The Short-Run Macroeconomic Impact of Foreign Aid to Small States: An Agnostic Time Series Analysis

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ABSTRACT

We investigate the short run macroeconomic impact of aid in small developing countries (SDCs) by applying a VAR model to study aid's impact on net-imports (absorption) and domestic demand (spending). We focus on average country effects within two sub-groups of countries and we find substantial differences between 'aid-dependent' SDCs and other SDCs that are more dependent on natural resources, tourism or financial services. In aid-dependent SDCs absorption of aid receipts more or less equals spending, although only half of the aid flow is absorbed and spent. In the non-aid dependent group, aid seems to be neither absorbed nor spent in any systematic fashion.

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1. Introduction

Although many aspects of small developing countries (SDCs) have been widely researched in the development literature, especially their structural differences to larger developing countries,[1] relatively little is known about aid effectiveness in SDCs.[2] This is surprising given that one of the most distinctive features of SDCs is their high degree of dependence upon foreign aid flows. On average, small states tend to receive two to three times as much aid (relative to GDP) as large states, and there are real concerns about the implications for both long run institutional development and short run macroeconomic management. A key objective of the present study is to expand our knowledge of this second area of concern, macroeconomic management.

Since aid can be highly fungible, donors wish to know whether their money is really being spent. But donors and recipients alike also wish to be sure that large aid inflows are not indirectly inducing macroeconomic problems that could limit the overall impact of foreign aid on growth and development. Of special concern in small open economies - i.e. economies that are heavily dependent upon strong export sectors generating enough exchange to satisfy demand for imports - is the possibility that aid flows denominated in foreign currencies either raise nominal exchange rates or push up the price of other critical resources that are in limited supply domestically, such as skilled workers or coastal land. These effects, known as Dutch Disease, are often believed to be one of the main reasons for the apparent ineffectiveness of aid.[3] The textbook solution to avoiding Dutch Disease is to 'absorb' aid inflows through increased imports. An alternative, but perhaps one less attractive to donors, is for aid recipients to simply put off absorption and spending the aid by bolstering their foreign exchange reserves.

With this focus on the short run macroeconomic impacts of aid, the present study is related to several strands of the recent literature evaluating foreign aid that use a variety of empirical approaches and techniques. For example, the fiscal response literature uses theoretically motivated models to simulate the effect of aid on government expenditure, tax revenue and other policies, given the utility preferences of policymakers (see, for example, McGillivray and Morrissey, 2004). Another literature looks at the volatility of aid flows, and considers what this might imply for appropriate utilization of this aid by recipients (Pallage and Robe, 2001; Bulíř and Hamann, 2003, 2008). A more recent literature uses an overtly historical analysis – combining narrative and empirical elements - of small sets of countries to better understand the absorption and spending decisions of aid recipients, where absorption is defined as increases in the current account deficit (net of aid), and spending as increases in the government fiscal deficit net of aid (IMF 2005; Aiyar et al. 2006; Berg et al. 2007; Foster and Killick 2006; Killick and Foster 2007).[4] Whilst still in its nascency, this research has offered some interesting insights into how recipients might respond to a significant scaling up of aid, as mandated by the Gleneagles summit in 2004. At the time of writing there is only one study, Aiyar and Ruthbah (2008), which econometrically analyses absorption and spending in a cross-section of countries. The study by Aiyar and Ruthbah generally supports the case studies in Berg et al. (2007) and Foster and Killick (2006) in finding quite low spending ratios and even smaller absorption ratios.

Our approach is methodologically similar to recent studies which adopt a more atheoretical or agnostic approach to gauging the effects of aid on the macroeconomy. These studies use vector autoregressive (VAR) models to estimate the impact of aid receipts on fiscal policy in individual countries, such as the study of Ghana by Osei, et al. (2005).

Though related to all these branches of the macroeconomic literature, our study is methodologically distinctive in that although we also use the agnostic VAR approach, we focus our attention on a range of countries rather than a single country. Whilst we look at the macroeconomic utilization of aid in the short run - like the more narrative Berg et al. (2007) and Foster and Killick (2006) studies – we examine both spending and absorption responses with more systematic econometric techniques.

Generally speaking, adopting a VAR approach to gauging short run aid impacts in a wide range of countries could be problematic given the arguably legitimate heterogeneity of aid's short term usage, a fact amply revealed even in the small numbers of countries analyzed in the Berg et al. (2007) and Foster and Killick (2006) studies. Moreover, heterogeneity in the quality of domestic policy could also confound the analysis, given that poor policy environments add an additional spanner into the workings of aid in the macroeconomy. Our focus on 20 small developing countries has two advantages in this regard. First, we are effectively studying the short run effects of aid in economies which are, in many cases, 'supra-open'. Second, small economies – especially small island economies – are typically thought to have somewhat better policies and institutions than other developing countries.[5] So in some sense our focus on SDCs allows us to investigate to what extent aid is absorbed and spent in a group of highly aid-dependent economies that satisfy the implicit assumptions of a textbook prescription: relatively good policies and institutions, including very high degrees of openness. So whilst we do not wish to over-emphasize the relevance of our results to issues such as the impacts of doubling aid to African countries, our results are indirectly relevant in that if aid-dependent SDCs do not absorb and spend aid in a textbook fashion, we would be sceptical that larger and less open economies would do so.

In summary, this study has three major objectives. The first objective is to improve our knowledge of aid usage in a group of countries that are highly aid-dependent and where there are strong concerns about the indirect impacts of aid on the macroeconomy. A second objective is to develop and test a new econometric tool for informing macroeconomic questions that have previously, mainly, relied on case study analysis, often of a narrative fashion. The third and final objective is to see whether countries which are broadly possessive of textbook characteristics do indeed absorb and spend aid inflows in a manner that do not disturb the short run macroeconomic balances.

Accordingly, the paper is organized as follows. Section 2 outlines the theoretical underpinnings of aid's short run effects on the macroeconomy in terms of absorption and spending, and discusses the diverse responses observed in the Berg et al. and Foster and Killick studies. Section 3 describes our econometric modelling techniques in detail while Section 4 presents our data set. In Section 5 we discuss our empirical results and Section 6 provides some brief concluding remarks and directions for future research.

2. A simple accounting framework for aid flows

In this section we discuss possible scenarios of the macroeconomic use of aid flows. In line with Berg et al. (2007), we do not formulate a fully fledged theoretical model but, instead, we adopt an accounting approach by using the balance-of-payments and the national accounts system as an organizing framework. The main purpose of the discussion is to identify channels by which an increase in aid inflows affects the macroeconomic aggregates. In contrast to the analyses in Berg et al. (2007) our focus is on economy-wide aggregates rather than on government decisions and the interaction between monetary and fiscal policy.

Aid flows in the balance-of-payments accounts

Most foreign aid is transferred to an economy either in the form of a grant or a loan to the recipient country government.[6] In the balance-of-payments system aid grants are recorded as current transfers on the current account while loans are recorded as changes in the net financial position vis-à-vis the rest of the world on the capital account. Hence, we can specify the following balance-of-payments identities

$$CA_t = (X_t - M_t) + W_t - (i_t L_{t-1} + r_t D_{t-1}) + A_t^g \quad (1)$$

$$KA_t = \Delta L_t^o + (A_t^l - A_t^r) \quad (2)$$

In equation (1) the current account (*CA*) is defined as the net export of goods and services (export, *X*, less import, *M*) plus net private transfers (*W*, mainly remittances and worker compensation) less net interest payments to foreigners (*iL* + *rD*), in which we separate interest payments on market loans (*iL*) from interest payments on the concessional aid loans (*rD*). The final term in the capital accounts definition (1) is the aid grants (A^g). The capital account (*KA*) is specified in equation (2), simply as the net change in non-aid foreign debt (DL^o), which has both private and public elements, plus the foreign aid loan given within the year (A^l) less repayments of principal on the aid loans (amortizations).[7]

Using the fact that the difference between the current account and the capital account equals the change in foreign reserves (ΔR), we have the following decomposition of the overall balance-of-payments

$$A_t^g + A_t^l - A_t^r = \Delta R_t + (M_t - X_t) + (i_t L_{t-1} + r_t D_{t-1}) - W_t - \Delta L_t^o \quad (3)$$

From this identity it is clear that, from a pure accounting perspective, an increase in the net aid inflow, be it a grant or a loan, can 'enter the economy' in five ways. The inflow may

(i) Increase foreign reserves

(ii) Increase net imports of goods and services

(iii) Finance interest payments on foreign debt (both aid and non-aid debt)

(iv) Finance a decrease in private transfers

(v) Decrease net external debt (or increase capital flight)

In some sense it is simplest to think of aid inflows as, initially, increasing foreign reserves because many large donations are transferred to dollar accounts in the recipient countries' central banks. From this point onward, it is up to the recipient country government and central bank to channel the aid resource into the economy.

As we will discuss below, it is not likely that there is any optimal way of 'distributing' the aid inflow across the BoP components, as aid increases are often granted and disbursed in a variety of different circumstances (e.g. macroeconomic crises). For the moment, we wish to analyze the impact of aid inflows 'under normal circumstances', so we focus on the most common intended use of aid inflows, an increase in net imports. Therefore, we define the rate of absorption of an increase in aid as the increase in net imports relative to the increase in aid. Letting Δ denote change over time, absorption of aid in a given period can be specified as

$$Absorption = \frac{\Delta(M_t - X_t)}{\Delta(A_t^g + A_t^l - A_t^r)} \tag{4}$$

Absorption can be seen as a measure of the direct, real resource transfer associated with an increase in the aid inflow.[8] As discussed in Berg et al. (2007), absorption is largely controlled by the central bank through its decisions on reserve accumulation and through its interest rate policy, to the extent that interest rates influences demand for private sector imports via aggregate demand. Some important exceptions to the central bank control of aid flows are aid-in-kind, aid given directly to the government for purchase of imported goods and services, aid given directly to NGOs and, of course, grants for debt forgiveness. In the first three cases aid is fully absorbed, while there is no absorption in the case of debt forgiveness. In most countries these exceptions are quite small in magnitude, leaving most of the decision to absorb the increase in the aid flow to the central bank.

Aid flows in the national accounts system

Moving from the balance-of-payment to the national account identities, aid loans do not appear directly while aid grants are part of disposable gross national income (*disp. GNI*):

$$\begin{aligned} disp.GNI_t &= Y_t + W_t - (i_t L_{t-1} + r_t D_{t-1}) + A_t^g \\ &= (C_t + I_t + G_t) - (M_t - X_t) + W_t - (i_t L_{t-1} + r_t D_{t-1}) + A_t^g \end{aligned} \tag{5}$$

The notation in equation (5) follows standard nomenclature: *Y* is GDP; *C* is household consumption expenditure; *I* is investment while *G* is government consumption. In the second line of equation (5) GDP is specified as domestic demand (*C* + *I* + *G*) less net imports (*M* - *X*).

It can be discerned from the above equations that GDP less net interest payments on foreign debt plus workers' compensation from abroad defines GNI, while adding remittances and aid grants yields disposable GNI. Hence, foreign aid as such has no direct impact on the main macroeconomic aggregates constituting GDP and GNI. An aid grant which is not financing net imports increases national financial saving but may leave both GDP and GNI completely unaltered (in the short run)

if the grant is used to either increase reserves or to decrease foreign debt.[9] Aid only affects the components of GDP when the recipient government spends the inflow.[10] Berg et al. (2007) look at the change in the government fiscal deficit (net of aid) relative to the change in the aid inflow in their definition of aid spending. While this definition clearly relates the spending decision to government policies, we wish to have a closer relation to the macro-economy. Therefore, we use a broader definition of spending, by looking at the change in total domestic demand relative to the change in aid

$$Spending = \frac{\Delta(C_t + I_t + G_t)}{\Delta(A_t^g + A_t^l - A_t^r)} \tag{6}$$

Using this definition, a government decision not to widen the fiscal deficit may still result in increased spending if the private sector increases consumption or investment.

Absorption, spending and production

The main reason for defining absorption and spending as above is that these definitions work directly on the national accounts identity by linking spending and absorption decisions to changes in GDP relative to the increase in aid inflows:

$$\begin{aligned} Production &= \frac{\Delta Y_t}{\Delta(A_t^g + A_t^l - A_t^r)} \\ &= Spending - Absorption \end{aligned} \tag{7}$$

Based on this identity we can discuss different short-run responses as combinations of spending and absorption of increased aid inflows.

With regard to spending, an increased aid transfer to the government can be utilised in four ways. The response generally preferred by bilateral donors is what Berg et al. (2007) term the textbook case: full absorption and spending, which leaves GDP unaffected (in the short run) because the increased domestic demand is exactly offset by increased net imports. In the long run it is hoped that the inflow results in increased productive capacity via investments in physical and human capital, and possibly even in improved institutions (financed by government consumption/-investment in the short run). But although this is the textbook response to an aid inflow, there are a variety of circumstances that could warrant a very different utilisation of aid inflows, as we aim to highlight below.

A second response would be to let the inflow be absorbed but not spent. This may result when the foreign exchange generated by the aid flow is used to sterilize the monetary impact of a fiscal deficit, which leads to an appreciated exchange rate and an increase in net imports (absorption). If government consumption and investment is decreased then spending will be less than absorption, such that there is a visible real resource transfer that has a negative short run impact on growth. This decision not to spend the inflow may be reasonable in times of fiscal stress, but it is clearly not a sustainable development strategy.

A third response would be if the inflow is spent but not absorbed. Such an expansion would be similar to an increase in domestic demand without any increase in the aid inflow and it results in a considerable short-run pressure on GDP, which also may not be sustainable. Both Berg et al. (2007) and Foster and Killick (2006) discuss the spending/no-absorption combination in detail, generally noting that this is a highly unattractive policy option because it is analogous to deficit financing of public expenditure.

Finally, a fourth option is to neither absorb nor spend. One way this could be done is via principal payment on external debt. In some situations aid has been disbursed to avoid arrears (so-called defensive lending), so in these situations the increased inflow is obviously meant to finance interest payments (and possibly principal repayment) on external debt.[11] In recent years grants for debt forgiveness have been very popular amongst several bilateral donors and it has been an integral part of the Heavily Indebted Poor Countries (HIPC) initiative. Grants for debt forgiveness are therefore clearly intended to decrease the net external debt.

A second and very important rationale for neither absorbing nor spending aid is to bolster foreign exchange reserves, as often advocated by the IMF in times of balance-of-payment crises (see IMF 2004). In small countries that are highly dependent on volatile and unpredictable export revenues and aid flows, smoothing out the inflow of foreign reserves and ensuring a relatively large stock of reserves may be a sound practice at any time (indeed, a common measure of reserve status is months of imports, implying that highly import-dependent SDCs ought to maintain larger-than-normal reserves). Conversely, this means that full absorption and spending of aid within any given year may be a bad choice when fiscal and macroeconomic stability is an issue. Hence, when aid flows are volatile, with unpredictable elements, full absorption and spending should only be achieved over time - not within a single year.

This idea of dynamic absorption and spending is implicit in the country studies in Berg et al. (2007) and Foster and Killick (2006), since absorption and spending of aid surges to the countries is measured over 2-4 year periods. However, while full absorption and spending is the best short run response it is not the desired medium term result as one would expect well managed aid flows to increase national income over the medium and long run through investment in physical and human

capital, as well as institutional capacity building. If aid has a medium term impact on productivity, then spending should ultimately exceed absorption and spending should be greater than one while absorption should be less than one, reflecting an increase in exports. This may be one reason why the country studies in Berg et al. (2007) and in Foster and Killick (2006) often found spending to exceed absorption.

3. A simple econometric model of absorption, spending and production

The discussion above illustrates the need for dynamic models when we wish to analyze absorption and spending econometrically because the optimal time horizon for measuring absorption and spending cannot be given a priori. The econometric model of absorption, spending and production developed here, is formulated so as to accommodate the complications arising in such a dynamic context.

The econometric model

We formulate a simple dynamic econometric model to account for a country's absorption, spending and changes to GDP following a sudden increase in foreign aid.[12] A type of model that does not impose too much a priori structure is the vector autoregressive (VAR) model. Our starting point for the econometric model is the national income accounts identity measured in constant local currency units and given as annual changes:

$$\begin{aligned} \Delta Y_{jt} &= \Delta C_{jt} + \Delta I_{jt} + \Delta G_{jt} - (\Delta M_{jt} - \Delta X_{jt}) \\ &= \Delta D_{jt} - \Delta NM_{jt}, \end{aligned} \tag{8}$$

where Y_{jt} is GDP in country j at time t, C_{jt} is household consumption, I_{jt} is gross capital formation (investment), G_{jt} is government consumption, X_{jt} is exports of goods and services and M_{jt} is imports

of goods and services. As in Section 2 we can specify the changes in GDP (Y_{jt}) as the change in domestic demand (D_{jt}) less the change in net imports (NM_{jt}) giving a direct link to our definitions of absorption and spending.

In order to get 'standardized' measures across countries we divide the changes in GDP and its components by GDP in the initial year. Hence, we look at the change in real GDP from year *t*-1 to *t* relative to the initial level and the contributions from the terms on the right hand side of the identity:

$$y_{jt} = d_{jt} - (m_{jt} - x_{jt}), \tag{9}$$

where each of the series have been transformed by

$$v_{jt} = \frac{\Delta V_{jt}}{Y_{j0}}, \quad V_{jt} = Y_{jt}, D_{jt}, X_{jt}, M_{jt}. \tag{10}$$

For foreign aid we look at the net inflows of aid (grants plus loans minus principal repayments) less emergency aid and technical cooperation. The aid inflow is measured analogously to the national income accounts variables in equation (9); that is, we model the change in aid inflows (*A*) in country *j* from *t*-1 to *t* relative to GDP in the initial year:

$$a_{jt} = \frac{\Delta A_{jt}}{Y_{j0}} \tag{11}$$

The national income accounts variables in (9) and the aid variable in (11) are used to specify a VAR model. However, as equation (9) is an identity the covariance matrix of disturbances is singular. As shown in Barten (1969) the parameters of the model can be consistently estimated by leaving out one of the variables from the system—in the present model it doesn't matter which variable is

omitted.[13] We omit imports from the model whereby the VAR is specified to include scaled changes in aid, real GDP, domestic demand and exports, i.e., we consider the 4 x 1 vector $Z_{jt} = (a_{jt}, y_{jt}, d_{jt}, x_{jt})'$. In addition to these four endogenous variables we control for the impact of natural disasters, F_{jt}, measured by the number of people per 100 who are affected by natural disasters each year.[14] The main reason for controlling for natural disasters is that aid flows to a disaster struck country may respond within-year to such exogenous events.

The resulting VAR model can be formulated as:

$$Z_{jt} = m_j + \sum_{k=1}^{p} \Gamma_{jk} Z_{jt-k} + \sum_{l=0}^{q} \Psi_{jl} F_{jt-l} + u_{jt} \qquad (12)$$

where m_j is a vector of country specific intercept terms, Γ_{jk}, $k = 1,\ldots,p$ and Ψ_{jl}, $l = 0,\ldots,q$, are country specific coefficient matrices, while u_{jt} is a zero mean innovation process with $E(u_{jt}u'_{jt}) = \Omega_j$ and $E(u_{jt}u'_{js}) = 0$ for $t \neq s$.

Identification of the aid shocks

The errors in the VAR model (u_{jt}) are reduced form innovations. Hence, in order to estimate responses to aid shocks we need to identify such aid shocks by transforming the reduced form innovations to structural shocks. As the model is based on an accounting identity there is little guidance from economic theory when it comes to specifying identifying restrictions. Therefore, we only impose a simple, just identifying, structure by assuming a causal ordering of the variables. Given the lack of economic theory, we can only give heuristic arguments for our preferred structure, which is as follows (using the variable names to indicate the innovations in the respective equations):

$$a_{jt} \rightarrow x_{jt} \rightarrow d_{jt} \rightarrow y_{jt} \rightarrow m_{jt}. \quad (13)$$

We assume innovations in aid changes are predetermined such that the innovations in the aid equation are 'structural' aid shocks.[15] In light of the importance of the endogeneity and instrumentation of aid in cross-country growth regressions, one may ask if this is a reasonable assumption. To this end it is important to note that we do not assume exogeneity of aid flows as such. Rather, we actually assume they are endogenous. Our assumption is that ***annual changes*** in the country specific aid flows—***conditional*** on lagged changes in the aid flows and on lagged changes in GDP, domestic demand, exports and imports—are exogenous and unpredictable given our information set. In light of the results of the country studies in Berg et al. (2007) this assumption is, in our view, not unreasonable.

The ordering within the national accounts identity is mainly governed by the fact that the countries in our sample are small open economies. Hence, we assume shocks to the changes in exports (again, conditional on the past) are mainly external events driven by changes in world market prices. As most of the countries in the sample have fixed exchange rates this makes export shocks independent of shocks to changes in domestic demand and GDP. The innovation in the change in domestic demand is the third variable in the chain because this variable includes government consumption and investment and, in the model, discretionary fiscal policy can be considered as consumption shocks or investment shocks. Finally, the change in GDP is fourth in the ordering but as it precedes changes in imports, the goods market is assumed to be cleared by changes in imports, not by changes in GDP.[16]

The VAR model is mainly formulated to analyze the short- and medium-run impact of aid flows. Therefore our specific choice of structural ordering should not be interpreted as an attempt to

provide a strict identification of structural shocks. Instead, the key assumption is that aid flows are predetermined, whereby the innovations in the aid equation can be interpreted as aid shocks to the economies in question.

Estimation of absorption, spending and production

The VAR model in (12) is specified with country specific parameters. Thus, in a cross-country setting we need to impose some kind of structure on the parameters to obtain representative (or average) parameter estimates. The simplest and most restrictive structure is to assume the parameters are identical across countries. Under this assumption the cross-country data can simply be pooled and the parameters of the VAR are estimated using ordinary least squares. A slightly less restrictive structure allows the intercepts (m_j) to vary across countries, while the slope parameters (Γ_{jk}, Ψ_{jk}, $k=1,\ldots,p$) are assumed to be equal. This assumption results in a dynamic panel data model with country specific fixed effects. Currently, this structure seems to be the most popular specification in cross-country analyses. However, in the present setting, in which the model is formulated for annual changes of all variables, assuming equal slope parameters may be overly restrictive. This leads us to consider the least restrictive structure, in which we allow both the intercepts and the slope parameters to vary across countries. By this assumption the VAR model in (12) is a version of the random coefficient dynamic panel data model analysed in, for example, Pesaran and Smith (1995) and Hsiao, Pesaran and Tahmiscioglu (1999).

Pesaran and Smith (1995) shows that the parameters of the random coefficient dynamic panel data model can be consistently estimated using the mean group estimator (MGE). The MGE is computed by estimating the parameters for each country using OLS and then taking the arithmetic average of the country specific parameters. We then use the MGE for the autoregressive parameters to estimate

mean group impulse response function parameters for aid, GDP, domestic demand and exports. Imports are omitted but, from the adding-up constraint, we know that the responses for imports equal the responses in domestic demand plus the responses in exports less the responses in GDP. Based on these response parameters we can then estimate responses and accumulated responses for all variables of interest. We focus on four functions of the impulse-response parameters including estimates of absorption, spending and changes in production following an unexpected increase in the aid flow.

Specifically, let $R_h(z,a)$ denote the response in variable z in period $t+h$ following an aid shock in period t, then the resulting cumulated change in the aid flows over time can be estimated from the accumulated response as

$$\text{Aid flow}(s) = \sum_{h=0}^{s} R_h(a,a) \times \frac{A_{t+s} - A_{t-1}}{A_t - A_{t-1}}, \quad s = 0,1,\mathbf{K},\infty, \tag{14}$$

Further, absorption up to a given year (s) following the aid shock is the accumulated response in net-imports relative to the accumulated response in the aid flow:

$$\text{Absorption}(s) = \frac{\sum_{h=0}^{s} \left(R_h(m,a) - R_h(x,a)\right)}{\sum_{h=0}^{s} R_h(a,a)} \times \frac{NM_{t+s} - NM_{t-1}}{A_{t+s} - A_{t-1}}, \quad s = 0,1,\mathbf{K},\infty, \tag{15}$$

Spending over time can be estimated analogously as the accumulated response in domestic demand relative to the accumulated response in the aid flow following an aid shock:

$$\text{Spending}(s) = \frac{\sum_{h=0}^{s} R_h(d,a)}{\sum_{h=0}^{s} R_h(a,a)} \times \frac{D_{t+s} - D_{t-1}}{A_{t+s} - A_{t-1}}, \quad s = 0,1,\mathbf{K}\,\infty. \tag{16}$$

Finally, the impact on production (GDP) can be estimated as the difference between absorption and spending up to a given year, s:

$$\text{Production}(s) = \frac{\sum_{h=0}^{s} R_h(y,a)}{\sum_{h=0}^{s} R_h(a,a)} \cdot \frac{Y_{t+s} - Y_{t-1}}{A_{t+s} - A_{t-1}} = \text{Spending}(s) - \text{Absorption}(s). \qquad (17)$$

The four dynamic response functions in equations (14)-(17) are useful as "descriptive" measures and, in addition, they can be used to test hypotheses about each of the processes. Some examples of specific hypotheses are

(i) H_0: Sudden changes in aid are permanent;
(ii) H_0: Absorption of additional aid flows is zero at any given horizon following the initial change;
(iii) H_0: Spending of additional aid flows is zero at any given horizon following the initial change; and
(iv) H_0: Absorption equals spending such that the impact on GDP of an additional aid flow is zero at any given horizon following the initial change.

Despite the mainly descriptive appearance of the VAR approach, these hypotheses are implicitly tested in the following section.

4. The data

As noted in the introduction, we focus on the short run impact of aid in small developing countries (SDCs). There is a range of definitions of SDCs in the literature, most of them based on somewhat arbitrary criteria and, interestingly, the definition of 'smallness' of countries appears to have decreased over time. Here we mainly focus on countries with populations in 1980 of less than one million and per capita incomes in 1980 of less than US$ 5,000 in 1990-dollars, although the sample does include some higher income SDCs. This definition does broadly match the World Bank's

(IDA) criterion for small countries that require special assistance because of their size, as well as the commonly used criterion of the cross-country growth regressions literature, which typically focus on 'large' countries of more than one million people.

>TABLE 1 ABOUT HERE<

Using the guideline above and selecting countries for which a reasonable amount of data of sufficient quality is available, we were able to construct a sample of 20 countries with annual data for the period from 1972 to 2003.[17] The sample of countries is given in Table 1, while some summary statistics for the countries and two sub-groupings are given in Table 2.

>TABLE 2 ABOUT HERE<

The countries in our sample are generally quite poor, having an overall average per capita GDP just below constant-USD 2,500 (Table 2). Another interesting, yet not surprising, fact is that these countries rely heavily on international trade with an average trade-to-GDP ratio just above 100 per cent and an average net import-to-GDP ratio about 20 per cent. The data on aid in Table 2 relates to our own definition, which includes grants and loans minus loan repayments but excludes emergency aid and technical cooperation. Using this definition the annual aid inflow could, on average, finance half of annual net imports, indicating that most of these small economies rely on more external resources than aid to finance net imports.

We use the average aid flow in each country to identify highly aid dependent economies but, in contrast to most other studies, we look at aid relative to trade (imports plus exports) instead of relative to GDP, because international trade is so important in the small developing countries, and because aid and trade are alternative means of earning foreign exchange. Somewhat arbitrarily we

have defined a group of countries to be dependent on aid if they have an average aid-to-trade ratio above 5 per cent. Some 13 countries are dependent on aid by this definition. The non-dependent countries are indicated by an asterisk in Table 1 and from the summary statistics in Table 2 it is clear that these seven countries have low aid-to-trade ratios because they export relatively more than the 13 aid-dependent countries. In fact, while the import shares are almost equal in the two country groupings, the average export share is significantly lower for the group of aid-dependent countries (35%) compared to the non-dependent countries (54%). The group of aid-dependent countries is also poorer on average, they have a much higher net import share, and the average aid-to-GDP share is significantly higher than for the group of non-dependent countries.[18]

>TABLE 3 ABOUT HERE<

Table 3 reports summary statistics for the data that we use in the VAR model. As in Table 2 we report the statistics for all 20 countries and for the subsamples of aid-dependent and non-dependent countries. The summary statistics indicate that aid flows to the 20 countries have been increasing slightly as the average change in aid relative to the country specific level of GDP in 1973 is 0.23 per cent. This increase is less than the increases in real GDP and the demand components by a factor of, at least, 10. We also find that changes in domestic demand have outpaced GDP, whereby net imports have been increasing over the sample period by more than the average increase in aid flows. The sample split shows that the seven non-aid dependent countries have seen an overall decrease in the aid flows over time.[19] Moreover, changes in both GDP and exports are larger, while the average changes in domestic demand and, thus net imports, are smaller than for the group of aid dependent countries. Finally by looking at the coefficient of variation (the standard deviation

divided by the mean) for the different measures it is clear that we have substantial variation in the data across both time and across countries, in particular the aid flows.[20]

Clearly, the dynamic properties of the data cannot be inferred from the tables above. Therefore, before turning to our formal econometric results in section 5, we look at the time series properties in an intuitive fashion by graphically examining the time series patterns for the key variables. Specifically, in Figures 1 and 2 we look at the time patterns of aid, net-imports and spending for each country in the sample. Figure 1 gives the plots for the 13 aid-dependent countries while Figure 2 has the plots for the 7 non-dependent countries.

>FIGURE 1 ABOUT HERE<

>FIGURE 2 ABOUT HERE<

The two figures highlight some interesting patterns, although we find a marked heterogeneity even within the group aid-dependent SDCs. The first point to reiterate is the size of aid changes. In the aid dependent countries the changes in aid (scaled by GDP in 1973) are of the same order of magnitude as the changes in net-imports and domestic demand for a large fraction of the countries. In contrast, aid flows are much less volatile in the group of non aid dependent countries. Secondly, net-imports and spending are likewise more volatile in the aid dependent countries. Thirdly, the closeness with which changes in aid track changes in imports or spending clearly varies across countries with clearest signals in the aid dependent countries. In countries like Dominica, Togo, and Vanuatu it looks like aid fairly closely tracks imports and spending. In the other countries the patterns are more mixed. In some years large aid changes seem to coincide with commensurate changes in imports or spending, but in many cases they do not. In The Gambia, for example, there are large changes in imports and spending that are unassociated with significant changes in aid. In

Guinea-Bissau larges aid changes in the late 1980s and 1990s often exceeded changes in imports and spending, suggesting absorbing and spending massive shocks is either very difficult or simply undesirable, or both.

5. Empirical results

Whilst the graphical results are interesting and a nice means of looking at country-specific results, they do not provide a rigorous tool for examining and formally testing more complex dynamic patterns in the data. The more formal econometric model we proposed in Section 3 is intended to fill this gap. As explained in Section 3, the autoregressive parameters of the VAR model are reduced form parameters with no direct interpretation which is why we do not present or discuss the autoregressive parameter estimates. Instead, we focus on the dynamic responses, represented by the estimated aid flow, absorption, spending and production change following an exogenous aid shock.

> TABLE 4 ABOUT HERE<

Table 4 reports the estimated average responses for the group of aid dependent countries following a shock in year 0.[21] This first thing to note in the table is that shocks to aid are followed by significantly decreased aid flows in the succeeding years. This confirms the often found result of highly volatile aid flows, a situation suggesting that policymakers in aid-receiving countries should not regard sudden increases in aid flows as permanent (Heller and Gupta 2002; Foster and Killick 2006; Berg et al. 2007). More specifically, the result in Table 4 indicates that about half of the initial change is transitory. As discussed in Section 2, a reasonable response to this reversion tendency in aid flows would be to delay and smooth the absorption and spending of sudden changes in aid.

A certain delay or smoothing of the response is clear from Table 4 as we record only small and insignificant changes in both absorption and spending in the initial year of the shock and, also, in the first year following the shock. Spending is increasing rather smoothly from the low level in the initial year to a peak 3 years after the shock. The point estimate of the peak level of spending is 48 per cent, indicating that about half of the change in aid is spent, and while we cannot reject the possibility of higher levels of spending, full spending of the additional aid flow is highly unlikely as it is clearly outside the two-standard error band. The absorption ratios are smaller than the spending ratios but only by a small margin and the time patterns are fairly similar. The peak level of absorption is also in year 3 following the shock. However, the point estimate of the peak is only 40 per cent, leaving a small effect on GDP.

The overall result indicated in Table 4 is one of clear smoothing of aid shocks and somewhat low absorption and spending ratios—compared to the ideal absorption and spending prescription. Still, absorption and spending rates just below 50 per cent are clearly higher than the findings for most of the countries examined in Berg et al. (2007) and Foster and Killick (2006) and the time pattern of absorption and spending indicates reasonably consistent monetary and fiscal policies in the aid dependent countries whereby severe macroeconomic imbalances, caused by the increased aid inflow, are avoided.

> TABLE 5 ABOUT HERE<

Table 5 reports the responses for the 7 non aid dependent countries. Comparing Tables 4 and 5 it is clear that while the aid dependent countries absorb and spend half of the sudden increase in aid, the non-dependent countries do not absorb the change at all. However, although we consistently find positive spending and (mainly) negative absorption, leaving a huge impact on production (the aid-

production ratio is just below 200 per cent at its peak in year 4 after the shock), the precision in the estimates is extremely low for this group of countries. Hence, given the very small sample size the results in Table 5 should be interpreted with more than the usual caution. The main conclusion from the analysis of the seven non aid dependent countries is that responses to sudden changes in aid do not appear to be very systematic—neither within nor across the countries.

6. Conclusion

In this paper we develop a simple vector autoregressive (VAR) model to describe the short-run macroeconomic responses to sudden aid shocks. Using the notions of absorption and spending introduced in the aid literature by IMF (2005) (later published in a revised version as Berg et al., 2007) we describe how this idea of absorbing and spending aid can be extended to the macroeconomic variables as describing change in net imports and domestic demand relative to the change in the aid flow. This broadening of the concepts is interesting, in our view, because absorption and spending are then naturally related to the national income accounts identity and, hence, to GDP.

We stress the importance of allowing for a flexible dynamic structure when modeling absorption and spending because the observed volatility of aid flows necessitates a certain degree of prudence in the absorption and spending decisions in recipient countries. This leads us to consider a VAR model as the least restrictive empirical framework. In addition, when we estimate average absorption and spending rates across a group of small developing countries we use the mean group estimator (Pesaran and Smith, 1995) to allow for country specific heterogeneity in the VAR model parameters. We consider such a flexible parametric approach to be necessary when looking at short run changes in macroeconomic variables across countries.

Whilst the novelty of our approach—as well as justified concerns over data quality—warrants considerable caution against drawing overly strong inferences from the econometric analysis, our results point to some reasonably clear conclusions. Specifically, for aid dependent countries we reject several hypotheses proposed. The first hypothesis was that sudden changes in aid are permanent. On the contrary, we find that aid flows to SDCs are mean reverting and, in addition, highly volatile. This reemphasizes the importance of 'aid smoothing' in aid dependent countries, and it is somewhat encouraging to see that the aid dependent countries typically appear to do this. Our second and third hypotheses were that aid flows were neither absorbed nor spent. Again, we are inclined to reject this hypothesis because we find a reasonably strong co-movement in absorption and spending for the group of aid dependent SDCs, which in turn implies little short run (demand driven) impact of aid shocks on GDP (as expected). This is in contrast to the country studies in Berg et al. (2007) and Foster and Killick (2006) and the only other econometric study of this kind that we know of, by Aiyar and Ruthbah (2008). Aiyer and Ruthbah find that spending significantly exceeds absorption both in the short- and the long-run in a large cross-section of countries. As both the data and the empirical methods differ it is highly uncertain what can be inferred from these differences, but both factors could play a role. For one thing, the results for our non aid dependent sample are much weaker, and therefore more in line with Aiyar and Ruthbah (2008).

Whilst we do not think these results are entirely surprising given the large aid inflows in aid dependent SDCs, the results do provide encouraging information to donors: When aid flows to an economy are an important source of resources there does appear to be sufficient focus on absorbing the resource flow. In contrast, when other resource flows, such as exports of natural resources or financial services, are more important than aid, then aid flows may well be used primarily to augment foreign exchange reserves. This is turn can lead to a possible mismatch between

absorption and spending, whereby large increases in aid may lead to short run problems and macroeconomic imbalances.

Since our approach is methodologically novel, it behooves us to consider the implications of our work for future research. Such research could further experiment with the econometric modeling of the short run responses. And whilst the VAR approach is largely atheoretical or 'agnostic', we are required to impose restrictions on the causal ordering of the variables in the VAR-model without formal theoretical guidance. Arguably the key assumption of this ordering is that changes in aid, conditional on the past, are predetermined with respect to the other variables. This assumption can be challenged. For example, in very small economies that are highly dependent on imports, donors may react to any factor which threatens the import capacity of the country (e.g., export shocks, or terms of trade shocks, such as the recent surge in international food prices). There are also different ways in which one might define subsamples or average across them, and future investigations in this area would do well to identify the robustness of alternative means of grouping responses. Nevertheless the use of VAR-type models in the context of aid flows seems a useful avenue for improving our understanding both of how aid is actually utilized in the short run, and how its utilization might be improved.

Notes

[1] A number of recent papers have systematically tested for differences between small and large states. See, among others Streeten (1993), Bertram (1993), Milner and Westaway (1993), Briguglio (1995), Armstrong, et al. (1998), Easterly and Kraay (2000), Armstrong and Read (2002), and Kose and Prasad (2002).

[2] In particular, there are very few cross-country studies, especially of the econometric kind, on aid effectiveness in SDCs. See Feeny (2007) for a recent example. There are, however, a reasonable number of country studies, too large in number to be adequately referenced herein.

[3] See Adam (2006) for a survey and discussion of Dutch Disease effects of aid flows.

[4] The studies by IMF (2005), Aiyar et al. (2006) and Berg et al. (2007) are closely related and (more or less) by the same group of authors. In the following we refer to Berg et al. (2007), although IMF (2005) was the first, because Berg et al. is the most comprehensive study.

[5] The reasons for the relatively good socioeconomic performance of SDCs are typically thought to be twofold. First, SDCs have apparent disadvantages which could work to their advantage in the long run, such as extreme dependence upon the world economy, which is thought to impose the discipline of competition on domestic markets, and to pressure policymakers into adopting internationally acceptable policies and institutional structures. Second, their lack of political and economic importance on the international stage could mean that larger countries do not view them as economically threatening, and may even see SDCs as a cost effective means of acquiring support in UN voting decisions (Bertram 1993). Thus, powerful countries may be more inclined to offer SDCs more favorable conditions on trade, offshore finance laws, migration and foreign aid, relative to other large LDCs.

[6] Both grants and loans may be "in kind" but this does not influence the discussion in the following.

[7] The sum of the aid grant and the aid loan less the repayment corresponds to the DAC definition of net official development aid: net ODA = $A^g + A^l - A^r$.

[8] Our definition of absorption differs from the definition in Berg et al. (2007) as we only include net imports of goods and services while they also include net interest payments and private transfers (the non-aid current account). As will be apparent later we think of the net imports of goods and services as a more natural choice in our setting.

[9] Naturally, over time, there may be second order effects from an increased reserve position or decreases in interest and principal payments on debt.

[10] When aid is given to an NGO the spending decision is recorded as an increase in household consumption and in private investment as NGOs are included in the private sector in the national accounts system.

[11] Needless to say, "defensive lending" is never stated explicitly as an aid program. However, there are fairly strong signs of defensive lending to highly indebted poor African countries (Birdsall et al. 2003).

[12] By a 'sudden increase' we are thinking of an unanticipated, exogenous, change in aid or, at least, a change in aid that is not predictable given the model we set up.

[13] See also Greene (2003, Chapter 14) for examples.

[14] Natural disasters cover; drought; earthquake; epidemic; extreme temperature; famine; flood; insect infestation; slides; volcano; wave surges; wild fires, and wind storm. Data are from The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain, Brussels, Belgium.

[15] This assumption is the main reason for subtracting emergency aid from the net aid flows, because that kind of aid may respond to within-year changes in the macroeconomic variables.

[16] Clearly, if lack of foreign exchange reserves is a binding constraint in a country this assumption is questionable. However, we consider the assumption to be reasonable under 'normal circumstances'.

[17] Data quality turned out to be a significant limiting factor as we require reliable annual observations for all expenditure components in the national accounts identity. A frequent problem in the national accounts data is that the real growth rate in one or several of the expenditure components is identical to the growth rate in real GDP—that is, data is constructed so as to keep a fixed expenditure-to-GDP ratio over time in real terms. The most extreme example is Kiribati where all the national income account components have identical growth rates from 1971 to 2003. Needless to say, such data are devastating for our approach.

[18] The 7 countries with low aid-to-trade shares have special characteristics affecting their international trade volume. For example, four of the countries have significant financial centers (Grenada, Mauritius, St. Lucia and St. Kitts and Nevis), Fiji and Suriname are mineral rich while Gabon is an oil/petroleum exporter.

[19] This is on average, and it does not hold for all 7 countries. Fiji and Grenada have seen increasing aid flows over time, while the other countries have had decreasing aid flows from 1974 to 2003. Several countries in the aid dependent group have also seen decreasing aid flows over time.

[20] This variation is mainly over time; the cross-country variation is less than 10 percent of the total variation in the aid variable.

[21] When reporting results for the impulse response parameters, we follow the suggestion in Sims and Zha (1999) and report parameter estimates and standard errors based on a Bayesian model formulation in which we condition on the initial observations and use a flat prior. The posterior probability distribution is estimated using Monte Carlo Integration based on 10,000 Monte Carlo draws.

References

Adam, C. (2006) Exogenous Inflows and Real Exchange Rates, in: P. Isard, L. Lipschitz, A. Mourmouras, and B. Yontcheva (eds) *The Macroeconomic Management of Foreign Aid: Opportunities and Pitfalls* (Washington, D.C.: International Monetary Fund), pp. 171-193.

Aiyar, S. Berg, A. Hussain, M., Mahone, A. and Roache, S. (2006) High aid inflows: the case of Ghana, in: P. Isard, L. Lipschitz, A. Mourmouras, and B. Yontcheva (eds) *The Macroeconomic Management of Foreign Aid: Opportunities and Pitfalls* (Washington, D.C.: International Monetary Fund), pp.105-140.

Aiyar, S. and Ruthbah, U. (2008) Where did all the aid go? An empirical analysis of absorption and spending, IMF Working Paper 08/34, International Monetary Fund, Washington, D.C.

Armstrong, H., de Kervenoael, R.J., Li, X., Read, R. (1998) A comparison of the economic performance of different micro-states, and between microstates and larger countries, *World Development*, 26(4), pp. 639-656.

Armstrong, H., Read, R., 2002. The phantom of liberty?: economic growth and the vulnerability of small states, *Journal of International Development*, 14(4), pp. 435-458.

Barten, A. P. (1969) Maximum likelihood estimation of a complete system of demand equations, *European Economic Review*, 1(1), pp. 7-73.

Berg, A., Aiyar, S. Hussain, M. Roache, S., Mirzoev, T. and Mahone, A. (2007) The macroeconomics of scaling up aid. Lessons from recent experience, *Occasional Paper 253*, International Monetary Fund, Washington D.C.

Bertram, G. (1993) Sustainability, aid, and material welfare in small South Pacific island economies, 1900-90, *World Development,* 21(2), pp. 247-258.

Birdsall, N., Claessens, S. and Diwan, I. (2003) Policy selectivity foregone: debt and donor behavior Africa, *World Bank Economic Review*, 17(3), pp. 409-435.

Briguglio, L. (1995) Small island developing states and their economic vulnerabilities, *World Development*, 23(9), pp. 1615-1632.

Bulíř, A., Hamann, A.J. (2003) Aid volatility: an empirical assessment, *IMF Staff Papers*, 50(1), pp. 64-89.

Bulíř, A., Hamann, A.J. (2008) Volatility of development aid: from the frying pan into the fire? *World Development*, 36(10), pp. 2048–2066.

Easterly, W., Kraay, A. (2000) Small states, small problems? income, growth and volatility in small states, *World Development*, 28(11), pp. 2013-2027.

Feeny, S. (2007) Impacts of foreign aid to Melanesia, *Journal of the Asia Pacific Economy*, 12(1), pp. 34-60.

Foster, M., Killick, T. (2006) What would doubling aid do for macroeconomic management in Africa?, ODI Working Paper 264, Overseas Development Institute: London.

Greene, W. H. (2003) *Econometric Analysis, 5th Edition,* (New Jersey: Pearson Education, Inc. Prentice Hall).

Heller, P., Gupta, S. (2002) Challenges in expanding development assistance, IMF Policy Discussion Paper PDP/02/5, International Monetary Fund, Washington D.C.

Hsiao, C., Pesaran, M.H. and Tahmiscioglu, A.K. (1999) Bayes estimation of short-run coefficients in dynamic panel data models, in: C. Hsiao, K. Lahiri, L.-F. Lee and M.H. Pesaran (eds) *Analysis of panels and limited dependent variable models*, (Cambridge University Press), pp. 268-296.

IMF (2005) The macroeconomics of managing increased aid inflows: experiences of low-income countries and policy implications, IMF Policy Development and Review Department (In consultation with the Area, Fiscal, Monetary and Financial Systems, and Research Departments), International Monetary Fund, Washington DC.

IMF (2004) *The IMF and aid to Sub-Saharan Africa*, Evaluation Report, Independent Evaluation Office of the IMF, International Monetary Fund, Washington, D.C.

Killick, T. and Foster, M. (2007) The macroeconomics of doubling aid to Africa and the centrality of the supply side, *Development Policy Review*, 25(2), pp. 167-192.

Kose, M.A., Prasad, E.S. (2002) Thinking big: how can small states hold their own in an increasingly globalized economy?, *Finance and Development*, 39(4).

McGillivray, M., Morrissey, O. (2004) Fiscal effects of aid, in: T. Addison and A. Roe (eds) *Fiscal policy for development: poverty, reconstruction and growth*, (Palgrave Macmillan), pp. 72-96.

Milner, C., Westaway, T. (1993) Country size and the medium term growth process: some country size evidence, *World Development*, 21(2), pp. 203-212.

Osei, R., Morrissey, O., Lloyd, T. (2005) The fiscal effects of aid in Ghana. *Journal of International Development*, 17(8), pp.1037-1053.

Pallage, S., Robe, M. (2001) Foreign aid and the business cycle, *Review of International Economics*, 9(4), pp. 641-672.

Pesaran, M.H. and Smith, R. (1995) Estimating long-run relationships from dynamic heterogeneous panels, *Journal of econometrics*, 68(11), pp. 79-113.

Sims, C. A. and Zha, T. (1999) Error bands for impulse responses, *Econometrica*, 67(5), pp.1113-1156.

Streeten, P. (1993) The special problems of small countries, *World Development*, 21(2), pp. 197-2002.

.

TABLES AND FIGURES

Table 1: The Sample of Small Developing Countries

Cape Verde	French Polynesia	Mauritius*	Seychelles
Comoros	Gabon*	St. Lucia*	Suriname*
Djibouti	The Gambia	St. Kitts & Nevis*	Togo
Dominica	Grenada*	St. Vincent & the Grenadines	Tonga
Fiji*	Guinea-Bissau	Sao Tome & Principe	Vanuatu

Note: Countries with '*' is the subsample of non-aid dependent countries.

Table 2: Summary statistics for the sample of Small Developing Countries, 1972-2003

	All (N = 20, Obs. = 577)		Aid dependent (N = 13, Obs. = 374)		Non-Aid dependent (N = 7, Obs. = 203)	
	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev
GDP per capita (Constant USD)	2467	3274	2225	3786	2914	1945
Dom. Dem./GDP	120.6	19.8	127.0	19.1	108.8	15.3
Net Imports/GDP	20.6	19.8	27.0	19.1	8.8	15.3
Exports/GDP	41.5	21.8	34.8	22.8	53.7	12.8
Imports/GDP	62.1	24.8	61.8	27.8	62.5	18.1
Aid/GDP	10.9	13.6	15.0	15.2	3.2	3.2
Aid/Trade	13.6	19.3	19.4	21.7	2.8	3.0

Notes: All ratios are reported as percentages. Trade is the sum of imports and exports. *N* is the number of countries while obs.is the total number of observations in the sample.

Table 3: Means and standard deviations for the variables in the VAR models, 1972-2003

	All (N = 20, Obs. = 577)		Aid dependent (N = 13, Obs. = 374)		Non-Aid dependent (N = 7, Obs. = 203)	
Scaled changes in	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev
Aid	0.23	12.90	0.45	15.76	-0.16	4.01
Exports	2.23	16.51	2.19	17.06	2.29	15.49
Domestic demand	6.31	18.32	6.68	20.37	5.62	13.77
GDP	5.49	9.81	5.68	10.15	5.13	9.17
Net Imports	0.82	16.04	0.99	17.92	0.49	11.85

Notes: All ratios are reported as percentages. *N* is the number of countries while obs.is the total number of observations in the sample.

Table 4: Dynamic responses to an aid shock: Aid flow, Absorption, Spending and Production. Averages for 13 aid dependent countries.

Year	Aid Flow	Absorption	Spending	Production
0	100.00	1.10	4.70	3.70
	--	(5.50)	(6.00)	(2.70)
1	***56.80***	14.20	11.80	-2.30
	(4.00)	(11.60)	(13.20)	(6.00)
2	***47.00***	7.50	28.20	***20.70***
	(4.50)	(14.60)	(16.20)	***(8.20)***
3	***60.30***	***39.40***	***48.10***	8.70
	(4.40)	***(11.10)***	***(11.60)***	(7.70)
4	***51.90***	16.90	***31.70***	14.80
	(3.20)	(10.50)	***(10.10)***	(9.50)
5	***56.90***	12.10	***30.90***	***18.80***
	(2.90)	(9.30)	***(8.90)***	***(8.90)***
6	***54.50***	19.40	***23.60***	4.30
	(3.20)	(10.80)	***(10.40)***	(9.60)
7	***57.30***	14.90	***25.00***	10.20
	(2.80)	(10.40)	***(10.00)***	(9.10)
8	***55.80***	19.00	***35.60***	16.60
	(3.00)	(10.90)	***(10.20)***	(9.60)

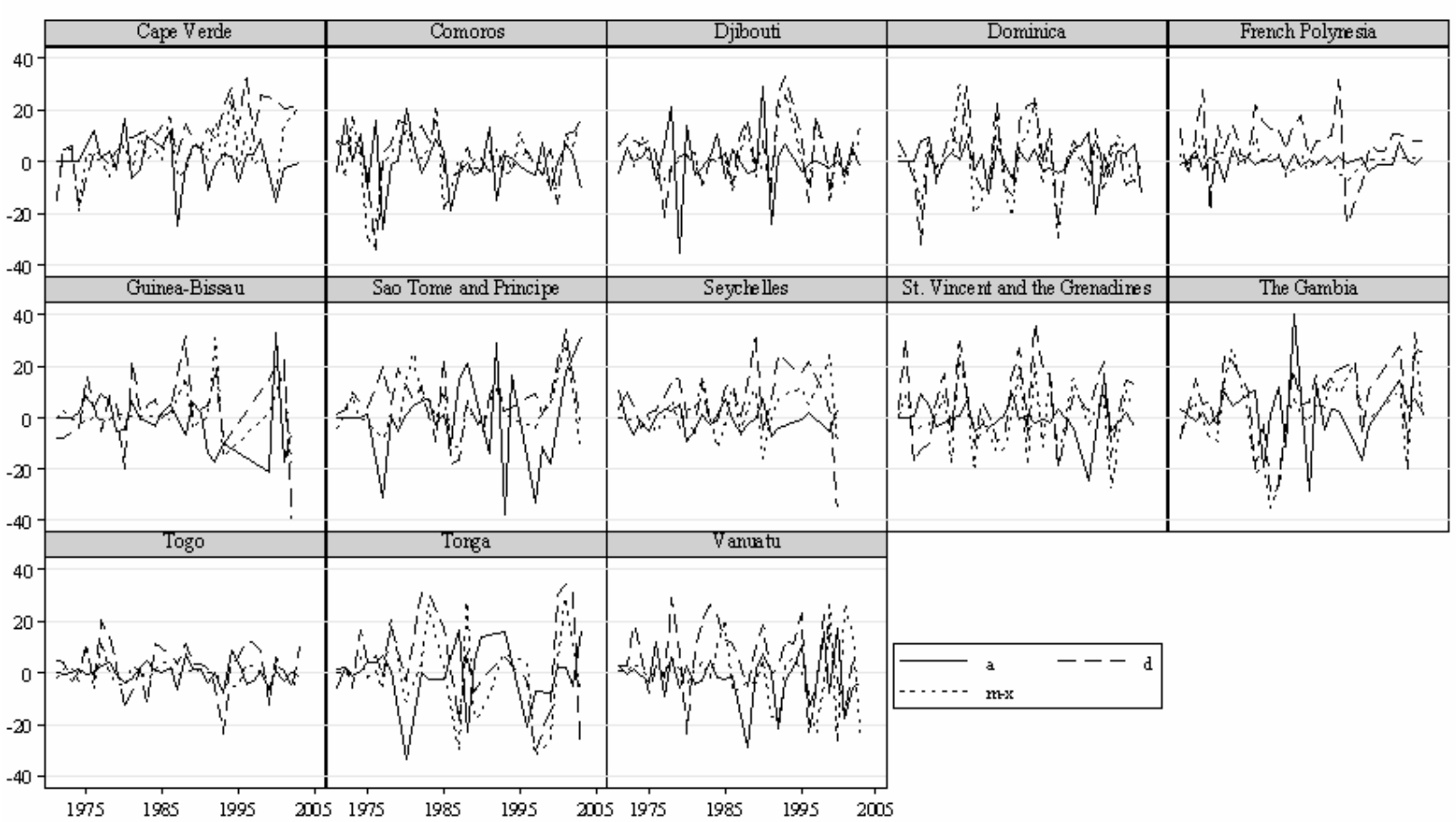
Note: The response parameters and their standard errors (reported in parentheses) are estimated using Monte Carlo Integration based on 10,000 Monte Carlo draws (see Sims and Zha, 1999). Coefficients exceeding 2 standard errors in absolute value are highlighted in bold + italics.

Table 5: Dynamic responses to an aid shock: Aid flow, Absorption, Spending and Production. Averages for 7 non aid dependent countries.

Year	Aid Flow	Absorption	Spending	Production
0	100.00	15.80	21.00	5.20
	--	(22.90)	(24.20)	(15.50)
1	***56.90***	-95.60	72.10	167.70
	(9.60)	(67.40)	(74.00)	(55.50)
2	***39.60***	35.30	91.30	56.00
	(11.10)	(157.30)	(206.90)	(227.20)
3	***57.30***	-38.50	49.90	88.40
	(10.50)	(84.00)	(103.70)	(67.50)
4	***41.40***	-92.80	98.10	***190.90***
	(7.80)	(103.60)	(123.80)	***(79.40)***
5	***55.90***	-45.70	30.40	76.10
	(6.90)	(66.90)	(80.70)	(48.60)
6	***51.80***	-70.90	58.60	***129.50***
	(8.10)	(74.70)	(84.20)	***(56.90)***
7	***43.10***	-51.80	81.40	133.20
	(7.40)	(89.40)	(101.10)	(68.40)
8	***53.20***	-40.00	46.60	86.50
	(6.90)	(70.20)	(81.50)	(55.30)

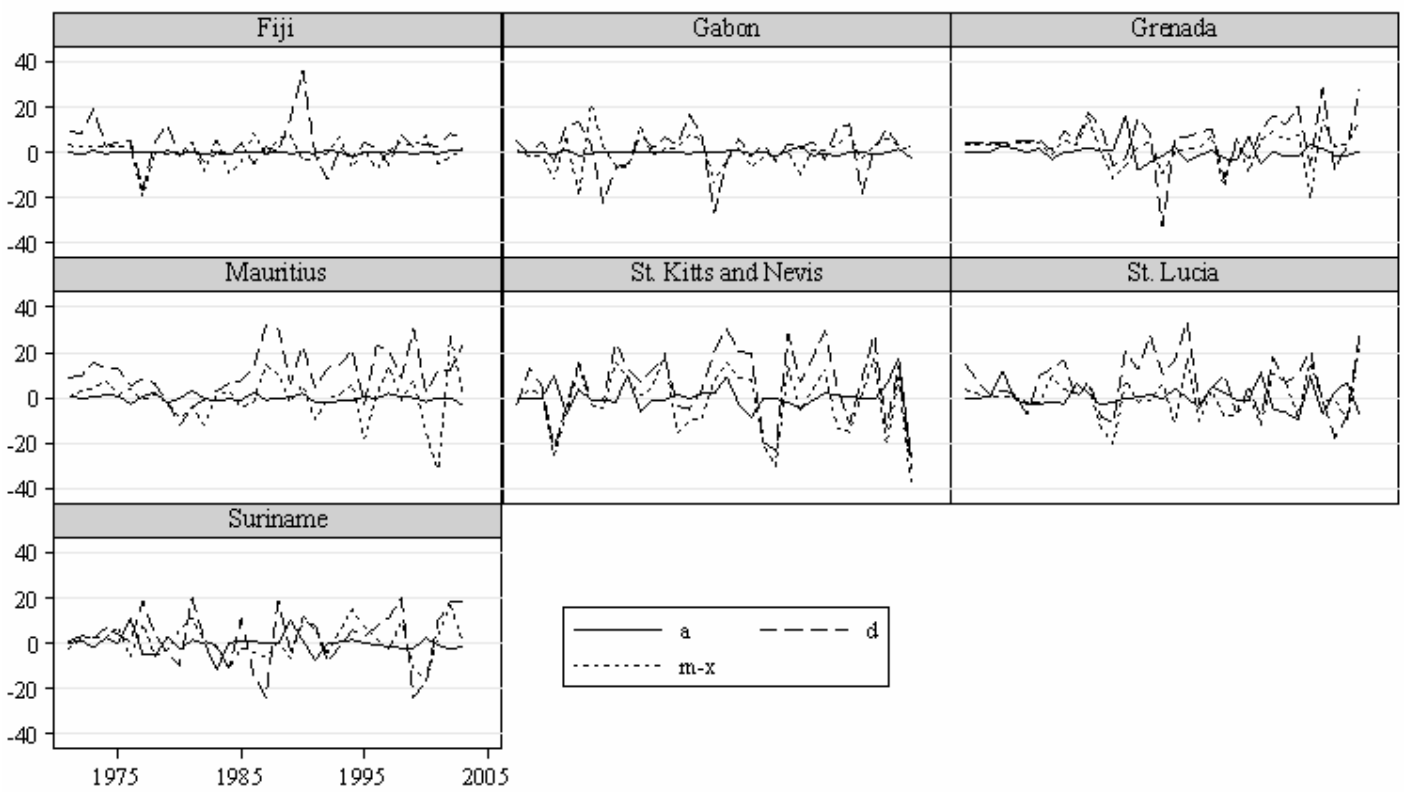
Note: The response parameters and their standard errors (reported in parentheses) are estimated using Monte Carlo Integration based on 10,000 Monte Carlo draws (see Sims and Zha, 1999). Coefficients exceeding 2 standard errors in absolute value are highlighted in bold + italics.

Figure 1: Changes in aid, net imports and domestic demand (% GDP in 1973) in 13 aid dependent SDCs



Note: Extreme observations (±40 per cent) are omitted from the plots. a=aid; d=demand; m-x=net imports. All measures are relative to initial GDP.

Figure 2: Changes in aid, net imports and domestic demand (% GDP in 1973) in 7 non aid dependent SDCs



Note: Extreme observations (±40 per cent) are omitted from the plots. a=aid; d=demand; m-x=net imports. All measures are relative to initial GDP.