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The Short-Run Macroeconomic Impact of Foreign Aid to Small States

An Agnostic Timeseries Analysis

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Abstract

This study econometrically evaluates the short-run impact of aid in small developing countries (SDCs) by applying a VAR model to study aid's impact on 'absorption' (increasing import demand) and 'spending' (increased domestic demand) across countries. Whilst our approach allows parameters to vary across countries, the focus is on average country effects and differential effects within certain subgroups of countries. In particular, we find substantial differences between 'aid-dependent' SDCs and other SDCs which are more dependent on mineral resources and financial services. In the latter group, aid seems to be neither absorbed nor spent in any systematic fashion. But in the aid-dependent SDCs, aid receipts seem to be used more in the textbook 'absorb and spend' fashion.

Keywords: foreign aid, small developing countries, macroeconomic adjustment, absorption, spending, VAR models, panel data

JEL classification: O11, O23, C53

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Acronyms

FEX foreign exchange/foreign currency

IDA World Bank's International Development Association

LDCs least developed countries

SDCs small developing countries

SIDS small island developing states

VAR vector autoregressive models

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1 Introduction

Although some 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 these countries.[2] This is surprising given that one of the most distinctive features of SDCs is their high degree of 'dependence' upon foreign aid flows. A key objective of the present study is to expand our knowledge of how aid is used in these countries, albeit in a limited fashion.

The limited scope of the study refers to our emphasis upon the short-run macroeconomic impacts of aid, rather than medium- to long-run impacts on growth or other aspects of development such as policies, institutions, health and education. In that sense our study is more related to the fiscal response literature, which 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 2001). A more recent literature uses an overtly historical (but nevertheless empirical) analysis 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 (i.e., net imports), and spending as increases in the government fiscal deficit net of aid (IMF 2005; Foster and Killick 2005). 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. And finally, our approach is methodologically most 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 gauge the impact of aid receipts on fiscal policy in individual countries, such as Malawi (Fagernas and Schurich 2004), Ghana (Osei, Morrissey and Lloyd 2005) and Jordan (Saif and Omet 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, and—not unlike the 2005 IMF study—we examine both spending and absorption responses.[3] Generally speaking, adopting a VAR approach to gauging short-run aid impacts in a wide range of countries would be problematic, given the arguably legitimate heterogeneity of aid's short-term usage, a fact amply revealed even in the small numbers of countries analysed in the IMF (2005) and Foster and Killick (2005) studies.

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1 A number of recent papers have systematically tested for differences between small and large states (Armstrong et al. 1998; Armstrong and Read 2002; Bertram 1993; Briguglio 1995; Collier and Dollar 1999; Easterly and Kraay 2000; Harden 1985; Kose and Prasad 2002; Milner and Westaway 1993; Ramkissoon 2002; Read 2001; Streeten 1993; UN 2002). Also see Appendix B of the present paper, as well as earlier works in this literature which generally provide descriptive analysis and basic statistics (Kuznets 1960; Scitovsky 1960).

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 Although in the present study 'spending' also includes private expenditure. Fuller definitions are provided later.

Moreover, heterogeneity in the quality of domestic policy could also confound the analysis, given that poor policy environments add an additional spanner to the workings of aid in the macroeconomy (Burnside and Dollar 2000).

Our focus on 22 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 better policies and institutions than other developing countries.[4] Of course, whilst policy quality may not be uniformly good across our sample, we have, in Appendix B, at least verified that this distinction mostly holds for the SDCs in this study. So in some sense our focus on SDCs allows us to investigate whether aid is used in the textbook fashion in economies that satisfy the implicit assumptions of that textbook prescription; i.e., good policies and institutions, including very high degrees of openness.

In summary, this study has three major objectives. In addition to improving our knowledge of aid usage in SDCs, a second objective is to provide a new and sufficiently powerful econometric methodology capable of informing macroeconomic questions which have previously 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 follow textbook prescriptions in their usage of aid. Accordingly, the remainder of this 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 distinguishes between textbook responses and the diverse responses observed in the IMF and Foster and Killick studies. Section 3 identifies some of the distinguishing features of the SDCs in question, outlines our dataset, and describes our econometric modelling techniques in detail. Section 4 presents our results, and section 5 provides some brief concluding remarks and directions for future research.

2 A framework for analysing the short-term macroeconomic response to increases in foreign aid

In this section we discuss possible scenarios of the macroeconomic management of aid flows. The brief summary of the special features of the small developing countries in comparison to other least developed countries (LDCs) above signifies that we expect the macroeconomic management of aid to the SDCs to be above average compared to the LDC group as a whole. This makes the SDCs especially interesting as aid impact studies.

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4 The reasons for the relatively good socioeconomic performance of SDCs are typically thought to be twofold (Read 2001). 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 favourable conditions on trade, offshore finance laws, migration and foreign aid, relative to other large LDCs.

Whilst there are a wide variety of cross-country studies intended to gauge the medium to long-run returns to foreign aid, as well as the effect of aid on institutions and policies, the literature on the short-run impact of aid on key macroeconomic aggregates is mostly limited to the much criticized fiscal response literature (see McGillivray and Morrissey 2001 for a discussion). An exception to this is the 2005 IMF study, which examines the effects of foreign aid increases in five relatively large African countries which experienced substantial aid increases in the 1990s, largely as a result of significant institutional improvements. In the present study we follow the theoretical framework developed in the IMF study, but we aim at developing a more formal econometric technique in order to be able to focus on a larger group of countries.

Consistent with the 2005 IMF study, Figure 1 broadly describes how recipient governments can use aid in the short run. Absorption is defined as the extent to which the non-aid current account deficit widens in response to an increase in aid inflows, or the extent to which direct and indirect increases in imports are financed by aid. Spending hereafter refers to the change in public and private expenditure. We note that this is a departure from the IMF and Foster and Killick (2005) studies, which define spending responses as increases in the fiscal deficit net of aid. This departure is chiefly necessary because of data constraints, although our broader definition of spending still permits us to make weaker inferences on the fiscal behaviour of recipient governments. The remaining macroeconomic aggregates are self-explanatory.

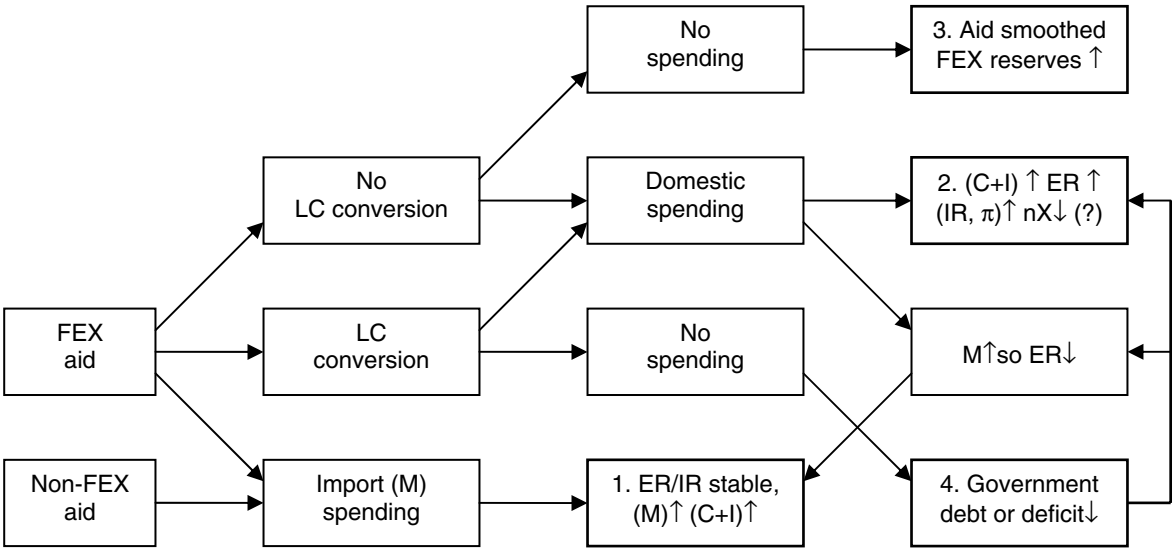
What, then, are the different ways in which aid flows may be processed in the recipient's macroeconomy? The ideal 'textbook' usage of aid would result in the domestic economy experiencing the benefits of increases in real resources—either increased imports, or increased domestic spending—without any substantial 'distortion' of domestic prices or the foreign exchange rate; i.e., all of the benefits, and none of the costs. We note that this textbook situation essentially precludes any explicit theory of growth, for such a theory would necessarily require a position on (among other things):

- whether domestic spending is to be preferred to increased imports (Hirschman 1958);
- to what extend additional expenditure should fund investment versus consumption (De Long and Summers 1991);
- whether price distortions are necessarily harmful (Amsden 1989); and
- whether donors should really be expanding the size of LDC governments (Bauer 1976).

Thus the macroeconomic framework relates more to presumed short-run welfare improvements rather than to faster long-run growth.

With this caveat in mind, there are several ways in which foreign aid can increase real resource availability without significantly altering prices. Foreign aid is normally given in a foreign currency (FEX), and the standard prescription for reasonably large countries is that FEX aid should be mostly converted to local currency and used to increase government spending or decrease revenues. A potential problem with this textbook prescription is that the aid inflow may act to appreciate the recipient's foreign exchange rate, thereby making exports less competitive, in what is known as the Dutch disease effect (see Young's (1993) discussion of Ghana, for example). However, in a good

Figure 1
Absorption and government spending responses to aid flows



Notes: M = Imports; nX = net exports; C = Consumption; I = Investment; FEX = foreign exchange or foreign exchange reserves; ER = Exchange rate; IR = Interest rate; π = inflation; LC = local currency.

Outcome 1. If aid is aid-in-kind, or if aid is entirely spent on imports by the government, then such aid is immediately absorbed as has no direct effects on ER or the IR (absorption and spending are equivalent). This outcome can also approximately be reached if aid is converted to local currency (leading to some appreciation) and spent on domestic goods and services which indirectly increase demand for imports (leading to some depreciation).

Outcome 2. If aid is converted to LC and spent domestically, but this domestic spending does not increase effective demand for imports, then this puts upward pressure on interest rates or exchange rates. If aid is not absorbed but spending still increases, this also puts pressure on interest or exchange rates and crowds out the private sector.

Outcome 3. If aid is neither absorbed nor spent, the FEX aid is effectively saved and used to build up FEX reserves. This action may be used to smooth aid flows.

Outcome 4. If aid is absorbed but not spent, then aid can be used to either reduce the government debt, or reduce the size of the current fiscal deficit. Either action may 'crowd in' the private sector.

Source: Compiled by the authors.

economic environment, aid-induced domestic spending should increase demand for imports, which would at least partly abate the Dutch disease effects on the exchange rate. Of course, in smaller economies it may be expected that most FEX aid is spent on imports (aid may also be given as aid-in-kind). In this scenario, one should observe increases in net imports as well as in domestic demand (C+I); that is, an 'absorb and spend' outcome. We also note that GDP should not significantly increase in the short run unless the increased investments (or institutional capacities) result in an increase in domestic capacity.[5] In any event, both these scenarios—increased domestic spending

[5] Recall that 'domestic' demand (C+I) includes imports. This double-counting is the reason that imports are subtracted from gross domestic product. So if C+I increases by a given amount, but net imports increase by the same amount, then GDP should not increase at all in this 'absorb and spend' scenario (in the short run, that is).

and indirect increases in import demand, or direct use of aid on imports—yield the standard textbook result described by *Outcome 1*.

A less favourable outcome (*Outcome 2*) results when aid is converted to the local currency and spent domestically but import demand fails to increase. If import demand is unresponsive to government expenditure, then one may observe a Dutch disease appreciation of the exchange rate, or an increase in interest rates if the exchange rate is pegged, since in this case the monetary authority must essentially print money to keep the nominal exchange rate fixed. This more adverse outcome can also come about if aid is not converted to the local currency and instead held as foreign exchange, but a spending increase is funded through printing money or increased debt. This leads to inflation, and is regarded by Foster and Killick (2006) as the only policy response which basically lacks any sound motivations (in their terminology, it breaks the only 'golden rule' of the absorption-spending mix).

A third outcome (*Outcome 3*) involves no absorption and no spending. Here, aid is used to bolster FEX reserves or to smooth out the domestic impact of aid flows, but the government is prudent enough not to increase spending. This outcome may be appropriate if an economy is experiencing FEX shortages or excessive volatility in aid flows. In small open economies with undiversified exports, FEX shortages or excessive volatility in aid flows and other macroeconomic aggregates could be of real concern, so that bolstering FEX reserves may be a relatively sensible form of precautionary saving. On the other hand, this outcome could simply result from poor macroeconomic management, and FEX shortages are themselves sometimes the result of bad policies (e.g., taxes on exports).

A fourth outcome (*Outcome* 4) involves conversion to the local currency without any increase in government spending. This policy would be appropriate when government spending is too high and is perhaps crowding out the private sector, or when government debt is excessive. In either scenario, this policy is capable of reducing interest rates and, hence, crowding in private sector investment, but it may be inappropriate when government debt or expenditure is not a binding constraint. Also, as with the case when there is local currency conversion of aid coupled with government spending, the effects on the macroeconomy depend on import demand. If government crowding out is an important constraint to effective import demand, then reducing the debt could have an indirect effect on imports, which would avert any Dutch disease effects, as in *Outcome 1*. However, if effective import demand is unresponsive to a reduction in government debt or the government deficit, then Dutch disease results could still occur, although the effects on domestic interest rates and inflation are generally ambiguous.[6]

Finally, we should note that these four outcomes—and the various channels by which such outcomes are reached—are not mutually exclusive. Aid can be spent partly on imports, partly on domestic spending (with varying effects on demand for imports),

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6 It is at least theoretically possible that government debt reduction via LCU conversion of foreign aid could increase private sector investment and consumption via a reduction in interest rates, but not much affect imports, thereby still exerting upward pressure on the exchange rate. In a fixed exchange rate system, the government would have to use monetary policy to counter this pressure, thereby putting upward pressure on interest rates. So the net effect on interest rates could be either positive or negative.

partly used to bolster FEX reserves, and partly used to cancel debt or reduce the government deficit. As for the existing literature on aid absorption and spending, this tends to find that economies use aid in quite different ways. The 2005 IMF study of several relatively large African aid recipients, for example, does not find any substantial Dutch disease effects precisely because of recipients' concerns over losing export competitiveness. Nevertheless, countries avoided Dutch disease in different ways: two countries—Ethiopia and Ghana—seemed to neither absorb nor spend aid, chiefly in order to bolster FEX reserves; Uganda, Tanzania and Mozambique, on the other hand, spent more than they absorbed, and then attempted to cope with inflationary pressures through diverse monetary instruments. These results suggest that in any cross-country study one is likely to find considerable diversity among countries, a point of considerable relevance to the cross-country methodology developed in the next section.

3 Data and methodology

3.1 Sample selection and distinguishing features of small developing countries (SDCs)

Procedurally, the first task of this study was to appropriately identify countries that are both 'small' and 'developing'. There is a range of definitions in the literature, most of which are based on somewhat arbitrary criteria.[7] In this study we define small developing countries as those with populations in 1980 of less than one million and incomes in 1980 of less than US$5,000 in 1990 dollars. This definition broadly matches the World Bank's (IDA) criterion for small countries that require special assistance, as well as the commonly used criterion of the cross-country growth regressions literature, which typically focuses on 'large' countries of more than one million. Using this definition, and selecting countries for which a reasonable amount of data is available, we were initially able to construct a sample of 33 small countries of which 25 are less developed countries (LDCs) while eight are middle-income countries. Table 1 lists the sample of countries.

However, due to data limitations, mainly missing information on aid flows and questionable national accounts data, we were only able to include 22 of the 33 countries in the econometric analysis below.[8] The eleven omitted countries are identified with

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7 Interestingly, the definition of 'small' appears to have decreased over the years. Starting with Kuznets (1960), he defines small states as countries with less than ten million people. Today, this definition would classify some 134 economies as small. Another definition is given by Armstrong et al. (1998), who define 'micro-states' as countries with less than three million people; a definition which still incorporates a lot of countries. More recently, Kose and Prasad (2002) define small states as having less than 1.5 million people in 2002 and microstates as having 40,000 or less. The Commonwealth Secretariat uses the same definition although they also include Jamaica, Lesotho, Namibia and Papua New Guinea, despite the fact that several of these countries have reasonably large populations. Moving further down in population size, Easterly and Kraay (2000) define small states as having an average population over the period 1960-95 of less than one million and the World Bank uses supra-normal income per capita cutoff levels to give special access to IDA credits for small island countries. At present, nine countries benefit from this exception: Cape Verde, Dominica, Grenada, Maldives, Samoa, St Lucia, St Vincent and the Grenadines, Tonga and Vanuatu.

8 The questionable national-accounts data refer to seven countries for which the real growth rates in some—or all—expenditure components equal the growth rate in real GDP in a very large fraction of

Table 1
Categorizing small developing countries

Small developing countries			Small middle-income countries
Micro island states	Small island states	Non-island states	
Antigua and Barbuda (a	Cape Verde	Djibouti	St Lucia (b
Dominica	Comoros	Equatorial Guinea (b	French Polynesia
Grenada (b	Fiji (b	Gabon (b	Aruba (a
Seychelles	Mauritius (b	The Gambia	Cayman Islands (a
St Kitts & Nevis (b	Sao Tome & Principe	Guinea-Bissau	Marshall Islands (a
Tonga	Solomon Islands (a	Guyana (b	Palau (a
Kiribati (a	St Vincent & the Grenadines	Suriname (b	Netherlands Antilles (a
	Vanuatu	Togo	Trinidad & Tobago (a
	Maldives (a		
	Samoa (a		

Notes: 'Small' is defined as having a population of less than one million in 1980. 'Developing' is defined as a having a mean income of US$5,000 in 1980, as measured in 1990 dollars. Larger per capita incomes qualify countries in the right-hand side column as middle income. The small middle-income countries are not included in the analysis in section 2. Countries marked with (a are not included in the econometric analysis in section 4. Countries marked by (b are included in the full econometric sample of 22 countries, but are defined as non aid-dependent because they are either mineral-rich or have significant financial services sectors.

Source: Compiled by the authors.

an '(a' in Table 1. For the remaining countries, the full sample from 1972 to 2003 is rarely available. Thus, in total we have an unbalanced panel of 22 countries with a total of 660 observations. Summary statistics are reported in Table A1 in the Appendix.

Since our study selectively uses cross-country data it also behooves to identify how these SDCs differ from larger LDCs, and also to identify key differences among SDCs. In fact, these between- and within-sample differences turn out to be crucial to our derivation and interpretation of key results.

In terms of differences between SDCs and larger LDCs, there is a large body of literature discussing the distinctive economic, biophysical, and sociopolitical characteristics of small developing countries and small island developing states. These differences are analysed in detail in Appendix B. From the existing literature we identified five key stylized facts on SDCs which at least partially distinguish them from larger developing countries. We then reexamined these stylized facts in considerable detail, including formal statistical tests (Appendix Table B2). In doing so we found that there are sufficient empirical grounds for concluding that SDCs generally have:

i) Higher standards of living, better institutions and (mostly) better policies than LDCs;

ii) Greater openness in terms of trade (but less diversity in export structures), financial flows and labour flows;

the sample years. The most extreme example is Kiribati where all the national income accounts components have identical growth rates from 1971 to 2003.

iii) Somewhat distinctive geographical disadvantages, including isolation and high transport costs, as well as more vulnerability to natural disasters;[9]

iv) Greater volatility of output, but not necessarily of exports; and

v) A larger size and role of government expenditure and foreign aid, doubtlessly related to SDCs' dependence on undiversified and quite volatile domestic production (Rodrik 1998).

All these factors are relevant to our study. We have already made note of the importance of policies, institutions and openness in influencing macroeconomic adjustment. Natural disasters and other exogenous shocks (e.g., terms of trade shocks) may also be important insofar as they may simultaneously determine aid flows and other macroeconomic outcomes. Section 2 also noted that the volatility of exports and output may influence decisions as to whether FEX aid should be converted to local currency or held as precautionary FEX reserves. And finally, the great importance of aid and government expenditure in SDCs could yield important insights into how economies with 'scaled up' aid receipts are likely to use that aid in the short run.

There is, however, a danger in presuming that SDCs constitute an extremely homogenous group of economies. We therefore also explored significant within-sample differences among SDCs. In particular, the literature on SDCs often distinguishes between non-island and island small states, between small states and micro states (say, of less than 250,000 inhabitants), and between generally wealthier SDCs with significant nonagricultural sectors (mining, tourism, financial services) and those which, bereft of these resources, are largely dependent upon foreign aid, remittances and non-mineral primary exports.

Although Appendix B verifies some important differences between subgroups of our SDCs,[10] we will argue that this last difference—that of differences in economic structure and aid dependence—is quite probably the largest and most relevant divergence within the present sample of SDCs. Importantly, this diversity could confound our econometric results because variation in aid responses could be significantly influenced by heterogeneity in economic structure and aid dependence, making meaningful inference difficult if not impossible. So in addition to defining a sample of SDCs, we also define two mutually exclusive subsamples. The first subsample consists of countries which we define as non aid-dependent because their economies are possessive of substantial mineral and/or financial services sectors: Equatorial Guinea and Gabon are oil/petroleum producers; Fiji, Guyana and Suriname are mineral rich; and four of our SDCs have significant financial centres (Grenada, St Kitts and Nevis, St Lucia and Mauritius).[11] These economies are marked with a '(b'

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9 It is not entirely clear that SDCs on average are more disadvantaged geographically that other LDCs. For one thing, many SDCs are coastal, and some are advantageously located near large economies. Many have fairly predictable weather patterns and fertile soil, and most seem to be less vulnerable to tropical diseases.

10 In particular, we often found substantial differences between island states and small non-island states, but rarely did we note significant differences between micro island states and other island states. So economic structure and aid dependence arguably identify the largest and most relevant divergence among the present sample of SDCs.

11 This financial services classification is based on information from the World Factbook published by the CIA (www.cia.gov/library/publications/the-world-factbook/).

in Table 1. The remaining thirteen countries define the second group of aid-dependent countries.[12] The idea is that the thirteen countries in the second group should have more similar aid-response profiles compared to the full sample.

3.2 A simple econometric model of absorption and spending

In this subsection we formulate a simple econometric model which we use to estimate the short-run absorption and spending impact of a 'sudden increase' in foreign aid. Since the effect of changes in aid receipts on the macroeconomy is likely to be distributed across several years, the empirical model must be dynamic. A simple dynamic model that does not impose too much a priori structure is a vector autoregressive (VAR) model. We, therefore, formulate a VAR model for the main macroeconomic aggregates and foreign aid.

The starting point is the national income accounts identity measured in constant local currency units:

$$Y_{jt} = C_{jt} + I_{jt} + X_{jt} - M_{jt} + R_{jt}, \tag{1}$$

where Y_{jt} is GDP in country j at time t, C_{jt} is total consumption (the sum of household consumption and government consumption), I_{jt} is gross fixed capital formation, X_{jt} is exports of goods and services, M_{jt} is imports of goods and services while R_{jt} is inventory investment.

As explained in section 2, the text-book response to an increase in foreign aid can be interpreted as an equal increase in net imports ($M_{jt} - X_{jt}$) and domestic demand ($C_{jt} + I_{jt}$), leaving the GDP unchanged in the short-run. In the econometric analysis we therefore relate absorption to the change in net imports relative to the aid inflow while spending is related to the change in domestic demand relative to the change in the aid flow.

In order to remove trends and to get 'standardized' measures across countries we move from the income identity to the national accounts growth identity by subtraction and subsequently division by GDP, lagged one year. Hence, we look at the growth rate in real GDP from year t-1 to t and the growth contributions from the terms on the right hand side of the identity:

$$y_{jt} = c_{jt} + i_{jt} + x_{jt} - m_{jt} + r_{jt}, \tag{2}$$

where:

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[12] Note that aid dependent is used in a fairly specific way here. Some of the countries in the subsample of mineral-rich economies with significant financial services still receive large amounts of aid, but we have not defined them as aid dependent because they have access to significantly large non-aid sources of foreign exchange and government. Nevertheless, We note that although we have not explicitly used aid/GDP ratios to define these subsample, the difference in aid/GDP ratios for these two groups is considerable over the time frame of our analysis (1973-2001): around 7 per cent of GDP in the case of the non-aid-dependent sample, and around 22 per cent of GDP in the case of the aid-dependent sample. Also, some readers may object to the phrase 'dependent'. We do not intend it to be derogatory in any way.

$$v_{jt} = \frac{V_{jt} - V_{jt-1}}{Y_{jt-1}}, \quad V_{jt} = Y_{jt}, C_{jt}, I_{jt}, X_{jt}, M_{jt}, R_{jt}. \tag{3}$$

For foreign aid we look at the net inflows of aid (grants plus loans minus loan repayments) less emergency aid and technical cooperation. The aid inflow is measured analogously to the growth contributions in equation (2); i.e., we model the change in aid inflows in country *j* from *t*-1 to *t* relative to GDP in year *t*-1:

$$a_{jt} = \frac{ODA_{jt} - ODA_{jt-1}}{Y_{jt-1}} \tag{4}$$

To accommodate the possibly diverse short- and medium-run impacts of aid inflows across countries we formulate country specific VAR models. The relatively small samples for each of the countries—we have annual observations broadly spanning the period 1972-2003—poses restrictions on the dimension of the VAR models. We therefore aggregate the growth contributions from consumption and fixed capital formation to get the growth contribution from domestic demand, d_{jt}:

$$d_{jt} = c_{jt} + i_{jt} \tag{5}$$

Moreover, as the growth accounting is an identity, we leave out one of the components from the VAR. Ideally, we would have liked to omit only inventory investment from the model; however, some countries in our sample have zero inventory investments in several years (i.e., the national income accounts identity holds for GDP, consumption, fixed capital formation, exports and imports). Therefore, we omit both inventory investment and imports from the VAR models.[13] The resulting VAR models thus include aid, real GDP growth and the growth contributions from 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, W_{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 models can be formulated as:

$$Z_{jt} = \mu_j + \sum_{k=1}^{p} A_{jk} Z_{jt-k} + \sum_{l=0}^{q} B_{jl} W_{jt-l} + u_{jt} \tag{6}$$

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

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13 The adding-up constraint implies that we are still analyzing the impact of aid flows on the sum of imports and inventory investment.

14 Natural disasters cover drought; earthquakes; epidemics; extreme temperatures; famine; floods; insect infestations; slides; volcanos; wave surges; wild fires; wind storms. Data are from The OFDA/CRED International Disaster Database (available at: www.em-dat.net) Université Catholique de Louvain, Brussels, Belgium.

The coefficient matrices, intercept terms and covariance matrices are estimated country-by-country, and subsequently, following the suggestion in Pesaran and Smith (1995), average parameters are estimated using the mean group estimator. Specifically:

$$\hat{A}_k = \frac{1}{N}\sum_{j=1}^{N}\hat{A}_{jk}, \quad k = 1,\ldots p, \tag{7}$$

$$\hat{\Omega} = \frac{1}{N}\sum_{j=1}^{N}\hat{\Omega}_j \tag{8}$$

where the hat-notation indicates estimators, and the number of countries is *N*, which may refer in this case to either the total sample, or a particular subsample of aid-dependent or non aid-dependent countries.

The mean group estimates are subsequently used to estimate average impulse response function parameters.[15] First, the mean group moving average parameters are estimated using the recursions:

$$\hat{\Phi}_h = \sum_{k=1}^{h}\hat{\Phi}_{h-k}\hat{A}_k, \quad h = 1,\ldots\infty, \tag{9}$$

starting with $\hat{\Phi}_0 = I_4$ and setting $\hat{A}_k = 0$ for $k > p$. Next the impulse response parameters are estimated by:

$$\hat{\Theta}_h = \hat{\Phi}_h\hat{P}, \tag{10}$$

Where $\hat{P}$ is a Choleski decomposition of the average covariance matrix of the innovations such that $\hat{P}\hat{P}' = \hat{\Omega}$.

We also estimate the average responses for the sum of imports and inventory investment (henceforth this is just referred to as imports). Because of the adding-up constraint, the response in the growth rate in real GDP per capita must equal the sum of the responses in the growth contributions, including imports. Hence, the responses in net imports (imports minus exports) can be estimated by:

$$\hat{\theta}_h = H\hat{\Theta}_h, \quad H = [0,-1,1,0], \tag{11}$$

when the ordering of the variables in the VAR-model is $Z_{jt} = (a_{jt}, y_{jt}, d_{jt}, x_{jt})'$.

The average impulse response functions in (10) and (11), in particular the responses to aid shocks, are the parameters of interest when we evaluate the dynamic impact of aid on the macroeconomic variables in the system in section 5.

Approximate measures of absorption and spending can also be estimated from the impulse response parameters. Absorption (over time) can be defined as the accumulated

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15 The derivations in the following only differ from the standard because we are using mean group estimators of the autoregressive parameters to estimate the impulse response function parameters. See e.g., Lütkepohl (1991) or Hamilton (1994) for text-book treatments of the standard VAR model.

change in net imports relative to the accumulated change in the aid inflow following an aid shock:

$$\text{Absorption}(s) = \sum_{h=0}^{s}\left(\frac{\delta m_{t+h}}{\delta u_{1,t}} - \frac{\delta x_{t+h}}{\delta u_{1,t}}\right) \Bigg/ \sum_{h=0}^{s}\frac{\delta a_{t+h}}{\delta u_{1,t}} = \sum_{h=0}^{s}\theta_h e_1 \Bigg/ \sum_{h=0}^{s} e_1'\Theta_h e_1, \quad s = 0,1,\ldots\infty \tag{12}$$

where $u_{1,t}$ is the shock to aid and e_i is the i-th column of I_4. Hence at any given time, s, after the aid shock we look at the fraction of aid that has been absorbed.

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

$$\text{Spending}(s) = \sum_{h=0}^{s}\frac{\delta d_{t+h}}{\delta u_{1,t}} \Bigg/ \sum_{h=0}^{s}\frac{\delta a_{t+h}}{\delta u_{1,t}} = \sum_{h=0}^{s} e_3'\Theta_h e_1 \Bigg/ \sum_{h=0}^{s} e_1'\Theta_h e_1, \quad s = 0,1,\ldots\infty. \tag{13}$$

When $s = \infty$ we get the total absorption and spending of the aid flow following a sudden increase in aid.

The Choleski decomposition implies a causal ordering of the variables in the VAR-model. As the model is based on an accounting identity there is little guidance from economic theory when it comes to specifying the causal chain. Therefore, we can only give heuristic arguments for our preferred structure.

The decision to omit imports from the VAR is the first step in the 'structural' ordering of the variables. Imports are chosen to be the omitted variable because we assume the contemporaneous causation runs from the four variables included in the model to imports. For the other variables in the model we use the following causal ordering:

$$a_{jt} \rightarrow x_{jt} \rightarrow d_{jt} \rightarrow y_{jt} \ (\rightarrow m_{jt} + r_{jt}). \tag{14}$$

Hence, we assume aid is predetermined such that innovations in aid are 'structural' aid shocks. 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. However, in the model, we assume that other aid flows are results of negotiations running prior to the actual disbursements in a given year.

The ordering within the national accounts identity is mainly governed by the observation that the countries in our sample are small open economies. Hence, we assume shocks to the growth contribution from exports 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 current events in the growth contribution from domestic demand and from the growth rate in GDP. The growth contribution from domestic demand is the third variable in the chain because this variable includes government consumption and investment and, in the model, discretionary fiscal policy changes can be considered as consumption shocks or investment shocks. Finally, the growth rate in GDP is last in the VAR ordering but, as it precedes imports and inventory investment, the goods market is assumed to be cleared by changes in the latter two variables, not by GDP.

The VAR model is mainly formulated to analyse 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. The key assumption above is that aid flows are predetermined, whereby the innovations in the aid equation can be interpreted as aid shocks to the economies in question.

4 Empirical results

In this section we present the econometric results based on the model discussed above. The focus is on the impulse response functions rather than on the autoregressive parameters, which are reported in the Appendix. And as noted above, we will present full sample results as well as results for the two subsamples.

Impulse responses to a one percentage point shock to aid are based on mean group estimates of VAR models with three lags (see Table A2 in the Appendix).[16] These estimates are shown in Figure 2 along with pointwise 95 per cent posterior probability bands.[17] The Figure shows the responses in aid, the growth contributions from domestic demand ($d = c + i$) and net imports ($m - x$), and the real growth rate in GDP.

The first thing to note in Figure 2 is that shocks to aid are followed by significantly decreased aid flows the succeeding years. This confirms the often found result that aid flows are quite volatile (Bulir and Hamann 2003; Lensink and Morrisey 2000; Pallage and Robe 2001), a situation which suggests that policymakers in the aid-receiving countries should not regard 'sudden' increases in the aid flows as permanent (Foster and Killick 2005; Heller and Gupta 2002; IMF 2005). The results in Figure 2 indicate that only about two-thirds of the initial change is a permanent change in the level of aid. As noted 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. Such a delay is consistent with Figure 2 as we find no significant changes in any of the growth contributions or in the growth rate in real GDP in the initial year of the aid shock (t=0).

The responses in the GDP growth rate are, in general, well determined. While there is no initial response, there is a fairly large response in the growth rate (a 0.37 percentage point increase) the first year after the initial shock. The first year response is followed by cyclical movements with alternating positive and negative responses, but these are all small compared to the first year response.

The responses in net imports and domestic demand are both imprecisely determined. The point estimates show negative effects on net imports in the first year after the aid shock followed by positive responses in year two and three. The positive response in the 3rd year is marginally significant and fairly large (0.23 percentage points). For domestic demand the responses are positive and relatively large (but insignificant) in the three first years following the aid shock.

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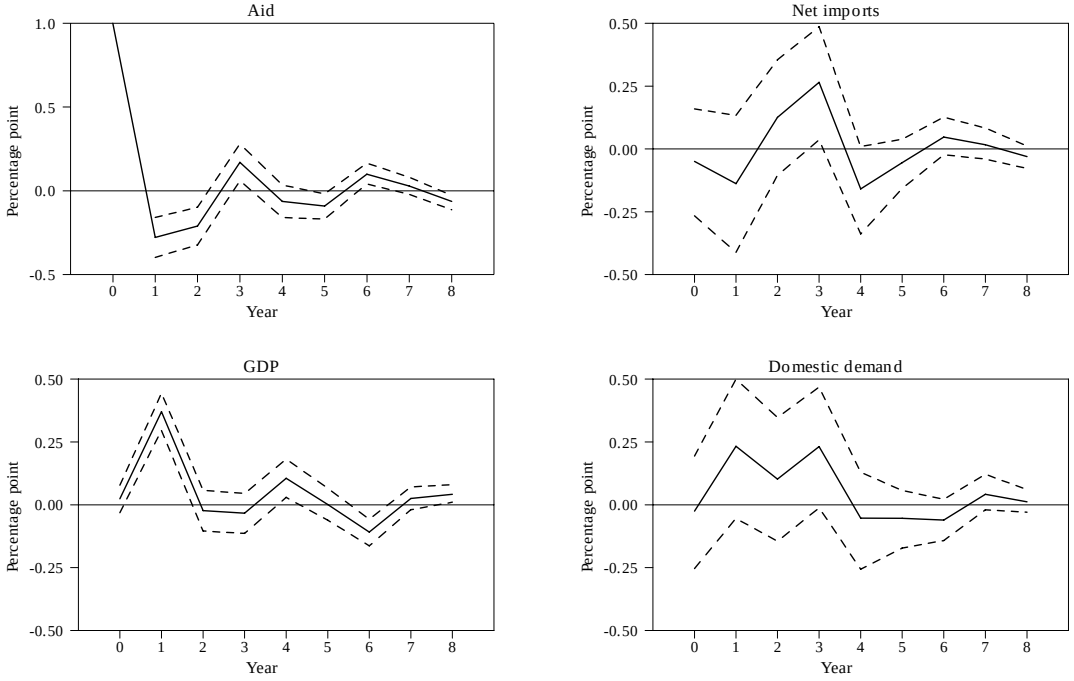
16 A one percentage point shock to aid is about four times the average value of the aid variable across all countries and periods, see Table A1. But the standard error of the aid residuals in Table A2 indicates that this is close to a one standard error shock.

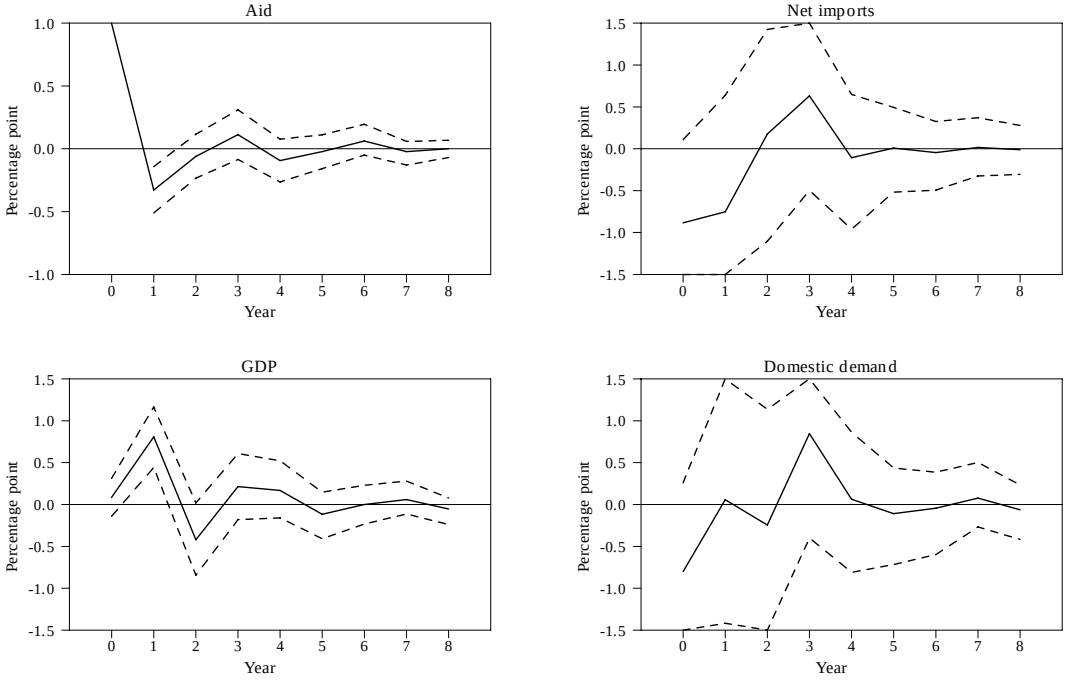
17 When reporting results for the impulse response parameters, we follow the suggestion in Sims and Zha (1999) and report approximate error bands based on a Bayesian posterior probability distribution in which we condition on the initial observations and use a flat-prior. The posterior probability distribution is estimated using Monte Carlo Integration based on 10,000 Monte Carlo draws.

Figure 2
Average responses to a one percentage point shock to aid: all countries.



Note: The dashed lines indicate 95 per cent pointwise probability bands.
Source: Compiled by the authors.

Figure 3
Average responses to a one percentage point shock to aid: 9 non aid-dependent states



Note: The dashed lines indicate 95 per cent pointwise probability bands.
Source: Compiled by the authors.

The poorly determined responses in net imports and domestic demand are a result of averaging over countries with very different aid-response profiles. Many growth studies omit oil producers and countries relying on mining industries, as well as countries with

other peculiar economic structures, such as large financial services sectors. As mentioned, our sample includes nine countries with such characteristics. In order to get a more homogenous group of countries we single out these nine countries (denoted 'non aid-dependent') while the remainder thirteen countries are gathered in another group (denoted 'aid dependent'). The idea is that the thirteen countries in the second group should have more similar aid-response profiles compared to the full sample. For the sake of completeness we report the impulse response results for both groups, even though non aid-dependent countries should not be considered as a homogenous group of countries. The regression results for the subsamples based on the aid dependence classification are reported in Tables A3 and A4 in the Appendix and the impulse response functions are given in Figures 3 and 4.

Figures 3 and 4 reveal two sets of very different responses to aid shocks for non aid-dependent and aid-dependent countries. One common response, though, is that the initial change in the aid flow is followed by a significant decrease the next year.

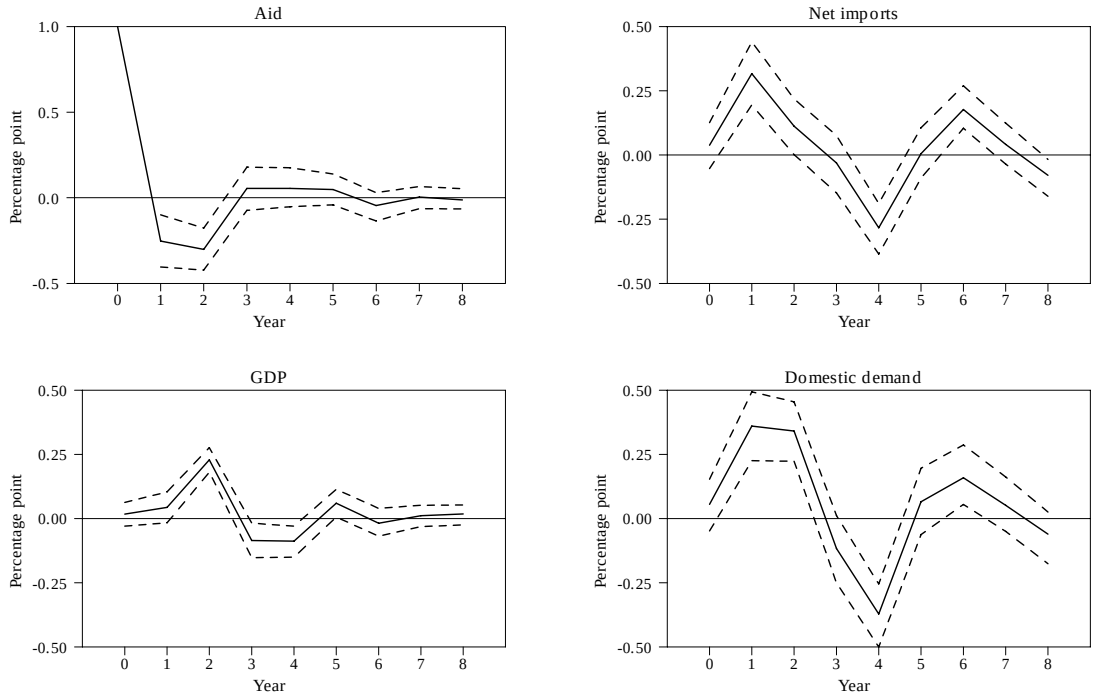
The response functions for the non aid-dependent group are fairly similar to the results for the whole sample as the responses in net imports and domestic demand are poorly determined while there is a large positive response in the growth rate the first year after the shock (Figure 3). The large negative responses in the first two years in net imports can be attributed to large positive responses in exports, which also account for the positive response in the GDP growth rate in year 1. Hence, the responses to aid shocks for this group of countries do not correspond in any systematic way to the absorption and spending framework set out in section 2.

For the thirteen aid-dependent countries, the picture is different (Figure 4). While there is no significant initial response to the aid shock, there are increases in both net imports and domestic demand in the following two years. Moreover, there is a strong cyclical pattern as the responses in the two growth contribution components turn negative in the 3rd and 4th year after the shock, subsequently reverting to positive responses later on (year 6). In general the responses in domestic demand are larger in absolute terms than the responses in net imports, leading to a positive impact on GDP growth in year 2 followed by smaller negative responses in the 3rd and 4th year. Yet, overall the short-run responses in the GDP growth rates are modest.

Next, we turn to estimates of absorption and spending, as they are defined in equations (12) and (13), i.e., absorption is the accumulated change in net imports relative to the accumulated change in aid following an aid shock, whilst spending is the accumulated change in domestic demand relative to the accumulated change in aid following an aid shock. Table 2 reports estimates of the total absorption and spending ($s = \infty$) for the different country groupings used in the impulse response analyses.

Average absorption for all 22 countries as a group is low (suggesting that the average real resource transfer is much lower than the aid transfer), while average spending is much larger than average absorption, which in principle suggests short-run demand pressures could be a problem in these economies. The results for the non aid-dependent economies are even more anomalous, with negative absorption and spending point estimates. The large standard errors in samples which include these states suggest that we should not attach too much importance to the resulting point estimates, however.

Figure 4
Average responses to a one percentage point shock to aid: 13 aid-dependent countries



Note: The dashed lines indicate 95 per cent pointwise probability bands.
Source: Compiled by the authors.

Table 2
Estimated total absorption and spending

	Absorption	Spending
All countries (22)	6.8	69.4
	(21.0)	(24.7)
Non aid-dependent states (9)	-136.8	-18.5
	(155.6)	(197.7)
Aid-dependent states (13)	51.7	81.7
	(7.7)	(9.1)

Note: Standard errors in parentheses.
Source: Compiled by the authors.

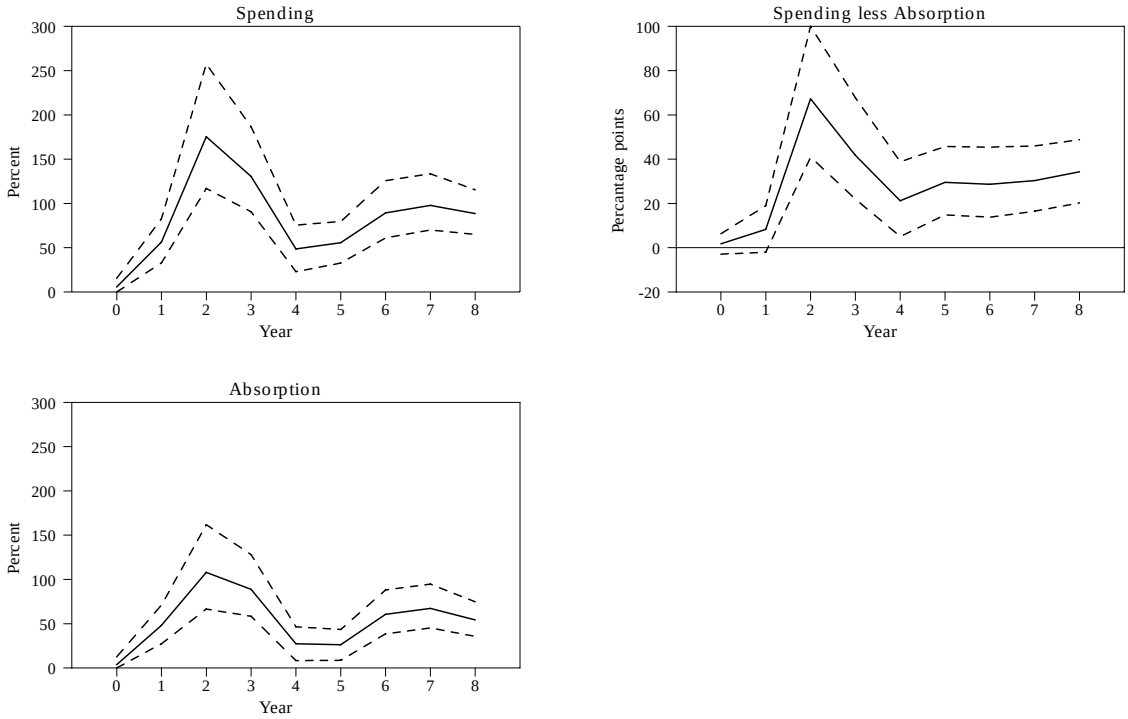
But much more encouragingly, confining the results to SDCs without significant mining and financial services sectors yields much more significant and interpretable results. For these aid-dependent states, we find that about half of the aid flow is absorbed while some 80 per cent is spent. Hence, even though there is absorption, these countries seem to break the 'golden rule' of absorption and spending. Yet, our finding of an average absorption rate around 50 per cent is much higher than was found in most of the countries examined in the 2005 IMF report and in Foster and Killick (2005). Doubtlessly these differences are due to differences in the sample of countries, the timeframes of the analyses and differences in methodology.

The impulse response functions in Figure 4 also illustrate that it is very difficult to infer the absorption and spending rates from case studies, even if all exogenous factors are

taken into account. The problem arises because the aid shock itself initiates a business-cycle kind of response, possibly caused by the excess spending relative to absorption. This means that spending and absorption vary over time. To illustrate the importance of time in the estimation of average absorption and spending behaviour, we plot the point estimates of absorption and spending as a function of time in Figure 5. While the long-run absorption of the aid shock is only 50 per cent, more than 100 per cent of the additional aid inflow is absorbed in year 2 after the shock. Likewise, in year 2 the accumulated spending is almost twice the accumulated aid flow (170 per cent). These peak responses subsequently taper off because of decreases in net imports and domestic demand and in year 8 after the initial shock, the accumulated effects are close to the long-run estimates.

These time patterns demonstrate the difficulties in quantifying absorption and spending from case studies because differences in outcomes from different cases may simply be due to differences in the timespan covered in the studies. Furthermore, the time patterns illustrate possible problems in the absorption and spending concepts because one could argue that the 3-year horizon is more relevant than the infinite horizon as the decrease in absorption from year 3 onwards could well be a result of 'mismanagement' of the additional aid flow causing a decrease in net imports and domestic demand. Further consideration of this problem is obviously beyond the scope of the present paper, but sensitivity to the timespan of the analysis is an issue that clearly deserves greater consideration in this literature, and is therefore a useful by-product of the present analysis.

Figure 5
Absorption and spending over time for 13 aid-dependent states



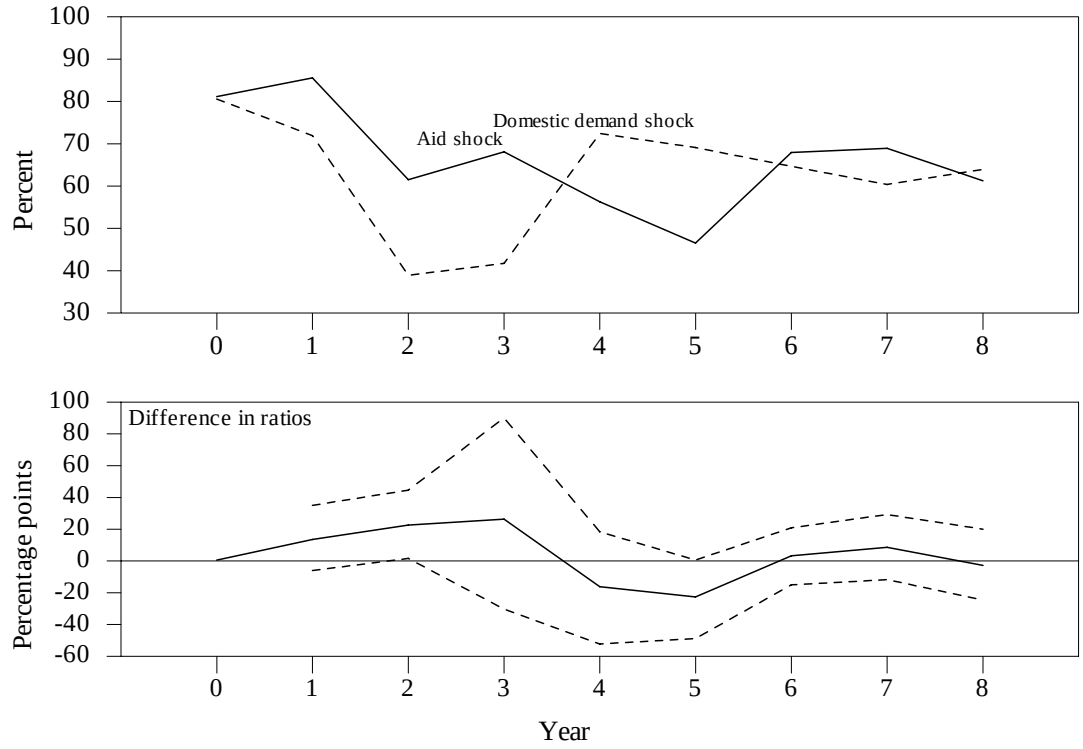
Note: The dynamic absorption and spending estimators are defined in equations (12) and (13). The dashed lines indicate 95 per cent pointwise probability bands.

Source: Compiled by the authors.

We conclude our results section by attempting to go one step further in our analysis of the macroeconomic behaviour of our aid-dependent states. One ambiguity in the results for these thirteen economies is that because these SDCs are supra-open economies, the fairly large absorption of an additional aid flow may simply be a result of very high marginal import/demand ratios and not a result of a proactive aid-absorption policy. To look into this issue further, we compare the accumulated response in net imports relative to the accumulated response in domestic demand for when the thirteen aid-dependent economies respond to an aid shock as opposed to a domestic demand shock (Figure 6).[18]

Figure 6 reveals that the short-run marginal net import-domestic demand ratio is higher when the economies respond to an aid shock as compared to a domestic demand shock for at least the first 3 years following a shock (which is probably the most important timespan to consider). Whilst not conclusive evidence given the sensitivity to the time frame of the analysis and the stochastic nature of the estimates, Figure 6 is supportive of the conclusion that the thirteen aid-dependent SDCs do pursue somewhat proactive short-run aid absorption policies.

Figure 6
Marginal ratios of net imports to domestic demand following a 1 percentage point shock to aid and to domestic demand, respectively



Note: The marginal ratios are estimated as the accumulated responses in net imports divided by the accumulated responses in domestic demand following a 1 percentage point aid shock and a 1 percentage demand shock, respectively. The dashed lines in the lower plot indicate 95 per cent pointwise probability bands.

Source: Compiled by the authors.

[18] Among other things, the domestic demand shock can be interpreted as a result of a fiscal expansion.

5 Conclusion

In this paper we developed a simple vector autoregressive model describing the short-run responses to sudden aid shocks in the national accounts growth identity components. The aim of this approach was to describe macroeconomic responses to aid shocks in a manner that was relatively unrestricted by a priori theorizing. We therefore think of this approach as an econometric complement to the recent case studies describing short-run responses to aid surges in selected African countries (Foster and Killick 2005; IMF 2005).

Whilst the novelty of our approach—as well as justified concerns over data quality—warrants considerable caution in drawing overly strong inferences from the econometric analysis presented above, our results point to some reasonably clear conclusions. First, aid flows to SDCs are indeed highly volatile and, one may infer, unpredictable. This reemphasizes the importance of 'aid smoothing' in aid-dependent countries. Second, whilst our sample of SDCs is clearly homogenous relative to other developing countries, there is fairly clear evidence that this group of SDCs has still reacted quite diversely to changes in aid flows, apparently because of diversity in their degree of aid dependency. And third, we have inferred that in the highly aid-dependent countries most aid is both absorbed and spent. Although this is a generally positive outcome—for absorption rates in these thirteen countries are high on average relative to the countries examined in previous research—these aid-dependent SDCs still appear to spend significantly more than they absorb, which may lead to short-run macroeconomic imbalances.

We have also pointed to some methodological problems in evaluating the degree to which the countries absorb and spend an increased aid inflow. In the very short run, i.e., 1 to 3 years after the initial aid shock, the aid-dependent countries, on average, absorb and spend more than the accumulated additional aid flow. This leads to reversals in net imports and domestic demand over time whereby the medium-term absorption and spending rates drop relative to the short-run rates. This implies that estimates of absorption and spending must refer explicitly to a given time horizon. This is an issue that has not yet been adequately dealt with in the existing literature, and is therefore an important methodological lesson of our research.

Finally, we have indicated a way to evaluate whether aid recipients actively seek to absorb aid flows in the short run. For the aid-dependent countries we found indications of a proactive aid absorption policy, namely higher observed marginal import-domestic demand ratios for aid shocks than for domestic demand shocks (at least, in the short run). However, further research is needed to refine this line of analysis.

As for future research, this could usefully experiment with modifications to the empirical approach adopted herein. Whilst the VAR approach is largely atheoretical, we were required to impose a priori restrictions on the causal ordering of the variables in the VAR-model without much formal theoretical guidance. Arguably the key assumption of this ordering was that aid was predetermined with respect to the other variables. This assumption can be challenged. For example, in very small economies that are highly dependent upon imports, donors may react to any factor which threatens the import capacity of the country (e.g., export shocks). 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 assumptions in this regard.

There are other aspects of our approach which can potentially be improved upon, although many of these deficiencies are common to most, if not all, macroeconomic regressions. Whilst our estimation procedure is relatively unrestrictive in that we have allowed the parameters to vary across countries, we have nevertheless assumed that they are constant over time. This assumption could be problematic if, for example, aid management has improved over time.[19] Also, the aid measure (ODA) is very noisy and this creates problems in dynamic analyses of annual data (i.e., measurement error problems). And finally, our ability to control for all the relevant factors in a macroeconomy is inherently limited, although in this respect our results are no different from other macroeconometric analyses. Indeed, even the more detailed case studies in this literature have struggled to 'isolate' aid shocks (Foster and Killick 2005).

These caveats aside, the approach formulated herein still constitutes a useful first attempt at measuring the absorption and spending responses to aid using flexible econometric techniques. And as with any new approach, the methods and the models employed can doubtlessly be improved and refined so as to provide a very useful and more formal complement to the case study type approach which has characterized the literature thus far.

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[19] Indeed, there are one or two papers in the aid effectiveness literature in which authors claim to have uncovered parameter heterogeneity across time (Headey 2007).

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Appendix I Summary statistics and mean group regression results

Appendix Table A1
Summary statistics for the countries in the econometric analysis.

	Mean	Std dev.	Minimum	Maximum
	All (22 countries, 660 observations)			
Aid	0.25	7.97	-70.46	67.65
GDP growth	3.64	7.44	-28.00	95.28
Domestic demand	5.27	19.98	-109.75	302.47
Net imports	1.86	17.70	-130.66	268.02
Exports	1.77	11.44	-80.73	123.10
Imports	3.63	22.08	-145.66	322.61
	Non aid-dependent (9 countries, 279 observations)			
Aid	-0.03	4.25	-23.48	29.36
GDP growth	3.92	9.21	-27.50	95.28
Domestic demand	6.77	28.25	-109.75	302.47
Net imports	3.46	24.99	-130.66	268.02
Exports	2.50	15.08	-62.26	123.10
Imports	5.96	30.95	-106.37	322.61
	Aid-dependent (13 countries, 381 observations)			
Aid	0.45	9.85	-70.46	67.65
GDP growth	3.44	5.81	-28.00	43.70
Domestic demand	4.16	10.27	-53.84	52.59
Net imports	0.68	9.13	-64.93	40.11
Exports	1.24	7.74	-80.73	35.52
Imports	1.92	11.75	-145.66	46.18

Note: The summary statistics are for the variables in the VAR analysis. Domestic demand, net imports, exports and imports are the growth contributions as defined in equation (2) while the aid variable is defined in equation (4). The growth contribution and the aid variables are measured as percentage points. GDP growth is per cent.

Appendix Table A2
The mean group VAR model parameter estimates for all 22 SDCs

	Aid	Exports	Domestic demand	GDP
Aid (*t*-1)	-0.289	0.050	0.220	0.370
	(6.95)	(0.33)	(1.01)	(2.41)
Aid (*t*-2)	-0.250	-0.228	0.195	0.102
	(6.23)	(1.45)	(0.91)	(0.65)
Aid (*t*-3)	(0.03)	(0.01)	(0.37)	(0.14)
	(0.79)	(0.06)	(2.11)	(1.04)
Exports (*t*-1)	0.106	-0.157	0.276	0.104
	(1.28)	(2.74)	(2.56)	(1.78)
Exports (*t*-2)	0.017	-0.162	0.148	-0.103
	(0.17)	(2.88)	(1.30)	(1.67)
Exports (*t*-3)	(0.21)	-(0.19)	-(0.19)	-(0.17)
	(2.16)	(3.56)	(1.74)	(3.08)
Domestic demand (*t*-1)	-0.237	0.009	-0.081	0.085
	(4.47)	(0.18)	(1.52)	(2.45)
Domestic demand (*t*-2)	-0.085	0.010	-0.135	0.087
	(1.62)	(0.19)	(2.26)	(2.37)
Domestic demand (*t*-3)	-0.049	-0.043	-0.341	-0.087
	(0.79)	(0.93)	(5.74)	(2.67)
GDP (*t*-1)	0.000	-0.001	-0.102	-0.094
	(0.00)	(0.01)	(0.68)	(1.48)
GDP (*t*-2)	0.171	0.142	0.149	-0.185
	1.838	1.344	0.929	2.882
GDP (*t*-3)	0.000	0.104	0.471	0.148
	0.002	1.054	3.087	2.447
Disaster	0.214	1.189	-1.027	1.020
	(0.75)	(2.28)	(1.69)	(1.93)
Disaster (*t*-1)	-1.159	-1.309	-0.547	-1.149
	(4.09)	(2.69)	(1.04)	(2.21)
Disaster (*t*-2)	0.532	-0.263	-0.083	0.433
	(1.61)	(0.47)	(0.15)	(0.70)
Constant	1.591	1.199	4.046	3.090
	(3.16)	(2.14)	(3.79)	(9.39)
Standard error	1.151	1.491	3.032	0.774
Residual correlations				
Aid	1.000	0.038	-0.010	0.036
Export	0.038	1.000	0.128	0.323
Domestic demand	-0.010	0.128	1.000	0.302
GDP	0.036	0.323	0.302	1.000
Countries/observations	22/588			

Appendix Table A3
The mean group VAR model parameter estimates for the 9 non aid-dependent states

	Aid	Exports	Domestic demand	GDP
Aid (*t*-1)	-0.371 (6.15)	0.078 (0.22)	-0.001 (0.00)	0.843 (2.38)
Aid (*t*-2)	-0.274 (4.09)	-0.521 (1.41)	-0.280 (0.57)	-0.079 (0.21)
Aid (*t*-3)	-(0.05) (0.80)	(0.09) (0.27)	(0.45) (1.15)	(0.41) (1.27)
Exports (*t*-1)	0.027 (0.82)	-0.067 (0.68)	0.374 (2.22)	0.225 (2.52)
Exports (*t*-2)	0.015 (0.47)	-0.157 (1.78)	0.334 (2.14)	0.095 (1.34)
Exports (*t*-3)	(0.02) (0.57)	-(0.14) (1.69)	-(0.08) (0.50)	-(0.13) (2.07)
Domestic demand (*t*-1)	-0.035 (1.67)	-0.015 (0.16)	0.130 (1.76)	0.162 (2.58)
Domestic demand (*t*-2)	-0.069 (2.95)	0.046 (0.48)	0.009 (0.10)	0.016 (0.25)
Domestic demand (*t*-3)	0.029 (1.21)	0.071 (0.82)	-0.315 (3.36)	-0.055 (1.06)
GDP (*t*-1)	0.015 (0.27)	0.367 (2.16)	-0.194 (0.71)	-0.143 (1.35)
GDP (*t*-2)	0.093 1.522	0.097 0.523	0.161 0.508	-0.135 1.282
GDP (*t*-3)	-0.053 0.881	-0.092 0.509	0.473 1.575	0.098 1.046
Disaster	-0.234 (0.53)	1.706 (1.47)	-0.263 (0.21)	2.100 (1.75)
Disaster (*t*-1)	0.078 (0.27)	-2.670 (2.56)	0.009 (0.01)	-1.349 (1.17)
Disaster (*t*-2)	0.097 (0.32)	-1.059 (0.84)	-0.595 (0.56)	0.436 (0.31)
Constant	0.202 (0.62)	0.617 (0.73)	3.640 (1.63)	3.044 (6.17)
Standard error	0.868	2.990	7.016	1.524
Residual correlations				
Aid	1.000	0.138	-0.099	0.048
Exports	0.138	1.000	0.078	0.388
Domestic demand	-0.099	0.078	1.000	0.287
GDP	0.048	0.388	0.287	1.000
Countries/observations	9/252			

Appendix Table A4
The mean group VAR model parameter estimates for the 13 aid-dependent states

	Aid	Exports	Domestic demand	GDP
Aid (*t*-1)	-0.233	0.031	0.373	0.043
	(4.10)	(0.33)	(2.39)	(0.49)
Aid (*t*-2)	-0.233	-0.025	0.524	0.228
	(4.70)	(0.34)	(4.09)	(3.22)
Aid (*t*-3)	(0.09)	-(0.05)	(0.32)	-(0.04)
	(1.63)	(0.63)	(2.67)	(0.64)
Exports (*t*-1)	0.161	-0.220	0.208	0.020
	(1.16)	(3.17)	(1.48)	(0.26)
Exports (*t*-2)	0.018	-0.166	0.019	-0.240
	(0.11)	(2.26)	(0.12)	(2.62)
Exports (*t*-3)	(0.35)	-(0.23)	-(0.27)	-(0.20)
	(2.11)	(3.21)	(1.82)	(2.39)
Domestic demand (*t*-1)	-0.376	0.026	-0.226	0.033
	(4.26)	(0.46)	(3.06)	(0.82)
Domestic demand (*t*-2)	-0.096	-0.016	-0.234	0.135
	(1.10)	(0.29)	(3.04)	(3.23)
Domestic demand (*t*-3)	-0.103	-0.122	-0.358	-0.110
	(0.99)	(2.42)	(4.68)	(2.61)
GDP (*t*-1)	-0.011	-0.257	-0.038	-0.061
	(0.08)	(2.18)	(0.22)	(0.77)
GDP (*t*-2)	0.224	0.173	0.140	-0.220
	1.482	1.390	0.883	2.724
GDP (*t*-3)	0.036	0.240	0.470	0.183
	(0.28)	(2.18)	(3.06)	(2.31)
Disaster	0.525	0.831	-1.555	0.272
	(1.40)	(2.30)	(2.84)	(0.82)
Disaster (*t*-1)	-2.016	-0.367	-0.931	-1.010
	(4.63)	(0.93)	(1.54)	(2.75)
Disaster (*t*-2)	0.832	0.288	0.272	0.431
	(1.60)	(0.77)	(0.46)	(1.18)
Constant	2.552	1.602	4.328	3.122
	(3.11)	(2.14)	(4.63)	(7.10)
Standard error	1.852	1.444	1.653	0.776
Residual correlations				
Aid	1.000	0.006	0.062	0.042
Exports	0.006	1.000	0.365	0.198
Domestic demand	0.062	0.365	1.000	0.433
GDP	0.042	0.198	0.433	1.000
Countries/observations	13/336			

Appendix II: Differences between SDCs and other LDCs

II.1 Existing views on the special features of SDCs

There is a large body of literature discussing the distinctive economic, biophysical, and sociopolitical characteristics of small developing countries and small island developing states (SIDS).[20] These stylized facts on SDCs, including SIDS, can be expressed as five broad features which, at least partially, distinguish them from larger developing countries.

1 *Higher standards of living, better institutions and (mostly) better policies*

The incomes of small states are generally much higher than other LDCs (Easterly and Kraay 2000),[21] but do show considerable variation. Moreover, most studies find that small developing countries perform better than other developing countries in terms of per capita output growth as well as health and education measures, albeit with some variation.

The reasons for the relatively good socioeconomic performance of SDCs are typically thought to be twofold (Read 2001). First, SDCs have apparent disadvantages which could work to their advantage in the long run. For example, SDCs have an inherent vulnerability to, and 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. Better policies may also include a greater emphasis on strategic specialization, in the manner envisaged by strategic trade theorists and institutionalists (Hausman and Rodrik 2003; Rodrik 2005).[22] The better policy and institutional environment could mean that despite their apparent diseconomies of scale, small states actually have higher productivity growth and investment levels than other LDCs (Easterly and Kraay 2000). Also, 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 favourable conditions on trade, offshore finance laws, migration and foreign aid, relative to other large LDCs.

A second explanation of the success of small states may be their greater social, ethnic and linguistic homogeneity (Kuznets 1960). Ethnolinguistic homogeneity has been shown to be a condition which fosters better policymaking, lower levels of

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20 Recent papers that systematically test for differences between small and large states include (Armstrong et al. 1998; Armstrong and Read 2002; Bertram 1993; Briguglio 1995; Collier and Dollar 1999; Easterly and Kraay 2000; Harden 1985; Kose and Prasad 2002; Milner and Westaway 1993; Ramkissoon 2002; Read 2001; Streeten 1993; UN 2002). Earlier works generally provide descriptive analysis and basic statistics (Kuznets 1960; Scitovsky 1960).

21 Easterly and Kraay find that small states have per capita incomes 40 per cent higher than other countries.

22 Similar arguments have been made about two highly successful city states, Hong Kong and Singapore, as well as other countries in precarious security positions (e.g., Taiwan, South Korea, Israel and its neighbours).

corruption and less conflict (Alesina et al. 2003; Easterly and Levine 1997). Whilst this explanation has some attraction at a general level, SDCs are not all characterized by ethnolinguistic homogeneity. Many SDCs are characterized by tribal and clan allegiances, and non-indigenous populations account for large portions of the total population in many countries. So whilst the degree of ethnic homogeneity and the quality of policies and institutions may partially explain the better than average performance of SDCs relative to larger developing countries, they probably also largely explain variation in economic performance among SDCs. Also, Easterly and Kraay (2000) find no substantial differences in the degree of ethnic heterogeneity, albeit with rather limited data.

2 *Greater openness*

Small states are generally more open (i.e., trade/GDP ratios), but demonstrate less diversity in trade structures than larger economies, partly because of a narrow resource base and sub-optimal scales of production. The largest export product in many small states accounts for over 50 per cent of total export earnings, and since much of formal production is exported, these economies are highly dependent upon imports to diversify their consumption and fund investment. Some small economies are also more open to international financial flows, and several have established themselves as offshore financial centres. Others are open in the sense that they export labour to other countries and in return receive large amounts of workers' remittances.

3 *A larger size and role of government expenditure and foreign aid*

Small states have inherently limited domestic competition, which could reduce efficiency in the non-traded sector and partially explain the large size of the government sector in these economies as the prevalence of natural monopolies may be greater than normal. Governments may also be larger because of the higher levels of foreign aid which these countries receive. And finally, the greater volatility of output may imply a greater role for government as a provider of de facto insurance. Rodrik (1998) for example, argues that this type of role explains why more open economies typically have bigger governments.

4 *Greater volatility of output*

Despite their higher average output growth, SDCs typically suffer from much higher volatility of output. Output volatility is chiefly related to four factors. First, volatility may result from their lack of diversification in the goods market, most of which is exported, and therefore subject to the vagaries of international export prices. Second, many small states, and islands states in particular, are highly vulnerable in an environmental sense. Chiefly they suffer from biophysical shocks such as cyclones/hurricanes, tsunamis, volcanic eruptions, earthquakes, but also from droughts, floods and mudslides. Third, it is sometimes claimed that small economies have insufficient international financial links by which to buffer shocks through insurance and hedging. Easterly and Kraay (2000) find that restrictions of capital inflows are unusually high in microstates, although raw measures of capital inflows are actually somewhat larger than average. Thus financial underdevelopment could potentially be viewed as a secondary cause of greater output volatility in SDCs.

A third factor is the tendency in these economies to adopt fixed rather than floating exchange rates. In general there is little competition in foreign exchange markets and

the banking sector, and many SDCs have close links to larger economies who constitute a primary source of export earnings. This implies that there are some clear benefits to eliminating nominal exchange rate volatility through pegging the national currency to a major foreign currency (or set of currencies), but nominal stability comes at the cost of a loss of independent monetary policy by which to smooth real shocks. Potentially a fourth factor contributing to greater volatility is the alleged procyclical distribution of aid flows, which are a major source of financing in SDCs.

5 *Large and special geographical disadvantages*

In addition to their aforementioned vulnerability to natural disasters and their narrow natural resource base, SDCs may suffer from a range of other geographical disadvantages. Pacific, Indian Ocean and African islands are isolated from major economic (OECD) centres. Other islands, such as Kiribati, are archipelagic in nature, so that their citizens are effectively isolated from each other. Isolation can greatly increase transport costs, create information asymmetries and significantly increase the costs of tax collection, which leads some small islands to generate tax revenue through second best instruments, such as taxes on imports. Moreover, many islands are highly mountainous, making farming difficult, lowering land productivity, and increasing the potential for land degradation (FAO 1990). Almost all islands are tropical, and thereby prone to tropical diseases which can decrease labour productivity, increase morbidity and mortality rates, and cause a range of other problems (Gallup, Sachs and Mellinger 1999).

II.2 Re-examining the differences between SDCs and 'large' LDCs

Table B1 examines a range of development factors across several categories which directly or indirectly incorporate the five stylized differences discussed above. We have separated countries into five categories. The first three categories break up small states (less than one million people in 1980) into micro island states (countries with less than 100,000 people in 1980), small island states and small non-island states. The last two categories compare all small states (the sum of the first three categories) to all large LDCs. For each category we report the sample mean of the factor in question, although we report medians in one or two instances where the median is very different to the mean. Also, we perform z-tests in which we formally compare the mean in each small state category to the large LDC mean. Asterixes indicate significance in these two-tailed tests at the 10 per cent level. All variables are measured as averages over the years 1970 to 2003, data permitting.

1 *Levels of living, policies, and institutions* (*including conflict*)

Income per capita (in constant US dollars) is substantially higher in island states compared to small non-island states and other LDCs. Infrastructure levels are also generally much higher for island states (especially micro island states) than for small non-island states and other LDCs. Island states have much higher life expectancies and literacy rates than other small states and other LDCs. Rural population densities are also significantly higher than other LDCs for island states, but only marginally higher for small non-island states.

In terms of polices, micro island states and island states have less distorted exchange rate regimes, in the sense that black market exchange rates do not diverge from

formal rates. Inflation (GDP deflator) is generally lower in island states than in other LDCs (about half as much, but with some variation), but inflation in small non-island states is just as high as in other LDCs. Real interest rate volatility does not significantly vary across groups. Tax revenue data are virtually unavailable for micro island states and small non-island states, but what data there are suggest that small island states actually have significantly higher revenue collection than other LDCs. This somewhat surprising result is probably a result of sample selection bias, as the data availability is likely to be positively correlated with the importance of the revenue in the government budget. Hence, we are reluctant to make strong conclusions based on the result. There are also insufficient data to comment on fiscal balances, although some authors have point to this as a problem in the Pacific region.

In terms of financial development, island states have about twice as much private credit and bank credit provision (relative to GDP) compared to non-island small states and other LDCs. This seems contrary to the widely held view that small states are insufficiently developed financially, although there may be two reasons why this is the case. First, these means may reflect the fact that some small states have developed successful offshore financial centres. And second, financial development is intimately linked to trade, see Headey (2006) for a review.

In terms of institutions, we use ethnic, linguistic and religious diversity data updated by (Alesina et al. 2003). These data significantly expand the coverage of these measures, which were briefly considered by Easterly and Kraay (2000), who conclude that ethnic homogeneity is not greater in the limited set of small states for which such data existed. With the updated data we find that island states have about half as much ethnolinguistic diversity as other LDCs, but the same degree of religious diversity, whereas there are no substantial differences for non-island small states and large LDCs. Finally, island states are less prone to antigovernment demonstrations, riots, assassinations and coups (as captured in the index of political instability) and guerrilla warfare than other LDCs and non-island small states.

2 *Economic structure* (*openness, government expenditure and aid*)

The small states have somewhat larger consumption to GDP ratios than other LDCs, essentially because of larger government consumption to GDP ratios (about twice as high, on average). Island states also have higher investment ratios, whereas the differences for small non-island states are more marginal. Trade ratios are also larger than other LDCs, and within the SDC they are larger for island states than non-island states. Tourism is much more important in island states in general than in non-island small states and other LDCs. Foreign aid to GDP ratios are equally high among the groups of small states, and all small states have significantly higher levels of foreign aid relative other LDCs. All of these findings are well in keeping with existing beliefs on differences in economic structure according to size.

3 *Volatility*

Volatility in GDP per capita growth is highest for non-island small states (some of whom are oil producers), and slightly higher for micro island states than for other islands. Small states as a whole have more volatile GDP than other LDCs, but not by a great margin (and this is true even after excluding two highly volatile, war-torn African countries, Liberia and Rwanda). However, small states have less volatile exports (as measured by the coefficient of variation of exports in constant US

dollars). Micro island states and small island states, however, have higher natural disaster incidences than other LDCs, but the difference is not statistically significant. Island states also have higher rainfall volatility (measured by the coefficient of variation of yearly rainfall). These findings are more or less in accord with existing beliefs on small states, although we are surprised not to find greater volatility in exports, or larger differences in the incidence of natural disasters.

II.3 Summarizing the special features of SDCs

At a general level we find substantial differences between our sample of small states and large states in most of the 'factors of development'. However, not all of the findings are intuitive or in accordance with a priori expectations and the existing literature on small states. In particular, we find that small states tend to have higher levels of financial development, much greater ethnolinguistic homogeneity, and less export volatility than other LDCs. In other areas findings are more in accordance with existing beliefs about these countries: higher consumption and investment levels, larger governments and foreign receipts, much higher levels of living, more open economies, and generally more peaceful societies with more stable governments. Another important point is that we often, but not always, find substantial differences between island states and small non-island states, but rarely if ever do we note significant differences between micro island states and other island states.

Appendix Table B1
Comparing development factors across small and large states

		Small state categories									
		'Micro' islands		Other islands		Non-islands		All small states		'Large' LDCs	
Type of factor	Factor indicator	Avg.	Obs	Avg.	Obs	Avg.	Obs	Avg.	Obs	Avg.	Obs
Political Instability	Ethnic heterogeneity	0.17*	6	0.24*	12	0.62	9	0.40	21	0.53	84
	Political instability index	0.04*	7	0.05*	15	0.06*	9	0.05*	24	0.30	87
	Guerrilla warfare	0.01*	7	0.01*	15	0.04*	9	0.02*	24	0.29	87
Policies	Exchange rate distortions	4.1	6	4.5	14	32.7	9	15.5	23	24.1	86
	Inflation#	9.2	8	6.1	16	10.9	9	6.9	25	10.8	88
	Real interest rate volatility	6.2	7	6.8	15	3.0	9	5.4	24	6.2	80
	Tax revenue (%GDP)*	23.5*	3	20.9*	7	19.3*	2	20.6*	9	14.4	65
	Private credit supply (%GDP)*	38.3*	7	31.7	15	22.9	9	28.4	24	26.3	85
Economic structure	Investment (%GDP)*	31.6*	8	29.0*	15	25.0	9	27.5*	24	20.8	87
	Govt. consumption (%GDP)	24.5*	8	22.1*	15	22.4*	9	22.2*	24	14.3	85
	ODA (%GDP)	20.4*	8	18.0*	16	18.3*	9	18.1*	25	7.2	87
	Trade (%GDP)	77.5*	8	74.2*	16	80.1*	9	76.3*	25	54.6	86
	Tourism receipts (%exports)	6.5*	2	8.9*	9	6.5	8	7.8*	17	6.0	65
Level of living	Rural pop. Density	1834*	8	1473*	16	1365	9	1434*	25	375	87
	Telephone lines per 1000 people*	135.7*	8	93.9*	16	24.7	9	69.0*	25	41.3	88
	Aircraft departures per capita	0.23	5	0.10	13	0.01	6	0.07	19	0.01	79
	Life expectancy*	68.8*	8	66.7*	16	53.0	9	61.8*	25	57.1	88
	Adult literacy*	95.4*	2	87.0*	8	74.8	4	82.9*	12	70.6	80
	GDP per capita (US$)#	3118	8	2522*	16	1659*	9	2212*	25	1322	80
Volatility	Growth volatility	5.3	8	4.9	16	7.6*	8	5.8	24	4.6	72
	Natural disaster incidence	3.1	8	2.8	16-	2.4	9	2.7	25	2.4	88
	Rainfall volatility	0.19#	5	0.15	12	0.16	9	0.16	21	0.14	88
	Export volatility	0.32*	7	0.33*	15	0.46	8	0.38*	23	0.51	82

Notes: See the Appendix for full definitions of variables. * indicates that the mean for this group was significantly different at the 10% level to the mean for the 'large LDCs' category, using a two-tailed z-test. # indicates that the median was reported if it was substantially different from the mean.

Source: Compiled by the authors.