Is Foreign Aid Beneficial for Sub-Saharan Africa? A panel Data Analysis

Stephen Armah and Carl Nelson

University of Illinois at Urbana-Champaign

April, 2008

- Selected Paper (467246) prepared for presentation as a poster at the American Agricultural Economics Association Annual Meeting, Orlando, FL, July 27-29, 2008.

Abstract

Significant ambiguity surrounds the magnitude and sign of the effect of foreign aid on economic economic growth. Foreign aid can potentialy augment scarce domestic capital to spur growth but foreign aid can also remove positive incentive to build wealth, stalling growth. This paper characterizes the effect of foreign aid on the growth of Sub-Saharan African countries after correcting endogeneity problems that plague the estimation. Foriegn aid is found to be growth promoting given good governance and using fixed effects in a static panel framework. Data from twenty-one Sub-Saharan African countries spanning 1995-2003 was used in the estimation. The finding of a significant foreign aid-growth relationship is pertinent because it suggests that increased aid to Sub Saharan Africa is one way to achieve the UN's Millennium goals. By lobbying for increased foreign aid, advocates are prescribing a necessary albeit insufficient medicine for Sub Saharan Africa's economic problems.

1 Introduction

In spite of criticisms by prominent economists, notably: Friedman (1958), Easterly (2006); Easterly (2003) and Collier (2007) regarding the effectiveness of foreign aid in stimulating growth, the developed world continues to commit substantial financial assistance to countries in Sub-Saharan Africa or SSA in an effort to stimulate growth ((Ali and Isse, 2004) and (Goumanee, Mourissey, and Girma, 2005). Easterly (2006) contends that existing aid organizations have achieved very little poverty reduction despite the astronomical sums of money they have spent on SSA and questions why such little growth has been achieved with so much aid. [1] Should OECD countries continue to pump aid to LDC countries? Is aid money to SSA justified? A major contribution of this research is to provide answers to questions raised. [2]

Aside from the political appeal that aid-giving represents for incumbent rich country governments, the OECD resolve to ramp up aid is hardly surprising because it is in line with the effort to achieve the United Nation's Millennium Development Goals (MDGs) [3]. The basic aim of the MDGs is to reduce the level of poverty in the world

[1] See for example (Mukherjee, Shukralla, and Kedir, 2008) and Easterly, 2006 for an expansion of the argument.

[2] We acknowledge that aid plummetted recently after steep increases in aid to Iraq and Nigeria in 2005. Total official development assistance (ODA) from members of the Development Assistance Committee (DAC) fell by 8.4 percent in real terms in 2007 to USD 103.7 billion. This represents a drop from 0.31 percent of members combined gross national income in 2006 to 0.28 percent in 2007: source: OECD DAC Statistics.

[3] The eight millenium development goals are: (1) Eradicate hunger and poverty (2) Achieve universal primary education (3) Promote gender equality and empower women (4) Reduce child mortality (5) Improve maternal health (6) Combat HIV/AIDA and malarial diseases (7) Ensure environmental sustainability and

to half the level it was in 2000 by 2015 (UN, 2000). The MDGs require countries to institue certain good macroeconomic policies reccomended in the work of Burnside and Dollar (2000). [4] The MDGs therefore inherently assume that aid is growth promoting. However if the necessary condition that ensures aid is growth-promoting is not "'good policy"' as the work of Burnside and Dollar (2000) dictates but aid is given only to good policy countries then the MDGs may likely not succeed. Given this important point, it makes sense to re-visit the empirical question of just how much foreign aid can be expected to help the growth effort in SSA.[5] Will the related expectations that donors have of aid such as promoting peace ever be realized? Or is the wrong medicine being used to fix this important problem? Is foreign aid to SSA more likely to act as a catalyst to domestic production, boosting exports and growth (Burton, 1969) or are SSA countries doomed to aid-dependence?(Arellano, Bulir, Lane, and Lipschitz, 2005). [6] It is likely that the answer to these questions lie more in the empirical realm than in theoretical foundations. Unfortunately the theoretical underpinnings of the aid-growth relationship are inadequate at best and most economists have had to rely on

(8) Develop a global partnership for development

[4]For example, countries were supposed to pursue policies that will guarante a budget surplus, low inflation rate, and trade openness. It was assumed such countries will neccessarily use aid to grow.

[5]Aid is formally defined as Official Development Assistance (ODA). In practice, there are two main types of aid: Bilateral and multilateral aid. Bilateral aid is given by the government of one country to another directly through an aid agency. Multilateral aid is given to a particular country through international agencies.

[6]Since aid is also given for sinister motives such as for strategic military purposes, the effect of aid on growth in Africa may be also be conditioned on other factors such as: whether the African country is a strategic millitaty ally, was a French colony, an English colony, a Portuguese, colony, an Islamic country, or has resident whites. Although we use ODA in this research, we are careful to filter out these effects in the methodology following the procedure used by (Islam, 2005).

empirical correlations with little relevance to theory. Furthermore there remain different endogeneity problems regarding the estimation of the aid-growth relation that are yet unexplored. This is because even though aid may boost growth it might be the very presence of low growth that attracts more aid, so we have manifested here one kind of endogeneity problem (Radelet, Clemens, and Bhavnani, 2005). [7]

It may also be the case that aid promotes growth and it is the countries that use aid successfully to grow that gets more aid. An alternative yet plausible view is that aid and growth are determined simultaneously so that countries that recieve more aid grow fastest (or slowest) and countries that grow fastest (or slowest) recieve more aid. This paper takes this later view. Furthermore, if country specific effects are present in the growth equation we potentially have another kind of endogeneity problem (Maddalla 1971 and Islam 1995). Finally it is plausible that the aid data is measured with error which can introduce finite sample bias into OLS estimates. Fortunately, the increasing availability of time series data and more sophisticated econometric methods to handle model misspecification problems means we can now address these variant endogeneity problems. For this reason, the question of the effect of aid on growth remains relevant. The resolution of the aid-growth puzzle makes even more sense in SSA Africa which has received the most aid but is still the world's poorest region. [8] It will certainly prove educative if the exact conditions under which foreign aid stimulates growth in SSA are identified and included in policy decisions[9]

[7]This might explain the persistently negative relationship between aid and growth often found in the literature

[8]According to the UN Sub-Saharan Africa (SSA) received nearly 600 billion dollars in aid from 1960-2007.

[9]For clarity and in order to avoid clutter all tables in this report are included at the end of the report.

Traditional analysis of the impact of aid on growth can be depressing as it highlights the transfer problem [10] and the possible negative Dutch Disease effects [11].

Although there also exist some more positive views about the efficacy of aid in promoting growth what is the actual relation between aid and growth in Africa?. Is the effect of aid on growth region-specific?, period-specific?, negative? positive? insignificant, conditional on specific variables or ambiguous? This paper is a contribution to the literature that is trying to understand the effect of aid on growth. Apart from using the most recent data and including new dummy variables (eg for oil producing and diamond producing countries) to control for group effects, and limiting my focus to SSA, the main contribution this paper makes is to address some of the different kinds of endogeneity problems that plague the aid-growth relation. These relevant endogeneity problems include: endogeneity due to individual specific effects [12] endogeneity due to simultaneity bias (aid, growth, political stability, and policies may be determined together), endogeneity due to measurement error which can lead to attenuation bias, endogeneity due to omitted variable bias, and endogeneity due to feedback effects (for

[10]The transfer problem: The problem of how an international transfer is executed through adjustment of the external trade balance (Arellano et al, 2005). Economics theory claims achieving the transfer involves a combination of higher imports, lower exports and foreign currency depreciations none of which is a particularly strong reason to advocate for more aid to developing countries

[11]Dutch Diseas in the context of aid dictates that a large in-transfer of aid to a poor country ultimately leads to a decrease in exports. Aid increases the supply of tradable goods and dampens their price. By the income effect it increases the demand for non-tradables. Scarce resources are then diverted from the export sector to the tradable sector (Arellano et al 2005)

[12]The key issue is whether the unobserved country specific effect is correlated with the matrix of explanatory variables. If it is, OLS is biased and inconsistent Wooldridge (2001) also Greene (2000); Anderson and Hsiao (1981) and Bond (2002).

example when growth is defined as persistent and Y_{t-1} is added to the right hand side of the growth equation).

To account for simultaneity bias, following Islam (2005), we define a 4-equation simultaneous system involving policy, political stability (or good governance), aid and growth since these variables are often determined together. We employ instrumental variable techniques to solve the simultaneous system. The SSA region is characterized by significant heterogeneity between the countries because of their history of colonization by different European powers [13] We argue that there might be unobserved country specific effects present in any growth equation using a sample of SSA countries. Correlation between these unobserved country specific effects and the error term usually renders pooled OLS inconsistent ((Islam 1995); (G.S.Madalla, 1971) and (Mundlak, 1978). We therefore appeal to different specification tests to isolate the correct model that accounts for this endogeneity. We confirm that the main causes of endogeneity bias are country-specific effects and find that the fixed effects panel estimator yields consistent results.

For completeness, we also analyze possible dynamic effects in the aid-growth relation. Specifically we include lagged growth as an explanatory variable, thus introducing ommited variable bias. We are less successful with this exercise and fail to pin down economically significant dynamic effects involving aid and growth. In order words, the aid variable ceases to be significant in the dynamic panel formulation of the

[13] Specifically because each country on average has more than a few tribes, languages, and to some extent economic systems they are different. Obviously there are similarities between some of the countries for example the block of Francophone countries but in general these countries are very dissimilar.

aid-growth system of equations.[14] Section 1 reviews the current literature regarding the aid-growth relationship. Section 2 describes the empirical model used, provides a brief description of static panel as well as dynamic panel data models, and describes the variables used. Section 3 summarizes and describes the data. Section 4 presents and discusses the results. Section 5 concludes and provides suggestions for further research.

2 Literature Review

It is rather ironic that the economic literature is yet to reach a consensus about the effect of aid on growth given the substantial work that has already been completed in the field Roodman (2004). At a minimum, the fact that a good number of the poor countries that have received the bulk of aid in history remain poor questions the effectiveness of aid as a poverty-alleviating tool (Ali and Isse 2005); (Sachs, 2005); Collier 2007). William Easterly puts the aid dilemma in perspective "After fifty years and more than 2.3 trillion dollars in aid from the West to alleviate poverty in the Rest, there is shockingly little to show for it" (Easterly 2006).

Why is the aid-growth relationship so difficult to pin down? There are valid theoretical arguments why the aid coefficient in a growth regression is ambiguous in sign.

[14]The key issue is whether the unobserved country specific effect is correlated with the matrix of explanatory variables. If it is, OLS is biased and inconsistent Wooldridge (2003) also (Greene, 2000), (Anderson and Hsiao, 1981); (Bond, 2002). One explanation why the dynamic panel model does not identify the aid-variable as a significant explanatory variable may be that all other independent variables (including aid) do not have much to explain, once the lagged dependent variable (in this case lagged growth) is accounted for.

In the forward direction, according to the "gap theory" [15] argument due to Chenery and Strout (1966), aid can promote growth because it often augments the foreign exchange needed in production for aid-dependent ventures (Chenery 1966; Islam 2005 and Easterly 2003). A valid counter argument to the effectiveness of aid is that countries that receive aid just use aid in consumption, effectively becoming aid dependent (Radelet et al 2005 and Ali and Isse 2005). These countries neither put the aid dollars into productive use nor invest it because of the fungibility of aid Gomannee (2005) and the ease with which it can be consumed (Burnside and Dollar 2000); (Hansen and Tarp, 2002) ; (Hansen, Dalgard, and Tarp, 2004). In fact Arrelano et al (2005) argue that a permanent flow of aid most likely ends up in consumption (Arrellano et al, 2005).

Of course there are also those economists that argue that aid actually retards growth or at best has an insignificant effect (Boon, 1996); (Cassen, 1994) also (Griffin and McKinley, 1994). Yet others believe that the relationship is non-linear.

The empirical evidence regarding the effect of aid on growth is just as confounding. Hansen and Tarp (2002) find that the aid-growth effect is sensitive to choice of estimator. Hansen and Dalgaard (2001) find that aid promotes growth irrespective of policy environment. Ghura, Hadjimichael, Mhleisen, and Nord (1995) and Lensik and White (2000) find positive but decreasing marginal returns to aid by introducing the square of the aid variable. Gomanee (2005) finds a positive aid-growth effect using only SSA data but to a large extent he concentrates his research on transmission mechanisms by

[15] The Chenery and Strout (1966) two-gap theory used to justify allocations of aid literally comprises of 2 gaps. The first gap consists of the amount of aid needed to achieve a target growth and domestic saving. The second gap consists of import requirement for a given level of production and foreign exchange Easterly (2003).

which aid affects growth and sidesteps to an extent some of the issues of endogeneity that emanates from the aid-growth specification.

In their seminal paper, Burnside and Dollar (2000) conclude that the aid-growth effect is positive for good policy countries but negative for countries with bad policies [16] Lensink and White (2000) also observe that policies are more growth promoting when supported by aid flows. There is also significant evidence in the literature that aid has a negative effect on growth or at best an insignificant effect. Boone (1996) and Mckinley (1994). Other writers find that if certain variables, for example policy is controlled for, aid has a significant effect (Easterly 2003 and Burnside and Dollar 2000).

Islam (2005) concludes that a stable political environment is a necessary condition for aid to promote growth. Burnside and Dollar (2000) had argued that the necessary condition was policy. Islam counters by arguing that the necessary condition for aid to be growth promoting is political stability. Islam (2005) and Easterly (2003) concur that the positive aid-growth relationship found by Burnside and Dollar (2000) was the result of the misinterpretation of the significant interaction term between aid and policy.

In direct contrast, other economists find aid has no effect even when we control for the so-called important variables. Goumanee et al (2005) argue that the consistently negative dummy found for SSA is evidence there is something ”different” about SSA and limit their study to 25 SSA countries over a 25-year period. They find that aid actually supports growth but the contribution of aid is indirect. Aid promotes growth

[16]Eskander Mukherjee, Debasri Shukralla and Elias Kedir, 2008 find basically the same result with some qualifications.

in SSA through its contribution to investment. Goumanee et al do not however adress the kinds of endogeneity problems that is the focus of this paper leaving thier conclusions in doubt. Islam (2005) finds that when the data is limited to stable countries, aid supports growth. In short, the controversy about the effect of aid on growth rages on.

This paper is a response to some of the questions generated from reviewing the aid literature. Following Goumanee (2005) the sample is limited to countries in the SSA region but in conformity with Islam (2005), possible endogeneity in the growth equation is controlled for by instrumenting the endogenous variables in the 4-equation simultaneous system although ultimately panel methods are used in contrast to pooled 2SLS that Islam emphasized. Islam's work, though innovative because it under-lined the importance of political instability has a few shortcomings. First and foremost, although he recognizes the possible non-linearity of the aid GDP relation and possible endogeneity problems he does not appeal to sufficient specification testing to enable him isolate the best possible estimator to generate his estimates. Furthermore, his decision to use pooled OLS as the preferred estimator is debatable. Almost invariably there will be endogeneity bias caused by country specific effects but unfortunately he used the FE estimator (which is an appropriate estimator to use) but does not provide sufficient explanation of this choice. This research focuses on the aid growth relation with exclusive regards to the SSA region for reasons already explained.

A sample of 21 countries for which data was available for all the pertinent variables was used. [17] By using the most recent data, including more relevant variables, and

[17]To replace missing values with appropriate substitutes, I employed the Multiple Imputation by Chained Equations (MICE) technique. I implemented the MICE procedure in STATA using the STATA command "ice". MICE techniques have been found to be superior to nave methods of controlling for missing values

addressing some of the endogeneity problems that plague the aid growth relationship, a more robust estimate of the returns to aid in SSA is realized.

3 The Empirical Model

The dynamic panel model used in this paper is due to Islam (1995). Islam adapted (Mankiw, Romer, and Weil, 1992)'s formulation of the textbook Solow Model to account for time-invariant country specific effects associated with the initial endowment. A general specification of Islam's dynamic panel model is shown in (1)

$$Y_{it} = \pi X_{it} + \beta_s \sum_{s=1} X_{s,it} + \alpha_i + \mu_{it} + \gamma \tag{1}$$

Where Y_{it-1} is the lagged dependent variable, α_t is the period specific effects,α_i are the country specific effects and the μ_{it} are idiosyncratic error (mean 0 and variance σ^2). γ is the over all constant and accounts for seasonal and cyclical effects.[18]

The vector X_{it} includes traditional determinants of growth (See Chart 1) and the following endogenous variables: A_{it} =Aid/GDP, PI = Political stability Index (a P*1 vector of variables; PS is the same as good governance in this paper) and POL = Policy Index (Burnside and Dollar, 2000). Furthermore, $(A_{it}/GDP_{it},)^2$, is also included to account for possible non-linearity. Some interaction variables were also included which I will discuss further in the procedure section. Before proceeding further we clarify

such as replacing missing values with averages of existing values Van Buren et all (1999)

[18]Suppose π = 1 then we have a unit root, which will undermine the results of this research. Given the short panel we could not apply the ADF test for unit root so we assume away this potentially damaging possibility and proceed with the assumption that growth does not follow a random walk.

that the research is divided into 2 distinct parts. In part 1, we do not include the lagged dependent variable as one of the explanatory variables. In order words we assume that there are no dynamics or feedback effects in the growth equation so part 1 only deals with static panel data models. In part 2, we relax this assumption and employ dynamic panel data methods in the spirit of Anderson and Hsiao (1981); Blundell and Bond (1998); (Arrelano and Bond, 1996) and Bond (2002). Recall that as previously stated, in part 1, we side-step the feedback issue and focus on the simultaneity bias problem so in pragmatic terms we are only dealing with a one shot, 4-eqn simultaneous system. We now proceed to discus the first stage equation for each of the three endogenous variables AID, Policy (POL) and Political Stability (PS) in the 4-equation simultaneous system of GDP growth.

3.1 The Aid Equation

$$A_{it} = \lambda_0 + \lambda_k K_{it} + \omega_{it} \tag{2}$$

Where K_{it} (which is the vector of instruments for aid) includes Initial GDP, Infant Mortality rate, log population, lagged policy index, and the lagged aid variables [19] As I have argued, aid may be endogenous in the growth equation so it is necessary to instrument aid with relevant instruments. Donor countries usually give aid for reasons linked to their own self-interest. Boone (1996) and Islam (2005) document that the allocation of aid depends on:

- Political links between donor and recipient countries
- Socio-economic climate

[19] Export instability Index is included in some studies.

- Structural vulnerability
- Economic policy.

A dummy for SSA countries belonging to the French block is included in the instrument list to capture strategic interests [20] Following Islam, the logarithm of population is included as a proxy of structural exposure to trade shocks. Finally the Lagged value of aid is also included in the instrument list. The results of the Aid equation is presented in column 3 of Table 3

3.2 The Political Stability or Good Governance Equation

$$PS_{it} = \gamma_0 + \gamma_z Z_{it} + M^{pi}_{it} \tag{3}$$

Where Z_{it} is a vector of instruments. The instruments and the proxies used to measure them are Education: Primary school enrolment as a percentage of GDP; Democracy: Dummy = 1 if democratic Good economic Performance: Positive growth rate of GDP; Diamonds/Oil: Dummy = 1 if present respectively. Political stability or good governance has been found to be a necessary condition for aid to be growth promoting at least for LDCs (Islam 2005). We therefore extend this argument to the sample of SSA countries. We use the Corruption Perception Index (CPI) of Transparency International to proxy for political stability.[21] The argument is made that that there is a strong correlation between corruption and political instability. The CPI ranges from 0-10 with 10

[20] These countries receive the bulk of French Aid to Africa.

[21] See Appendix for the attached methodology for the generation of this variable. Also found at transparency.com. We also repeated the estimations in this paper using different mesures of poltical stability but the results did not change much

being the most stable countries. To ensure that the political stability is not endogenous in the growth equation, it is instrumented with appropriate variables. Several factors affect political stability (or by implication, political instability in a country). Average level of education, system or type of government (democracy or dictatorship), good economic performance, whether the country has diamonds or oil may also be a significant factor. A high level of education is expected to be positively correlated with political stability (Barro, 1996), democracies are more stable on average than other types of government and should also be positively correlated with political stability. On average good economic performance is expected to be positively correlated with political stability while having diamonds or oil will be negatively correlated with political stability [22]

Table 4, columns 2 and 3 reports the estimates from the political stability equation. Column 2 reports the weights that were used in creating the PS index. Column 3 is a report of the 1st stage instrumental variable regression involving the PS index and its instruments

3.3 The Policy Equation

$$POL_{it} = \theta_0 + \theta_G G_{it} + N^{POL}{}_{i\,t} \tag{4}$$

Borrowing from Burnside and Dollar (2000) and Islam (2005) the policy variable used in this paper is constructed as a linear combination of three main indicators of

[22] Other relevant variables include Party fractionalization index (PFI), which captures the degree of disharmony among members of the legislature. Ethno-linguistic fractionalization index is also included to capture the effect of homogeneity of a society on political instability.

macro policy: Trade openness [23], Budget surplus (defined as government revenue-expenditures) and inflation. Weights in the index depend on relative influence on growth [24]. To mitigate endogeneity bias of policy in the growth equation, the policy index in this paper is instrumented by: Initial Level of Human capital (EDU), initial value of GDP per capita (Y_0), lagged value of policy index (PI_{t1}) and lagged Aid (AID_{t1}) (See Table 4, Column2). The effect of policy on growth has enjoyed significant analysis in the literature with Easterly (2003), Hansen and Tarp (2001), Burnside and Dollar (2001) and Arrellano et al (2005) having all contributed. Evidence has been mixed. [25]

3.4 Identification

Both the rank and order conditions for the simultaneous system are achieved because the system contains several exogenous variables and only 4 endogenous variables. As has been extensively described, the endogenous variables are instrumented to minimize endogeneity bias before being included in the growth equation (1)

[23] As Harrison (1996) explains there are numerous measures of trade openness but the two main kinds of trade openness measure openness by means of trade volume and restrictions to trade. The typical volume measure is the value of trade share = (export-imports)/GDP. I use export/GDP. The black market premium is also sometimes used The black market premium gauges the severity of trade restriction as a reflection of how successful the price rationing mechanism is in the foreign exchange market. The black market premium is typically growth retarding so it is negatively correlated to growth. I used the balck premium in some of my regression trials but results aere not different.

[24] To determine weights in the POL index, the independent variables in the policy index are regressed on GDP per capita growth by pooled OLS. The coefficients are used as the weights to construct the policy index

[25] Among the prominent economists who build indices of openness are Leammer (1998), Dollar (1992) and Sachs and Warriner (1998).

4 A Primer on Panel Data Models

Since panel data estimators were used extensively in this work, we pause to discuss briefly their relevance. Different econometric procedures exist for estimating static and dynamic panel data models but we focus first on the static panel data models: pooled least square (PLS), random effects (ER) and fixed effects (FE)

4.1 Pooled LS (PLS)

Consider the pooled LS model below

$$Y_{it} = \pi X_{it} + \beta_s \sum_{s=1} X_{s,it} + \alpha_i + \mu_{it} + \gamma \tag{5}$$

Where γ is an over-all constant and μ_{it} is assumed to be an *iid* random error. Pooled LS ignores country specific characteristics. Note that in this specification t is the time index and i is the country index. Furthermore s indexes the explanatory variables.

4.2 Random Effect(RE)

$$Y_{it} = \pi X_{it} + \beta_s \sum_{s=1} X_{s,it} + \alpha_i + \epsilon_i + \mu_{it} + \gamma \tag{6}$$

Where ϵ_i is the random disturbance characterizing the i-th country. Other variables retain original definitions. RE does not ignore the country specific effect but assumes that the correlation between the unobserved country specific effect and the RHS matrix of explanatory variables is zero [26]

[26] RE assumes all heterogeneity is observed.

4.3 Fixed Effect(FE)

$$Y_{it} = \pi X_{it} + \beta_s \sum_{s=1} X_{s,it} + \alpha_i + \alpha_t + \mu_{it} + \gamma \tag{7}$$

Here α_t represents the set of time dummies; one for each time period and α_i is the country specific effect all other variables retain earlier definitions from the PLS equation. LSDV ignores neither the country specific nor does it assume that it is unobservable. Rather, LSDV tries to control for the country specific effect by using dummy variables. However, LSDV does assume E (X_{its}, μ_{it}) = 0. If E (X_{its}, μ_{it}) is really zero so that there is no feedback from past values of the dependent variable to affect the present level of the dependent variable then LSDV or the within estimator is unbiased and efficient. However, ex ante it is not clear whether a high level of growth today is not affected by yesterday's growth, as there is contrasting evidence in the literature. We make a simplifying assumption as does Islam that these variables are determined together and specify a 4-equation simultaneous system and estimate by fixed effects.

In part 2 where we add $Y_{t-1} to the RHS of the growth equation, we cannot longer guarantee that E(X_{its}$, μ_{it}) = 0. When Y_{t-1} belongs to the matrix of explanatory variables it is, it is unlikely E (X_{its}, μ_{it}) will be zero so OLS is biased and inconsistent (Anderson and Hsiao 1981 and (Bond, 2002). In fact, adding the lagged dependent variable to the RHS of the regression can produce additional endogeneity bias quite distinct from the endogeneity caused by country specific effects (Yasar, Nelson, and Rejesus, 2007) and Bond 2002). This is because although first differencing can be used to easily eliminate the country specific effect, the country specific effect is eliminated at the cost of creating a new error term (μ_{it} - μ_{it-1}) that is correlated with the lagged dependent variable (Yassar, Nelson and Rejesus, 2007). Clearly we need instrumental variables to get consistent

estimates. Under the assumption that there is no autocorrelation in the error term, Anderson and Hsiao use the second lagged level, Y_{it-2}, or second lagged difference, dY_{it-2}(since it is not correlated with the first differenced error (μ_{it} - μ_{it-1}), as an instrument to correct for the existing correlation. In order words, First differencing and the within transformation both eliminate the individual specific effect but in addition create an unwanted and significant correlation between the first differenced error and the country specific term (Bond 2002). Because of this correlation, fixed effects (FE) and first differencing (FD) are no longer the consistent estimators since the IV estimator is asymptotically superior to FE and FD in this case. In the dynamic panel data context, we use the GMM estimator, which is equivalent to 2SLS. [27] But what are the appropriate instruments to use? We have already mentioned one form of instrument that was used by Anderson and Hsiao (1981).

Recall that to define acceptable moments we need corresponding and valid orthogonality or moment conditions. Further in picking the right instruments we should not lose sight of the need for strong instruments. The Anderson and Hsiao estimator suffers from the weak instrument problem because it does not make use of all the moment conditions available to obtain the maximum number of instruments (Bond 2002). Arrellano and Bond (1991) introduced the one-step GMM estimator[28] which, improved on the Anderson first differenced GMM estimator by defining more moment conditions

[27]The seminal paper that analyzed feedback effects in the growth equation is due to (Islam, 1995) although he was primarily concerned with convergence. We draw on Islam analysis for the interpretation of the coefficients.

[28]There is also a two-step version of the estimator. The 1-step and 2-step estimator differ only in the var-covariance matrix.

and enabling the use of more instruments. Blundel and Bond (1998) subsequently improved on the Arrelano and Bond estimator by defining the system GMM dynamic panel estimator, which used all possible instruments and by implication all possible moments. The system GMM dynamic panel estimator uses the levels of the dependent variables (lagged 2 periods) as instruments in the 1st difference equation and used the differenced dependent variable (2 periods) as instruments in the level equation. By using the maximum number of instruments, the system GMM dynamic estimator is potentially the most efficient of all the dynamic panel estimators.

5 Procedure

5.1 Procedure For Part 1

Following Barro (1996), Islam (1995) and Renelt (1992), we apply the general specification of a growth model (1) that derives from neoclassical growth theory to a sample of Sub-Sarahan African countries. Islam (1995) rigorously derives the dynamic panel analog of the growth model from a textbook Solow model. Such a panel growth specification is employed to allow for the possibility of individual specific effects in the growth equation. To address simultaneity bias, we instrument the aid equation , the policy equation and the political stability equation[29] (all displayed earlier) and calculate predicted values from each equation. We then include the predicted values of these endogenous variables in the growth equation (1) so as to minimize endogeneity bias.

In order to fully account for endogeneity, the best method to estimate (1) was iso-

[29]Islam defined this variable as Political Instability which is the inverse of my variable (Political Stability

lated by using different specification tests in a step-wise manner [30]. Since Islam ignored country-specific effects by using 2SLS on pooled time series-cross-section data for his model, we test whether the possible presence of country specific effect is causing endogeneity in the growth equation. Specifically we test for endogeneity due to country specific effects using two asymptotically equivalent methods. The first test is due to Hausman (1986) and an equivalent reproduced in Woolridge (2003). The latter test requires the addition of country means to the rest of the variables in the equation and estimating by fixed effects. The results of the Wooldride test of endogeneity are reported in Table 1. Unfortunately the Hausman test was not successful, as my data did not meet the asymptotic requirement of the Hausman test [31]As described already, the Wooldridge test was used to decide between the consistent estimator (FE) and the GLS estimator (RE). We cannot reject the presence of individual specific effect so we con-

[30]Although not reported, we did test and reject strict exogeneity following the procedure outlined in Wooldridge (2003). The test involves including the leads of the explanatory variables as additional exogenous variables and estimating by fixed effects. A rejection of the null hypothesis that the coefficients of the leads are all zero establishes strict exogeneity. If strict exogeneity holds and the variance of the error term is constant, then pooled LS (PLS) is the BLUE estimator (Green 2000). However, the probability that PLS will ever be chosen as the preferred estimator is very low. This is because the error variance will have to be a scalar for that to happen and this almost never occurs. If strict exogeneity holds but the error term is heteroskedastic, then RE is preferred to PLS (Bond 2002). In the event that strict exogeneity is violated and country specific effects present endogeneity problems, First differencing (FD) is the optimal estimator. FD is preferred to FE when strict exogeneity fails because the within transformation causes specifications problems more frequently than the FD estimator (Wooldridge 2003). In this research the First difference estimator and the within transformation produced near identical estmates

[31]This is not too problematic, as there has been some criticism of the Hausman test procedure among the STATA community of users. The Wooldridge test is at the moment the preferred test of endogeneity.

clude that fixed is the appropriate estimator (see Table 2) We also test for and reject the presence of serially correlated errors in the growth equation (see Table 3, Column 2). To test for AR (1) serial correlation we added a lagged value of the residual from the growth equation and estimated by pooled OLS. Non-significance of the lagged residual confirms no serial correlation. To further explore the aid growth regression, the square of the aid variable was included in the regression and (1) was estimated by fixed effects. The aid-policy interaction was also subsequently included and (1) was re-estimated by fixed effect. The results are presented Table 3, column 4. Due to multicollinearity problems and because we had a rather limited sample size I did not include both the aid interaction and the square of the aid variable at the same time.[32]

5.2 Procedure For Part 2

We now include the lagged dependent variable as an explanatory variable in the growth equation and execute the first difference estimator due to Anderson and Hsiao (1981). We also operationalize the Arrellano and Bover (1995) and Bludel and Bond (1998) dynamic panel estimators using the STATA code used in Bond (2002). Table 4 compares these dynamic panel model estimates. Tables 4 also reports the Sargan test of over-riding restrictions as well as the Arrelano and Bond test of AR(1) and AR(2) serial correlation.

[32]We also performed a regression where we replaced the aid-policy interaction with the aid-good governance (or political stability) intraction and got a significant result: Conditional on political stability aid was significant

6 Data Description

The bulk of the data used in the study came from the World Development Indicators of the World Bank, the Penn World Tables (Alan Heston and Aten, 2003), FAO, The Polity Index of political Measures, Transparency International's Corruption Perception Index (CPI) and the University of Illinois (UIUC)'s GMID index. As a result of difficulty locating data for some countries for all the variables in the model, only the following 21 SSA countries (see List 1 below) were included in the study.

LIST 1: Angola Benin Burkina-Faso Cameroon Cape-Verde CIV Congo-Dem-Republic Gabon Gambia Ghana Namibia Niger Nigeria Rwanda Senegal South-Africa Togo Uganda Zambia Zimbabwe.

The countries that were excluded from the list either had too few observations per year or had observations for years that were too far apart to be useful. The data used covered the period 1995 to 2003. We use 1-year growth rates for the sake of data availability although Islam N (1995) and Islam M (2005) both suggest that one-year intervals might be too short to capture growth rates. We use one-year growth rates on the assumption that this is long enough time for aid effect to manifest in growth, as it is an absolute necessity in SSA. In a later paper we will also divide the data set into 5-year subs-samples. The argument by Islam (1995) in support of using 5 year averages is straightforward: "not only do convergence effects disappear in short panels but also cyclical influences are less pronounced". In a 5-year averages sample, the errors are separated by 5 calendar years and are less likely to be correlated. Note that for the sake of organizational clarity, all tables referred to in this paper are included at the end of the report. Chart 1 outlines the main variables used in the analysis. Note that multi-

colinearity problems forced the omission of several of the interaction variables. We did however include the AID*POL interaction.

7 Results

From Table 2, it is obvious that we cannot ignore the possibility of the presence of country specific effects. Applying the test of endogeneity reiterated in Wooldridge (2003), we reject the null hypothesis that the means of the independent variables are jointly zero. This means FE is preferred to RE and Pooled OLS. Pooled LS or RE effects will yield inconsistent results therefore fixed effects is the appropriate estimator. Table 3, column 2 points to the fact that serial correlation is not a problem in this model because the coefficient on the lagged residual is insignificant. Tables 4 contain the results of first stage regression from attempts to minimize endogeneity bias by instrumenting the endogenous variables but since my focus is the growth equation I do not well on these results. Paradoxically we find that we cannot confirm Burnside and Dollar (2000) result of a positive aid-Growth interaction for our subset of SSA countries. This is most clearly seen by comparing Table 3, columns 5 and Table 3 column 4. While the aid-policy interaction is insignificant in column 5, the political stability coefficient is significant at 1 percent in column 4 when we exclude the policy-aid interaction. Our result however agrees with Islam (2005) who concluded that political stability was necessary for aid to promote growth but policy is not. We therefore select the model displayed by Table 3, columns 5 as the right model [33]. We acknowledge that

[33]When we replace the aid policy interaction with the aid political stability interaction we get significant results. We do not introduce both interaction effects to minimize multicollinearity problems

there are still some problems with this model. For example the sign of the government consumption ratio is positive but we expect it to be negative, thankfully this variable is not significant. On the positive side, the model in Table 3, columns 5 has a lot of good econometric properties and conforms to most of the theoretical predictions. First of all, we are able to confirm convergence because the sign of the initial GDP variable is negative. This is consistent with theoretical prediction. According to the standard neo-classical theory of growth, countries that start of with low endowments grow faster than resource rich countries Islam (1996), Romer (1996). Barro and Sala-i Martin (1996) confirm convergence for OECD countries so we are not surprised by congergence in this sample of SSA countries. The openness variable is positive and significant. Harrison (1996) argues that more open countries grow faster. The political stability or good govenance variable is also positive and significant as expected and as found by Islam (2005). The democracy variable is positive and significant as can be expected because more democratic or "free" countries usually grow faster Barro (1996). But perhaps the most significant result is the finding of a positive and significant result for the aid variable. It seems that this result does not depend on good policy because when we include policy the aid variable actually become insignificant (Table 3, columns 5). If this is true, then conditional on policy aid is actually growth retarding which is in direct contrast to what Burnside and Dollar (2000) claim. Furthermore, we also find that the aid-growth interaction term is insignificant.

The major problem with the model presented in Table 3, columns 5 is the negative and significant coefficient of the education variable. We will expect that higher levels of education will promote growth so this is a contradiction. We hesitate to invalidate

our model however because the growth promoting process in SSA may not be too dependent on the level of education. Most SSA communities are subsistence farmers who do not have the means to use a good education to effectively add to output. What we are trying to say is that the productive processes in SSA that actually augment GDP may be only weakly dependent on education. It is true that by getting more education and changing the technology of production process education will certainly be growth promoting. We however concede that this might be a problem with the model specification. Furthermore since aid is such a big promoter of growth and most of the aid might go primarily to promote commerce, and not to schooling education may not contribute so much to growth through its effect on aid.

Analysis of the dynamic panel model proved a lot more challenging. The most consistent result obtained by comparing the results of the different types of dynamic models (Anderson and Hsiao (1981), Arrellano and Bond (1995), Arrellano and Bond (1998) to a parsimonious dynamic panel model is rather surprising. From Table 4, it is clear that the parsimony model that only has the lagged growth model explains the biggest portion of the variation in growth. One explanation for this is that there is little left over for other conditioning variables in the dynamic specification of the growth model to explain once the lagged growth is included in the equation.

8 Conclusions and Challenges for Future Research

By defining a 4-equation simultaneous system to account for the possible simultaneity bias that arises because aid, growth, and political stability are determined together we

find that aid is growth promoting in SSA after estimation by FE. We cannot not confirm Burnside and Dollar (2000)'s claim that this relationship is conditional on good policy. We however substantiate Islam (2005)'s finding that political stability is necessary for aid to effectively promote growth. We find that the aid growth relation does not have decreasing returns to scale because the aid square coefficient is not significant. Based on this result, it seems that there is no end to how much aid the developed world should pump into SSA to help achieve the goals of the millennium project. However caution should be exercised before using the results of this study for policy. First of all, still remain endogeneity problems that I side- stepped in my analysis. For example we did not attack endogeneity due to measurement error. There may also remain endogeneity due to omitted variable bias and feedback. Although these are important problems we did not focus on them and further research into these problems is needed. Furthermore, it is important to understand the real reasons why donors give aid and how recipient countries strategize to receive aid. Clearly there are issues of asymmetric information here, as donors cannot completely monitor how the aid they give is used. By contrast recipients are often uncertain about aid packages they will receive in the future. It will be interesting to investigate what proportion of a typical SSA country's budget each year comes from aid and how that has evolved over time? If we are to save SSA countries from aid dependency then we should put in place incentives that will augment the ability for aid to promote growth and eliminate incentives that encourage aid dependency. It is gratifying to discover that aid does promote growth; the challenge is how to optimize growth-promoting power of aid by channeling it to the right paces

in SSA. [34]

References

ALAN HESTON, R. S., AND B. ATEN (2003): "PENN World Tables," *Center for International Comparisons at the University of Pennsylvania*.

ALI, A., AND H. ISSE (2004): "An Empirical Analysis of the effect of Aid on Growth," *International Advances in Economics Research*, 11, 1–11.

ANDERSON, T. W., AND C. HSIAO (1981): "Estimation of dynamic models with error components," *Journal of Economics Statistical Association*, 76, 589606.

ARELLANO, A. BULIR, T. LANE, AND L. LIPSCHITZ (2005): "Dynamic Implications of Foreign Aid and its Variability," *IMF Working paper*.

ARRELANO, M., AND S. R. BOND (1996): "Some tests of Specification for Panel Data: Monte Carlo Evidence and Application to Employment Equations," *Quarterly Journal of Economics*, 106.

BARRO, J. (1996): "GEconomic Growth in a Cross Section of Countries," *Quarterly Journal of Economics*, 106.

BLUNDELL, R., AND S. BOND (1998): "GMM estimation with persistent panel data: an application to production functions," *Paper presented at the Eighth International Conference on Panel Data Gteborg University, June 11-12, 1998*.

[34] Collier, 2007. Oxford University Press

BOND, S. (2002): "FDynamic Panel Data Models. A guide to micro data methods and practice.," *Institute of physical Studies*.

BOON, P. (1996): "Politics and Effectiveness of Foreign Aid," *European Economic Review*, 40, 289–329.

BURNSIDE, C., AND D. DOLLAR (2000): "Aid Policies and Growth," *American Economic Review*, 59(4), 847–868.

BURTON, H. (1969): "The two-Gap Approach to Development," *American Economic Review*, 59.

CASSEN (1994): "Does Aid Work?," *Oxford University Press*.

COLLIER, P. (2007): "The Bottom Billion: The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done About it," *Oxford University Press*.

EASTERLY, W. (2003): "Can Foreign Aid Buy Growth?," *Journal of Economic Perspectives*, 7(3), 23–48.

——— (2006): "The White Man's Burden: Why the West's efforts to aid the rest have done so little good," *The Penguin Press*.

FRIEDMAN, M. (1958): "Foreign Economic Aid," *Yale Review*, 47(2-3), 500–516.

GHURA, D., M. HADJIMICHAEL, M. MHLEISEN, AND R. NORD (1995): "Sub-Saharn Africa Growth Savings and Investment," *IMF Occasional Paper*.

GOUMANEE, MOURISSEY, AND GIRMA (2005): "Aid and Growth in SSA: Accounting for Transmission Mechanisms," *Journal of International Development*, 17, 1055–1075.

GREENE, W. H. (2000): "Econometric Analysis 4th Edition," *Prentice Hall Inc, Upper Saddle River NJ*.

GRIFFIN, K., AND MCKINLEY (1994): "A new framework for Development Cooperation," *Human Dvelopment Report Office Occasional Paper 11*.

G.S.MADALLA (1971): "The use of variance component models in pooling time series and cross-section data," *Econometrica*, 39, 341–378.

HANSEN, DALGARD, AND TARP (2004): "On the Empirics of Foreign Aid and Growth," *The Economic Journal*, 114(496), F191.

HANSEN, AND F. TARP (2002): "Aid and Growth Regressions," *Journal of Development*, 64(2), 547–570.

ISLAM, N. (1995): "Growth Empirics: A Panel Data Approach," *Quarterly Journal of Economics*, 110.

ISLAM, N. (2005): "Regime Changes, Economic Policies and the effect of Aid on Growth," *The Journal of Development Studies*, 4(8), 1467–1492.

LENSIK, AND R. WHITE (2000): "Aid Allocation Poverty Reduction and Assessing the Aid Report," *Journal of International Devlopment*, 12, 399–412.

MANKIW, ROMER, AND WEIL (1992): "A contribution to the empirics of economic growth," *Quarterly Journal of Economics*.

MUKHERJEE, A. E., D. SHUKRALLA, AND E. KEDIR (2008): "Aid, policies, and growth in developing countries: a new look at the empirics," *Southern Economic Journal*, 17(4), 693–706.

MUNDLAK, Y. (1978): "On the pooling of time series and cross section data," *Econometrica*, 46.

RADELET, S., M. CLEMENS, AND R. BHAVNANI (2005): "Aid and Growth: New evidence that aid aimed at growth have produced Results," *Finance and Development September*, 45, 3.

ROODMAN, D. (2004): "The Anarchy of Numbers: Aid, Development, and Cross-country Empirics," *Development and Comp Systems 0412003*.

SACHS, J. (2005): "The The end of poverty: the economic possibilities of our time," *Development and Comp Systems 0412003*.

WOOLDRIDGE, J. M. (2001): "Econometric Analysis of Cross Section and Panel Data," *The MIT Press*.

YASAR, M., C. NELSON, AND R. REJESUS (2007): "Is there Evidence of Learning-by-Exporting in Turkish Manufacturing Industries?," *International Review of Applied Economics*, 21.

Chart 1: variable List Used in Regressions, Signs Expected and Proxies

Variable Index X_{it} i =1, 2,..			Variable Name	Proxy for: And sign expected	Cited By
		1	Initial GDP	Convergence (-)	Barro and Sala-i Martin (1996)
		2	Life Expectancy	Health of population (-)	Barro (1996)
		3	Education	Effective Labor endowment (+)	Barro (1996)
		4	Fertility Rate	(-)	Barro (1996)
		5	Gov Cons Ratio	(-)	Barro (1996)
		6	OIL (Dummy)	Initial Resource Curse (-)	Barro (1996)
		7	Aid per Capita		Barro (1996)
		8	TRADE Openness	Absence of trade barriers (+)	Barro (1996)
		9			Harrison (1996)
		10	Inflation (CPI)	(-)	
		11			
		12	Democracy	Measure of Freedom (+)	Polity Index
		13	Investment	(+)	
Interactions	14		(AID*POL)		Islam (2005), Dollar (2000)
		15	(AID*PI)		Islam (2005), Dollar (2000)
		16	(AID*PI*POL)		
		17	(POL*PI)		
		18	(Investment *AID)	Transmission mechanism for Aid	
		19	Lagged GDP Growth	Persistence and dynamics (+)	
		20	Lagged M2/GDP	Development of the financial system (+)	

Table 1aCorrelation Matrix of Independent Variables

	IGDP	LE	GCR	OIL	AID	OPEN	SCH
IGDP	1.00						
LE	0.14	1.00					
GCR	-0.05	1.13	1.00				
OIL	0.17	-0.25	-0.22	1.00			
AID	0.03	0.47	-0.04	-0.30	1.00		
OPEN	0.17	-0.03	0.01	0.47	-0.08	1.00	
SCH	0.05	0.47	0.07	0.09	0.25	0.103	1.00

Table 1b Descriptive Statistics

Descriptive	Statistics
IGDP	144392.7
	(305809.8)
CPI	2.66
	(1.20)
GCR	13.57
	(48.71)
OPEN	29.88
	(17.63)
AID	
GROWTH	3.95
	(4.41)
PS	
POL	
DEM	-4.03
	(22.5)
INV	8.67
	(4.27)
INF	66.60
	(366.91)
OIL	3.3*e-1
	(4.7*e-1)
POP	1.80*e7
	(2.48*e7)
DIAM	3.8*e-1
	(4.8*e-1)
BS	1.28*e11
	(6.07*e11)
INFMORT	95.05
	(73.06)

The table reports the mean for the most important variables used in the analysis. Standard deviations are reported in parentheses below the mean values.

Table 2: Country-Specific Effect- Endogeneity test results

Table 1 VARIABLES	Endogeneity Marginal Effect	Test St Error	P-value
IGDP	-3.47 *e-5	1.98*e-5	0.08
LE	1.70*e-1	9.9*e-2	0.08
GCR	-2.2*e-3	8.3*e-3	0.79
OIL	*-6.96*e1*	4.20*e1	0.09
AID	9.58*e-2	2.09*e-2	0
OPEN	*-1.3*e-3*	2.9*e-2	0.96
DEM	1.6*e-2	2.3*e-2	0.51
SCH	2.4*e-2	8.3*e-2	0.77
AVIGDP	3.54*e-5	1.98*e-5	0.07
AVGCR	3.6*e-3	1.3*e-2	0.79
AVLE	-3.08*e-2	1.41*e-1	0.02
AVSCH	2.77	1.76	0.12
AVINF	2.5*e-3	2.81*e-3	0.38
AVAID	-9.5*e-2	3*e-2	0
AVPOSGR	30.69	13.17	0.02
AVPOL	2.16e-10	10 8.05e-10	0.8
AVPS	-6.7*e1	41.5	0.11
AVM2	-2.74e-18	1.07*e-17	0.8
CONS	9.95*e1	6.30*e1	0.12

Test AVIGDP AVGCR AVLE AVSCH AVINF AVAID AVPOSGR AVPOL AVPS AVM2
ChiSq (10) = 46.63
Prob>ChiSq= 0

GROWTH= growth rate of GDP per capita, AID =Aid per capita, PS = Political Stability or good governance, INF = Inflation, DEM = a dummy for democracy, OPEN is a measure of openness of the economy, DIAM= a dummy for if the county exports diamonds, OIL = a dummy for if the county exports OIL.

Table 2 reports results from an endogeneity test reproduced in Wooldridge (2003). The mechanics of the test involves including the individual means of the exogenous variables as additional exogenous variables and estimating by fixed effects. For example IGDP = Initial GDP and AVIGDP = mean of IGDP. The null hypothesis is that that the individual means are jointly not significantly different from zero. Rejection of the null indicates a preference for FE over RE.

Table 3: Serial correlation test and static panel regression model results

Table3 Dep Var-->	Auto-Corr-Test GROWTH	Aid-Eqn AID	Aid-Policy GROWTH	Model of Choice GROWTH	No PS, POL GROWTH
l.GROWTH	0.022				
	(0.093)				
IGDP	-3.0*e-5	-1.3*e-5	3.0*e-5	-2.76*e5	-4.36*e-5
	(1.86*e-5)		(1.4*e-5)	(2.3*e-5)	(2.6*e-5)
LE	4.3*e-1		2.2*e-2	7.2*e-2	1.3*e-1
	(1.57*e-1)		(6.8*e-2)	(9.0*e-2)	(1.0*e-1)
GCR	3.5*e-4		1.6*e-3	6.2*e-3	7.5*e-3
	(9.8*e-3)		(5.4*e-3)	(3.3*e-2)	(3.8*e-2)
OIL	-23.06				
	(54.20)				
AID	0.04		7.0*e-2	6.5*e-2*	8.5*e-2
	(0.03)		(4.8*e-2)	(2.5*e-2)	(2.75*e-2)
OPEN	-0.03		9.5*e-3	1.43*e-2	1.2*e-1
	(0.02)		(3.4*e-2)	(5.3*e-2)	(6.0*e-1)
INF			8.7*e-4	-2.4*e-3	-3.5*e-3
			(6.3*e-4)	(3.1*e-3)	(3.6*e-3)
SCH	-0.02		-9.6*e-1	-7.0*e-1*	1.3*e-1
	(0.08)		(1.2*e-1)	(2.10*e-1)	(1.28e-2)
DEM			-5.7*e-3		5.3*e-3
			(1.6*e-2)		(3.1*e-2)
PS				20.45399	
INFMORT		-9.6*e-3		(4.50)	
FRANCE		-0.43			
POL					
LPOP		-4.93			
l.AID		0.86			
l.POL		-8.33e-10			
AIDPOL			3.24e-13		
			(1.96e-11)		
INV					7.6*e-2
CONS	29.01	88.36*	-25.82	-32.43452	-4.347983
R^2-Overall	0.5	0.9	0.5	0.5	
F-Test (a,b)					4.52
RSS					

Table 3 displays the results of a test of autocorrelation (column 2) as well the output from 3 different regressions that help tease out the real effect of aid on growth (columns 4, 5 and 6). Column 3 documents the instrumentation of the aid equation to minimize endogeneity before including the aid variable in the growth equation. The BP test in Table 2 is essentially an LM test of heteroskedasticity caused by individual or in this case country fixed effects.

Table 4: Results of regression for political stability index as well as 1st stage IV regression results for political stability and policy.

Table4 Dep Var-->	PS EQN1 GROWTH	PS EQN2 Political Stability (PS)	Policy EQ Policy
OPEN	-4.04*e-3 1.9*e-2		
BS	-2.4*e-12 (5.04*e-13)		
INF	1.4*e-3 (9.0*e-4)		
SCH		4.2*e-2* (1.45e-09)	-6787837 (1.02e+07)
DEM		3.4*e-4* (4.28e-10)	
DIAM		1.8*e-2* (3.39e-08)	
POSGR		2.95*e-1* (2.11e-08)	
AID			
l.AID			1035364 (3382553)
IGDP			270 (564.01)
l.POL			8.0*E-1 (5.18E-2)
CONS	4.24 6.3*e-1	1.1 1.1*e-1	2.78e+08
R^2-Overall			0.7
F-Test (a,b)			3.90e+08

Table 4 reports the regression that identifies the political stability index (column 2) as well as the first stage instrumental variable regressions for the 2 endogenous variables political stability (PS) and policy (POL) in columns 3 and 4 respectively.

Table 5: Comparing Dynamic Panel Estimates

GROWTH	A&H1981	Parsimony Model	A&B (1995) One-Step	System 2-step GMM
GROWTH-2	-2.65	-2.7*e-1	-3.8*e-1*	
	(5.00)	(1.02*e-1)	(9.0*e-2)	
d.AID	2.8*e-1		4.4*e-3	3.5*e-2
	(7.1*e-1)		(3.0*e-2)	
d.PS	18.4		2.83	Dropped
	(32.4)			
d.POL	-15.7		-2.07e-10	-5.90e-10
	(49.5)		(9.98e-11)	
d.IGDP	2.2*e-4		2.1*e-5	6.33e-06
	(1.2*e-4)		(2.3*e-5)	
d.GCR				Dropped
d.INF				
d.INV	1.6*e-2			
	(1.93*e-1)			
d.DEM	-3.0*e-1			
	(5.1*e-1)			
d.OPEN				
d.DIAM	Dropped			
OIL	Dropped			
BS1000				
CONSTANT				2.334619
HANSEN-j		1.85*e-1	1.00	3*e-1
AR(1)			4.0*e-2	
AR(2)			7.3*e-2	
Prob>F			1	5.2*e-1
		2.2		

GROWTH= growth rate of GDP per capita, AID =Aid per capita, PS = Political Stability or good governance, INF = Inflation, DEM = a dummy for democracy, OPEN is a measure of openness of the economy, DIAM= a dummy for if the county exports diamonds, OIL = a dummy for if the county exports OIL.

1