Aid, Policies, and Growth

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This paper uses a new database on foreign aid to examine the relationships among foreign aid, economic policies, and growth of per capita GDP. We find that aid has a positive impact on growth in developing countries with good fiscal, monetary, and trade policies but has little effect in the presence of poor policies. Good policies are ones that are themselves important for growth. The quality of policy has only a small impact on the allocation of aid. Our results suggest that aid would be more effective if it were more systematically conditioned on good policy. (*JEL* F350, O230, O400)

Growth of developing economies depends to a large extent on their own economic policies: this finding has been established in a wide range of recent studies.[1] On the other hand, foreign aid has not raised growth rates in the typical poor country, according to recent work by Peter Boone (1995, 1996). We investigate a new hypothesis about aid: that it does affect growth, but that its impact is conditional on the same policies that affect growth. Poor countries with sound economic policies benefit directly from the policies, and in this environment aid accelerates growth. In highly distorted economies, however, aid is dissipated in unproductive government expenditure.

A modified neoclassical growth model provides the analytical framework for this investigation. To the extent that international capital markets are imperfect, foreign aid can have an important impact on a poor country. One interpretation of foreign aid is that it acts as an income transfer. This income transfer may or may not produce growth. The outcome depends on how aid is used: is it invested, so that domestic output can increase, or is it consumed? To the extent that it is invested, aid will be effective. Both the incentive to invest aid and its subsequent productivity as capital are affected by various policy distortions that can lower the return to capital. It is straightforward to show, in a neoclassical model, that the impact of aid will be greater when there are fewer distortions. In general, developing country growth rates will depend on initial income, institutional and policy distortions, aid, and aid interacted with distortions.[2]

To investigate our hypothesis empirically we use a new database on foreign aid developed by the World Bank. The grant components of concessional loans have been added to outright grants to yield a truer estimate of foreign aid. We draw on the recent empirical growth literature to develop a model of growth with a range of institutional and policy distortions, and we estimate this model using a panel of 56 countries and six four-year time periods from 1970–1973 until 1990–1993. Aside from the institutional and political variables, the policies that have considerable weight in this equation are the budget surplus, the inflation rate, and the openness dummy developed by Sachs and Warner (1995). We form an index of these three policies to interact it with foreign aid.

Once we enter foreign aid into our empirical model, we find that it has a positive effect on growth in a good policy environment. The result is robust to a variety of specifications in which outliers are included or excluded, and middle-income countries are included or excluded. This finding is

* World Bank, Washington, DC 20433. Views expressed are those of the authors and do not necessarily represent official opinions of the World Bank. Helpful comments on this work have been provided by an anonymous referee, Alberto Alesina, Paul Collier, William Easterly, and Lant Pritchett. We thank Charles Chang and Eliana La Ferrara for excellent research assistance. We gratefully acknowledge financial assistance from the World Bank Research Committee (RPO 681-70).

[1] The particular papers in the literature that we focus on are William R. Easterly and Sergio T. Rebelo (1993), Stanley Fischer (1993), and Jeffrey D. Sachs and Andrew M. Warner (1995).

[2] These results are established in an Appendix available from the authors upon request.

consistent with Boone's work in that the estimated impact of aid for a country with average policies is zero. Countries with good policies and significant amounts of aid, on the other hand, perform very well, better than can be explained by the other variables in the growth regression.

Turning to allocation issues, we estimate an equation to explain aid receipts (as a share of GDP). Donors direct their aid to low-income countries, but are also influenced by population (small countries get more) and by variables that reflect their own strategic interests. After controlling for these other influences, we find no tendency to allocate more aid to countries with good policies, as measured by our index. When we distinguish between bilateral and multilateral aid, we find that it is the former that is most influenced by donor interests, whereas the latter is largely a function of income level, population, and policy.

We also estimate an equation for government consumption as a share of GDP. We treat this variable separately from the other policy variables because it has no robust association with growth. We find that bilateral aid, in particular, has a strong positive impact on government consumption. This result is consistent with other evidence that aid is fungible and tends to increase government spending proportionately, not just in the sector that donors think they are financing. That aid tends to increase government consumption, which in turn has no positive effect on growth, provides some insight into why aid is not promoting growth in the average recipient country.

In our work we considered the possibility that the policy index should be treated as endogenous. In an earlier draft of the paper we estimated an equation for policy and found that exogenous changes in aid had no systematic effect on the index of policies. For simplicity, here we treat policy as exogenous and present the results of specification tests to justify this assumption.

Overall, our results indicate that aid might have more impact on growth in the developing world if it were systematically allocated toward good policy environments. Up through the mid-1990's, however, donors were not favoring good policy environments in their allocations. One caution about this conclusion is that, if donors change their allocation rule, then the quantity of aid may begin to affect policies. Intuitively, one would think that aid conditioned on good policy might have a positive effect on policy. Empirically, this is an interesting and open area for further research.

The remainder of the paper is organized as follows: in the first section we describe the model to be estimated, our empirical methodology, the identifying assumptions we make, and the data used in the analysis. In the second section we describe the results concerning the impact of aid on growth. In the third section we describe the determinants of aid. The fourth section examines the impact of aid on government consumption. The fifth section contains concluding remarks.

I. Empirical Model and Data Sources

Our empirical work attempts to answer two key questions: (1) Is the effect of aid on growth conditional on economic policies? and (2) Do donor governments and agencies allocate more aid to countries with good policies? More generally we ask what other factors affect growth and aid flows.

We investigate these questions by estimating variants of the following equations:

$$(1)\qquad g_{it} = y_{it}\beta_y + a_{it}\beta_a + \mathbf{p}'_{it}\boldsymbol{\beta}_p + a_{it}\mathbf{p}'_{it}\boldsymbol{\beta}_1 + \mathbf{z}'_{it}\boldsymbol{\beta}_z + g_t + \varepsilon^g_{it},$$

$$(2)\qquad a_{it} = y_{it}\gamma_y + \mathbf{p}'_{it}\boldsymbol{\gamma}_p + \mathbf{z}'_{it}\boldsymbol{\gamma}_z + a_t + \varepsilon^a_{it},$$

where i indexes countries, t indexes time, g_{it} is per capita real GDP growth, y_{it} is the logarithm of initial real per capita GDP, a_{it} is aid receipts relative to GDP, $\mathbf{p}_{it}$ is a $P \times 1$ vector of policies that affect growth, $\mathbf{z}_{it}$ is a $K \times 1$ vector of other exogenous variables that might affect growth and the allocation of aid, g_t and a_t are fixed-time effects, and ε^g_{it} and ε^a_{it} are mean zero scalars. We include fixed-time effects to capture the impact of worldwide business cycles.

The way in which aid and the policy variables enter equation (1) can be derived from a neoclassical growth model. For example, a lump-sum gift of aid should have a positive effect on growth, which would be transitory if there were diminishing returns to capital. If there were policies that affected growth, however, they

would also affect the extent to which a gift of aid is used productively. Hence, if aid is added to the growth equation, it should be interacted with policies, as in equation (1).

Earlier work on aid and growth estimated an equation such as (1) without the interaction of aid and policy. For example, Keith Griffin (1970), Thomas E. Weisskopf (1972), Hollis B. Chenery and Moises Syrquin (1975), Paul Mosley et al. (1987), and Victor Levy (1988) have previously attempted to measure the impact of aid on savings, investment, and growth in developing countries. The conclusions reached by the authors of these papers have differed widely, and they have faced numerous econometric difficulties, in particular the fact that the error terms in equations (1) and (2) are likely to be correlated. Recent papers by Boone (1995, 1996) have used instrumental variable techniques and have concluded that aid has no significant positive impact on growth. We revisit that work, introducing the hypothesis that the impact of aid is conditional on policy.

To estimate equation (1) we use both ordinary least squares (OLS) and a two-stage least-squares (2SLS) procedure because the error terms in equations (1) and (2) may be correlated. The direction of correlation is not obvious. The error terms would have a negative correlation to the extent that donors respond to negative growth shocks by providing more assistance. But there are plausible reasons why the errors may have a positive correlation. One conclusion of earlier studies and our own work is that aid is not given only for developmental purposes; it may serve the strategic or commercial interests of donors. In that case a country enjoying a commodity boom, or any positive shock to growth, may receive special favor from some donors, introducing a positive correlation between the error terms.

Our strategy for achieving identification of the system is as follows: we build the specification of the growth equation drawing on the large empirical literature on growth. Then we develop the specification of the aid equation drawing on the literature on aid allocation. These literatures suggest that there are variables that belong in the aid equation that do not affect growth, and vice versa, allowing us to achieve identification by using zero restrictions on β_z and γ_z. We provide the details of these exclusion restrictions in the following subsections.

Having achieved identification by excluding some of the exogenous variables from each of the equations, we estimate them by 2SLS and present summary statistics from our first-stage regressions to indicate the relevance of our instruments. The equations are estimated using a panel across six four-year periods from 1970–1973 through 1990–1993. Thus, an observation is a country's performance averaged over a four-year period.

A. *The Growth Equation*

The recent empirical growth literature provides guidance concerning the institutional and political factors and economic policies that affect growth, and we follow this literature in building up the base specification.[3] The general strategy is to account for a range of institutional and policy distortions that can help to explain the growth performance of poor countries, to ensure that any inferences about the relationship between aid and growth are robust.

As is standard in the empirical growth literature, to capture convergence effects we allow growth during period t to depend on y_{it}, the logarithm of real per capita GDP at the beginning of the period. Since we are interested in assessing the effectiveness of foreign aid, our growth equation includes a_{it}, the level of aid, as a fraction of GDP, received by country i in period t.

We also want to know how macroeconomic policies affect growth. As indicators of macroeconomic policy we include the following variables as elements of $\mathbf{p}_{it}$. First we use a dummy variable for trade openness developed by Sachs and Warner (1995). Closed economies are ones that have average tariffs on machinery and materials above 40 percent, or a black-market premium above 20 percent, or pervasive government control of key tradables. Following Fischer (1993), we take inflation as a measure of monetary policy. Finally, we considered two fiscal variables suggested by Easterly and Rebelo (1993), the budget surplus and government consumption, both relative to GDP. The budget surplus variable has foreign grants included in revenue and aid-financed projects

[3] See Ross Levine and David Renelt (1992) for a review of alternative specifications of empirical growth equations.

included in expenditures, so that there is no necessary relationship between aid and this measure of the budget surplus. The budget surplus is quite strongly negatively correlated with government consumption. In regressions that included both variables, we generally found the budget surplus to be marginally significant, whereas government consumption was not. For this reason we dropped government consumption from our analysis. Our results were not sensitive to this choice.

In the previous section we argued that the effectiveness of foreign aid would depend on the nature of economic policies, so our growth equation includes not only measures of aid and policies, but also their interaction.

Our growth equation also includes a subset of the $K \times 1$ vector of exogenous variables $\mathbf{z}_{it}$, which we assume are not affected by shocks to growth or the level of aid. These variables are included to capture various institutional and political factors that might affect growth. In particular, with reference to Stephen Knack and Phillip Keefer (1995) we use a measure of institutional quality that captures security of property rights and efficiency of the government bureaucracy. Since this variable is not widely available before 1980 we use each country's 1980 figure throughout, on the assumption that institutional factors change slowly over time. Another variable that does not change over time in our data set is the ethnolinguistic fractionalization variable used by Easterly and Levine (1997), who find that ethnic fractionalization is correlated with bad policies and with poor growth performance after controlling for policies. Thus the institutional quality and the ethnic fractionalization variables capture long-term characteristics of countries that affect both policies and growth.

We also include the assassinations variable used by several studies to capture civil unrest, and an interactive term between ethnic fractionalization and assassinations. The final institutional variable is the level of broad money (M2) over GDP, which proxies for the development of the financial system (Robert G. King and Levine, 1993). Because of concern over the endogeneity of the latter variable we lag it one period.

We considered some other variables that have been used in the literature, in particular the education variables developed by Robert J. Barro and Jong-Wha Lee (1993). We found that these variables had little explanatory power (t-statistics well below 1.0), but their inclusion significantly reduced the number of countries in the sample, so we did not include them.

Finally, we include regional dummy variables for sub-Saharan Africa and East Asia in the growth equation.

B. *The Aid Equation*

There is a significant literature on the determinants of aid, a few examples of which are Robert D. McKinlay and Richard Little (1978, 1979), Alfred Maizels and Machiko K. Nissanke (1984), Bruno S. Frey and Friedrich Schneider (1986), and William N. Trumbull and Howard J. Wall (1994). In general this literature has found that donors' strategic interests play an important role in the allocation of aid, whereas commercial interests have not been as important. Furthermore, more aid is given to countries with low income, and aid relative to GDP is much higher for countries with small populations. Frey and Schneider (1986) find evidence that commitment of World Bank assistance is associated with good policies such as low inflation, but no one has examined whether total aid is allocated in favor of good policies.

Our specification of the aid equation (2) builds on this literature. It includes the logarithm of initial income y_{it}. It also includes a number of other variables: the logarithm of population and a group of variables that capture donors' strategic interests. For these we use dummy variables for sub-Saharan Africa (to which most European aid is directed), the Franc zone (which gets special treatment from France), Egypt (an important ally of the United States), and Central American countries (also in the U.S. sphere of influence). We also use a measure of arms imports relative to total imports lagged one period. To explore whether aid is allocated in favor of good policy we also include our policy variables in the aid allocation equation.

C. *Constructing a Policy Index*

In practice, we found it difficult to obtain precise estimates, even in OLS regressions, of the vector of coefficients $\boldsymbol{\beta}_1$ on the three interactions terms in equation (1). In addition, in

terms of exposition and simplicity we thought it would be useful if we had one overall measure of economic policy rather than three separate variables. We considered a number of alternative methods. The first method we considered was a simple principal components approach, that is, using the first principal component in our analysis rather than all three policy variables. Unfortunately, in our sample the first two principal components are almost perfectly correlated with openness and inflation, respectively. Thus, the principal components approach did not lead us to a natural single index measure of policy. Instead it effectively suggested that we drop the budget surplus variable and include both openness and inflation in our regressions. This turned out not to solve our problem with precision in estimating interaction terms, so we proceeded to an alternative method.

Our model suggests that it is the distortions that affect growth that will determine the effectiveness of aid. Therefore, we thought it was natural that our policy index should weight the policies according to their impact on growth, a feature that is absent from the principal components analysis. This would allow us to discuss the effectiveness of aid in "good" and "bad" policy environments, where "good" and "bad" would have a precise meaning. Thus, the key feature of our policy index is that it weights the policy variables according to their correlation with growth.

To be more precise, we use an OLS regression of the growth equation with no aid terms

$$(3)\quad g_{it} = y_{it}\beta_y + \mathbf{p}'_{it}\boldsymbol{\beta}_p + \mathbf{z}'_{it}\boldsymbol{\beta}_z + g_t + \varepsilon^g_{it},$$

to fix the values of the coefficients that determine the policy index. That is, we let $p_{it} = \mathbf{p}'_{it}\mathbf{b}_p$, where $\mathbf{b}_p$ is the OLS estimate of $\boldsymbol{\beta}_p$ in equation (3). Then, rather than estimating equations (1) and (2) we estimate

$$(4)\quad g_{it} = y_{it}\beta_y + a_{it}\beta_a + p_{it}\theta_p + a_{it}p_{it}\theta_1 + \mathbf{z}'_{it}\boldsymbol{\beta}_z + g_t + \varepsilon^g_{it}$$

and

$$(5)\quad a_{it} = y_{it}\gamma_y + p_{it}\phi_p + \mathbf{z}'_{it}\boldsymbol{\gamma}_z + a_t + \varepsilon^a_{it}.$$

Two aspects of this change in specification are important. First, equations (4) and (5) are implicitly restricted versions of equations (1) and (2). Suppose that $\beta_{1j}/\beta_{pj} = \beta_{11}/\beta_{p1} = \theta_1$, $j = 2, 3$, where β_{1j} and β_{pj} are the jth elements of $\boldsymbol{\beta}_1$ and $\boldsymbol{\beta}_p$, respectively. Then equation (1) can be rewritten as

$$(6)\quad g_{it} = y_{it}\beta_y + a_{it}\beta_a + \mathbf{p}'_{it}\boldsymbol{\beta}_p + a_{it}(\mathbf{p}'_{it}\boldsymbol{\beta}_p)\theta_1 + \mathbf{z}'_{it}\boldsymbol{\beta}_x + \varepsilon^g_{it}.$$

Notice the similarity between equations (4) and (6) given that $p_{it} = \mathbf{p}'_{it}\mathbf{b}_p$. A similar argument applies to equation (5).

Second, by estimating $\boldsymbol{\beta}_p$ using an initial OLS regression of equation (3) we risk the possibility of bias, if either the restrictions implicit in equations (4) and (5) are false, or if the policy variables are endogenous.

To address the first issue we considered an alternative approach, which was to estimate equation (6) directly and test its restrictions explicitly. When we did this, we found no evidence against the restrictions. A disadvantage of this alternative is that it leads to a different measure of the policy index, depending on the exact specification of the growth equation or subsample of the data being used. We preferred to fix the policy index, for all subsequent analysis, using one specification of equation (3). We were conscious of the fact that in doing this we might run into problems of misspecification. We return to the issue of misspecification later.

To address the second issue we considered the possibility that the policy variables should be treated as endogenous. Indeed, in an earlier draft of the paper we estimated a separate equation for policy. Here we report the results of specification tests that suggest that the policy variables can be considered exogenous variables both in the growth equation and in the aid equation.

D. *Summary of Estimation and Identification*

We estimate equations (4) and (5) treating growth g_{it}, aid a_{it}, and aid's interaction term with the policy index $a_{it}p_{it}$ as endogenous variables. The policy index p_{it} and the logarithm of

TABLE 1—SUMMARY OF REGRESSION SPECIFICATIONS AND IDENTIFICATION

Variable	Equation			
	Variants of (4), growth			(5), aid
Endogenous variables				
Real growth rate	LHS	LHS	LHS	
Aid/GDP	RHS	RHS	RHS	LHS
(Aid/GDP) × policy		RHS	RHS	
$(\text{Aid/GDP})^2$ × policy			RHS	
Exogenous variables				
Logarithm of initial income	Included	Included	Included	Included
Policy index	Included	Included	Included	Included
Institutional quality	Included	Included	Included	
Ethnic fractionalization	Included	Included	Included	
Assassinations	Included	Included	Included	
Ethnic fractionalization × assassinations	Included	Included	Included	
M2/GDP, lagged	Included	Included	Included	
Logarithm of population				Included
Arms imports/imports, lagged				Included
Sub-Saharan Africa dummy	Included	Included	Included	Included
East Asia dummy	Included	Included	Included	
Egypt dummy				Included
Franc zone dummy				Included
Central America dummy				Included
Logarithm of initial income × policy				
Logarithm of population × policy				
Arms imports/imports, lagged × policy				
$(\text{Logarithm of initial income})^2$ × policy				
$(\text{Logarithm of population})^2$ × policy				

Notes: LHS indicates that a variable is included as the left-hand-side variable. RHS indicates that a variable is included as a right-hand-side variable. All exogenous variables are used as instruments in 2SLS estimation.

initial income y_{it} are treated as exogenous or predetermined variables. As described in the previous subsections, the vector of exogenous variables $\mathbf{z}_{it}$ includes a measure of institutional quality, a measure of ethnic fractionalization, a measure of the frequency of assassinations, the interaction between ethnic fractionalization and assassinations, M2 as a fraction of GDP lagged one period, a dummy for sub-Saharan Africa, a dummy for East Asia, the logarithm of population, a dummy for Egypt, a dummy for the Franc zone, a dummy for Central America, and arms imports as a fraction of total imports lagged one period.

On occasion we estimate variants of equation (4) without the interaction term between aid and policy, or with an additional interaction term between aid squared and policy. To attempt to better explain the interaction terms in first-stage regressions, we also include, as exogenous, the following five variables: the logarithm of initial income × policy, the logarithm of population × policy, the arms imports variable × policy, the squared logarithm of initial income × policy, and the squared logarithm of population × policy.

We refer the reader to Table 1 for a summary of the variables included in our equations, and the exclusion restrictions with which we achieve identification. Notice that our variants of equation (4) have between one and three endogenous right-hand-side variables, and that we have a total of 10 excluded exogenous variables, so our 2SLS estimator is overidentified. In equation (5) we have no endogenous right-hand-side variables, so we estimate by OLS.

As for inference, for our estimates of equation (4) we use heteroskedasticity-consistent standard errors of the type proposed by Halbert White (1980). In practice we found evidence of serial correlation in the residuals from our estimates of equation (5). For this reason, for these

TABLE 2—AID, POLICIES, AND GROWTH: SUMMARY STATISTICS

	Per capita GDP in 1970 (1985 US$)	Per capita GDP growth (percent per annum)	Aid (percent of GDP)	Policy index
All observations				
Mean	1833	1.2	1.6	1.2
Median	1419	1.2	0.8	0.9
Standard deviation	1479	3.6	2.1	1.3
Low-income countries				
Mean	1138	1.1	2.1	1.2
Median	1132	1.2	1.3	0.9
Standard deviation	471	3.6	2.3	1.3

Notes: The policy index is described in the text. It is the weighted average of the openness measure, the inflation rate, and the budget surplus, where the weights are given by the corresponding coefficients in the regression reported in Table 3 column (1). It is scaled to have the same mean as per capita GDP growth in the "All observations" sample. The index is measured in terms of percentage points of GDP growth, and can be interpreted as predicted GDP growth holding all variables in that regression, except policy, constant. The "All observations" case is based on 56 countries and 275 observations. The "Low-income countries" case is based on 40 countries and 189 observations.

estimates we use heteroskedasticity- and autocorrelation-consistent standard errors of the type proposed by Whitney K. Newey and Kenneth D. West (1987).

E. *Data Sources*

Previous studies of foreign aid have used a measure of aid that does not distinguish between grants and concessional loans. The World Bank has developed a new database on foreign aid (Charles C. Chang et al., 1998). The underlying source is the World Bank Debt Reporting System that contains, among other things, all of the official loans received by developing countries from multilateral or bilateral sources. The grant component of each concessional loan has been calculated and added to outright grants to provide a more accurate measure of foreign aid. These data are in current U.S. dollars. For our study we converted them into constant 1985 dollars using the unit-value of imports price index from International Financial Statistics. This provides a measure of aid that is constant in terms of its purchasing power over a representative bundle of world imports. Finally, we divided this aid figure by real GDP in constant 1985 prices from the Robert Summers and Alan Heston (1991; Penn World Tables 5.6) data set.

The aid data cover a large number of countries, but the institutional and policy variables are not available for many countries. We were able to collect the requisite information for 56 countries. Some countries are missing data for some variables, in some time periods, so that we end up with a total of about 270 observations in each of our regressions.[4] The countries covered are listed in Table A1. Twenty-one African countries are included, as well as major aid recipients in other regions. Clearly good coverage of poor countries is important if the results are to be robust. Note, however, that countries such as Argentina, Brazil, and Chile are also included. These are middle-income countries with good access to international capital markets. Not surprisingly they have been getting a tiny amount of aid throughout this period (an average of less than 0.03 percent of GDP for Brazil, for example). Thus, we have chosen to examine the relationship between aid and growth, first using the maximum number of observations available and then using a smaller data set in which middle-income countries are dropped. Table A1 indicates the countries that are dropped in the latter analysis.

The dependent variable in our study is the average annual growth rate of real GDP per capita. Table 2 provides summary statistics for a

[4] The fact that our panel is unbalanced is one reason we computed heteroskedasticity-consistent standard errors.

few key variables.[5] The mean growth rate was 1.2 percent for the 275 observations in the full sample and 1.1 percent for the low-income subsample (189 observations). Because we have measured aid relative to real GDP we end up with smaller aid/GDP figures than reported in other studies. For the whole sample the mean value of aid/GDP was 1.6 percent (2.0 percent for the low-income sample). Nevertheless, there are some very large aid recipients, such as Zambia (9.4 percent of GDP in the 1990–1993 period). The other explanatory variables in our growth regressions have been noted earlier.

II. Growth Regressions

A. *Regressions with the Full Data Set*

We begin with a regression of our base specification given by equation (1), but excluding any of the terms involving aid. The results are presented in Table 3 column (1). The most significant variables in the regression are institutional quality, the dummy for sub-Saharan Africa, the inflation rate, and openness. Other variables have the intuitive signs, although several are not significant. The assassinations variable, its interaction with ethnic fractionalization, the budget surplus, the regional dummy for East Asia, and initial income all have moderate explanatory power. In all of the growth regressions with aid included, this same set of variables will be retained, even if some t-statistics become very low. We chose this approach so that the reader would not wonder about the effect of including or excluding different variables. Furthermore, several of them are significant in later regressions.[6]

TABLE 3—GROWTH REGRESSIONS: USING ALL COUNTRIES AND THE INDIVIDUAL POLICY VARIABLES

	(1)	(2)	
Estimation method	OLS	OLS	2SLS
Initial GDP	−0.65	−0.61	−0.74
	(0.55)	(0.58)	(0.62)
Ethnic fractionalization	−0.58	−0.53	−0.69
	(0.73)	(0.73)	(0.78)
Assassinations	−0.44*	−0.44*	−0.44
	(0.27)	(0.27)	(0.27)
Ethnic fractionalization	0.81*	0.81*	0.81*
× assassinations	(0.45)	(0.45)	(0.46)
Institutional quality	0.64**	0.64**	0.63**
	(0.17)	(0.17)	(0.17)
M2/GDP (lagged)	0.015	0.014	0.017
	(0.015)	(0.015)	(0.016)
Sub-Saharan Africa	−1.53**	−1.61**	−1.35*
	(0.73)	(0.76)	(0.76)
East Asia	0.89	0.93*	0.80
	(0.56)	(0.57)	(0.58)
Budget surplus	6.85**	7.00**	6.49*
	(3.39)	(3.38)	(3.47)
Inflation	−1.40**	−1.40**	−1.39**
	(0.41)	(0.41)	(0.41)
Openness	2.16**	2.12**	2.25**
	(0.51)	(0.50)	(0.54)
Aid/GDP	—	0.036	−0.085
		(0.13)	(0.19)
Partial R^2 of first-stage regressions			
Aid/GDP	—	—	0.44
Test for exogeneity of the aid variables			
$\chi^2(1)$	—	—	0.61
			[0.43]
Other statistics			
Observations	275	275	275
$\bar{R}^2$	0.35	0.35	0.35

Notes: The variables are described in more detail in the text. The dependent variable is real per capita GDP growth. The excluded exogenous variables for 2SLS estimation are listed in Table 1. White heteroskedasticity-consistent standard errors are in parentheses. p-values for the tests of exogeneity appear in brackets.

* Significant at the 10-percent level.

** Significant at the 5-percent level.

[5] Table A2 provides some country-specific information about the variables that are the main focus of our analysis: growth, aid, and policy.

[6] We tested our assumption that the policy variables are orthogonal to the error term in the growth equation using the Durbin-Wu-Hausman procedure described by Russell Davidson and James G. MacKinnon (1993 p. 237). This involves reestimating the growth equation by 2SLS treating the policy variables as endogenous. To do this we used the other right-hand-side variables and lagged policy variables as instruments. When we tested the exogeneity of the three variables individually or as a group, we found little change in the coefficients moving from OLS to 2SLS. The test statistics generated by Davidson and MacKinnon's procedure had p values equal to 0.38 for the budget balance, 0.62 for the inflation rate, 0.80 for openness, and 0.83 for the three variables as a group.

We use this regression to form a policy index comprised of the budget surplus, inflation, and trade openness. The policy index is formed by using the regression coefficients from Table 3 column (1):

$$(7)\quad \text{Policy} = 1.28 + 6.85 \times \text{Budget surplus} - 1.40 \times \text{Inflation} + 2.16 \times \text{Openness}.$$

As described earlier, in this way we let the growth regression determine the relative importance of the different policies in our index. By adding the constant 1.28, the index can be interpreted as a country's predicted growth rate, given its budget surplus, inflation rate, and trade openness, assuming that it had the mean values of all other characteristics.

Consistent with its large coefficient in the growth regression, the openness dummy has a large impact on the policy index. Note that the index can be negative if inflation is high or if the budget deficit is very large. The data set contains a number of observations with a negative value for the policy index. As Table 2 indicates, for the whole data set, the mean of the index is, by construction, the same as that of GDP growth, 1.2 percent. This is also the mean for the low-income countries. The standard deviation of the policy index is 1.3 for the whole sample and 1.3 for the low-income countries.

As we move to specifications of the growth equation including aid variables, we present estimates obtained using both OLS and 2SLS. Our strategy here is to present the results in parallel so that the impact of treating aid as endogenous can be seen clearly. We start by considering the OLS estimates of the growth equation with only aid/GDP introduced into it. As indicated by Table 3 column (2), using OLS, aid/GDP has an insignificant and small, positive coefficient. Notice that the coefficients on our policy variables are almost unchanged, indicating that the partial correlation between aid and our policy variables is close to 0. Using 2SLS, the coefficient on aid/GDP is still not significantly different from zero, although it is now slightly negative. Most of the other coefficients are similar in magnitude and significance across the two regressions. The interaction of assassinations with ethnic fractionalization, institutional quality, the policy variables, and the sub-Saharan Africa dummy all remain significant. The East Asia dummy and the assassinations variable lose a little significance, whereas initial GDP appears to be slightly more important. Table 3 also reports a measure of instrument relevance proposed by John Shea (1997): the partial R^2 between aid and its fitted values is 0.44.[7]

The fact that the coefficient on aid declines suggests that there may be positive correlation between aid and the error term in the growth equation. As we pointed out previously, there is no clear direction that the least-squares bias should take based on theory. Furthermore, as we discover later, the result that the effect of aid is apparently lower in 2SLS regressions is not robust throughout our analysis. One result that is robust, and is reported in Table 3, is that aid appears to be uncorrelated with the error term in the growth equation. When we tested for the exogeneity of aid using the difference between the OLS and 2SLS estimators, we obtained a test statistic with a p value of 0.43.[8] This suggests that we can have a certain degree of faith in our OLS results.

The most important result, however, is that with either the OLS or the 2SLS estimator, there is no significant relationship between aid and growth, consistent with Boone's findings.

Given that the coefficients on the policy variables did not change much when we added aid to the growth equation, it is not surprising that when we replace the policy variables by the policy index, as in Table 4 column (3), the coefficient on policy is very close to 1 and the coefficient on aid remains small and insignificant. The coefficients on the other variables retain their quantitative magnitudes and significance, and the OLS and

[7] This measure is obtained as the R^2 from a regression of a on b, where a is the component of an endogenous right-hand-side variable that cannot be explained by the other right-hand-side variables, and b is the component of the fitted values of an endogenous right-hand-side variable that cannot be explained by the fitted values of the other right-hand-side variables. The fitted values are obtained by projections onto the full instrument set.

[8] Once again, we used the procedure suggested by Davidson and MacKinnon (1993).

TABLE 4—GROWTH REGRESSIONS: USING ALL COUNTRIES AND THE POLICY INDEX

	(3)		(4)		(5)	
Estimation method	OLS	2SLS	OLS	2SLS	OLS	2SLS
Initial GDP	−0.61	−0.79	−0.56	−0.71	−0.60	−0.90
	(0.56)	(0.59)	(0.56)	(0.60)	(0.57)	(0.65)
Ethnic fractionalization	−0.54	−0.70	−0.42	−0.47	−0.42	−0.73
	(0.72)	(0.75)	(0.73)	(0.83)	(0.72)	(0.81)
Assassinations	−0.44*	−0.43	−0.45*	−0.44*	−0.45*	−0.41
	(0.26)	(0.27)	(0.26)	(0.26)	(0.26)	(0.27)
Ethnic fractionalization × assassinations	0.82*	0.78*	0.80*	0.75*	0.79*	0.71
	(0.44)	(0.44)	(0.44)	(0.45)	(0.44)	(0.45)
Institutional quality	0.64**	0.63**	0.67**	0.68**	0.69**	0.66**
	(0.17)	(0.17)	(0.17)	(0.19)	(0.17)	(0.18)
M2/GDP (lagged)	0.014	0.019	0.016	0.025	0.012	0.017
	(0.013)	(0.015)	(0.014)	(0.017)	(0.014)	(0.016)
Sub-Saharan Africa	−1.60**	−1.31*	−1.84**	−1.71**	−1.87**	−1.29
	(0.73)	(0.72)	(0.74)	(0.82)	(0.75)	(0.84)
East Asia	0.91*	0.81	1.20**	1.27**	1.31**	1.15**
	(0.54)	(0.53)	(0.58)	(0.63)	(0.58)	(0.56)
Policy index	1.00**	1.01**	0.78**	0.65**	0.71**	0.74**
	(0.14)	(0.14)	(0.20)	(0.30)	(0.19)	(0.20)
Aid/GDP	0.034	−0.12	0.49	−0.10	−0.021	−0.32
	(0.12)	(0.18)	(0.12)	(0.21)	(0.16)	(0.36)
(Aid/GDP) × policy	—	—	0.20**	0.37	0.19**	0.18*
			(0.09)	(0.33)	(0.07)	(0.10)
$(\text{Aid/GDP})^2$ × policy	—	—	−0.019**	−0.038	—	—
			(0.0084)	(0.038)		
Partial R^2 of first-stage regressions						
Aid/GDP	—	0.44	—	0.42	—	0.29
(Aid/GDP) × policy	—	—	—	0.16	—	0.60
$(\text{Aid/GDP})^2$ × policy	—	—	—	0.11	—	—
Test for exogeneity of the aid variables						
$\chi^2(j)$	—	1.10	—	0.85	—	1.51
		[0.29]		[0.84]		[0.47]
Other statistics						
Observations	275	275	275	275	270	270
$\bar{R}^2$	0.36	0.35	0.36	0.34	0.36	0.35

Notes: The variables are described in more detail in the text. The dependent variable is real per capita GDP growth. The excluded exogenous variables for 2SLS estimation are listed in Table 1. White heteroskedasticity consistent standard errors are in parentheses. p-values for the tests of exogeneity appear in brackets. The degrees of freedom parameter j is 1 in column (3), 3 in column (4), and 2 in column (5).

* Significant at the 10-percent level.

** Significant at the 5-percent level.

2SLS results are similar. As Table 4 reports, we continue not to reject the hypothesis that aid is uncorrelated with the error term in the growth equation.

In Section I we argued that the effectiveness of aid would likely depend on policy. To address this issue we entered two interactive terms, aid/GDP × policy and $(\text{aid/GDP})^2$ × policy, into our regression.[9] As Table 4 column (4) indicates, an interesting story then emerges from the OLS results. Aid itself still has a small,

[9] We entered the quadratic term because (i) including it is consistent with theory, when returns to capital are diminishing, and (ii) it appeared to improve the fit of the regression.

insignificant coefficient, but aid interacted with policy has a significantly positive coefficient, whereas the quadratic term has a significantly negative coefficient. These results imply that the impact of aid on growth is a positive function of the level of policy and a negative function of the level of aid (diminishing returns).

There are two aspects of the derivative of growth with respect to aid with which we are particularly concerned. First, is the slope of this derivative in the policy dimension significantly positive? This tells us whether aid is more effective in good policy environments than in bad ones. Second, is the derivative positive when evaluated at a "good" level of policy, for example, at policy equal to 2.4 (one standard deviation above the mean)? It is important to point out that the first question is the more important of the two for the following reason. If the cross-derivative of growth with respect to aid and policy is significantly positive, then there will always be some level of policy that is sufficient to make the derivative of growth with respect to aid significantly positive. This level may simply be higher than 2.4. In any case, for the regression in Table 4 column (4), the answer to both questions is "yes" at, respectively, the 7- and 14-percent significance levels. (We report these results and summarize the different estimates of the derivative of growth with respect to aid later in Table 6.) We now examine how robust these answers are when we instrument for aid, drop outliers, and restrict the sample to low-income countries.

The 2SLS regression with the two interactive terms is broadly consistent with its OLS counterpart. The magnitudes of the coefficients on the aid variables are quite similar across the two regressions, but they lose significance in the 2SLS regression. One reason for this may be that we have difficulty maintaining instrument relevance when there are three endogenous right-hand-side variables: Table 4 column (4) reports that the measures of instrument relevance are 0.16 and 0.11, respectively, for the two interaction terms with policy. Table 4 also reports that we continue not to reject the hypothesis that aid is exogenous, suggesting that our OLS results are reliable.

We suspect that five big outliers (Gambia 1986–1989, 1990–1993; Guyana 1990–1993; and Nicaragua 1986–1989, 1990–1993) are creating a problem in getting a precise estimate in the 2SLS regression. It turns out that the significance of the quadratic term depends completely on these five outliers. We gain some insight into this if we exclude the quadratic term and determine which observations influence the coefficient on aid × policy. Consider Figure 1. The y-axis in the graph is the difference between the coefficient on aid × policy using all observations and the coefficient on aid × policy with one observation at a time eliminated. The x-axis in the graph is the value of aid × policy for each observation. It is clear that the major outliers in the aid × policy dimension have considerable influence on the slope coefficient. These observations are more than 5 standard deviations from the mean of the data set that remains when they are dropped. We should emphasize that including the outliers leads to estimates that are consistent with our basic story about the effects of aid and policy on growth. We think, however, that they lead to an overestimate of the impact of aid on growth in the range where most of the observations are located.

Once the outliers are dropped from the analysis, the quadratic term becomes insignificant. With the outliers dropped a regression with just aid/GDP and aid/GDP × policy leads to the results in Table 4 column (5). In the OLS regression the interaction between aid and policy is highly significant and has a coefficient of 0.19. The corresponding 2SLS regression has a similar point estimate, 0.18, and is also significant, although only at the 8-percent level.

B. *Regressions with Only Low-Income Countries*

The next step in our analysis was to drop middle-income countries; these countries have good access to international capital markets and there is no compelling reason to think that aid would have the same effect on their growth rates as it would on those of low-income countries. We arbitrarily defined middle-income as countries with real per capita GDP above $1,900 at the beginning of our sample time period, 1970. We excluded Nicaragua from the middle-income category because its real per capita GDP fell below

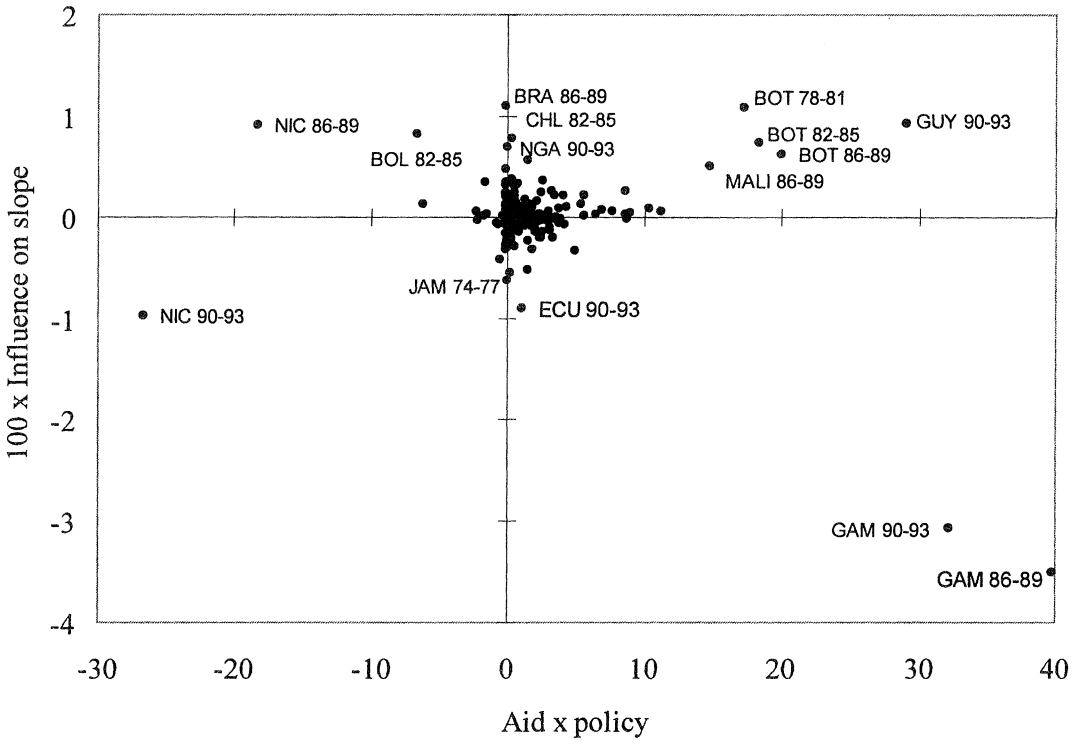

FIGURE 1. OUTLIERS IN THE AID × POLICY DIMENSION

Notes: The *y*-axis illustrates the influence of each observation on the slope coefficient on the interaction term, aid × policy, when the quadratic interaction term is omitted from the regression. Influence is defined as the difference in the slope coefficient when each observation is omitted. The *x*-axis is the value of aid × policy for each observation. Country mnemonics (used in World Bank publications) are given along with time periods for some important points.

$1,900 by 1982.[10] In total we eliminated 16 countries, listed in Table A1, leaving us with 40 countries and 189 observations.

First, in Table 5 column (6) we present the OLS and 2SLS regressions with no interaction terms in them. The results there are quite consistent with our findings in the other similarly specified regressions. Aid appears to have no significant impact on growth, although now the point estimates for the two cases are almost identical.

When we introduce the interaction of aid and policy, however, we get results similar to those for the whole sample. Table 5 column (7) shows that for lower-income countries the simple interaction term and the quadratic term are both highly significant in the OLS regression. Once again, the coefficient on the quadratic term depends on the outliers, which are all lower-income country observations. Perhaps because of problems with instrument relevance we again lose significance of these coefficients when we move to the 2SLS regression. On the other hand, the magnitudes of the point estimates are quite similar.

When we drop the outliers, in Table 5 column (8), the coefficient on aid × policy is highly significant in both the OLS and the 2SLS regressions. Once again, across all our regressions we never reject the hypothesis that the aid variables are orthogonal to the error term in the growth equation. Therefore, we rely most heavily on our OLS results.

Table 6 conveniently brings together all of the estimates of the derivative of growth with

[10] Nicaragua is the only country with an initial per capita GDP above 1,900 dollars, whose per capita GDP fell below 1,900 dollars within our sample period.

TABLE 5—GROWTH REGRESSIONS: USING LOWER-INCOME COUNTRIES AND THE POLICY INDEX

	(6)		(7)		(8)	
Estimation method	OLS	2SLS	OLS	2SLS	OLS	2SLS
Initial GDP	−0.74	−0.74	−0.60	−0.58	−0.72	−0.83
	(0.80)	(0.78)	(0.79)	(0.78)	(0.81)	(0.77)
Ethnic fractionalization	−0.78	−0.78	−0.56	−0.45	−0.58	−0.67
	(0.81)	(0.83)	(0.80)	(0.95)	(0.80)	(0.84)
Assassinations	−0.75*	−0.75*	−0.84*	−0.90**	−0.79*	−0.76*
	(0.46)	(0.45)	(0.43)	(0.45)	(0.44)	(0.44)
Ethnic fractionalization × assassinations	0.95	0.95	0.88	0.85	0.69	0.63
	(0.89)	(0.89)	(0.90)	(0.90)	(0.91)	(0.90)
Institutional quality	0.77**	0.77**	0.80**	0.81**	0.84**	0.84**
	(0.19)	(0.19)	(0.20)	(0.21)	(0.20)	(0.19)
M2/GDP (lagged)	0.028*	0.028*	0.031*	0.035*	0.024	0.025
	(0.016)	(0.016)	(0.017)	(0.019)	(0.017)	(0.017)
Sub-Saharan Africa	−1.86**	−1.85**	−2.20**	−2.35**	−2.24**	−2.11**
	(0.65)	(0.67)	(0.67)	(0.91)	(0.67)	(0.73)
East Asia	0.70	0.69	1.33*	1.63	1.54**	1.46**
	(0.56)	(0.56)	(0.71)	(1.21)	(0.67)	(0.71)
Policy index	1.14**	1.14**	0.74**	0.55	0.56*	0.59
	(0.19)	(0.19)	(0.35)	(0.76)	(0.31)	(0.38)
Aid/GDP	−0.033	−0.034	−0.013	−0.010	−0.18	−0.24
	(0.13)	(0.16)	(0.13)	(0.17)	(0.17)	(0.26)
(Aid/GDP) × policy	—		0.27**	0.43	0.26**	0.25**
			(0.12)	(0.49)	(0.08)	(0.12)
$(\text{Aid/GDP})^2$ × policy	—		−0.024**	−0.041	—	—
			(0.0093)	(0.047)		
Partial R^2 of first-stage regressions						
Aid/GDP	—	0.57	—	0.56	—	0.39
(Aid/GDP) × policy	—	—	—	0.11	—	0.58
$(\text{Aid/GDP})^2$ × policy	—	—	—	0.09	—	—
Test for exogeneity of the aid variables						
$\chi^2(j)$	—	0.00	—	0.04	—	0.24
		[0.99]		[1.00]		[0.89]
Other statistics						
Observations	189	189	189	189	184	184
$\bar{R}^2$	0.42	0.42	0.42	0.42	0.42	0.42

Notes: The variables are described in more detail in the text. The dependent variable is real per capita GDP growth. The excluded exogenous variables for 2SLS estimation are listed in Table 1. White heteroskedasticity-consistent standard errors are in parentheses. p-values for the tests of exogeneity appear in brackets. The degrees of freedom parameter j is 1 in column (6), 3 in column (7), and 2 in column (8).

* Significant at the 10-percent level.

** Significant at the 5-percent level.

respect to aid. If the interaction of aid and policy is omitted, the estimates are never significantly different from zero, as in other work. With the interaction term added, we consistently find that the impact of aid is greater in a good policy environment than in a poor policy environment. That result is statistically significant in all of the regressions, except for the 2SLS regressions that include the outliers. For most of the OLS regressions, we have confidence that the derivative of growth with respect to aid is positive at a good level of policy (policy = 2.4).

Our favored specification is the one with the

TABLE 6—THE IMPACT OF AID AND POLICY ON GROWTH

Regression	Method	Derivative of growth with respect to: Aid/GDP	Policy
A. In regressions without interaction terms			
All countries (3)	OLS	0.03	1.00
		(0.12)	(0.14)
	2SLS	−0.12	1.01
		(0.18)	(0.14)
Lower-income countries (6)	OLS	−0.03	1.14
		(0.13)	(0.19)
	2SLS	−0.03	1.14
		(0.16)	(0.19)

B. In regressions with simple and quadratic interaction terms

		At policy = 1.2	At policy = 2.4	Difference	At aid = 1.6
All countries (4)	OLS	0.21	0.39	0.18*	1.06
		(0.19)	(0.26)	(0.10)	(0.17)
	2SLS	0.20	0.51	0.32	1.15
		(0.39)	(0.63)	(0.26)	(0.23)
Lower-income countries (7)	OLS	0.21	0.44*	0.24**	1.10
		(0.18)	(0.27)	(0.12)	(0.24)
	2SLS	0.34	0.71	0.37	1.13
		(0.47)	(0.88)	(0.43)	(0.23)

C. In regressions with simple interaction terms

		At policy = 1.2	At policy = 2.4	Difference	At aid = 1.6
All countries (5)	OLS	0.20	0.43**	0.23**	1.01
		(0.15)	(0.18)	(0.09)	(0.14)
	2SLS	−0.12	0.11	0.22*	1.02
		(0.31)	(0.31)	(0.13)	(0.15)
Lower-income countries (8)	OLS	0.13	0.47**	0.33**	0.99
		(0.15)	(0.20)	(0.11)	(0.22)
	2SLS	0.05	0.37	0.32**	1.00
		(0.22)	(0.27)	(0.15)	(0.24)

* Significantly greater than 0 at the 10-percent level.
** Significantly greater than 0 at the 5-percent level.

single interaction term (aid × policy) and the outliers excluded (Table 6, Part C). For both samples, we find that the derivative of growth with respect to aid is significantly higher in a good policy environment than in an average one. We also find that policy seems to be more important for aid effectiveness in lower-income countries: the cross-derivative of growth with respect to aid and policy is around 0.23 for the whole sample and 0.33 for the lower-income sample.

We interpret the higher estimate in the low-income sample in the following way. Our overall sample includes middle-income countries such as Chile and Mexico. Thus, if you think that the experience of Chile or Mexico conveys useful information about what would happen to a low-income reformer without aid, you should prefer the estimates obtained with the full sample, which are based on the regressions in Table 4. If you are skeptical that low-income reformers such as Mali and Ghana will obtain the same impact from reform as Chile and Mexico, then you should prefer the results based on Table 5, from the data set that excludes the middle-income countries. Fortunately, at dispute here is only the quantitative estimate of the impact of policy on aid effectiveness. The qualitative results are quite robust.

The reason that the results are so robust can be

TABLE 7—EXPLAINING THE INTERACTION OF AID AND POLICY

13 Largest values of unexplained (Aid/GDP) × policy						
Country	Time period	Aid/GDP	Policy	Aid/GDP × policy	Unexplained Aid/GDP × policy	Unexplained growth
Botswana	1978–1981	6.4	2.7	17.3	7.3	4.4
Botswana	1986–1989	4.4	4.5	20.0	7.2	1.5
Botswana	1982–1985	4.6	4.0	18.4	6.8	2.2
Mali	1986–1989	7.6	1.9	14.9	5.1	4.3
Bolivia	1982–1985	1.4	−4.5	−6.5	4.8	3.8
Philippines	1978–1981	0.3	1.0	0.2	3.4	1.5
Philippines	1974–1977	0.3	1.0	0.3	3.0	1.0
Bolivia	1990–1993	3.3	3.1	10.5	3.0	1.3
Ghana	1986–1989	3.7	3.1	11.3	2.4	0.2
Philippines	1970–1973	0.4	1.0	0.4	2.2	0.6
Honduras	1990–1993	3.4	2.6	8.9	2.2	0.9
Nigeria	1990–1993	0.2	0.2	0.0	2.0	5.2
Ghana	1990–1993	2.9	3.1	9.0	1.8	0.9

Notes: Unexplained (Aid/GDP) × policy is the residual from a regression of (Aid/GDP) × policy on the other right-hand-side variables in the OLS regression in Table 5 column (8). Unexplained growth is the residual from a regression of per capita real GDP growth on the same regressors.

seen in Table 7. This table summarizes information from the OLS regression reported in Table 5 column (8). The coefficient on the interaction term between aid/GDP and policy depends on the correlation between the components of growth and aid/GDP × policy that cannot be explained by the other right-hand-side variables. We have listed the 13 observations for which the unexplained component of aid/GDP × policy is one standard deviation above its mean. These 13 observations happen to include the 8 largest values of aid/GDP × policy, and 5 observations for which aid/GDP × policy was well below its average value. All 8 of the large values of aid/GDP × policy correspond to observations in which both aid and policy were well above their mean values. Notice also, that in all 13 cases, the unexplained component of growth is also positive. For these 13 observations the correlation between unexplained aid/GDP × policy and unexplained growth is 0.40. For the rest of the data set, including the negative outliers, the correlation is 0.01.

We think of the countries that have large values of aid/GDP × policy as reformers who have also received lots of aid; and, as we see in Table 7, many of these countries are ones that have grown quite fast. We think of these as the observations that largely explain our findings and they include a wide range of countries: Bolivia, Botswana, El Salvador, Ghana, Honduras, and Mali.

A final question about the estimates of the impact of aid on growth is whether, aside from statistical significance, they are economically meaningful and plausible in light of the models that underlie our empirical work. With an aggregate production function of the form $Y = AK^{\theta}$ aid can affect output only through its effect on the stock of capital, that is, to the extent that it is used for investment rather than consumption. A first-order approximation to the effect of aid on growth can be obtained as follows:

$$dY = \theta A K^{\theta-1} \frac{\partial K}{\partial F} dF, \tag{8}$$

where dY represents the increase in output induced by the injection of aid, $\partial K/\partial F$ is the fraction of an additional unit of aid that is invested, and dF is the size of the aid injection. Notice that we can measure the quantities dY and dF relative to the previous level of output Y. Furthermore, $\theta A K^{\theta-1} = MPK = r + \delta$, where MPK is the marginal product of capital and r is the net rate of return to capital. Hence we may write

TABLE 8—ALLOCATION OF AID: LOWER-INCOME COUNTRIES

	Total	Bilateral	Multilateral	World Bank
Initial GDP	−2.43**	−1.11**	−1.32**	−0.47**
	(0.44)	(0.27)	(0.27)	(0.080)
Population	−0.84**	−0.45**	−0.39**	−0.079**
	(0.14)	(0.082)	(0.084)	(0.018)
Policy	0.20	0.061	0.14**	0.040**
	(0.16)	(0.12)	(0.062)	(0.020)
Sub-Saharan Africa	0.082	0.43	−0.34	−0.12*
	(0.38)	(0.26)	(0.25)	(0.068)
Egypt	1.81**	1.60**	0.21	0.10
	(0.56)	(0.45)	(0.19)	(0.071)
Franc zone	0.54	0.34	0.19	0.040
	(0.50)	(0.36)	(0.18)	(0.098)
Central America	0.28	0.52	−0.23	−0.060
	(0.40)	(0.34)	(0.21)	(0.072)
Arms imports (lagged)	0.012	0.011	0.0006	−0.0028*
	(0.018)	(0.014)	(0.0044)	(0.0015)
Observations	195	195	195	195
Mean of aid/GDP	2.07	1.38	0.69	0.17
$\bar{R}^2$	0.61	0.53	0.55	0.50

Notes: The estimates were obtained by OLS. The variables are described in the text. The dependent variable is the indicated type of aid as a percentage of GDP. Standard errors are in parentheses. They were computed to be robust to heteroskedasticity and first-order serial correlation.

* Significant at the 10-percent level.

** Significant at the 5-percent level.

$$\frac{dY}{Y} = (r + \delta)\frac{\partial K}{\partial F}\frac{dF}{Y}. \tag{9}$$

One could interpret the derivative of growth with respect to aid in our regressions as an estimate of $(r + \delta)(\partial K/\partial F)$. At a "good" level of policy, the estimates of this derivative from our preferred specification (with one interaction term and the outliers excluded) range from 0.11 to 0.47 (Table 6). The upper end of this range is fairly high but plausible, provided that there is a high return to capital and a high marginal propensity to save out of additional income. A poor country that has put good policy into place should have a relatively high marginal propensity to save.[11] If we take it that this country is well below its steady state level of capital stock, then it would also have a high marginal return to capital in a world with diminishing returns.

Table 6 also partially addresses the issue of possible misspecification. Recall that in forming the policy index we used the coefficients in a growth regression that excluded aid. By doing this we may have misspecified the relationship between growth and policy in our subsequent regressions. But, had we grossly misspecified any of these subsequent regressions, the coefficient on the policy index should have departed greatly from 1. Table 7 shows that it did not do so.

III. Explaining the Allocation of Aid

We turn now to estimating equation (2), which describes the allocation of aid/GDP, for the low-income subset of our data. We use OLS since we are treating policy and the other variables included in the equation as exogenous. The estimates are found in Table 8, under the heading "Total."

As expected, the aid allocation equation has large negative coefficients on initial income and population. Smaller and poorer countries get more aid. The dummy variables we used to capture donors' strategic interests are, for the

[11] Low-income countries do not necessarily have low marginal propensities to save, despite empirical evidence that shows they have low average savings rates. As Lawrence J. Christiano (1989) and Rebelo (1992) have shown, models with subsistence consumption can explain this empirical regularity in an environment where there is a high marginal propensity to save.

most part, insignificant in explaining the allocation of aid, although they all have the expected signs. The dummy variable for Egypt, an ally of the United States, is highly significant, indicating that Egypt gets about 2 percent of its GDP in aid, beyond what can be explained by the other variables. To capture strategic interests we also use a measure of arms imports relative to total imports lagged one period. This variable helps explain the allocation of aid to middle-income countries, but has only minor relevance in the low-income country data set.

Does aid favor good policy? It can be seen that policy has a positive coefficient. The magnitude is small, however: a 1-standard-deviation improvement in policy would result in about 12 percent more aid for the average country (0.09 of the standard deviation of aid). The estimate is also not significantly different from zero. We also estimate separate equations for bilateral and multilateral aid, and for World Bank aid, which is part of the latter.[12] Not surprisingly, the donor interest variables are more important for bilateral than for multilateral aid. The dummy variable for Egypt remains significant, whereas the dummy variables for sub-Saharan Africa and Central America are very close to being significant at the 10-percent level. In the bilateral aid equation, the coefficient on policy is very close to zero. This finding is important since bilateral aid is about two-thirds of total aid.

For multilateral aid, and for the World Bank part of that, there is a significant positive coefficient on policy. A 1-standard-deviation improvement in policy results in 24 percent more multilateral aid and 30 percent more World Bank assistance. World Bank aid is also the most sensitive to initial income when scaled appropriately.

As a diagnostic we also estimated the aid equations by 2SLS, treating the policy index as an endogenous variable. (We used the procedure described in footnote 6). The test statistics had *p*-values equal to 0.52 for total aid, 0.23 for bilateral aid, 0.97 for multilateral aid, and 0.64 for World Bank aid. Thus, it seems reasonable that we treated policy as exogenous in the aid equation.

[12] To facilitate comparisons across different categories of donor, it is useful to note the different means of the categories of aid. Relative to coefficients in the equation for total aid, the coefficients in the bilateral aid equation should be scaled up by a factor of 1.5. For multilateral and World Bank aid, the scale factors are 3 and 12.5, respectively.

TABLE 9—DETERMINANTS OF GOVERNMENT CONSUMPTION

Dependent variable	Government consumption
Initial GDP	3.63**
	(1.14)
Ethnic fractionalization	1.73
	(1.58)
Assassinations	−0.93*
	(0.55)
Ethnic fractionalization × assassinations	1.24
	(1.27)
Institutional quality	−0.58*
	(0.31)
M2/GDP (lagged)	0.17**
	(0.039)
Sub-Saharan Africa	2.29**
	(1.15)
East Asia	−0.021
	(0.88)
Bilateral aid/GDP	1.71**
	(0.53)
Multilateral aid/GDP	0.41
	(0.80)
Population	−0.25
	(0.39)
Dependent population	0.081**
	(0.037)
Observations	176
$\bar{R}^2$	0.49

Notes: The variables are described in the text. The dependent variable is government consumption as a percentage of GDP. The estimates were computed using OLS. Standard errors are in parentheses. They were computed to be robust to heteroskedasticity and first-order serial correlation.

* Significant at the 10-percent level.

** Significant at the 5-percent level.

IV. Aid and Government Consumption

Using the lower-income country subsample, we also estimated an equation for government consumption that is presented in Table 9. It turns out that government consumption is a strong, positive function of aid. We model government consumption as a function of the institutional-political variables that affect growth. Following the literature, we also include population and the dependency ratio of the population as explanatory variables (Dani Rodrik, 1998). In this equation we distinguish between bilateral aid and multilateral aid; the former has a large positive association with government consumption, whereas the latter has none.

Given that aid does not appear to be correlated with shocks in the growth equation (our earlier tests for exogeneity showed this) and that aid responds very little to policy, we treat aid as exogenous and estimate the equation for government consumption by OLS. The results suggest that the aid associated with donor interests, primarily bilateral aid, increases government consumption. When we included government consumption in our growth equations it was never significant. So these results may provide some insight into why aid is not effective in the typical recipient country.

V. Conclusion

In this paper we have investigated several questions regarding the interactions among foreign aid, economic policies, and growth. Our primary question concerned the effect of aid on growth. Consistent with other authors, we found that on average aid has had little impact on growth, although a robust finding was that aid has had a more positive impact on growth in good policy environments. This effect goes beyond the direct impact that the policies themselves have on growth.

A second question concerned the allocation of aid: do donors favor good policy? We found no significant tendency for total aid or bilateral aid to favor good policy. On the other hand, aid that is managed multilaterally (about one-third of the total) is allocated in favor of good policy. These findings, combined with a separate finding that bilateral aid is strongly positively correlated with government consumption, may help to explain why the impact of foreign aid on growth is not more broadly positive. Our results indicate that making aid more systematically conditional on the quality of policies would likely increase its impact on developing country growth. This would be true as long as conditional aid of this type had plausible incentive effects.

A final point is that there is a marked trend toward better policy among poor countries, which means that the climate for effective aid is improving. In our sample the mean of the policy index reached a nadir of 1.0 in the 1982–1985 period, and then climbed to a peak of 1.8 in the most recent period, 1990–1993. Our OLS results suggest that the effect of aid was significantly positive for a policy level of 2.4: by 1990–1993, 15 of our 40 poor countries had attained that level. Ironically, the past few years have seen cutbacks in the financing of foreign aid: in 1997 OECD countries gave less, as a share of their GNP, than they have in decades. Thus, the climate for effective aid is improving, while the amount of aid diminishes.

APPENDIX

TABLE A1—COUNTRY COVERAGE OF THE AID DATA SET

Sub-Saharan Africa	Latin America	Middle East and North Africa	East Asia	South Asia
		A. Lower income		
Botswana	Bolivia	Algeria	Indonesia	India
Cameroon[a]	Dominican Republic	Egypt	Korea	Pakistan
Côte d'Ivoire[a]	Ecuador	Morocco	Philippines	Sri Lanka
Ethiopia	El Salvador[b]	Tunisia	Thailand	
Gambia	Guyana			
Ghana	Haiti			
Kenya	Honduras[b]			
Madagascar	Nicaragua[b]			
Malawi	Paraguay			
Mali[a]				
Niger[a]				
Nigeria				
Senegal[a]				
Sierra Leone				
Somalia				
Tanzania				
Togo[a]				
Zaire				
Zambia				
Zimbabwe				
		B. Middle income		
Gabon[a]	Argentina	Syria	Malaysia	
	Brazil	Turkey		
	Chile			
	Colombia			
	Costa Rica[b]			
	Guatemala[b]			
	Jamaica			
	Mexico			
	Peru			
	Trinidad and Tobago			
	Uruguay			
	Venezuela			

Notes: Countries defined as middle income had, in 1970, per capita real GDP greater than 1,900 constant (1985) U.S. dollars. Nicaragua was excluded from the middle-income set because its income level shrank to below 1,900 dollars by 1982. All other countries are referred to as lower income.

[a] Indicates that a country is in the Franc zone.

[b] Indicates that a country is in Central America.

TABLE A2—COUNTRY-SPECIFIC SUMMARY STATISTICS

Country	*N*	Per capita GDP in 1970 (1985 US$)	Per capita GDP growth (percent per annum)	Aid (percent of GDP)	Policy index
Algeria	2	1826	2.8	0.77	1.1
Argentina	6	5637	0.4	0.02	−0.2
Bolivia	6	1661	0.0	1.80	1.5
Botswana	3	823	7.5	5.12	3.8
Brazil	6	2434	2.4	0.03	−0.2
Cameroon	5	804	0.8	1.88	1.2
Chile	6	3605	2.1	0.16	2.2
Colombia	6	2140	2.1	0.12	1.6
Costa Rica	6	2904	1.5	1.02	1.6
Côte d'Ivoire	1	1615	−2.6	0.85	0.4
Dominican Republic	6	1536	2.7	0.60	1.0
Ecuador	6	1789	2.6	0.32	2.3
Egypt	5	1163	3.8	2.39	0.4
El Salvador	6	1810	−0.3	1.87	1.4
Ethiopia	2	296	−4.7	3.75	0.8
Gabon	6	3704	1.3	1.91	0.9
Gambia	6	722	0.3	7.08	1.6
Ghana	6	1059	−0.7	1.92	1.4
Guatemala	6	2028	0.6	0.49	1.5
Guyana	6	1816	−0.4	3.74	0.1
Haiti	5	834	0.1	1.77	1.0
Honduras	6	1237	0.9	2.19	1.2
India	6	802	2.1	0.26	0.8
Indonesia	6	715	4.9	0.39	3.2
Jamaica	3	2645	−2.9	1.42	0.1
Kenya	6	586	1.3	2.34	0.9
Korea	6	1680	7.0	0.20	3.2
Madagascar	4	1146	−1.7	2.70	0.9
Malawi	4	440	−1.1	5.65	0.6
Malaysia	6	2154	4.4	0.20	2.8
Mali	1	419	4.6	7.65	1.9
Mexico	6	3987	1.4	0.02	1.3
Morocco	6	1342	1.7	0.94	1.6
Nicaragua	6	2359	−3.5	3.14	−1.0
Niger	2	805	1.5	5.38	0.9
Nigeria	6	767	0.8	0.14	0.8
Pakistan	6	1029	2.8	0.77	0.7
Paraguay	6	1394	2.2	0.69	1.5
Peru	6	2736	−0.7	0.41	0.1
Philippines	6	1403	0.9	0.44	1.5
Senegal	4	1146	−0.2	3.63	1.0
Sierra Leone	6	1435	−0.4	1.70	0.3
Somalia	2	921	0.6	4.44	0.6
Sri Lanka	6	1243	2.9	1.17	1.2
Syria	5	2294	3.1	1.86	0.8
Tanzania	2	424	0.3	5.86	0.4
Thailand	6	1526	5.2	0.24	3.2
Togo	4	618	−0.2	5.36	0.5
Trinidad and Tobago	5	6795	0.6	0.07	1.1
Tunisia	3	1442	1.3	0.91	1.7
Turkey	1	2202	3.8	0.33	2.4
Uruguay	6	4121	1.2	0.13	0.8
Venezuela	6	7753	−0.5	0.01	1.5
Zaire	5	686	−1.9	2.35	0.6
Zambia	6	1117	−2.0	4.81	0.1
Zimbabwe	3	1082	−0.7	2.34	0.5

Notes: *N* indicates the number of four-year periods for which the variables in our regressions were observed for the country indicated. The policy index is described in the text. It is the weighted average of the openness measure, the inflation rate, and the budget surplus, where the weights are given by the corresponding coefficients in the regression reported in Table 4 column 1. The index is measured in terms of percentage points of GDP growth. The figures for GDP growth, aid, and the policy index are averages across all four-year periods in which they are defined during the interval 1970–1993.

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