Zero Foreign Aid? Policy Implications for Donor and Recipient Countries
by Hafiz Akhand and Kanhaya Gupta

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**Introduction**

In 2002, Canada gave about $3.3 billion in foreign aid, which amounts to a 29% increase over the aid given in 2001. A similar trend in aid giving is observed in other donor countries. To help poorer countries meet the Millennium Development Goals, the United Nations Millennium Project calls for a further increase in foreign aid given by the donor countries: that at least 0.7 percent of the donor countries' gross national product (GNP) be given as official development assistance (ODA) to developing countries. The United Nations' plea that donor countries contribute 0.7 percent of their GNP as ODA revives an old target that was originally recommended by the Pearson Commission in 1969.

Why is there a sudden increase in interest in giving more foreign aid? Many argue that this increase is motivated primarily by the research findings of Burnside and Dollar (2000, from here on BD). In their extraordinarily influential paper, Burnside and Dollar find that “foreign aid has a positive impact on growth in developing countries with good fiscal, monetary, and trade policies but has very little effect in the presence of poor policies.”

Public policymakers and international aid agencies have quickly recognized the importance of the BD study. This is clearly reflected in the World Bank policy research report, *Assessing Aid: What Works, What Doesn’t, and Why* [from here on World Bank (1998)] which is primarily based on the BD study. The World Bank report suggests several policy reforms that will make aid more effective. One of the key recommendations being that financial assistance be targeted more effectively to low-income countries with sound economic management. This is largely responsible for the recent change in aid allocation rules adopted by the major donor countries. For example, on November 26, 2002, the White House created the Millennium Challenge Corporation (MCC) to administer a five billion dollar increase in aid. The administration announced that a country’s eligibility for the MCC aid will be determined by sixteen indicators of a country’s performance.
Three of these indicators are versions of the BD policy measure and the remaining indicators measure quality of institutions.

In response to the BD finding, a growing number of researchers have reassessed the empirical links between aid, policy and growth. These works show that the BD finding is highly sensitive to alterations in the data used and/or specification of the aid effectiveness model estimated. Taking the findings of these works at face value, it is reasonable to ask: what will happen if donor countries stop giving foreign aid? According to Bardsall and Williamson (2002), an implementation of the zero aid policy may result in an end of aid dependency and debt relief for recipient counties. For donor countries, an end to foreign aid may lead to important policy changes in areas such as taxation.

Perhaps one of the reasons that aid has not been effective thus far, some researchers argue [see, for example, Dollar (2003) and Radelet (2003)], is that the amount of aid given to the poor countries is inadequate. These authors therefore call for a significant increase in the amount of aid given by the donor countries. How large should the increase in aid be? Would a doubling of the present amount of aid given to the poor countries, for example, be enough? Yes, according to the Report of the International Conference on Financing for Development, held in Monterrey, Mexico, during 18–22 March 2002. In this report, the United Nations point out that the Millennium Development Goals cannot be achieved without at least an additional $50 billion a year of ODA---roughly double current levels.

The aim of this paper is to provide answers to these counterfactual but relevant and intriguing questions. To this end, we specify an aid effectiveness model which draws upon three strands of literature; namely, the literature on the debate about the relative merits of using single versus simultaneous equations models, the literature on aid effectiveness, and the literature on growth empirics. This results in a simultaneous equations model of growth, gross domestic product (GDP)
per capita, consumption, investment, life expectancy, and infant mortality. We use the most recent data for a wide range of aid recipient countries to estimate the aid effectiveness model. We then simulate the model to analyze the effects of changes in the aid policy on the endogenous variables of our model.

Our estimation results suggest that foreign aid is ineffective even when good economic policies are present. This is consistent with the results reported in Boone (1996), Akhand and Gupta (2002), and Easterly et al. (2004), Roodman (2004), and Rajan and Subramanian (2005a). More importantly, our simulation experiments show that a sizable increase in aid will not necessarily improve the economic conditions in the aid recipient countries. Our results also imply that maintaining the status quo with regards to the aid policy is not a good strategy either. We find that maintaining aid at its present level will not benefit the aid recipient countries in the long run. This is because, as our simulation results show, a lion's share of aid (increased or otherwise) given to the developing countries is devoted to consumption leaving little or nothing for investment.

Similar results have been reported in previous studies. For example, Boone (1996) finds that aid finances consumption rather than investment. Obstfeld (1999) shows that within a Ramsey-Cass-Koopmans model, a permanent increase in the level of foreign aid raises the long-run level of per capita consumption one for one and in consequence, leaves the steady state level capital per worker unchanged. Dalgaard et al. (2004) generalizes these results by demonstrating that a permanent increase in aid will raise the steady state capital per worker only if the return to capital investment is sufficiently high. Failing this, an increase in aid will merely increase consumption per capita.

Therefore our results and their implications for the aid policy are not entirely new. What is new in this paper is that we provide an answer to the parochial question: what will happen to the aid recipient countries if a policy of zero aid is implemented today? This question naturally arises from
the aid effectiveness debate, but has never been formally investigated. We show that, within the scope of our aid effectiveness model, the aid recipient countries are worse-off under an aid policy that either maintains foreign aid at its present level or increases the level of foreign aid dramatically. In light of this finding, the best course of action for the donor countries is therefore an immediate cessation of all aid.

The existing aid effectiveness literature has identified several channels through which aid may adversely affect an aid recipient country in the long run. Acemoglu et al. (2003), for example, observe that many developing countries have suffered under the personal rule of kleptocrats who implement highly inefficient economic policies, expropriate the wealth and incomes of their citizens, and use the proceeds for their own consumption as well as to remain in power without a significant base of support in societies they rule. Acemoglu et al. argue that the success of kleptocrats depends on their ability to use the “divide-and-rule” strategy. The ruler counters any attempt to depose him by imposing punitive taxes on the group proposing to depose the kleptoctrat and rewarding those who need to agree to the proposal. Acemoglu et al. show that kleptocratic policies are more likely when foreign aid provides rulers with substantial resources to buy off opponents. Thus, increased foreign aid weakens institutions or helps maintain weak institutions resulting in disastrous economic performance and the impoverishment of the citizens of the aid recipient nations.

Foreign aid may cause the real exchange rate in the aid recipient country to be overvalued resulting in a loss of competitiveness. In a flexible exchange rate, aid inflows exert an upward pressure on the nominal exchange rate rendering the traded goods sector uncompetitive if wages in that sector do not adjust downwards. In a fixed exchange rate regime, the spending of aid inflows on home goods, results in an increase in the price of other critical resources such as skilled workers or coastal land—resources that are in limited supply domestically. Consequently, industries that
compete in the world market and use these resources become uncompetitive. Rajan and Subramanian (2005b) find strong evidence consistent with aid undermining the competitiveness of the traditional exporting sectors. In particular, they find that the exporting sectors in the aid recipient countries grow slower than non-exporting sectors. Employment growth in the exporting sectors is therefore also slower.

In what follows, Section 2 outlines the model used in this paper to determine the effectiveness of foreign aid. Section 3 describes the estimation procedure and presents the estimation results. Section 4 presents the simulation results based on the estimated aid effectiveness model of Section 2. Section 5 concludes and discusses some policy implications of the findings of this paper.

Section 2: The model

In this paper, we assess the effectiveness of foreign aid with and without the presence of “good” economic policies in a simultaneous equations model. More importantly, based on the estimated underlying aid effectiveness model, we carry out simulation experiments to determine whether a dramatic increase in foreign aid would actually benefit the aid recipient countries.

It must be conceded at the outset that all models of aid effectiveness are ad hoc in that we can almost never have an all-inclusive model. But the literature on aid and growth provides some clear guidelines which one should follow when specifying an aid effectiveness model. Such guidelines emerged from the debate on the merits of using a simultaneous equations model as opposed to using a single equation model; the recent literature on growth empirics; and the debate on whether aid is more effective in the presence of good economic policies. In order to specify our aid effectiveness model, we draw upon these three strands of literature.
The model we estimate in this paper is a variant of the simultaneous equations model of growth, GDP per capita, consumption, investment, life expectancy, and infant mortality presented in Akhand and Gupta (2002). The Akhand-Gupta model (henceforth AG model) consists of ten equations and builds on Gupta (1975) but also draws on the works by Gersovitz (1988), Boone (1995 and 1996), Bloom and Williamson (1998), Obstfeld (1999), Burnside and Dollar (2000), Bloom, Canning and Sevilla (2001), Barro and Sala-i-Martin (2004), and Lorentzen et al. (2005). However, Akhand and Gupta (2002) treat the population growth rate as an exogenous variable. Therefore the AG model has only nine simultaneous equations in as many endogenous variables. Furthermore, the last four equations in the AG model are essentially definitions. We therefore employ a model that consists of only the first six equations of the AG model.\(^\text{11}\)

\[
\begin{align*}
GDG_{it} &= \alpha_0 + \alpha_1MLIT_t + \alpha_2FLIT_t + \alpha_3INVT_t + \alpha_4AID_t + \alpha_5POLICY_t \\
&\quad + \alpha_6(AID_t \times POLICY_t) + \alpha_7LIFE_t + \alpha_8LGDP_t \\
INVT_t &= \beta_0 + \beta_1GDG_{it} + \beta_2AID_t + \beta_3POLICY_t + \beta_6(AID_t \times POLICY_t) \\
LIFE_t &= \gamma_0 + \gamma_1MORT_t + \gamma_2GDG_t + \gamma_3GDG_t^2 + \gamma_4AID_t + \gamma_5POLICY_t \\
&\quad + \gamma_6(AID_t \times POLICY_t) + \gamma_7MLIT_t + \gamma_8FLIT_t \\
MORT_t &= \delta_0 + \delta_1GDG_t + \delta_2AID_t + \delta_3POLICY_t + \delta_6(AID_t \times POLICY_t) \\
&\quad + \delta_5MLIT_t + \delta_6FLIT_t \\
GDG_t &= (1 + GDG_t)GDG_{t-1} \\
CONS_t &= 1 + AID_t - INVT_t
\end{align*}
\]

Where \(t\) represents time period, GDPG is per capita GDP growth, MLIT (FLIT) is male (female) literacy rates, INVT is the investment share in GDP, AID is the total foreign aid receipts to GDP, POLICY is policy index---an overall measure of economic policy,\(^\text{12}\) (AID x POLICY) is aid's interaction with policy, LIFE is life expectancy at birth (total number of years), LGDP is the
natural logarithm of GDP per capita for the first year of each period, $MORT$ is infant mortality rate (per 1,000 live births), $GDP$ is real GDP per capita, and $CONS$ is the consumption share in GDP.

The growth equation (2.1) is closely related to BD's preferred specification which includes several control variables common to the empirical growth literature, plus $AID$, $POLICY$, and $(AID \times POLICY)$. Variants of equation (2.1) have been extensively estimated in the aid effectiveness literature.

Levine and Renelt (1992) find that there is a significant positive relationship between the investment share in GDP ($INVT$) and growth ($GDPG$). Furthermore, they show that the empirical relationship between $INVT$ and $GDPG$ is robust. We therefore also include $INVT$ in our growth regression as an additional control variable. Following Barro and Sala-i-Martin (2004), we also include $LIFE$ as an explanatory variable in equation (2.1).

Both Boone (1995), and Barro and Sala-i-Martin (2004) include $INVT$ in their growth equations. But more importantly, these authors consider $GDPG$ and $INVT$ as jointly dependent variables, so that each is used as an explanatory variable in the other. Thus, equations (2.1) and (2.2) reflect the Boone-Barro-Sala-i-Martin methodology in which $GDPG$ and $INVT$ are assumed to be interdependent.

Our specification of the two remaining behavioral equations (2.3) and (2.4) draws upon a fast growing literature devoted to investigating the role of demographic transition in economic growth. Bloom and Williamson (1998) observe that the demographic transition---a change from high to low rates of mortality and fertility---has been more dramatic in East Asia during the last century than in any other region or historical period. They argue that this transition has contributed substantially to East Asia's economic miracle. Based on their analysis of a variety of cross-national and sub-national data, Lorentzen et al. (2005) argue that high adult mortality (and
therefore low life expectancy) reduces growth by shortening the time horizon. They find that low life expectancy is associated with increased levels of risky behaviour, higher fertility rate, and lower investment in physical and human capital. Furthermore, Lorentzen et al. suggest that the feedback effect from economic prosperity to better health care implies that mortality is a potential cause of a poverty trap.

By introducing demographic variables such as life expectancy and infant mortality into an empirical model of economic growth, we hope to capture the effects of demographic transition on the key macroeconomic variables in our model. Equation (2.3) determines life expectancy while equation (2.4) determines the infant mortality rate. Equation (2.5) is an identity. Finally, equation (2.6) is the income balance condition which simply states that the consumption share in GDP equals a nation's total endowment \((1 + AID)\), as a share of GDP, less the investment share in GDP.

We emphasize several key features of our aid effectiveness model, equations (2.1) -- (2.6). First, all four behavioral equations in the model include \(AID\), \(POLICY\), and \((AID \times POLICY)\) as explanatory variables. This reflects our view that there is no \textit{a priori} reason why economic policy effects, whether good or bad, should be confined only to growth rate. Second, the aid effectiveness model allows for complex interactions among the endogenous variables \(GDPG\), \(INVT\), \(LIFE\), \(MORT\), \(GDP\), and \(CONS\). As the model indicates, these variables also depend on the exogenous and predetermined variables \(MLIT\), \(FLIT\), \(LGDP\), \(AID\), \(POLICY\), and \((AID \times POLICY)\). Thus, policy changes affect the six endogenous variables in our model both directly and indirectly.\(^{15}\) Finally, there is no technological progress in our aid effectiveness model. Therefore our model economy eventually reaches a steady-state where the growth rate of real GDP per capita is zero.
Section 3: Estimation

Equations (2.1) -- (2.6) characterize our aid effectiveness model within which the six endogenous variables $GDPG$, $GDP$, $INVT$, $LIFE$, $MORT$, and $CONS$ are determined jointly as functions of the exogenous as well as predetermined variables included in our model. We note, however, that our model is block-recursive in that equations (2.1) -- (2.5) jointly determine $GDPG$, $GDP$, $INVT$, $LIFE$, and $MORT$. Equation (2.6) then determines $CONS$, given $AID$ and $INVT$. We therefore need to estimate (jointly) only the sub-system, equations (2.1) -- (2.5). Furthermore, equation (2.5) can be incorporated into equations (2.3) and (2.4) to eliminate the variables $GDP$ and $GDP^2$. Consequently, we estimate the following simultaneous nonlinear equations system.\(^{16}\)

\[
\begin{align*}
GDPG_{jt} &= \alpha_0 + \alpha_1 MLIT_{jt} + \alpha_2 FLIT_{jt} + \alpha_3 INVT_{jt} + \alpha_4 AID_{jt} + \alpha_5 POLICY_{jt} \\
& \quad + \alpha_6 (AID_{jt} \times POLICY_{jt}) + \alpha_7 LIF_{jt} + \alpha_8 LGDP_{jt} + \varepsilon_{jt} \\
\text{(3.1)} \\
INVT_{jt} &= \beta_0 + \beta_1 GDPG_{jt} + \beta_2 AID_{jt} + \beta_3 POLICY_{jt} \\
& \quad + \beta_4 (AID_{jt} \times POLICY_{jt}) + \zeta_{jt} \\
\text{(3.2)} \\
LIFE_{jt} &= \gamma_0 + \gamma_1 MOR_{jt} + \gamma_2 (1 + GDPG_{jt}) GDP_{jt-1} + \gamma_3 (1 + GDPG_{jt})^2 GDP^2_{jt-1} \\
& \quad + \gamma_4 AID_{jt} + \gamma_5 POLICY_{jt} + \gamma_6 (AID_{jt} \times POLICY_{jt}) \\
& \quad + \gamma_7 MLIT_{jt} + \gamma_8 FLIT_{jt} + \eta_{jt} \\
\text{(3.3)} \\
MORT_{jt} &= \delta_0 + \delta_1 (1 + GDPG_{jt}) GDP_{jt-1} + \delta_2 AID_{jt} + \delta_3 POLICY_{jt} \\
& \quad + \delta_4 (AID_{jt} \times POLICY_{jt}) + \delta_5 MLIT_{jt} + \delta_6 FLIT_{jt} + \xi_{jt} \\
\text{(3.4)}
\end{align*}
\]

Where the subscript $j$, refers to countries and $\varepsilon$, $\zeta$, $\eta$, and $\xi$ are error terms. Equations (3.1) and (3.2) are simply equations (2.1) and (2.2), reproduced. Equations (3.3) and (3.4) are obtained by substituting the values of $GDP$ and $GDP^2$, implied by equation (2.5), into equations (2.3) and (2.4), thereby eliminating $GDP$ and $GDP^2$ from the equations system.
Before outlining the estimation procedure used in this paper, we briefly explain the expected signs of the regression coefficients in our model. Educational attainment, measured by male and female literary rate, is included in the growth equation to control for the role of human capital in growth. Consequently, we expect \((\alpha_1 + \alpha_2)\) to be positive. The investment share in GDP included in the growth equation, and growth in the investment equation reflect the interaction between growth and investment. To be consistent with the existing growth literature we expect that both \(\alpha_3\) and \(\beta_1\) will be positive. The aid effectiveness literature suggests that aid, policy, and aid's interaction with policy should have favorable effects on growth. To be consistent with this strand of literature, we therefore expect \(\alpha_4\), \(\alpha_5\), and \(\alpha_6\) to be positive. In addition, we hypothesize that \(\beta_2\), \(\beta_3\), and \(\beta_4\) are greater than zero.

Life expectancy included in the growth equation proxies characteristics other than good health that reflect desirable performance of a nation. For example, an increase in life expectancy may be associated with better working habits and a higher level of skills resulting in higher growth. We therefore anticipate that \(\alpha_7\) will be greater than zero. Following the growth literature, we include real per capita initial GDP in the growth equation to capture conditional convergence which predicts higher growth in response to lower initial GDP per capita. We therefore expect \(\alpha_8\) to be negative.

An increase in infant mortality is likely to affect life expectancy adversely. We therefore expect \(\gamma_1\) to be negative. An increase in real GDP per capita is likely to promote better nutrition and health leading to an increase in life expectancy. We therefore expect \(\gamma_2\) to exceed zero. Barro and Sala-i-Martin (2004) find that the impact of GDP on life expectancy diminishes as GDP increases (diminishing returns). Barro and Sala-i-Martin’s results therefore suggest that \(\gamma_3\) is negative.
We anticipate that aid, policy, aid's interaction with policy, and male (female) literacy rates will have favorable effects on life expectancy. We therefore expect $\gamma_4$, $\gamma_5$, $\gamma_6$, and $(\gamma_7 + \gamma_8)$ to be positive. It is reasonable to expect that aid, policy, aid's interaction with policy, and male (female) literacy rates will reduce infant mortality. We therefore hypothesize that $\delta_2$, $\delta_3$, $\delta_4$, and $(\delta_5 + \delta_6)$ are less than zero. Finally, an increase in real GDP per capita is likely to promote better nutrition and health leading to a fall in the infant mortality rate. We therefore expect $\delta_1$ to be negative.

Since the equations system (3.1) -- (3.4) is nonlinear in endogenous variables, we estimate the aid effectiveness model using the method of nonlinear three-stage least squares (NL3SLS). Alternatively, one could use the method of ordinary least squares (OLS) and estimate each behavioral equation of our model separately. Endogenous variables included in each equation, however, are correlated with the error terms $\varepsilon$, $\zeta$, $\eta$, and $\xi$. Consequently, the OLS method will yield inconsistent estimates of the structural parameters of our model. Furthermore, the OLS estimator is inefficient because it neglects information contained in the other equations of the system. By contrast, NL3SLS is a full information estimator: it estimates all equations in the system jointly and hence leads to greater efficiency.

In estimating the four behavioural equations of our model, equations (3.1) -- (3.4), we treat $GDP_G$, $INVT$, $LIFE$, and $MORT$ as endogenous variables. The remaining variables included in these equations are considered either exogenous or predetermined. Table 1 provides a summary of the variables included in equations (3.1) -- (3.4). It also indicates the exclusion restrictions with which identification is achieved. Table 1 Column 2 shows that the growth equation includes two endogenous right-hand-side variables but excludes a total of seventeen exogenous variables. Column 3 indicates that the investment equation includes one right-hand-
side endogenous variable while it excludes a total of twenty exogenous variables. Table 1 Column 4, specifies the life expectancy equation. It indicates that the life expectancy equation includes three right-hand-side endogenous variables while it excludes a total of fifteen exogenous variables. Finally, Table 1 Column 5 shows that the infant mortality equation includes two right-hand-side endogenous variables and excludes sixteen exogenous variables. Our NL3SLS estimator is therefore over identified. (Please see Table 1 on the next page.)
<table>
<thead>
<tr>
<th>Variable</th>
<th>GDPG</th>
<th>INVT</th>
<th>LIFE</th>
<th>MORT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Endogenous variables:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP growth, GDPG</td>
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<td>RHS</td>
<td>RHS</td>
<td>RHS</td>
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<td>Investment/GDP, INVT</td>
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<td>LHS</td>
<td>RHS</td>
<td>RHS</td>
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<td>Life expectancy, LIFE</td>
<td>RHS</td>
<td>LHS</td>
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<tr>
<td>Infant mortality, MORT</td>
<td>RHS</td>
<td>LHS</td>
<td>RHS</td>
<td>LHS</td>
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<tr>
<td>GDPG$^2$</td>
<td>RHS</td>
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<tr>
<td><strong>Exogenous variables:</strong></td>
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<tr>
<td>Aid/GDP, AID</td>
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<td>Included</td>
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<td>Included</td>
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<tr>
<td>Aid's interaction with policy, AID x POLICY</td>
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<td>Included</td>
<td>Included</td>
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<tr>
<td>Male literacy rate, MLIT</td>
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<tr>
<td>Female literacy rate, FLIT</td>
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<td>Log initial GDP, LGDP</td>
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<tr>
<td>GDP, lagged one period</td>
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<td>GDP$^2$, lagged one period</td>
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<tr>
<td>LIFE, lagged one period</td>
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<tr>
<td>MORT, lagged one period</td>
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<tr>
<td>INVT, lagged one period</td>
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<tr>
<td>GDPG, lagged one period</td>
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<tr>
<td>Log of population, LPOP</td>
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<tr>
<td>LGDP x POLICY</td>
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<td>LPOP x POLICY</td>
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<tr>
<td>LGDP$^2$ x POLICY</td>
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<td>Ethnic fractionalization</td>
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<td>Institutional quality</td>
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<tr>
<td>Assassinations</td>
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<tr>
<td>M2/GDP, lagged one period</td>
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<tr>
<td>Arms imports/total imports, lagged one period</td>
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<tr>
<td>Various regional dummies</td>
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</tbody>
</table>

**Notes:** LHS indicates that a variable is included in the left-hand-side variable in the growth regression. RHS indicates that a variable is included as a right-hand-side variable. All exogenous variables are used as instruments in NL3SLS estimation. The regional dummies included in each regression are Sub-Saharan Africa and Fast-growing East Asia.
Easterly et al. (2004) reconstructed the entire BD data set and extended the data through 1997. In estimating our model, we primarily use the Easterly et al. data set. Variables such as INVT, GDP, LIFE, MORT, MLIT, and FLIT are not used by Easterly et al. because they only estimate the growth equation. Consequently, their data set do not provide any information on these additional variables that we include in our model. We constructed data for these variables from the raw data published in the World Development Indicators online, 2004.

The Easterly et al. data set spans over the period 1970—1997 and covers 62 countries. However, some countries are missing data for some of the additional variables included in our model. We therefore end up with a total of 323 observations (including outliers).\textsuperscript{17}

Table 2 provides summary statistics for the key variables in our model. The mean growth rate of GDP per capita was 1.6 percent for the sample of 62 countries. The average share of investment in GDP over the sample period was 21.5 percent. The mean value of life expectancy at birth was 60.2 years while the mean infant mortality rate was 70.3 per 1,000 live births. Finally, Table 2 shows that the mean value of foreign aid over the sample period was 1.2 percent of GDP while the mean value of the policy index was 1.4 for the entire sample.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard deviation</th>
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<tr>
<td>INV$T$</td>
<td>21.5</td>
<td>6.7</td>
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<tr>
<td>LIFE</td>
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<tr>
<td>MORT</td>
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<td>37.6</td>
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<tr>
<td>AID</td>
<td>1.2</td>
<td>1.7</td>
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<tr>
<td>POLICY</td>
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<td>1.1</td>
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</tbody>
</table>

Notes: All variables are described in the text as well as in Table 1. The total number of observations is 323 while the total number of countries is 62.
Table 3 reports the estimated growth, investment, life expectancy, and infant mortality equations. We note that all four equations include the regional dummy variables, Sub-Saharan Africa and Fast-growing East Asia. Since regional disparity is not the focus of our study, the coefficient estimates of the regional dummies are omitted from the results reported in Table 3.

3.1 Growth equation

Our estimation results reported in Table 3 Column 1 indicate that most of the variables we include in the growth regression appear with the expected signs—the exceptions being \( AID \), \( LIFE \), and \( (AID \times POLICY) \). However, of all the variables that enter into the growth equation, only \( INVT \) and \( POLICY \) are found to be significantly different from zero. Furthermore, both variables appear with the expected positive signs. These results are consistent with the findings which have been established in a wide range of recent studies: that the investment share in GDP is one of the key determinants of growth in developing economies, and that growth of these economies depends to a large extent on their own economic policies.

Our results also indicate that the combined effect of male and female literacy rates on growth is positive. However, the effect is not statistically significant. We also find, as do most empirical works on growth, that the coefficient of initial GDP in the growth regression is negative but statistically insignificant.

For the purpose of this paper, the most significant finding, however, is that both \( AID \) and \( (AID \times POLICY) \) in the estimated growth equation appear with wrong signs and, more importantly, the coefficient estimates are not significantly different from zero. Our results therefore suggest that the direct effect of changes in foreign aid on growth is insignificant. Furthermore, there is no necessary connection between aid effectiveness and good policy.
Thus, our results reinforce the findings of Boone (1996), Burnside and Dollar (2000), Akhand and Gupta (2002), and Easterly et al. (2004). Boone is the first to formally demonstrate that foreign aid has had no significant effect on growth in the aid recipient countries. Burnside and Dollar show that while aid alone has had no significant effect on growth, it has been effective in countries with good policies. Burnside and Dollar, however, acknowledge that their finding that aid is effective in the presence of good policy holds only for low-income countries and when outliers are excluded from the sample. Akhand and Gupta use the data collected from a sample of fifty-five heavily aid-dependent countries to estimate a simultaneous equations model of aid effectiveness, and show that the BD finding that aid works only in a good policy environment does not hold for the heavily aid-dependent countries. Akhand and Gupta argue that the BD result arises from the single equation approach that Burnside and Dollar employ.21 Easterly et al., also find the BD inference to be fragile. By adding new data that were unavailable to BD, Easterly et al. show that the relationship between aid effectiveness and good policy vanishes when they use the new data that includes additional countries and extends the coverage through 1997. They, therefore, argue that the BD finding is an artefact of the missing data.

3.2 Investment equation

Table 3 Column 2 reports the estimated investment equation. Our results indicate that GDPG appears in the investment equation with the expected positive sign and is the only variable which is statistically significant in that equation. This merely reaffirms our finding, reported in Column 1, that INVt is significantly positively correlated with GDPG. The estimated coefficients of the remaining variables AID, POLICY, and (AID x POLICY) are all statistically insignificant. Furthermore, both POLICY and (AID x POLICY) appear in the investment equation with the sign which is contrary to what one would expect.
Table 3: Nonlinear three-stage least squares estimates

<table>
<thead>
<tr>
<th>Right-hand-side</th>
<th>Estimated equations</th>
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<tbody>
<tr>
<td>Variable</td>
<td>GDPG 1</td>
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<tr>
<td>GDPG</td>
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<tr>
<td>INV</td>
<td>0.2913</td>
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<tr>
<td>LIFE</td>
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<tr>
<td>MORT</td>
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</tr>
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<tr>
<td>GDP^2</td>
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<tr>
<td>AID</td>
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</tr>
<tr>
<td>POLICY</td>
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</tr>
<tr>
<td>AID X POLICY</td>
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<tr>
<td>MLIT</td>
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<tr>
<td>FLIT</td>
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</tr>
<tr>
<td>LGDP</td>
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</tr>
<tr>
<td>Number of Observations</td>
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</tr>
<tr>
<td>System R^2</td>
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</tr>
<tr>
<td>Joint significance of the Slope coefficients (p-value)</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Notes: The dependent variables are per capita GDP growth, investment share in GDP, life expectancy and infant mortality. Variables included in the regression equations are described in Table 1. The excluded exogenous variables for the NL3SLS equation are also listed in Table 1. Numbers in brackets are the asymptotic t-ratios.
3.3 Life expectancy equation

The estimated life expectancy equation is reported in Table 3 Columns 3. Our results indicate a significant negative relationship between the infant mortality rate and life expectancy. As well, we find evidence of a nonlinear relationship between GDP per capita and life expectancy. In particular, our results indicate a significant positive relationship between GDP per capita and life expectancy, and a significant negative relationship between GDP per capita squared and life expectancy. In other words, our results suggest that the beneficial effect of GDP per capita on life expectancy diminishes as GDP per capita increases. Finally, we find that the coefficient estimates of the remaining variables, with the exception of AID, in the life expectancy equation are statistically insignificant. As for AID, we find that it is significantly negatively correlated with life expectancy.

3.4 Infant mortality equation

Finally, Table 3 Column 4 reports the estimated infant mortality equation. Our results show that GDP, POLICY, and FLIT are all significantly negatively related to infant mortality. The remaining variables appear in the estimated infant mortality equation with statistically insignificant coefficients. Our results therefore imply that aid is ineffective in reducing the infant mortality rate. Furthermore, aid does not necessarily become more effective in a good policy environment.

To summarize, the estimation results reported in Table 3 indicate that on the whole our aid effectiveness model fits the data quite well. The system $R^2$ is 0.95 and the slope coefficients are jointly highly significant. We note that some variables appear in the estimated model with opposite signs than what we anticipated. As well, several variables in our model appear to be statistically insignificant. This combined with high system $R^2$ and the joint significance of the slope coefficients may well be indicative of multicollinearity. However, as noted earlier, our estimation results are generally consistent with those reported in the existing literature.
Finally, we note that the interaction variable \((AID \times POLICY)\) is seldom statistically significant (see Table 3). This raises the question of whether one should re-estimate the model without the interaction term. Akhand and Gupta (2002) do just that and find that the main conclusion of the model is robust to such alteration. However, the model performs much better when the interaction term is included. Therefore when we simulate our aid effectiveness model, following the standard forecasting methodology, we keep the interaction term in the model.

**Section 4: Simulation results**

Our estimation results reported in the previous section show that \(AID\) is statistically insignificant in all but one equation of our aid effectiveness model [see Table 3 Column 3]. The estimated coefficient of \(AID\) in the life expectancy equation, however, appears with a wrong sign. Furthermore, our results indicate that \((AID \times POLICY)\) is statistically insignificant in all four equations of our model. These findings may lead one to conclude that aid has no effect on the key endogenous variables of our model and that aid is not more effective in a good policy environment. While it is apparent from our estimation results that the direct effects of a change in aid on the endogenous variables are insignificant, the overall effect of a change in the aid policy on these variables may not necessarily be small. This is because the sum of the coefficients of \(AID\) and \((AID \times POLICY)\) in an equation merely reflects the direct effect of a change in aid.

The total impact effect (direct and indirect) of a change in the aid policy on the endogenous variables of our model is reflected in the reduced form coefficient of \(AID\). To capture the overall effects of a change in foreign aid on growth, the investment share in GDP, the consumption share in GDP, life expectancy, infant mortality, real GDP per capita, and consumption per capita, we need to solve our aid effectiveness model explicitly and examine the implied coefficient of \(AID\) in each equation.
Treating $LGDP$ and $GDP_{t-1}$ as predetermined variables, Akhand and Gupta (2002) obtain a one-period solution to the equations system (2.1) -- (2.6). They demonstrate that the model yields two solutions. While both solutions are real, only the negative root ensures a stable equilibrium. To ensure convergence to a stable equilibrium, for the remaining analysis, we will only consider the negative root.

It is evident from the model that the equilibrium values of the endogenous variables depend not only on the structural parameters of our model but also on the exogenous and predetermined variables $AID$, $POLICY$, $(AID \times POLICY)$, $MLIT$, $FLIT$, $LGDP$, and $GDP_{t-1}$. We obtain the predicted values of the endogenous variables in a given period by evaluating the negative root of the equations system (2.1) -- (2.6) at the estimated values of the structural parameters reported in Table 3 and the sample mean values of the variables $POLICY$, $(AID \times POLICY)$, $MLIT$, $FLIT$, $LGDP$, and $GDP_{t-1}$.

As for $AID$, we consider three scenarios: maintain aid at its present mean level of 1.2 percent; reduce the level of aid to zero; and finally, raise the level of aid to 2.4 percent. The value of $(AID \times POLICY)$ is adjusted accordingly. The predicted values of the endogenous variables we obtain reflect these changes in the aid policy.

In order to assess the overall effects of aid policy changes on the endogenous variables of our model, we conduct three separate simulation experiments. The first simulation experiment is called *status quo*. In this experiment, we ask our aid effectiveness model to predict the time paths that the key endogenous variables will take in the event that the present aid policy is maintained for the next 30 periods. In the second simulation experiment, which we call *zero aid*, we ask our model to predict the paths that the endogenous variables will take for the next 29 periods if foreign aid is permanently reduced to zero in the next period. In our final simulation experiment, *doubling aid* (proxy for enough increase in aid), we permanently raise the level of aid in the next period to 2.4 percent. This
amounts to doubling of the mean level of aid 1.2 percent under the current aid policy. We then ask our model to predict the implied time paths of the endogenous variables. Figures 1 through 7 show the results of the three simulation experiments we carry out. We discuss these results in turn.

**Figure 1: Effects of aid on per capita real GDP growth (Source: Authors' calculations)**

![GDP per Capita Growth Rate over Time](image)

**4.1 Status quo**

Figures 1 through 7 sketch the time paths of growth, the investment share in GDP, GDP per capita, the consumption share in GDP, life expectancy, the infant mortality rate, and consumption per capita when the volume of aid is held at its present sample mean level 1.2 percent. According to Figure 1, the model economy begins in period 0 with a predicted growth rate of 1.2 percent. With aid held at its present level, the growth rate eventually reaches its steady-state value of zero. Investment share in GDP begins with a predicted value of 20.9 percent and eventually reaches its long-run equilibrium value of 19.0 (see Figure 2). Similarly, the predicted values of the consumption share in
GDP and infant mortality rate at the beginning of the simulation period, respectively, are 80.3 percent and 60.0 per thousand live births. As Figures 4 and 5 show, these variables reach their steady-state values 82.2 and 52.7, respectively. Finally, our simulation results indicate that both GDP per capita and life expectancy will rise from their period 0 values 5587 (1985 US dollar, international base prices) and 64.6 years, respectively, to their long-run equilibrium values 7701 and 66.3 respectively. Figures 3 and 6 plot the time paths of GDP per capita and life expectancy.

4.2 Doubling aid

As in the previous case, our model economy begins in period 0 with the predicted values of GDPG, INVT, GDP, CONS, LIFE, and MORT equal to 1.2, 20.9, 5587, 80.3, 64.6, and 60, respectively. In period 1 aid is raised to 2.4 percent and is held at that level for the remaining 28 periods. Figures 1 through 7 summarize the effects, on impact as well as in the long run, of the doubling of aid on the endogenous variables. It follows from Figure 1 that GDPG in period 1 falls to 0.005 percent and continues to decline until it reaches its long-run value. We note, however, that GDPG falls at a much higher rate when the level of aid is doubled than in the other two cases we consider. This is reflected in the steeper time path of GDPG under a doubling of aid policy (see Figure 1).
Figures 3 and 4 show that following a doubling of aid, both GDP and CONS rise in period 1. Both variables continue to rise until they reach their new steady-state values 5855 and 83.4, respectively. Our results show that the long-run equilibrium GDP is significantly lower when aid is doubled than when aid is maintained at its present level or aid is reduced to zero. By contrast, a much larger share of GDP is devoted to consumption when the level of aid is doubled. We note further that the consumption share in GDP rises much more quickly when aid is doubled than in the other two cases (see Figure 4).

Finally, the simulation results show that the investment share in GDP, life expectancy, and infant mortality rate decline in period 1. These variables continue to decline until they reach their new steady-state values 18.9, 64.2, and 59.9, respectively. In comparison with the two other cases, we find that the decline in the investment share in GDP in period 1 is much larger when the level of aid is doubled (see Figure 2). We also note that the doubling of aid policy yields the
smallest investment share in GDP in the long run. We further note that a doubling of aid has very little effect on the long-run equilibrium values of life expectancy and the infant mortality rate (see Figures 5 and 6). Our simulation results show that the increased level of aid is mostly devoted to consumption activities (see Figures 4 and 7) and thus, leaves very little for investment and growth.

Figure 3: Effects of aid on per capita real GDP (Source: Authors' calculations)

![Graph showing effects of aid on per capita real GDP](Image)

4.3 Zero aid

Once again, our model economy begins in period 0 with the predicted values of $GDP_G$, $INVT$, $GDP$, $CONS$, $LIFE$, and $MORT$ equal to 1.2, 20.9, 5587, 80.3, 64.6, and 60, respectively. In period 1, aid is reduced to zero and is held at that level for the remaining 28 periods. Figures 1 through 7 summarize the effects of a permanent decrease in aid.
Figure 1 shows that GDPG in period 1 falls to 0.9 percent and continues to decline until it reaches its long-run value of zero. We note, however, that GDPG falls at a much slower rate in this case than when aid is raised to 2.4 or maintained at its present level. This is reflected in the flatter time path that GDPG takes under a zero aid policy (see Figure 1).

As in the previous two cases, GDP rises in period 1 as the level of aid is reduced to zero. The increase in GDP continues until it reaches its new steady-state value 9960. We note that the zero aid policy yields a much higher value of GDP in the long run than those are achieved under the two other policies we consider (see Figure 4 above).
Figures 2 and 5 show that, both INVT and MORT decline in period 1. Both variables continue to decline until they reach their new steady-state values 19.1 and 44.3, respectively. In comparison with the two other cases, we find that the decline in INVT in period 1 is much smaller when the level of aid is reduced to zero (see Figure 2). We also note that the zero aid policy yields the highest rate of investment in the long run. We note further that a zero aid policy reduces the infant mortality rate significantly in the long run. Figure 6 shows that LIFE Increases in period 1 as the level of aid is reduced to zero. The increase in LIFE continues until it reaches its new steady-state value of 67.7 years. We note that a zero aid policy results in a higher steady-state value of LIFE than what is achieved under the two other aid policies.
Figure 6: Effects of aid on life expectancy (Source: Authors' calculations)

Finally, it follows from Figures 4 and 7 that the zero aid policy affects the consumption share in GDP (and consumption per capita) quite differently than the other two aid policy changes we consider. As Figure 4 demonstrates, under the zero aid policy the consumption share in GDP falls drastically in period 1 and then slowly rises to its new steady-state value. Figure 4 also shows that the zero aid policy results in a much lower path of consumption share in GDP. Despite this, our simulation results show that consumption per capita is much higher under a zero aid policy than what is obtained under the two other aid policies. This is apparent in Figure 7.
Our simulation results paint a bleak picture for those who call for a large-scale increase in foreign aid. Contrary to the popular view, we find that doubling aid would actually harm the aid recipient countries. In fact, our simulation results show that a doubling of aid leads to the worst outcome relative to the two other aid policy alternatives we consider in this paper. Figures 2 through 7 illustrate this further. For example, Figure 7 shows that consumption per capita is much higher when aid is reduced to zero. This appears to be the case despite the fact that the consumption share in GDP is systematically lower under the zero aid policy (see Figure 4). Higher consumption per capita arises from the result that GDP per capita is much higher in a zero aid regime than in other regimes (see Figure 3). Zero aid policy leads to higher GDP per capita in the long run because the investment share in GDP is also higher under this policy (see Figure 3). High GDP per capita under the zero aid policy leads to lower infant mortality and
higher life expectancy in the long run. This is apparent in Figures 5 and 6. Thus, the citizens of our model economy are far better off under the zero aid policy than under the regimes where either the level of aid is maintained at its present level or the level of aid is doubled.

**Section 5: Conclusions**

The debate on the effectiveness of foreign aid has gone on for a long time and at various levels. The latest one is the view that most of the problems of the poorest countries will be solved if enough aid is provided. This immediately raises the question: how much is enough? Clearly at the analytical level, there can be no answer. We therefore tried to provide an answer based on simulation experiments. We considered three possible scenarios: first, maintain the status quo; second, double aid; and third, abolish aid. We then posited the following question: assuming a plausible underlying model of aid effectiveness, which one of these three scenarios would constitute the best course of action?

We used the most recent data for a wide range of aid recipient countries and a simulation methodology to show that the best course of action for the donor countries would be an immediate cessation of all aid. While this may appear to be a provocative conclusion, we demonstrated that within the scope of our aid effectiveness model, this outcome is very plausible.

Our results cast new doubts about the effectiveness of aid and suggest that economists and policymakers should not expect that a sizable increase in aid will necessarily improve the economic conditions in the aid recipient countries. Does this mean that the donor countries should stop giving aid? Not necessarily. Instead, we believe that aid policy reforms must wait until we have a better understanding of the key issues surrounding foreign aid, such as whether
aid can foment reforms in the policies and institutions of the aid recipient countries that in turn foster economic growth, whether some foreign aid delivery mechanisms work better than others, and what is the political economy of aid in both the donor and the recipient countries.

We conclude by noting that our results and their policy implications are subject to several caveats. First, we consider $AID$ [and in consequence, $(AID \times POLICY)$] as exogenous. However, there are plausible reasons for which these variables are endogenous. It would be worthwhile to re-estimate the model either by including additional equations for $AID$ [and in consequence, $(AID \times POLICY)$] or by instrumenting for these variables. However, for reasons stated earlier, we suspect that our results, at least qualitatively, will change very much.

Finally, Davidson and MacKinnon (1993) note several difficulties with estimating a simultaneous equations model that is nonlinear in the endogenous variables. In particular, they point out that when estimating such models, it not clear how many instruments one should use. In estimating our aid effectiveness model, we follow the Davidson and MacKinnon suggestion that the set of instruments in this case should include all the exogenous variables, their powers, and even cross-products of the exogenous variables. However, there is a tradeoff: while adding more instruments will generally improve asymptotic efficiency, it will also tend to worsen finite-sample bias. In view of these caveats, policymakers should use caution when interpreting our results and their policy implications.
About the Authors

Dr. Hafiz Akhand received his Ph.D. in Economics from Queen's University and is currently Associate Professor at the University of Regina. His research interests include foreign aid, economic and political institutions, and economic growth and development. In addition to publishing in both national and international journals, Dr. Akhand has co-authored two books with Kanhaya Gupta, Emeritus Professor at the University of Alberta: *Economic Development in Pacific Asia* (2005) and *Foreign Aid in the Twenty-First Century* (2002).

Dr. Kanhaya Gupta received his Ph.D. from the University of Toronto and specializes in macro and monetary economics, and economic development and planning. He is currently Professor Emeritus at the University of Alberta. Dr. Gupta has published numerous articles and books. As well, he refereed for a large number of national and international journals and is the general editor for the Routledge Series on "Contemporary Economic Policy Issues". He is a frequent commentator in the media on local, provincial and national economic issues, particularly relating to money and banking.

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Endnotes

1 Source: *International Development Statistics on CD-ROM, 2004*, Development Assistance Committee, OECD.


3 We thank an anonymous referee for bringing this to our attention.

4 See Beynon (2002) for a detailed survey of recent research on aid effectiveness and selectivity as well as the policy implications of this research on aid allocations. Easterly (2003) and Dalgaard *et al.* (2004) document how the BD study has influenced both individual governments and international organizations.


6 Acemoglu *et al.* (2003) provide several examples of kleptocratic regimes—the Democratic Republic of the Congo under Mobutu Sese Seko, the Dominican Republic under Rafael Trujillo, Haiti under the Duvaliers, Nicaragua under the Somozas, Uganda under Idi Amin, Liberia under Charles Taylor, the Philippines under Ferdinand Marcos.

7 As noted earlier, our simulation results show that aid inflows are primarily devoted to consumption.

8 See, for example, Gupta (1975), Gupta and Islam (1983), Obstfeld (1999), Burnside and Dollar (2000) and Easterly *et al.* (2004). The single equation approach is widely used in the aid effectiveness literature. Gupta (1975), however, points out that a single equation approach merely focuses only on the direct effects of aid, and therefore does not provide an accurate picture about the aid effectiveness. By contrast, Gupta argues, a simultaneous equations approach allows for both the direct and the indirect effects, and therefore is a more appropriate framework for assessing the effectiveness of foreign aid. Both Gupta and Islam (1983) and Akhand and Gupta (2002) employ the simultaneous equations approach suggested by Gupta (1975). These works show that the findings of a simultaneous equations model lead to dramatically different conclusions about the aid effectiveness as compared to a single equation model. In particular, the findings of these studies indicate that the aid effectiveness debate is probably much more complicated than what the BD type single equation models suggest.

9 See, for example, Leveine and Renelt (1992) and the references therein.


11 We note further that Akhand and Gupta (2002) include percentage changes in life expectancy and infant mortality as endogenous variables in their model. The estimated coefficients of these variables, however, are difficult to interpret. Furthermore, we are interested in the determinants of life expectancy and infant mortality rate rather than the percentage changes in these variables. We therefore replace percentage changes in life expectancy and infant mortality in the AG model with life expectancy and infant mortality rate.
The policy index used in this paper is obtained from Easterly et al. (2004), and is constructed using the formula:

\[ POLICY = 1.574 + 5.919 \text{BUDGET} - 1.889 \text{INFLATION} + 1.459 \text{SACW} \]

where BUDGET is budget surplus to GDP ratio, INFLATION is the natural logarithm of \((1 + \text{inflation rate})\), and SACW is Sachs-Warner openness index, updated by Easterly, Levine, and Roodman.

See Levine and Renelt (1992) observe that investment share in GDP is frequently used as an explanatory variable in the empirical growth literature.

See Bloom et al. (2001) for an extensive survey of this literature.

Our treatment of AID and AID \(X\) POLICY as exogenous variables breaks the tradition of the existing empirical aid effectiveness literature which considers these variables as endogenous. See, for example, Burnside and Dollar (2000), Akhand and Gupta (2002), and Easterly et al. (2004). These researchers address this endogeneity issue either by estimating a separate equation for aid, as in Burnside and Dollar (2000), or instrumenting for AID and AID \(X\) POLICY, as do Burnside and Dollar (2000), Akhand and Gupta (2002), and Easterly et al. (2004). We note, however, that the estimation results presented in this paper are qualitatively the same as those of Akhand and Gupta (2002), Tables 6.7 -- 6.10, pp. 94--100.

Akhand and Gupta (2002) experiment with two variants of the structural model presented in Section 2. The first variant of the structural model is obtained by dropping the interaction term between aid and policy from equations (2.1) -- (2.4). The second variant of the model includes in each of the four equations an additional interaction term between aid squared and policy. However, they find that their preferred model, equations (2.1) -- (2.6), performs far better than its variants. In this paper, we therefore only estimate the model favored by Akhand and Gupta (2002). We note as well that the growth regression included in our model is Burnside-Dollar's preferred specification except that we also include the investment share in GDP as an additional explanatory variable.

An Appendix to Easterly et al. (2004), available on the Internet at www.cgdev.org, describes most of the variables included in our model, explains the methodology used to construct the Easterly et al. data set, and provides a list of the countries for which the data has been collected.

Following BD, Easterly et al. (2004) exclude observations which BD considers outliers. However, Easterly et al. point out that keeping the outliers in the regression does not alter their findings about the effectiveness of foreign aid. Since we use the Easterly et al. data set, our estimation results, qualitatively, are also robust to the exclusion or inclusion of the outliers in the regression. Table 3 therefore only reports the regression results obtained using the full sample of 323 observations.


See, for example, Easterly and Rebelo (1993), Fischer (1993), and Sachs and Warner (1995).

As noted earlier, a single equation approach is not an appropriate framework for determining the efficacy of aid because the single equation approach focuses only on the direct effects of aid, and therefore provides an inaccurate assessment of the aid effectiveness.
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