A Sensitivity Analysis Approach on the Effect of Foreign Aid on Growth

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There is a huge body of literature on the relationship between aid and economic growth using all kinds of econometric techniques, however, little work is done on whether these econometric results are robust to changes in critical parameters included in the model or changes in model specifications. The empirical evidence that foreign aid helps or hurts economic growth is dubious at best despite the intuitive reasoning of both proponents and opponents of foreign aid. Whatever cogent theoretical reasons may be given in support of one perspective or another, the empirical results do not clarify the issue one way or the other. The ambiguity and the inconclusiveness of the empirical results demand a new approach. Using a robust approach and a novel econometric practice, this paper adds a new dimension into the current debate and tries to address the shortcomings of the literature and the nature of the conflicting findings in the literature.

INTRODUCTION

The effectiveness of foreign aid and its impact on economic growth is one of the hotly debated and controversial issues in the growth literature. There is a voluminous amount of cross-country as well as single-country studies examining the effect of aid on growth. Some of the most recent contributions include Ruhashyankiko (2005), Feeny (2007), Alvi, Makherjee and Shukralla (2008), and Kraay and Raddatz (2007). Among the atest contributions include those that provide evidence of a positive and a significant relationship between foreign aid and growth (Irandoust and Ericsson 2005, Berthault 2005, Karras 2006, Trevino and Upadhyaya 2003, Dalgaard and Hansen 2004, and Hatemi and Irandoust 2005).

Most of these recent studies suggest that from a micro point of view, foreign aid is found both theoretically and empirically, to be a positive engine of economic growth. The current analyses of the positive empirical relationships between foreign aid and growth focuses on the design of

new theoretical models (Dalgaard and Hansen 2004, Mourmouras and Ranzagas 2007, Economides, Kalyvitis and Philippopoulos 2008, Chatterjee and Turnovsky 2005 and 2007, Durbarry 2004), and on the application of advanced econometric methods (Minoiu and Reddy 2007, Gounder 2001, Mavrotas 2002, Outtara and Strobl 2008, and Gomanee, Girma and Morrissey 2005). Burnside and Dollar (2000) and Boone (1996).

However, other recent studies contradict the above empirical studies and suggest that foreign aid contributes negatively to economic growth. Among these are Burnside and Dollar (2000) and Boone (1996). Boone's studies came negatively against aid while Burnside and Dollar study suggest that aid works if complemented with good economic policies. Burnside and Dollar argue that aid works only if given to countries with low inflation, small budget deficits, openness to trade, strong rule of law, and competent bureaucracy.

Moreover, most of the earlier empirical studies are also inconclusive and ambiguous at best. Michalopoulos and Sukhatme (1989) conclude that the cross-country evidence is ambiguous, and White (1992a) asserts that little is known about the macroeconomic impacts of aid. White (1992b) also argues that there is no agreement as to the positive or the negative relationship between aid and growth. In their survey of the aid literature Hansen and Tarp (1999) found that 25 out of 41 studies showed a negative and significant relationship between foreign aid and domestic savings, while only one study found a positive and significant relationship between aid and savings. The remaining 15 studies were not conclusive.

Although there is a huge body of literature on the relationship between aid and economic growth using all kinds of econometric techniques, little work is done on whether these econometric results are robust to changes in critical parameters included in the model or changes in model specifications.

The current scholarship on the effect of foreign aid on growth tries to remedy the empirical anomalies of earlier and uses advanced and state-of-the-art econometric techniques including asymptotic theory of likelihood-based panel cointegration (Irandoust and Ericsson 2005), time lags to test the short-run and long-run effects of foreign aid (Berthault 2005), the Autoregressive Distributed Lag approach to cointegration (Feeny 2005), OLG models and dynamic GEM (Dalgaard, Hansen and Tarp 2004), and Mourmouras and Ranzagas 2007), the cointegration methodology within a neoclassical growth model (Quazi 2005), and residual generated regressors (Gomanee, Girma and Morrissey 2005).

However, the empirical evidence that foreign aid helps or hurts economic growth is still dubious at best despite the intuitive reasoning of both proponents and opponents of foreign aid. Whatever cogent theoretical reasons may be given in support of one perspective or another, the empirical results do not clarify the issue one way or the other. The ambiguity and the inconclusiveness of the empirical results demand a new approach. Using a robust approach and a novel econometric practice, this paper adds a new dimension into the current debate and tries to address the shortcomings of the literature and the nature of the conflicting findings in the literature. The rest of the paper is organized as follows. Section 2 highlights the alternative views of the effect of aid on growth. Section 3 is a methodology and data description. Section 4 presents the empirical results. Section 5 re-examines the empirical results using extreme-bound analysis (EBA) and verifies the robustness of the empirical results. Section 4 concludes and provides suggestions for further research.

ALTERNATIVE VIEWS ON FOREIGN AID AND ECONOMIC GROWTH

Foreign Aid as an Engine of Economic Growth

The view that aid enhances growth is predicated on the assumption that foreign aid is an exogenous net increment to the capital stock of the recipient country (Rosenstein-Rodan 1961). The underlying theoretical framework of Rosenstein-Rodan and others is based on Harrod-Domar model whereby increases in foreign aid will fill the savings-investment gap and will ultimately contribute to capital formation and economic growth. This theory dubbed as the Financial Two Gap Approach is based on the assumption that foreign aid is not fungible and will increase saving and investment in a one-to-one ratio. The Financial Two Gap Approach assumed that a gap exists either between saving and investment or between exports and imports. It posited that developing countries could not overcome the shortage of savings and foreign exchange on their own due to their limited resources. Thus, the rationale of the Financial Two Gap Approach is that foreign aid should make up the differences between either the saving-investment gap or the export-import gap.

Papanek (1972) examined empirically the relationship between foreign aid, saving, and foreign private investment. He argued that foreign aid should be channeled to those countries that have a balance of payments constraint. His findings conclude that foreign aid, unlike foreign direct investment and domestic saving, can fill the foreign exchange and savings gap. He finds a positive and a significant relationship between foreign aid as a percentage of national income and growth. Nevertheless, Papanek's study remains controversial and incorporates many econometric anomalies, such as simultaneity and measurement problems. Similarly, Mosley, Hudson and Horrel (1987) find a positive correlation between foreign aid and economic growth; however, their coefficient on aid was insignificant. Levy (1987b) reports that foreign aid in low-income countries raised investment in a one-to-one ratio and Chaudhuri (1978) finds similar results in his study of India. Roemer (1989) suggests that foreign aid relaxes the foreign exchange bottleneck and therefore increases output. Newlyn (1990) also claimed that foreign aid is effective while noting that foreign aid's positive effects are offset by negative oil shocks, debt crisis, and other exogenous variables.

Foreign Aid as an Obstacle to Economic Growth

The notion that foreign aid is inimical to economic growth is based on the assumption that it will lead to lower domestic savings (Griffin 1970 and Griffin and Enos 1970). Griffin (1970) argued that foreign aid displaces savings, which in turn retards investment and consequently economic growth. One of the most widely cited results of the aid-growth relationship are those by Mosley, Hudson, and Horrell (1992) in which they concluded that aid doesn't spur growth. Easterly (1998) renounced the validity of foreign aid studies and asserted that foreign aid failed to increase investment. He noted that the Financial Two Gap Approach calculation produced distorted incentive for aid- the lower a country's domestic saving, the larger the gap and the more the aid a country is expected to receive.

Another proposition that foreign aid is inimical to economic growth is based on the presumption that it will strengthen the power of predatory governments and thus undermines the emergence of the private sector (Friedman 1958, and Bauer 1972). Krauss (1997) claimed that Taiwan's high growth rate was mainly encouraged by the loss of American aid in early 1960s.

As the foreign aid was withheld, Taiwan had no option but to abandon its protectionist trade policy that was previously sustained by foreign aid.

Furthermore, Levy (1984) found that the negative impact of foreign aid on public savings as government reduces tax levels or tax efforts is not completely offset by its positive impact on income. Likewise, Pillai (1982) found that sixty percent of foreign aid in Jordan was used to finance investment while the remaining forty percent was used either to reduce taxes or slacken revenue collection. Boone (1996) overturned the positive results of Dowling and Hiemenz (1982) and Levy (1988) by using instrument techniques and panel data. He finds that foreign aid has no impact on investment and economic growth. Rather, he found that foreign aid increased the scope of government activities. He also noted that only wealthy and powerful groups gain from foreign aid.

AID AND ECONOMIC GROWTH: METHODOLOGY AND DESCRIPTION OF THE VARIABLES

The specification of the growth equation is similar to that adopted in Barro (1996) and Levine and Renelt (1992) and can be written as follows:

$$\begin{aligned} &\textit{Real Per Capita GDP Growth Rate} = \alpha_1 \textit{Initial GDP} + \alpha_2 \textit{INV} + \alpha_3 \textit{Edu} \qquad (1) \\ &+ \alpha_4 \textit{Policy Index} + \alpha_5 \textit{Aid/GDP} + \alpha_6 \textit{Policy Index*Aid/GDP} + \\ &\alpha_7 \textit{Institutional Quality} + \alpha_8 (\textit{dummy}) + \mu \end{aligned}$$

The dependent variable in equation 1 is the real per capita GDP growth rate from 1975-2005. The control variables are standard in the literature including a proxy for the initial level of income and the level of physical and human capital. Most of the empirical literature on growth includes one or more of these conditioning variables. The control variables also include measures of institutional quality and the quality of the economic policy. Appendix A provides a detailed description of the variables.

The initial level of real GDP per capita in 1975 is included to verify the convergence hypothesis. The convergence hypothesis and the steady-state theory predicted in the neoclassical growth theory rests on the premise that countries are similar except for their starting GDP level. Therefore, poor countries are predicted to grow faster than rich countries. If this is true, we expect a negative sign for the coefficient of this variable (α_1).

The level of investment is also included as a control variable. INV is the average Investment/GDP ratio and is a measurement of the endowment of physical capital and the accumulation of savings in different countries. The higher the investment; the higher the growth rate, therefore, we expect a positive sign for the coefficient of investment (α_2).

EDU is Secondary School Enrollment Rate in 1975 and measures the percentage of school age population that was enrolled in secondary schools in 1975.[1] Equation (1) is a modified neoclassical growth model and the definition of capital is broadened by including EDU as a proxy for human capital. Thus, the GDP growth rate is a positive function of education. We expect a positive sign for the coefficient of EDU (α_3).

Another control variable included in equation 1 is a policy index. The policy index is a weighted average of inflation rate, the ratio of total trade to GDP, and the ratio of budget surplus/deficit to GDP. It is a measure of the quality of economic policy; the higher the index the

higher the quality of economic policy. Therefore, we hypothesize a positive sign for the coefficient of this variable (α_6). Obviously, countries with good economic policies tend to grow faster than countries with bad economic policies.

The model also includes a control variable for the quality of the country's institutions. The institutional settings within which economic policies are formulated are of crucial importance, because the quality of these institutions can be a primary source of the differences in economic growth among nations. The institutional quality index is from the Political Risk Services of Syracuse, New York, and ranks countries in the scale of 0-6; the higher the score the better the institutions.

The index is a weighted average of five institutional variables: The Rule of Law, Repudiation of Contracts, Expropriation Risk, Bureaucratic Quality, and Corruption. Countries with good institutions such as lower level of confiscation of private properties, effective judiciary, lower level of governmental corruption, lower risk of contract repudiation, and efficient bureaucracy are expected to grow faster than countries with bad institutions. Poor institutions interfere with economic growth by inducing economic agents to engage in redistributive politics rather economic activity with lower economic returns [Murphy et. al., 1991]. The coefficient of institutional quality (α_7) is expected to be positive.

The key independent variable in equation (1) and the variable of interest is (AID/GDP) which is foreign aid expressed as percentage of GDP. The aid variable used is the Effective Development Assistance (EDA), which measures official aid flows as the sum of grants and the grant equivalent of official loans. The grant equivalent of a financial inflow is the amount that, at the time of its commitment, is not expected to be repaid, i.e., the amount subsidized through below-market terms at the time of commitment. Finally, Equation (1) employs a vector of regional dummies as explanatory variables to capture the qualitative effect of different regions. The dummy variable equals one for African, Asian, and Latin American countries and zero for other nations. The inclusion of the continental dummies minimizes the lack of data comparability, especially where data definitions do not vary over time. We expect the coefficient of this variable (α_8) to be negative.

AID AND ECONOMIC GROWTH: THE EMPIRICAL RESULTS

Incorporating foreign aid into the commonly-used growth equations, this section re- estimates the relationship between foreign aid and economic growth. Most of the variables are from the World Development Indicators of the World Bank. The data is from 1975-2005 and the sample includes a cross-section of 90 countries, all countries for which data are available for the years 1975 through 2005.[2]

Table 1 reports the empirical results of the relationship between foreign aid and economic growth when other exogenous parameters are also entered into the growth equation. Because heteroskedasticity can be important across countries, the standard errors are based on White's (1980) Heteroskedasticity-Consistent Covariance Matrix. The regression results of the basic Model are in Column 1 of Table 1.

The initial GDP level is negatively and significantly correlated with the GDP growth rate when controlled for other correlates of economic growth confirming the conditional convergence hypothesis of Barro (1991), Barro and Sala-i-Martin (1992), Levine and Renelt (1992), and Barro (1996). The coefficient of investment is positive and highly significant. However, the coefficient of human capital (Education) is positive as expected but not significant at the

conventional level. Model 1 also includes a measure of institutional quality. It is an aggregate index of five institutional quality measures: the rule of law, enforceability of contracts, the risk of expropriating private property, the quality of the bureaucracy, and the prevalence of governmental corruption. It measures the degree of confidence and trust that economic agents have in their dealings with the state and the degree to which individual investors are unwilling to tie up their resources in danger of being expropriated by the political regime. The coefficient of institutional quality is positive and significant; the higher the quality of institutions, the higher the growth rate.

Column 2 adds two variables into the basic model. Following Burnside and Dollar (2000), an economic policy index variable is included into the regression equation. The policy index variable is a weighted sum of inflation rate, the budget surplus/deficit, and trade openness.

The coefficient of economic policy index is positive and significant. The regression results show that countries with sound economic policies are likely to grow faster than those with poor economic policies. Column 2 also includes aid as a percent of GDP. The coefficient of aid as a percent of GDP is negative but not significant at the conventional level. The effect of aid on growth may not be linear as suggested by Boone (1996). There are several reasons for expecting a non-linear relation between aid and growth. Hadjimichael et al. (1995) suggested that many countries might have a limited capacity to absorb foreign resources. Column 3 includes the variables in the basic model and adds aid as a percent of GDP and an aid squared term to capture possible nonlinearities in the aid-growth relations. The results in Column 3 indicate that the relationship between aid and growth is nonlinear. The coefficient of aid as a percent of GDP is positive and insignificant. However, the coefficient of aid-square is negative and highly significant. The positive sign on Aid/GDP and the negative sign on Aid-squared show that there are decreasing marginal returns to increased foreign aid. This confirms Hansen and Tarp's result that the effect of aid on growth is positive as long as the aid to GDP ratio is not successively high.

Column 4 includes the control variables in the base model, our variable of interest (Aid/GDP), and an interaction term of Aid and Policy. All of the control variables have the expected sign and are statistically significant. The coefficient of aid as a percent of GDP is negative and insignificant. However, the coefficient of the interaction term is positive and highly significant. The result is similar to that found by Burnside and Dollar. It shows that the effectiveness of aid in the growth process depends on the level and quality of economic policies.

The negative relationship between aid and growth in Models 2 and 4 does not say much about the direction of causality. The negative relationship could equally be a consequence of the failure of aid to improve growth as it could be the consequence of the donor's explicit choice to help poor and poorly performing countries more. It is therefore possible that the foreign aid is a function of the growth rate. The possibility that foreign aid is itself a function of income creates a potential endogeneity bias. It is possible that countries receive more foreign aid because of lower income. Therefore, Model 5 tests the presence of endogeneity between aid and growth. The growth equation is estimated using two-stage least squares. It utilizes ethnolinguistic fractionalization (**Ethno**) as an instrument to correct for endogeneity bias. **Ethno** is an index of ethnolinguistic fractionalization and measures the probability that two randomly selected individuals from a given country will not belong to the same ethnolinguistic group. Ethnolinguistic fractionalization is exogenous to growth but positively and significantly correlated with foreign aid. Easterly and Levine (1997) empirically found that enthnolinguistic fractionalization is associated with poor policies that lower economic growth.

Ethnic diversity predictably increases foreign aid for two reasons. First, diversity means that more interest groups are seeking funding for their pet projects. Second, governments may attempt to use foreign aid to obtain interest group support. In that case, the cost of obtaining a majority support rises with ethnic diversity. For example, the support of a single tribe or clan is less costly than the support of two or more tribes or clans. Each ethnic group might attempt to enrich their constituents, class and clan members, exhausting foreign aid money in distributive activities. As a result greater ethnic diversity leads to an increase in foreign aid. The coefficient of foreign is negative and significant. The two-stage least square estimation in Model 5 indicates that aid has a substantial explanatory power for economic growth. It also suggest that the observed negative correlation between aid and economic growth might be the consequence of more aid causing lower economic growth rather lower growth leading to more aid. A sensitivity analysis approach might further verify the results of the empirical results, an issue addressed in the following section.

TABLE 1
THE EFFECT OF AID ON GROWTH
DEPENDENT VARIABLE: REAL PER CAPITA GDP GROWTH RATE

	1	2	3	4	5
Initial GDP	-0.846 (-3.24)	-0.632 (-1.930)	-0.555 (-3.149)	-0.456 (-1.856)	-0.345 (-2.941)
Investment	0.544 (4.34)	0.422 (3.23)	0.224 (3.833)	0.424 (3.782)	0.646 (4.671)
Education	0.012 (1.49)	0.0442 (1.582)	0.0333 (1.777)	0.0426 (1.813)	0.0215 (1.889)
Institutional Quality	0.038 (2.381)	0.074 (1.887)	0.036 (1.849)	0.047 (3.028)	0.0283 (2.839)
Policy Index		0.5341 (1.955)			
Aid/GDP		-0.451 (-1.413)	0.1651 (1.6854)	-0.0512 (-1.363)	-0.0744 (-3.033)
Aid2			-0.431 (-2.853)		
(Aid/GDP)*Policy				0.0637 (2.540)	
Dummy for Africa, Asia, and Latin America	-0.1234 (-1.743)	-0.0459 (-1.788)	-0.0254 (-1.845)	-0.0231 (-1.791)	-0.0176 (-2.003)
Constant	-0.0045 (-1.062)	-0.0134 (-1.274)	-0.0454 (-1.051)	-0.0637 (-1.112)	-0.0103 (-1.326)
Sample	87	87	87	87	87
Method of Estimation	OLS	OLS	OLS	OLS	2SLS
R2	0.532	0.564	0.476	0.503	0.587

SENSITIVITY ANALYSIS

Methodology

How sensitive are the results to model changes? This section presents a sensitivity analysis of the effect of aid on growth and investment. The sensitivity analysis uses the approach in Levine and Renelt (1992), which for its part relies on the extreme-bounds analysis (EBA) suggested by Leamer (1983 and 1985). The basic estimation equation adopts the notation and core variables suggested in Levine and Renelt (1992):

$$Y = \text{Constant} + \beta_i \mathbf{I} + \beta_m M + \beta_z \mathbf{Z} + u, \quad (2)$$

where

Y = real per capita GDP growth, or the share of investment in GDP;
I = a set of core variables always included in the regressions;
M = the variable of interest (*i.e.,* Effective Development Assistance (EDA) and Official Development Assistance (ODA);
Z = is a vector of up-to-three possible additional explanatory variables of growth, which according to Levine and Renelt (1992) may be related to the dependent variable.
u = a random disturbance term.

The EBA examines a dependent variable, real per capita GDP growth rate. Four variables constitute **I**, the set of core variables always included in the EBA: the investment share of GDP (INV); the initial level of GDP in 1975 (GDP75); the secondary-school enrollment rate in 1975 (EDU); and the average annual rate of population growth (GPOP). The EBA evaluates two foreign aid variables (*i.e.*, the " M variables" as defined in Equation (2)). The two M variables used are Effective Development Assistance (EDA) and Official Development Assistance (ODA). The procedure first regresses Y on I and produces a "base" regression result for each variable. We then regress Y on I, M, and all linear combinations of a set of three Z variables, generating six regressions for each M variable. The subsets of variables allow us to identify the highest and lowest values for the coefficient on M (denoted β_m), and thereby define the upper and lower bounds of β_m. The extreme upper bound is the highest value of β_m plus two standard deviations; the extreme lower bound is the lowest value of β_m minus two standard deviations. If β_m remains significant and of the same sign at the extreme bounds, we label the partial correlation between Y and the M variable "robust." If β_m does not remain significant or if it changes signs at the extreme bounds, we label the partial correlation "fragile."

The set of Z variables for the EBA is selected from a pool of explanatory variables. This set includes: the ratio of total trade to GDP (TRD); the ratio of government consumption to GDP (GOV); and Inflation (INF). These are fiscal, trade, and monetary variables that the current literature predominantly uses as explanatory regressors of growth. We used the Extreme Bound Analysis (EBA) as it offers a meticulous approach of testing the robustness of the effect of Aid on growth.

Results of the Extreme Bounds Analysis

The core model of the EBA for real GDP growth yields the following regression results (t-statistics are in parentheses):

$$GDP = -0.243 + 3.17\,INV - 0.401\,GDP75 + 0.120\,EDU - 0.66\,GPOP \quad (3)$$
$$(-0.42)\ (5.47)\ (-1.976)\ (1.43)\ (-3.219)$$
R-squared = 0.587
F-statistic = 13.76
Obs. = 87

The estimated coefficients in Equation (2) closely correspond with the findings in Section 4. All of the "I" variables are significant and of the expected sign. The initial level of GDP correlates negatively and significantly with GDP growth rate. Again, this confirms the conditional convergence hypothesis suggested by Barro and others. The GDP growth rate correlates negatively with the population growth rate. The proxy for human capital is also positively and insignificantly correlated with the GDP growth rate.

The EBA uses this core specification as a starting point to evaluate the effect of small changes in the conditioning information on the foreign aid variables. Table 2 summarizes the EBA results for the EDA and ODA. The findings indicate that the negative effect of foreign aid on growth is robust. The effect of foreign aid on growth is not sensitive to model specification and the estimated coefficient remains significant at the 5 percent level. The two variables of interest (ODA and EDA) remain negative and significant after linear combinations of the "Z" variables are also included in the regression equation.

The core model of the EBA for the investment share of GDP growth yields the following (t-statistics are in parentheses):

$$INV = 0.223 - 0.0341\,GDP75 + 0.091\,EDU - 0.063\,GPOP \quad (4)$$
$$(3.250)\ (-1.432)\ (1.081)\ (-1.954)$$
R-Square = 0.45
F-statistic = 5.610
Obs. = 87

Again, the estimated core model for investment in Equation (4) suggests that human capital is a positive and insignificant determinant of capital investment while the population growth is negatively and significantly correlated with capital accumulation. The coefficient of the initial level of GDP is negative but insignificant. Table 3 provides the EBA results using the investment equation for the Effective Development Assistance (EDA) and the Official Development Assistance (ODA). Neither EDA nor ODA exhibit a significant coefficient in the core investment equation; and both relationships are fragile after linear combinations of the "Z" variables are also included in the equation.

The sensitivity analysis offers two main conclusions. First, the two commonly employed measures of foreign aid both exhibit a negative and a robust relationship to economic growth, but neither ODA nor EDA has any effect on growth through enhanced investment. Second, the absence of a reliable relationship between foreign aid and investment indicates that the growth-retarding influence of foreign aid results from disturbing the efficiency of resource allocation and not on its effect on capital accumulation.

TABLE 2
SENSITIVITY RESULTS FOR THE FOREIGN AID VARIABLES
DEPENDENT VARIABLE: REAL GDP PER CAPITA GROWTH RATE

M-Variable	Model	β	t-Stat	Sample	R^2	Other Variables	Robust or Fragile
EDA	High	-0.485	-2.73	87	0.502	TRD, GOV	Robust
	Base	-0.337	-3.52	87	0.418		
	Low	-0.283	-3.34	87	0.551	INF, GOV	Robust
ODA	High	-0.581	-2.26	87	0.510	TRD, INF	Robust
	Base	-0.248	-3.11	87	0.475		
	Low	-0.169	-2.83	87	0.408	TRD, INF, GOV	Robust

Explanatory Notes

The "Base" model estimates the β coefficient from the regression with only the variable of interest (the M-variable). The "High" model β is the estimated coefficient from the regression with the extreme high bound (β_m+ two standard deviations); the "Low" model β is the estimation of the coefficient from the regression with the extreme lower bound. EDA is the effective development assistance and ODA is the official development assistance. The "Other Variables" are the Z-variables included in the base regression that produced the extreme bounds. The "Robust or Fragile" designation summarizes the sensitivity analysis, and if Fragile, a (0) value indicates that the coefficient is insignificant with only the I-variables included.

TABLE 3
SENSITIVITY RESULTS FOR THE FOREIGN AID VARIABLES
DEPENDENT VARIABLE: INVESTMENT SHARE OF REAL GDP

M-Variable	Model	β	t-Stat	Sample	R^2	Other Variables	Robust or Fragile
EDA	High	0.113	1.70	87	0.297	TAXES, INF	Fragile (1)
	Base	0.102	1.73	87	0.162		
	Low	-0.003	-0.05	87	0.222	TRD	Fragile (0)
ODA	High	0.027	0.86	87	0.238	INF, TRD	Fragile (1)
	Base	0.012	0.33	87	0.034		
	Low	-0.028	-0.63	87	0.129	INF, TAXES	Fragile (0)

Explanatory Notes: see Table 2

CONCLUDING COMMENTS

Aid allocation to developing countries has changed significantly and total aid spent has gone down in the last decade. Aid fatigue and the ineffectiveness of foreign aid as an instrument of resource mobilization in reducing poverty in developing countries, is found to be one of the important reasons for this decline in aid flows. This paper is an empirical investigation of the effect of aid on growth. It used the most recent available data and incorporates some of the important features of the empirical literature on growth and aid. Three important conclusions

emerged from the empirical analysis of the paper. First, it shows that the effect of aid on growth is nonlinear. The nonlinearity of the relationship indicates a threshold for foreign aid beyond which more aid is detrimental to economic growth. Hansen and Tarp (1999) found similar results and they suggest that the turning point from which increased aid will have a negative effect on growth is an aid/GDP ratio of about 25 percent. Second, the empirical results of this paper support Burnside and Dollar's findings that a good policy environment is important for aid to work effectively. The interaction term of AID/GDP and Policy in Model 4 indicate that good policies and aid effectiveness go hand in hand. Aid effectiveness can only be sustained in an environment of good economic policy. Finally, using etholinguistic fractionalization as an instrument, the empirical results of the paper indicate that the relationship between AID/GDP and economic growth is sequential. More and more aid lead to lower economic growth.

The paper also points to two sources underlying the frustration of the lack of a consistent, robust relationship between aid and growth. One source is essentially definitional: most of the empirical work on foreign aid and economic growth use "Official Development Assistance (ODA)" which lumps together both grants and loans received by developing countries. This paper uses ODA and a similar measure called "Effective Development Assistance (EDA)." EDA is a better measure than official development assistance, nevertheless, both measures provide similar results; a negative and significant correlation between foreign aid and economic growth. The second source revealed in this analysis is more substantive. The sensitivity analysis approach used in this paper provides a clear-cut case that the growth-retarding effect of foreign aid comes through its distortionary effect on the efficiency of resource allocation and has no effect on capital accumulation.

ENDNOTES

1. Secondary school enrollment is a better measurement than primary school or literacy rate since most of the countries reached the upper bound of these variables.
2. Note that all the countries are not included in each model because some variable values are missing for some countries.

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