avoid deficits. We therefore expect incentive aid to be associated with reduced (increased) budget deficit (budget balance). This connotes a negative (positive) correlation between year to year inflows of incentive aid and the recipients budget deficit (budget balance). On the other hand, we expect the disbursement of humanitarian aid to be associated with increased (reduced) budget deficit (budget balance). The reason is that there is increased inflow of humanitarian aid to a given recipient country during episodes of fiscal difficulties (including larger budget deficits). This connotes a positive (negative) correlation between year to year disbursement of humanitarian aid and the recipient's budget deficit (budget balance). Therefore, the correlation between year to year disbursement of total aid and the recipient's budget balance – and, for that matter, the incentive effect of total aid receipt on the recipient's budget balance – depends on which objective for aid disbursement is predominant. If the year-to-year inflows of aid are predominantly for poverty alleviation purposes, then the recipient government would have less incentive to avoid deficits, and the likely result would be increased budget deficits. On the other hand, if the year to year inflows are predominantly for creating development incentive, then less aid would be received during episodes of weak fiscal discipline. The recipient government would therefore have the incentive to exercise fiscal discipline in order to receive more aid.[40]Thus, the

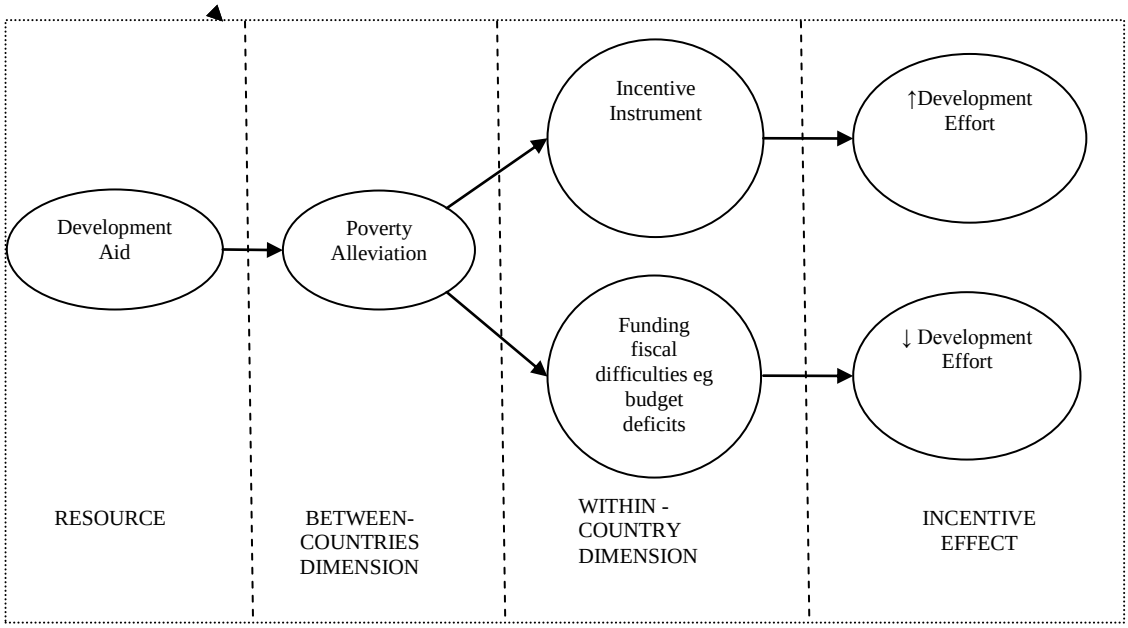
[40] The assumption is that exerting high development effort increases the likelihood of improved growth and welfare.

incentive effect of aid is a within-country rather than between-country phenomenon. Therefore, the underlying concept of the present study suggests that, contrary to what Svensson (1995) suggests, giving more aid to recipients faced with larger budget deficits is not the underlying reason why aid induces weak fiscal discipline. Rather, the effect of aid on the fiscal performance of a given recipient country is influenced by the dominant objective for aid disbursement, and for that matter, the pattern of year to year aid inflows. This leads to the hypothesis that, despite allocating more aid to recipients with higher budget difficulties, aid induces lower budget deficit when the within-country dimension of aid conditionality is successfully implemented. Aid conditionality is said to be successfully implemented only when donors punish default of aid agreements. How this is enforced is beyond the scope of the present study.

In the rest of the study, we set out our empirical approach and carry out the examination of our research hypotheses as follows: first, we show that there is a divergence in the between-countries and the within-country dimensions of aid disbursement. We then estimate the coefficient of aid conditionality as our empirical measure of the extent of implementation of aid conditionality within a given recipient country.[41] Finally, we investigate the effect of aid on the budget balance (budget deficit) as the coefficient of aid conditionality increases. Specifically, we construct an interaction term between aid and the estimated coefficient of aid conditionality for each recipient country in order to determine the differential effect of aid on the budget balance as aid conditionality improves.

[41]We obtain the coefficient of aid conditionality as the short-run elasticity of aid with respect to reform effort. Countries where the implementation of aid conditionality is more successful have more positive values of the coefficient.

Figure 4.1 Conceptual Framework



4.5 Empirical Specification

In this section, we present the empirical specifications that we use in testing our research hypotheses. The first hypothesis is that there is divergence in the within-country and between-countries dimensions of the determination of aid disbursement (with respect to the budget balance of recipients). The second is that, even though aid conditionality is not implemented across countries, it is still possible to implement it within a given recipient country. The within-country aid conditionality is whereby year-to-year aid disbursement to a given country is associated with reduced budget deficits (increased budget balance). The third hypothesis is that, in spite of giving more aid to countries that have larger budget deficits, aid induces lower budget deficits when the within-country (year to year) aid conditionality is implemented.

4.5.1 Determination of Aid disbursement

The test for the first hypothesis (that there is divergence in the within-country and between-country dimensions of aid determination) is based on cross-section and fixed-effect estimates of the aid equation from the previous chapter. The cross-section estimate is based on variations in the between-country dimension of the data, whereas the fixed-effect estimate is based on the within-country (year to year) variation in the data. Panel OLS, 2SLS, and 3SLS estimates, also from the previous chapter, are used as benchmark since these are based on variations in both the within- and between-countries dimensions of the data, and could be perceived as the net of the estimates

from the two dimensions. Aid is estimated within the system of simultaneous equations in (3.18);[42]this is re-written below for readability.

(4.4) (a) $AID_{it} = \delta_0 + \delta_1 BB_{it} + \delta_2 \log GDP_{it} + \delta_3 GROWTH_{it} + \delta_4 X_{it} + \pi_{it}$

(4.4) (b) $BB_{it} = \gamma_0 + \gamma_1 AID_{it} + \gamma_2 BB_{it-1} + \gamma_3 \log GDP_{it} + \gamma_4 GROWTH_{it} + \gamma_5 Z_{it} + \upsilon_{it}$

All variables are as defined previously.

To show the divergence in the two dimensions of aid determination with respect to the budget balance, the coefficient of interest is δ_2 in the aid determination equation. We show that δ_2 is different for the cross-section, fixed-effect, and panel (OLS, 2SLS, and 3SLS) estimates. It is noteworthy that the lag of BB in equation (4.4)(b), as an additional identifying restriction for the BB in equation (4.4)(a), does not exist in the cross-section and would therefore be omitted.

4.5.2 Aid conditionality as a within-country phenomenon and the incentive effect of aid

In this section we address our second and third hypotheses. We begin with the second hypothesis, that it is possible to implement year to year aid conditionality within a given recipient country even though aid conditionality is not implemented across countries. To show this, we estimate the coefficient of aid conditionality for each of the sample countries using time-series data. The coefficient of aid conditionality

[42] The specification is based on Svensson (1995) system of simultaneous equations. What we do differently is that we include the lag of the budget balance in the marginal (budget balance) equation as an additional identifying restriction.

measures the short-term correlation between the year-to-year disbursement of aid and the corresponding budget balance of the recipient, and is obtained for each recipient country within a single equation equilibrium-correction model (SECM). The empirical SECM model is formalised as follows:

$$(4.5)\ \Delta AID_t = \alpha_0 + \alpha_1 \Delta \log GDP_t + \beta \Delta BB_t + \theta(\log AID_{t-1} - \gamma_1 \log GDP_{t-1} - \gamma_2 BB_{t-1} + \gamma_3 trend) + \omega_t$$

where α_0 denotes the constant term, α_1 and β denote the short-run coefficients, and θ denotes the equilibrium adjustment coefficient. The cointegrating vector is denoted by γ, and the residual by ω_t. All other variables remain as already defined. Of interest is the coefficient of aid conditionality, denoted by the short-run parameter, β.[43] Positive values of β suggest that year to year disbursement of aid is associated with reduced budget deficit, implying successful enforcement of aid conditionality.

One limitation of our measure of the β coefficient is that it is estimated within a contemporaneous specification. Yet, in the real world, the implementation of aid conditionality is not always a contemporaneous process – it varies across countries, over time, and between countries. For instance, aid may be withheld from some recipients for repeated default in the past. Nonetheless, our measure is valid because, over time, the extent of implementation should reflect in the contemporaneous relationship between aid and the budget balance since aid conditionality is a repeated

[43] We do not identify the direction of causality (between aid and the budget balance) in the estimation of β because we are interested in the extent of implementation of aid conditionality – that includes not only punishment of non-compliance but also the enforcement of the intended use for aid. There is therefore no need to separate the feedback effect from aid to the budget balance.

game. Another limitation is that an increase in the budget deficit caused by the disbursement of less-than-promised amount of aid cannot be differentiated from 'punishing' increased deficits. This limitation is however unlikely to have any major impact on the results. The reason is that it only applies if recipients commit to aid projects before receiving aid, and is less likely to recur since aid conditionality is a repeated game. Conversely, giving more than the promised amount of aid, by reason of lowering the budget deficit (net of aid), may be misinterpreted as rewarding lower deficit. However, this is also unlikely since donors have limited aid budget. The strength of the SECM method lies in the fact that it separates the short- and long-run elasticities of aid with respect to the budget balance within a stationary specification and, where there is a long run relationship between variables, short-run adjustment to disequilibrium is accounted for. We control for the per capita GDP level in order to capture, as much as possible, the influence of income shocks on aid conditionality.

Having defined the coefficient of aid conditionality – as the measure of the extent to which year to year aid inflows are associated with reduced budget deficits – we address our third hypothesis, which is that, in spite of committing higher aid budget to recipients facing larger budget deficits, aid induces lower budget deficits if the within-country dimension of aid conditionality is enforced. To test this, we introduce an interaction term between aid and the coefficient of conditionality into a cross-section budget balance determination equation to investigate whether aid induces lower budget deficits as the coefficient of aid conditionality increases.[44] Drawing from the baseline equations (3.16) and (3.17) in the previous chapter, we estimate the budget balance determination equation within the following simultaneous system of equations.

[44] We use only the cross-section method in this case because the coefficient of aid conditionality was estimated from time-series data and would therefore be correlated with the time dimension of the budget balance by construction when the panel method is used.

(4.6a) $$BB_i = \partial_0 + \partial_1 AID_i + \partial_2 \beta_i + \partial_3 (\beta_i * AID_i) + \partial_4 \log GDP_i + \partial_5 GROWTH_i + \partial_6 Z_i + \pi_i$$

(4.6b) $$AID_i = \phi_0 + \phi_1 BB_i + \phi_2 \log GDP_i + \phi_3 GROWTH_i + \phi_4 X_i + \tau_i$$

All variables are as defined above. The coefficient of interest is ∂_3 which measures the differential effect of aid on the budget balance as the aid conditionality coefficient, β, increases. A positive ∂_3 implies that, among countries with a similar level of aid, the effect of aid on the budget balance is more positive in those within which the implementation of inter-temporal aid conditionality is more successful. *A priori*, we expect ∂_3 to be significantly positive since the aid incentive theory predicts that conditioning aid on the budget balance serves as an incentive for recipient governments to improve upon the budget balance in order to attract more aid.

In a nutshell, ∂_3 within our empirical set-up measures the effect of incentive aid on the budget balance. We use this stylized empirical approach because we are unable to perform a separate empirical examination of aid used for incentive purposes only. This is because foreign aid is donated for different, and at times inconsistent, purposes including incentive creation and the alleviation of poverty among others (Burnside and Dollar, 2000) – yet aid data for African countries is not disaggregated according to its objectives. We however expect the year-to-year inflows of incentive aid, by reason of punishing non-compliance to agreements, to be negatively (positively) correlated with budget deficits (budget balance). Therefore we consider countries in which the year-to-

year inflows of aid is negatively (positively) correlated with the budget deficit (budget balance), reflected by positive coefficients of aid conditionality, as those for which aid receipts are predominantly for incentive purposes. The current chapter uses the same data as the previous chapter.

4.6 Pre-analysis: Data distribution and behaviour of the aid and the budget balance variables

In this section, we use graphs to show the distribution of the aid and budget balance data. This enables us to examine whether the behaviour of these variables at a glance is consistent with the hypothesis of the present study.

For the data to be consistent with need-based pattern of aid disbursement across countries, as existing evidence suggests,[45] we expect a plot of the average annual aid receipt against the average annual budget balance across our sample countries to depict a negative relationship. The dense region of figure 4.2 shows that, indeed, there is a negative relationship between the average annual level of aid and the budget balance across countries. Given the small number of sample countries, however, figure 4.2 is less pronounced. Besides, the negative relationship perceived is influenced by outliers. We therefore repeat the illustration using a 5year pooled cross-sectional data for aid and the budget balance in figure 4.3. The dense region of the plot in figure 4.3 is relatively more pronounced in showing that there is a negative relationship between average annual aid receipts and the average annual budget balance.

[45] See Svensson (1995) and chapter 3 of the thesis.

Figure 4.2 Between-country relationship between aid and the budget balance, using cross-sectional data

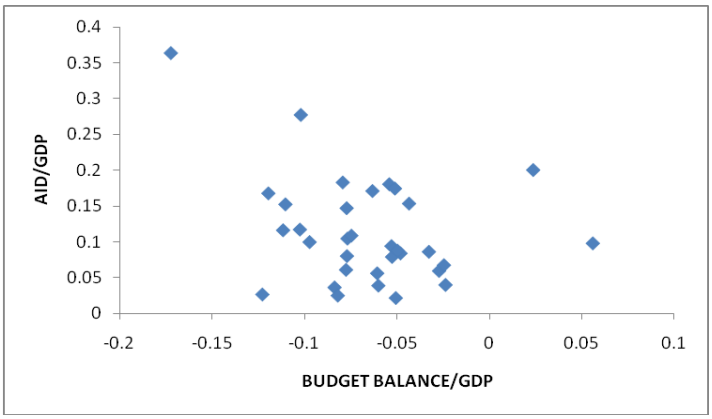
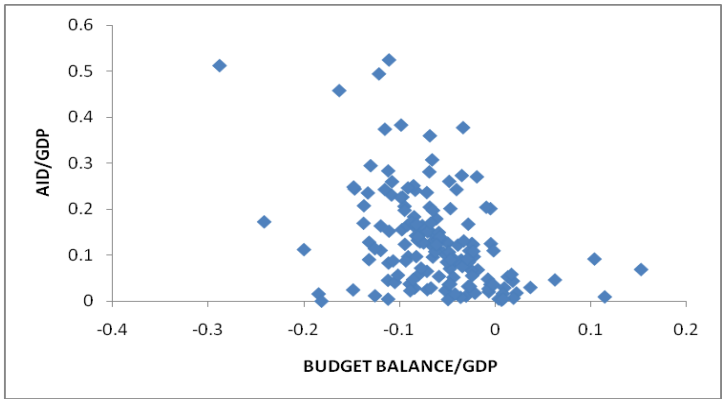


Figure 4.3 Between-country relationship between aid and the budget balance, using 5 year pooled cross-sectional data



Next, we examine the data for the 'within-country' relationship between aid and the budget balance. The objective here is to determine whether, in accordance with the second hypothesis of the present study, it is possible to implement aid conditionality even when the relationship between aid and the budget balance (deficit) across countries is negative (positive). Our *a priori* expectation, which constitutes the

necessary condition, is that the 'within-country' relationship between the two variables is positive in some countries and negative in others. Rather than voluminously illustrating the within-country relationship between aid and the budget balance with a graphical representation for each of our sample countries, we summarise the result with correlation coefficients. Thus, we obtain the correlation coefficient between de-trended aid and budget balance series for each recipient country. The result is as reported in table 4.1. The correlation between de-trended aid and budget balance series is positive for 11 recipient countries and negative for 22 recipient countries. We do not obtain correlation coefficients for 4 countries due to insufficient time series data. With these results, we categorise our sample countries into those for which the year-to-year relationship between aid and the budget balance is negative and those for which the relationship is positive (henceforth negative and positive correlation-beta countries respectively).

To confirm that the distribution of the data is consistent with the second hypothesis – i.e., divergence in the cross-country and within-country dimensions of the aid-budget balance relationship – the sufficient condition is that the 'within-country' dimension of the aid-budget balance relationship is not endogenous to the determination of aid disbursement, relative to the budget balance, across countries. Two implications of the sufficient condition are investigated as follows: the first is that the 'between-country' dimension of aid disbursement, relative to the budget balance, is similar and need-based for both negative and positive correlation-beta countries. Otherwise, it may be argued that the implementation of the 'within-country' aid conditionality depends on the extent to which the 'between-country' aid disbursement is motivated by need or performance. To investigate this, we reproduce the 'between-country' relationship

Table 4.1 Correlation between de-trended aid and budget balance series

Country	CORLNBETAPOLICY
Benin	-0.212
Botswana	0.091
Burkina Faso	-0.011
Burundi	0.02
Cameroon	-0.156
Central African Rep	.
Chad	-0.198
Congo	0.02
Cote d'Ivoire	-0.098
Equatorial Guinea	-0.325
Ethiopia	-0.081
Gabon	0.148
Gambia	0.063
Ghana	0.47
Guinea-Bissau	-0.535
Kenya	-0.163
Lesotho	-0.042
Liberia	.
Madagascar	0.137
Malawi	-0.663
Mali	0.102
Mauritania	-0.017
Mauritius	-0.374
Mozambique	-0.234
Namibia	0.279
Niger	-0.385
Nigeria	.
Rwanda	-0.331
Senegal	-0.323
Sierra Leone	-0.372
Somalia	.
Swaziland	-0.201
Tanzania	0.086
Togo	0.317
Uganda	-0.515
Zambia	-0.233
Zimbabwe	-0.083

between average annual aid and budget balance variables in figures 4.2 and 4.3 using separate markings for the positive and negative correlation-beta countries. Figure 4.4 shows that the latter relationship is not different for positive and negative correlation-beta countries. However, there are not enough positive correlation-beta countries to depict a clear pattern. We therefore resort to the 5 year pooled cross-section data to confirm in figure 4.5 that the relationship is similar and negative for both positive and negative correlation-beta countries. The distribution of aid and budget balance data in our sample is therefore consistent with the suggested divergence in the 'within-country' and 'between-country' dimensions of aid disbursement and, for that matter, its connotation that it is possible to implement aid conditionality within a given country even when aid disbursement across countries is need-based.

The second implication of an exogenous 'within-country' aid conditionality (with respect to the deficit-induced aid disbursement across countries) is that, in its implementation, a given country receives more aid during episodes of improved budget performance but not necessarily more aid than what countries with larger budget deficits receive. Conversely, a given country receives less aid during episodes of poor budget performance but not necessarily less aid than what countries with lesser budget difficulties receive. This has two testable connotations that are key to the concept of 'within-country' aid incentive. The first is that, irrespective of the year-to-year variation of aid inflows to a given recipient country, those facing higher budget constraints due to non-policy causes such as lower tax capacities persistently receive more aid on average. The second is that the implementation of within-country aid conditionality is neither influenced by the relative size of average annual aid receipt

Figure 4.4 Between-country relationship between aid and the budget balance, using cross-sectional data for positive and negative correlation-beta countries

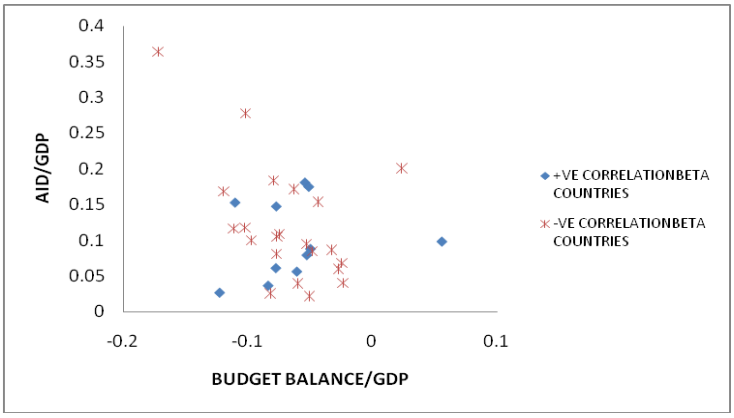
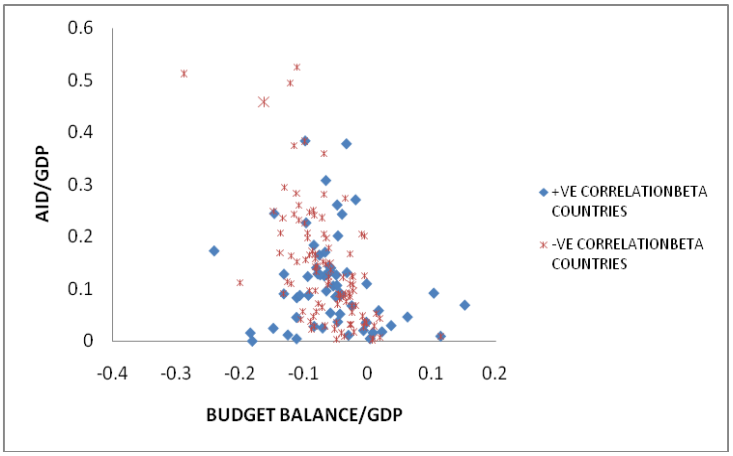


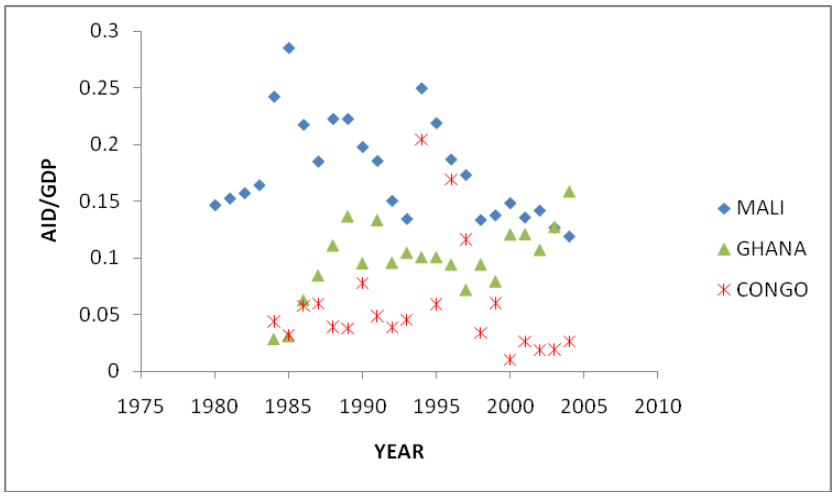
Figure 4.5 Between-country relationship between aid and the budget balance: using 5 year pooled cross-sectional data for positive and negative correlation-beta countries



nor the relative size of the average annual budget deficit of the recipient country, *ceteris paribus*. These two connotations are tested in what follows. Since both connotations focus on the (successful) implementation of 'within-country' aid conditionality, the final graphical analysis is based on positive correlation-beta countries only. So far, our graphical illustrations have shown relationships between aid and the budget balance that are relatively less pronounced because there are other need-based determinants of aid inflows across countries, such as the level of per capita GDP, which are not controlled for. For a more pronounced illustration, we limit our final graphical analysis to three recipient countries that are selected in a manner that minimizes the masking effect of other uncontrolled cross-country determinants of aid receipts on the relationship between aid and the budget balance. Also, in order for any possible influence of the relative size of aid and the relative size of the budget balance on the successful implementation of within-country aid conditionality to be conspicuous, we select countries that are clearly different in their annual averages of aid receipts and budget balances. To do so, we first rank all the sample countries in descending order of the average amount of aid received. We then choose a country each from the upper, middle, and the bottom third of the aid ranking. To minimize the possible masking effect of other uncontrolled cross-country determinants of aid receipts, we treat the negative relationship between aid and the budget balance across countries as a fact, given that it is proven empirically, and we select positive correlation-beta countries that best satisfy that fact. Specifically, we choose the country with the highest budget deficit from the upper third of the aid ranking. We then choose the country with the lowest budget deficit in the bottom third of the aid ranking, and the country with the budget deficit in-between the lowest and highest is chosen from the middle third of the aid ranking.

The three countries selected for the final graphical analysis are - in decreasing order of average annual budget deficit and average annual aid receipt - Mali, Ghana, and Congo. Figure 4.6 shows the time profile of aid for the three positive correlation-beta countries. We find that there is variation in the year-to-year aid inflows to each of the recipient countries. However, the amount of aid received each year is nearly consistently highest for Mali, followed by Ghana and then Congo.

Figure 4.6 Time profile of aid for Congo, Ghana, and Mali

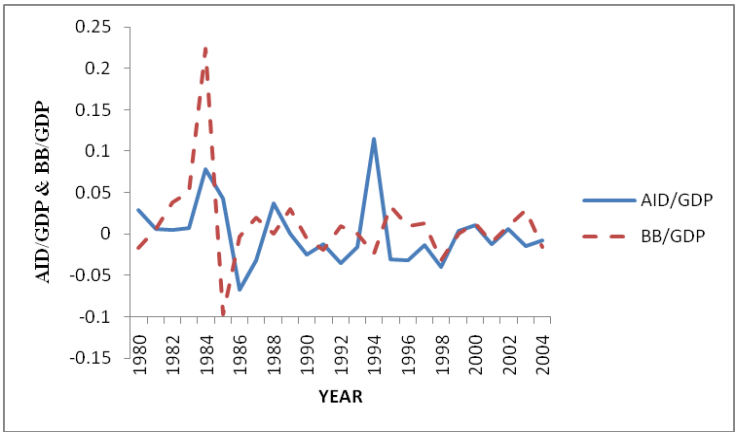


Figures 4.7 to 4.9 show the time profile of de-trended aid and budget balance series for Mali, Ghana, and Congo respectively. The series show that aid inflows to Ghana is more closely associated with reduced budget deficits than the two other countries, with Congo showing the least association of aid inflows with reduced budget deficit.[46] By our definition, therefore, the implementation of aid conditionality is most successful in Ghana, followed by Mali and then Congo. However, this ordering neither coincides

[46] The correlation-beta coefficients are 0.470, 0.102, and 0.020 for Ghana, Mali and Congo respectively.

with the ordering of the three selected countries based on the size of average annual aid receipts nor the ordering based on the size of the average annual budget balance. For instance, Mali, with the highest average annual aid receipt and budget deficit neither shows the strongest nor weakest association of year-to-year aid inflows with the budget deficit, just as Ghana, with the strongest association of year-to-year aid inflows with reduced budget deficit, is not the highest or the lowest in either of the rankings based on the size of average annual aid receipts and the average annual budget balance. This suggests that the extent of implementation of within-country aid conditionality is not influenced by the relative size of average annual aid receipt and the relative size of the average annual budget deficit of the recipient country, *ceteris paribus*.

Figure 4.7 Time profile of de-trended aid and budget balance series for Mali[47]



[47] We use de-trended series because we are interested in the short-run correlation. This is similar to the use of first differences of the ratios but with the advantage of not losing one data point. Time profiles of the first differences of aid and budget balance variables as ratios to GDP are shown in the appendix to this chapter.

Figure 4.8 Time profile of de-trended aid and budget balance series for Ghana

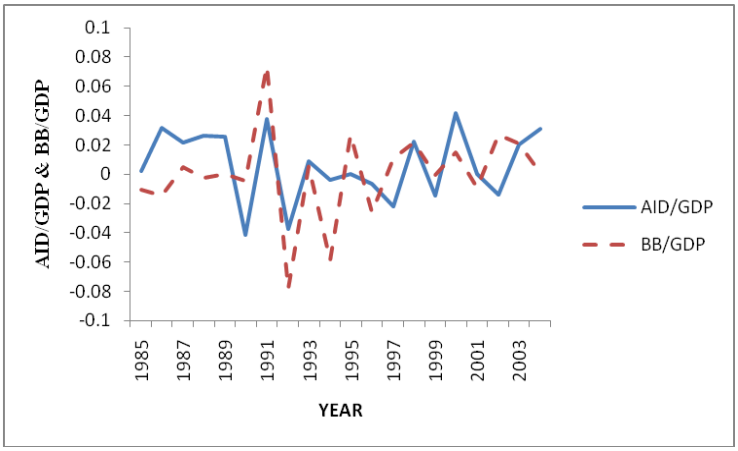
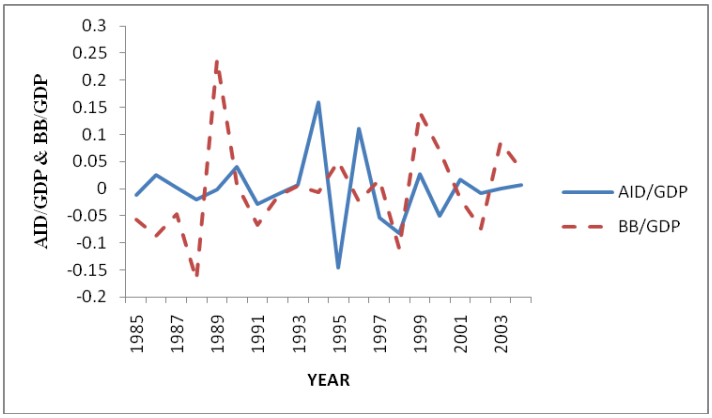


Figure 4.9 Time profile of de-trended aid and budget balance series for Congo



We therefore conclude that the distribution of aid and budget balance data is consistent with the fundamental idea of the present study, which is that it is possible to implement 'within-country' aid conditionality even when aid disbursement across countries is need-based. We however treat this conclusion with caution because the graphical analysis does not formally control for the effect of other variables that influence the determination of aid inflows and the budget balance. Also, with the graphical analysis,

we are unable to examine whether the data is consistent with our third hypothesis – which is that, even when aid disbursement across countries is need-based, aid induces lower budget balance once the 'within-country' aid conditionality is implemented – because it requires us to identify the causal effect of aid on the budget balance. Therefore, we examine all three hypotheses in the next section, using econometric methods.

4.7 Empirical estimation and discussion of results

Panel, cross-section and time series techniques, as well as data on 37 developing countries in sub-Saharan Africa over the period 1980 - 2004, are used for the empirical estimations. In what follows, the estimation results are reported and discussed in turn for the three hypotheses.

4.7.1 Empirical results for aid determination

To examine our first research hypothesis, that there is divergence in the 'within-country' and 'between-countries' dimensions of aid disbursement, we draw on estimates of the empirical aid equation in (4.4a) from chapter 3. However, our focus in this section is different. Specifically, we examine how the coefficient on the budget balance differs across the panel, cross-section and fixed effect estimations. Therefore, we do not discuss other variables in the estimation. We first obtain OLS estimates. However, given that aid inflows may also impact upon the budget balance, we also use estimates of the aid equation from instrumental variable (IV) methods that are more robust to endogeneity bias. Results based on panel (OLS, 2SLS, 3SLS, fixed-effect)

and cross-section estimates are reported in table 4.2. Panel OLS, panel 2SLS and panel 3SLS are labelled ‘combined’ panel henceforth.

The panel OLS, 2SLS and 3SLS estimates, in columns 1, 2, and 3 respectively, show that increased budget deficit leads to significantly higher aid inflows. Since the ‘combined’ panel methods obtain estimates based on combined variation in the within- and between-countries dimensions of the data, the negative coefficient for the budget balance is simply the resultant effect of the budget balance on aid when the cross-section and within-country effects are combined. We are however unable to determine from the ‘combined’ panel estimates whether the signs or magnitudes of the coefficient for the budget balance variable are the same for the ‘within-country’ and ‘between-countries’ dimensions of aid determination, as would be the case if there was no divergence in the two dimensions. To investigate this, we re-estimate equation (4.4a) using fixed-effect and cross-sectional methods for estimates based on the ‘within-countries’ and ‘between-countries’ variation of the data respectively.

In column 4, the ordinary fixed-effect estimate shows that the budget balance is a significant determinant of year to year aid inflows to a given recipient country such that increased budget deficit leads to increased inflow of aid. However, the magnitude of the negative coefficient on the budget balance in the ordinary fixed-effect estimation is considerably lower than what the panel OLS estimate suggests (i.e., -0.184 in the ordinary fixed effect and -0.318 in the panel OLS). The fixed-effect results may be indicative of the situation in most aid recipient countries or it could well be the case that increased budget deficit leads to increased aid inflows to some countries but decreased inflows to others, with the net effect being of a lower negative magnitude

than the panel OLS estimate suggests. Either way, the results suggest that the within-country effect of the budget balance on aid inflows, estimated from the ordinary fixed-effect method, is not comparable to the combined (within- and between-countries) effect estimated from the panel OLS estimation.

Table 4.2 Determination of aid disbursement: Panel, fixed effect, and cross-section estimations

	AID/GDP							
	PANEL_OLS	PANEL_2SLS	PANEL_3SLS	FE	FE_IV	CSECTION_OLS	CROSS_2SLS	CROSS_3SLS
	2(a)	2(b)	2(c)	2(d)	2(e)	2(f)	2(g)	2(h)
BB	-0.318***	-0.517*	-0.536***	-0.184*	-0.194	-0.307	-0.257	-0.286
	(0.099)	(0.269)	(0.207)	(0.104)	(0.244)	(0.247)	(0.914)	(0.842)
GDPGROWTH	0.245	0.352	0.389	0.121	-0.445	0.992**	0.469	0.500
	(0.167)	(0.527)	(0.476)	(0.128)	(1.128)	(0.357)	(1.416)	(1.141)
GDPLEVEL	-0.258***	-0.241***	-0.235***	-0.258***	-0.174*	-0.203***	-0.202***	-0.201***
	(0.023)	(0.030)	(0.025)	(0.060)	(0.092)	(0.061)	(0.06)	(0.035)
LOGPOP	-0.123***	-0.251	-0.099***	-0.031	-0.102	-0.102***	-0.115***	-0.116***
	(0.014)	(0.165)	(0.014)	(0.197)	(0.216)	(0.02)	(0.031)	(0.028)
LIFEXP	-0.312***	-0.532*	-0.249*	-0.180	-0.563	-0.217*	-0.258**	-0.262
	(0.102)	(0.314)	(0.138)	(0.142)	(0.841)	(0.109)	(0.092)	(0.165)
INFMORT	-0.595***	-0.100***	0.456	-0.677	0.155	-0.405	-0.461	-0.457
	(0.225)	(0.02)	(0.304)	(0.669)	(0.296)	(0.704)	(0.669)	(0.554)
CONS	1.926***	1.671***	1.632***	1.266	-0.281	1.559***	1.681***	1.679***
	(0.183)	(0.29)	(0.202)	(1.405)	(2.059)	(0.27)	(0.32)	(0.306)
R2	0.683	0.633	0.664	0.269	0.285	0.759	0.714	0.713
N	153	105	105	153	105	33	30	30

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively. OLS_NODUM is read as estimation of Aid determination equation using OLS on the model without time dummy. The panel estimations include unreported time dummies (see Chapter 3).

INSTRUMENTS FOR PANEL AND FIXED EFFECTS: Lag of budget balance (not available in cross-section estimation), change in terms of trade, ethno-linguistic fractionalisation, and war dummy.

Column 5 of table 4.2 shows the results for the fixed-effect IV estimation. We find that, with respect to the sign and magnitude, the coefficient of the budget balance variable is not very different from the corresponding coefficient from the ordinary fixed-effect estimate. However, the budget balance is not significant in the fixed-effect IV estimation. This finding may be representative of the aid recipient countries in the sample, but may possibly be the net effect when increase budget deficit leads to increased aid inflows to some recipient countries and decreased inflows to others. Both ways, the fixed-effect IV result is not consistent with the panel 2SLS and 3SLS estimates (i.e., -0.194 in the fixed-effect IV estimations respectively, and -0.517 and -0.536 in the panel 2SLS and 3SLS respectively). Given that the budget balance is potentially endogenous in the aid equation, the fixed-effect IV results, that the budget balance is not a significant determinant of periodic aid inflows to a given recipient country, may be more indicative of the 'within-country' relationship between aid and the budget balance across countries than the ordinary fixed-effect results. Generally, the fixed-effect results (especially, the IV fixed-effect estimates) are not consistent with the 'combined' panel results, suggesting that the latter is primarily driven by variation in the cross-sectional dimension of the data. To establish the latter suggestion, we turn to the cross-section estimation of the aid equation.

Column 6 reports the cross-section OLS estimates of the aid determination equation. We find that the magnitude and sign of the coefficient on the budget balance is consistent with the panel estimates (i.e., -0.307 and -0.318 in the cross-section and panel OLS estimations respectively). This suggests that, as expected, the panel result is mainly driven by the cross-section variation in the data. The coefficient of the budget balance is however not significant in the cross-section OLS estimation. This may be

due to the small sample size for the cross-section estimation. Given that the 'combined' panel and fixed effect estimations are based on larger sample sizes, and that their results suggest that the panel result is driven primarily by the cross-sectional variation of the data, we ascribe the insignificance of the budget balance coefficient in the cross-sectional estimate to the small sample size. This argument is also reinforced by the fact that, in the previous section, there was no clear and pronounced negative relationship between average annual aid and the average annual budget balance in figure 4.2 due to the small sample size, but a clearer and more pronounced negative pattern emerged in figure 4.3 when the 5 year pooled cross-sectional data was employed to increase the sample size.

In the 2SLS and 3SLS cross-section estimations of columns 7 and 8, we find that the coefficient on the budget balance is lower in magnitude than the 'combined' panel estimates and the OLS cross-section estimate, although the signs are the same (i.e., -0.257 and -0.286 in the 2SLS and 3SLS cross-section estimates respectively). We however interpret this with caution because we expect the biasing effect of small sample size on the estimated coefficients to be greater in the cross-section IV estimates (2SLS and 3SLS) than in the cross-section OLS estimates due to lower degrees of freedom and instrument validity problem in the former. This may explain why the standard errors of the budget balance coefficient in the 2SLS and 3SLS cross-section estimations are largest (0.914 and 0.842 respectively). We therefore conclude that the significant negative coefficient of the budget balance in the panel estimation is mainly driven by the cross-sectional ('between' country) dimension of the data and is not always true about the 'within-country' dimension. There is therefore a divergence in the 'between-countries' and 'within-country' dimensions of aid disbursement.

4.7.2 Estimation of aid conditionality coefficients and the incentive effect of aid

Empirical evidence shows that aid conditionality is not implemented across-countries. Aid conditionality is therefore not a 'between-countries' phenomenon. Further empirical evidence from the present study however confims that there is divergence in the within-country and between-countries dimensions of aid determination, suggesting that it may still be possible to implement aid conditionality within countries (based on year-to-year disbursement to a given country). A natural next step in the present study therefore is to investigate whether aid conditionality is implemented within some of the recipient countries in our sample. To do so, we estimate the SECM representation of aid determination in equation (4.5) for each recipient country. The extent of implementation of aid conditionality is captured by the coefficient on the budget balance variable, which we refer to as the coefficient of aid conditionality. A summary of the coefficient estimate for the sample countries is reported in table 4.3 (and the regression output in table A4.1 of the appendix). A positive coefficient implies that, on average, the year to year inflows of aid to a given recipient country are associated with increased budget balance and vice versa. We find that aid conditionality was implemented in 16 countries, aid inflows were associated with higher budget deficits in 17 countries, and coefficients were not obtained for 4 countries due to insufficient time-series data.

Given that aid conditionality is a 'within-country' but not a 'between-country' phenomenon, and that aid induces larger budget deficits across countries, the study finally investigates whether the effect of aid on the budget balance across countries is influenced by the extent of implementation of the 'within-country' aid conditionality. The purpose of this final step is to investigate whether giving more aid to countries

Table 4.3 Equilibrium-correction model estimates of coefficients of aid conditionality (beta policy)

COUNTRY	BETA POLICY
Benin	-0.389
Botswana	0.037
Burkina Faso	0.460
Burundi	0.290
Cameroon	0.019
Central African Rep	.
Chad	-0.096
Congo	-0.067
Cote d'Ivoire	0.543
Equatorial Guinea	0.140
Ethiopia	-0.018
Gabon	0.020
Gambia	0.299
Ghana	0.350
Guinea-Bissau	-0.272
Kenya	-0.067
Lesotho	-0.032
Liberia	.
Madagascar	0.330
Malawi	-0.340
Mali	0.121
Mauritania	0.003
Mauritius	-0.077
Mozambique	-1.620
Namibia	0.220
Niger	-1.390
Nigeria	.
Rwanda	0.039
Senegal	0.096
Sierra Leone	-0.477
Somalia	.
Swaziland	-0.079
Tanzania	-0.631
Togo	0.137
Uganda	-1.014
Zambia	-0.146
Zimbabwe	-0.1000

The regression output is summarized in table A4.1 of the appendix.

with higher budget deficits is the underlying reason why aid induces higher budget deficits across countries as implied by the Svensson (2000) aid incentive model.

We estimate the cross-section budget balance equation in (4.6a) which has an interaction term between aid and the coefficient of aid conditionality as a regressor. The respective results from OLS, 2SLS, and 3SLS methods of cross-section estimation are reported in columns 8(a) to 8(c) of table 4.4. Of interest is the coefficient on the interaction term between aid and the aid conditionality variable, which is positive and significant. This means that aid induces higher budget balances (lower budget deficits) as the coefficient of aid conditionality increases, ceteris paribus.

An important point to note is that the influence of the aid conditionality variable (betapolicy) on the effect of aid on the budget balance is not by construction of the aid conditionality variable. To see this, note that positive correlation between year-to-year inflows of aid and the budget balance of a given country (positive aid conditionality coefficient), for instance, may be associated with increases in aid inflows and budget balances or decreases in aid inflows and budget balances. Therefore, between two countries with equal amount of aid (on average) and aid conditionality coefficient, it is not obvious *a priori* whether aid would induce a higher budget balance. After all, punishing non-compliance to aid agreements (or refusing to promise aid disbursement when an agreement is not reached) does not guarantee that recipient governments would change their stance. Neither would the use of aid to reward 'effective policies' guarantee further pursuit of such policies. We therefore suggest that it is the enforcement of 'within-country' aid conditionality that actually causes aid to induce lower budget deficits.

Table 4.4 Cross-section determination of the effect of aid on the budget balance

	BUDGET BALANCE/GDP					
	OLS	2SLS	3SLS	OLS	2SLS	3SLS
	3(a)	3(b)	3(c)	3(d)	3(e)	3(f)
AID	-0.061	-0.018	-0.034	-0.283**	-0.205	-0.273**
	(0.141)	(0.143)	(0.114)	(0.128)	(0.165)	(0.130)
BETAPOLICY	-0.058	-0.067	-0.085			
	(0.047)	(0.05)	(0.053)			
AID*BETAPOLICY	0.768*	0.830*	1.021**			
	(0.433)	(0.442)	(0.410)			
GDPGROWTH	1.113**	0.936*	0.915***	0.995**	1.280*	1.224***
	(0.431)	(0.474)	(0.355)	(0.435)	(0.648)	(0.446)
GDPLEVEL	0.023	0.039	0.028	-0.021	-0.009	-0.018
	(0.031)	(0.035)	(0.026)	(0.030)	(0.033)	(0.025)
ΔTOT	-0.230**	-0.223**	-0.176	-0.151	-0.156*	-0.122
	(0.100)	(0.101)	(0.139)	(0.132)	(0.077)	(0.131)
ELF	0.046	0.054	0.044	-0.012	-0.006	-0.017
	(0.042)	(0.043)	(0.036)	(0.025)	(0.029)	(0.034)
WAR	0.030***	0.032***	0.030	0.020	0.022*	0.023
	(0.010)	(0.010)	(0.029)	(0.012)	(0.012)	(0.034)
CONS	-0.168	-0.225	-0.184*	0.028	-0.026	0.016
	(0.126)	(0.136)	(0.101)	(0.115)	(0.131)	(0.101)
R2	0.561	0.565	0.548	0.371	0.394	0.384
N	31	30	30	33	30	30

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively

INSTRUMENTS: life expectancy, infant mortality, population, life expectancy* beta coefficient, infant mortality* beta coefficient, and population* beta coefficient.

It is also noteworthy that the aid conditionality coefficient (betapolicy), on its own, is not significant in the cross-section budget balance equation, indicating that a given aid conditionality coefficient may be associated with both countries with higher and lower inflows of aid (and by implication, countries with larger and lower budget deficits). Therefore, giving more aid to countries with larger budget deficits is not the underlying reason why aid induces larger budget deficits. Rather, the incentive effect

of aid on the budget balance depends on the extent of implementation of the 'within-country' (year-to-year) aid conditionality. Incentive-creating aid conditionality is therefore a 'within-country' phenomenon and not a 'between-countries' phenomenon.

4.8 Summary

Empirical evidence shows that countries with larger budget deficits receive more aid and aid, so disbursed, induces larger budget deficits. The explanation based on the incentive aid literature is that such need-based pattern of aid disbursement is a disincentive for recipient governments to avoid deficits. The policy implication of this view is that, in order to create the incentive for lower budget deficits, more aid should be given countries with lower budget deficits. An implicit assumption, however, is that aid recipients have similar characteristics in which case differences in fiscal outcomes across countries are attributable to development effort.

In contrast to the aforementioned explanation, the present study argues that giving more aid to countries facing larger budget deficits is not the underlying reason why aid induces larger budget deficits. Rather, aid conditionality with respect to the budget balance is a within-country phenomenon such that a given country's year to year inflows of aid are conditioned on the budget balance and does not depend on the relative amount of aid receipts across countries. To arrive at this conclusion, the study first acknowledges that various countries have different characteristics, and the fundamental reason for giving aid is that, generally, low income countries are not able to obtain enough resources from taxation and the international financial markets. Therefore, it is optimal to give more aid to countries with more difficulties in this regard. Next, the study shows that there is a divergence between aid disbursement

across and within countries. Aid disbursement across countries is mainly need-based whereas year-to-year aid disbursement within a given country may be predominantly performance- or need-based. Thus, aid conditionality with respect to the budget deficit is a within-country phenomenon and can be implemented even when more aid is given to countries with larger budget deficits.

Finally, the study shows that aid induces lower budget deficits in countries within which year-to-year aid conditionality is implemented. To arrive at the latter result, we obtain a regression-based coefficient of aid conditionality (which increases with the extent of implementation of aid conditionality) for each of the recipient countries in the sample. The latter is then interacted with aid in a cross-country regression to show that aid induces larger budget balances as the coefficient of aid conditionality increases. Thus, in spite of giving more aid to countries with larger budget deficits, aid induces lower budget deficits once the within-country aid conditionality is implemented. We therefore conclude that giving more aid to countries with larger budget difficulties is not the underlying reason why aid induces larger budget deficits. Rather, the main culprit is failure to implement within-country aid conditionality.

APPENDIX

Estimating beta-policy – the short-run correlation between aid and the budget balance

(1980 – 2004)

(i) BENIN - LIBERIA

	$\Delta BBGDP_t$		$\Delta logY_t$		ECM_{t-1}		R^2
BENIN	-0.389	(0.286)	0.422	(0.310)	-0.843**	(0.334)	0.530
BOTSWANA	0.037	(0.034)	-0.115**	(0.048)	-0.452	(0.260)	0.415
BURK. FASO	0.46	(0.573)	-0.616	(0.485)	-0.637*	(0.311)	0.306
BURUNDI	0.29	(0.344)	0.100	(0.386)	-0.251	(0.183)	0.298
CAMEROUN	0.019	(0.085)	-0.180	(0.128)	-1.091***	(0.260)	0.559
CENT.AFR.REP.	.	.	.	.	.	.	.
CHAD	-0.096	(0.136)	0.084	(0.121)	-0.839***	(0.270)	0.428
CONGO REP. OF	-0.067	(0.150)	-0.137	(0.173)	-0.856**	(0.289)	0.459
COTE D'IV.	0.543	(0.334)	-0.882**	(0.355)	-1.336***	(0.292)	0.695
EQU. GUINEA	0.14	(0.264)	-0.199	(0.116)	-0.896	(0.645)	0.541
ETHIOPIA	-0.018	(0.203)	0.059	(0.122)	-0.361*	(0.200)	0.201
GABON	0.02	(0.035)	0.002	(0.049)	-0.777***	(0.258)	0.396
GAMBIA	0.299	(0.389)	-0.218	(0.352)	-0.949***	(0.226)	0.543
GHANA	0.352*	(0.188)	-0.366	(0.325)	-0.476**	(0.200)	0.486
G. BISSAU	-0.272	(0.372)	0.527	(0.497)	-1.276***	(0.322)	0.697
KENYA	-0.067	(0.083)	-0.272	(0.285)	-0.265	(0.169)	0.283
LESOTHO	-0.032	(0.090)	-0.453*	(0.261)	-0.195	(0.115)	0.162
LIBERIA	.	.	.	.	.	.	.

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively. The dependent variable is the change in aid to GDP ratio. Beta policy refers to the coefficient of $\Delta logBBGDP_t$ and it measures the short-run correlation between aid and the budget balance. Y, BBGDP and ECM represent GDP, the budget balance to GDP ratio, and the equilibrium-correction component respectively.

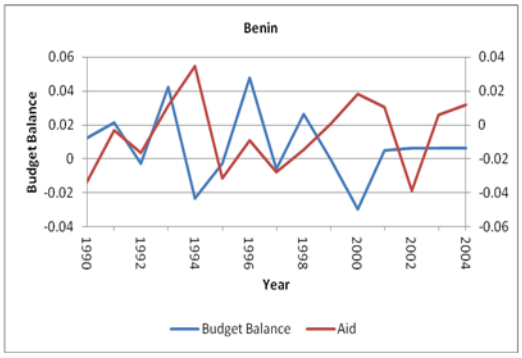
Continuation of table

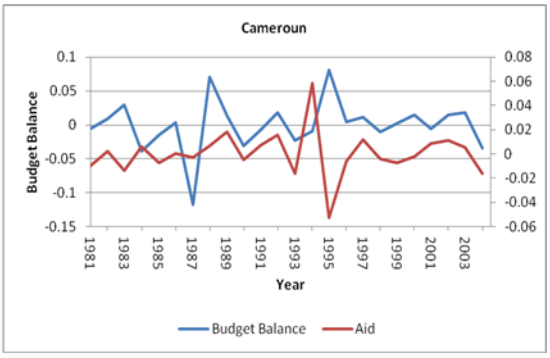
(ii) MADAGASCAR – ZIMBABWE

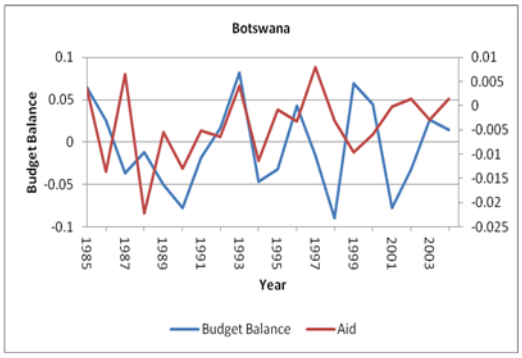
	$\Delta BBGDP_t$		$\Delta logY_t$		ECM_{t-1}		R^2
MADAGASCAR	0.330	(0.500)	0.289	(0.612)	-0.851**	(0.355)	0.338
MALAWI	-0.340*	(0.169)	-1.019***	(0.261)	-1.055***	(0.201)	0.771
MALI	0.121	(0.100)	-0.609***	(0.211)	-0.681***	(0.160)	0.485
MAURITANIA	0.003	(0.224)	1.443**	(0.506)	-0.829***	(0.253)	0.694
MAURITIUS	-0.077	(0.119)	0.182	(0.102)	-0.843***	(0.273)	0.56
MOZAMBIQUE	-1.62	(1.021)	-1.562**	(0.727)	-0.387**	(0.178)	0.344
NAMIBIA	0.220**	(0.086)	-0.259***	(0.083)	-0.840***	(0.256)	0.674
NIGER	-1.390***	(0.406)	-0.791*	(0.396)	-0.815***	(0.252)	0.608
NIGERIA	.	.	.	.	.	.	.
RWANDA	0.039	(1.036)	-1.253**	(0.404)	-0.668*	(0.355)	0.732
SENEGAL	0.096	(0.237)	-0.446*	(0.245)	-0.956***	(0.231)	0.573
S. LEONE	-0.477	(0.280)	0.244	(0.397)	-0.495**	(0.215)	0.375
SOMALIA	.	.	.	.	.	.	.
SWAZILAND	-0.079	(0.060)	0.078	(0.072)	-1.055**	(0.320)	0.619
TANZANIA	-0.631	(0.549)	-0.456	(0.322)	-0.567	(0.434)	0.446
TOGO	0.137	(0.131)	0.221	(0.162)	-0.948***	(0.191)	0.636
UGANDA	-1.014***	(0.303)	-0.258	(0.379)	-0.604**	(0.243)	0.48
ZAMBIA	-0.146	(0.483)	-0.017	(0.917)	-0.972***	(0.269)	0.541
ZIMBABWE	-0.1	(0.087)	-0.234**	(0.096)	-0.337**	(0.157)	0.373

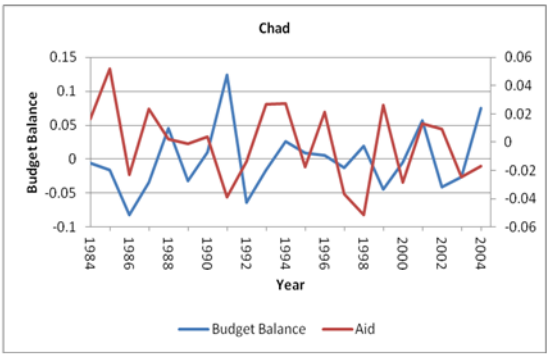
Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively. The dependent variable is the change in aid to GDP ratio. Beta policy refers to the coefficient of $\Delta logBBGDP_t$ and it measures the short-run correlation between aid and the budget balance. Y, BBGDP and ECM represent GDP, the budget balance to GDP ratio, and the equilibrium-correction component respectively.

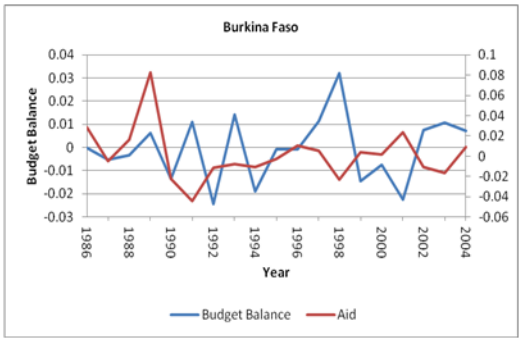
Time profile of differenced aid and budget balance series (as ratios to GDP)[48]

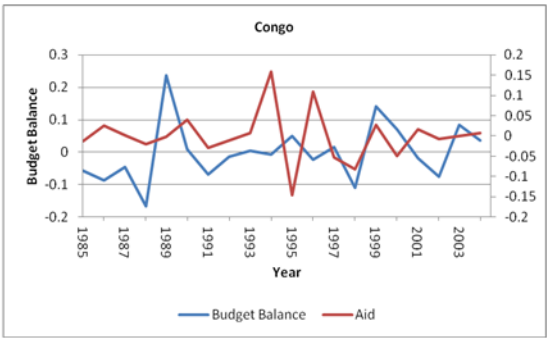


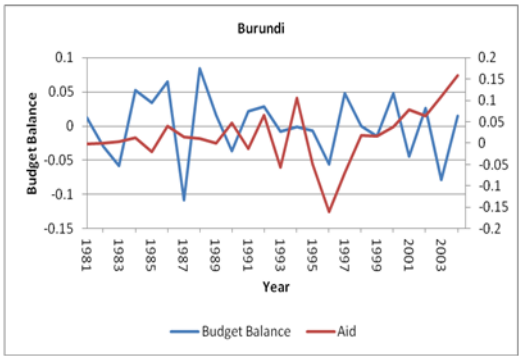


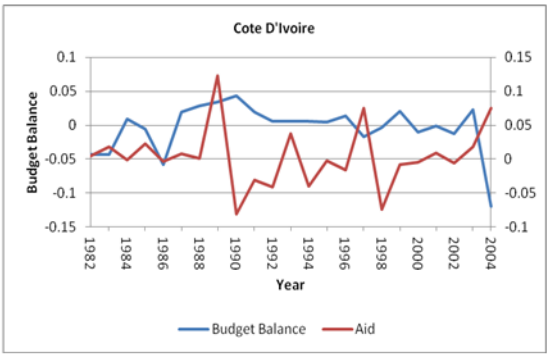




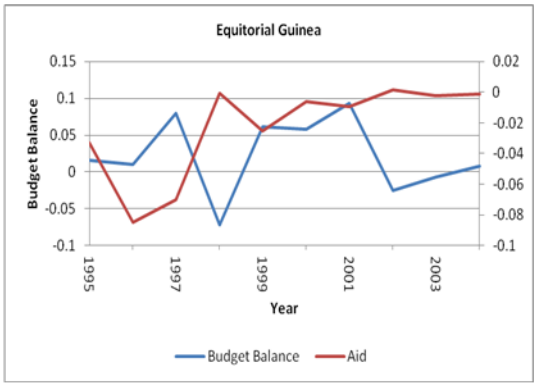








[48] Only series with at least 18 years of data were included in the analysis. Countries with extremely short series are not included in the illustrations.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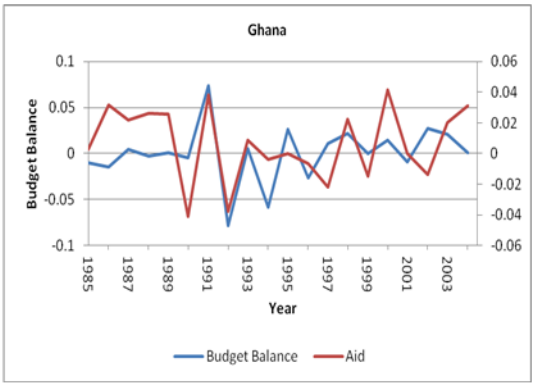
Budget Balance
Year
Budget Balance
Aid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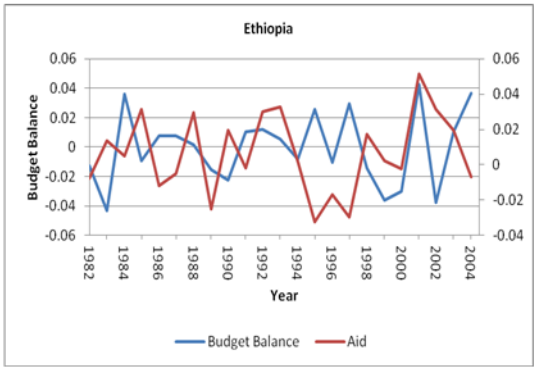
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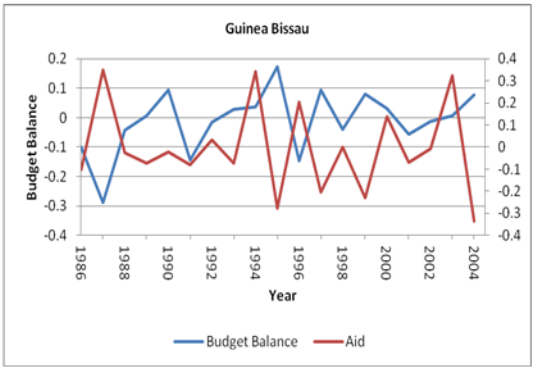
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Budget Balance
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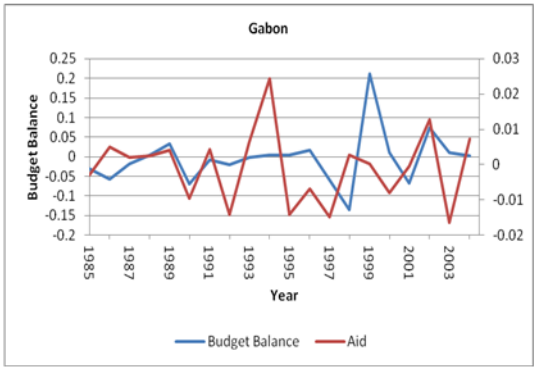
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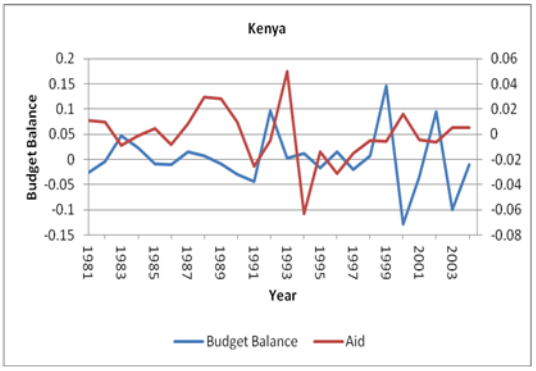
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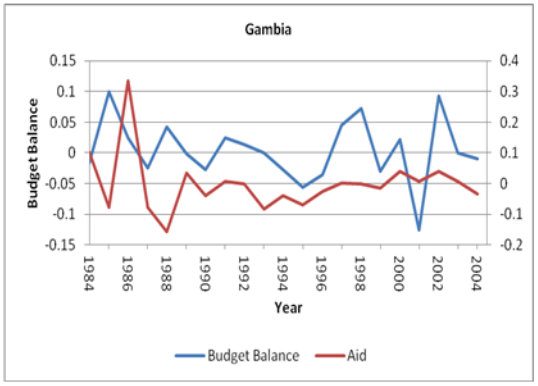
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Budget Balance
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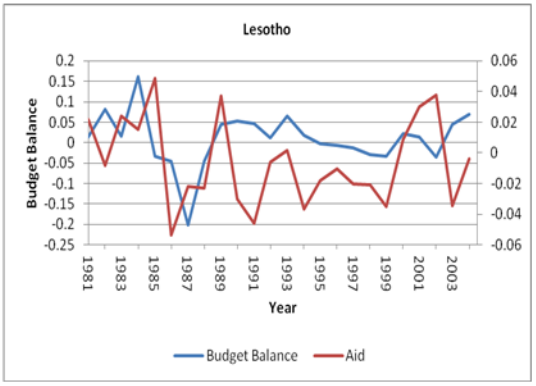
Lesotho
Budget Balance
Year
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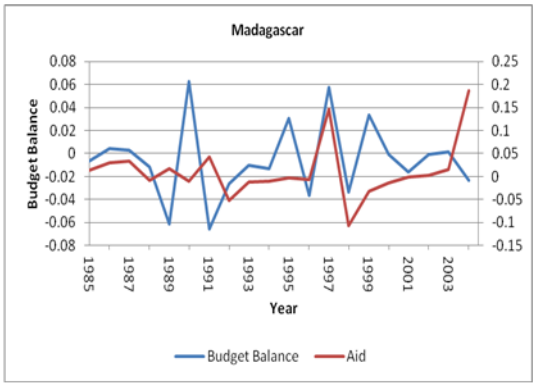
Madagascar
Budget Balance
Year
Budget Balance
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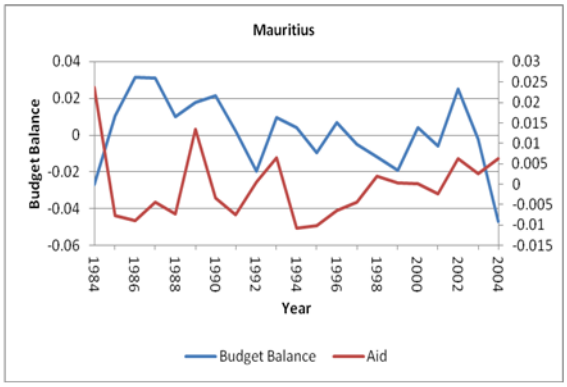
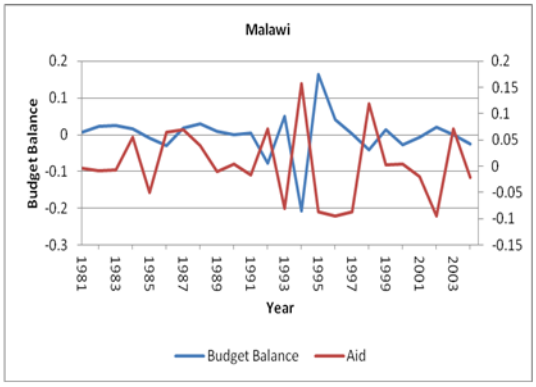

Mauritius
Budget Balance
Year
Budget Balance
Aid


Malawi
Budget Balance
Year
Budget Balance
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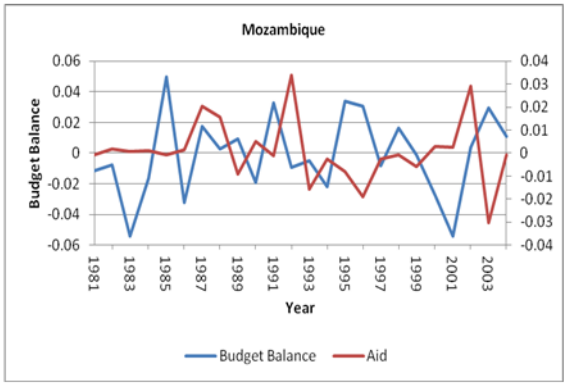
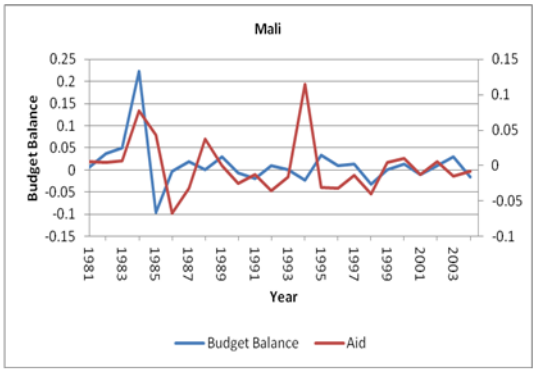

Mozambique
Budget Balance
Year
Budget Balance
Aid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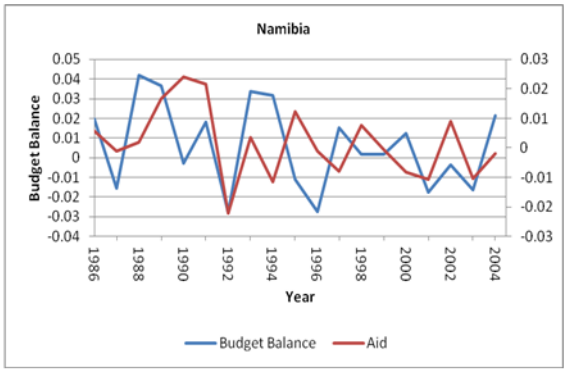
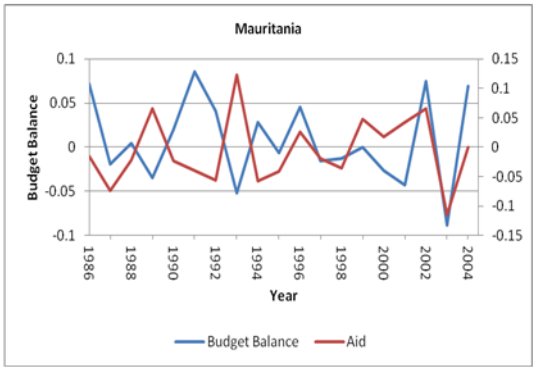
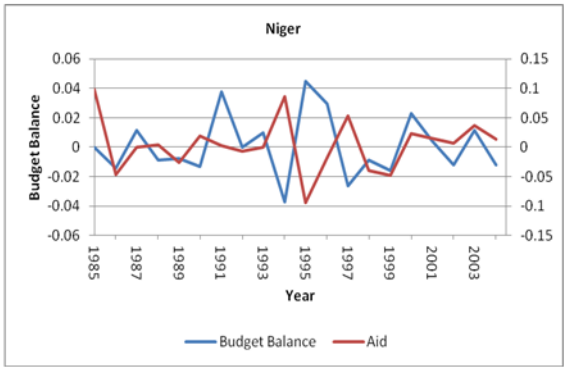
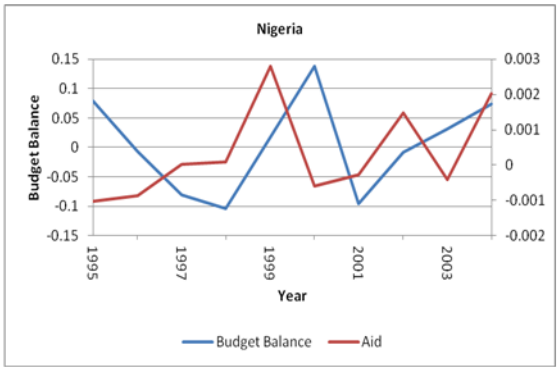
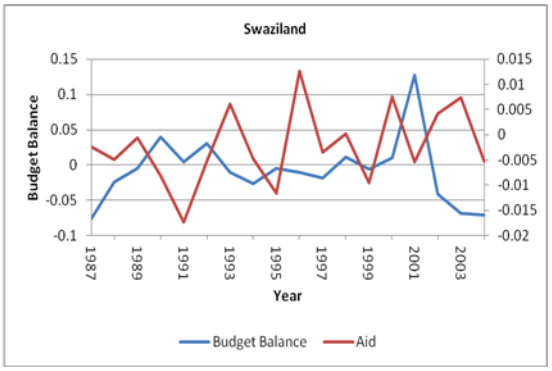
Budget Balance
Year
Budget Balance
Aid

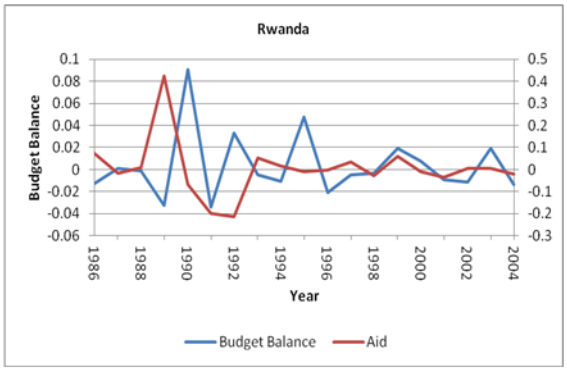

Namibia
Budget Balance
Year
Budget Balance
Aid

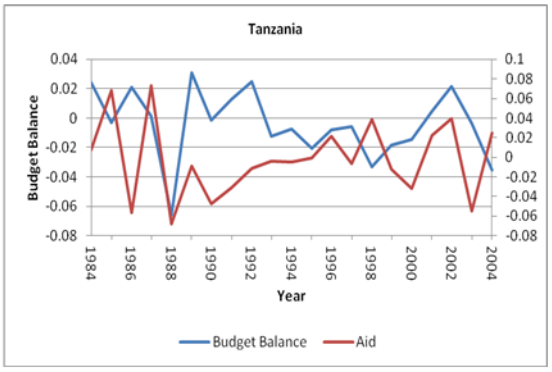

Mauritania
Budget Balance
Year
Budget Balance
Aid

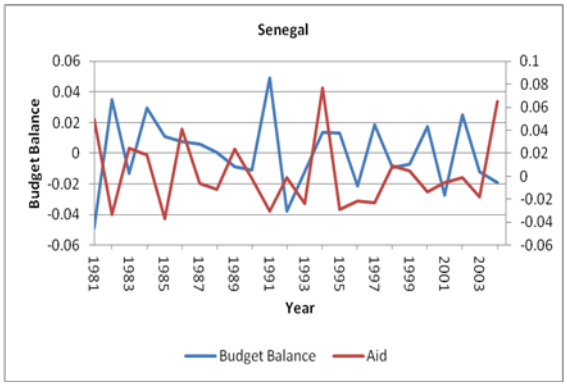

Niger
Budget Balance
Year
Budget Balance
Aid

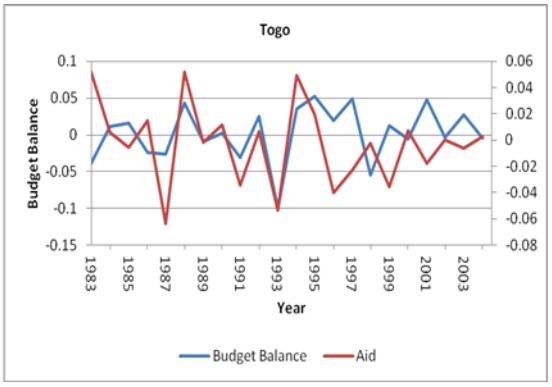

Nigeria
Budget Balance
Year
Budget Balance
Aid

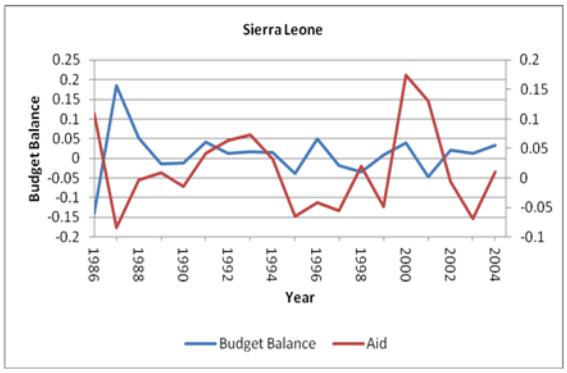

Swaziland
Budget Balance
Year
Budget Balance
Aid

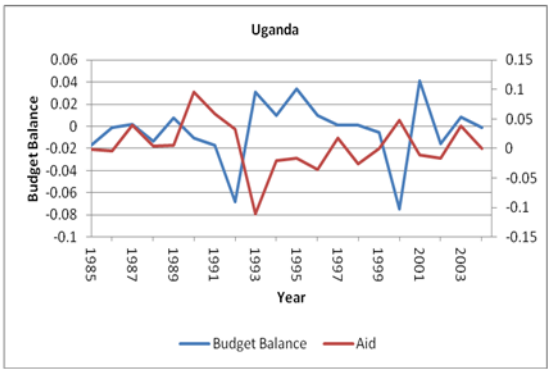

Rwanda
Budget Balance
Year
Budget Balance
Aid

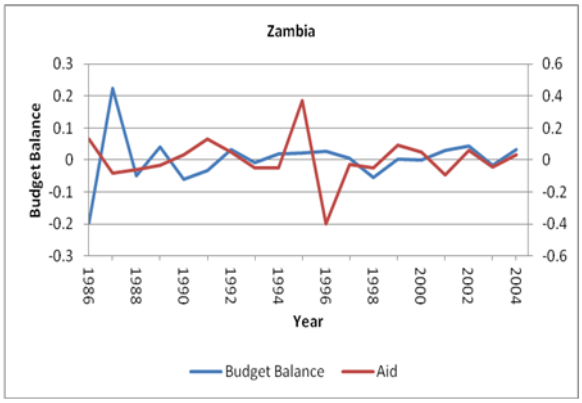

Tanzania
Budget Balance
Year
Budget Balance
Aid

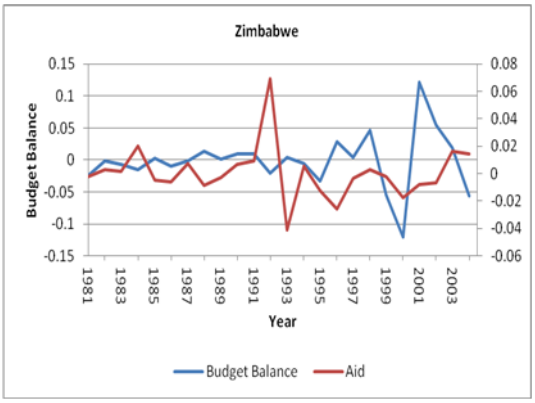

Senegal
Budget Balance
Year
Budget Balance
Aid


Togo
Budget Balance
Year
Budget Balance
Aid


Sierra Leone
Budget Balance
Year
Budget Balance
Aid


Uganda
Budget Balance
Year
Budget Balance
Aid


Zambia
Budget Balance
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
Year
Budget Balance
Aid


Zimbabwe
Budget Balance
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
Year
Budget Balance
Aid

CHAPTER 5

EXPLAINING THE CONTRASTING AID – BUDGET DEFICIT RELATIONSHIPS IN SUB-SAHARAN AFRICAN COUNTRIES: THE CASE OF GHANA AND ZAMBIA

5.1 Introduction

5.1.1 Background

Given the overwhelming evidence on how ineffective foreign aid has been at promoting growth in low income countries, the focus of recent studies in the literature has shifted towards examining the channel through which aid affects growth. Of particular interest is the effect of aid on pro-growth policies. Since most aid is given to the government directly,[49] and policy implementation is also by the government, the effect of aid on pro-growth policies largely depends on the interest of the recipient government in those policies. Therefore, donors seeking to improve aid effectiveness must seek to influence the interest of recipient governments towards pro-growth policies. The most likely way of achieving this, proposed mainly in the aid incentive literature, is to condition disbursement on the implementation of pro-growth policies (labelled aid conditionality). This way, recipient governments, in their quest for more aid, would be obliged to implement pro-growth policies. Evidence however shows that donors have been inconsistent with regards to the purpose and determinants of aid disbursement. In effect, aid has induced different policy actions across recipient countries, some of which flout the expected association of aid with pro-growth

[49] See Fagernas and Roberts (2004a).

policies. In the light of this, the question that the present study seeks to answer is what actions of donors and recipient governments are responsible for the contrasting relationship between aid and pro-growth policies across recipient countries? For reasons outlined below, we address the research question using Ghana and Zambia as case studies whiles focusing on reduced budget deficit as a pro-growth policy.

Giving aid to the recipient government generates fiscal policy response because the budget constraint facing fiscal authorities is relaxed. Therefore, fiscal policy constitutes a relevant policy-focus in the context of an aid-effectiveness study. In particular, reducing the fiscal deficit is often a target in conditional aid agreements that seek to achieve economic stability and growth. The reason is that, firstly, increasing fiscal deficits persistently may cause government debt to reach unsustainable limits, resulting in high and unproductive spending on debt servicing and loss of credibility. Secondly, since the fiscal deficit is mainly financed domestically in low income countries, high deficits may crowd-out the private sector with the possibility that gains from development spending are nullified (Deverajan and Go, 2002). Thirdly, persistent budget deficits may lead to fiscal dominance, whereby monetary policy, and inflation for that matter, is driven by deficit financing rather than stable inflation targets. Thus, even when aid spending fails to make any remarkable impact on growth, exploiting the incentive role of aid to reduce the budget deficit presents an indirect channel for improving growth. We therefore consider reduced budget deficit as an appropriate pro-growth policy to focus on in the present study.

To answer our research question, we use Ghana and Zambia as case studies for the following reasons: (i) Sub-Saharan African countries are highly dependent on aid,

implying that its effect is not likely to be negligible. (ii) Ghana and Zambia have contrasting outcomes with regards to the implementation of aid conditionality. Generally, Zambia is known to be a country where aid conditionality is not met, whereas the opposite is true for Ghana. For instance, using an aggregate measure of policy (comprising budget deficit, inflation, and trade openness), aid inflows to Zambia is shown to be associated with poor policy performance whereas inflows to Ghana are a reflection of its improved policy performance (Burnside and Dollar, 2000 and 2004). (iii) For most of the period between 1970 and 2006, which constitutes our study period, both countries engaged in some form of aid program – unlike Ghana, however, Zambia repeatedly defaulted agreements, including fiscal targets (Fagernas and Roberts, 2004; Goldsbrough and Cheelo, 2007). (iv) There is adequate data on aid and fiscal aggregates for both countries covering the study period.

In chapter 4 we find that, consistent with the aforementioned aid-policy relationship observed by Burnside and Dollar (2000 and 2004), aid inflows to Ghana are associated with reduced budget deficits, whereas aid inflows to Zambia are associated with increased budget deficits. Knowing the underlying cause of the different outcomes in the two countries may be useful for shaping future aid policies. Although different countries with similar outcomes may have different explanations, knowing one way of achieving a given outcome may be as useful as knowing several ways of achieving that outcome. Therefore, the specific objective of the present study is to investigate the different donor and/or recipient behaviour(s), in terms of the relationship between aid inflows and the recipients' fiscal aggregates, which are responsible for the contrasting aid-budget deficit relationships in Ghana and Zambia.

The possible cause(s) of the difference in aid-fiscal deficit relationship across countries may range from factors associated with donor response to fiscal policy, to factors associated with fiscal response to aid. From the donor's point of view, conditioning aid disbursement on reduced budget deficit, reduced expenditure, or increased revenue may all lead to a negative correlation between aid and deficit. Also, from the recipient government's point of view, adhering to contractionary fiscal agreements after aid is received (be it a reduction of the deficit, an increased effort at raising revenue, or a cut in spending) would result in a negative correlation between aid and deficit. Thus, establishing the underlying cause of the observed relationship between aid and the budget deficit in a given country requires an examination of the causal mechanism between aid and the components of the budget. Central to the present study, however, is how this objective is achieved. To be specific, we coin our research questions into testable hypotheses within a vector error correction model (VECM) which provides a statistical framework for testing economic concepts, without having to make prior assumptions about the structural relationship between the variables. Another advantage of our approach is that the VECM models the short- and long-run relationships between the variables explicitly and separately, permitting us to gain insight into how aid is spent. For instance, when aid has no significant long-run impact on the fiscal variables, the implications are that aid may have been used for relaxing the budget constraint in the short- and medium-run, or in other words for funding mainly consumption expenditure and debt repayments rather than investment expenditure (Martins, 2010). The specification and estimation of the VECM is based on a new approach suggested by Juselius (2009).

Our results show that the negative correlation between aid inflows and the budget deficit in Ghana is ascribable to actions of both donors and the fiscal authorities. Specifically, aid disbursement is conditioned on decreases in total expenditure and domestic finance, both of which are associated with deficit reduction. In response, fiscal authorities use aid in a way that is consistent with agreed deficit-reducing conditions. Particularly, aid has a significant reducing effect on total expenditure and domestic finance. On the other hand, there is increased inflow of aid to Zambia when total government expenditure increases, possibly because donors are interested in preventing further increases in the already high deficits and domestic financing. Therefore, the actions of the aid donors contribute towards the positive correlation observed between aid and the budget deficit in Zambia, but aid does not cause the deficit to widen. Rather, aid induces cuts in total expenditure, implying that the actions of fiscal authorities (in response to aid inflows) are not responsible for the positive correlation between aid and the budget deficit in Zambia. Given that aid has no significant effect on domestic borrowing in Zambia, and that there is a close positive association between domestic borrowing and the budget deficit in developing countries, we infer that the cuts in government expenditure, induced by aid inflows, are not enough (compared to the initial increase in government expenditure that attracted aid) to cause a reduction in the budget deficit. We therefore suggest the need for a more proactive stance by donors in conditional aid programs, whereby aid is directly conditioned on reduced total government expenditure, budget deficit and/or domestic finance.

The study is organised as follows. The econometric method employed is presented in section 5.2, followed by a discussion on the variables used and the sources of data in

section 5.3. The analysis and discussion of results on Ghana and Zambia are presented separately in sections 5.4 and 5.5 respectively. Finally, in section 5.6, we present a summary of our results and conclusion.

5.1.2 Literature review

This section reviews the literature on three different classes of studies on aid effectiveness with regards to government behaviour, focusing on the strengths and limitations of the underlying concepts and empirical approaches used. The classes considered are fungibility studies, studies based on fiscal response models (FRMs), and studies based on vector autoregressive models (VARs). McGillivray and Morrissey (2004) give a detailed review of the literature on fungibility studies and FRMs; Osei et al. (2005) address the departure from fungibility studies and FRMs to VARs, and Martins (2010) addresses recent improvements on VARs. Given the voluminous literature review on these issues in recent studies, we present only a brief discussion and address more recent suggestions in Juselius (2009).

The first class of studies on the effect of aid on the behaviour of government focuses on 'categorical' fungibility, that is, whether or not aid receipts are used as intended by donors (Pack and Pack, 1990; Gupta, 1993; Feyzioglu et al., 1998; Swaroop et al., 2000). Aid is fungible when used for purposes other than what donors intend. Fungibility studies investigate which components of government expenditure (such as social activities, health and education, or on a more aggregate level, consumption and capital expenditure) increase with aid inflows. Since aid is mainly for development and poverty alleviation purposes, it is considered as fungible if inflows are associated with increases in recurrent components of expenditure.

The underlying concept of this class of studies is that recipient governments maximise utility derived from public consumption by relaxing their budget constraint with the fungible part of aid which they have control over (Feyzioglu et al., 1998; McGillivray and Morrissey, 2004). There is therefore the tendency to use fungible aid against the interest of donors. Empirically, OLS and simultaneous systems of estimation, such as two- and three-stage least squares (i.e., 2SLS and 3SLS respectively), seemingly unrelated regressions (SUR), and full information maximum likelihood (FIML) methods are often used. However, McGillivray and Morrissey, (2004) argue that SUR, 3SLS, and FIML methods are more appropriate since fiscal variables are jointly determined and shocks to the system are not orthogonal. Generally, aid is found to be fungible although the details of the results vary across studies. The credibility of fungibility studies have been questioned for the following reasons: firstly, determining aid effectiveness on the basis of components of government expenditure may be misleading. This is because some recurrent spending such as improved wages in the health or education sectors may be in line with donor interest. Secondly, fungibility studies leave no room for the effect of aid on more aggregate budget components such as domestic revenue and borrowing which are also important indicators of fiscal performance. A related limitation is that fungibility studies do not allow for the joint determination of fiscal variables.

To address these shortcomings of fungibility studies, another class of studies on aid effectiveness use fiscal response models (FRMs) which focused on more aggregate components of the government budget (Mosley et al., 1987; Gang and Khan, 1991; McGillivray, 1994; Franco-Rodriguez et al., 1998). Specifically, FRMs acknowledge the simultaneous determination of fiscal aggregates (and aid in studies that consider

aid as endogenous)[50] and estimate the interrelationships between aid, government revenue, expenditure, and borrowing. Commonest estimation methods used in this class of studies are two stage least squares and three stage least squares. Like fungibility studies, FRMs are founded on theories of government utility maximization. However, unlike fungibility studies, the government sets targets for revenue (including aid revenue when endogenous), borrowing and expenditure, and derives utility from meeting those targets. Empirical results vary across studies, suggesting that the interrelationship between aid and fiscal aggregates of recipients is an empirical issue. For instance, in Cost Rica, aid inflows are shown to be associated with increases in government consumption and tax revenue and decreases in capital expenditure and domestic borrowing (Franco-Rodriguez, 2000); Aid does not have any significant impact on fiscal aggregates in India (Gang and Khan, 1991); Aid has a positive effect on capital spending, revenue and government consumption in Asia (Khan and Hoshino, 1992).

FRMs have received their share of criticisms. The main criticism is to do with model specification problems and, as a structural model, the imposition of the structural form of the model. For instance, revenue and expenditure targets are difficult to estimate due to data limitations, and have therefore been captured by estimates that are arguably problematic (White, 1994). Also, whether or not aid is exogenous to the budget of the government is imposed rather than decided empirically; Mosley et al. (1987) and Gang and Khan (1991) treat aid as exogenous, while later work by Franco-Rodriguez et al. (1998) treated aid as endogenous. Yet, results are sensitive to model specification as well as the structure imposed on the model (McGillivray and Morrissey, 2004).

[50] Gang and Khan (1991) consider aid to be exogenous but Franco-Rodriguez (1998) endogenize aid.

Another criticism is associated with estimation problems. As with fungibility studies, the 2SLS and 3SLS simultaneous systems of estimation used in estimating FRMs are very demanding in terms of data. This poses a limitation to such studies as the most aid dependent countries are the low income counties that are also the most likely to have the shortest length of comprehensive data.

To avoid the challenge of 'getting the structure and specification right', as was the case with fungibility and FRM studies, VARs have become a widely accepted toolkit in recent fiscal response studies (See for instance, Fagernas and Schurich, 2004; Fagernas and Roberts 2004; Osei et al., 2005; Martins, 2010). This is because VARs present a framework for modelling the interrelationships between aid and fiscal aggregates without imposing any structure. Moreover, whether or not aid is exogenous is an empirical question that is determined (rather than imposed) within the VAR framework. As with FRMs, the results have varied across studies. In Zambia, it is shown that aid inflows are associated with a decrease in domestic revenue and increases in domestic borrowing, debt repayment, and recurrent and capital expenditure (Fagernas and Roberts, 2004a). In Ghana on the other hand, the evidence shows that aid inflows are associated with increased revenue and decreased domestic borrowing, and that there is no significant direct relationship between aid and total government expenditure (Osei et al., 2005). This reinforces the notion that the relationship between aid and fiscal aggregates is an empirical question.

The VAR method also has some limitations. As with simultaneous system estimators used in fungibility and FRM studies, the VAR is method is a large sample estimator. Yet, the most aid dependent countries (particularly in sub-Saharan Africa) are the ones

with the shortest length of data. For instance, out of five recent studies on aid effectiveness in sub-Saharan African countries reviewed in Martin (2010), the largest sample size was 39 (for Kenya) and the lowest is 27 (for Zambia). This may question the validity of estimation results from VAR. A related setback is that VARs can easily be over-parameterised. This is because any additional (endogenous) variable introduces additional parameters (of the order of the lag length) to existing equations in the system as well as an additional equation.

Other limitations of VARs which receive particular attention in the present chapter are as follows: Firstly, results are very sensitive to the choice of lag length. Yet, determining the correct lag length is not straight forward. Several studies use lag length information criteria such as the Akaike (AIC), Schwartz (SC) and Hannan Quinn (HQ). The problem, however, is that these information criteria depend on correct model specification, while correct model specification depends on the correct choice of lag length. For instance, when a model is wrongly specified by reason of not appropriately controlling for outliers, longer lag lengths may be suggested by the criteria above, resulting in misspecification of the VAR model. This may be the reason why the short-run parameter estimates for some recent aid-fiscal response studies are not meaningful, and could be very misleading when these estimates are of interest. For instance, the short-run estimates for Ghana obtained in Osei et al. (2005) shows that increased (decreased) inflows of aid are associated with decreased (increased) inflows in the previous year, and increased revenue is associated with decreased expenditure in the previous years. Also, increased domestic borrowing is associated with increases in aid inflows and revenue in the previous year. While it may be argued that the latter is the result of aid illusion, this is not consistent with the long-term (equilibrium)

relationship between the variables. Another example relates to Zambia, where increase in domestic borrowing is associated with decrease in current expenditure in the previous year (Cordella and Dell'Ariccia, 2007).

The second limitation that is addressed as one of the key objectives of the present chapter is that, as reduced-form models, short-run parameter estimates from VARs are mere correlations with no meaningful economic interpretation unless the underlying structure of the model is identified. Short-run identification in reduced-form VARs involves (though not the sole objective) purging the correlation of the residuals of the system. Therefore, several recent studies limit the interpretation of short-run dynamics to generalised impulse response functions (GIRFs) since they purge residual correlations (Fagernas and Roberts, 2004a; Osei et al., 2005). While GIRFs are considered superior over their orthogonal Cholesky counterparts that impose arbitrary causal structure on the variables of the system, they are not without drawbacks. GIRFs treat every variable as being caused by all other variables in the system and so correlation of system residuals are purged without actually identifying the correct causal structure of the variables. Moreover, while impulse response functions in general are useful for determining the end effect of a shock to the system after all simultaneous interactions between the variables have gone through, it requires the *ceteris paribus* short-run dynamics of the system to inform policy as to why different resultant effects are achieved for different countries. Thus, impulse response functions on their own may not provide useful information for reform policies.

To circumvent the problem associated with estimation of redundant lags, Juselius (2009) suggests a tentative method that begins with VAR(2), controls for outliers, and

tests for the adequacy of the VAR(2). Also, in response to the short-run identification of the VAR model, Juselius (2009) suggests the use of empirical identification. The latter includes contemporaneous variables in the equations of VAR (to obtain a structural VAR), imposes identifying restrictions on lagged variables in the VAR system, and uses full information maximum likelihood (FIML) method to estimate the identified equations as a system. This is a relatively new approach to VAR estimations that may be adapted in aid-fiscal response studies. Martins (2010) used the tentative approach for determining the correct lag length. However, they find VAR(1) as adequate for their model for Ethiopia and are unable to carry out empirical identification of the short-run structure of their model since there were no lagged differences to help with the empirical identification process.

5.2 Econometric methodology

5.2.1 Econometric model

Following their adoption by Johansen (1988) for the estimation and testing of multivariate relationships among non-stationary data, vector autoregressive (VAR) methods have become the 'tool of choice' in much of time series macro-econometrics. As a reduced form representation of a large class of dynamic structural models (Hamilton 1994: 326-7) the VAR offers both empirical tractability and a link between data and theory in economics. Accordingly, in the current application, where the fiscal aggregates are likely to be non-stationary and cointegrated, it will be convenient to couch the empirical analysis in a vector autoregressive (VAR) framework (Hendry and Doornik, 2001:129). Consider an unrestricted VAR(p) model:

$$\text{(5.1)} \quad \mathbf{x}_t = \mathbf{\Pi}_1 \mathbf{x}_{t-1} + \mathbf{\Pi}_2 \mathbf{x}_{t-2} + \ldots + \mathbf{\Pi}_p \mathbf{x}_{t-p} + \mathbf{\Psi} \mathbf{d}_t + \boldsymbol{\varepsilon}_t$$

where $\mathbf{x}_t$ is a $(n \times 1)$ vector of jointly determined variables at most integrated of order one I(1), $\mathbf{d}_t$ is a $(q \times 1)$ vector of deterministic terms (such as constants, linear trends and dummies) and $\boldsymbol{\varepsilon}_t$ is a $(n \times 1)$ vector of n.i.d. disturbances with zero mean and non-diagonal covariance matrix, $\boldsymbol{\Sigma}$. In what follows, it will be convenient to express (5.1) in its unrestricted error correction representation,

$$\Delta \mathbf{x}_t = -\boldsymbol{\Pi} \mathbf{x}_{t-1} + \sum_{i=1}^{p-1} \boldsymbol{\Gamma}_i \Delta \mathbf{x}_{t-i} + \boldsymbol{\Psi} \mathbf{d}_t + \boldsymbol{\varepsilon}_t \tag{5.2}$$

where each of the $(n \times n)$ matrices $\boldsymbol{\Gamma}_i = (-\boldsymbol{\Pi}_{i+1})$ and $\boldsymbol{\Pi} = (\mathbf{I} - \boldsymbol{\Pi}_1 - \ldots - \boldsymbol{\Pi}_p)$ comprise coefficients to be estimated by Johansens's (1988) maximum likelihood procedure using a (t = 1, . . .T) sample of data. The ('reduced rank') procedure allows $\boldsymbol{\Pi}$ to be factorised such that, $\boldsymbol{\Pi} = \boldsymbol{\alpha}\boldsymbol{\beta}'$ where $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are both $(n \times r)$ and r is the rank of $\boldsymbol{\Pi}$ corresponding to the number of linearly independent relationships among the variables in $\mathbf{x}_t$. This is advantageous since it delivers a neat economic interpretation to the vector error correction model (VECM) of (5.2), whereby the r columns of $\boldsymbol{\beta}$ represents the *co-integrating vector*s that quantify the 'long-run' (or equilibrium) relationships between the variables in the system and the r columns of *error correction coefficients* of $\boldsymbol{\alpha}$, load deviations from equilibrium (*i.e.* $\boldsymbol{\beta}' \mathbf{x}_{t-k}$) into $\Delta \mathbf{x}_t$ for correction, thereby ensuring that the equilibrium is maintained. The $\boldsymbol{\Gamma}_i$ matrices in (5.2) estimate the short-run or transient effect of shocks on $\Delta \mathbf{x}_t$ and thereby allow the short and long-run responses to differ. The parameterisation in (5.2) allows the short run adjustment effects embodied in the new equilibrium (which lead to permanent changes in the level) to be distinguished from the effects of lagged differences (which are transitory).

As we discuss in the following section, (5.2) readily facilitates estimation and inference on key parameters relevant to aid and fiscal response modelling, thereby providing a framework for addressing issues on aid conditionality and its implications for components of the government budget. By construction, estimated parameters are predicted on the *ceteris paribus* clause, and need to be interpreted in this light. Where the variables in an economic system are characterised by simultaneous and potentially rich dynamic interaction, inference based on 'everything else held constant' can be usefully augmented by the estimation of impulse response functions (see *inter alia* Lutkepohl and Reimers 1992) which explicitly incorporate such interactions. Impulse response functions are readily calculated from reduced forms such as (5.1) and (5.2).

As a reduced form model, parameter estimates from the VAR model cannot be given a meaningful economic interpretation unless the structural economic representation from which (5.1) and (5.2) derive is known. Equivalently, impulse response functions cannot be legitimately attributed to economic (causal) mechanisms. To see why, note that in its reduced form the right-hand-side variables of the VAR comprise only predetermined and exogenous variables, whiles all contemporaneous effects are confined to the residual. Therefore, where significant contemporaneous relationship exists between variables, residuals of their reduced form representations, associated with shocks, are correlated contemporaneously such that shocks through the system cannot be given economic interpretation. It follows then that the estimated parameters upon which dynamic responses are based cannot be given economic (causal) interpretation either. Recovering the structural representation of the VAR therefore involves correct identification of the matrix of contemporaneous relationships among

variables which is required to purge the residuals of any contemporaneous correlation. It is only when the residuals are mutually uncorrelated that they can be considered as 'structural' shocks and be given economic interpretation, in which case dynamic responses of the system (and the estimated reduced form parameters that generate those responses) are also given economic interpretation.

To formalise the concept of identification in VAR models, the natural starting point is to show the relationship between the reduced form and structural VAR models. To do so, consider the structural economic representation of (5.2), namely,

$$\text{(5.3)} \quad \mathbf{A}\Delta\mathbf{x}_t = \tilde{\boldsymbol{\alpha}}\left[\boldsymbol{\beta}\mathbf{x}_{t-p}\right] + \sum_{i=1}^{p-1}\tilde{\boldsymbol{\Gamma}}_i\Delta\mathbf{x}_{t-i} + \tilde{\boldsymbol{\Psi}}\mathbf{d}_t + \mathbf{v}_t$$

where $\mathbf{A}$ represents the $(n \times n)$ matrix of coefficients defining the contemporaneous structural linkages in the system, $\tilde{\boldsymbol{\alpha}} = \mathbf{A}\boldsymbol{\alpha}$, $\tilde{\boldsymbol{\Gamma}}_i = \mathbf{A}\boldsymbol{\Gamma}_i$, $\tilde{\boldsymbol{\Psi}}_i = \mathbf{A}\boldsymbol{\Psi}_i$ and $v_t = \mathbf{A}\boldsymbol{\varepsilon}_t$ are the structural shocks which, as pure disturbances, are assumed to be serially uncorrelated and uncorrelated with each other with zero means and diagonal variance-covariance matrix, $\boldsymbol{\Omega} = \mathrm{E}[v_t v_t^{'}] = \mathrm{A}\boldsymbol{\Sigma}\mathrm{A}'$ (Hamilton, 1994, p.329). Thus, recovering the structural shocks, v_t, from the reduced form residuals, $\boldsymbol{\varepsilon}_t$, requires the identification of the matrix of contemporaneous relationship between the variables, **A**.

The exact identification of the structural VECM of (5.3) requires $n(n-1)$ (identifying) restrictions to be imposed. A typical way of achieving this is to transform the VAR model by pre-multiplying all terms with the inverse of the Choleski decomposition of the covariance matrix, $\hat{\Omega}^{-1/2}$, in which case **A** is chosen as the lower triangular matrix, $\hat{\Omega}^{-1/2}$. This approach imposes $n(n-1)/2$ zero restrictions on **A** and the residual

correlation matrix, Σ, alike, in order to account for the required total restrictions. Although the resulting residuals are mutually uncorrelated by construction, this identification scheme, pioneered by Sims (1980), arbitrarily imposes a recursive causal ordering on the contemporaneous relationships among the endogenous variables, which can be difficult to justify in the empirical setting. However, in small systems with less complex residual correlation structure it is relatively easier to use empirical identification of current effects, proposed in Juselius (2009: 243-245), as a guide to impose an empirically justifiable recursive causal ordering on the variables of the system. Empirical identification accounts for any significant residual correlation as a contemporaneous effect in **A** whiles leaving the residual correlation matrix, Σ, unrestricted. The model is identified by imposing identifying restrictions on the short term parameters **A**, $\tilde{\boldsymbol{\alpha}}$, $\tilde{\boldsymbol{\Gamma}}_i$, and $\tilde{\boldsymbol{\Psi}}_i$.

To give a theoretical exposition of the empirical identification process, we employ a VAR(2) model in VECM form in which $\mathbf{x}_t$ is decomposed into $\mathbf{x}_{1t}$ and $\mathbf{x}_{2t}$. In the context of aid conditionality (with respect to the components of the fiscal budget) and the effect of aid on the components of the fiscal budget, we consider $\mathbf{x}_{1t}$ as comprising only aid while $\mathbf{x}_{2t}$ contains the components of the fiscal budget. Accordingly, when $\mathbf{d_t}$ is excluded for readability, (5.2) could be re-written as follows:

$$\begin{aligned}\Delta\mathbf{x}_{1t} &= \boldsymbol{\Gamma}_{11}\Delta\mathbf{x}_{1t-1} + \boldsymbol{\Gamma}_{12}\Delta\mathbf{x}_{2t-1} + (-\alpha_1)\beta'\mathbf{x}_{t-1} + \boldsymbol{\varepsilon}_{1t} \\ \Delta\mathbf{x}_{2t} &= \boldsymbol{\Gamma}_{21}\Delta\mathbf{x}_{1t-1} + \boldsymbol{\Gamma}_{22}\Delta\mathbf{x}_{2t-1} + (-\alpha_2)\beta'\mathbf{x}_{t-1} + \boldsymbol{\varepsilon}_{2t}\end{aligned} \tag{5.4}$$

where $\boldsymbol{\varepsilon}_t \sim NI(0,\Omega)$ and $\Omega = \begin{bmatrix} \Omega_{11} & \Omega_{12} \\ \Omega_{21} & \Omega_{22} \end{bmatrix}$

Assume just for illustration purposes that $\mathbf{x}_{2t}$ contemporaneously causes $\mathbf{x}_{1t}$. Then, leaving out this information leads to a contemporaneous correlation between the residuals of the two equations in (5.4) (i.e. $\Omega_{12} = \Omega_{21} \neq 0$). The residual correlation could be purged by explicitly accounting for the contemporaneous effect of $\mathbf{x}_{2t}$ on $\mathbf{x}_{1t}$. To explain the role of empirical identification in the latter process, we de-compose (5.4) into the conditional model for $\mathbf{x}_{1t}$ given $\mathbf{x}_{2t}$, and the marginal model for $\mathbf{x}_{2t}$ as follows:[51]

$$\begin{aligned} \Delta\mathbf{x}_{1t} &= \overline{\boldsymbol{\Gamma}}_{10}\Delta\mathbf{x}_{2t} + \overline{\boldsymbol{\Gamma}}_{11}\Delta\mathbf{x}_{1t-1} + \overline{\boldsymbol{\Gamma}}_{12}\Delta\mathbf{x}_{2t-1} + (-\overline{\alpha}_1)\beta'\mathbf{x}_{t-1} + \pi_{1t} \\ \Delta\mathbf{x}_{2t} &= \boldsymbol{\Gamma}_{21}\Delta\mathbf{x}_{1t-1} + \boldsymbol{\Gamma}_{22}\Delta\mathbf{x}_{2t-1} + (-\alpha_2)\beta'\mathbf{x}_{t-1} + \boldsymbol{\varepsilon}_{2t} \end{aligned} \tag{5.5}$$

where $\overline{\boldsymbol{\Gamma}}_{10} = \Omega_{21}\Omega_{22}^{-1}$, $\overline{\boldsymbol{\Gamma}}_{11} = \boldsymbol{\Gamma}_{11} - \overline{\boldsymbol{\Gamma}}_{10}\boldsymbol{\Gamma}_{21}$, $\overline{\boldsymbol{\Gamma}}_{12} = \boldsymbol{\Gamma}_{12} - \overline{\boldsymbol{\Gamma}}_{10}\boldsymbol{\Gamma}_{22}$, and $\overline{\alpha}_1 = \alpha_1 - \overline{\boldsymbol{\Gamma}}_{10}\alpha_2$. Given that the second equation of the system in (5.5) is a subset of the first equation, the system is not identified. The objective is to identify $\mathbf{x}_{2t}$, and the whole point of an empirical identification is to achieve this objective by imposing identifying restrictions guided by the empirical estimation of (5.4). To be specific, a fundamental step in the empirical identification process is to exclude lagged regressors that are statistically insignificant in the estimation of (5.4) from the corresponding equation in (5.5). More

[51] See Harris and Roberts (2005:137), Juselius (2009: 244), and Johansen (1992).

often than not, however, zero restrictions on insignificant lagged regressors are not enough to achieve empirical identification. The reason is that insignificant (or significant) lagged regressors may be common to the two equations in (5.4) in which case identification is not achieved in (5.5). In such circumstances, empirical identification may still be achieved but this would require the imposition of zero restrictions on some statistically significant lagged regressors. To explain the concept underlying the latter process, note that when $\mathbf{x}_{2t-1}$ is a significant determinant of $\mathbf{x}_{2t}$ in the second equation of (5.4), it may appear to be significant in the first equation as well, not because it significantly affects $\mathbf{x}_{1t}$, but because it is strongly correlated with the significant contemporaneous regressor, $\mathbf{x}_{2t}$, that is omitted from the $\mathbf{x}_{1t}$ equation in (5.4). In that case, $\mathbf{x}_{2t-1}$ would no longer be significant in the $\mathbf{x}_{1t}$ equation once $\mathbf{x}_{2t}$ is included as a regressor, as in the first equation of (5.5). This suggests that once the omitted contemporaneous variable, $\mathbf{x}_{2t}$, is included in the structural estimation of $\mathbf{x}_{1t}$ in (5.5), it would be possible to impose zero restriction on $\mathbf{x}_{2t-1}$ for identification purposes, notwithstanding the fact that it emerged significant in the corresponding reduced-form equation in (5.4), whiles purging the residual correlation in the system at the same time. However, this is possible if and only if the direction of causation is from $\mathbf{x}_{2t}$ to $\mathbf{x}_{1t}$ as in the present illustration, and may therefore serve as a test for determining the direction of causation. Thus, knowing whether $\mathbf{x}_{2t}$ indeed causes $\mathbf{x}_{1t}$ contemporaneously is a matter of inspecting the residual correlation from (5.5), as when the direction of causality is wrong, the contemporaneous correlation between the residuals from the $\mathbf{x}_{1t}$ and $\mathbf{x}_{2t}$ equations in (5.5) would still remain statistically significant. Knowing which significant lags could be useful for empirical identification is explained in section 5.4.3.

Two justifications for considering the contemporaneous structure, and not only the lagged structure, of the aid-fiscal response are that, firstly, if aid disbursement in a given period depends on agreed fiscal conditions, and the conditions are met later in that period, then modelling aid as a function of the expected (or agreed) fiscal condition is equivalent to modelling aid as a function of the realised fiscal policy in that period. Secondly, when the lag between the response of aid to fiscal policy or the fiscal response to aid is only a few months, then the relationship between fiscal policy and aid would be contemporaneous when annual data is used (See Juselius, 2009: 239-240, and Martins, 2010). Therefore, as an empirical guide for identifying the VAR model, empirical identification is an important tool in the context of the present study. Moreover, empirical identification of the contemporaneous relationships among variables may be useful for answering some relevant policy questions that the reduced form exposition does not address, particularly in the present context where aid conditionality with respect to certain fiscal variables may be a contemporaneous phenomenon.

5.2.2 Model Specification and Hypothesis Testing

The VECM of section 5.1 is particularly attractive in the current context since it provides a natural framework in which the parallels between the economics and econometrics of fiscal response models can be exploited. Specifically, the framework not only facilitates a statistical investigation of the effect of aid on the budget of different recipient countries but it also shows how fiscal conditions in those recipient countries affect aid-allocation behaviour of their respective donors. This permits comparison across recipient countries with regards to the different impacts of aid and the associated aid-allocation behaviours. Because these economic hypotheses of

interest represent parameter restrictions within the VECM, they can be evaluated formally. In what follows these economic issues of interest are set-out as a number of key propositions.

Distinguishing between the long- and short-run impacts of aid on the budget of recipients may give an insight into the role of aid. Insofar as aid represents an injection of foreign finance, it relaxes the budget constraint. Aid allocated to finance debt or domestic consumption is unlikely to achieve longer term effects on the budget, in which case the impact of aid will be confined to the short run. In contrast, where aid is used as a source of investment for development projects, such as healthcare or infrastructure, there may be more long-term effects on the budget, as such investments spawn further spending (*aid illusion*) or increased tax revenues. Since development projects of this sort are likely to have come about as a result of aid's incorporation into the process of budgetary planning, it is convenient to think of the aid's long-run effects and its incorporation into budgetary planning synonymously. Clearly, whether aid is anticipated or not has a decisive bearing on the uses to which it is put and thus the (short and/or long run) effects that it has.

The economic distinction between short-and long-run tie in neatly to the econometric formulation of the VECM. These in turn offer insights into the role of aid in the empirical setting. Indeed, the correspondence between the economics and econometrics of aid in fiscal response is central to this chapter since it provides the basis for the empirical testing of a range of economic hypotheses relating to the effects that aid has in developing countries. Before we examine how these economic

hypotheses can be tested, it is instructive to recognise the role of deterministic terms in cointegrated VARs.

Deterministic Terms

As set-out in Johansen (1994), the specification of deterministic terms contained in $\mathbf{d}_t$ (such as intercepts, trends and intervention dummies) has important implications for cointegration analysis, both statistically and economically. While in general the introduction of dynamic terms into a static model alters the interpretation of the coefficients (Hendry and Juselius, 2000), this is especially true in an error correction representation of the data which explicitly incorporates data expressed in levels and first differences. This mixture of levels and first differences that is characteristic of the VECM underscores the potentially complex role of deterministic terms in dynamic models comprising non-stationary variables. For example, the inclusion of an unrestricted constant in $\mathbf{d}_t$ to account for the non-zero mean of the cointegrating relationships (i.e. $\mathrm{E}[\boldsymbol{\beta}'\mathbf{x}_{t-1}] = \boldsymbol{\mu}$) will also allow for linear trends in $\mathbf{x}_t$ via accumulation of the constant in the first difference (in which case $\mathrm{E}[\Delta\mathbf{x}_t] = \boldsymbol{\gamma}$). Should these linear trends not cancel out in the cointegrating relation, $\mathbf{d}_t$ should be augmented with a linear trend to account for it, which if left unrestricted, would allow for quadratic trends in $\mathbf{x}_t$ (this being implied where $\mathrm{E}[\Delta\mathbf{x}_t] = \boldsymbol{\rho}t$). Hence, unrestricted intercepts (trends) in $\mathbf{d}_t$ may give rise to linear (quadratic) trends in $\mathbf{x}_t$ and where these do not occur in the data parsimony dictates they should not appear in the model either. Moreover, because deterministic terms affect the limiting distributions of the cointegration test statistics, the precise specification of $\mathbf{d}_t$ is rarely a simple or innocuous decision. Knowledge of the economic problem at hand can be usefully

brought to bear to determine the appropriate specification, or at least rule out some possibilities. For instance, where there is no evidence of trend in the data, 'with-trend' variants may be ruled out a priori.[52]

As Juselius (2009) demonstrates, each unrestricted deterministic term in $\mathbf{d}_t$ of (5.1) or (5.2) represents the combined sum of its contribution to the cointegrating relation(s) and growth rates in $\Delta\mathbf{x}_t$. By explicitly separating the long- from short-run behaviour in the data, the VECM allows the dual role of deterministic terms to be isolated, if required. Consider the cointegrated VAR(2) model in its error correction model representation given in (5.2) where $\mathbf{d}_t$ is simply a $(q \times 1)$ vector of constants giving

$$\Delta\mathbf{x}_t = -\boldsymbol{\alpha}\left[\boldsymbol{\beta}'\mathbf{x}_{t-1}\right] + \boldsymbol{\Gamma}_1\Delta\mathbf{x}_{t-1} + \boldsymbol{\psi} + \boldsymbol{\varepsilon}_t \tag{5.6}$$

Under cointegration, all terms in (5.6) are stationary and thus have a constant mean which we may obtain by taking expectations, so that $\mathrm{E}\left[\Delta\mathbf{x}_t\right] = \boldsymbol{\gamma}$ is a $(q \times 1)$ vector describing the unconditional growth rates of each series and $\mathrm{E}\left[\boldsymbol{\beta}'\mathbf{x}_{t-1}\right] = \boldsymbol{\mu}$ is a $(r \times 1)$ vector of intercepts in the cointegrating relations. Hence, taking expectations of (5.6) gives

$$\begin{aligned}\left[\mathbf{I} - \boldsymbol{\Gamma}_1\right]\boldsymbol{\gamma} &= \boldsymbol{\alpha}\mathrm{E}\left[\boldsymbol{\beta}'\mathbf{x}_{t-1}\right] + \boldsymbol{\psi} \\ &= \boldsymbol{\alpha}\boldsymbol{\mu} + \boldsymbol{\psi}\end{aligned}$$

As a result $\boldsymbol{\psi} = \left[\mathbf{I} - \boldsymbol{\Gamma}_1\right]\boldsymbol{\gamma} - \boldsymbol{\alpha}\boldsymbol{\mu}$ demonstrating that the constant term in (5.6) consists of two components, one related to linear growth rates in the data and the other to the

[52] Calculation of the mean growth rates of all of the variables (and their standard deviation) may assist visual inspection for detection of trend in the data.

mean values of the cointegrating relations (as given by the intercepts of the equilibrium relations).

The same applies to all other deterministic elements in $\mathbf{d}_t$ such as the intervention dummies that are typically required to satisfy the normality of $\boldsymbol{\varepsilon}_t$ that is required for valid inference. For example, where an intervention (exogenous shock) affects a subset of variables (or all but to different degrees) the short-run impact may carry-over into the equilibrium relation necessitating an additional dummy(s) there too. Hence the components of $\mathbf{d}_t$ and the restrictions that are placed on them play an important part of the modelling process. As parameter restrictions in the VECM, intervention effects are directly testable where degrees of freedom allow. In short samples, it is customary to confine intervention effects to (say) the short run only. This, of course, emphasises the importance of institutional knowledge of the interventions at hand, in contrast to their all-too-common use as a 'quick fix'. Juselius (2009) provides detail on this issue, but it should be borne in mind that in general the precise composition of deterministic elements in $\mathbf{d}_t$ (and whether they are restricted or unrestricted) affects the distributions of cointegration test statistics and hence the critical values that are appropriate. Hendry and Julselius (2001) set out the most commonly estimated combinations of trend and intercept (for which separate critical values apply).

Formulating Aid Hypotheses

The cointegrating relation is the statistical analogue of the budgetary equilibrium in fiscal response models. Hence, fiscal response theory predicts the presence of a single cointegrating relation (*i.e.* stationary linear combination of the variables in $\mathbf{x}_t$) such that $\boldsymbol{\beta}$ is an $n \times 1$ vector, the coefficients of which quantify the budgetary equilibrium.

Of course, this presupposes that all variables in $\mathbf{x}_t$ are integrated of order one, [I(1)]. Where a variable is I(0) it will form a stationary linear combination with itself, so that there can exist at most n of these stationary linear combinations; $n = r$ implying that all variables are I(0). As Johansen (1992) demonstrates, the r columns of $\boldsymbol{\alpha}$ correspond to the r rows of $\boldsymbol{\beta}'$ so that inference on the number of cointegrating vectors (non-zero rows in $\boldsymbol{\beta}'$) can be evaluated by hypothesis testing on the adjustment coefficients (non-zero columns in $\boldsymbol{\alpha}$) using likelihood ratio methods. Specifically, standard tests for cointegration are equivalent to testing that the α_r are significantly less than zero for $r = 1,\ldots n$. This leads us to the first set of *cointegration hypothesis* tests, which amount to zero restrictions on each of the *n* columns of $\boldsymbol{\alpha}$ in (5.7):

$$H_c(r):\ \boldsymbol{\alpha}_r = 0,\quad r = 1,\ldots n$$

To assist the exposition, consider a VAR(2) in VECM form with unrestricted constant partitioned conformably as in section (5.1),

$$(5.7)\quad \begin{bmatrix} \Delta\mathbf{x}_{1t} \\ \Delta\mathbf{x}_{2t} \end{bmatrix} = \begin{bmatrix} \boldsymbol{\alpha}_{11} & \boldsymbol{\alpha}_{12} \\ \boldsymbol{\alpha}_{21} & \boldsymbol{\alpha}_{22} \end{bmatrix} \begin{bmatrix} \boldsymbol{\beta}_{11}' & \boldsymbol{\beta}_{12}' \\ \boldsymbol{\beta}_{21}' & \boldsymbol{\beta}_{22}' \end{bmatrix} \begin{bmatrix} \mathbf{x}_{1t-1} \\ \mathbf{x}_{2t-1} \end{bmatrix} + \begin{bmatrix} \boldsymbol{\Gamma}_{11} & \boldsymbol{\Gamma}_{12} \\ \boldsymbol{\Gamma}_{21} & \boldsymbol{\Gamma}_{22} \end{bmatrix} \begin{bmatrix} \Delta\mathbf{x}_{1t-1} \\ \Delta\mathbf{x}_{2t-1} \end{bmatrix} + \boldsymbol{\Psi}\mathbf{d}_t + \begin{bmatrix} \boldsymbol{\varepsilon}_{1t} \\ \boldsymbol{\varepsilon}_{2t} \end{bmatrix}$$

where $\mathbf{x}_{1t}$ comprises aid and $\mathbf{x}_{2t}$ contains the other components of the fiscal budget. The $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ coefficients are partitioned by cointegrating vector, such that $\boldsymbol{\beta}'$ is divided by row into two subsets of cointegrating vectors $\boldsymbol{\beta}_1'$ and $\boldsymbol{\beta}_2'$ which are themselves partitioned by variable in the same way as $\mathbf{x}_t$. Thus, $\boldsymbol{\alpha}_1$ and $\boldsymbol{\alpha}_2$ load each of the subsets of cointegrating vectors into each equation for correction. We assume that $\boldsymbol{\beta}_1'$ represents the budgetary equilibrium so that $\boldsymbol{\beta}_2'$ (and $\boldsymbol{\alpha}_2 = [\boldsymbol{\alpha}_{12} : \boldsymbol{\alpha}_{22}]$) will be a null matrix unless some variables are I(0).

Proposition I: The existence of fiscal equilibrium

Evaluation of Proposition I is by $H_c(1)$ and is confirmed by $\boldsymbol{\alpha}_{11} = \boldsymbol{\alpha}_{21} < 0$, $\boldsymbol{\alpha}_{12} = \boldsymbol{\alpha}_{22} = 0$ using cointegration tests. While all variables in $\mathbf{x}_t$ will be tested for the order of integration prior to the estimation of (5.7), where results from testing $H_c(r)$ suggests two (or more) stationary linear combinations of the data, the stationarity of variables in $\mathbf{x}_t$ (such as aid) may account for it. Generally, any linear combination of variables in $\mathbf{x}_t$ that appear to be stationary by reason of one or more I(0) variables is not of economic interest and is therefore confined to $\boldsymbol{\beta}_2'$ and removed from the model. Adjusting the dimensions of $\boldsymbol{\alpha}$ and β accordingly, yields[53]

$$\begin{bmatrix} \Delta\mathbf{x}_{1t} \\ \Delta\mathbf{x}_{2t} \end{bmatrix} = \begin{bmatrix} \boldsymbol{\alpha}_{11} \\ \boldsymbol{\alpha}_{21} \end{bmatrix} \begin{bmatrix} \boldsymbol{\beta}_{11}' & \boldsymbol{\beta}_{12}' \end{bmatrix} \begin{bmatrix} \mathbf{x}_{1t-1} \\ \mathbf{x}_{2t-1} \end{bmatrix} + \begin{bmatrix} \boldsymbol{\Gamma}_{11} & \boldsymbol{\Gamma}_{12} \\ \boldsymbol{\Gamma}_{21} & \boldsymbol{\Gamma}_{22} \end{bmatrix} \begin{bmatrix} \Delta\mathbf{x}_{1t-1} \\ \Delta\mathbf{x}_{2t-1} \end{bmatrix} + \boldsymbol{\Psi}\mathbf{d}_t + \begin{bmatrix} \boldsymbol{\varepsilon}_{1t} \\ \boldsymbol{\varepsilon}_{2t} \end{bmatrix} \quad (5.8)$$

When the focus of the study is on the long-run only, stationary variables are transferred from $\mathbf{x}_t$ to $\mathbf{d}_t$, so that the former contains only those variables germane to the long run. However, stationary variables may contain some relevant information for the short-run and therefore, when the short-run is of interest, as in the context of the present study, stationary variables are maintained in $\mathbf{x}_t$ (though removed from the long-run) to yield (5.8).

It is apparent that this set of tests performs a dual role in the analysis: (a) it determines the appropriate formulation of variables in (5.2) and (b) results offer an important insight into the role of aid in the recipient country. Specifically, where aid is found to

[53] Where variables are found to be I(0) Rahbek and Mosconi (1999) suggest a tractable modification to ensure that the limiting distributions of the cointegration test statistics are invariant to the presence of the stationary regressors.

be I(0), it cannot belong to the fiscal equilibrium relationship and thus its principal role is to relax the budget constraint. This may be indicative of countries where aid is too small to be included in the process of budget planning or suggest that aid is diverted away from investment purposes for other reasons.

Having established the number of stationary linear combinations within $\mathbf{x}_t$ the next step is to establish the variables that each contains. We proceed on the assumption that $r = 1$ having dealt with the multiple cointegrating vector case above.[54] Testing the statistical significance of each variable in the cointegrating relation requires *long run exclusion* tests, which amount to testing zero restrictions on each coefficient in $\boldsymbol{\beta}_1'$, namely,

$$H_e(j): \boldsymbol{\beta}_{1j}^{'} = 0, \ j = 1,\ldots n$$

Of particular interest is the significance of the aid variable which gives rise to,

Proposition II: Aid forms part of the fiscal equilibrium relation

which is evaluated by $H_e(x_t): \boldsymbol{\beta}_{11}^{'} = 0$ in (5.8). As with the cointegration tests, long run exclusion tests have economic implications. Where aid is found to be I(1) but redundant to the long run relation suggests that there may be institutional factors preventing aid from playing a role in the fiscal equilibrium. Any variable that is unimportant in the long run can nonetheless be informative in the short-run and is therefore maintained in $\mathbf{x}_t$ for the purpose of investigating the short-run when the latter

[54] In practice, long run exclusion tests would be applied in conjunction with cointegration tests to determine whether multiple cointegrating vectors were indeed due to the presence of stationary variables in $\mathbf{x}_t$ or multiple cointegrating relations among I(1) variables in $\mathbf{x}_t$. Since the latter case is implausible from an economic viewpoint it is ruled-out in the following development.

is also of economic interest as in the present study, implying a VECM specification of the form in (5.8).

In seeking to investigate the way in which aid impacts on the budget of recipient countries attention naturally focuses upon the causal mechanisms that exist between aid and the other components of the budget. Specifically, we may want to establish whether aid is treated as given in the budget or whether its allocation actually reflects the state of the budget in some way. More generally, issues of exogeneity (or endogeneity) may be addressed with respect to the short- and long-run behaviours. Regarding the latter, it is useful to know which of the variables adjust to maintain the budgetary equilibrium. This can be accomplished econometrically, by application of Johansen's (1992) *long run weak exogeneity* test. This represents a set of exclusion tests on the $(n \times 1)$ vector of error correction coefficients, $\boldsymbol{\alpha} = \boldsymbol{\alpha}_1 = [\boldsymbol{\alpha}_{11} \quad \boldsymbol{\alpha}_{21}]'$ in (5.8). Since these measure the speed at which the corresponding variables in $\Delta \mathbf{x}_t = [\Delta \mathbf{x}_{1t} \quad \Delta \mathbf{x}_{2t}]'$ adjusts to deviations from the equilibrium, a zero coefficient implies that the variable does not adjust to disequilibrium in the system and is exogenous to the long run part of the system.[55]

By Granger's Representation Theorem (Engle and Granger, 1987) at least one variable must adjust in order to maintain the equilibrium relation(s) and thus the exogeneity status of the variables is typically an issue of economic interest. For example, when applied to the domestic fiscal variables in $\mathbf{x}_t$, the test offers a guide as to the behaviour

[55] Importantly, weak exogeneity specifies parameters of interest (unlike Granger Non-Causality for example) thus a variable that is weakly exogenous for the long run parameters need not be weakly exogenous for other parameters (such as those describing the short run).

of the fiscal authorities, indicating which fiscal aggregate adjusts in light of deficit or surplus to restore the budgetary equilibrium. This gives rise to,

Proposition III: Recipient governments do not react to fiscal disequilibrium

which is tested by $H_{we}(\mathbf{x}_{2t}) : \boldsymbol{\alpha}_{21} = 0$ in (5.8). Given that we might ordinarily expect the government to maintain the fiscal equilibrium, in which case $H_{we}(\mathbf{x}_{2t})$ is rejected, similar tests can be applied to the individual coefficients within $\boldsymbol{\alpha}_{21}$ to establish which, if any, components are weakly exogenous.

Weak exogeneity tests also cast light on the behaviour of aid donors and leads to,

Proposition IV: Donor governments do not react to fiscal disequilibrium

which is tested by $H_{we}(\mathbf{x}_{1t}) : \boldsymbol{\alpha}_{11} = 0$ in (5.8). Where rejected, donors' aid allocation reacts to past fiscal imbalance in the recipient country. Conversely, a non-rejection implies aid is weakly exogenous to the long run relation, so that departures from the recipients budgetary equilibrium do not influence the donor's aid allocation. Once more the formulation of the VECM offers some interesting insights into the economic behaviours embodied in the data.

The foregoing discussion assesses whether any of the non-stationary variables can be treated as weakly exogenous for the estimation of the long run parameters ($\boldsymbol{\alpha}\boldsymbol{\beta}'$). Any variable that forms part of the cointegrating relation but is weakly exogenous to it is described as *long run forcing* (Pesaran *et al.* 2000).[56] It should also be borne in mind

[56] As a concept long-run forcing is weaker than Granger non-causality (see below). While both concepts rule-out the possibility that shocks to the endogenous variables have any long-run impact on the variable

that all stationary variables are also weakly exogenous for $\boldsymbol{\alpha\beta}'$ by construction. As stationary regressors, they can play no part in the long-run part of the model, and may therefore be treated as fixed for the purpose of estimation of it. In practice, if the parameters of interest are solely those pertaining to the long run (*i.e.* $\boldsymbol{\alpha\beta}'$) there are no advantages to estimating separate equations for the weakly exogenous variables, which as a consequence, enter contemporaneously on the right hand side of (5.2) as discussed above (see for example, Ericsson *et al.*, 1998). While, this usually simplifies the modelling exercise, it is inappropriate in the current context, since short-run parameters are also of interest for impulse response analysis and for addressing issues on aid conditionality. With regards to the latter, short-run parameters in the aid equation are relevant since aid may adjust to short-run changes in fiscal variables, even if it does not respond to deviations from their values in the long run relation (*i.e.* even if it is weakly exogenous). In other words, because the VECM distinguishes the short- from long-run relationships among the data, we are able to evaluate whether variables such as aid are exogenous to both short- and long-run behaviours. Questions of this sort lead in to Granger non-causality testing (Granger, 1969 but see e.g., Ericsson *et al.* 1998) and gives rise to,

Proposition V: Donors aid allocation is not influenced by past fiscal conditions in the recipient country

which can be expressed in terms of (5.8) as the null hypothesis that $\mathbf{x}_{2t}$ does not Granger-cause $\mathbf{x}_{1t}$,

$$H_G(\mathbf{x}_2 \not\rightarrow \mathbf{x}_1) : (\boldsymbol{\alpha}_{11}\boldsymbol{\beta}_{12}^{'}) = 0 \text{ and } \boldsymbol{\Gamma}_{12} = 0$$

in question, lagged changes in those endogenous variables may influence it under long run forcing, but denied under Granger non-causality.

Where they are upheld, these restrictions ensure that past values of the fiscal variables do not influence current values of aid, whether in terms of long- or short-run behaviours. The weak exogeneity of $\mathbf{x}_{1t}$ (i.e. $\boldsymbol{\alpha}_{11} = 0$) ensures that $(\boldsymbol{\alpha}_{11}\boldsymbol{\beta}_{12}^{'}) = 0$ and $\mathbf{x}_{2t}$ does not Granger-cause $\mathbf{x}_{1t}$ providing lagged changes in $\mathbf{x}_{2t}$ do not influence $\mathbf{x}_{1t}$. Where this is so, $\mathbf{x}_{1t}$ is described as being strongly exogenous (Engle, Hendry and Richard, 1983). Given the stationarity of (5.8), this can be evaluated using standard *t* and *F* tests. Of course, it may also be of interest to evaluate whether aid is Granger non-causal for the domestic budget (*i.e.* the domestic fiscal variables). Where this hypothesis is upheld, aid is unlikely to be effective, however in practice it may result when aid is numerically small rather than statistically insignificant. This gives rise to the most fundamental of the economic hypotheses, namely,

Proposition VI: Aid does not influence the fiscal conditions in the recipient

This proposition amounts to the null hypothesis that aid is Granger non-causal for the budget in the recipient country, (i.e. $\mathbf{x}_{1t}$ does not Granger-cause $\mathbf{x}_{2t}$) and evaluated in (5.8) by,

$$H_G(\mathbf{x}_1 \not\rightarrow \mathbf{x}_2) : (\boldsymbol{\alpha}_{21}\boldsymbol{\beta}_{11}^{'}) = 0 \text{ and } \boldsymbol{\Gamma}_{21} = 0$$

in an analogous manner to that given above. Table 5.1 contains a summary of the economic propositions of interest and the restrictions they impose on the VECM. In general, all hypotheses within a VECM are conditional upon the correct choice of cointegrating rank (*r*) and this also applies here. Thus the cointegrating rank (and appropriate specification of deterministic terms) is established prior to the estimation of the VECM.

In summary, this section has set out some key issues and principal propositions relevant to the representation of aid in fiscal response modelling. We adopt a VAR framework for this purpose owing to the tractability of the VECM and the insights that it brings to the investigation of aid in developing countries. In particular we consider six propositions of relevance to the aid relationships between donors and recipients and set out the parameter restrictions these imply in the VECM. In the following section we apply these methods to data from two developing countries in sub-Saharan Africa, namely Ghana and Zambia.

Table 5.1 Summary of Aid Propositions

Maintained Model I

$$\begin{bmatrix}\Delta\mathbf{x}_{1t}\\ \Delta\mathbf{x}_{2t}\end{bmatrix}=\begin{bmatrix}\boldsymbol{\alpha}_{11} & \boldsymbol{\alpha}_{12}\\ \boldsymbol{\alpha}_{21} & \boldsymbol{\alpha}_{22}\end{bmatrix}\begin{bmatrix}\boldsymbol{\beta}_{11}' & \boldsymbol{\beta}_{12}'\\ \boldsymbol{\beta}_{21}' & \boldsymbol{\beta}_{22}'\end{bmatrix}\begin{bmatrix}\mathbf{x}_{1t}\\ \mathbf{x}_{2t}\end{bmatrix}+\begin{bmatrix}\boldsymbol{\Gamma}_{11} & \boldsymbol{\Gamma}_{12}\\ \boldsymbol{\Gamma}_{21} & \boldsymbol{\Gamma}_{22}\end{bmatrix}\begin{bmatrix}\Delta\mathbf{x}_{1t-1}\\ \Delta\mathbf{x}_{2t-1}\end{bmatrix}+\boldsymbol{\Psi}\mathbf{d}_t+\begin{bmatrix}\boldsymbol{\varepsilon}_{1t}\\ \boldsymbol{\varepsilon}_{2t}\end{bmatrix}$$

Proposition	Evaluation	Restrictions	Inference
I. The existence of fiscal equilibrium	How many stationary linear combinations (r) of the data exist?	$H_c(0)$: $\boldsymbol{\alpha}_{11}=\boldsymbol{\alpha}_{21}=\boldsymbol{\alpha}_{12}=\boldsymbol{\alpha}_{22}=0$ $H_c(1)$: $\boldsymbol{\alpha}_{11}=\boldsymbol{\alpha}_{21}\neq 0$, $\boldsymbol{\alpha}_{12}=\boldsymbol{\alpha}_{22}=0$ $H_c(2,\ldots,n)$: $\boldsymbol{\alpha}_{11}=\boldsymbol{\alpha}_{21}\neq 0$, $\boldsymbol{\alpha}_{12}=\boldsymbol{\alpha}_{22}\neq 0$	Theory of fiscal response indicates a single cointegrating vector ($r=1$) so rejection of $H_c(0)$ is consistent with this. Where $r>1$ suggests that aid (and potentially other variables) may be stationary and thus plays no role in the fiscal equilibrium relation.

Maintained Model II
(single equilibrium assumed)

$$\begin{bmatrix}\Delta\mathbf{x}_{1t}\\ \Delta\mathbf{x}_{2t}\end{bmatrix}=\begin{bmatrix}\boldsymbol{\alpha}_{11}\\ \boldsymbol{\alpha}_{21}\end{bmatrix}\begin{bmatrix}\boldsymbol{\beta}_{11}' & \boldsymbol{\beta}_{12}'\end{bmatrix}\begin{bmatrix}\mathbf{x}_{1t}\\ \mathbf{x}_{2t}\end{bmatrix}+\begin{bmatrix}\boldsymbol{\Gamma}_{11} & \boldsymbol{\Gamma}_{12}\\ \boldsymbol{\Gamma}_{21} & \boldsymbol{\Gamma}_{22}\end{bmatrix}\begin{bmatrix}\Delta\mathbf{x}_{1t-1}\\ \Delta\mathbf{x}_{2t-1}\end{bmatrix}+\boldsymbol{\Psi}\mathbf{d}_t+\begin{bmatrix}\boldsymbol{\varepsilon}_{1t}\\ \boldsymbol{\varepsilon}_{2t}\end{bmatrix}$$

Proposition	Evaluation	Restrictions	Inference
II. Aid forms part of the fiscal equilibrium	Is aid statistically significant in the fiscal relation?	$H_e(\mathbf{x}_{1t})$: $\beta'_{11}=0$	Assuming aid is I(1), non-rejection implies institutional factors deny aid a long-run role. Rejection of $H_e(\mathbf{x}_{1t})$ suggests aid belongs in the fiscal relation.
III. Recipient governments do not react to fiscal disequilibrium	Are fiscal aggregates weakly exogenous to the fiscal relation?	$H_{we}(\mathbf{x}_{2t})$: $\boldsymbol{\alpha}_{21}=0$	Rejection of $H_{we}(\mathbf{x}_{2t})$ implies governments in recipient countries adjust to maintain fiscal equilibrium. Similar further testing identifies those variables that maintain equilibrium.
IV. Donors do not react to fiscal disequilibrium in recipient country	Is aid weakly exogenous to the fiscal relation?	$H_{we}(\mathbf{x}_{1t})$: $\boldsymbol{\alpha}_{11}=0$	Non-rejection of $H_{we}(\mathbf{x}_{2t})$ implies governments in recipient countries do not adjust to maintain fiscal equilibrium; rejection implies they do.
V. Donor's aid allocation is not influenced by past fiscal conditions in recipient	Are fiscal variables Granger-non-causal for aid?	$H_G(\mathbf{x}_2 \not\rightarrow \mathbf{x}_1)$: $(\boldsymbol{\alpha}_{11}\boldsymbol{\beta}_{12}')=0$ and $\boldsymbol{\Gamma}_{12}=0$	Non-rejection of $H_G(\mathbf{x}_2 \not\rightarrow \mathbf{x}_1)$ implies donor behaviour is unaffected by past fiscal conditions in either the long or short run.
VI. Aid does not influence fiscal conditions in recipient	Is Aid Granger-non-causal for the fiscal variables?	$H_G(\mathbf{x}_1 \not\rightarrow \mathbf{x}_2)$: $(\boldsymbol{\alpha}_{21}\boldsymbol{\beta}_{11}')=0$ and $\boldsymbol{\Gamma}_{21}=0$	Non-rejection of $H_G(\mathbf{x}_1 \not\rightarrow \mathbf{x}_2)$ implies aid has no impact on the budget of the recipient in either the long or short run.

5.3 Description of variables and sources of data

The present study investigates the source of differences in the aid-budget deficit relationships in Ghana and Zambia, using annual time-series data over the period 1972 to 2006. The components of the government budget included in the analyses are government expenditure, government revenue, domestic borrowing, and foreign aid. Foreign aid is obtained as net official development assistance (ODA), and includes concessional loans with a grant element of 25% or more; While it may be argued that the loan component of this measure over-estimates the actual amount of aid received by the fiscal authorities, it does not pose much problem for the present study since our focus is on relaxing the budget constraint and the fiscal response induced. It may also be argued that ODA includes technical assistance, projects carried out by donors, and food aid, which are not included in the 'pot' of aid received by the fiscal authorities and would therefore not induce fiscal response; In disagreement with this view, we purport that the latter components of ODA are likely to affect fiscal policy since they relax the fiscal budget constraint by reason of eliminating what would have constituted a target of government spending. Data on foreign aid was compiled by the Development Assistance Committee (DAC) of the Organisation for Economic Co-operation and Development (OECD) but obtained from the African Development Indicators database of the World Bank.

Unlike Osei et al (2005) on Ghana, our measure of government revenue includes both tax and non-tax revenues. Whereas this measure has the advantage of capturing the induced effort of the government at raising revenue by all means, tax revenue may not be a functional indicator when the tax capacity is reached, as is believed to be the case in Zambia (Cordella and Dell'Ariccia, 2007). Data on government revenue is obtained

from the International Financial Statistics (IFS) and the Government Finance Statistics (GFS) databases of the International Monetary Fund (IMF). Also, unlike several other studies in this area,[57] we do not disaggregate government expenditure into its current and capital components. This is because, given the relatively small sample sizes involved in the present study, we may already be trading-off some useful degrees of freedom as we encourage the use of dummy variables to induce Gaussian residuals. Moreover, investigating how aid is actually spent is not the focus of the present study. Data on government expenditure is also obtained from the IFS and GFS databases of the IMF.

Data on domestic borrowing in Zambia was obtained from the GFS database of the IMF and the ADI database of the World Bank; data from the two sources were consistent. We however did not succeed in obtaining a consistent data on domestic borrowing for Ghana covering the study period. We therefore use domestic finance by the monetary authorities as a proxy. The latter constitutes a good proxy because, in addition to being a component of domestic borrowing, the correlation is relatively high (87% and 97% in constant 2000 price and current price denominations respectively, using data obtained from 1972 to 1989 from the GFS of IMF). Nonetheless, it is worth noting that results associated with domestic financing by monetary authorities are more indicative of the implication of aid for fiscal dominance than for 'crowding-out' of the private sector; none of these however constitutes the main focus of the study and therefore the difference is not a drawback. Data on domestic finance from monetary authorities was obtained from the GFS database of the IMF and the ADI database of the World Bank.

[57] See Martin (2010), Osei et al (2005), Fagernas and Roberts (2004a and b), and Fagernas and Schurich (2004).

All the variables were in constant 2000 price LCU (ie Cedis in Ghana and Kwacha in Zambia). The latter transformation was computed using the GDP deflator (and exchange rate data – for converting aid from US dollars) obtained from the ADI database of the World Bank. As in Martins (2010) and Osei et al (2005), we preserve the budget identity by not taking the logarithms of the transformed variables. Also, by leaving out some components of the government budget such as external borrowing (and other domestic borrowing in the case of Ghana) and loans, we are not estimating an identity.

5.4 Estimations for Ghana

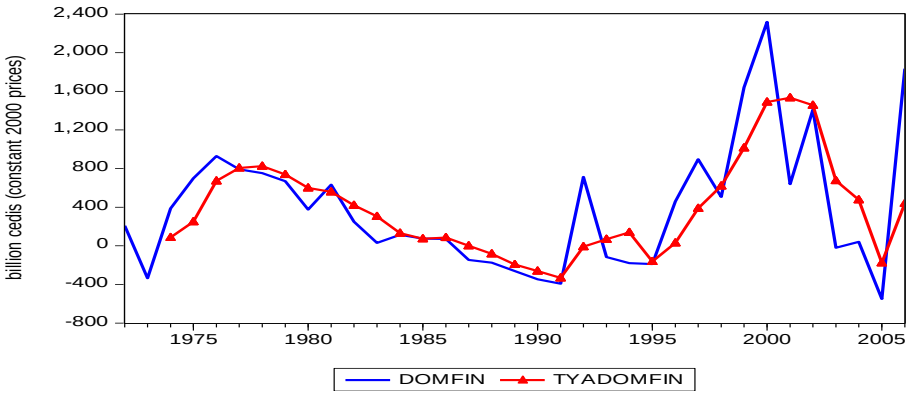
5.4.1 Unit root test

In order to obtain valid economic and statistical inferences, there is the need to augment the standard economic techniques to allow for unit roots where necessary. As a natural starting point, therefore, we begin our empirical estimations by testing for the order of integration of the individual series, using the Augmented Dicky Fuller (ADF) test. Since the ADF specification includes lagged differences on the right-hand-side to correct for potential autocorrelation in the residuals, τ_t, there may be loss of power of the test as a result of loss of degrees of freedom. Therefore, we also employ an alternative approach, known as the Phillip-Perron's (PP) test, which deals with non-normality without adding extra parameters to the test formulation. The PP test uses a non-parametric method that accounts for structural breaks in the series.

Table 5.2 below shows the results of the ADF and the PP test for unit roots. At the 99% and in all three deterministic forms of the model, none of the variables in levels is stationary but when differenced once all the variables become stationary. This implies that all variables are integrated of order one (denoted I(1)) at the 99 percent confidence level. Notable, however, is that domestic finance in levels appears to be stationary around a constant (and trend) at the 95 (90) percent level of significance. By inspecting the domestic finance series in figure 5.1, we suspect that the apparent stationarity at relatively lower levels of significance may be because a combination of seasonal interventions or outliers (associated with the four-year elections among others)

nullifies the effect of unit roots on the temporal ordering of the series.[58] Therefore, to obtain a clearer profile of the series, we smooth out the outliers by taking the three-year averages of the data. The corresponding time profile is also illustrated in figure 5.1. We conclude from the ADF and PP tests, reported in table A5.3 of the appendix, that the three-year-average domestic finance series is I(1). We therefore proceed with an integration of order one for domestic finance, as with all the other variables.

Figure 5.1 Time profile of domestic finance



[58] Osei et al (2005) find domestic borrowing to be I(1) when the data is over the period 1964-1998. Considering domestic finance as stationary could be considered as tentative at this point, and would be evaluated when the cointegration vector is estimated.

Table 5.2 Unit root test: ADF and Phillip Perron (Variables in constant 2000 LCU)

Maintained model: $\Delta x_t = \alpha_1 + \alpha_2 t + \rho x_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta x_{t-i} + \tau_t$

	LEVELS			1ST DIFF.	Inference
	H_0: $\rho=0$	H_0: $\rho= \alpha_2=0$	H_0: $\rho= \alpha_1= \alpha_2=0$	H_0: $\rho=0$	
ADF TEST					
Aid	-3.358*	-0.851	0.195	-7.478***	I(1)
Domfin	-3.407*	-3.353**	-2.572**	-7.355***	I(1)
GovRev	-1.740	1.274	2.556	-6.250***	I(1)
GovExp	-0.086	0.966	1.673	-6.463***	I(1)
P-P TEST					
Aid	-3.306*	-0.665	0.195	-7.537***	I(1)
Domfin	-3.407*	-3.353**	-2.382**	-7.477***	I(1)
GovRev	-1.661	1.386	2.723	-6.387***	I(1)
GovExp	0.328	3.627	4.488	-6.864***	I(1)
Crit. Val.	H_0: $\rho=0$	H_0: $\rho= \alpha_2=0$	H_0: $\rho= \alpha_1= \alpha_2=0$		
99%	-4.253	-3.639	-2.635		
95%	-3.549	-2.951	-1.951		
90%	-3.207	-2.614	-1.611		

*,**, and *** denote significant at the 10%, 5%, and 1% levels respectively.

5.4.2 Model specification

Determination of the lag length

The validity of inferences drawn from the VAR model depends crucially on the adequacy of the specified model. A wrongly specified model is likely to breach one or more of the standard assumptions underlying a statistical model and may therefore lead to results that are economically and statistically false. The challenge of specifying an adequate model includes the correct choice of lag length. To determine the appropriate lag length, three information criteria that are commonly used are the Akaike (AIC), the Schwartz (SC) and the Hannan-Quinn (HQ). Though similar in the underlying likelihood function, results from the three criteria may be different because they apply different penalties to the loss of degrees of freedom associated with increased lag lengths. Conventionally, the sequence of events in a VAR analysis is to use the aforementioned lag length criteria to determine a tentative lag length of the VAR in levels for which there is no sign of autocorrelation, check the residuals for model misspecification, and specify structural dummies to correct for non-normalities (if model misspecification tests suggest so) before conducting the cointegration rank test. However, the problem associated with this approach is that the choice of lag length is valid only when the model is correctly specified. For instance, not accounting for outliers and structural shifts in the series may wrongly suggest the need for longer lag lengths to deal with potential autocorrelation, and longer lag lengths conceal other model specification problems. We therefore prefer to have a prior knowledge of the nature of outliers and 'shifts', before determining the lag length. Another problem associated with the conventional approach to VAR analysis is that the nature of residuals from the VAR in levels is not indicative of the normality of residuals from the actual model. This is because, for I(1) variables, the actual model would comprise

the differenced variables and, possibly, an error-correction term that are not accounted for when the VAR is estimated in levels, suggesting that testing residuals from the latter for model specification problems may be misleading. We therefore prefer to test for model specification problems on a tentatively estimated VECM or VAR in differences (when there is no cointegration). Thus, our approach is to proceed with the test for cointegration rank using a tentative model that incorporates identified structural dummies and a reasonable (and possibly redundant) lag length. Using the estimated rank, we estimate a tentative VECM and test for misspecification. In the event of redundant or inadequate lag length, the rank (trace) test is re-conducted.[59]

Before choosing a reasonable lag length to start with, we report the estimates from the formal lag length criteria to show how the different approaches compare. The estimated lag lengths from the AIC, SC, and HQ criteria, whose validity are conditional on correct model specification, are reported in table 5.3 below.

Table 5.3 Lag length criteria

Lag	LogL	AIC	SC	HQ
0	-3537.65	228.752	229.122	228.872
1	-3481.27	226.146	227.256*	226.508*
2	-3470.09	226.457	228.307	227.06
3	-3447.3	226.019*	228.61	226.864
4	-3432.48	226.096	229.426	227.181

* indicates lag order selected by the criterion at 5%

[59]In large samples, altering the lag length would not necessarily warrant another rank test since the nature of the test is such that the short-run dynamics are concentrated out, in accordance with the Frisch-Waugh theorem, before determining the rank (Juselius, 2009:116). However, this may not hold for small samples.

The AIC points to three lags whiles the SC and HQ suggest one lag. Whereas too few lags may understate the dynamics of the model, too many lags may be equally harmful by reason of compromising useful degrees of freedom and masking specification problems. There is a strong argument in favour of specifying a VAR(2) for a start and correcting for possible structural problems. For instance, Juselius (2009: 72) suggests that, in practice, a correctly specified model does not often require a longer VAR order than two, and Martin (2010) concluded from their review of literature that most empirical studies on fiscal response to aid often find an appropriate VAR order of two. We therefore proceed using a VAR (2) model with structural dummies, though tentative for a start, and attempt to identify and correct for structural specification problems once the corresponding VECM is estimated.

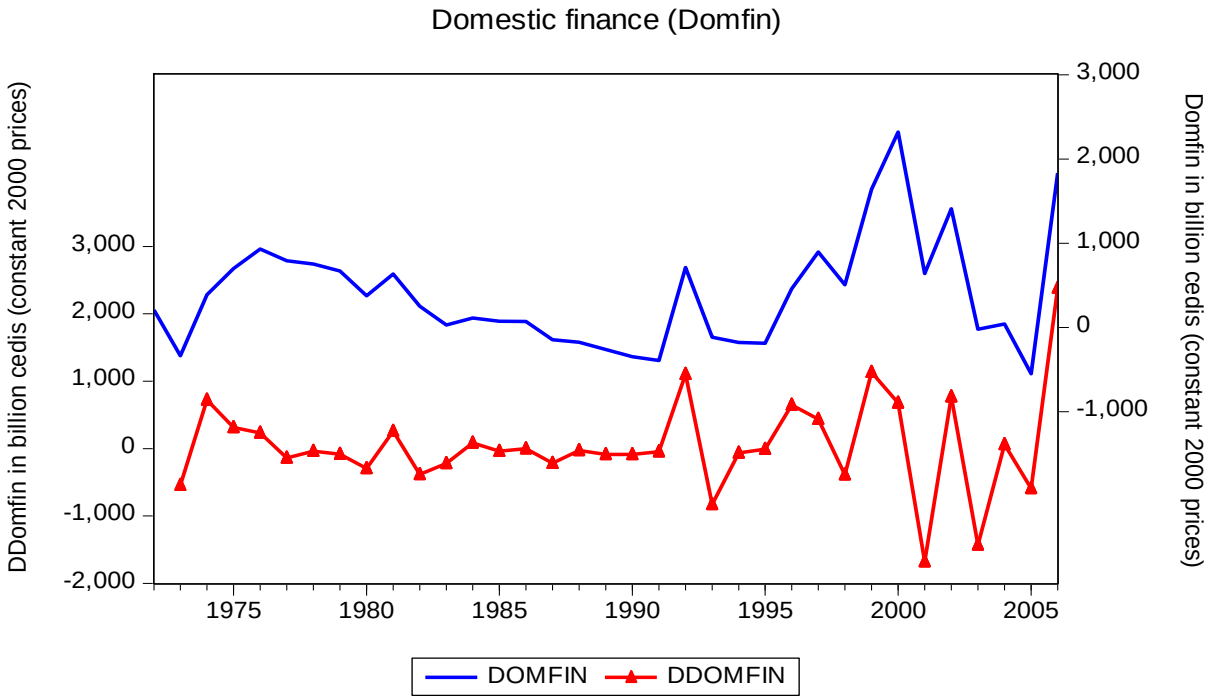
Dummy Variables

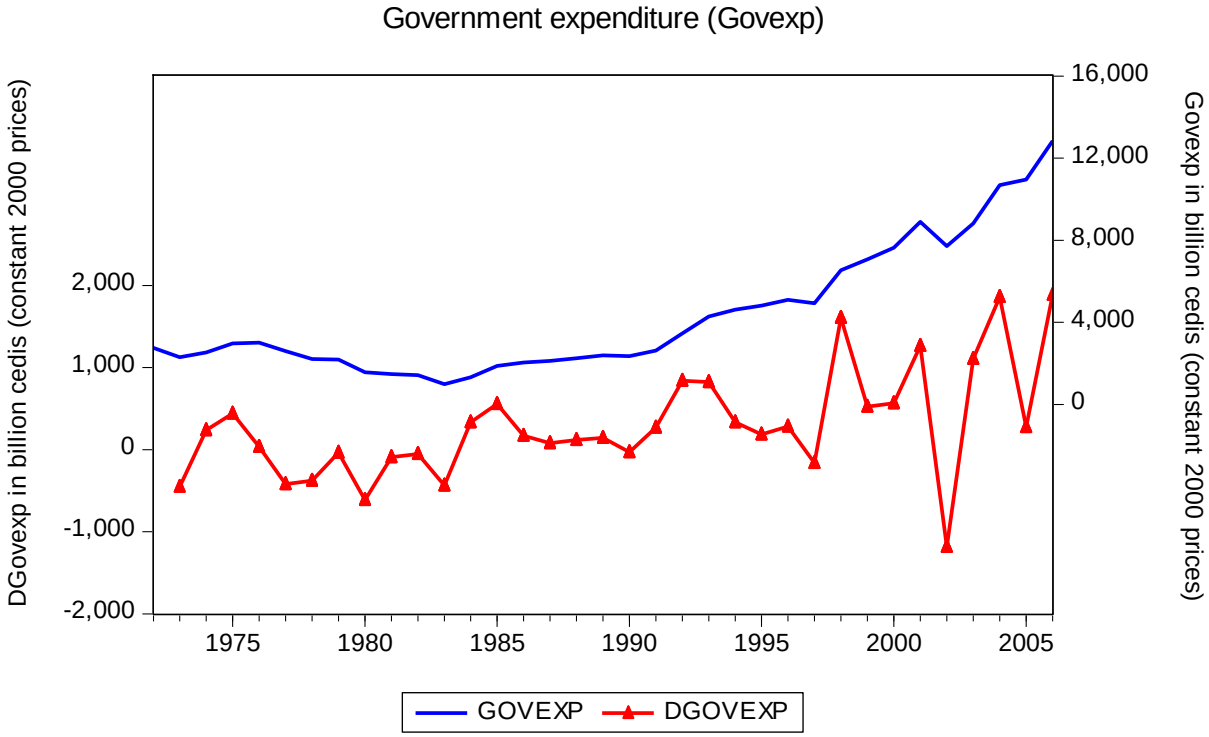
A readily available econometric toolkit for dealing with non-normalities in VAR models is the use of 'intervention' (or outlier) and 'shift' dummies. Choosing the correct dummy, and particularly getting the timing right, is however a non-trivial exercise. When wrongly specified, the dummy variable may be of no use or even detrimental to the estimation (Juselius, 2009: 104). To specify dummy variables, therefore, we use as much information and evidence as possible, ranging from the examination of the series in levels and differences *vis a vis* the economic calendar, to the inspection of estimated residuals from a tentatively specified VECM model. Inspecting tentative VECM residuals, rather than the residuals from the VAR in levels, is useful because the latter may not be reflective of the actual model specification. To see this, note that when the VAR is in levels, outliers may not show up in the residuals because they may cancel out when they affect two or more (cointegrating) variables.

This is however not the case when the variables are in differences. Therefore, given that all the variables are I(1) and for that matter, the analyses would involve mainly the first differences (and, possibly, the levels of the series only in the event of existing cointegration relation(s)), it would be more useful to inspect residuals that capture specification problems associated with the differenced data. It is noteworthy that model misspecification results in large residual variance that may conceal specification problems. In this case, correcting one specification problem reveals another (Juselius 2009: 77). Therefore, examining the graphical representation of the series in levels and in differences, along with the economic calendar, is a useful precursor since it helps specify some very obvious dummy variables for a start. The series in levels and first differences are as illustrated in figure 5.2 below.

The time profile shows that, in levels, domestic finance trended downwards between the late 1970s and the mid 1990s, reflecting the implementation of economic reform programs that targeted lower levels of domestic borrowing. The sudden upsurge in the level of domestic borrowing in 1992, depicted by a transitory 'blip' in the profile for the differences, was associated with election spending by the incumbent PNDC government during the very first democratic election in Ghana. Given that there is a re-election of government every four years, the upsurge in domestic borrowing was bound to recur accordingly. Indeed, that appeared to be the case for the year 1996 and 2000 election years but not in 2004. The change in pattern of election borrowing in 2004 may be associated with improved institutions that enforce reform programs even during election years. This suggests that different intervention dummies are required for each election year.

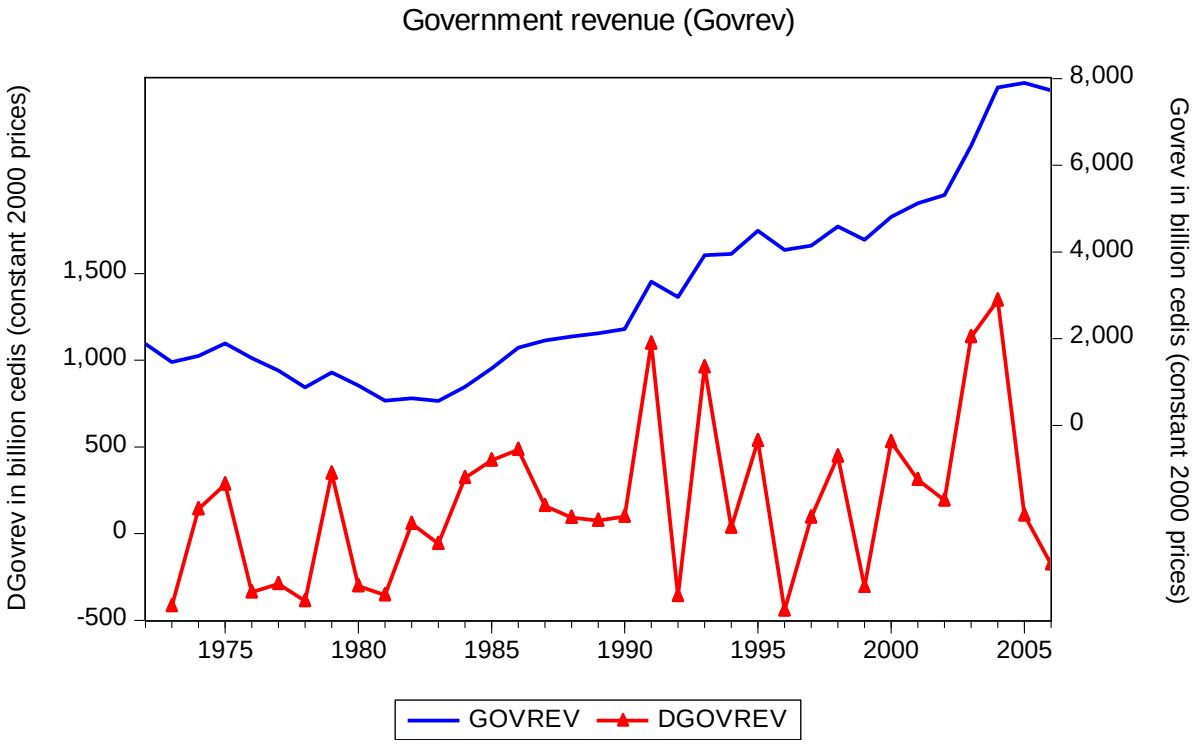
Figure 5.2 Time Profiles of the fiscal variables and aid[60]

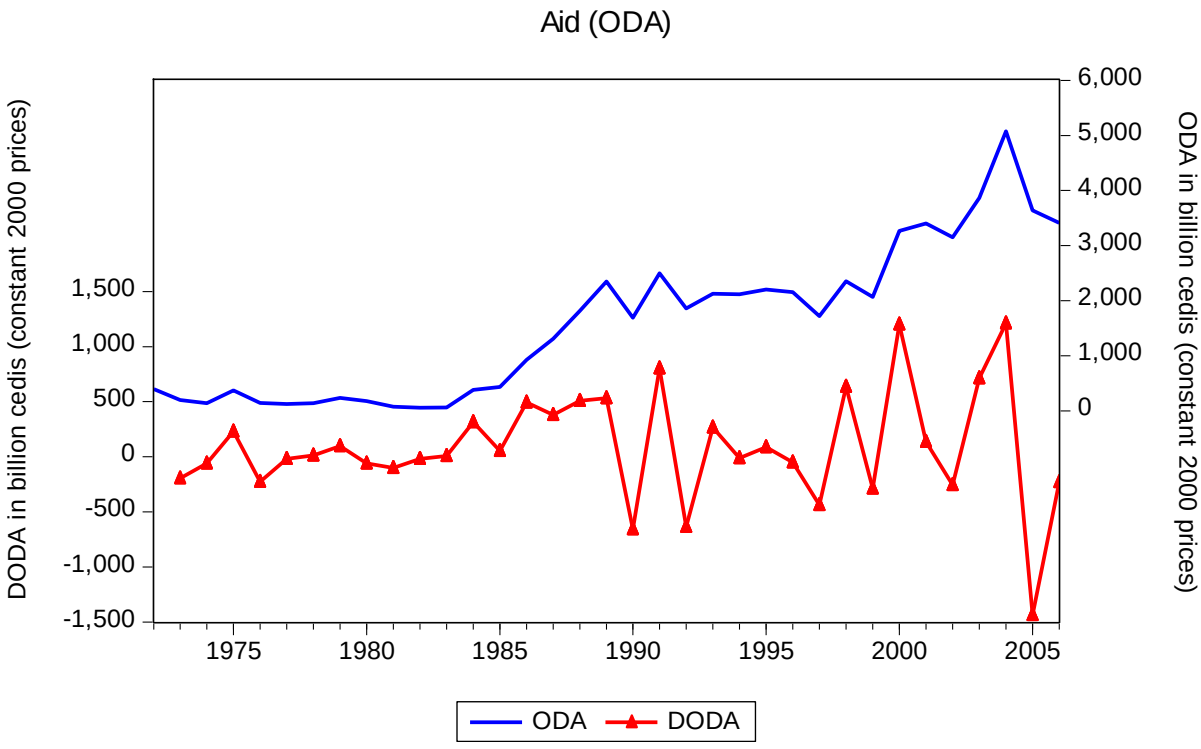




[60] Note: The prefix 'D' in the nomenclature within the legend denotes first difference.

Figure 5.2 continued





Note:The prefix 'D' implies the first difference of the variable.

With regards to government expenditure and revenue, we clearly identify three trends: a downward trend from the early 1970s till the famine year of 1983 when the economy collapsed, a rising trend of a mild gradient from 1984 till 1997, and yet another rising trend with even higher gradient from 1998 onwards. Given the similarity between the two variables, these trends are likely to cancel out without generating any non-normality when estimations include only the levels of government expenditure and revenue. However, there is the need to account for a mean-shift dummy when estimation involves the differences of the two variables, as is the case with VECMs. Thus, broken trends in the levels data translate into mean-shifts in the differenced data, which is more obvious in the differences profile for government expenditure and revenue when the pre-1983 and 1984-1997 periods are observed, but blurred out by outliers in the later period. Like domestic borrowing, the pattern of government expenditure is affected in the election years. Unlike domestic borrowing, however, government spending continues to rise following an upsurge in an election year. The trend in government expenditure is interrupted temporarily by an excessive reduction in government spending in 2002, when aid donation to Ghana was inexplicably low and the resulting increase in domestic borrowing was not enough to make amends, hence the need for a 2002 outlier dummy. The government revenue data, however, does not appear to be plagued by the elections and the 2002 outliers.

The aid data also seems to depict three regimes that coincide with those identified for government expenditure and revenue. However, the polygonal quadratic pattern is less pronounced in the levels data for aid. Surprisingly, the aid profile shows a sudden fall in aid during the first election year, in 1992, but not in the subsequent election years. In fact, aid inflows to Ghana increased in the 2000 election year, and actually peaked

in the 2004 election year. This reinforces the need to employ different dummies for each election year if any possible non-normality is to be dealt with effectively. In addition to the aforementioned unexplained fall in aid inflows in 2002, the aid profile also shows another sudden unexplained reduction in 1990, suggesting the need for a 1990 outlier dummy.

In order to ensure that less conspicuous but influential outliers are not over-looked, we obtain and inspect the residuals from a tentatively specified VECM that includes only the election dummies. The process confirmed the non-normalities and the corresponding dummy variables already identified. Upon inspection of the series, in levels and differences, and the residuals of the tentative VECM estimation, the dummy variables suggested for the adequate specification of the VECM are as summarised in table 5.4 below. The 1992 election dummy takes on a value of '1' in 1992 and '-1' in 1993, and follows in that order for all other election dummies and outliers. The mean-shift dummy takes on a value of '0' from 1972 to 1983, '1' from 1984 to 1997, and '2' from 1998 to 2006.

Table 5.4 Dummy Variables

SERIES	**SUGGESTED DUMMIES**
Domestic Finance	Election, outlier2002 dummies
Gov. Expenditure	Mean-shift, election, and outlier2002 dummies
Gov. Revenue	Mean-shift dummy
Aid	Mean-shift, election, outlier1990 and outlier2002 dummies

Determination of the cointegration rank

The cointegration rank refers to the number of unique equilibrium combinations of the variables in the system. The importance of correct model specification cannot be overemphasised in the determination of the cointegration rank; a misspecified model may lead to the wrong choice of cointegration rank (obtained from the trace test), especially in small samples, resulting in false inferences from the VECM model since the latter is influenced by the choice of cointegration rank.

Using the VAR(2) model with the dummy variables suggested in table 5.4, namely election dummies, mean-shift dummy, and the outlier dummies for aid, the trace test predicts a cointegration rank of one as shown in table 5.5. This means that one unique equilibrium relationship exists between the variables in the system, and ***leads to the rejection of the hypothesis that no fiscal equilibrium exists in Ghana***. To arrive at this result, we allow for a trend term in the cointegration space to capture trending exogenous effects that have not been accounted for, whiles we allow for a constant term in the short-run specification. It is noteworthy that whereas the treatment of these deterministic components often affects the estimate of cointegration rank, this is not the case in the present study. As summarised in table 5.6, all possible specifications of the deterministic components point to a cointegration rank of one.

Typically, accounting for dummy variables in the rank test alters the asymptotic distribution of the estimator and, for that matter, the critical values. The latter are however indicative of the true values when the dummy variables do not enter the cointegration space. In the present study we expect non-normalities to cancel out in the

cointegration space since each cause affects more than one variable in the system.[61] We therefore restrict the dummy variables to the short-term, implying that inferences based on the critical values are valid. Therefore, consistent with Osei et al. (2005), we proceed with the estimation of the VECM using a single cointegrating relation.

Table 5.5 Cointegration Rank Test

Hypothesized No. of CE(s)	. Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.732	73.388	63.876	0.006
At most 1	0.408	29.906	42.915	0.508
At most 2	0.282	12.588	25.872	0.770
At most 3	0.049	1.666	12.518	0.985

Trend restricted to cointegration space, but constant unrestricted in model
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 5.6 Summary of cointegration rank for different assumptions about the deterministic components

Data Trend	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	1	1	1	1

[61]This is confirmed by plotting the error-correction term in the next section.

5.4.3 Estimation of the VECM

Model misspecification tests

The VECM is estimated using the Johansen's approach which is in two parts. The first part comprises maximum likelihood estimation of the long-run (cointegration) relation based on reduced rank regression. The second part estimates the short-run dynamics in a VAR whiles including the estimated long-run relation explicitly as an error-correction term. The estimator is derived under the assumption of the residuals being Gaussian and is considered full maximum likelihood provided the underlying assumptions are met. It follows then that the model estimates are valid only when the estimated residuals are indeed Gaussian. Therefore, before reporting the long- and short-run estimates and testing the corresponding hypotheses, we first test for model misspecification by conducting the standard tests on the distribution of the residual, namely autocorrelation, normality and heteroscedasticity tests. The distribution of residuals is reported in figure 5.3 and the test results in table 5.7 below.

Figure 5.3 Distribution of residuals

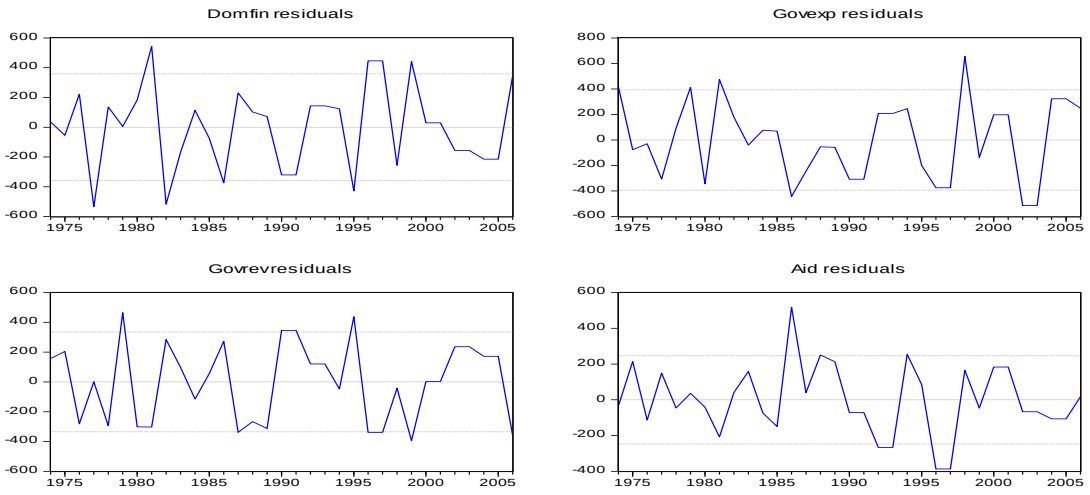


Table 5.7 Test for model misspecification

(a) Test for autocorrelation

Lags	LM-Stat	Prob
1	19.994	0.221
2	18.205	0.312
3	20.919	0.182
4	16.004	0.453

(b) Test for normality

Component	Jarque-Bera	df	Prob.
1	0.659	2	0.719
2	1.026	2	0.599
3	0.073	2	0.964
4	2.431	2	0.297
Joint	4.190	8	0.840

(c) Test for heteroscedasticity

Joint test:		
Chi-sq	df	Prob.
248.455	240	0.340

Standard test results show that, even at the 90 percent confidence level, there are no signs of significant autocorrelation (up to the fourth lag), non-normality and heteroscedasticity. To ascertain the redundancy of the second lag, we perform a lag exclusion test on the lagged difference. The results in table 5.8 shows that with the exception of government revenue series, the lagged differences are significant in all the series and jointly even at the 99 percent confidence level. This rules out the VAR(1) suggested by the SC and HQ information criteria. We therefore consider the VECM transformation of the VAR (2) model as adequately specified.

Table 5.8 Lag exclusion test

	ΔDOMFIN	ΔGOVEXP	ΔGOVREV	ΔAID	Joint
Lag 1	29.020	13.483	5.440	15.435	79.013
	[0.000]	[0.009]	[0.245]	[0.004]	[0.000]
df	4	4	4	4	16

Numbers in [ ] are p-values

Long-run estimates and hypotheses

Normalising on domestic finance, the long-run relationship between the fiscal variables and aid, with the Johansen's maximum likelihood coefficients substituted, is as shown in (5.10) below.

$$(5.10) \quad Domfin = \underset{(5.019)}{0.350}*Gov\exp - \underset{(-0.527)}{0.078}*Aid - \underset{(-2.182)}{0.331}*Govrev - \underset{(-2.116)}{0.043}*trend - 0.785$$

where the figures in parenthesis represent the t-statistic. The result shows that *ceteris paribus*, domestic finance is positively correlated with government expenditure but negatively correlated with aid and government revenue. We also find that the magnitude of the estimates for government expenditure and revenue are very similar and with opposite signs. These findings are consistent with Osei et al. (2005). With the exception of aid, however, the sizes of the coefficient estimates are relatively a third of what Osei et al. (2005) obtains.[62] This may be ascribed to the fact that the present study uses the domestic finance from monetary authorities rather than domestic borrowing in general. Given the similarity of the coefficients for aid, and the large proportion of domestic borrowing that is accounted for by domestic finance from monetary authorities, we do not rule out the possibility that the influence of the fiscal authorities on monetary policy (fiscal dominance) has reduced (possibly as a result of

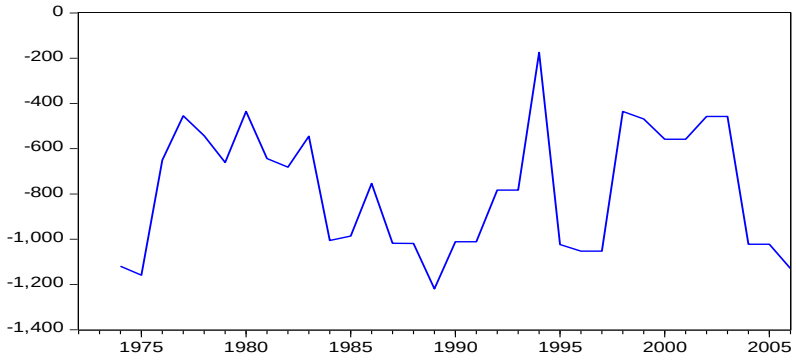
[62] In Osei et al. (2005), the coefficient estimates for government expenditure, government revenue and aid in the corresponding long-run equation were 0.841, -1.040, and -0.074 respectively.

improved institutions). This view suggests that, in recent times, fiscal authorities resort to alternative means (rather than domestic sources) to finance the primary deficit, and is supported by the significant and negative coefficient of the trend term that suggests that, ceteris paribus, domestic finance is falling over time.

The result also shows that, unlike government expenditure and revenue, ***aid is statistically insignificant and therefore does not form part of the fiscal equilibrium relation***. This suggests that, in Ghana, aid has been used principally to relax the budget constraint rather than for investment purposes. Nonetheless, aid may still impact on growth if it was used as an incentive instrument in the short-run to encourage growth enhancing policies such as the reduction of the primary deficit. In what follows we acquire more insight into the determination and role of aid in the short-run.

Although we do not account for dummy variables in the equilibrium relationship, we do not expect the long-run estimates to be affected because, as explained earlier, we expect non-normalities to cancel out in the cointegration space since each of them is associated with more than one variable. To confirm this expectation, we present a graphical illustration of the equilibrium-correction term, when the short-run effect is concentrated out, in figure 5.4. We find that, indeed, the cointegration space is stationary and shows no signs of non-normality.

Figure 5.4 Equilibrium-correction term (Residuals from equation 5.10)



Short-run estimates and hypotheses

As a reduced form model, short-run parameter estimates from a VECM are unique (generically identified) but cannot be given causal interpretation unless the underlying structure of the model shows no significant contemporaneous relationship between the variables (in which case the reduced-form is also the structural form). Therefore, until we identify the underlying structure of the reduced-form VECM, a significant regressor is said to Granger-cause the dependent variable, which simply means that the dependent variable is not exogenous to the regressor, but the effect may occur indirectly through other (contemporaneous) variables. Thus, the reduced-form parameter estimates are simply considered as correlations. Nonetheless, since our hypotheses of interest only requires information as to whether or not a lagged regressor contains statistically significant information about future values of the dependent variable (even if the link between the variables is indirect) rather than a quantification of the (direct) structural effect, we proceed with the estimation and interpretation of the reduced-form model to address our hypotheses. An important caveat, however, is that if there exist any significant contemporaneous relationships between the variables (that have been relegated to the residuals by construction of the reduced-form VECM), then

OLS estimates could be biased in some cases.[63]Also the resulting correlations between residuals could cause OLS estimates of the VECM to be inefficient (with the possibility of a type IV error).[64] Therefore, the test of hypotheses based on the reduced-form VECM becomes substantiated when the underlying structure of the model is identified.

The short-run estimates of the VECM are as reported in table 5.9. Since the error-correction term is insignificant in the aid equation, ***we do not reject the hypothesis that donor governments do not react to fiscal disequilibrium.***[65] However, aid inflows are significantly associated with past reduction in government expenditure (at the 1% level), suggesting that donors may have used aid as an incentive for the Ghanaian government to reduce the fiscal deficit. This finding is consistent with elements of aid conditionality which target the reduction of domestic borrowing and debt sustainability through cuts in government spending, and ***leads to the rejection of the hypothesis that donors' aid allocation is not influenced by past fiscal conditions in Ghana***. Donor actions therefore contribute to the negative correlation between aid inflows and the budget deficit in Ghana. Nonetheless, the humanitarian use for aid appears to exist marginally, evidenced by the marginally significant positive correlation between aid inflows and the level of domestic finance in the previous year.

[63] Parameter estimates may be biased if the lagged regressor has indirect effect (occurring through the omitted contemporaneous variable) that is opposite the direct effect on the variable. A typical example is the error-correction (ecm) term in the aid equation; the ecm term may have a direct negative effect on aid but also an indirect positive effect occurring through domestic finance. Therefore, controlling for contemporaneous domestic finance in the aid equation (when suggested by identification criteria) may cause an otherwise insignificant ecm to become more negative and significant.
[64] Type IV error is whereby variables appear to be insignificant when they are actually significant.
[65] As will become clear later, the error-correction term becomes significant in the aid equation when the underlying structure is identified.

Given that a considerable amount of aid is channeled through to the fiscal authorities directly, we expect aid to impact on the fiscal conditions in Ghana in the short-run. However, considering the numerous uses to which aid could be put, the nature of the impact is not known *a priori*. ***The result indeed rejects the hypothesis that aid does not affect the fiscal conditions in Ghana***. Specifically, aid inflows have significant reducing effect on domestic borrowing and government expenditure (at the 1% and 5% levels respectively), reflecting the efficacy of aid conditionality in Ghana. Since these impacts of aid are closely associated with deficit reduction,[66] we conclude that the actions of the Ghanaian government, regarding the use of aid, contribute to the negative correlation between aid and the budget deficit in Ghana. The error-correction term is statistically significant and with the right (negative) sign in the domestic finance and government expenditure equations, meaning these two fiscal variables adjust to correct fiscal disequilibrium in Ghana. ***We therefore reject the hypothesis that the Ghanaian government does not respond to fiscal disequilibrium***.

This far we have established the 'ceteris paribus' relationship between aid and the fiscal variables in Ghana, and for that matter the behaviours of aid donors and the Ghanaian government underlying the relatively successful implementation of aid conditionality. A useful next step, for policy purposes, is to draw inferences about the dynamic effect of aid on the fiscal variables when all simultaneous and dynamic interactions between the variables are incorporated. To do so, we augment the 'ceteris paribus' reduced-form estimates of table 5.9 into impulse response functions. Since the latter quantify the causal effects of an economic shock that is unique to the variable of interest (aid in this case), obtaining structural parameter estimates is essential. In what

[66] The budget deficit is principally financed by domestic borrowing. Therefore, reduced domestic borrowing is likely to be associated with reduced budget deficit. Also, *ceteris paribus*, government expenditure cuts lead to reduced budget deficits.

follows, therefore, we identify the underlying structure of the VECM before estimating the impulse responses of the fiscal variables to an aid shock.

Table 5.9 Short-run estimates of reduced-form VECM

	$\Delta Domfin_t$	$\Delta Govexp_t$	$\Delta Govrev_t$	ΔAid_t
$\Delta Domfin_{t-1}$	-0.557***	0.178	0.018	0.196*
	(0.168)	(0.184)	(0.157)	(0.115)
$\Delta Govexp_{t-1}$	1.068***	0.310	-0.367*	-0.512***
	(0.236)	(0.258)	(0.220)	(0.162)
$\Delta Govrev_{t-1}$	-0.961***	0.170	0.303	0.107
	(0.336)	(0.368)	(0.314)	(0.231)
ΔAid_{t-1}	-0.806***	-0.471**	0.264	0.338**
	(0.209)	(0.229)	(0.195)	(0.144)
Const	0.200	0.353**	0.192	0.106
	(0.150)	(0.160)	(0.140)	(0.100)
Ecm_{t-2}	-0.601***	-0.461**	-0.237	-0.079
	(0.202)	(0.221)	(0.189)	(0.139)
R2	0.848	0.787	0.668	0.861

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively. The regression includes dummy variables that have been confined to the appendix for readability.

Structural identification of the VECM

As explained in section 5.2.1, the reduced-form VECM restricts contemporaneous relationships between the variables to the residuals, leading to contemporaneous correlations between residuals. Therefore, shocks through the system cannot be identified as unique to any variables (or equations), and cannot be given structural (economic) interpretation, unless the underlying structure of the VECM is identified. Identifying the underlying structure of the VECM is essentially an exercise to purge off any contemporaneous correlations between the residuals. Therefore, a natural first

step is to inspect the residual correlation matrix for any significant correlations. The residual correlation matrix is reported in table 5.10 below.

Table 5.10 Residual correlation Matrix

	ΔDomfin	ΔGovexp	ΔGovrev	ΔAid
ΔDomfin	1	0.118	-0.771	-0.448
ΔGovexp	0.118	1	0.006	0.018
ΔGovrev	-0.771	0.006	1	0.188
ΔAid	-0.448	0.018	0.188	1

The critical value for the correlation coefficients is $c_{ij} = 2/\sqrt{T} = 0.35$, where T is the effective sample size (N-k).

We find that, by standard measure,[67] the significant contemporaneous residual correlations of concern are between aid and domestic finance, and between government revenue and domestic finance. A contemporaneous causal effect from domestic finance to government revenue is inexplicable and very unlikely. Based on empirical knowledge, therefore, we purge the corresponding residual correlation by imposing a contemporaneous causal effect from government revenue to domestic finance. Thus, an increase in revenue results in less borrowing by the Ghanaian government.

Identifying the contemporaneous causal direction between aid and domestic finance is less straightforward because either direction is possible. For instance, donation of development aid is often conditioned on agreed developmental actions, (including fiscal policy actions) to be carried out by the recipient government and some donors wait for the recipient to commit to the actions before disbursing aid, suggesting a

[67] The critical value for the correlation coefficients is $c_{ij} = 2/\sqrt{T} = 0.35$, where T is the effective sample size (N-k).

causal effect from domestic borrowing to aid. On the other hand, most aid is given to the fiscal authorities directly as a source of foreign revenue and therefore, for a given level of spending, less borrowing would be required; hence aid may be viewed as causing changes in domestic borrowing.

To identify the causal direction between aid and domestic borrowing, we employ the empirical identification scheme described in the methodology section; the scheme is based on the empirical estimates of the reduced-form VECM in table 5.9 (see Juselius, 2009: 243-245). To be specific, we first isolate the domestic finance and aid equations from the VECM to obtain a system of two equations. We then estimate the system twice; in the first estimation, we assume the causation is from domestic finance to aid. We therefore include domestic finance as a contemporaneous regressor in the aid equation. We then assume that the causal direction is from aid to domestic finance and run the second estimation in which case contemporaneous aid is included as a regressor in the domestic finance equation. In each of the two estimations, the empirical identification of the contemporaneous right-hand-side variable is achieved by imposing zero restrictions. The specification that is considered adequate, in terms of the correct causal direction between the aid and domestic finance variables, is the one in which the identified contemporaneous regressor emerges statistically significant and, at the same time, succeeds in purging the residual of any significant contemporaneous correlation.

Fundamentally, the empirical identification process involves imposition of zero restrictions on lagged regressors that are insignificant in the reduced-form VECM estimation in table 5.9. As explained in section 5.2.1, however, it is often necessary to

impose zero restrictions on some significant lagged regressors as well during the empirical identification process. To achieve this, we first look for the lagged regressors that are statistically significant in both equations but with opposite signs, given that the correlation between aid and domestic finance is negative; the variables that meet this requirement are the lags of domestic finance, government expenditure and aid. We then impose zero restrictions on these lagged regressors in the aid equation during the first estimation, whereby contemporaneous domestic finance is included as a regressor in the aid equation. The process is repeated for the domestic finance equation during the second estimation, but in this case it is the contemporaneous aid variable that is included as a regressor in the domestic finance equation. Note that we also include the contemporaneous government expenditure and revenue variables as additional regressors in both equations of the system in order to eliminate their influence on the resulting correlation between the residuals. Since the equations of the system do not have the same regressors in this procedure, OLS estimates would not be equivalent to full information maximum likelihood (FIML) estimates, hence we use FIML method in what follows.

The FIML estimates and the corresponding residual correlation matrices are reported in table 5.11. In the first two columns, we show that domestic finance has a (negative) contemporaneous effect on aid which is significant at the 5% level, and once this effect is controlled for, the contemporaneous correlation between the residuals of the aid and domestic finance equations becomes insignificant (0.126). This suggests that changes in domestic finance affect changes in aid contemporaneously. Given that the contemporaneous effect could be two way, we still investigate the reverse causality.

Table 5.11 FIML estimation of aid and domestic finance

	zero restriction on contemp. aid		zero restriction on contemp. dom. finance	
	ΔDomfint	ΔAidt	ΔDomfint	ΔAidt
ΔDomfint		-0.337**		
		(0.156)		
ΔGovexpt	0.313	0.081	0.247	0.043
	(0.405)	(0.178)	(0.279)	(0.333)
ΔGovrevt	-0.491**	-0.080	-1.015	0.319
	(0.239)	(0.310)	(0.691)	(0.320)
ΔAidt	-	-	0.940	
			(0.991)	
ΔDomfint-1	-0.558			0.005
	(0.406)			(0.212)
ΔGovexpt-1	0.911***			0.125
	(0.246)			(0.297)
ΔGovrevt-1	-0.801*		-0.282	
	(0.468)		(0.618)	
ΔAidt-1	-0.779***			-0.167
	(0.249)			(0.261)
ECMt-2	-0.307		-0.04	
	(0.562)		(0.394)	
Const	0.080	-0.018	0.015	0.022
	(0.155)	(0.153)	(0.411)	(0.267)
Elect1992	1.730	-0.172	1.640	-0.226
	(1.490)	(0.443)	(1.000)	(0.424)
Elect2000		0.873		0.517
		(0.845)		(0.421)
Elect2004		1.420***		1.060**
		(0.345)		(0.503)
AidOut1990		-0.735		-0.549
		(0.869)		(0.401)
Mean-shift		0.128		-0.011
		(0.102)		(0.201)
Log. L'hood	-1826.576		-1852.198	
Res. Corr.	0.126		-0.818	

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively.

We however find that the contemporaneous effect of aid on domestic finance is statistically insignificant (even at the 10% level) and the residual correlation between the two equations (which is -0.818) remains statistically significant in the second estimation, as shown in the third and fourth columns of table 5.11. We therefore conclude that the contemporaneous causal direction is from domestic finance to aid. A possible explanation, informed by the fact that the budget deficit of developing countries is mainly financed domestically, is that aid disbursement is actually conditioned on the budget deficit as a way of targeting lower domestic finance and fiscal stability in general. Thus, domestic finance in the present study may be serving as a proxy for budget deficit in an environment where donors aiming to enforce aid conditionality wait for the recipient government to commit to a lower fiscal deficit before disbursing aid. This finding therefore reinforces the previously established view that the implementation of aid conditionality is relatively successful in Ghana.

Having deduced the positions of government revenue, domestic finance and foreign aid in the causal chain, the final variable to position is government expenditure. It is noteworthy that the location of government expenditure is not likely to have any significant impact on the results because its reduced-form residual has no significant correlation with any other reduced-form residual in the system, suggesting that government expenditure has no significant contemporaneous relationship with the other variables. Nonetheless, it is essential to locate government expenditure in the causal chain because not doing so would relax the number of identifying restrictions required, in which case OLS estimates would no longer be equivalent to FIML estimates. We therefore use empirical knowledge to locate the position of government expenditure in the causal chain. We expect the revenue of the government in a given

year to dictate spending in that year (rather than the reverse causality), and we expect expenditure decisions to precede government borrowing in general. We therefore identify the causal chain between aid and the fiscal variables in Ghana as follows:

$$\Delta Govrev \rightarrow \Delta Govexp \rightarrow \Delta Domfin \rightarrow \Delta Aid$$

When we impose this causal structure on the variables, we obtain the structural VECM estimates in table 5.12. Consistent with the residual correlation matrix of table 5.11, the results show that the only variables with statistically significant contemporaneous effect in the structural VECM are domestic finance (at the 5% level) in the aid equation and government revenue (at the 1% level) in the domestic finance equation with coefficient estimates of -0.538 and -0.827 respectively. Qualitatively, the results of the structural domestic finance equation, with the exception of the additional current (government revenue) variable, do not differ from the reduced-form results; as a result of controlling for the contemporaneous effect of government revenue, however, the magnitudes of the coefficients of the lagged variables become smaller since their indirect effects, occurring through current government revenue, are sifted out. For instance, the coefficient of the lagged (difference) government revenue variable reduces from -0.961 in the reduced-form to -0.729 in the structural-form domestic finance equation but still remains significant at the 1% level. In the context of the present study, such reduction in the magnitude of the structural-form coefficient does not imply a bias in the reduced-form estimates; rather, the reduced-form estimates include indirect impacts once the linking contemporaneous variable is omitted.

With regards to the structural aid equation, we find that, once the contemporaneous effect of domestic finance is accounted for, the lags of domestic finance, government

expenditure and aid become insignificant in the structural aid equation (even at the 10% level), implying that they affect aid indirectly through their impact on current domestic finance (confirmed by their significance in the domestic finance equation). An interesting finding, however, is that the error-correction term becomes statistically significant with a negative coefficient (-0.443) at the 10% level, ***leading to the rejection of the null hypothesis that aid donors do not respond to fiscal disequilibrium***. All other conclusions from the hypotheses tests based on the reduced-form remain the same – A summary of our conclusions on the hypotheses tests is shown in table 5.13 (page 226).

Table 5.12 Short-run estimates of structural VECM

	ΔGovrevt	ΔGovexpt	ΔDomfint	ΔAidt
ΔDomfin	-	-	-	-0.538**
				(0.227)
ΔGovexp	-	-	0.112	0.071
			(0.135)	(0.132)
ΔGovrev	-	0.007	-0.827***	-0.307
		(0.269)	(0.158)	(0.242)
ΔDomfint-1	0.018	0.178	-0.562***	-0.110
	(0.157)	(0.189)	(0.113)	(0.168)
ΔGovexpt-1	-0.367*	0.312	0.730***	-0.073
	(0.220)	(0.282)	(0.171)	(0.234)
ΔGovrevt-1	0.303	0.168	-0.729***	-0.329
	(0.314)	(0.386)	(0.228)	(0.275)
ΔAidt-1	0.264	-0.473*	-0.535***	0.019
	(0.195)	(0.245)	(0.157)	(0.194)
Const	-0.192	-0.352**	-0.319***	-0.247*
	(0.139)	(0.175)	(0.113)	(0.131)
Ecmt-2	-0.237	-0.459*	-0.746***	-0.443*
	(0.189)	(0.236)	(0.152)	(0.224)
R2	0.668	0.787	0.941	0.899
Normality	2.307	1.208	3.194	2.431
.	[0.316]	[0.547]	[0.203]	[0.300]

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively. This regression includes dummy variables that have been confined to the appendix (A5.3) for readability.

Coefficient estimates of the structural government expenditure equation remain almost the same as in the reduced-form, both qualitatively and quantitatively. To be specific, the coefficients on the lags (in differences) of aid and the error-correction term are respectively -0.471 and -0.461 in the reduced-form government expenditure equation and -0.473 and -0.459 in the structural equation. However, the error-correction term and the lag of aid become less significant compared to the reduced-form estimates. Seeing that the additional insignificant current government revenue variable does not improve the goodness of fit of the model (with the R-squared remaining at 78.7%), we ascribe the loss of significance of the two variables to the loss of degrees of freedom. The coefficients on the lags (in differences) of domestic finance, government expenditure, and government revenue remain insignificant in the structural government expenditure equation.

Finally, we find evidence that increase in government expenditure may be associated with 'crowding-out' of the private sector. Specifically, the results show that an increase in government expenditure leads to an increase in domestic finance, coupled with a decrease in government revenue, in the following year. Our interpretation is that the decrease in government revenue, when expenditure and domestic finance increases, may be associated with a reduction of private sector activities that tend to reduce the revenue base of the government.

In summary, the 'ceteris paribus' findings from the structural VECM estimation that are of relevance to policy are as follows: aid donors condition aid disbursement to Ghana on reduced domestic borrowing and aid, so disbursed, influences the reductions of domestic borrowing both directly and through cuts in government expenditure.

Conditioning aid disbursement on reduced domestic borrowing, with the aim of inducing lower domestic borrowing, is justified by evidence of 'crowding-out' effect; increased domestic borrowing is associated with decreased government revenue in the following year, indicating loss of private sector activities. With the underlying structure of the reduced-form VECM identified, our next step is to estimate impulse response functions to examine the full impact of aid when the 'ceteris paribus' clause is relaxed.

Table 5.13 Summary of test results on hypotheses

NULL HYPOTHESES	TEST RESULTS
I. The existence of fiscal equilibrium	Not rejected
II. Aid does not form part of the fiscal equilibrium	Not rejected
III. Recipient governments do not react to fiscal disequilibrium	Rejected
IV. Donors do not react to fiscal disequilibrium in recipient country	Rejected
V. Donor's aid allocation is not influenced by past fiscal conditions in recipient	Rejected
VI. Aid does not influence fiscal conditions in recipient	Rejected

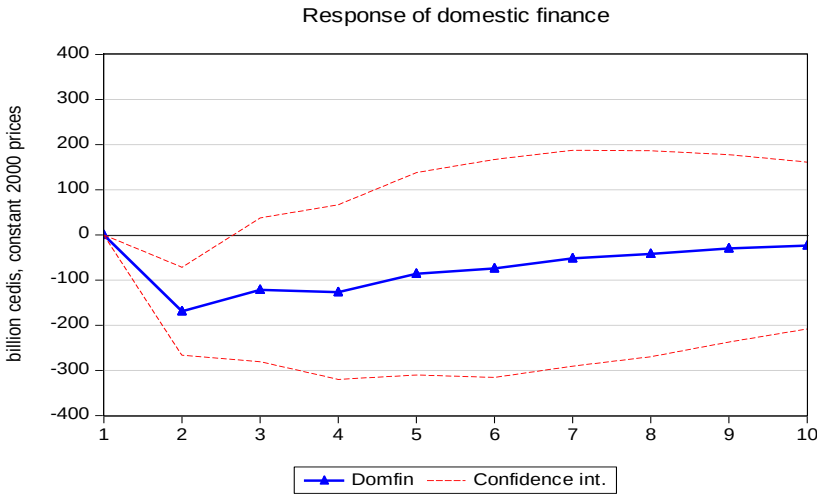
Impulse response analyses

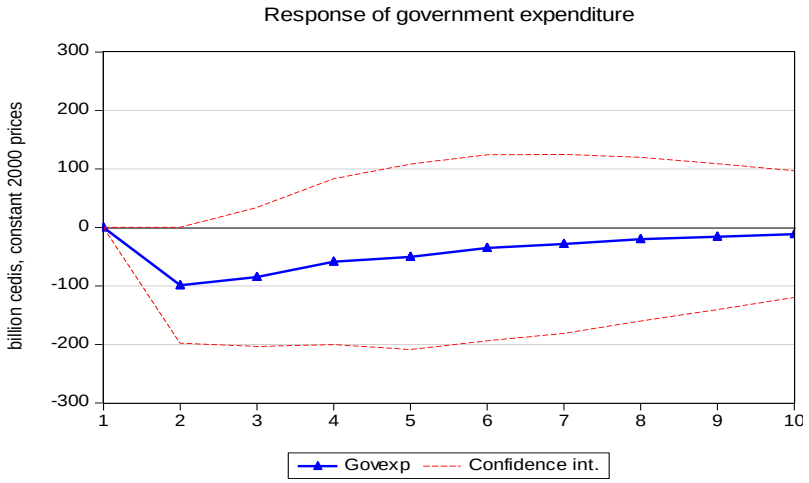
The full impacts of one standard deviation (positive) shock to aid on domestic finance, government expenditure, and government revenue over time, when all dynamic and simultaneous relationships between the variables are taken into consideration, are illustrated by the impulse response functions in figure 5.5. The shock occurs only in the first year and is of a magnitude of 210 billion cedis (in 2000 prices). As a guide to determine whether or not the impact of the aid shock is significant in a given period, a

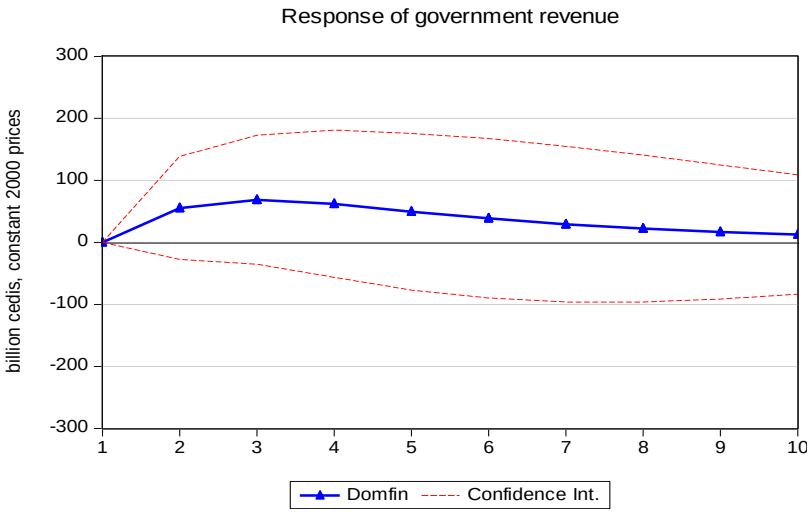
90% confidence interval is shown on each diagram; the impact of aid is significant when both margins of the confidence interval are positive or negative.

All the three fiscal variables of interest (domestic finance, government expenditure, and government revenue) respond to the aid shock with a lag as a result of their causal ordering. With regards to domestic finance, the impact of the aid shock is significant in the second year but not in the subsequent years. Specifically, domestic finance decreases by a significant amount of 169 billion cedis in the second year but the impact of the shock continually diminishes thereafter. Nonetheless, the cumulative decrease in domestic finance by the end of the fifth year is about 504 billion cedis, which is more than twice the magnitude of the shock to aid. Also, government expenditure responds significantly to the aid shock only in the second year with a decrease of 99 billion cedis. Cumulatively, however, the impact of the shock on government expenditure by the end of the fifth year is a decrease of about 292 billion cedis, which is more than the magnitude of the aid shock. On the other hand, the aid shock has no significant impact on government revenue in any year but the cumulative impact by the end of the fifth year is an increase of 235 billion cedis, which exceeds the magnitude of the aid shock. The largest effect of the shock to government revenue in a year is an increase of 55 billion cedis in the second year. All three fiscal variables of interest respond to the aid shock in a manner that is consistent, though not significantly so in the case of government revenue, with the objective of reducing domestic debt to sustainable levels.

Figure 5.5 Impulse responses to aid shock







In sum, our results show that, by conditioning disbursement on reduced domestic financing, aid has been used as an incentive for fiscal stability, particularly lower domestic finance, in Ghana. We also find that aid, so disbursed, has been relatively effective at promoting fiscal stability in Ghana, evidenced by the contractionary effect of aid on fiscal policy and the reduction in domestic financing. Our explanation is that the Ghanaian government makes the effort to reduce domestic financing in order to receive more aid. Given the limited access to foreign borrowing, lower domestic finance is associated with reduced budget deficit, which is in turn achieved through cuts in government expenditure and increase in revenue. Therefore aid has been relatively effective at promoting fiscal stability in Ghana.

5.5 Estimations for Zambia

5.5.1 Formulation of empirical model

In this section, we determine the empirical specification that is suitable for the estimation of our VAR model for Zambia. To be specific, we determine the appropriate transformation of the variables, guided by unit root tests, as well as the lag length. It is noteworthy that the VAR approaches used in the empirical estimations for Zambia and Ghana are fundamentally similar and have been discussed in considerable detail in the sections on methodology and estimation for Ghana. Therefore, we provide only a brief description and explanation of methodological issues in this section.

Unit root test and model types

As with most time series analyses, the empirical estimations for Zambia are preceded by unit root tests to determine the order of integration of the series and, for that matter, the suitable transformation of the data to use if there are unit roots. Results of the ADF and PP unit root tests are reported in table 5.14 below. Both unit root tests show that, with the exception of the government revenue series, all series are stationary around a trend and/ or drift at the 1% level of significance. In the ADF test, government revenue emerges non-stationary even around a deterministic trend, but shows some signs of stationarity around the drift, though at the 10% level of significance only; When structural breaks are controlled for, as with the PP test, the government revenue series becomes stationary around the deterministic trend as well, but still at the 10% level of significance only. The implication of these findings is that at the 10% level of significance, all the series are stationary (I(0)) around a trend (and/ or drift) and could be estimated in levels within a VAR model. However, the latter estimation approach

Table 5.14 Unit root test: ADF and Phillip Perron (Variables in constant 2000 LCU)

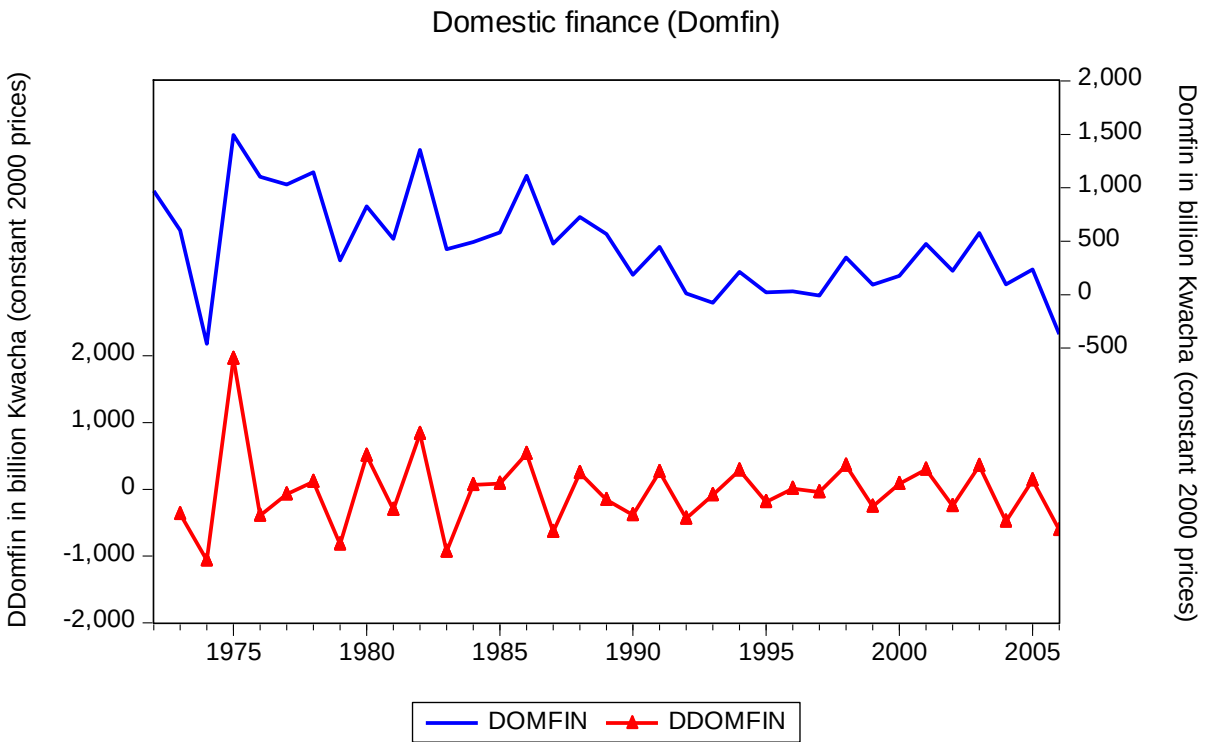
Maintained model: $\Delta x_t = \alpha_1 + \alpha_2 t + \rho x_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta x_{t-i} + \tau_t$

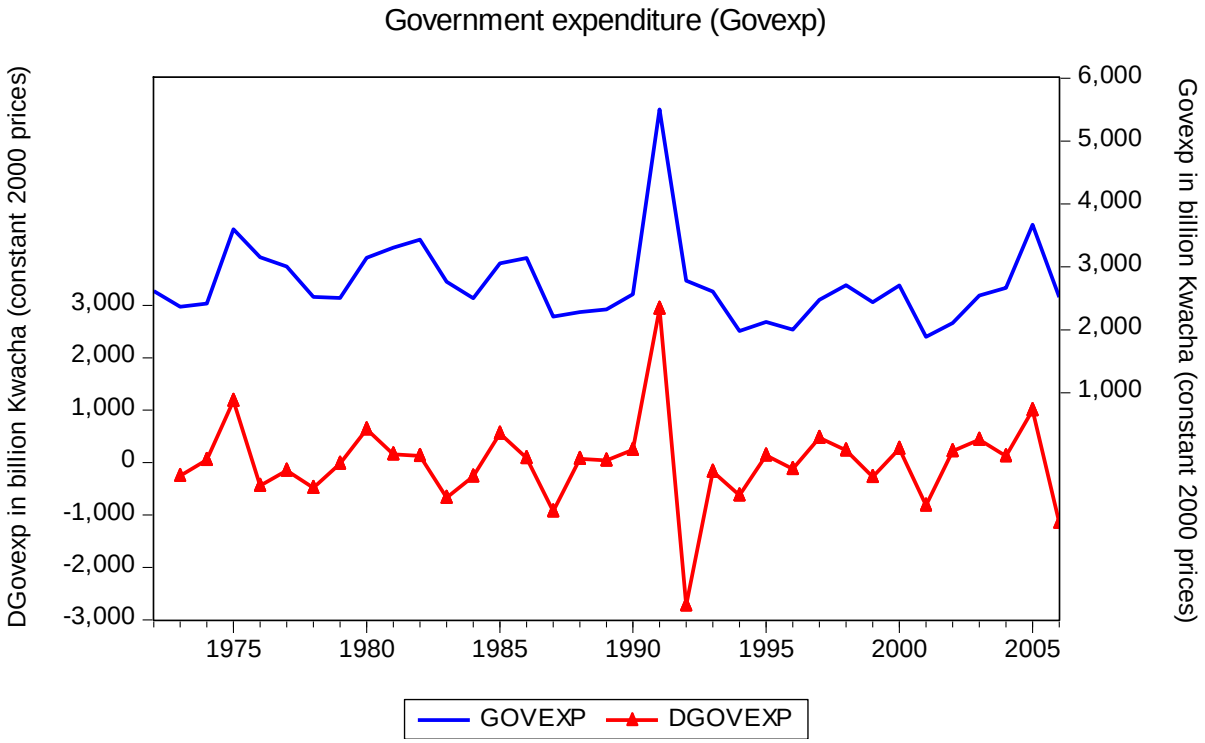
VARIABLES	LEVELS			1ST DIFF.	Inference
	H_0: $\rho=0$	H_0: $\rho= \alpha_2=0$	H_0: $\rho= \alpha_1= \alpha_2=0$	H_0: $\rho=0$	
ADF TEST					
Aid	-4.300***	-3.148**	-0.757	-8.965***	I(0)
Domfin	-5.824***	-2.287	-1.739*	-10.076***	I(0)
GovRev	-3.041	-2.819*	-0.056	-6.694***	I(1)
GovExp	-4.833***	-4.744***	-0.478	-7.829***	I(0)
P-P TEST					
Aid	-4.300***	-3.148**	-1.163	-23.705***	I(0)
Domfin	-5.825***	-4.389***	-2.839***	-32.756***	I(0)
GovRev	-3.226*	-2.910*	0.342	-19.199***	I(1)
GovExp	-5.656***	-4.636***	-0.610	-20.467***	I(0)
Crit. Val.	H_0: $\rho=0$	H_0: $\rho= \alpha_2=0$	H_0: $\rho= \alpha_1= \alpha_2=0$		
99%	-4.253	-3.639	-2.635		
95%	-3.549	-2.951	-1.951		
90%	-3.207	-2.614	-1.611		

*,**, and *** denote significant at the 10%, 5%, and 1% levels respectively.

has to be treated with caution because, statistically, there is only weak evidence that government revenue is I(0); estimating this variable in a VAR comprising I(0) variables in levels, when it is actually I(1), would result in inconsistent regression problem, in which case inferences would be invalid. On the other hand, treating government revenue as I(1) when it is actually I(0) is not a preferred option because that may result in loss of information, associated with the transformation of data into first differences (I(0)), and for that matter, weak estimates. Yet, we are unable to rule out any of the two possible estimation approaches because there is reasonable evidence in support of each. On one hand, the evidence from unit root tests point towards a VAR with transformed variables (by first differencing). On the other hand, evidence from the literature and the plot of the government revenue profile in figure 5.6. below suggests that government revenue is likely to be I(0) – once interventions are controlled for – and therefore a VAR in levels is preferred; Fagernas and Robert (2004) found the government revenue series for Zambia, between 1972 and 1998 (which excludes the latter end of our series), to be stationary around the trend, even at the 5% level of significance, using both the ADF and PP tests. Therefore, the apparent unit root in the longer series (1972 to 2006) may be merely due to interventions that are not well captured even in the PP test; Indeed, the government revenue profile (see figure 5.6) reveals that there are two unexplained outliers close to the two extreme ends of the series, specifically in 1974 and 2000, and these have the potential of confounding the unit root test. As a precaution, therefore, we estimate two VAR models, one in differences and the other in levels, and determine which one is adequate. The model in differences would be preferred if government revenue, unlike the rest of the variables, is confirmed to be I(1). On the other hand, the estimation in levels would be superior if all variables are indeed stationary. One advantage of

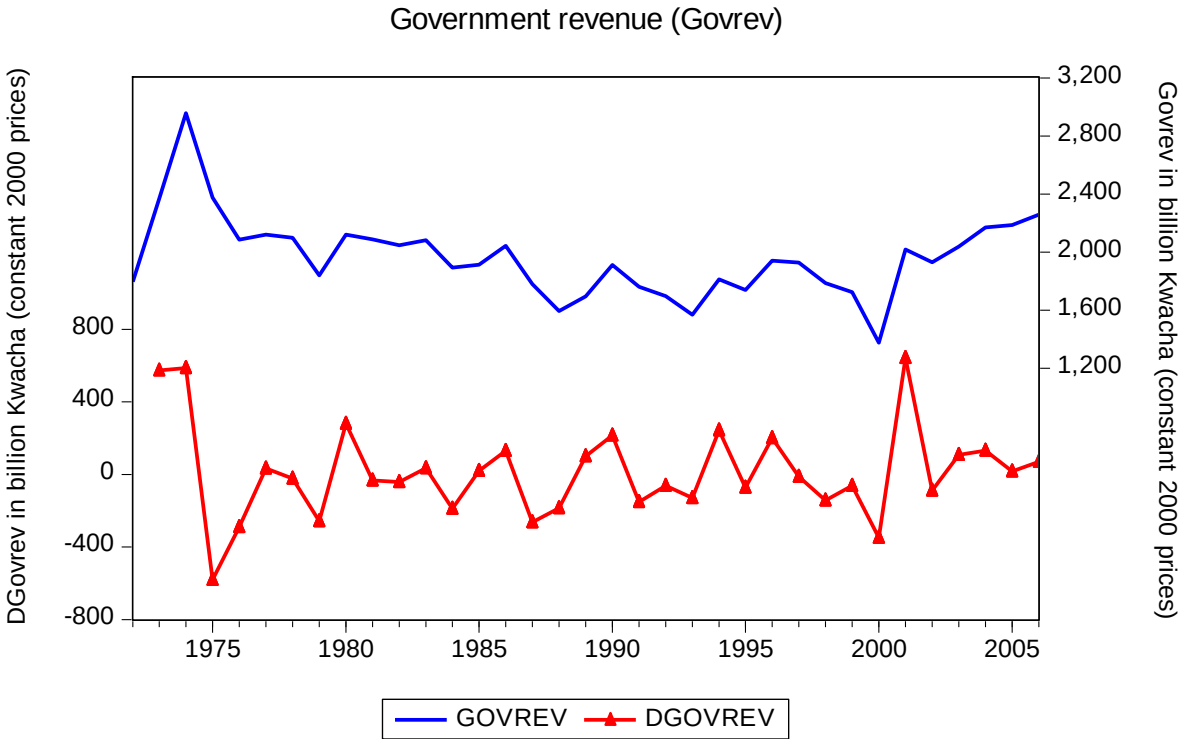
Figure 5.6 Time Profiles of the fiscal variables and aid[68]

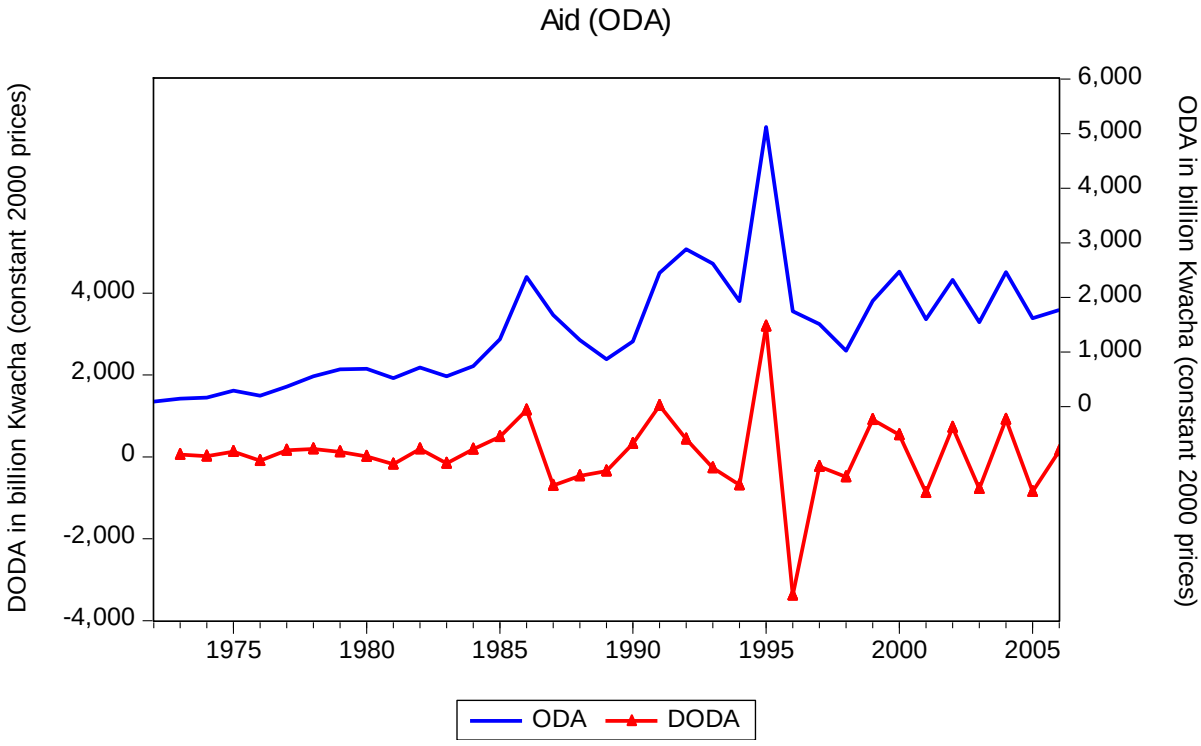




[68] Note: The prefix 'D' in the nomenclature within the legend denotes first difference.

Figure 5.6 continued





estimating both models is that we are able to determine which model is more suitable after controlling for outliers, given that outliers may confound the result of unit root tests, not only for government revenue, but also for all the other variables of the VAR, namely domestic finance, government expenditure, and foreign aid variables.

In addition to the aforementioned 1974 and 2000 outliers in the government revenue series, other outliers revealed from inspection of the time profile of the variables in figure 5.6 are the 1991 election outlier (evident in the government expenditure profile) and the 1995 outlier in the aid profile which may be associated with the restoration of donor confidence when the economic performance of Zambia begun to improve in the mid-1990s. There is also an unexplained 1974-outlier observed in the domestic borrowing profile. However, with the exception of the government revenue profile which exhibits a mild trough-shape defined by a combination of interventions, all other profiles seem to be consistent with results of the unit root tests irrespective of the observed outliers.

It is noteworthy that, unlike Ghana, the empirical model specification for Zambia is devoid of the challenge associated with the determination of the correct cointegration rank whether or not government revenue is I(0). This is because, when all the four variables are stationary on their own, they would not have a long-run relation with any other variable. Even when government revenue is I(1), three out of the four endogenous variables, namely domestic finance, government expenditure and foreign aid, are stationary on their own and would therefore not form equilibrium relation among themselves. The remaining I(1) variable, government revenue, would require at least one other I(1) variable to form a long-run equilibrium relation. We therefore

conclude from the unit root test that, given the variables of interest in the present study, the concept of cointegration is of no relevance in the Zambian context. On this basis, therefore, ***we reject the hypothesis that a fiscal equilibrium exists in Zambia***. This automatically leads to the following conclusions about the long-run: ***(i) aid has no significant effect on the fiscal variables in the long-run;*** **(ii)** ***the donor and recipient governments do not react to an existing fiscal equilibrium*****.** However, given the uncertainty about the unit root test results, particularly regarding the stationarity of the government revenue variable, the long run conclusions may be treated as tentative until they are confirmed by the cointegration rank test; Full rank of four implies that there are four stationary relations out of four variables, indicating that all four variables are stationary on their own and would not form long run equilibrium relations with each other. Zero rank also implies that there are no cointegrating relations but none of the variables is stationary. Cointegrating ranks between one and three (when there are four endogenous variables in total) are less indicative of the order of integration of the variables since they may be reflecting stationary variables, cointegrating relations (in which case variables are not stationary on their own) or a combination of the two. When the cointegrating rank is between one and three (given that there are four endogenous variables), confirmation of the order of integration of the variables can be achieved only after the cointegrating vectors and the equilibrium adjustment coefficient are estimated.

Determination of the lag length

As explained in section 5.4, the correct choice of lag length constitutes a fundamental objective of all VAR analyses. To reiterate, lag length criteria such as AIC, SC, and HQ are reliable only when the model is correctly specified. Therefore, we maintain the tentative method for determining the lag length in section 5.4.2. Nonetheless, we report the results of the AIC, SC, and HQ in table 5.15, to show the priors of the data with regards to the choice of lag length when outliers are not controlled for. The lag lengths suggested are zero by the SC and HQ, and 4 by the AIC. As would become clear, these two suggested lag lengths appear to be at the opposite extremes as lag exclusion test accepts the exclusion of the second lag but rejects the exclusion of the first lag.

In what follows, we estimate two VAR model types, namely the differences and levels. We begin with the VAR in differences, which is to safeguard against the possibility of an inconsistent-regression problem which occurs when an I(1) variable (government revenue in this case according to unit root test results, though evidence is weak) is estimated with I(0) variables in levels.[69] We then estimate the VAR in levels to ensure that useful information is not lost if government revenue is actually I(0).[70] In both estimations, we include dummy variables to control for the outliers in the data. As mentioned previously, the outliers identified upon inspection of the variable profiles are the unexplained 1974 outliers in the domestic finance and government revenue series, the 1991 outlier in the government expenditure series which is associated with the first election year, the 1995 outlier in the aid series, that is possibly associated with the re-gain of donor confidence as a result of improved macroeconomic performance,

[69] Note that the VAR in first differences is still valid if government revenue is I(0). Some information would however be lost as a result of the transformation of the data.

[70] Fagernas and Roberts (2004) estimated a VAR (2) in levels even though government current expenditure was an I(1) variable among four I(0) variables, namely capital expenditure, revenue, domestic borrowing and aid.

and the unexplained 2000 outlier in the government revenue series. Accordingly, the dummy variables specified are the 1974, 1991, 1995, and 2000 dummies. In the VAR-in-levels, the 1974 dummy variable takes on a value of '1' in 1974; in the VAR-in-differences, however, the 1974 dummy variable takes on a value of '1' in 1974 and '-1' in 1975. As summarised in table 5.16, these sequences of dummy variable specification, for the levels and first-difference VAR models, apply to all other dummy variables.

Table 5.15 Lag length criteria

Lag	LogL	AIC	SC	HQ
0	-3501.56	226.165	226.350*	226.225*
1	-3482.94	225.996	226.921	226.297
2	-3468.07	226.069	227.734	226.612
3	-3459.99	226.580	228.985	227.364
4	-3433.9	225.929*	229.075	226.954

*indicates lag order selected by the criterion at 5%

Table 5.16 Dummy Variables

SERIES	**SUGGESTED DUMMIES**
Domestic Finance	Outlier1974 dummy
Gov. Expenditure	Election1991 dummy
Gov. Revenue	Outlier1974 and outlier2000 dummies
Aid	Outlier1995 dummy

5.5.2 Model 1: Estimation of the VAR in differences

In this section, we summarise the main conclusions from the estimation of model 1 (VAR in differences). The estimation results for model 1 are relegated to the appendix (B5) because, as would become clear, cointegrating rank test result for model 2 (VAR in levels) suggests that the latter is superior to model 1. Specifically, the rank test

shows full rank (of four) for the four endogenous variables in the VAR, suggesting that all the variables are stationary and therefore model 1 (VAR in differences) would be less preferred due to possible loss of information associated with transformation of data from levels to first differences.

In summary, there is no significant lagged fiscal variable in the aid equation; neither is the lag of aid significant in any of the fiscal equations in the system. Therefore, we do not reject the following hypotheses based on model 1: (i) ***that aid inflows are not influenced by past fiscal conditions in Zambia***; (ii) ***that aid does not influence the fiscal conditions in Zambia***. Combining the latter conclusions with previous ones regarding the long run (equilibrium relationship between aid and the fiscal variables), the test results on our hypotheses when model 1 is used are as outlined in table 5.17. The conclusions apply to both the structural and reduced-form.

Table 5.17 Summary of test results on hypotheses

NULL HYPOTHESES	TEST RESULTS
I. The existence of fiscal equilibrium	Rejected
II. Aid does not form part of the fiscal equilibrium	Not rejected
III. Recipient governments do not react to fiscal disequilibrium	Not rejected
IV. Donors do not react to fiscal disequilibrium in recipient country	Not rejected
V. Donor's aid allocation is not influenced by past fiscal conditions in recipient	Not rejected
VI. Aid does not influence fiscal conditions in recipient	Not rejected

The empirical results for model 1 also show that an increase in domestic finance results in significant decreases in all three fiscal variables (domestic finance, government expenditure, and government revenue) in the following year. Two interpretations for the latter finding are that, firstly, by reducing domestic finance and government expenditure in response to a previous increase in domestic finance, the Zambian government makes the effort to stabilize domestic debt. Secondly, the fall in government revenue that follows a rise in domestic borrowing is an indication that the latter is associated with the crowding-out of private investment; That is to say, government revenue falls because the rise in domestic borrowing by the government limits private sector activities and the tax base for that matter.

5.5.3 Model 2: Estimation of the VAR in levels

Following the empirical rule of thumb in model 1, we begin the estimation of model 2 (VAR in levels) within a tentative VAR (2) framework. We however do not report the latter results because, as with model 1, lag exclusion test, reported in table 5.18, shows that the second lag is not jointly significant, even at the 10% level of significance; In fact, the second lag is neither significant in any of the individual equations of the VAR system. However, the first lag is jointly significant even at the 1% level. Model 2 therefore constitutes the estimation of VAR (1) in levels.

Table 5.18 Lag exclusion test for VAR (2) in levels

	SCDOMBOR_ZBIA	SCGOVEXP_ZBIA	SCGOVREV_ZBIA	SCODA_ZBIA	Joint
Lag 1	3.684	14.651	7.712	9.442	33.926
	[0.450]	[0.005]	[0.103]	[0.051]	[0.006]
Lag 2	4.054	1.440	3.464	8.595	14.862
	[0.399]	[0.837]	[0.483]	[0.072]	[0.535]
df	4	4	4	4	16

Numbers in [] are p-values

As have been our preferred order of presentation, we first address the adequacy of the specified model before discussing the estimation results since a mis-specified model invalidates the estimates. The distributions of residuals are shown in figure 5.7 and the results of standard model mis-specification tests, specifically for the detection of autocorrelation, non-normalities, and heteroscedasticity, are reported in table 5.19. There is no significant autocorrelation, non-normality or heteroscedasticity even at the 10% level of significance. An important remark however is that, in addition to the 1974, 1991, 1995 and 2000 dummy variables identified from inspection of the variable profiles, model 2 (both in the form of VAR(2) and VAR(1) in levels) requires additional dummy variables for 1986 and 2005 in order to induce Gaussian residuals. The two dummy variables are associated with outliers that are less pronounced in the estimation of model 1 (VAR in differences). The 1986 outlier, which is unexplained, is observed in the aid series. The 2005 outlier is observed in the government expenditure series and is associated with Zambia's first comprehensive debt relief under the HIPC initiative which requires beneficiaries to increase spending on specific poverty-reducing elements of the economy.

Figure 5.7 Distribution of residuals from VAR (1) in levels

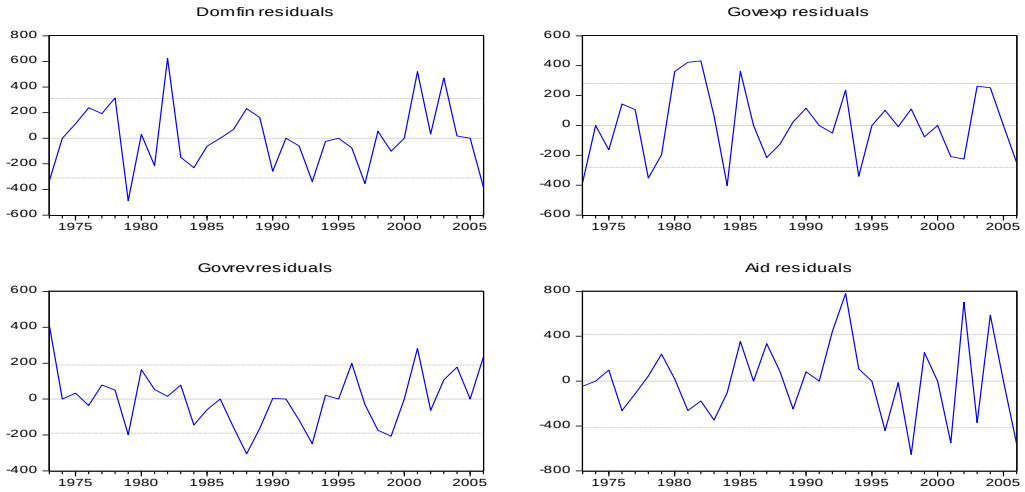


Table 5.19 Model mis-specification tests

(a) Autocorrelation

Lags	LM-Stat	Prob
1	7.538476	0.9614
2	10.39497	0.8452
3	12.27706	0.7247
4	17.94546	0.3271

(b) Normality

Component	Jarque-Bera	df	Prob.
1	1.053726	2	0.5905
2	0.639939	2	0.7262
3	1.216863	2	0.5442
4	1.107824	2	0.5747
Joint	4.018352	8	0.8555

(c) Heteroscedasticity

Joint test:		
Chi-sq	df	Prob.
120.3897	160	0.9916

Notwithstanding the positive evidence from the model specification tests, estimation results may still be plagued with the inconsistent regression problem if, as suggested by unit root test results at the 5% level of significance (but not at the 10% level),[71] the government revenue variable happens to be I(1) amidst three I(0) variables in a VAR(1) in levels. We therefore conduct a cointegration rank test to check the consistency of the result with the unit root test. As reported in table 5.20, the result shows a full rank of four which is only possible when all four variables are stationary. This finding suggests that an inconsistent regression problem is very unlikely in the levels estimation, rendering model 2 superior over model 1 since estimations based on the latter may be affected by the loss of information that is often associated with transformed data (from levels to differences in this case). The results also confirm previous conclusions about the long-run implied by unit root tests at the 10% level of significance; Specifically, ***we reject the hypothesis that a fiscal equilibrium exists in Zambia***. The corollaries of this are that ***(i) aid has no significant effect on the fiscal variables in the long-run, and*** **(ii)** ***the donor and recipient governments do not react to an existing fiscal equilibrium*****.** Thus, evidence based on the model mis-specification tests and the cointegration rank test shows that the model 2 (VAR(1) in levels) is suitable for addressing the hypotheses of interest in the present study.

[71] Note that the null hypothesis is that the variable is non-stationary and therefore larger (absolute) statistics imply stationarity. Therefore, it is possible for the test statistic to be large enough to reflect stationarity at the 10% level but not large enough for the 5% level.

Table 5.20 Rank test

Hypothesized No. of CE(s)	. Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.883	190.483	63.876	0.00
At most 1 *	0.806	117.519	42.915	0.00
At most 2 *	0.693	61.777	25.872	0.00
At most 3 *	0.471	21.618	12.518	0.0012

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Trace test indicates 4 cointegrating eqn(s) at the 0.05 level

Short-run estimates and hypotheses

The estimates from model 2 (reduced-form VAR (1) in levels) are reported in table 5.21 below. More coefficients become significant compared with the estimation of model 1 (VAR(1) in differences – table B5.3 of appendix B5) suggesting that there may have been some loss of information in the latter as a result of variable transformation from levels to differences; in the levels estimation (model 2), the lags of government expenditure, government revenue, and aid become significant in the government expenditure equation, the lags of government expenditure and aid in the aid equation, and the lag of government revenue in the government revenue equation. On the other hand, the lag of domestic finance (which is significant in the differences equations of domestic finance and government revenue at the 1% and 10% levels respectively) is not significant in the levels domestic finance and government revenue equations. However, the lag of domestic finance remains significant at the 5% level in the levels government expenditure equation as in the differences equation with coefficient estimates of -0.312 and -0.383 respectively.

Table 5.21 Short-run estimates of reduced-form VAR in levels

	Domfint	Govexpt	Govrevt	Aidt
Domfint-1	-0.113	-0.312**	-0.006	-0.141
	(0.161)	(0.145)	(0.098)	(0.215)
Govexpt-1	-0.079	0.178**	-0.014	0.296**
	(0.090)	(0.081)	(0.055)	(0.120)
Govrevt-1	0.286	0.550**	0.323**	-0.212
	(0.245)	(0.221)	(0.150)	(0.328)
Aidt-1	-0.059	-0.151**	-0.045	0.185*
	(0.077)	(0.070)	(0.047)	(0.103)
Const	0.802	1.632***	1.426***	-0.173
	(0.613)	(0.552)	(0.375)	(0.819)
Trend	-0.029***	-0.012	0.001	0.046***
	(0.008)	(0.008)	(0.005)	(0.011)
OUTL1974	-1.589***	-0.693**	0.808***	0.062
	(0.338)	(0.305)	(0.207)	(0.452)
OUTL1986	0.577*	0.452	0.094	1.213***
	(0.318)	(0.287)	(0.194)	(0.425)
ELEC1991	-0.032	2.830***	-0.202	1.150***
	(0.322)	(0.290)	(0.197)	(0.430)
AIDOUT1995	-0.314	-0.226	-0.168	3.660***
	(0.325)	(0.293)	(0.199)	(0.434)
OUTL2000	0.032	0.344	-0.500**	0.608
	(0.326)	(0.294)	(0.200)	(0.437)
OUTL2005	0.158	1.159***	0.191	-0.547
	(0.345)	(0.311)	(0.211)	(0.462)
R2	0.697	0.883	0.703	0.892

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively.

The estimates from model 2 (levels estimation) show that, at the 5% level, past government expenditure has a significant positive effect on aid receipts, ***leading to the rejection of the hypothesis that aid inflows are not influenced by past fiscal conditions in Zambia***. On the other hand, past aid receipt has a significant reducing effect on government expenditure at the 5% level, ***leading to the rejection of the hypothesis that aid does not influence the fiscal conditions in the recipient country***.

There is no significant relationship between aid and any other fiscal variable in the reduced-form estimation of model 2. We however find that, at the 5% level, an increase in the past government revenue causes a significant rise in government expenditure in the following year. The implication of these findings for our main objective, which is to determine the roles of aid donors and the recipient government that culminates in a positive correlation between aid and the budget deficit in Zambia, is as follows: The Zambian government reduces total expenditure after receiving foreign aid, suggesting some compliance (to an extent at least) with aid conditionality, which seeks to reduce the budget deficit through cuts in government expenditure. Even though the magnitude of the reduction in government expenditure might not meet agreed targets,[72] the evidence suggests that the positive correlation between aid and the budget deficit is not driven by the actions of the Zambian government in response to aid.

In addition to cuts in total expenditure, it can also be deduced from the documented dichotomy between financing of current and capital expenditures in Zambia, which are by domestic revenue (including domestic borrowing) and foreign aid respectively

[72] The Zambian government has repeatedly defaulted conditional aid agreements between the early 1970s and mid-2000 (CGD, 2007; Fagernas and Roberts, 2004).

(Fagernas and Roberts, 2004), that the incentive effect of aid extends to the composition of spending – non-development spending decreases and development spending increases. With the financing dichotomy, it is possible for aid to lower total government expenditure only when non-development expenditure falls, given that aid increases capital expenditure. Although, we do not disaggregate total expenditure into its current and capital components, we find evidence consistent with the existence of current and capital expenditure financing dichotomy. For instance, *ceteris paribus*, aid has no significant influence on domestic finance, implying that the two sources of finance are not substitutes. A weaker evidence, which nonetheless reflects the fact that domestic finance only pays for a component of total government expenditure is that an increase in total government expenditure (which may be driven by an increase in current spending at one point in time, capital spending at another point in time, and both in other times) has no significant effect on the domestic finance. We therefore conclude that the Zambian government complies with aid conditionality to some extent at the least. With regards to the actions of the aid donors, we find that an increase in government expenditure results in an increase in aid inflows (at the 5% level). This is possibly because donors are willing to prevent increases in the budget deficit and domestic financing for that matter. It follows then that the humanitarian actions of aid donors contribute to the positive correlation between aid and the budget deficit in Zambia though aid does not cause the budget deficit to widen.

Given that aid appears to be used effectively by the Zambian government and does not cause the budget deficit to widen, a question that clearly remains unanswered is why aid does not achieve its ultimate fiscal objective, which is to reduce domestic borrowing? This question may be addressed from a structural identification of model 2

by reason of giving additional information about the contemporaneous relationship between the variables. As explained in section 5.4.3, another importance of a structural identification is to facilitate the estimation of impulse response functions which, together with the *ceteris paribus* estimates of the reduced-form, is useful for policy purposes. In what follows, therefore, we identify the underlying structure of model 2.

Structural identification of Model 2 (VAR(1) in levels)

By inspecting the residual correlation of the reduced-form estimates of model 2 that is shown in table 5.22, we find, by standard measure,[73]

Table 5.22 Residual correlation matrix

	Domfint	Govexpt	Govrevt	Aidt
Domfint-1	1	0.197	0.089	-0.251
Govexpt	0.197	1	-0.010	-0.034
Govrevt	0.089	-0.010	1	-0.392
Aidt	-0.251	-0.034	-0.392	1

The critical value for the correlation coefficients is $c_{ij} = 2/\sqrt{T} = 0.34$, where T is the effective sample size (N-k).

that the only significant residual correlation exists between aid and government revenue (with a correlation coefficient of -0.392). This suggests that the two variables have a significant contemporaneous relationship. We therefore employ the empirical identification process (section 5.2.1) to determine the direction of causality. As explained in the econometric model section (5.2.1), where zero restrictions on insignificant reduced-form estimates are not enough to achieve identification, further zero restrictions on some variables that are significant in the reduced-form estimation (table 5.21) may be required. Given that the correlation between the residuals of the reduced-form aid and government revenue equations is negative, the significant

[73] Footnote 18 holds. The critical value for the correlation coefficient, $c_{ij} = 0.34$.

variables that qualify for zero restrictions are those that are significant in both the aid and government revenue equation but with the opposite signs.[74] Table 5.21, however, shows that there are no such variables in the present case and therefore empirical identification may be relatively weak. It is noteworthy, however, that the latter observation suggests that the omitted contemporaneous variable(s) is(are) not correlated with the regressors in the reduced-form aid and government revenue equations in model 2 and therefore the estimates in table 5.21 are likely to be close approximations of their structural counterparts; it also suggests that the contemporaneous relationship is between aspects of revenue and aid that are not predicted by past fiscal conditions and aid (e.g. contemporaneous shocks). Nonetheless, we proceed with the empirical identification process in order to identify unique shocks to aid. The results are as reported in table 5.23.

As expected, weak empirical identification of contemporaneous aid and government revenue variables leads to both variables becoming insignificant in the FIML estimations. However, controlling for contemporaneous government revenue in the aid equation purges the system of the residual correlation (reducing the correlation coefficient from -0.392 to -0.063). On the contrary, controlling for contemporaneous aid in the government revenue equation does not purge the residual correlation though it reduces marginally from -0.392 to -0.353. We therefore conclude that the direction of causality is from contemporaneous government revenue to aid and, as a result, we

[74] See the methodology section for intuition.

Table 5.23 FIML estimation of aid and government revenue: zero restriction on contemporaneous aid versus zero restriction on government revenue

	zero restriction on contemp. gov't rev.		zero restriction on contemp. aid	
	Govrevt	Aidt	Govrevt	Aidt
Domfint	-0.012	-0.289	0.081	-0.363
	(0.158)	(0.440)	(0.112)	(0.420)
Govexpt	-0.006	-0.011	-0.023	0.032
	(0.133)	(0.241)	(0.122)	(0.236)
Govrevt				-0.774
				(0.932)
Aidt	-0.060			
	(0.074)			
Domfint-1				
Govexpt-1		0.188*		0.211**
		(0.104)		(0.101)
Govrevt-1	0.319		0.386*	
	(0.198)		(0.212)	
Aidt-1		0.197**		0.137
		(0.085)		(0.095)
Const	1.445***	-0.098	1.238***	1.423
	(0.333)	(0.859)	(0.314)	(1.700)
Trend		0.040**		0.037***
		(0.016)		(0.013)
OUTL1974	0.007		0.009	
	(0.424)		(0.118)	
OUTL1986		0.168		0.147
		(0.168)		(1.418)
ELEC1991		0.073		0.094
		(0.074)		(1.437)
AIDOUT1995		0.366**		0.342
		(0.159)		(0.601)
OUTL2000	-0.033		-0.047	
	(0.090)		(0.534)	
OUTL2005				
Log. L'hood	-468.309		-465.181	
Res. Corr.	-0.353		-0.063	

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively.

maintain the same causal ordering of the four objective variables suggested by model 1, bearing in mind that it is only the positions of government revenue and aid relative to each other that are relevant.[75] The causal ordering adopted is as illustrated below.

Govrev → Govexp → Domfin → Aid

When the causal ordering above is imposed, we obtain the structural estimates of model 2 reported in table 5.24. With the exception of the lag of aid in the aid equation, the rest of the results remain similar to their reduced-form counterparts qualitatively.

The lag of aid, which was marginally significant (at the 10% level) in the aid equation of the reduced-form of model 2, becomes insignificant in the structural form. Since the lag of aid does not affect government revenue significantly, we ascribe the loss of significance to the loss of degrees of freedom since the sample size is relatively small. Otherwise, there is no qualitative difference between the reduced-form estimates and their structural counterparts and therefore we maintain our conclusions from the hypotheses tests, as summarised in table 5.25 (page 253).

Consistent with the residual correlation matrix of the reduced-form estimation, the only contemporaneous variable that becomes significant (with a negative sign and at the 10% level) is the government revenue variable in the aid equation. Thus, a fall (rise) in government revenue leads to increased (decreased) inflow of aid in the same year. Given that aid inflows have no significant effect on domestic borrowing, even

[75] We nonetheless control for all contemporaneous variables because excluding 'unimportant' contemporaneous variables relaxes the number of zero restrictions on the residual covariance matrix that are required for OLS estimates to be equivalent to FIML estimates (see Juselius, 2009: 241).

Table 5.24 Short-run estimates of structural VECM

	Govrevt	Govexpt	Domfint	Aidt
Domfint				-0.293
				(0.281)
Govexpt			0.220	0.009
			(0.242)	(0.310)
Govrevt		-0.015	0.148	-0.814*
		(0.322)	(0.357)	(0.450)
Domfint-1	-0.006	-0.312**	-0.044	-0.176
	(0.098)	(0.148)	(0.181)	(0.228)
Govexpt-1	-0.014	0.178**	-0.116	0.259*
	(0.055)	(0.083)	(0.102)	(0.132)
Govrevt-1	0.323**	0.555**	0.117	0.130
	(0.150)	(0.249)	(0.307)	(0.387)
Aidt-1	-0.045	-0.151**	-0.020	0.133
	(0.047)	(0.073)	(0.089)	(0.112)
Const	1.426***	1.653**	0.232	1.209
	(0.375)	(0.728)	(0.902)	(1.135)
Trend	0.0005	-0.012	-0.026***	0.038***
	(0.0052)	(0.008)	(0.009)	(0.014)
OUTL1974	0.808***	-0.681*	-1.557***	0.261
	(0.207)	(0.406)	(0.480)	(0.745)
OUTL1986	0.094	0.453	0.464	1.455***
	(0.194)	(0.295)	(0.345)	(0.453)
ELEC1991	-0.202	2.826***	-0.623	0.950
	(0.197)	(0.304)	(0.763)	(0.974)
AIDOUT1995	-0.168	-0.229	-0.240	3.433***
	(0.199)	(0.304)	(0.342)	(0.435)
OUTL2000	-0.500**	0.337	0.031	0.207
	(0.200)	(0.342)	(0.388)	(0.487)
OUTL2005	0.191	1.162***	-0.125	-0.356
	(0.211)	(0.324)	(0.457)	(0.575)
R2	0.703	0.883	0.712	0.914

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively.

though aid has a reducing effect on total government expenditure, it could be deduced that the fall in total expenditure associated with aid inflows is only enough to cancel out the additional demands that a decrease in total government revenue would pose on domestic borrowing. Also, given the expenditure dichotomy in Zambia (whereby capital and current spending are uniquely funded by aid and domestic borrowing respectively),[76]it may further be deduced from the results that aid-induced cuts in total expenditure occur through reduction of capital expenditure. The latter is not in conformity with the fundamental objective for giving development aid, which is to reduce poverty through sustained growth. It may therefore be useful to condition aid on the budget deficit or domestic borrowing directly if the ultimate fiscal objective for aid conditionality is to discourage domestic borrowing. The structural estimates of model 2 underlie the impulse response functions estimated in the next section to show the resultant effect of an aid shock on the fiscal variables when the *ceteris paribus* assumption is relaxed.

Table 5.25 Summary of test results on hypotheses

NULL HYPOTHESES	TEST RESULTS
I. The existence of fiscal equilibrium	Rejected
II. Aid does not form part of the fiscal equilibrium	Not rejected
III. Recipient governments do not react to fiscal disequilibrium	Not rejected
IV. Donors do not react to fiscal disequilibrium in recipient country	Not rejected
V. Donor's aid allocation is not influenced by past fiscal conditions in recipient	Rejected
VI. Aid does not influence fiscal conditions in recipient	Rejected

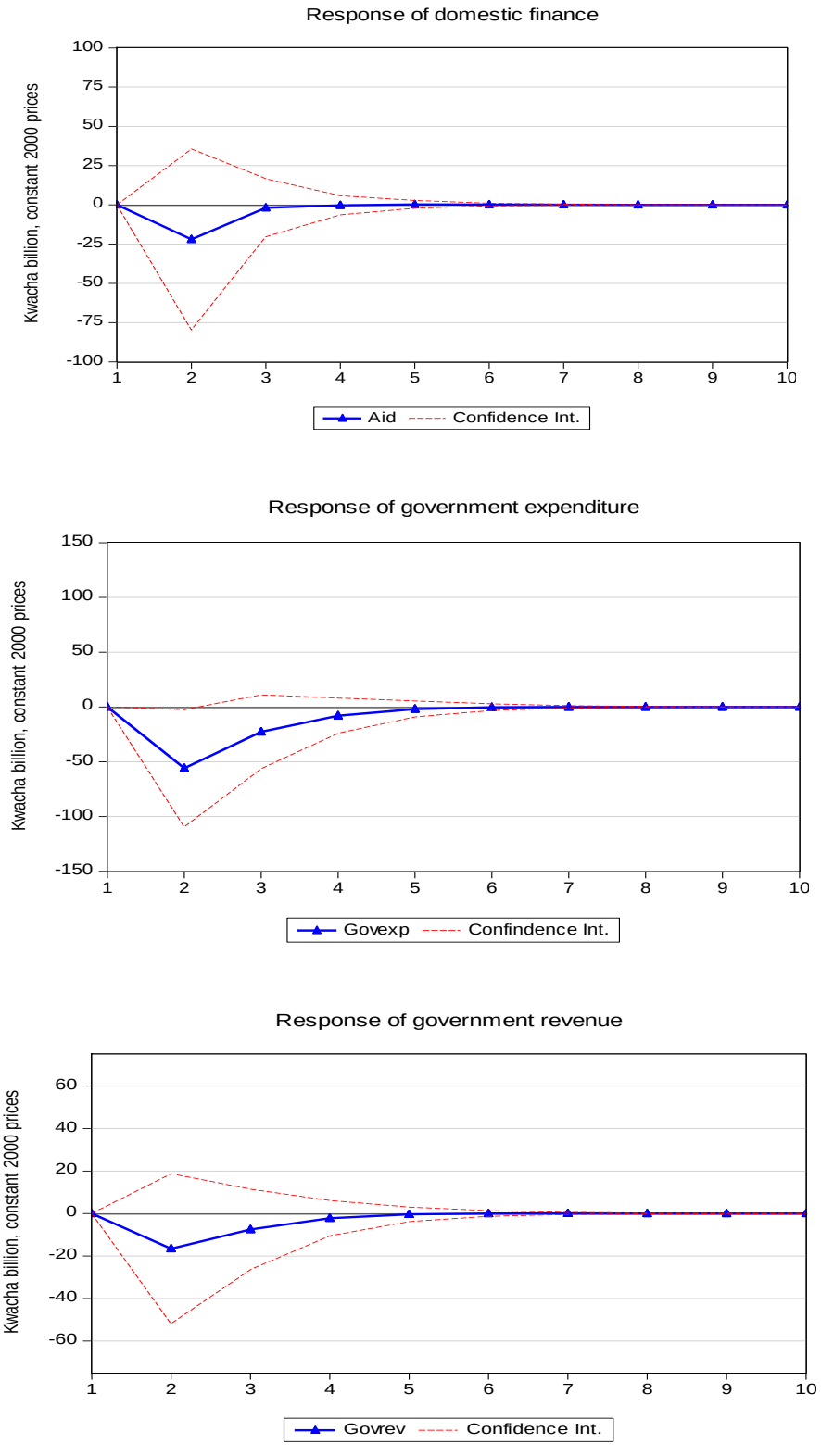
[76] Cordella and Dell'Ariccia (2007).

Impulse response analyses

The effect of one standard deviation (positive) shock to aid on the fiscal variables after all simultaneous and lagged effects have gone through is illustrated by the impulse response functions in figure 5.8. The shock, which occurs only in the first year, is of magnitude K339 billion (in 2000 prices). As explained previously, the aid shock has a significant effect only when both margins of the 90% confidence interval are positive or negative.

With the exception of government expenditure, the aid shock has no significant effect on the fiscal variables. For instance, domestic finance falls by approximately K22 billion in the second year and K1.9 billion in the third year, with the cumulative decrease being approximately K24 by the fourth year. Similarly, the effect of the shock on government revenue diminishes over time, starting with an initial fall of approximately K17 billion in the second year and K7 billion in the second year, with a cumulative decrease of about K26 billion by the fourth year. With regards to government expenditure, however, a significant reduction of K56 billion occurs in the second year, but the impact of the shock diminishes to insignificant levels in the subsequent years, falling by approximately K23 billion in the third year and K87 billion cumulatively by the fourth year. The significant fall in government expenditure is consistent with the objective of donors to help stabilize Zambia's debt problem through reduction of the fiscal deficit.

Figure 5.8 Impulse responses to an aid shock of one standard deviation



In summary, the results show that aid disbursement to Zambia is not conditioned on improved fiscal performance. Rather, more aid is received when total expenditure rises as well as when revenue falls, explaining the positive correlation between aid and the budget deficit. Even though aid has been successful at inducing cuts in total government expenditure, the magnitude of the cuts is just enough to offset the extra demands of falling revenue on domestic borrowing. Therefore, aid does not affect domestic borrowing significantly. In accordance with the aid incentive theory, therefore, aid might be more effective at reducing domestic borrowing if it is condition on the latter or the budget deficit directly.[77]

5.6 Summary of results and conclusion[78]

High domestic borrowing by the government is a common feature of low income countries, and has consequences such as unsustainable debt levels, high unproductive spending on debt servicing, loss of credibility of the government, crowding out of private investment, and fiscal dominance, all of which are detrimental to economic growth. Given the relatively high dependency of such countries on foreign aid, the incentive-aid literature suggests that conditioning aid disbursement on contractionary fiscal policy would induce government actions that lead to reduced deficit and, for that matter, reduced domestic borrowing. Yet, the fiscal determinants of aid disbursement and the fiscal effect of aid vary across countries, resulting in different aid-budget deficit relationship across countries. Therefore, the main objective of the present study is to determine which actions of aid donors and recipient governments are responsible for the contrasting aid-budget deficit relationship across low income countries. We use

[77] The budget deficit is mainly financed by domestic borrowing (Cordella and Dell'Ariccia, 2007).
[78] Inferences on the tested hypotheses are in italics.

Ghana and Zambia as case studies. The main reason is that the two countries are known to have contrasting aid-budget deficit relationship – The relationship is positive in Zambia where aid conditionality has been defaulted repeatedly over the study period and negative in Ghana where the implementation of aid conditionality has been relatively successful. Another reason is that, as low income sub-Saharan countries, Ghana and Zambia have relatively high aid dependency, implying that the effect of aid is not negligible.

We proceed by addressing a number of hypotheses about the relationship between the components of the fiscal budget and the inflow of foreign aid. Our hypotheses allow us to draw inferences about the fiscal determinants of aid disbursement and the consequences for fiscal policy in the two countries. The component of the fiscal budget considered are government revenue, government expenditure, and domestic financing. Our results show that in Ghana, the negative correlation between aid and the budget deficit is the result of both donors' and recipient government's actions. Donors condition aid disbursement on expenditure cuts (in the previous year) and decreased domestic borrowing, both of which are associated with reduced budget deficit. In order to maintain inflows of aid, therefore, the recipient government uses aid in a fashion that is consistent with conditional aid programs that target deficit reduction. Particularly, aid has a decreasing effect on domestic financing and total government expenditure in Ghana.

On the other hand, aid disbursement to Zambia increases with total government expenditure (in the previous year) but decreases with revenue. It follows then that, all things being equal, more aid is received when the budget deficit increases. This is

possibly because donors are willing to prevent the worsening of the already high budget deficits and domestic financing. We therefore conclude that donor actions, in terms of disbursement pattern, are responsible for the positive correlation between aid and the budget deficit in Zambia, but aid does not necessarily cause the widening of the deficit. In fact, aid has a decreasing effect on total government expenditure, implying that the Zambian government complies with conditional aid programs to a certain extent at the least. However, since aid does not affect domestic finance significantly, we deduce that the cut in total expenditure, induced by aid receipt, is only enough to offset the initial rise in expenditure and fall in revenue that attracted aid in the first place. Therefore, aid neither worsens nor improves the budget deficit, implying that the actions of the Zambian government, with regards to the use of aid, are not responsible for the positive correlation between aid and the budget deficit. The results suggest that, for aid to be more effective at inducing lower budget deficits and domestic finance, donors must take a more proactive stance by conditioning aid disbursement on decreased deficits and/or domestic finance.

The relationship between aid and the components of the fiscal budget in Ghana and Zambia leads to the rejection, in both countries, of the hypotheses that *donors' aid allocation is not influenced by the recipient's past fiscal conditions*, and that *aid does not influence the fiscal conditions in the recipient country*. To address the main objectives of the present study, which is a short-term phenomenon, it is necessary to use an approach that separates the short- and long-term relationship between aid and the components of the fiscal budget. Although not part of our main objectives, the approach permits us to compare and draw inferences about the long-run focus of aid donors and recipient governments, as well as the composition of aid spending, in

Ghana and Zambia. We find contrasting results on the existence of fiscal equilibrium in the two countries; *we reject the hypothesis that fiscal equilibrium exists in Zambia*. Consequently, we reject all hypothesis related to fiscal equilibrium in Zambia. This limits our analysis on Zambia to the short-run and further limits any inferences about the likely composition of aid spending, given that the only way to determine the latter when total government expenditure is not disaggregated is by its long-term implications. Nonetheless, our results are consistent with evidence in the literature about the financing dichotomy of current and capital expenditure in Zambia, whereby aid is used to finance capital expenditure and current expenditure is financed from domestic sources. To be specific, we find that aid has no significant influence on domestic finance, suggesting that the two sources of finance are not substitutes. Moreover, increase in total government expenditure has no significant effect on domestic finance, indicating that the latter only pays for a component of total government expenditure.

In Ghana, on the other hand, *we do not reject the existence of fiscal equilibrium*. However, *aid does not form part of the fiscal equilibrium*. The latter suggests that aid has been used predominantly for short-term objectives, such as relaxing Ghana's budget constraint, rather than long-term investments or possibly that aid is too small to affect the equilibrium. Nonetheless, *aid donors react to fiscal disequilibrium in Ghana*.

We also find that, without the influence of aid, *the Ghanaian government reacts to fiscal disequilibrium* (caused by expansionary measures) by decreasing total expenditure and domestic borrowing for that matter. Thus, results related to the long-run suggest that aid donors and fiscal authorities in Ghana and Zambia have differed in

their focus on the long-run. Whereas achieving long-run fiscal equilibrium has been at the centre of donor and recipient government actions in Ghana, this does not appear to be the case in Zambia. On the other hand, it appears that aid is used for long-term purposes such as financing capital spending in Zambia, but is used for short-term purposes, including relaxing the budget constraint and financing consumption expenditure, in Ghana. The conclusions on the composition of aid spending are only implied and would require further research involving more disaggregate components of government expenditure.

Finally, we use impulse response functions to determine the resultant effect of an increase in aid on the fiscal variables after all simultaneous interactions have gone through. We find that, in Ghana, both government expenditure and domestic finance decrease significantly in the year following the upsurge in aid, but the impact fades to insignificant levels in the subsequent years. The decrease in domestic finance is indicative of a reduction in the budget deficit since the two are closely associated. The resultant effect of an aid increase on government revenue is however insignificant in Ghana. With regards to Zambia, both domestic finance and government revenue do not respond significantly to an increase in aid when all simultaneous interactions between variables have taken place. In contrast, total government expenditure decreases significantly in the following year in response to the increase in aid; Given the close association between the budget deficit and domestic finance in developing countries, the irresponsiveness of the latter to an increase in aid suggests that the fall in total government expenditure is not enough to induce a significant decrease in the budget deficit.

APPENDIX A5

Table A5.1 Dummies from reduced-form VECM estimation for Ghana

	Domfin	Govexp	Govrev	Aid
ELEC1992	2.130***	0.336	-1.200***	-0.818***
	(0.380)	(0.420)	(0.360)	(0.260)
ELEC1996	0.453	0.210	-0.464*	0.152
	(0.290)	(0.320)	(0.280)	(0.200)
ELEC2000	0.0665	-0.863**	0.316	0.739***
	(0.310)	(0.340)	(0.290)	(0.210)
ELEC2004	0.416	1.250***	0.751***	1.430***
	(0.300)	(0.330)	(0.280)	(0.210)
HIPC2002	-0.084	-0.770	0.163	0.388
	(0.460)	(0.500)	(0.430)	(0.310)
AIDOUT1990	0.363	0.112	-0.618**	-0.883***
	(0.280)	(0.310)	(0.260)	(0.190)
MEAN-SHIFT	0.249	0.634***	0.404***	0.291***
	(0.150)	(0.170)	(0.140)	(0.100)

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively. The dummy for the 2002 HIPC debt cancellation year is insignificant at the 10% level but is nonetheless maintained because its exclusion results in heteroscedasticity.

Table A5.2 Dummies from structural VECM estimation for Ghana

	ΔGovrevt	ΔGovexpt	ΔDomfint	ΔAidt
Elect1992	-1.200***	0.345	1.100***	-0.065
	(0.356)	(0.536)	(0.318)	(0.395)
Elect1996	-0.464*	0.213	0.046	0.239
	(0.275)	(0.354)	(0.209)	(0.202)
Elect2000	0.316	-0.865**	0.425*	0.933***
	(0.286)	(0.354)	(0.238)	(0.249)
Elect2004	0.751***	1.250***	0.897***	1.790***
	(0.282)	(0.394)	(0.286)	(0.342)
HIPC2002	0.163	-0.772	0.137	0.447
	(0.425)	(0.513)	(0.318)	(0.308)
AIDOUT1990	-0.618**	0.116	-0.160	-0.885***
	(0.263)	(0.357)	(0.210)	(0.206)
MEAN-SHIFT	0.404***	0.631***	0.512***	0.504***
	(0.143)	(0.203)	(0.146)	(0.183)

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively.

Table A5.3 Unit root test for three-year averaged domestic finance series for Ghana

(Maintained model: $\Delta x_t = \alpha_1 + \alpha_2 t + \rho x_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta x_{t-i} + \tau_t$)

		LEVELS		1ST DIFF.	
Test	H_0: $\rho=0$	$\rho= \alpha_2=0$	$\rho= \alpha_1= \alpha_2=0$	H_0: $\rho=0$	Inference
ADF	-1.695	-1.425	-0.943	-4.356	I(1)
PP	-1.840	-1.879	-1.207	-3.465	I(1)

Crit. Val.	ADF		
	H_0: $\rho=0$	$\rho= \alpha_2=0$	H_0: $\rho= \alpha_1= \alpha_2=0$
99%	-4.310	-3.679	-2.647
95%	-3.574	-2.968	-1.953
90%	-3.222	-2.623	-1.610

*,**, and *** denote significant at the 10%, 5%, and 1% levels respectively.

APPENDIX B5

Model 1: Estimation results for the VAR in differences (Zambia)

Model mis-specification tests

Table B5.1 Lag exclusion tests

(a) VAR (2)

	ΔDOMFIN	ΔGOVEXP	ΔGOVREV	ΔAID	Joint
Lag 1	8.247 [0.083]	5.924 [0.205]	2.337 [0.674]	5.799 [0.215]	19.967 [0.222]
Lag 2	2.041 [0.728]	2.475 [0.649]	8.356 [0.079]	5.284 [0.259]	19.836 [0.228]
df	4	4	4	4	16

Numbers in [] are p-values

(b) VAR (1)

	ΔDOMFIN	ΔGOVEXP	ΔGOVREV	ΔAID	Joint
Lag 1	16.756 [0.002]	8.520 [0.074]	3.044 [0.551]	3.324 [0.505]	26.053 [0.053]
df	4	4	4	4	16

Numbers in [] are p-values

Figure B5.1 Distributions of the residuals

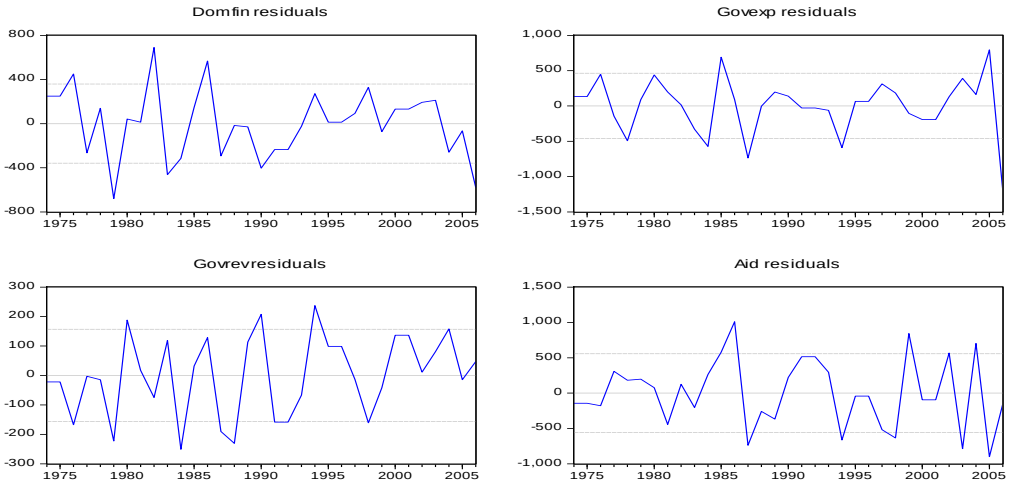


Table B5.2 Test for model mis-specification

(a) Test for autocorrelation

Lags	LM-Stat	Prob
1	7.187	0.970
2	17.511	0.353
3	18.047	0.321
4	23.334	0.105

(b) Test for normality

Component	Jarque-Bera	df	Prob.
1	0.058	2	0.971
2	1.021	2	0.600
3	1.539	2	0.463
4	0.373	2	0.830
Joint	2.991	8	0.935

(c) Test for heteroscedasticity

Joint test:		
Chi-sq	df	Prob.
102.454	160	0.999

Short-run estimates and hypotheses

Table B5.3 Short-run estimates of reduced-form VAR

	Δ**Domfin$_t$**	Δ**Govexp$_t$**	Δ**Govrev$_t$**	Δ**Aid$_t$**
Δ**Domfin$_{t-1}$**	-0.539***	-0.383**	-0.100*	0.005
	(0.134)	(0.172)	(0.058)	(0.208)
Δ**Govexp$_{t-1}$**	0.100	0.008	0.037	0.203
	(0.091)	(0.117)	(0.040)	(0.141)
Δ**Govrev$_{t-1}$**	-0.236	0.394	-0.064	0.346
	(0.264)	(0.340)	(0.115)	(0.410)
Δ**Aid$_{t-1}$**	0.008	-0.032	-0.008	-0.058
	(0.076)	(0.097)	(0.033)	(0.117)
Const	-0.042	-0.010	-0.006	0.041
	(0.063)	(0.081)	(0.027)	(0.098)
OUTL1974	-1.309***	-0.414	0.624***	-0.021
	(0.259)	(0.334)	(0.113)	(0.403)
ELEC1991	0.357	2.733***	-0.018	0.593
	(0.281)	(0.361)	(0.123)	(0.436)
AIDOUT1995	0.120	0.130	-0.103	3.195***
	(0.297)	(0.381)	(0.129)	(0.460)
OUTL2000	-0.139	0.449	-0.492***	0.721*
	(0.258)	(0.332)	(0.113)	(0.400)
R2	0.694	0.789	0.686	0.763

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively.

Structural identification of model 1 (VAR(1) in differences)

Table B5.4 Residual correlation matrix

.	ΔDomfint	ΔGovexpt	ΔGovrevt	ΔAidt
ΔDomfint	1	0.367	0.129	-0.066
ΔGovexpt	0.367	1	0.067	-0.003
ΔGovrevt	0.129	0.067	1	0.004
ΔAidt	-0.066	-0.003	0.004	1

The critical value for the correlation coefficients is $c_{ij} = 2/\sqrt{T} = 0.34$, where T is the effective sample size (N-k).

As long as identification is concerned, table B5.4 suggests that locating the positions of government expenditure and domestic finance relative to each other in the causal chain is what matters. This task is lessened in the present instance since a causal direction from domestic finance to government expenditure appears to be unreasonable. Rather, the government falls on domestic borrowing to pay for planned expenditure after all other sources of finance (such as aid and government revenue) have been exhausted. We therefore maintain the same causal chain derived for Ghana. Thus, the causal chain imposed is given as follows:

$\Delta Govrev \rightarrow \Delta Govexp \rightarrow \Delta Domfin \rightarrow \Delta Aid$

Imposing this causal structure on the VAR estimation yields the results in table B5.5.

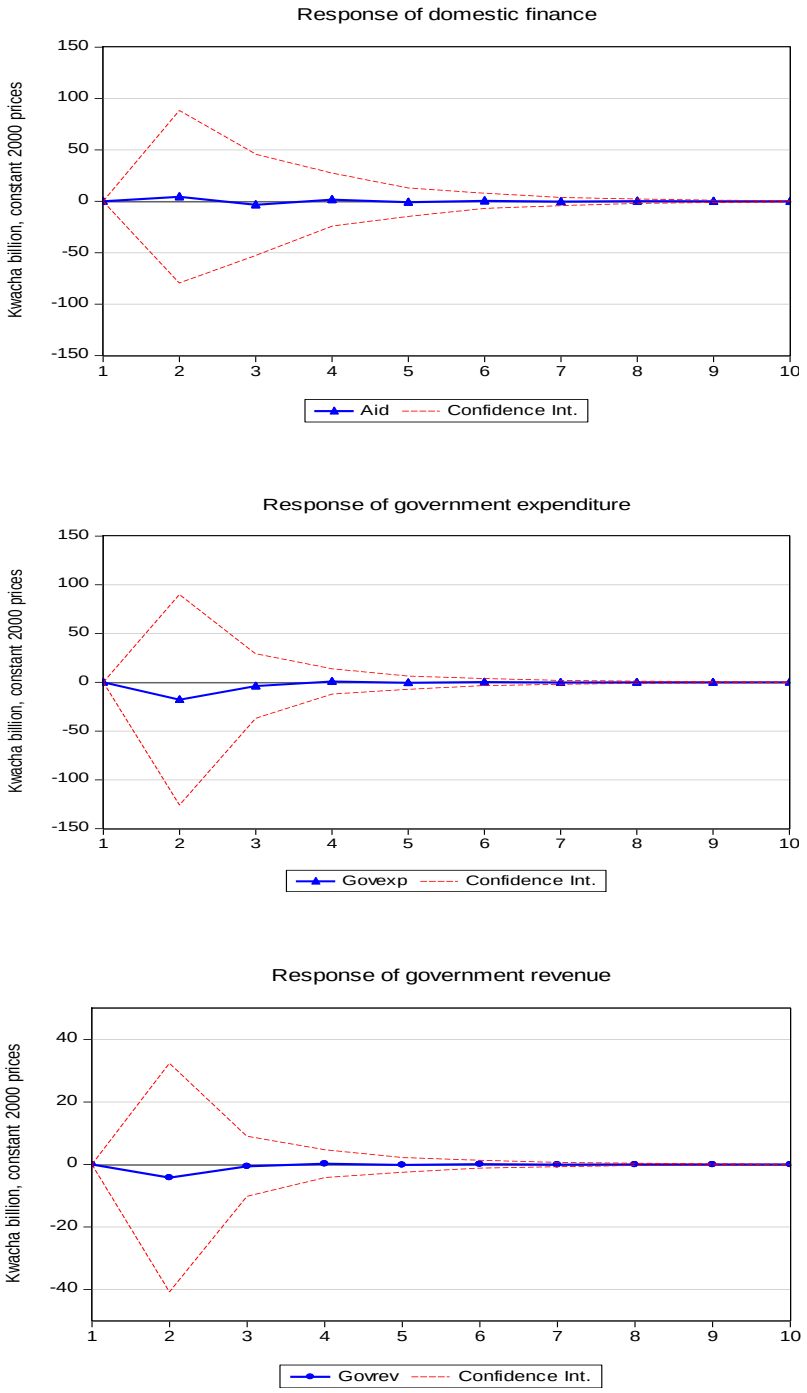
Table B5.5 Short-run estimate of structural VAR

	ΔGovrevt	ΔGovexpt	ΔDomfint	ΔAidt
ΔDomfint				-0.118
				(0.365)
ΔGovexpt			0.280*	0.029
			(0.154)	(0.282)
ΔGovrevt		0.197	0.241	0.043
		(0.613)	(0.453)	(0.781)
ΔDomfint-1	-0.100*	-0.363*	-0.408***	-0.043
	(0.058)	(0.186)	(0.148)	(0.294)
ΔGovexpt-1	0.037	0.077	0.068	0.211
	(0.040)	(0.121)	(0.090)	(0.157)
ΔGovrevt-1	-0.064	0.406	-0.331	0.309
	(0.115)	(0.348)	(0.264)	(0.468)
ΔAidt-1	-0.006	-0.031	0.019	-0.056
	(0.033)	(0.099)	(0.073)	(0.125)
Const	-0.006	-0.009	-0.038	0.037
	(0.027)	(0.082)	(0.061)	(0.105)
OUTL1974	0.624***	-0.537	-1.343***	-0.190
	(0.113)	(0.512)	(0.386)	(0.824)
ELEC1991	-0.018	2.736***	-0.403	0.557
	(0.123)	(0.369)	(0.500)	(0.870)
AIDOUT1995	-0.103	0.151	0.108	3.209***
	(0.129)	(0.394)	(0.291)	(0.500)
OUTL2000	-0.492	0.546	-0.146	0.713
	(0.113)	(0.453)	(0.344)	(0.592)
R2	0.686	0.789	0.738	0.764
Normality				

Standard errors are reported in parenthesis. Significance at 1%, 5%, and 10% levels are indicated by ***, **, and * respectively.

Impulse responses

Figure B5.2 Impulse responses to an aid shock of one standard deviation



CHAPTER 6

CONCLUSION

6.1 Summary of main findings

Government actions that exacerbate economic volatility, create disincentive for increasing development effort, and contribute to high debt levels may complicate macroeconomic management and slow down economic growth, and are therefore considered to be sub-optimal. The thesis addresses two of such actions.

The first is that, even though theory suggests the contrary, government consumption (which is our fiscal policy variable) is pro-cyclical in developing countries. That is, government consumption increases when income is high and decreases when income is low. This practice clearly worsens economic volatility and growth for that matter. Even more, it is suggested theoretically (and indirectly supported by some empirical results) that income volatility may also cause fiscal policy to be pro-cyclical, creating a vicious cycle. Understanding the relationship between pro-cyclical government consumption and economic volatility is therefore an important first step towards breaking this cycle, especially when the focus is on rapid and sustainable growth. We address this issue for sub-Saharan African (SSA) countries where fiscal policy is most pro-cyclical and income is very volatile.

Unlike existing studies, we overcome problems associated with model misspecification and spurious results by estimating the coefficients of fiscal policy cyclicality within a stationary specification. Consistent with existing evidence, we find that government consumption is predominantly pro-cyclical in SSA. Our estimates however suggest

that existing studies may have under-estimated the absolute magnitude of the coefficients of fiscal policy cyclicality. We also find that pro-cyclicality of fiscal policy increases with income volatility in SSA. Unlike existing explanations that ascribe the latter to credit constraint in bad times and political pressure to spend in good times, our results suggest that it is the result of optimal solvency behaviour of governments facing imperfect risk sharing (associated with non-state contingent bonds) and uncertainty (associated with income volatility).

The second sub-optimal fiscal policy addressed is that giving more aid to countries with larger budget deficits further induces larger deficits. This may worsen the already high debt levels and slow down economic growth even further. The explanation given in the incentive aid literature is that since aid disbursement is motivated by the recipient's need, there is no incentive for the recipient government to avoid deficits, especially when the actions of the government cannot be easily monitored. The suggestion therefore is to condition aid disbursement on improved performance in order to create an incentive for exerting higher development effort. This however means that those who actually need more aid would receive less of it and economic fluctuations may be worsened. Therefore, further research to determine what constitutes an effective aid disbursement policy, in terms of ensuring that more aid is given to those who need it most while creating the incentive to avoid unnecessary deficits, is essential. This requires an in-depth knowledge of the relationship between aid and the recipient government's behaviour. We address this for SSA by answering three secondary objectives. Given that the present study focuses mainly on the recipients' budget performance, aid conditionality refers mainly to budget conditions.

In the first of the secondary objectives, we re-examine the existing evidence on the relationship between aid and the budget balance using more recent data. Our results show that, in line with past evidence, more aid is given to SSA recipients with larger budget deficits and aid induces larger budget deficits. However, an interesting finding is that whereas the response of aid inflows to the size of the budget deficit is comparable existing evidence suggests, the rate at which the budget deficit increases with aid inflows is less than half of what was observed in the past. This suggests that it may be possible to give more aid to countries with larger budget deficits without inducing larger deficits; investigating this constitutes the next secondary objective.

By suggesting that aid conditionality – or budget conditions in the present context – should be implemented across countries, the Svensson aid incentive model assumes that differences in budget deficit across countries are entirely ascribable to differences in fiscal discipline. An implicit assumption then is that recipient countries have similar characteristics. This is a strong assumption because different countries have different tax capacities and ability to access credit from international financial markets, which is the main reason for aid donation. We therefore relax the assumption and show that there is a divergence between the determination of aid allocation across countries and the year-to-year disbursement of aid to a given country (labelled 'between-country' and 'within-country' dimensions of aid disbursement respectively). We also show that aid conditionality is a 'within-country' phenomenon; aid induces lower (higher) budget deficits (budget balances) when 'within-country' aid conditionality is implemented. To arrive at this conclusion, we obtain coefficients of aid conditionality (which measure the extent of implementation) and find that aid induces smaller deficits as the

coefficient of conditionality increases. This suggests that giving more aid to countries with larger budget deficits is not the reason why aid induces larger budget deficits.

Finally, we investigate the actions of aid donors and recipients that are responsible for the different aid-budget balance relationships across countries. To do so, we use an improved approach to estimating vector error correction model (VECM) that is new to this area of research. This aspect of the study uses Ghana and Zambia as case studies. Both countries were involved in some form of aid agreements over the study period. However, Zambia is known to have defaulted on agreements repeatedly whereas Ghana is known to be more successful in complying with conditional aid agreements. In effect, there is a positive (negative) correlation between aid inflows to Ghana and the budget balance (budget deficit) while the opposite is true for Zambia. We find that aid conditionality, with respect to reduced budget deficit, is more effective (in terms of inducing larger budget balances) when disbursements are conditioned directly on reduced budget deficit (and/or domestic borrowing) rather than its components.

6.2 Policy implications of the findings

Based on the existing credit constraint explanation, it is believed that fiscal policy in developing countries would be less pro-cyclical in volatile economies if international financial institutions facilitate the accessibility of such countries to credit in bad times. On the other hand, the political distortion argument suggests that the solution lies in improving fiscal institutions to prevent increased spending (associated with political pressures) in good times in order to save enough for bad times. Contrary to both suggestions, the policy implication of our main finding is that government consumption would be less pro-cyclical in volatile economies if governments have

access to state-contingent bonds. We do identify the need for improved economic stabilization policies in the first place, but given that efforts in that direction have either stalled or been inconsistent, alternative arrangements to curb the pro-cyclicality of fiscal policy are useful.

Note that, by contrasting the credit constraint explanation for the effect of income volatility on the pro-cyclicality of government spending, we do not suggest that not being able to access credit in bad times is not an underlying reason why fiscal policy is pro-cyclicality. We only suggest that it does not explain the effect of income volatility on pro-cyclicality of fiscal policy in SSA. In fact, we find that fiscal policy is more pro-cyclical in countries facing higher credit constraints. Also, by contrasting the political distortion explanation, we do not suggest that saving enough in good times to subsidize spending in bad times would not result in counter-cyclical pattern of fiscal spending. We only argue that the relationship between income volatility and the cyclicality of fiscal policy is not because of not saving enough in good times. In practice, due to pressing expenditure requirements combined with relatively limited resources, saving in good times in SSA is more about running lower deficits (rather than surpluses) in which case the precautionary role of savings implied by the political distortion argument is hardly realistic.

Our findings also suggest that giving more aid to countries with larger budget deficits is not the reason why aid induces larger budget deficits; the major culprit is not implementing the year-to-year aid conditionality within a given recipient country. It is encouraging to know that, unlike what existing knowledge implied, it is possible to maintain the deficit-induced aid disbursement across countries and yet implement aid conditionality within a given recipient country by way of conditioning year-to-year

disbursements on reduced deficits. It is therefore not imperative for performance-motivated disbursement to deprive recipients with the most need of aid. As a matter of fact, the effectiveness of aid conditionality, when enforced, increases with the amount of aid. Therefore, as with the implementation of conditions, giving more aid to recipients who need it most is useful.

Finally, the degree of enforcement of aid conditionality within a recipient country explains a large part of the variation in aid-fiscal behaviour across countries. When the focus is to reduce domestic borrowing and maintain sustainable debt levels, a more direct approach that conditions aid disbursement on domestic borrowing or the budget deficit is more effective than an indirect approach that conditions aid disbursement on other fiscal aggregates. As a concluding note, while we imply that aid conditionality works, we do not suggest that donors should be responsible for setting conditions as is often the case in practice. Action Aid International (UK), in their 2005 report (labelled 'An Agenda for Making Aid Work'), suggested the need for conditions to be set by recipient governments; this is however beyond the present study.

6.3 Limitations of study and suggestions for future research

Given that the present study uses large sample estimators, including VECM and IV (systems) estimators, one limitation derives from the use of relatively small sample sizes. For instance, the longest sample sizes are 44 and 37 in the time series and cross-section estimations respectively. Though these are not smaller than the usual sample sizes in studies on SSA countries, results are more reliable when large samples are used. Also because of limited data availability, the sample periods varied across countries in several instances; this may reduce the reliability of the cross-country and

panel results. It is therefore useful to re-evaluate the essays as more data becomes available.

Another limitation, which relates to small sample size, is to do with uncontrolled regressors. In the VECM, for instance, only a limited number of endogenous variables are included in order not to deplete useful degrees of freedom. For instance, we do not decompose total government expenditure to its capital and current components because doing so would decrease the degrees of freedom significantly, considering the number of dummy variables included to induce Gaussian residuals and the relatively short time series for Ghana and Zambia. Similarly, as a result of small sample size, we do not specify instruments for GDP growth in the aid and budget balance equations. To minimise the effect of potential endogeneity bias, we use initial GDP instead. This may result in loss of useful information and could therefore be addressed in future studies.

Some regressors were omitted because there was not enough data on them. For instance, the evidence given for the optimal solvency rationale – that underlies the positive effect of income volatility on the pro-cyclicality of fiscal policy – would be more complete if it is shown that the effect of income volatility increases with the dependability on non-state-contingent bonds. However, there is lack of comprehensive data on non-state-contingent bonds. Also, future studies on the aid-budget balance relationship can include debt to GDP ratio in the budget balance equation to account for the effect of credit constraint on the budget deficit. Otherwise, part of this effect may be captured by foreign aid, resulting in an underestimation of the extent to which aid induces budget deficits. We omit the debt to GDP variable for two reasons: firstly,

the series was too short for several countries in our sample and, secondly, to maintain comparability of our results with existing studies.

The DAC measure of aid that we use overstates the actual amount in government expenditure. This is because much of the aid to the government is through projects that may not be included in government expenditure; for instance, if the government increases expenditure from its own resources by less as a result of aid projects. Moreover, a large proportion of the aid gets spent in the donor country on technical aspects. Future studies may use the measure of aid actually received by the government when more data becomes available.

Finally, we make two suggestions for future research that are beyond the scope of the present thesis: the first is to address the incentive effect of aid on a composite measure of policy (comprising different types of policy indicators such as openness, inflation and the budget balance in Burnside and Dollar, 1997 and 2004). This is because, though suitable for our purpose, the budget balance as a measure of policy is too narrow to be generalized as the relationship between aid and policy as a whole. Secondly, to determine whether pro-cyclicality of fiscal policy is sub-optimal, as theory has it, future research should investigate the cost of debt default compared to the cost of income volatility in developing countries.

In spite of the aforementioned limitations, this thesis provides a useful guide for policy makers who seek to address issues relating to pro-cyclical government consumption and the increases in the budget deficit associated with aid inflows. It also serves as a guide for future research in this area of study.

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