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Aid and Growth in Sub-Saharan Africa

Accounting for Transmission Mechanisms

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Abstract

This paper is a contribution to the literature on aid and growth. Despite an extensive empirical literature in this area, existing studies have not addressed directly the mechanisms via which aid should affect growth. We identify investment as the most significant transmission mechanism, and also consider effects through financing imports and government consumption spending. With the use of residual generated regressors, we achieve a measure of the total effect of aid on growth, accounting for the effect via investment. Pooled panel results for a sample of 25 Sub-Saharan African countries over the period 1970 to 1997 point to a significant positive effect of foreign aid on growth, *ceteris paribus*. On average, each one percentage point increase in the aid/GNP ratio contributes one-quarter of one percentage point to the growth rate. Africa's poor growth record should not therefore be attributed to aid ineffectiveness.

Keywords: aid effectiveness, aid, growth, Sub-Saharan Africa

JEL classification: F35, O40, O55

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1 Introduction

A fundamental argument for aid, at least on economic grounds, is that it contributes to economic growth in recipient countries. To many observers, Sub-Saharan Africa (SSA) represents a challenge to this argument: the region has been a major recipient of aid for decades, yet has exhibited very poor economic growth performance over that period. A variety of factors have contributed to poor performance in SSA, including a lack of political will to push through major reforms (e.g., improving governance, tackling corruption, land reform) and a lack of resources for financing investment (Commission for Africa 2005, especially Chapter 7). Nevertheless, the Commission for Africa (2005) argues for a substantial increase in resources for SSA, especially to finance needed investment, estimated as requiring an additional US$25 billion per annum in aid to Africa to be achieved by 2010, with a further US$25 billion per annum increase by 2015. Would increased aid improve growth in SSA? This paper contributes to an answer by assessing the effectiveness of aid to SSA, specifically accounting for the impact on growth via investment. We argue that aid has been growth-promoting but may not have been sufficient to overcome the many growth-retarding factors faced by SSA. This suggests that an increase in aid, properly deployed, could be beneficial.

In recent years many papers in the 'cross-country growth' tradition have tested the hypothesis that aid has a positive impact on growth. Burnside and Dollar (2000) stimulated the recent literature. They find that when other determinants of growth are controlled for, especially an indicator of economic policy, aid has no independent effect. Aid makes a positive contribution to growth only in those countries with high values for the policy indicator; if policy is poor, aid is ineffective. This result is explained by the tendency of recipients, especially if they have poor policies, to divert aid to government consumption spending rather than using it to finance growth-promoting investment (Burnside and Dollar 2000: 863). Hansen and Tarp (2001) and Dalgaard, Hansen and Tarp (2004) differ: using essentially the same data for the same sample, but with different specifications and estimators, they find that aid does have a positive effect on growth and this result is not conditional on policy. In a comprehensive review and re-estimation of the many contributions to this literature, Roodman (2004) concludes that the results tend not to be robust, especially the result that the effectiveness of aid is conditional on policy. In particular, whereas studies following essentially the Burnside-Dollar specification tend to find that aid is ineffective, studies using alternative specifications tend to find that aid is effective. Unsurprisingly, in a cross-country context, specification seems to matter. However, other than including aid as an explanatory variable in the growth regression, these studies do not attempt to specify and test the mechanism by which aid impacts on growth. The major contribution of this paper is to specify mechanisms through which aid can impact on growth.

This paper differs from most of the previous literature in two other respects. We restrict our analysis to a sample of SSA countries only. There is considerable evidence in the empirical growth literature that SSA countries are different. It is generally the case that in cross-country growth regressions an 'Africa' dummy is negative and significant. 'Africa's slow growth is thus partly explicable in terms of particular variables that are globally important for the growth process but are low in Africa' (Collier and Gunning 1999: 65). If the region is demonstrably different from other regions, it is legitimate to sample the region only. We also use a different measure of aid than previous studies, excluding types of aid that are unlikely to have any medium-term impact on growth (e.g., technical assistance). Clemens, Radelet and Bhavnani (2004) use similar measures

of aid to this study, and interpret these as capturing the short-term impact of aid on growth. They find that aid has a significant positive short-term impact, this effect is largely independent of policy and is present in SSA and developing countries overall.

This paper is specifically concerned with the treatment of investment; how sensitive are results to the treatment of investment in the aid-growth equation? Empirical growth studies are based on reduced form specifications and aid-growth regressions typically omit investment. Burnside and Dollar (2000) argue that aid adds to investment whereas policy determines the productivity of investment and therefore include an 'aid×policy' interaction term but exclude investment. Similarly, Roodman (2004) does not include investment in any of the regressions. Hansen and Tarp (2001) acknowledge that the implicit growth theory will have investment, not aid, as an argument. They present some results including aid and investment. In general, aid is not significant in these regressions, but they do find that aid is a significant determinant of investment.

This represents a deficiency in the existing aid effectiveness literature. Aid is intended to affect growth via its effect on investment. However, not all aid is intended for investment, and not all investment is financed by aid. Indeed, Dollar and Easterly (1999) argue that there is no evident association between aid and investment in a sample of SSA countries, although they only report summary results from a simple bivariate regression of gross investment on aid (our more complete specification identifies an effect of aid on investment, see Appendix B). If one adopts the approach of omitting investment, there is potential omitted variable bias—any effect of investment on growth is attributed to the other variables (especially aid). If one includes aid *and* investment, there is double counting (as some aid is used for investment), and the coefficients are biased. We propose the technique of generated regressors to address this problem.

The basic argument of this paper is that central variables in the growth equation are directly, at least in part, financed by aid and this inherent interrelationship should be addressed in the empirical analysis. Whilst one could estimate a set of simultaneous equations, this is very demanding of the data. We propose a more parsimonious approach. First, we test whether aid is a direct determinant of the variable in question (what we term the transmission mechanism). If so, the second step is to remove the direct influence of aid by constructing a generated regressor for the variable. In this way, we can estimate the effect of aid on growth accounting for the effect of aid on mediating variables—investment, imports and government consumption spending are the variables considered here. Our aim is not to explain the transmission mechanisms but simply to determine if aid is a significant factor, hence these supplementary regressions are reported in an appendix.

The analysis is conducted for a sample of 25 SSA countries over the period 1970-97 (the sample comprises all countries for which data on all variables was available for the full period). These SSA countries tend to be major aid recipients. Despite large aid inflows, they experienced on average only 0.6 per cent growth in real per capita GDP per annum over the period 1970 to 1997, and only six of our sample managed to 'upgrade' to the group of middle-income countries.[1] *A priori*, this may appear to be a

[1] Botswana, Gabon, Mauritius, Seychelles, South Africa and Swaziland according to the World Bank classification.

case of aid ineffectiveness. If aid has been generally misused and ineffective, we should find evidence of this in a sample comprising SSA countries.

Whilst our specific focus is on the treatment of aid and investment, it is clear from the aid effectiveness literature that any effect of aid on growth is indirect. Section 2 presents a brief discussion of the various factors that mediate the effect of aid on growth, what we refer to as the transmission mechanisms. In addition to investment, aid may affect growth via effects on government spending or imports. The data used and econometric methods are discussed in section 3 (with further details in Gomanee, Girma and Morrissey 2002); Appendix A provides information on the data, and Appendix B reports the supplementary regressions for transmission mechanisms. Section 4 presents the empirical results for aid effectiveness and discusses the implications. Section 5 concludes with some final observations.

2 Transmission mechanisms

Although there have been major advances in growth theory, the conceptual underpinning of the link between aid and growth remains rooted (implicitly if not explicitly) in the two-gap model pioneered by Chenery and Strout (1966). The analytical framework is grounded in a Harrod-Domar growth model where savings are needed to fund the investment required to attain a target growth rate, conditional on the productivity of capital. Easterly (1999) has provided a strong critique of gap models as a basis for a theory of growth, and specifically of their use by multilateral agencies to guide aid allocation as filling financing gaps. Nevertheless, the gap approach is useful in identifying *how* aid may affect growth by relaxing specific constraints. Bacha (1990) identifies three such constraints: the limit on investment due to low domestic savings, the limited ability to import investment goods if export earnings are low, and fiscal constraints on investment. By relaxing these constraints aid can affect growth via increased investment.

Poor countries lack sufficient domestic resources to finance investment and the foreign exchange to import capital goods and technology. Aid to finance investment can directly fill the savings-investment gap and, as it is in the form of hard currency, aid can indirectly fill the foreign exchange gap. As official aid is issued to government, it can also fund government spending and compensate for a small domestic taxbase. Bacha (1990) demonstrates that government fiscal behaviour represents an important channel through which aid flows can influence growth. Recent studies also highlight the potential importance of government policy as a determinant of the effects of aid.

A proper framework to study how aid works should address all of these interactions. The analysis here focuses on the effect of aid on growth taking into account the transmission mechanisms of investment, trade (imports) and fiscal behaviour (government consumption spending). If aid finances investment then, conditional on the productivity of investment (which may of course be related to policy), aid contributes to growth. Low-income countries will need to import capital goods and intermediate inputs (and in most cases fuel), but export earnings are often low and volatile. Aid can finance necessary imports, specifically investment goods, so this is a potential transmission mechanism. If aid is treated as fungible, so that funds intended for investment are diverted to recurrent expenditures, its effectiveness could be reduced. This is addressed

by considering government consumption as a (constraining) transmission mechanism. Note, however, that this implies that the objective of aid is to finance investment. If aid is intended to finance spending on welfare and human capital formation, we would expect some to go to consumption spending and not impact on growth, at least not in the short term.[2] The basic approach is to identify if aid determines the transmission variables. If it does, this effect is accounted for in estimating the aid-growth relationship.

There are two reasons why we do not pursue the transmission mechanism via government policy in this paper. First, the conventional view, at least in the context of cross-country growth regressions, is that it is difficult to establish that aid affects policy (Burnside and Dollar 2000; World Bank 1998). In simple terms, the nature of this transmission mechanism and how to model it is not well understood. We would therefore expect this mechanism to be weak in cross-country regressions.[3] Second, recent work on aid effectiveness incorporates policy indicators as control variables, and we do this rather than include an aid×policy term. Thus, in order to focus on specific transmission mechanisms, we account for policy indicators but do not specifically account for aid-policy interactions.

Another issue we do not incorporate is the tendency for SSA countries to be subject to political and economic instability. Relative to other regions, SSA is especially susceptible to climatic and agricultural risk and especially vulnerable to terms of trade shocks, famines, political conflict, droughts and, more recently, floods. Guillaumont, Guillaumont-Jeanney and Brun (1999) find that SSA has higher levels of primary instabilities (political, climatic and terms of trade) than other developing-country regions. Such vulnerability is a source of 'economic uncertainty' that may reduce growth rates and help to explain aid ineffectiveness. Lensink and Morrissey (2000) use aid instability, deviations of aid from a trend incorporating adaptive expectations, as a measure of uncertainty. They find that when one controls for such uncertainty in the aid-growth regression, the coefficient on aid is positive and significant whereas the coefficient on the aid instability measure is negative and significant. This result holds for the sample of SSA countries. They also find that the principal (positive) impact of aid is via its impact on investment, a result corroborated by Hansen and Tarp (2001).

There is related evidence for the importance of instability or uncertainty in SSA. Gyimah-Brempong and Traynor (1999) find that political instability has a direct negative effect on growth and also an indirect effect via discouraging investment. Guillaumont, Guillaumont-Jeanney and Brun (1999) find that primary instabilities in SSA reduce growth by distorting economic policy; the rate of investment is volatile, hence the growth rate is lowered. As discussed in the next section, by including policy indicators (notably inflation), a political variable and investment in our specification we hope to pick up some of these effects. We can also try to account for these omitted

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2 Observing that aid-financed consumption does not contribute to growth does not mean that the aid provides no benefits. Gomanee, Girma and Morrissey (2005) show that aid can improve welfare indicators, such as infant mortality, by financing consumption spending on social sectors (health, education and sanitation).

3 The point is that the way in which aid affects policy is complex and will depend on specific, often unmeasurable, features of the recipient (see Morrissey 2004). Furthermore, aid may affect some policies and not others, and may affect policies over varying time spans (often of five and more years). This is a complex research topic in its own right, beyond the scope of this paper.

variable effects in the estimation (testing between fixed and random effects estimators and using robust regressions). Nevertheless, our specification is likely to omit some factors that explain the poor growth performance in SSA countries.

The specific aim of this paper is to account for the transmission mechanism of aid on growth via investment. Although we concentrate on a sample of SSA countries, we want to relate the results to the recent contributions on aid effectiveness (Burnside and Dollar 2000; Hansen and Tarp 2001; Roodman 2004). Consequently, we choose a specification close in spirit to that used in these studies. As our intention is to assess the sensitivity of results to alternative treatments of the aid-investment link, we deviate from those studies in omitting the aid-policy interaction term. It is well known that there are many variables that might be significant in cross-country growth regressions, but degrees of freedom considerations and data constraints require choices to be made. The data used here and the estimation techniques are discussed in the next section.

3 Data and estimation issues

Estimation is conducted in a panel of seven four-year periods over 1970-97. Our dependent variable (*GROWTH*) is (period) growth of real per capita GDP (data definitions and sources are provided in Appendix A). Real GDP per capita in the year preceding the period (*GDP0*) is included to capture initial country specific effects.[4] The percentage of population aged 15 or above who have completed primary education (*PRIC15*) and investment as a share of GDP (*INV*) are included as indicators of (additions to) human and physical capital. We use two measures of aid, both expressed as a percentage of GNP and taken from OECD (1999).[5] The first is simply the total of grant aid (*GRANTS*) while total aid (*TAID*) is net ODA excluding food aid (which does not directly affect growth),[6] emergency relief and technical cooperation (which might influence growth but with a long time lag). In rough terms, *TAID* corresponds to net grants and loans (the original source does not identify net loans separately). Squared aid terms (*GRANTSQ* and *TAIDSQ*) are included to account for diminishing returns, in line with most studies of aid effectiveness that posit a non-linear relationship (e.g., Lensink and White 2001).

We include a number of indicators of political and economic policy features of the countries. Alesina *et al.* (1992) construct a democracy index *DEM* taking values

4 Many studies, such as Burnside and Dollar (2000), use *lnGDP0* rather than *GDP0*, essentially as the log specification is a test for convergence. As our sample is restricted to SSA and initial GDP is used to control for initial country conditions rather than to test for convergence, we use *GDP0*. The transformation *GDP0* to *lnGDP0* reduces the variance of the series. We did include *lnGDP0* in the regressions and the results are similar although significance levels on all variables are reduced.

5 Although other variables are expressed relative to GDP, aid is expressed relative to GNP for consistency with the source: OECD (1999) also reports GNP (but not GDP). This may affect the size of estimated coefficients on aid, but is unlikely to alter sign or significance. Roodman (2004: Table 3) shows that different measures of aid tend to be highly correlated, although he does not include our measure.

6 As a referee observed, insofar as food aid is delivered as food that the government can sell, it provides revenue that may be used for investment. Nevertheless, we exclude food aid because (i) the donor value reported need not be a good indicator of the value to the recipient, and (ii) any disincentive effects on domestic producers would have an adverse impact.

between 1 and 3 based on information on electoral systems.[7] Higher values indicate weaker political rights. Three policy variables are included: the inflation rate (*INFL*), government consumption as a share of GDP (*GCON*) and imports as a percentage of GDP (*MGDP*) as an indicator of openness.[8] The latter two variables also represent potential transmission mechanisms. As we report and discuss later, however, the effect of aid is not mediated by these variables. Hence in the regressions, all three can be interpreted as policy indicators.

The base specification in general terms is therefore (suppressing country and time subscripts, and designating the error term as *U*):

$$g = \boldsymbol{\beta}_C'\mathbf{c} + \beta_A A + \boldsymbol{\beta}_E'\mathbf{e} + \boldsymbol{\beta}_P'\mathbf{p} + U \quad (1)$$

The dependent variable is growth (*g*) and the measure of aid is designated by *A*. There are three vectors of other variables. The vector of conditioning variables (**c**) includes initial income, investment and human capital. The economic policy indicators (**e**) are inflation, government consumption and the import/GDP ratio. The political indicator (**p**) is democracy.

Two core issues that characterize any empirical study based on panel data are endogeneity and country-specific effects. The former relates to problems which arise from the time series dimension while the latter results from observing several countries together. We consider each briefly before discussing the generated regressor technique employed in the analysis.

A critical assumption of OLS is that there is zero correlation between the error term and any explanatory variable. If this is violated, the latter is endogenous and OLS estimates will not be consistent. The standard instrumental variables (IV) solution is to perform a two-stage procedure whereby instruments are used for the endogenous variable, and it is generally the case that results using IV techniques are sensitive to the choice of instruments. We use the Hausman test to investigate whether investment and aid terms are endogenous. This involves comparing the results of OLS and IV regressions (using the Sargan test for the validity of instruments). The test strongly fails to reject the null hypothesis that regressors and error term are uncorrelated. Consequently, in our sample, we find no evidence of the need to use instruments. Furthermore, we test and reject the need to use fixed effects estimators (econometric details are in Gomanee, Girma and Morrissey 2002).[9] We report results using lagged aid, on the basis that aid via investment will take time to impact on growth, and this can be interpreted as an instrument (in the spirit of Hansen and Tarp).

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7 This takes the value 1 for democratic regimes (countries with free competitive general elections with more than one party running), 2 for mixed democratic and authoritarian features (countries with some form of elections but with severe limits in the competitiveness of such ballots) and 3 for authoritarian regimes (countries in which their leaders are not elected).

8 The difficulty of measuring openness is recognized in the literature. This measure is chosen as it also reflects a transmission mechanism.

9 A popular solution to the problem of fixed effects is to remove the effects by first differencing and then use an instrumental variable technique such as GMM. However, first differencing reduces the sample size and reduces the variation and covariation in the data (Gomanee, Girma and Morrissey 2002). One reason why fixed effects may not be so important is that our sample comprises SSA countries only (and we use robust regression to account for outliers).

Another problem frequently encountered in estimation relates to outliers, values of the dependent variable that are unusual, given the values of the explanatory variables (response outliers), or unusual values of an explanatory variable (design outliers). The inclusion or exclusion of outliers, especially if the sample size is small, can substantially alter the results of regression analysis. If useful generalizations are to be drawn, it becomes important to ensure that the results reflect what is going on in the majority of the sample rather than being driven by a few outlying observations only.

In the empirical literature, various approaches have been used to address the issue of outliers. In some cases, the regression model is re-estimated iteratively omitting one observation at a time with the aim of identifying that which exerts a significant influence on the set of estimates. In other cases, observations with high residuals are excluded from the sample. Both procedures can be seen as part of a sensitivity analysis after the main results have been obtained. It is also quite common to omit data points with extreme values of the explanatory variables. We have here chosen an alternative method—robust regression (Rousseeuw and Leroy 1987), detailed in Gomanee, Girma and Morrissey (2002). The advantage with the robust estimation procedure is that it minimizes the influence of outlying observations on the estimated equation rather than omitting them altogether from an already small sample of which they are part.

Another inherent problem in panel growth regressions is that one is observing a relationship across countries, hence there is potential heterogeneity. SSA countries are similar to each other in respect to some structural characteristics, relating mainly to their stage of economic and political development and climatic conditions. However, they comprise a heterogeneous group of countries in terms of size, population, level of GDP, institutional arrangements, resource endowments and so on. While we try to control for many of these variables (and robust estimation accounts for some of the problems), we cannot discount the possibility of country-specific effects due to omitted variables (although the test for fixed effects does not suggest that this is a problem).

Residual generated regressors

It has become common practice to estimate regression equations in which constructed variables appear. The most popular method to generate regressors is to use predicted values or residuals from a supplementary regression (indeed, IV is an example of the former). Given the prevalence of such models, Pagan (1984) presents 'a fairly complete treatment' of the econometric issues underlying regressions with generated variables. As this is the method we use to incorporate transmission mechanisms, a brief discussion is in order. Formally, the approach is a special case of the following general model (in matrix form):

$$\mathbf{Y} = \mu\, \mathbf{X^*} + \gamma(\mathbf{X}-\mathbf{X^*}) + \mathbf{U} \qquad (2a)$$

$$\mathbf{X} = \mathbf{X^*} + \eta = \omega\mathbf{Z} + \eta \qquad (2b)$$

The expression (**X-X***) represents that part of **X** which is explained by factors other than **Z**. Equation 2b estimates the relationship between **Z** and **X** such that ω gives a measure of the strength of the link that exists between them. Pagan (1984) shows that the two-step procedure, of estimating (2b) and using the results in (2a), gives asymptotically

efficient estimates and the correct values for the standard errors. We construct the generated regressor using only the residuals from a supplementary equation. This implies that OLS gives us the correct estimates of variance as well as efficient coefficient estimates. This conclusion is independent of whether (2a) includes additional regressors or/and the latter appear in the matrix **Z**—in our case, aid appears in (2b). Hence, the use of residuals does not invalidate the inferences made and coefficient estimates are efficient.

We construct the variable representing that part of investment that is not attributed to aid (*INVRES*) using residuals from an aid-investment bivariate regression (capturing the transmission from aid to investment). *INVRES* is the estimate of κ_1 from the regression $INV = \kappa_1 + \kappa_2 AID$. We then substitute *INVRES* for *INV* in the growth regression. It is worth noting that this transformation affects only the estimated coefficient on the aid variables. This can easily be demonstrated in general terms. Suppose the initial regression is:

$$g = \beta_1 X + \beta_2 A + \boldsymbol{\beta}_Z' \mathbf{z} + U \tag{3a}$$

where **z** is the vector of other variables, substituting $X = \kappa_1 + \kappa_2 A$:

$$g = \beta_1(X - \kappa_2 A) + \beta_1(\kappa_2 A) + \beta_2 A + \boldsymbol{\beta}_Z' \mathbf{z} + U \tag{3b}$$

or

$$g = \beta_1 \kappa_1 + (\beta_1 \kappa_2 + \beta_2)A + \boldsymbol{\beta}_Z' \mathbf{z} + U \tag{3c}$$

Thus, it is clear that only the coefficient on the aid variable is altered. In cases where the 'transmission' variable (X) has a positive effect on growth, and aid has a positive effect on the variable, this method will provide for a larger coefficient on aid. If the variable has a negative effect on growth, and aid is a positive determinant of the variable, the coefficient on aid is reduced. If it transpires that aid is not a determinant of the variable, there is no effect and the method is not used.

4 Results and discussion

As discussed above, three potential transmission variables are included (*INV*, *GCON* and *MGDP*). We first test if these are indeed transmission mechanisms for the effect of aid, and the results are reported in Appendix B. This first step is simply to determine if the coefficient on the aid variable is significant in a multivariate regression of influences on the particular transmission variable. It transpires that aid is only a significant determinant of investment and imports among these variables, but only investment is a significant determinant of growth. Although aid is not found to be a significant determinant of government consumption spending in the sample (possible reasons are discussed in Appendix B), we also include results below with a generated regressor for *GCONS*.

Our basic specification is:

$$\begin{aligned} GROWTH_{it} &= \delta_0 + \delta_1 GDP0_{i,t-1} + \delta_2 PRIC15_{it} + \delta_3 INV_{it} + \delta_4 DEM_i + \delta_5 INFL_{it} \\ &\quad + \delta_6 GCON_{it} + \delta_7 MGDP_{it} + \delta_8 AID_{it} + \delta_9 AIDSQ_{it} + u_{it} \end{aligned} \tag{4}$$

For ease of comparison with previous studies, which adopt a specification similar to (4) without investment, and given that the treatment of investment plays an important role in our analysis, we begin by presenting results from estimating (3) with *INV* excluded. Table 1 presents the results of this general reduced form regression. All control variables except *GCON* and *MGDP* are significant and of the expected sign. Inflation is negatively associated with growth whereas education is positively associated. Democracy is positively associated with growth (recall that higher values imply less democratic regimes) as is initial GDP (i.e., countries with more favourable initial conditions tended to perform better). We can note that coefficients on both aid measures are positive and significant, whether current or lagged values are used. We compare these results with our other estimates below.

As investment is omitted from the reduced form in Table 1, a normal inference would be that the coefficient on aid is capturing the investment effect. It is possible, however, that omitting investment affects some of the coefficient estimates for other variables. To the extent that variables capturing the policy environment influence the productivity of investment, this is a distinct possibility. We explore this further by incorporating directly the effect of aid through financing investment by creating a separate variable for investment not financed by aid directly.

Table 1
Robust aid-growth regressions excluding investment

	Effect of current aid		Effect of lagged aid	
GDPO	0.001	0.001	0.001	0.001
	(2.93)***	(2.84)***	(3.26)***	(3.14)***
PRIC15	0.273	0.264	0.268	0.259
	(3.87)***	(3.76)***	(3.41)***	(3.26)***
DEM	-1.129	-1.188	-1.033	-0.962
	(2.99)***	(3.14)***	(2.61)**	(2.40)**
INFL	-0.004	-0.004	-0.004	-0.004
	(2.84)***	(2.89)***	(2.76)***	(2.94)***
GCON	-0.073	-0.062	-0.085	-0.056
	(1.31)	(1.13)	(1.49)	(0.99)
MGDP	0.004	0.004	-0.002	-0.001
	(0.38)	(0.40)	(0.22)	(0.10)
GRANTS	0.203		0.499	
	(2.26)**		(3.49)***	
GRANTSQ	-0.004		-0.016	
	(2.05)**		(2.66)***	
TAID		0.207		0.497
		(2.10)**		(3.28)***
TAIDSQ		-0.004		-0.016
		(1.97)*		(2.63)***
Constant	0.225	0.386	-0.894	-1.370
	(0.13)	(0.22)	(0.50)	(0.71)
Observations	149	149	134	134
R-squared	0.37	0.37	0.39	0.37

Notes: Time dummies included in all regressions. Absolute t-statistics reported as a weighting system is used for the robust regression. Significance levels indicated as ***, ** and * for 1%, 5% and 10% levels respectively.

Table 2
Robust aid-growth regressions with INVRES

	Effect of current aid		Effect of lagged aid	
Constant	0.525	0.655	0.477	0.310
	(0.32)	(0.39)	(0.28)	(0.17)
GDPO	0.001	0.001	0.001	0.001
	(2.38)**	(2.35)**	(2.22)**	(2.07)**
PRIC15	0.212	0.205	0.182	0.177
	(3.09)***	(2.99)***	(2.34)**	(2.27)**
INVRES	0.109	0.111	0.105	0.106
	(4.42)***	(4.49)***	(4.01)***	(4.02)***
DEM	-1.261	-1.328	-1.287	-1.231
	(3.52)***	(3.69)***	(3.34)***	(3.19)***
INFL	-0.004	-0.004	-0.004	-0.004
	(2.50)**	(2.50)**	(2.55)**	(2.68)***
GCON	-0.149	-0.143	-0.151	-0.134
	(2.64)***	(2.58)**	(2.59)**	(2.33)**
MGDP	0.002	0.002	-0.001	0.000
	(0.22)	(0.21)	(0.12)	(0.02)
GRANTS	0.306		0.431	
	(3.46)***		(4.08)***	
GRANTSQ	-0.003		-0.006	
	(1.65)		(2.22)**	
TAID		0.319		0.402
		(3.31)***		(3.66)***
TAIDSQ		-0.004		-0.006
		(1.69)*		(1.99)**
Coefficient on aid with INV				
GRANTS	0.161		0.265	
	(1.89)*		(2.59)**	
GRANTSSQ	-0.003		-0.006	
	(1.65)		(2.22)**	
TAID		0.174		0.242
		(1.85)*		(2.25)**
TAIDSQ		-0.004		-0.006
		(1.69)*		(1.99)**
Observations	149	149	135	135
R-squared	0.46	0.46	0.44	0.43

Notes: See Table 1.

The 'transmission regressions' in Appendix B show that aid is a significant factor in explaining variations in investment and imports. As the import variable is never significant in the growth regressions, investment is the mechanism we address.

Table 2 presents the estimation results of the growth model as specified by equation (3) with the generated regressor *INVRES*.[10] All control variables are significant, except

[10] *INVRES* is estimated from (t-ratios in parentheses):

INV= 1.33 GRANTS R^2=0.41; INV= 1.58 GRANTS_1 R^2=0.46
(12.78) (13.20)
INV= 1.30 TAID R^2=0.39; INV= 1.51 TAID_1 R^2=0.42
(12.17) (12.16)

MGDP, and have the expected sign (if *GDPO* were to pick up convergence, the sign should be negative but here it is controlling for initial conditions). In contrast to Table 1, the coefficient on government consumption is now found to be significant and negative. Both measures of aid have positive and significant coefficients that are remarkably similar, 0.3 on the current value (average over the period) and 0.5 on the lagged value (previous period average), suggesting that grants and loans have almost identical effects on growth (on average). The negatively signed aid squared terms are consistent with the proposition of an aid Laffer curve (Lensink and White 2001), or more generally diminishing returns to aid.

The coefficient estimates for the aid variables do vary according to the specification. The lagged effect of aid on growth is greater than the current effect in all specifications. When investment is excluded (Table 1), the coefficient on current aid of 0.2 is lower than when *INVRES* is used, but the coefficient of 0.5 on lagged aid is higher. When *INV* itself is included (separate results in Table 2), the coefficient on current aid is only weakly significant while that on lagged aid is significant but, at 0.25, lower than in other estimates. This supports our hypothesis that the aid coefficient in a regression including an investment term will underestimate the true effect of aid on growth.

Considering only the estimates on lagged aid, as effects of aid on growth should take place over time, we find evidence of a significant positive effect of aid in all specifications. The treatment of investment does not alter the finding of significance, but it does affect the value of the estimated coefficient, ranging from about 0.25 to 0.5. It is reassuring for our approach that excluding investment completely gives the highest estimate (all of the investment effect may be attributed to aid) whereas including *INV* with aid yields the lowest estimate (by under-valuing the effect of aid via investment). In this sense the use of the generated regressor may give a 'better' estimate.

Although we find no evidence that aid explains variations in government consumption spending (Appendix B), we do find that such expenditures have a negative effect on growth but only when investment is also included. As a robustness check, in Table 3 we allow for the fact that some aid does directly finance consumption spending and construct a generated regressor *GCONRES*. As would be expected, this reduces the estimated coefficient on the aid variables (but again the results are not sensitive to the measure of aid used). Indeed, the coefficient on current aid is no longer significant, a result consistent with Burnside and Dollar (2000), but that on lagged aid is significant with a coefficient of 0.23. It should be emphasized that whilst aid allocated to consumption spending may not have an effect on growth, this does not necessarily imply that such aid does not benefit the recipient (funding health or education may well contribute to human development).[11]

Our results show that aid is associated with higher growth in SSA countries. This applies once diminishing returns are accounted for, as only two countries in the sample received aid beyond the threshold level.[12] Based on the point estimates obtained in

[11] For evidence that aid-financed current spending may be beneficial see Gomanee, Girma and Morrissey (2005) and Gomanee *et al.* (2005).

[12] Based on Regression 1 and 2 from Table 5, GRANTS and TAID would have to surpass 51 per cent and 40 per cent for diminishing returns to set in. Only Rwanda (in 1994-97) and Gambia (in 1986-89) received aid in excess of this optimal level.

previous section, Table 4 reports the marginal aid effects by bringing together all the estimates of the derivative of growth with respect to aid.

Evaluated at mean aid level, we again find that once the indirect effects through investment are included, the impact of aid on growth is positive and significant. We recognize the fact that these effects are observed on average. Despite the focus on a sample restricted to SSA countries only, it is reasonable to believe that estimates on average mask both within- and across-country variance in aid effects. For practical purposes, what holds more appeal is the extent to which our estimates are useful in providing information on individual country experiences.

Table 3
Robust aid-growth regressions with INVRES and GCONRES

	Effect of current aid		Effect of lagged aid	
GDPO	0.001	0.001	0.001	0.001
	(2.38)**	(2.35)**	(2.22)**	(2.07)**
PRIC15	0.212	0.205	0.182	0.177
	(3.09)***	(2.99)***	(2.34)**	(2.27)**
INVRES	0.109	0.111	0.105	0.106
	(4.42)***	(4.49)***	(4.01)***	(4.02)***
DEM	-1.261	-1.328	-1.287	-1.231
	(3.52)***	(3.69)***	(3.34)***	(3.19)***
INFL	-0.004	-0.004	-0.004	-0.004
	(2.50)**	(2.50)**	(2.55)**	(2.68)***
GCONRES	-0.149	-0.143	-0.151	-0.134
	(2.64)***	(2.58)**	(2.59)**	(2.33)**
MGDP	0.002	0.002	-0.001	-0.000
	(0.22)	(0.21)	(0.12)	(0.02)
GRANTS	0.138		0.236	
	(1.51)		(2.15)**	
GRANTSQ	-0.003		-0.006	
	(1.65)		(2.22)**	
TAID		0.160		0.234
		(1.56)		(1.99)**
TAIDSQ		-0.004		-0.006
		(1.69)*		(1.99)**
Constant	0.525	0.655	0.477	0.310
	(0.32)	(0.39)	(0.28)	(0.17)
Observations	149	149	135	135
R-squared	0.46	0.46	0.44	0.43

Notes: As for Table 1. *GCONRES* is estimated from (t-stats in parentheses):
GCON=1.13GRANTS (16.26) R^2=0.54; GCON=1.29GRANTS_1 (15.72) R^2=0.56
GCON=1.11TAID(15.60) R^2=0.52; GCON=1.25TAID_1 (14.58) R^2=0.52

Table 4
Marginal effect of aid on growth

	At *GRANTS*=8.16	At *TAID*=7.96
In model with *INV*	0.112	0.110
	(1.02)	(0.87)
In model with INVRES	0.257	0.255
	(2.34)**	(1.96)*

Note: t-ratios in parentheses.

Table 5a
Regressions with GRANTS

Country	Time period	Unexplained growth	GRANTS	Growth	Contribution of aid (δ_8AID-δ_9AID^2)
10 lowest absolute values of unexplained GROWTH					
South Africa	1994-97	0.07	0.29	1.20	0.09
Gambia	1978-81	0.10	15.71	0.60	4.07
Zimbabwe	1990-93	0.12	6.75	**-1.47**	1.93
Congo Dem	1990-93	0.13	4.41	**-12.62**	1.29
Zimbabwe	1994-97	0.13	5.26	1.98	1.53
Senegal	1982-85	0.14	7.97	1.43	2.25
Congo Dem	1970-73	0.16	2.47	0.75	0.74
Mauritius	1994-97	0.17	0.97	3.62	0.29
Togo	1974-77	0.19	6.00	0.44	1.73
Togo	1970-73	0.25	6.56	0.53	1.88
10 highest absolute values of unexplained GROWTH					
Botswana	1970-73	10.99	9.82	18.51	2.72
Togo	1994-97	6.81	9.19	6.29	2.56
Cameroon	1986-89	6.38	1.90	**-3.99**	0.57
Sierra Leone	1994-97	6.23	12.20	**-7.78**	3.29
Niger	1970-73	6.01	5.69	**-5.78**	1.64
Congo Rep	1994-97	5.87	13.66	**-2.07**	3.62
Senegal	1978-81	5.84	7.25	**-3.14**	2.06
Swaziland	1986-89	5.77	6.61	7.29	1.89
Cameroon	1990-93	5.62	3.28	**-6.69**	0.97
Mauritius	1978-81	5.52	2.05	**-0.73**	0.61

Note: Residuals are from Regression 1 of Table 2.

With this in mind, we calculate the predicted contribution of aid to growth, $\delta_8 AID$-$\delta_9 AID^2$, where *GRANTS* and *TAID* are the relevant aid definitions (Table 5a and 5b, respectively). Obviously, as we are using the estimated coefficients from the panel regressions, aid is predicted to have a positive effect on growth (and the magnitude will depend on the amount of aid received). We cannot estimate the actual effect of aid for each country. We can however compare cases where the regression performed well (the lowest residuals, top panel in each table) with those where it performed poorly (the lower panel in each table). The presumption would be that the finding of aid effectiveness is more reliable in the former, whereas omitted variables played a more important role in the latter cases (so that the 'expected' growth was not achieved).

In the upper panel of each table, we list the ten observations for which unexplained growth is lowest in absolute terms. Our chosen set of explanatory variables explains reasonably well the growth experience of those countries in that particular period. In the bottom panel of each table, the ten observations with the largest residual (unexplained growth) are listed. These are mostly countries that experienced negative growth.

Consider the two panels in Table 5a. In the top panel, simple mean growth (excluding the Congo) is 1 per cent whereas aid is estimated to contribute 1.6 per cent to growth as a simple mean. For the lower panel, simple mean growth (excluding Botswana) is -1.8 per cent whereas the mean contribution of aid to growth is 1.9 per cent. The

predicted contribution of aid to growth is not very different in the two panels, but growth performance is dramatically different. One way of interpreting this is that aid was actually ineffective in the lower panel group of countries (implicitly assuming that the outcome would have been no worse in the absence of aid). Another interpretation, or perhaps qualification, is that other factors undermined the effectiveness of aid in the poor performing countries. One potential source might be exogenous shocks; Guillaumont and Chauvet (2001) and Lensink and Morrissey (2000) show that external shocks and aid instability are growth-reducing although aid remains a positive factor. Our analysis cannot identify these (growth-retarding) factors, but it can suggest countries (and periods) that may warrant further investigation. Such a case study complement is beyond the scope of this paper.

Table 5b
Regressions with TAID

Country	Time period	Unexplained growth	TAID	Growth	Contribution of aid (δ_8AID-δ_9AID^2)
10 lowest absolute values of unexplained GROWTH					
Senegal	1982-85	0.01	8.36	1.43	2.39
Zimbabwe	1994-97	0.02	5.02	1.98	1.50
South Africa	1994-93	0.03	0.14	1.20	0.05
Togo	1970-73	0.10	3.44	0.53	1.05
Congo Dem	1990-93	0.12	4.42	**-12.62**	1.33
Lesotho	1978-81	0.13	9.05	2.22	2.56
Togo	1974-77	0.14	4.88	0.44	1.46
Mauritius	1994-97	0.17	0.02	3.62	0.01
Congo Dem	1970-73	0.19	1.36	0.75	0.43
Mali	1982-85	0.26	18.70	**-0.89**	4.57
10 highest absolute values of unexplained GROWTH					
Botswana	1970-73	10.00	16.47	18.51	4.17
Sierra Leone	1994-97	6.74	20.90	**-7.78**	4.92
Togo	1994-97	6.67	10.10	6.29	2.81
Swaziland	1986-89	6.44	2.29	7.29	0.71
Cameroon	1986-89	6.31	1.73	**-3.99**	0.54
Niger	1970-73	6.14	4.87	**-5.78**	1.46
Congo Rep	1994-97	6.12	15.09	**-2.07**	3.90
Senegal	1978-81	5.96	7.56	**-3.14**	2.18
Cameroon	1990-93	5.82	4.09	**-6.69**	1.24
Rwanda	1978-81	5.60	8.46	5.35	2.41

Note: Residuals are from regression 2 of Table 2.

6 Conclusion

Our concern has been to address the question of aid effectiveness in Sub-Saharan Africa. Empirical studies of the impact of aid on growth fail to recognize explicitly in the regression specification that aid does not have a direct effect; it operates via transmission mechanisms, such as investment or government spending. The contribution of this paper lies in throwing some light on this neglected aspect.

Investment, the most important transmission mechanism, is often omitted from aid-growth regressions. As a result, estimated aid coefficients in typical growth regressions may suffer from omitted variable bias. However, simply including an investment term in the regression would lead to identification problems as some aid finances investment. In this paper we use the technique of generated regressors to address this problem. This enables us to identify that part of the effect on growth of the relevant transmission mechanism that is not due to aid, so that double counting and omitted variable problems concerning investment are avoided. Similarly, we identify and account for the part of aid that directly finances government consumption spending, and which may not contribute to growth.

We apply the method to examine the relationship between aid and growth using a panel of 25 SSA countries over the period 1970 to 1997. Despite large aid inflows, SSA countries on average experienced only 0.6 per cent growth in real per capita GDP per annum over the period. On the face of it, this may appear to be a case of aid ineffectiveness. Our econometric results, which are robust regarding outliers and endogeneity, show that aid has had a positive effect on growth, largely through aid-financed investment. On average (using the marginal effect estimates), a one percentage point increase in the aid/GNP ratio adds one-quarter of one percentage point to the growth rate. As we use different measures and specification to other studies, our estimates are not directly comparable. However, the broad finding that aid has a positive and significant impact on growth is consistent with Lensink and Morrissey (2000) and Clemens, Radelet and Bhavnani (2004), two other studies that identify an SSA sample.

Inflation is included as a (macroeconomic) policy control, and has the expected negative sign. Government consumption spending also has a negative association with growth. More democratic regimes appear to have higher growth performance. The variables with positive effects on growth are aid, investment, education and initial GDP (i.e., divergence in the sample as countries with higher incomes at the start of the period tended to have higher subsequent growth rates). The results, in demonstrating benefits of aid, investment and education and recognizing the effects of governance and macroeconomic policy, support the arguments of the Commission for Africa (2005).

An inherent limitation of cross-country panel regressions is that one estimates the average value of a coefficient, and this is not an estimate valid for any particular country. However, what one is seeking is patterns or empirical regularities. In this respect we identify a tendency for aid to contribute to growth through investment. This does not imply that aid ensures growth. Indeed, most SSA countries have had a very poor growth performance (and this is one reason why they continue to be large recipients of aid). In many cases this is partly due to bad policy, but that is not the whole explanation and our results suggest that aid can be effective even if policies are bad (we do include variables to capture policy). The variables in our aid-growth model capture sources of positive growth better than explaining the forces behind negative growth performance. Stated differently, the negative growth in SSA countries appears to be due to factors other than those represented in our regressions. This supports our belief that the observed combination of generous aid flows and slow growth in SSA does not necessarily imply aid ineffectiveness. One cannot ignore the possibility that had SSA countries not received aid, they might have experienced even slower, or in some cases more severe negative, growth. Aid effectiveness lower than could otherwise be possible in the absence of shocks (or other omitted variables) would seem to be a more plausible explanation.

This is not to claim that aid to Africa has been a success—evidently it has not, as observed growth performance has not matched aid receipts. However, there is more than a pedantic difference between claiming that this implies that aid is ineffective and claiming that aid has been effective although its potential contribution to growth has not been fully realized. The latter emphasizes, implicitly at least, the desirability of maintaining aid while identifying and addressing the factors that explain Africa's poor growth performance. Africa's poor growth record should not therefore be attributed to aid ineffectiveness. Our conclusion is that aid has been beneficial to African countries, but more needs to be done to ensure that these benefits lead to sustained growth.

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Appendix A: Definitions and sources of data

GROWTH	growth of real GDP per capita
GDPO	real GDP per capita (in the year preceding the period)
PRIC15	population aged 15 or above having completed primary education (per cent), at beginning of each period. Source: Barro and Lee Data Set, Updated April 2000 (Harvard CID, downloaded from www.cid.harvard.edu/ciddata/)
INV	gross domestic investment (per cent of GDP)
DEM	democracy index, in 1970 and 1982; values between 1 and 3 with lower values being more democratic. Source: Alesina *et al.* (1992)
INFL	inflation rate
GCON	government consumption (per cent of GDP)
MGDP	imports (per cent of GDP)
XGDP	exports (per cent of GDP)
TOT	terms of trade
RER	real exchange rate, calculated from the nominal exchange rate figures
BMP	black market premium. Source: downloaded from the Global Development Network Growth Database, accessed October 2000 (no longer on the World Bank web site)
CFA	dummy takes value of 1 for CFA franc zone member countries and 0 otherwise
CRED	credit available to private sector (per cent of total domestic credit)
GASTILS	Gastils Political Rights index. Source: Freedom House (downloaded March 2001, www.freedomhouse.org/)
GRANTS	ODA grants (per cent of GNP). Source: OECD (1999)
TAID	Total net ODA less technical cooperation, food aid and emergency relief (per cent of GNP). Source: OECD (1999)
TRGDP	total tax revenue (per cent of GDP)
EXTDEBT	external debt (per cent of GDP)
STATE	dummy takes value of 1 for legitimate countries and 0 otherwise. Source: Englebert (2000)

Unless otherwise stated, the source for all variables is World Bank Africa Database (2000, available on CD-ROM). All variables refer to period averages 1970-73, 1974-77, 1978-81, 1982-85, 1986-89, 1990-93 and 1994-97 except GDPO and the time invariant regressors.

25 countries in the sample for regressions:

Benin	Botswana	Cameroon
Central Africa	Congo Republic	Congo Democratic Republic
Gambia	Ghana	Kenya
Lesotho	Madagascar	Malawi
Mali	Mauritius	Niger
Rwanda	Senegal	Sierra Leone
South Africa	Swaziland	Tanzania
Togo	Uganda	Zambia
Zimbabwe		

Table A1
Summary statistics

Variable	N	Mean	Std dev.	Min	Max	Std dev. first difference
GROWTH	34	0.660	3.750	-12.618	18.510	4.572
GDPO	34	1242.382	1096.644	247	6409.000	330.913
INV	34	19.547	10.518	3.268	84.551	6.662
PRIC15	25	7.257	3.710	1	19.900	1.560
DEM	32	2.656	0.644	1	3	0
GRANTS	34	8.161	6.992	0.044	57.317	5.158
TAID	34	7.960	7.188	-0.009	50.712	5.286
INFL	34	50.631	428.068	-3.574	6287.344	325.801
GCON	34	15.461	5.749	5.859	43.938	3.855
MGDP	34	38.317	22.411	8.333	142.697	7.984

Note: Summary statistics reported for the variables in levels, unless stated otherwise.

Appendix B: Transmission mechanisms

Note that the aim is simply to determine if the coefficient on the aid variable is significant in a multivariate regression of influences on the particular transmission variable. Although we are not trying to 'explain' the transmission variables, we seek a parsimonious specification that reflects the relevant literature. It is important to emphasize that we are not actually concerned with estimating the behavioural relationship, but rather with a financing relationship. Put simply, we want to know if aid is a significant determinant of cross-country variations in the level of the transmission variable under consideration.

B1 Determinants of investment

The explanatory variable used is total investment, in large part public (which is mostly aid financed) but including private (which, in a behavioural relationship, will be affected by aid and public investment). Much of the literature focuses on private investment (e.g., Dollar and Easterly 1999; Greene and Villanueva 1991), and is not directly relevant. Our specification is intended to include major factors influencing both private and public investment. To account for the dependence of current investment levels on physical and human capital stock, we include one period lagged investment and a measure of human capital (*PRIC15*). We did not have data on the real interest rate, and use two policy variables to capture this effect—the inflation rate (*INFL*) and the logarithm of credit available to the private sector, measured relative to total domestic credit (*LNCRED*). The political indicator used is Gastils index of rights (*GASTILS*); this takes values between 1 and 7, where higher values indicate less freedom. Two measures of foreign aid are tested to see if they are significant sources of finance.

The investment regression is given as:

$$INV_{it} = \beta_0 + \beta_1 INV_{i,t-1} + \beta_2 PRIC15_{it} + \beta_3 INFL_{it} + \beta_4 GASTILS_i + \beta_5 LNCRED_{it} + \beta_6 AID_{it} + \beta_7 AIDSQ_{it} + \varepsilon_{it} \quad \text{(B1)}$$

Table B1 presents the set of estimates. The regressions generate coefficient estimates with the expected signs. We obtain evidence of a highly significant positive effect of aid on investment. On average, an increase in *GRANTS* and *TAID* by one percentage point raises the investment share in GDP by about 0.33 and 0.53 percentage points respectively. As expected, *TAID* is more important both in terms of magnitude and significance. Results suggest that investment is a significant transmission mechanism and therefore it is necessary to consider the 'double-counting' problem.

The results differ from Dollar and Easterly (1999), who find no evidence that aid was a significant determinant of investment. However, they only report summary results of a simple bivariate OLS regression for each country. We tried such regressions on our sample, and on balance aid is found to be a significant positive influence on investment (results available on request).

Table B1
Pooled OLS investment regressions

	INV	INV
INV_{t-1}	0.785	0.799
	(5.51)***	(5.69)***
GASTILS	-0.902	-0.984
	(2.59)**	(2.94)***
PRIC15	0.275	0.290
	(1.80)*	(1.94)*
LNCRED	1.773	2.005
	(2.79)***	(3.04)***
INFL	-0.003	-0.002
	(2.43)**	(1.69)*
GRANTS	0.333	
	(2.09)**	
GRANTSQ	-0.007	
	(2.77)***	
TAID		0.528
		(3.04)***
TAIDSQ		-0.012
		(3.56)***
Constant	-2.074	-4.341
	(0.54)	(1.06)
Observations	126	126
R-squared	0.65	0.66
F-Stat	27.17	22.91
Prob>F-Stat	0.00	0.00

Notes: All regressions run in a panel of seven four-year periods over 1970-97. Time dummies included in all regressions. Absolute t-values based on White heteroscedasticity-consistent standard errors are reported in brackets.

* Significant at 10% level; ** 5% level; *** 1% level. F-Stat tests the joint significance of all coefficients.

B2 Financing imports

Although the literature on trade and growth tends to focus on exports or trade volume (exports plus imports as a measure of openness), there are reasons why imports may themselves contribute to growth. As Thirlwall (2003) argues, a major benefit of exports is that they generate the foreign exchange required to purchase the imports required for growth. The most obvious, on our context, is imported investment goods, but another possibility is that imports may proxy technology transfer. However, our concern is to explain the level of imports in terms of how they are financed. We use *MGDP* as the dependent variable. Exports and the two measures of aid are introduced as sources of the foreign exchange required to pay for imports. The purchasing power of these revenues will depend on the exchange rate. We include a number of measures to capture such effects: terms of trade (*TOT*), real exchange rate (*ER*), black market premium (*BMP*) and a dummy (*CFA*) that takes a value of 1 for countries which are members in CFA franc zone. The import regression is given as:

$$MGDP_{it} = \eta_0 + \eta_1 XGDP + \eta_2 AID_{it} + \eta_3 TOT_{it} + \eta_4 RER_{it} + \eta_5 \text{BMP}_{it} + \eta_6 CFA + e_{it} \quad \text{(B2)}$$

Overall, the regressions perform well (Table B2). The chosen specification explains at least 31 per cent of the variation in the dependent variable. Aid flows seem to be a significant source of finance for imports (as would be expected). On average, a one percentage point increase in *GRANTS* increases imports/GDP by 0.9 percentage points, whilst each extra percentage point of *TAID* adds 0.7 percentage points to the share of imports in GDP. Based on these estimates, it would appear that imports are a potential transmission mechanism. The fact that the coefficients on exports and aid as sources of foreign exchange sum to more than unity is not itself an issue. Many countries maintain large (aid-financed) trade deficits, and other variables tend to reduce imports (or, reduce the purchasing power of export and aid revenue). As in our case imports are not found to be determinants of growth, the transmission effect does not need to be incorporated.

Table B2
Pooled OLS imports regressions

	IMPORT	IMPORT
XGDP	0.614	0.610
	(5.51)***	(5.50)***
GRANTS	0.921	
	(3.24)***	
TAID		0.713
		(3.42)***
TOT	-0.045	-0.049
	(2.04)**	(2.14)**
RER	-0.003	-0.004
	(1.96)*	(2.07)**
BMP	-0.027	-0.029
	(2.02)**	(2.07)**
CFA	-6.236	-6.187
	(1.80)*	(1.75)*
Constant	22.095	25.115
	(3.16)***	(3.24)***
Observations	131	131
R-squared	0.33	0.31
F-Stat Prob>F-Stat	13.36	14.01
	0.00	0.00

Notes: As for Table B1.

B3 Determinants of government consumption

There is a large literature on how aid influences government fiscal behaviour, addressing either fungibility or fiscal response models (a comprehensive review is in McGillivray and Morrissey 2004). Of necessity, we abstract from the complexities of these models and adopt a simple framework. Government consumption spending, by definition, is some proportion of revenue. We consider both domestic and foreign sources of government revenue—total tax revenue as a share of GDP (*TRGDP*), inflation (*INFL*) to represent seigniorage, external debt as a share of GDP (*EXTDEBT*)

and foreign aid flows (*AID*). In recognition of the fact that features of the existing political institution may influence the allocation of government resources, we introduce the variable *STATE* (Englebert 2000) as more appropriate for our purposes than *DEM* or *Gastils* used previously. This takes a value of 1 (0 otherwise) for legitimate countries which are believed to have more efficient governments. On the assumption that more efficient or legitimate regimes will be more likely to spend on investment, the hypothesized coefficient is negative. We estimate the following equation:

$$GCON_{it} = \lambda_0 + \lambda_1 TRGDP_{it} + \lambda_2 INFL_{it} + \lambda_3 EXTDEBT_{it} + \lambda_4 AID_{it} + \lambda_5 STATE_i + u_{it} \quad \text{(B3)}$$

Table B3 presents the results. In general, the regressions perform reasonably well. They explain about 50 per cent of the variation in government consumption and all variables enter with the expected signs. However, the coefficient on aid is insignificant. Aid does not appear to explain cross-country variation in *GCONS* in our sample. Instead, tax revenue and seigniorage explain variations in recurrent spending. Consequently, government consumption does not appear to be a transmission mechanism, i.e., the coefficient on *GCON* in aid-growth regressions may not include any substantial indirect effect of aid. This result may appear surprising (although it is not inconsistent with the evidence from fiscal response models), so in the paper we allow for a (negative) transmission effect.

Table B3
Government consumption regressions

	GCON	GCON
TRGDP	0.524	0.516
	(8.97)***	(8.89)***
INFL	0.003	0.003
	(4.47)***	(4.19)***
EXTDEBT	-0.001	0.000
	(0.09)	(0.03)
GRANTS	0.106	
	(1.38)	
TAID		0.076
		(1.02)
STATE	-1.508	-1.296
	(1.71)*	(1.56)
Constant	4.809	5.187
	(3.12)***	(3.48)***
Observations	138	138
R-squared	0.51	0.50
F-Stat	10.89	11.51
Prob>F-Stat	0.00	0.00

Notes: As for Table B1.