

**FOREIGN AID AND ECONOMIC GROWTH: An Empirical Study of
Sub-Saharan Countries of Africa**

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Abstract

Much of the empirical work on the relationship between foreign aid and economic growth covers countries of Eastern Europe, East Asia and Latin America. Little has been done for sub-Saharan Africa although it would have been expected that as one of the least developed regions, it should have attracted a commensurate level of attention from development experts. This paper aims to bridge this gap. Based on results from pooled OLS and fixed effects regressions for the 1980-2004 period, the study finds that: 1) aid does not have an independent effect on economic growth; and 2) aid is effective only in a viable policy environment, hence lending support to the Burnside and Dollar (2000) view. Beyond the aid-growth relationship, this paper identifies foreign direct investment as the most significant variable in enhancing economic growth rates for a sample of 25 countries of sub-Saharan Africa. In general, the findings suggest that the donor community should award more aid to those sub-Saharan countries of Africa which commit themselves to improved policy frameworks.

1. INTRODUCTION

Controversy over the effectiveness of aid in developing countries has been around for over four decades among development economists. Across all these years, aid critics have stated that foreign aid to poor countries constitutes a waste of resources, arguing that it is merely consumed or diverted to unproductive expenditures such as enlarging the army in recipient countries or maintaining dictatorial regimes (Friedman, 1958; Bauer, 1972, 1976). A number of empirical studies such as Mosley, Hudson, and Horrell (1987) and Easterly, Levine and Roodman (2003) have bolstered this traditional anti-aid view. These studies and many others have found that foreign aid is either negatively correlated with economic growth or has no effect at all on growth.

Conversely, pro-aid economists have on their part provided empirical evidence in support of aid provision to developing countries. Studies such as those by Rosenstein-Rodan (1961) and Levy (1988) argue that foreign aid and economic growth are positively correlated. Recent papers by Burnside and Dollar (2000) and Collier (2005) argue that aid does not work just anywhere. They state that aid's effectiveness is conditional upon a good policy environment.

Hansen and Tarp (2000) tries to explain the underlying perceptions and concepts of studies on this topic within a three-generation time framework. This study states that earlier literature perceived foreign aid as an exogenous increase in resources, which could be easily diverted to government consumption. It also suggests that the second generation of studies assumes that any positive relation between aid and growth takes place via investment. The above authors also state that recent empirical work is marked by the use

of panel data that involve many years, and that some studies of this generation include measures of economic policy and institutional environment in their models. According to the same paper, a number of recent studies base their analysis on new growth theory, and some studies treat the aid-growth relationship as a non-linear one.

However, much of the empirical work on the aid-growth relationship covers countries of Eastern Europe, East Asia and Latin America. There is a dearth of studies on the above topic that relate to the region of sub-Saharan Africa. This paper addresses this gap by investigating the effectiveness of foreign aid on economic growth in that region. This focus is of interest with respect to the topic since sub-Saharan African countries have been characterized by negative values of GDP growth for the last three decades despite receiving huge amounts of aid from rich countries over the same period. This study differs from much of the previous work on three accounts. First, it uses a different data set than has been used before. Data are from the World Development Indicators database. Second, it focuses on sub-Saharan African countries exclusively. Twenty-eight countries are initially selected under the criterion of data availability for at least 5 consecutive years for the required variables. Among the selected countries, 3 are identified as outliers and excluded from the sample, leaving a total of 25 sub-Saharan African countries, with 451 observations. Third, this paper covers a different time period than its predecessors. The time period under study runs from 1980 to 2004.

Investigation of the hypothesis that aid is effective in the presence of a good policy environment is carried out through pooled regression analysis and fixed effects regressions. Using the OLS estimation method, empirical tests are done on a simple

linear model that involves four variables. The dependent variable is the GDP growth rate and there are three explanatory variables. This paper examines the impact of aid, aid interacted with policy, and foreign direct investment on GDP growth to test if results for the region of sub-Saharan Africa support findings by Burnside and Dollar (2000) that aid is only effective in a good policy environment. Hence, similar to the latter study, I introduce an aid and policy interaction term into the main specification, using the policy index developed by the above-mentioned authors. Also, since some researchers have argued that aid's impact on growth takes time to manifest itself (Radelet, Clemens, and Bhavnani, 2005; Rahim, 2005), I introduce a one-year lag period on the explanatory variables in one regression (out of three regressions) to account for impact delays.

Results from both cross-country regressions and fixed effects regressions, concerning the exclusive region of sub-Saharan Africa, lend support to the Burnside and Dollar (2000) view that aid works only in a good policy environment. On the one hand, it appears that aid does not have any independent effect on economic growth. The coefficients associated with the aid per capita variable are small, negative and statistically insignificant in all regressions. On the other hand, the coefficients associated with foreign direct investment and aid interacted with policy are positive and strongly significant, in all regressions, suggesting a positive impact on economic growth.

The remainder of this study consists of five sections. Section 2 provides a literature review. Section 3 discusses the countries included and the data. Section 4 describes the econometric model. Section 5 reports on the pooled regression analysis and fixed effects regressions. Section 6 concludes the paper.

2. LITERATURE REVIEW: The relationship between foreign aid and economic growth

For many years, industrial countries have supported poor countries in order to enhance their economies. Huge amounts of aid have flown from rich western countries to the developing countries of Eastern Europe, East Asia, Latin America and Africa for many decades. Extending back to the Second World War, debates over the effectiveness of aid with respect to economic growth raged among economists. This paper looks at two main opposing views: 1) that foreign aid is positively correlated with growth; 2) that aid has no influence (or has a negative influence) on growth. Among the advocates of aid, some found that aid works only in an environment of effective economic policies and institutions.

This literature review is presented in two parts. In the first part, I look at the two different views expressed by development economists on the topic of aid effectiveness, over four decades. The second part focuses on four recent studies: Burnside and Dollar (2000); Easterly, Levine and Roodman (2003); Rahim (2005); and Radelet, Clemens and Bhavnani (2005). In the latter part, the first two studies disagree on the impact that a sound economic policy environment can have on the effectiveness of aid, while the last two papers acknowledge the importance of disaggregating foreign aid into its different components for a better grasp of aid effectiveness vis-à-vis economic growth enhancement.

2.1 Advocacy and critics of aid effectiveness over the last four decades

This part of the literature review presents the aid and growth relationship debate using two time periods, a concept borrowed from Hansen and Tarp (2000). The latter examine work done on Aid and Growth relationships within a three-generation time framework. According to the above work, the first generation studies, which the authors also call the early literature, look at the Aid, Savings and Growth relationship. The second generation studies focus on Aid, Investment and Growth links, while the third generation ones, which corresponds to the recent work, examines Aid, Policy and Growth connections. However, unlike Hansen and Tarp (2000), this review presents the debate in two specific time boundaries, where each time boundary covers two decades. The two time periods are as follows: 1) from the mid 1950s to the 1970s; and 2) from the 1980s to the 1990s.

First time period – mid 1950s to the 1970s

Hansen and Tarp (2000) state that in the early literature, the Harrod-Domar growth model was the underlying theoretical framework for many studies. According to the same study, this framework assumes that the causality flow goes from aid to savings, to investment and then to growth. Also, according to the same source, foreign aid was perceived as an exogenous net increase of resources, which made it possible for recipient governments to divert it to consumption.

Economists such as Milton Friedman (1958) and Peter Bauer (1972, 1976) argue that foreign aid proved to be a waste of resources in that it has perpetuated bad governments during the cold war era, without fostering any economic growth within beneficiary countries. The latter study concludes that foreign aid has no effect on the determinants

that drive development such as peoples' attitudes, good economic policies and institutions, and therefore cannot serve as a major economic tool for poor countries' economic development. Bauer argues that "...if the mainsprings of development are present, material progress will occur even without foreign aid. If they are absent, it will not occur even with aid." (Bauer, 1976, p.98).

On the opposite side, a study by Rosenstein-Rodan (1961) states that each additional dollar of foreign aid yields a one-dollar increase in savings. Other studies consider such a view of the impact of aid on growth to be too naïve. They establish some boundaries by introducing the notion of diminishing returns to aid (Griffin, 1970; Griffin and Enos, 1970). These studies argue that the more the amounts of foreign aid increase the smaller the impact on growth rates of recipient countries.

Second time period – the 1980s to the 1990s

Hansen and Tarp (2000) note that in the second generation, empirical studies contain more observations than their predecessors and that the underlying assumption for this generation is that foreign aid impacts economic growth via investment. The study argues that if there is a positive correlation between aid and investment, aid has a positive effect on growth.

As in the previous time period, some economists argue that aid does not spur growth (Mosley, Hudson, and Horrell, 1987 & 1992). These studies base their objection on the fungibility characteristic of foreign aid. They argue that a recipient government may have had, prior to the grant of aid, a sum of money earmarked for a specific project. If the

government receives aid money for the same project, it can switch the amount initially earmarked for the project towards another purpose. Other purposes may include enlarging the army or reductions in taxation, which can negatively impact the macro-economy of recipient countries via the impact on exchange rates and the level of interest rates. These studies find that aid negatively impacts the private sector of the receiving country through the price system.

Other economists find the aid and growth correlation to be ambiguous (Cassen and Associates, 1986). They argue that given the diversity aspect of aid from developed to developing countries, each type of aid's impact on growth must be different from other types', and the impact timing must also vary across diverse forms of aid, hence yielding results that are either ambiguous or weak as far as the aid-growth relationship is concerned. This study concludes that despite the lack of clear results on the above relationship, aid should foster growth whenever it is appropriately used in the presence of sound economic policies and all other determinants of growth. "If such a relationship does not emerge overall, it only shows the unexciting conclusion that aid may or may not be strongly related to growth, depending on circumstances" (Cassen and Associates, 1986, p. 33).

Levy (1988) focuses on the sub-Sahara African region in his study on the relationships between savings, foreign aid, investment and growth. He finds a positive association between foreign aid and economic growth while expressing caution about drawing any conclusion that aid directly impacts growth, since the causal relationship could be through investment. According to this study's empirical results, there is a positive

correlation between above average investment rates and labour growth and above average GDP growth for the sub-Saharan region, hence concluding that there is a positive and significant correlation between aid and investment and economic growth. The above study also argues that the reason behind the poor economic performance of sub-Saharan African countries since the early 1970s can be explained by the negative impact of the ongoing disadvantaged terms of trade on this region's economic growth.

With respect to cross-country studies of the 1990s, Hansen and Tarp (2000) note an emergence of panel data usage whereby large samples of countries and longer time series are involved. According to this source, a number of studies of the 1990s base their analyses on new growth theory (endogenous growth models) and some studies introduce measures of economic policy and institutional environment in their models. In this era, some empirical papers treat the aid-growth relationship as a non-linear one.

A number of studies in this second time period find that aid has a significant impact on growth, provided that the ratio of aid to GDP does not get too high (Hadjimichael et al., 1995; Durbarry et al., 1998; and Hansen and Tarp, 1999). Although these authors describe a positive relationship between aid and growth, they add that it depends on the ability of recipient countries to absorb the aid. Once the absorptive capacity is reached, additional inflows of aid could yield counterproductive results (Dutch Disease Effect)¹ (Hadjimichael et al., 1995). Aid would fail to produce additional growth. The above study suggests that the absorptive capacity of aid is generally reached when aid amounts

¹ Dutch Disease: "The effect of an increase in one form of net exports in driving up a country's exchange rates, which handicaps the sale of other exports and impairs the ability of domestic products to compete with imports. The name comes from the supposed effects of natural gas discoveries on the Netherlands economy." (Black, 1997, p.134)

to around 8% of GDP for a typical recipient country. With respect to Africa, Collier (2005) argues that the absorptive capacity for aid can be increased provided that African governments take seriously the improvement of their economic policies and governance. On economic growth enhancement, Hadjimichael et al. (1995) also state that macro-economic stability and structural reforms play a big role. The study also suggests that improvements in human capital have a positive contribution to economic growth.

Conversely, Boone (1994,1996) find that foreign aid increases government size and consumption significantly, with no effect on investment or growth: "The lack of robustness of the aid variable in the regression, and its zero correlation with investment, shows that aid does not create, nor correlate with, those underlying factors which cause growth" (Boone, 1994, p. 25).

2.2 Focus on four recent studies

I have selected four recent studies for an update on the aid-growth relationship debate. The studies are: 1) Aid, Policies, and Growth (Burnside and Dollar, 2000); 2) New Data New Doubts: A Comment on Burnside and Dollar's "Aid, Policies, and Growth"(2000) (Easterly, Levine and Roodman, 2003); 3) Effects of Foreign Aid on GDP growth and Fiscal Behaviour: An Econometric Case Study of Bangladesh (Rahim, 2005); and 4) Aid and Growth (Radelet, Clemens and Bhavnani, 2005). Tables referred to in the section are the ones in the paper under focus.

2.2.1. Aid, Policies and Growth (Burnside and Dollar, 2000)

This paper gained momentum within the aid donor community by offering an insight into the circumstances under which aid fosters economic growth. This study hypothesizes that aid "... does affect growth, but that its impact is conditional on the same policies that affect growth" (p.847). With respect to aid allocation, the authors state that much of the literature finds that aid is allocated to developing countries based on donors' strategic interests and the population size of recipient countries. "More aid is given to countries with low income, and aid relative to GDP is much higher for countries with small populations" (p.850).

Seeking to reinvestigate the question of whether foreign aid impacts economic growth, Burnside and Dollar (2000) introduce economic policies into the model. They work with panel data for 56 countries² covering six four-year time periods from 1970-73 to 1990-93. Twenty-one countries in the sample are from the African continent. The total number of observations amounts to 272. The study examines the relationship between aid, policy and growth within a neoclassical model framework. The authors state that unlike previous empirical studies, simultaneous interactions between foreign aid, economic policies and economic growth of recipient countries are here modeled and two-stage least squares (2SLS) is used to estimate simultaneous equations for growth and aid. According to the authors, the main innovation of this study within the growth literature is the introduction of economic policies into the system of equations. This system is defined as follows:

$$g_{it} = y_{it}\beta_y + a_{it}\beta_a + p'_{it}\beta_p + a_{it}p'_{it}\beta_1 + z'_{it}\beta_z + g_t + \varepsilon_{it}^g; \quad (1);$$

$$a_{it} = y_{it}\gamma_y + p'_{it}\gamma_p + z'_{it}\gamma_z + a_t + \varepsilon_{it}^a; \quad (2);$$

where g_{it} is the growth rate of real per capita GDP of country i during period t . It is the dependent variable of equation 1. y_{it} is the logarithm of initial real per capita GDP in country i at the beginning of period t ; a_{it} is the level of foreign aid as a fraction of GDP received by country i in period t ; and p'_{it} is a $P \times 1$ vector of policies that have an impact on growth in country i at time t . It includes institutional/ political variables and measures of economic policies (trade openness, inflation and budget surplus)³. z_{it} is a $K \times 1$ vector of other exogenous variables that might affect growth and aid; g_t and a_t are fixed time effects (meant to capture the impact of world wide business cycles); and ε_{it}^g and ε_{it}^a are defined as mean zero scalars whereas $a_{it}p'_{it}$ is the interaction term meant to capture impacts of aid interacted with policy on growth.

The study estimates the growth equation, which is equation 1. As the authors state, each observation is the average of a country's economic performance over a four year-period.

The impact of aid on growth is identified, in the study, by the first derivative of the

growth equation with respect to aid as follows: $\frac{\partial g_{it}}{\partial a_{it}} = \beta_a + p'_{it}\beta_1$.

² The sample of countries includes some middle income countries such as Argentina, Brazil and Chile; but the majority are developing countries which in fact receive huge amounts of aid.

³ The authors indicate that the trade openness used is the one developed by Sachs Warner (1995), inflation is taken as a measure of monetary policy as per Fischer (1993), the budget surplus is taken into account following suggestion by Easterly and Rebelo (1993). They also indicate that the latter variable include foreign grants in revenue while aid-financed projects are in expenditures in order to avoid any linkage between the budget surplus and the aid variable.

Data source

Data for the annual growth rates of real GDP per capita and the aid data are taken from the World Bank database. For the aid data, the authors state that the World Bank new database provides a combination of the grant part of concessional loans with the outright grants. Also, according to the authors, aid/GDP is actually measured as aid relative to real GDP, which explains why figures in the study are smaller than those found in other studies.

According to the authors, their study uses institutional quality data from the work by Knack and Keefer (1995), which include measures of the security of property rights and government bureaucracy efficiency. The authors state that these data become available as of 1980. They apply each country's 1980 figure to all subsequent years, under the assumption that institutional measures change in the long run only. Another variable that remains constant over time is the measure of ethnic fractionalization that the authors borrowed from the work by Easterly and Levine (1997). In addition, the authors introduce in the growth equation regional dummy variables for East Asia and sub-Saharan Africa.

Regression results

The most powerful results appear when restrictions are applied to eliminate middle-income countries⁴ from the 2SLS regression. 16 countries are eliminated and only 189 observations are kept for the remaining 40 countries. However, the policy index is formed using regression coefficients for the full sample (table 3, regression 1). In this

regression, aid variables are excluded from the growth equation. The policy index equation is as follows:

$$\text{Policy} = 1.28 + 6.85 \times \text{Budget surplus} - 1.40 \times \text{Inflation} + 2.16 \times \text{Openness}$$

The policy index is interpreted as “a country’s predicted growth rate, given its budget surplus, inflation rate, and trade openness, assuming that it had the mean values of other characteristics.” (p.855).

Highlights:

In the first step of accounting for aid variables, the authors introduce the aid/GDP ratio alone in the growth regression. OLS and 2SLS regressions⁵ reveal the following (figures in parentheses are standard errors):

- OLS: the coefficient for aid/GDP variable is insignificant and positive: 0.036 (0.13);
- 2SLS: the coefficient for aid/GDP variable is insignificant and negative: -0.085 (0.19);
- Partial correlation between aid/GDP policy variables is insignificant.⁶

In light of the above results, the authors conclude that there is no correlation between aid and growth and they shift their attention to the role that policy might play in the effectiveness of aid.

⁴ Countries with real per capita GDP above \$1900 at the beginning and at the end of the period of study are arbitrarily considered here as middle-income countries.

⁵ The authors indicate that the 2SLS regression method is used as a means to treat aid as endogenous.

⁶ There is only a slight change on policy variables’ coefficients: 7.00 against 6.85 for budget surplus; zero change for inflation and 2.12 against 2.16 for trade openness.

Aid interacted with policy and aid squared interacted with policy [Aid/GDP x policy and (aid/GDP)² x policy] are introduced in the growth equation. The study finds that the quadratic term depends on 5 big outliers, which are among the low-income countries' observations. Once these outliers are dropped, the coefficient of the quadratic term becomes insignificant. Therefore, the outliers and the quadratic term are excluded from further analysis. In fact the most robust results are generated once the 16 middle-income countries and the 5 big outliers are dropped from the model. The study finds that with the low-income countries sample, both the OLS and 2SLS regressions yield positive and significant coefficients, at the 5% level, for the aid x policy term: 0.26 (0.08) and 0.25 (0.12) respectively (Table 5, column 8). The results, as reported in the study's table 6 (part C), show that "the impact of aid is greater in a good policy environment than in a poor policy environment" (p.959), for both OLS and 2SLS when middle-income countries and outliers are excluded. The study states that "the derivative of growth with respect to aid is significantly higher in a good policy environment than in an average one" (p.860). In addition to statistical significance, the authors use a production function of the form $Y = AK^{\theta}$ to show that their estimates are also economically viable. They state that: "aid can affect output only through its effect on the stock of capital, that is, to the extent that it is used for investment rather than consumption"⁷ (p.861).

On the other hand estimates for aid allocation, equation (2), exhibit significant negative coefficients, at the 5% level, for initial income and population variables as depicted by

⁷ The authors present "a first-order approximation to the effect of aid on growth ... as follows: $dY = \theta AK^{\theta-1} (\delta K/\delta F)dF$; where dY represents the increase in output induced by the injection of aid, $\delta K/\delta F$ is the fraction of an additional unit of aid that is invested, and dF is the size of the aid injection." (p.861)

table 8: -2.43 (0.44) and -0.84 (0.14) respectively. The study concludes that more aid finds its way to countries which are poorer and whose populations are smaller in comparison with other aid recipients.

The authors also model a government consumption equation in which government consumption is a function of the institutional/political variables, which impact economic growth. The OLS estimation reveals that bilateral aid, in particular, increases government consumption while multilateral aid does not. The authors add however that government consumption appears insignificant when introduced in the growth regressions. They conclude that the above result may explain why aid has proven to be ineffective in the typical aid recipient country.

Taking into consideration all of the above results, the paper concludes that aid has a positive impact on growth in an environment of good fiscal, monetary, and trade policies, adding, "this effect goes beyond the direct impact that the policies themselves have on growth" (p.864). Hence, the study argues that providing aid conditional on the quality of policies would yield higher economic growth rates.

2.2.2 New Data New Doubts: A Comment on Burnside and Dollar's "Aid, policies, and growth" (2000) (Easterly, Levine, and Roodman, 2003)

This study re-examines the relationship between aid, policies and growth. It extends the Burnside and Dollar (2000) data time limit from 1993 to 1997 and fills in missing data that were unavailable at the time of the latter paper. The exercise augments the number of countries from the initial 56 to 62 and the observations from 272 to 365. The authors point out that they also use the same methodology as Burnside and Dollar (2000).

The study identifies and removes 5 to 11 outliers using the Hadi method with a 0.05 significance level. Despite using the same sources, as noted by the authors data for the two studies do not match exactly due to revisions that have been carried out. However, the correlation between the two data sets⁸ amounts to 0.92 for budget balance, 0.90 for institutional quality and above 0.95 for all other variables in the study sample. The authors indicate that the black market premium provides new data which they use to construct their data set, and they also acknowledge that the two data sets in comparison do not totally match because they were unable to reproduce some of the observations found in Burnside and Dollar (2000).

The study argues that although it has followed closely the BD methodology, once its new inputs (additional countries and observations and the time extension) are introduced, the positive correlation between the aid interacted with policy variable and growth disappears for both OLS and 2SLS regressions; and the coefficients become negative: -.15 and -.202 with t-statistics of -1.09 and -.65 respectively (Table 1). In light of these results, the study concludes that the confidence that one can have in the BD (2000) conclusion is diminished.

2.2.3 Effects of Foreign Aid on GDP Growth and Fiscal Behavior: An Econometric Case Study of Bangladesh (Rahim, 2005)

This study analyzes the impact of foreign aid on Bangladesh's economy through two time series models (a model for the aid-growth relationship and a model for the aid-fiscal

⁸ The two data sets refer to Burnside and Dollar (2000) data set and the one for Easterly, Levine and Roodman (2003)

link), covering the 1973 – 1999 period, with annual data. Only the aid-growth model is here reviewed.

For his investigation, the author uses a cointegration method to account for possible spurious results in the time series regressions. He argues that since the probability of coming across non-stationary time series variables is very high in estimated regressions, the use of the OLS single equation method or the 2SLS simultaneous equation method found in earlier econometric papers does not deal with the problem associated with their time series variables' trend.

The author uses a neoclassical growth equation as his model to test for the aid-growth effects:

$$GR_t = a_1 + b_1 Aid_{t-1} + b_2 S_{t-1} + b_3 CLF_t + b_4 MX_t + b_5 M2_t + u_t \quad (\text{equation 1});$$

where, as the author indicates, GR is the real GDP growth rate; Aid is foreign aid as a percentage of GDP; S is gross domestic savings as a percentage of GDP; CLF represents increments in the labour force; MX is imports plus exports as a percentage of GDP; M2 is the broad money supply as a percentage of GDP; and t is a time trend. Data for GDP, domestic savings, labour force, imports, exports, and broad money supply are from the World Bank whereas data for foreign aid, loans, and grants come from the Bangladesh Economic Survey.

The impacts of foreign aid and domestic savings on GDP are arbitrarily lagged by one period in order to account for impact delays given that much of aid provision finance projects such as roads construction and education where effects do not take place at once. With respect to savings, the author explains that “since higher savings rate leads to higher rate of capital formation and investment, which leads to higher national income and that, in turn, leads to higher savings rate, there exists a simultaneous causal relationship between GDP growth and savings rate. Therefore, equation (1) would suffer from simultaneity bias if the endogeneity of savings (S_t) were not properly accounted for. Accordingly, S_t is instrumented by S_{t-1} to eliminate the simultaneous bias” (p.99).

One major contribution of this paper to the growth literature is the separation of foreign aid into loans and grants in the second equation. The two estimated equations appear as follows in the paper (t –statistics are in parentheses):

Equation 1a:

$$DGR_t = -0.81 + 0.89DAid_{t-1} + 0.72DS_{t-1} - 0.49DCLF_t + 0.17DMX_t + 0.79DM2_t - 0.91ECM_{t-1} + e_t$$

(1.53) (1.97) (-0.28) (2.6) (1.45) (-2.69)

Equation 1b:

$$DGR_t = -1.19 + 1.05DLoans_{t-1} - 0.004Dgrants_{t-1} + 0.74DS_{t-1} + 0.004DCLF_t + 0.18DMX_t + 0.96DM2_t - 0.88ECM_{t-1} + e_t$$

(1.72) (-0.01) (1.99) (0.002) (2.73) (1.77) (-2.67)

In light of the above results, this study finds that “aggregated foreign aid has had only marginal effects on GDP growth in Bangladesh. When the total effect of aid is separated into the disaggregated effects of loans vis-à-vis grants, it is found that loans have

significantly raised GDP growth, but grants in fact have had very insignificant effects” (p.108). According to the author, the explanation may be that the government allocates foreign loans into productive activities that increase growth while grants may be allocated to mere consumption and other activities, which are not productive. One should notice also that coefficients associated with domestic savings, trade openness and financial liberalization indicate that these variables are also positively correlated with economic growth.

2.2.4. Aid and Growth (Radelet, Clemens and Bhavnani, 2005)

This paper argues that most studies of aid effectiveness have missed the point by not making a distinction between different types of aid, which have different impacts on growth. It states that not all aid flows target economic growth. In light of this shortfall, the authors hereby focus on the effect of the specific type of aid that targets economic growth.

According to the authors, the weak results on the aid-growth relationship found in a number of studies can be explained by the use of total aid flows instead of specific aid flows that are aimed at growth. They argue that total aid is a flawed measure in both substance and timing, with respect to its impact on growth. In terms of substance, the authors contrast types of aid that have an indirect or no effect on growth (ex. food and humanitarian aid) and aid directly aimed at economic growth (ex. aid to build bridges or telecommunication infrastructures). On timing issues, the authors argue that the majority of cross-country panel data papers produce estimates associated with four-year time

periods while investigating impacts of aid on growth, which manifest beyond this time limit.

The study identifies three types of aid: 1) aid for disasters, emergencies, and humanitarian relief effort; 2) aid that might affect growth not only indirectly but also in the long run (ex. aid to support democratic reform); and 3) aid that might impact growth within the four-year standard period (ex. aid to build infrastructure such as roads and irrigation systems). The paper disaggregates aid and investigates the latter category of aid-growth relationship in a cross-country panel that involves 67 countries, covering a period that runs from 1974 to 2001. The authors acknowledge using a model that has a nonlinear link between the fast impact of aid and growth, characterized by diminishing returns.⁹ Alongside an OLS estimation method, they also use a 2SLS technique and the generalized method of moments estimator for robustness check purposes.

With the 2SLS regression technique, the paper reports that including all three types of aid separately but at the same time, the short-impact aid's coefficient appears to be three times larger than that on total aid, at the 10% significance level. When only the short-impact aid is included, its coefficient becomes four times larger than it was initially, at the 1% significance level.

With the OLS regression technique, the paper reports using the short-impact aid and the short-impact aid squared lagged one four-year period. It states that the coefficient obtained, although smaller, remains significant. The authors then state that after

⁹ The authors state to have used terms for both aid and aid squared to allow for diminishing returns.

examination of each explanatory variable results show that institutional quality and life expectancy distinguish countries in terms of how strong the relationship is between short-term aid and growth.¹⁰

Motivation for the topic and hypothesis

This paper focuses on the sub-Saharan African region exclusively. There is a shortage of studies on the aid-growth relationship for this part of the region and yet, as described by Sachs et al. (2004), not only it is the poorest part of the world but also it has long registered declining and even negative economic growth performance despite substantial aid provision from rich countries. World Bank data on this region exhibit negative values of GDP growth for the region since the 1970s. So far, the literature on the aid-growth relationship reveals that much of the work is on Eastern Europe, East Asia and Latin America regions and little has been done for Africa in general and for the sub-Saharan African region in particular.

The debate among economists over the ability of foreign aid to enhance economic growth in developing countries has been characterized by different views. Given the existing controversy over the aid and growth relationships, this paper reassesses whether aid has a positive impact on growth, using a different data set from the World Development Indicators comprising of all sub-Sahara African countries that have at least five years of consistent time series data on selected variables. The time period under study runs from 1980 to 2004. This paper's premise echoes Burnside and Dollar (2000), which

¹⁰ The paper interprets that short-impact aid on growth is stronger in the presence of better institutions on one hand and for countries with high life expectancy on the other hand than otherwise.

hypothesizes that the effectiveness of aid depends upon the presence of a good policy environment.

3. EMPIRICAL ANALYSIS

First, this section presents the countries covered by this study as well as the selection criterion. Second, the data and selected variables are described and discussed.

3.1 Coverage of countries and selection criterion

I attempt to include all sub-Saharan African countries. However, time series data are available only for a few countries. In order to include a large number of countries, I chose countries that have at least 5 years of consistent time series data. Table 1A, in the appendix, shows the names of the countries and the number of years of observation. Twenty-eight countries met the above criterion but three of these were later identified as outliers.¹¹

3.2 Data

This sub-section consists of four parts. First, it presents the data sources and describes the data. Second, the data assessment follows. Third, some methodological problems related to OLS estimation are discussed and particularly problems pertaining to heterogeneity in cross-country growth regressions. Also highlighted are problems with omitted-variables as well as simultaneity problems. Finally, an analysis of outliers is conducted.

¹¹ The three identified outliers are: Gabon, Rwanda and Zambia. A discussion on them will follow shortly.

3.2.1 Data sources and variable description

The first three variables listed were extracted from the World Bank database for socio-economic development indicators. The calculations were either done by the World Bank staff or extracted from other sources. The data in this study is a panel data comprised of 28 countries for which I have the same three explanatory variables. The panel data has both time and cross-section dimensions, contains a total of 451 observations and covers the 1980-2004 period. The complete list of the data is as follows:

1. Annual percentage growth rates of GDP per capita.¹² These data are derived from GDP divided by midyear population. It constitutes the dependent variable and is called 'Gr' in the model.
2. Aid per capita (current US\$),¹³ which includes both official development assistance (ODA) and official aid, is calculated by dividing total aid by the midyear population estimate. Aid per capita is the first independent variable in the model and is labelled as 'Ac'.
3. Foreign direct investment as a percentage of GDP,¹⁴ which is the net flow of investment to acquire a lasting management interest (10% or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows in the reporting economy. This variable is called 'FDIg' in the model.

¹² Source: World Bank National Accounts data, and OECD National Accounts data files. WDI. Data retrieval date: November 20, 2005.

¹³ Source: Development Assistance Committee of the Organization for Economic Cooperation and Development, and World Bank population estimates. WDI. Data retrieval date: November 20, 2005.

¹⁴ Source: International Monetary Fund, International Financial Statistics and Balance of Payments databases, World Bank, Global Development Finance, and World Bank and OECD GDP estimates. WDI. Data retrieval date: November 20, 2005.

4. Institutional quality measure, which is an overall index of institutional/ policy variables compiled by averaging and standardizing all of the different institutional variables.¹⁵ This variable is called 'P' for policy index.

This study's panel data set includes country, year, GDP growth rate (Gr), aid per capita (Ac), foreign direct investment (FDI_g) and an interaction term of aid and policy (AP).

An empirical analysis of economic growth in sub-Sahara African countries is conducted in this study. A sample of these countries is chosen and a cross-sectional regression is run with OLS. On the left hand side is each country's average growth rate over a period going from 1980 to 2004, and on the right hand side is a set of three variables (Ac, FDI_g and AP) that may influence that growth rate. AP is an interaction term of aid and the policy index constructed by Burnside and Dollar (2000). I consider this term necessary in the model given the importance accorded to institutions and policies in the recent literature. Burnside and Dollar (2000) and Collier and Dehn (2001) state that aid is effective only in countries that have adopted sound economic variables.

The variables have been deliberately selected. All three regressors are considered to be determinants of economic growth for developing countries in the literature. Foreign aid is seen as a transfer of resources that can enhance poor countries' economies (Guillaumont and Chauvet, 2002; Collier, 2005). Other studies such as Rahim (2005) and Radelet, Clemens, and Bhavnani (2005) argue that only the component of aid, which is invested, yields economic growth, while Levy (1988) advances that aid may affect growth through

¹⁵ Source: Burnside and Dollar (2000)

investment. Therefore, it may be useful to know by how much more foreign direct investment could contribute to the GDP growth of countries under study.

3.2.2 Data assessment

Two main questions have served as selection criteria for the data. Are these data reliable and comparable across countries involved? Are they consistently available?

To address the accuracy problem, I use World Bank sources whenever possible given that this institution has attempted to establish standard definitions for census taking, accounting methods and data analysis procedures. It appears that the World Bank databases are particularly suitable to the sub-Saharan region of Africa when it comes to data accuracy options. However, depending on the type of data, the selection can be challenging in light of data scarcity for the region. Pure economic data such as GDP per capita are indeed available in World Bank databases, even for the least developed countries in the region. Nevertheless, data that reflect institutional/policy and political conditions and other social aspects are extremely difficult to get. Lack of financial resources and skilled personnel are often cited as the underlying reason for both data scarcity and data accuracy shortfall for the region.

Apart from the lack of resources dilemma, there is another less discussed problem. Sometimes a government may not want to admit that certain data are unavailable and may try to hide its own low competence or the state of the nation's development. In such cases, data may even be made up without much empirical reference. In fact, the appearance of economic strength or rapid development or a literate and healthy

population might be an important asset in international politics. Where the true data may indicate otherwise, they may be modified, and it may be tremendously difficult for researchers to determine the presence or degree of modification.

Thus, the availability and accuracy problem of data for countries of the sub-Saharan African region present a challenge for empirical research and this study is no exception in this regard.

The above constraints notwithstanding, testing a behavioral growth equation for countries of sub-Saharan Africa requires the inclusion of institutional/ policy indicators, which are associated with economic growth. For this purpose and as a compromise, I use the institutional/ policy index data constructed by Burnside and Dollar (2000). This policy index is an overall policy measure of economic policy comprised of fiscal surplus, inflation and trade openness. Burnside and Dollar (2000) state that among many other institutional and policy distortions that can be correlated with growth, the above three economic policies have proven to have more weight in explaining developing countries' economic performance. This makes the policy index interesting for this paper, in which, like Burnside and Dollar (2000), I argue that for the sub-Saharan countries of Africa, aid would be effective if it was coupled with viable economic policies.

In light of the data limitations cited above, the reader should bear in mind that since the ideal data can not be obtained, speculation should be that this paper's final results might have been even more clear and more interpreted had ideal data been used!

3.3. Methodological problems with OLS

There exist substantial problems in estimating and interpreting cross-section growth regressions.¹⁶ Some of the frequent concerns are problems associated with heterogeneity, simultaneity and omitted variables.

3.3.1 Heterogeneity, Simultaneity and Omitted variables issues

Economic growth literature is confronted with the problem of heterogeneity as far as cross-section growth regressions are concerned. In fact, attempt to carry out an empirical study on a relationship across countries raises the potential for heterogeneity problem. Although sub-Saharan countries of Africa might be homogeneous with respect to their economic and political development or climatic situation, they are heterogeneous on other grounds such as country size, demography, natural resources endowment and institutional characteristics (Gomanee, Girma and Morrissey, 2005). Thus, failure to account for potential heterogeneity inherent condition might yield inconsistent results in light of omitted variables. In this study, the use of panel data allows for more degrees of freedom, and country dummy variables are used to account for country specific effects.

Another obstacle pertaining to cross-section growth regressions is the simultaneity problem. This refers to the situation when the right hand side variables are not exogenous (they are endogenous), but are jointly determined with the growth rate. In growth literature, investment is generally found to be strongly correlated with growth. But does this mean that investment causes high growth or does high growth cause investment?

¹⁶ In general, this is due to assumptions of normality, homoscedasticity and others that are involved in regression analysis. These assumptions are reported in the appendix and explanations are drawn from Gujarati (2003).

This question can equally be applied to other variables such as economic aid. Does economic aid boost growth or does high growth motivate donors to provide more aid? In order to control for simultaneity concerns, some researchers make use of initial values such as initial income (Burnside and Dollar, 2000), while others introduce lags of the endogenous variables as instruments (Rahim, 2005). Finding good instruments is not an easy task as it involves construction constraints.

Another concern worth covering is the omission of variables that ought to be included in a model, or vice versa. Such a problem can yield results that are biased. As far as this study is concerned, specification approaches were simply and mainly driven by previous results in the literature. The theoretical framework is therefore of an ad hoc character and thus does not follow any growth theoretical background. The choice of only three explanatory variables is particularly due to the limited availability of data, a problem that gives ground to potential risk for biased parameter estimates.

3.3.2 Outliers analysis

Now that the problem of parameter heterogeneity has been acknowledged, it is also important to highlight that any regression model is an approximation to reality. Therefore, a regression model is likely to misfit some observations particularly way beyond others. Such observations become “unrepresentative” of the sample due for instance to parameter heterogeneity or omitted variables, and they can act as outliers. An outlier among a set of residuals is often much larger than the rest in absolute value. For instance, an outlier can be found at three or more standard deviations from the mean of residuals. The presence of such an extreme value can affect the least squares fitting of a

model. It is therefore important to detect the presence of outliers. The means and standard deviations of the variables are reported in the appendix, Table 2A.

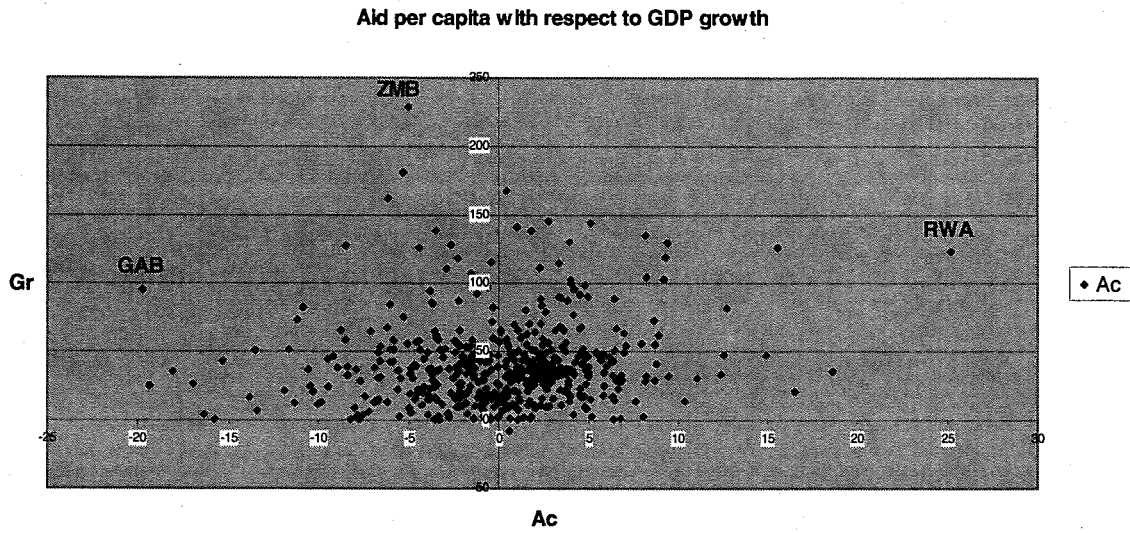
Different procedures can be used for evaluating the presence of outliers. An outlier, in the context of this study is rather defined as any rare or unusual observation that appears at one of the extremes of the data range. Another approach in the study has been to run the regressions with and without the identified outliers as a sensitivity analysis. The results are reported in the appendix, regressions 1A and 2A.

The objective in the study is to identify observations that I believe significantly can affect either the accuracy of the variables in the models or the accuracy of estimations of the regression coefficients and associated standard errors. It may be enough to just consider the location of the dependent value, in our case, Gr, relative to the values of the other responses. An extreme response value may then deserve more attention to assess its importance. This is the first approach used in the paper in order to detect outliers in the sample.

With respect to the independent variables presented in the model, three outliers have been identified. There are Gabon (GAB), Rwanda (RWA) and Zambia (ZMB).

Each outlier is associated with the relationship between at least one independent variable and the dependent variable as shown in the scatter diagrams below.

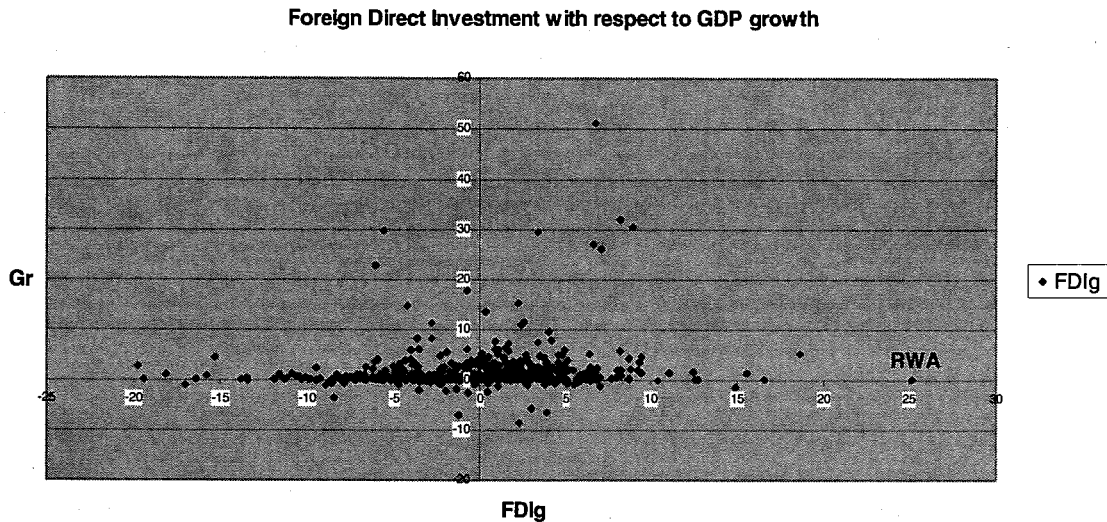
Diagram 1



Diagrams 1 and 3 reveal that Gabon has had some growth, which cannot be attributed to aid. Gabon is endowed in natural resources, mainly oil. It is considered to be a middle-income country. For the period under study, Gabon's GDP per capita (constant 2000 US\$) highest level was US\$4,798 in 1980 while its lowest level reached US\$3,503 in 1987.

In a similar vein, the above-mentioned diagram also shows that Zambia has attained relative substantial economic growth that is not associated with aid provision. This could be explained by the fact that for the years covered in the study, Zambia has been relatively politically stable with government changes in a democratic way, and with overall well functioning institutions. Such an environment could have allowed the country to gain economically from its rich copper and other mineral reserves.

Diagram 2



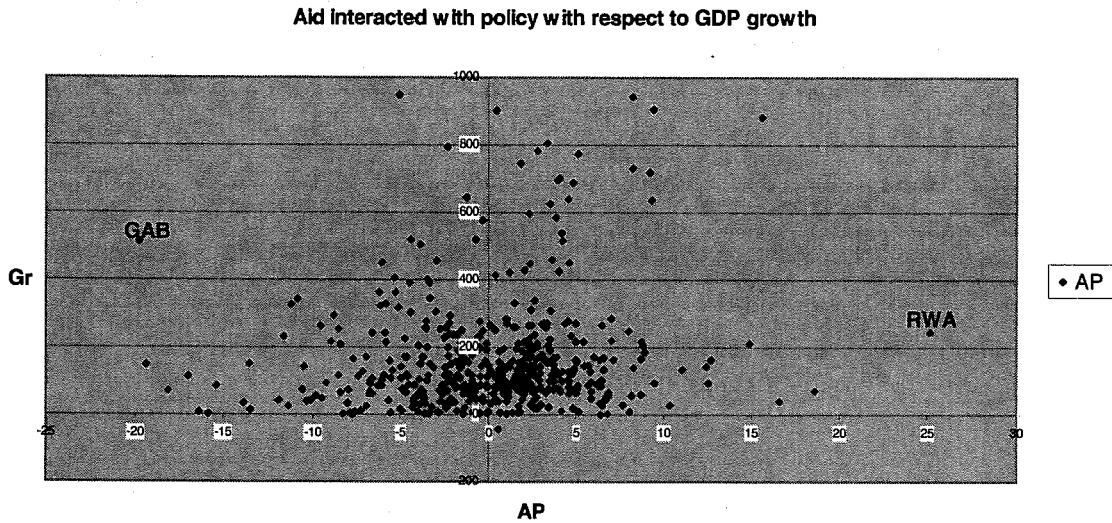
Diagrams 2 and 3 exhibit Rwanda as an outlier. They show that Rwanda has received considerable amounts in foreign direct investment and in aid, which did not produce much growth. It is worthwhile remembering that Rwanda has suffered for many years from a legacy of social unrest, which culminated in the 1994 genocide. Meanwhile, the country continued to receive huge amounts of aid but the political climate was not favorable to an appropriate use of those funds.

However, a decade after the genocide, the new leadership has managed to implement a good governance environment. The country was last year cited by the World Bank as a successful reformer ranking number eleven among the top twelve (World Bank, 2005).¹⁷ Should such a new status attract more foreign direct investments and aid in the future, expectations for greater GDP growth and poverty alleviation in the long run could

¹⁷ The top 12 performers cited by the World Bank are: Serbia and Montenegro, Georgia, Vietnam, Slovakia, Germany, Egypt, Finland, Romania, Latvia, Pakistan, Rwanda and the Netherlands.

become a reality. But, for the period under study, Rwanda is here identified as an outlier for poor economic performance despite receiving substantial amounts of aid over time.

Diagram 3



As mentioned earlier, the second approach used to detect outliers involves a sensitivity analysis¹⁸ whereby I run regressions with and without the three countries identified as outliers in the sample. The full results are reported in the appendix (Regressions 1A and 2A). The value for R^2 in the model (Regression 1A) is 0.06, with S.E. of regression being 4.95. To test whether the results are stable, I rerun the regression model with the three outliers included this time. The results are reported in the appendix (Regressions 2A). With outliers included in the model, R^2 is reduced to 0.03, suggesting a worsening in the model fitting and S.E. regression increases from 4.95 to 5.16, thus registering an important increase in variance. Overall, when the outliers are included in the sample, the

¹⁸ By sensitivity analysis I aim at including the identified outliers in the same sample and see whether the parameter estimates remain stable.

parameter estimates worsen. For instance, aid and policy interacted is positive and significant in the regression model where the outliers are excluded (Regression 1A). The same variable becomes insignificant once the three countries identified as outliers are included in the sample (Regression 2A).

The outlier analysis conducted above suggests deleting observations in the sample in order to improve the quality of the models. However, one should also bear in mind that the potential penalty associated with such improvements in fitting a model is biased results. Generally, deleting observations is safest when dealing with large samples, as it is the case in this study. Therefore, I exclude all three countries identified as outliers from the sample for more robust results in light of the aid-growth relationship in the sub-Saharan region of Africa.

4. ESTIMATION WITH OLS – AN ECONOMETRIC APPROACH

4.1 Panel Data: An overview¹⁹

I use panel data where multiple countries of the sub-Saharan region of Africa are observed over a period running from 1980 to 2004. In the panel data, I am interested in two kinds of information. The first kind of information concerns the cross-sectional information reflected in the differences between countries. The second kind of information is the information reflected in the changes within countries over time. Cross-country regression using OLS allows us to take advantage of these different types of information.

¹⁹ Panel data can also be called time series cross-sectional data

The framework equation within which the growth rate is explained can be expressed as:

$$y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \varepsilon_{it} \quad (1)$$

This framework is represented in equation (1a) which will be provided later. The structure gives the variables two dimensions. On the one hand, each country i constitutes a cross-sectional unit of observation. On the other hand, there is a temporal reference, t , which is the year in the study. The error term has two dimensions: one for the country and one for the time period (Says, 1989).

4.2 The analytical frameworks

This study uses two types of models. There are the constant coefficients model and the fixed effects model.²⁰ Both models are estimated using OLS.

The constant coefficients model refers to both intercepts and slopes. It is the first model to be estimated. In this model, all coefficients are assumed to be the same across countries and years. I assume that there is neither significant country nor significant temporal effects and I therefore pool all of the data and just run an ordinary least squares regression model (OLS) within the framework presented above. The pooled model tested is of the form expressed in (1) and is estimated as:

$$Gr_{it} = \alpha_0 + \beta_1 Ac_{it} + \beta_2 FDIg_{it} + \beta_3 AP_{it} + \varepsilon_{it} \quad (1a)$$

where the variables are defined and described in sub-section 3.2.1 above.

In the estimated model (1a), I assume that only the current values of the explanatory variables affect the current value of the dependent variable. I also explore the extent to which effects of explanatory variables on the dependent variable may be delayed. For this purpose, I relax the previous assumption. The second model depicts this lag structure of the aid-growth relationship. It contains the aid variable, the foreign direct investment and the aid interacted with policy variable that are lagged by a one-year period²¹, as follows:

$$Gr_{it} = \alpha_0 + \beta_1 Ac_{i(t-1)} + \beta_2 FDIg_{i(t-1)t} + \beta_3 AP_{i(t-1)} + \varepsilon_{it} \quad (1b)$$

Both of the above models assume that neither country nor temporal effects are statistically significant. However, as I have discussed earlier in the study, the possible existence of heterogeneity or omitted variables might make this assumption unrealistic. In order to control for country effects, I turn to the fixed effects model.

- **Fixed Effects Model (Least Squares Dummy Variables Model)**

In this model, the assumption is that there are differences among countries. It is a panel model with constant slopes, intercepts that differ from one cross-sectional unit to the other,²² and no temporal effects. The estimating equation for this model is the same as the one in equation (1), except that country dummy variables are added. To test for country effects, I carry out an F test of the null hypothesis that the coefficients of the country dummies are jointly zero.

²⁰ Fixed Effects model are also called Least Squares Dummy Variable Model

²¹ A one period lag is also found in Rahim (2005); the underlying argument being that aid results will not manifest themselves in the same period it is provided but in subsequent period(s).

In general, fixed effects models may have too many dummy variables for their specification, which in turn may weaken the model due to an insufficient number of degrees of freedom for adequately powerful statistical tests (Kleinbaum, D,G et al 1992). Moreover, a model with many such variables may be plagued with multicollinearity, which increases the standard errors and thereby drains the model of the statistical power to test parameters. Problems of heteroskedasticity²³ or autocorrelation²⁴ over time are also problems that could further disturb estimations.

5. EMPIRICAL RESULTS

The OLS method is applied to the panel data set. In this section, I present the results and interpret them. Figures in parentheses, in Table 1, are standard errors. All regressions are placed in the appendix.

5.1 Pooled regression analysis

I first estimate a pooled regression with OLS and with no lag on the variables. Results appear in both Table 1, column 1, and in the following estimated equation (1a):

$$\text{Gr}_{it} = -1.028 - 0.011 \text{Ac}_{it} + 0.175 \text{FDI}_{it} + 0.009 \text{AP}_{it} + e_{it} \quad (1a)$$

(-1.815)
(-0.579)
(4.361)
(2.721)

The results show that the coefficient on aid per capita variable is negative and statistically insignificant. This result lends support to aid critics such as Friedman (1958), Bauer

²² The cross-sectional unit here refers to country.

²³ Heteroscedasticity refers to the case in which the variance of the probability distribution of the disturbance term is different for different observations (see Gujarati, 2003 or Kleinbaum, 1988).

²⁴ The consequences of autocorrelation are somewhat similar to those of heteroscedasticity. It normally occurs in regression analysis using time series data (see Gujarati, 2003 or Kleinbaum, 1988).

(1972) and Boone (1994, 1996). However, the fact that the coefficient is negative and insignificant does not necessarily mean that aid is ineffective (Gomanee, Girma and Morrissey, 2005). The later study argues that aid does not affect growth rate directly and identifies investment as the most significant transmission mechanism. Therefore, the insignificance of aid could be due to model misspecification or it could be that aid without a sound policy environment does not spur growth (Burnside and Dollar, 2000). The discussion is thus not settled. On the other hand, table 1, column1 reports coefficients on foreign direct investment and on aid interacted with policy that are positive and statistically significant at less than the 1% level.

However, in equation (1a), it is possible that the significant coefficient of AP only reflects the positive effect of good policy on growth rather than that of an interaction between aid and policy. In order to verify that this is not the case, I re-estimate model (1a) again but this time with the policy variable included in the model separately. The following estimates are obtained (the values in parentheses are t-statistics):

$$Gr_{it} = -0.377 - 0.020 Ac_{it} + 0.171 FDIg_{it} - 0.174 P_{it} + 0.011 AP_{it} + e_{it} \quad (1b)$$

(-0.263) (-0.760) (4.106) (-0.574) (2.067)

The full results are in the appendix, Regression 1A. The coefficient of the Policy variable alone is negative and insignificant. This result reinforces the idea that aid has a positive effect on the growth rate in the presence of a good policy environment.

Table 1: Results of Pooled regressions & Fixed Effects regressions

(Standard errors are reported in parentheses)

	Regression (1)	Regression (2)	Regression (3)
	Pooled OLS - No time lag -	Pooled OLS - with 1-year lag -	Fixed Effects Estimation - No time lag -
Ac	-0.0105 (0.0182)	-0.0023 (0.0195)	-0.0263 (0.0266)
FDI _g	0.1747** (0.0400)	0.1937** (0.0416)	0.1106** (0.0475)
AP	0.0085** (0.0031)	0.0074** (0.0035)	0.0102** (0.0050)
C	-1.0278* (0.5663)	-1.2662** (0.5860)	
R ²	0.061	0.067	0.171
Adj. R ²	0.054	0.060	0.118

*: Significant at less than the 10% level

**: Significant at less than the 1% level

At the same time, no evidence is found that aid alone (or the policy variable itself) boosts growth. More interestingly, the coefficient estimate on 'AP' (see equation (1b)) indicates a positive and significant effect on growth of a higher magnitude than the one observed in

equation (1a). On average, an additional percentage point of aid interacted with policy raises the growth rate by about 0.011 percentage point. Burnside and Dollar (2000) exhibits a higher impact of 0.19 percentage point increase in the growth rate derived from an extra percentage point of aid interacted with policy.

In line with a common practice in the literature, I introduce a one-year time lag on the variables to account for impact delays (Rahim, 2005; Radelet, Clemens and Bhavnani, 2005). OLS estimation with the variables lagged one-year period yields the following results:

$$Gr_{it} = -1.266 - 0.002 Ac_{i(t-1)} + 0.194 FDIg_{i(t-1)} + 0.007 AP_{i(t-1)} + e_{it} \quad (2a)$$

(-2.160) (-0.118)
(4.657)
(2.128)

Table 1, regression 2 depicts the above results as well. The coefficient on aid per capita is negative and statistically insignificant while coefficients on foreign direct investment and aid interacted with policy are positive and statistically significant at less than the 1% level. Once again, the results suggest that there is no independent effect of aid on economic growth for sub-Saharan countries of Africa. The results suggest that aid can raise GDP growth when it is coupled with a good policy environment. The full results are reported in the appendix, Regressions 3A.

At this point, I turn to Fixed Effects regressions in order to control for country effects. For this purpose, I introduce a country dummy variable for each country in the sample.

5.2 Fixed Effects regressions

Results for Fixed Effects regressions are reported in Table 1, regression 3 and can also be observed in the estimated equation (1a) below:

$$Gr_{it} = -0.026 Ac_{it} + 0.111 FDIg_{it} + 0.010 AP_{it} + e_{it} \quad (1a)$$

(-0.987) (2.325) (2.044)

The results show that the independent effect of aid per capita on GDP growth is negative and statistically insignificant. On the other hand, the results suggest that foreign direct investment and aid interacted with policy have a significant and positive impact on GDP growth, at less than the 1% level.

Up to now, all results lend support to the pro-aid view, which emphasizes the importance of the presence of a good policy environment for aid to be effective. In this particular section, the results also suggest that countries of the sub-Saharan region of Africa are heterogeneous.

Meanwhile, the results generated in the fixed effects regression show that the null hypothesis using individual *t-statistics* that coefficients of country dummies were individually zero could not be rejected for all countries. The coefficients that are significantly different from zero involve country dummies for Congo Democratic Republic (DRDC), Ivory Cost (DCIV) and Niger (DNER). These could also be potential outliers.

Overall, the *t-statistics* of individual country dummies are very small and their coefficients are in their majority negative and insignificant. This lends support to the idea that the sub-Saharan countries of Africa as a group are somewhat homogenous. Although they might differ in some characteristics, they seem to present the same profile with respect to the economical aspect such as, for instance, their level of economic development. It looks as if the income patterns are basically the same in all the countries represented in the sample. However, the overall results do not clearly show whether the countries of sub-Saharan Africa are heterogeneous or homogeneous. This could be an interesting issue for further research.

In addition, although positive, coefficients on the aid interacted with policy are small in all regressions. They range from 0.0074 to 0.0102. The result suggests that even in the presence of a viable policy environment, it may require huge amounts of foreign aid to produce economic growth. On the other hand, the coefficients on foreign direct investment exhibit much more strength. They range from 0.1106 to 0.1937. For comparison purposes, Gomancee, Girma and Morrissey (2005)'s results suggest that a one-percentage point increase in investment yields a 0.133 percentage point increase in growth rate. Therefore, the results seem to imply that foreign direct investment is a better determinant of economic growth than aid for the sub-Saharan countries of Africa. Foreign direct investment flows to the region provide both machinery and equipment capital and non-machinery and equipment capital, which are used to create outputs. An empirical study by Abdi (2004) on Canada states that both the above types of capital investment raise output significantly. In the presence of improved institutions, good governance and viable economic policies, the countries of the sub-Saharan region of

Africa could not only attract foreign direct investments but also they could significantly enhance their economies through the latter. In fact, foreign investors are interested in investment opportunities in countries with macroeconomic stability, economic openness and regulatory and legal systems that are impediments free (IMF, 2001).

Overall, the results suggest that a good policy environment is of paramount importance for improving the economic performance of the sub-Saharan Africa region. Whether or not foreign direct investments should be promoted more than foreign aid as a means of enhancing the economies of the region's countries will be determined by future research.

6. CONCLUSION

This paper investigates the aid-growth relationship for countries of the sub-Saharan region of Africa, with data on aid per capita, foreign direct investments from the World Development Indicators and a policy index data from Burnside and Dollar (2000). As in the later study, I introduce an aid interacted with policy variable in the model.

Similar to other recent papers found in the growth literature, this study faces some limitations pertaining to specification and potential simultaneity biases. It is equally worth acknowledging the potential problem associated with omitted variables which could also yield biases in the results. The approaches adopted in this study were simply driven, in their specifications, mainly by the previous results in the literature. Also, there is a potential risk that the parameter estimates could somewhat be biased in light of the problem of limited availability of data for this study.

Through pooled OLS and Fixed Effects regressions, this paper confirms the hypothesis that for the sub-Saharan countries of Africa, aid is effective when it is received in a viable policy environment. This finding lends support to Burnside and Dollar (2000) conclusion concerning aid effectiveness. However, the coefficients on the aid interacted with policy variable are very small, ranging from 0.007 to 0.0102. They are smaller than the ones found in the study by Burnside and Dollar (2000) which exhibits a coefficient of 0.19. The small magnitude of coefficients suggest that even in the presence of a good policy environment, it requires huge amounts of aid to spur economic growth in the region. I hereby agree with Burnside and Dollar (2000) statement: "countries with good policies and significant amounts of aid ... perform very well" (p.848). Meanwhile, the foreign direct investment variable seems to exhibit much more power than the aid interacted with policy variable. Future research on such a comparison could reveal whether or not foreign direct investments should be more recommended than aid as far as enhancing economies of sub-Saharan countries of Africa is concerned.

Given that foreign investors are attracted to viable economic and legal policy environments that are impediments free, countries of the sub-Saharan region of Africa should make it a priority to improve their governance. The above results are timely given that they coincide with a shift toward better governance in Africa through requirements imposed by the global village context. Hence, in light of such a 'turnaround' for sound institutional and viable economic policies, the donor community should reverse the shrinking trend of their aid envelope for the sub-Saharan countries of Africa, which are committed to improve their policy environments. Such countries have a potential

opportunity to overcome decades of falling income through both foreign aid and foreign direct investment flows.

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APPENDIX

ASSUMPTIONS OF MULTIPLE REGRESSIONS

The following are some of the assumptions upon which models are based when conducting multiple regressions

Assumption 1: Existence

For each specific combination of values of the (basic) independent variables X_1, X_2, \dots, X_k , Y is a (univariate) random variable with a certain probability distribution having finite mean and variance

Assumption 2: Independency

The Y observations are statistically independent of one another.

Assumption 3: Linearity

The mean value for each specific combination of X_1, X_2, \dots, X_k , is a linear function of X_1, X_2, \dots, X_k . That is,

$$M_{Y | X_1, X_2, \dots, X_k} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$$

Or

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + E$$

where E is the error component reflecting the difference between an individual's observed response Y and the true average response. Some comments regarding assumption 3 should be made:

Assumption 4: Homoscedasticity

The variance of Y is the same for any fixed combination of X_1, X_2, \dots, X_k . That is,

$$\sigma^2_{Y | X_1, X_2, \dots, X_k} = \text{Var} (Y | X_1, X_2, \dots, X_k) = \sigma^2$$

Assumption 5: Normality

For one fixed combination of X_1, X_2, \dots, X_k , the variable Y is normally distributed. That is,

$$E \sim N(0, \sigma^2)$$

TABLES

TABLE 1

Selected Sub-Saharan Countries of Africa			
#	Abbreviation	Name of Countries	Number of year observations
1.	BEN	Benin	15
2.	BWA	Botswana	22
3.	BFA	Burkina Faso	22
4.	BDI	Burundi	14
5.	CMR	Cameroun	23
6.	CAF	Central African Republic	22
7.	TCD	Chad	20
8.	DRC	Congo Democratic Republic	21
9.	COG	Congo Republic	14
10.	CIV	Ivory Cost	22
11.	DJI	Djibouti	6
12.	ERI	Eritrea	8
13.	ETH	Ethiopia	22
14.	GAB	Gabon	
15.	GHA	Ghana	22
16.	KEN	Kenya	22
17.	LSO	Lesotho	18
18.	MWI	Malawi	22
19.	MLI	Mali	22
20.	NER	Niger	22
21.	NGA	Nigeria	24
22.	RWA	Rwanda	
23.	ZAF	South Africa	11
24.	TZA	Tanzania	12
25.	TGO	Togo	11
26.	UGA	Uganda	13
27.	ZMB	Zambia	
28.	ZWE	Zimbabwe	21

Countries in grey zone are outliers

TABLE 2A

MEANS & STANDARD DEVIATIONS											
#	COUNTRY	Gr		Ac		FDIg		P		AP	
		Means	Std Dev.	Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
1.	Benin	1.35	2.27	46.43	8.96	2.22	1.76	2.00	0.00	92.86	17.92
2.	Botswana	4.67	3.72	76.78	37.61	1.84	2.85	7.00	0.00	537.49	263.30
3.	Burkina Faso	1.50	3.58	36.37	7.54	0.25	0.26	2.00	0.00	72.75	15.07
4.	Burundi	-1.10	4.70	40.07	8.35	0.10	0.07	2.00	0.00	80.14	16.69
5.	Cameroun	-0.69	4.91	32.89	12.50	0.66	1.14	5.66	0.00	186.03	70.70
6.	Central Afr. Rep.	-1.07	4.57	44.64	19.33	0.34	0.54	2.00	0.00	89.28	38.66
7.	Chad	1.45	7.97	33.89	9.65	7.23	13.55	2.00	0.00	67.78	19.30
8.	Congo Dem. Rep.	-4.91	4.88	10.06	6.90	0.14	0.83	2.00	0.00	20.13	13.79
9.	Congo Republic	-1.25	3.53	53.78	41.69	5.60	6.51	2.00	0.00	107.56	83.39
10.	Ivory Cost	-1.93	3.15	41.28	28.51	1.16	1.23	6.09	1.16	259.22	195.32
11.	Djibouti	-3.30	2.18	138.72	28.33	0.64	0.10	2.00	0.00	277.44	56.66
12.	Eritrea	-0.25	7.14	48.75	13.56	6.68	6.26	2.00	0.00	97.50	27.13
13.	Ethiopia	0.18	7.32	15.15	5.01	0.70	1.27	2.00	0.00	30.30	10.02
14.	Gabon	-0.78	5.97	82.79	48.81	-0.04	3.56	5.38	0.00	445.05	262.40
15.	Ghana	1.02	3.40	32.04	11.43	1.19	1.24	3.70	0.00	118.40	42.25
16.	Kenya	-0.19	1.91	25.52	11.16	0.35	0.29	5.56	0.00	141.96	62.10
17.	Lesotho	2.86	3.59	60.47	23.65	10.85	11.34	3.00	0.00	181.41	70.96
18.	Malawi	0.54	5.57	41.84	14.54	0.62	1.04	4.47	0.00	187.08	65.00
19.	Mali	0.95	5.31	44.14	8.79	1.33	2.06	3.00	0.00	132.43	26.38
20.	Niger	-1.66	5.56	36.84	11.02	0.51	0.95	5.83	0.00	214.90	64.28
21.	Nigeria	-0.39	5.17	1.57	0.92	2.80	2.22	3.08	0.00	4.83	2.84
20.	Rwanda	5.67	9.33	55.32	29.19	0.23	0.12	2.00	0.00	110.63	58.38
23.	South Africa	0.73	1.27	10.59	2.04	1.25	1.75	6.92	0.00	73.33	14.11
24.	Tanzania	1.33	2.50	34.62	6.73	2.50	1.69	4.64	0.00	160.61	31.20
25.	Togo	0.62	8.30	24.59	13.47	2.04	1.52	4.35	0.00	106.86	58.55
26.	Uganda	3.52	2.31	34.25	4.90	2.17	1.04	4.77	0.83	162.72	36.02
27.	Zambia	-1.38	3.93	72.25	42.42	3.13	2.23	4.14	0.00	298.84	175.48
28.	Zimbabwe	-1.01	5.08	31.18	13.71	0.66	1.72	4.44	0.00	138.34	60.82

REGRESSIONS

1. POOLED REGRESSIONS

REGRESSION 1A

OLS - OUTLIERS (GAB, RWA & ZMB) ARE EXCLUDED - NO LAG

Dependent Variable: GR

Method: Least Squares

Date: 05/07/06 Time: 16:07

Sample: 2 452

Included observations: 451

Newey-West HAC Standard Errors & Covariance (lag truncation=5)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.376646	1.429705	-0.263443	0.7923
AC	-0.020261	0.026666	-0.759803	0.4478
FDIG	0.170634	0.041561	4.105611	0.0000
P	-0.173568	0.302271	-0.574214	0.5661
AP	0.011115	0.005377	2.067180	0.0393
R-squared	0.061979	Mean dependent var		0.136515
Adjusted R-squared	0.053566	S.D. dependent var		5.086089
S.E. of regression	4.947994	Akaike info criterion		6.046866
Sum squared resid	10919.26	Schwarz criterion		6.092448
Log likelihood	-1358.568	F-statistic		7.367215
Durbin-Watson stat	1.743661	Prob(F-statistic)		0.000009

REGRESSION 2A

OLS - OUTLIERS (GAB, RWA & ZMB) ARE INCLUDED - NO LAG

Dependent Variable: GR

Method: Least Squares

Date: 05/07/06 Time: 15:56

Sample: 2 505

Included observations: 504

Newey-West HAC Standard Errors & Covariance (lag truncation=5)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.631745	1.512500	-0.417683	0.6764
AC	-0.003245	0.034858	-0.093092	0.9259
FDIG	0.152519	0.040323	3.782468	0.0002
P	-0.065059	0.321049	-0.202645	0.8395
AP	0.005278	0.007105	0.742785	0.4580
R-squared	0.034660	Mean dependent var		0.129191
Adjusted R-squared	0.026922	S.D. dependent var		5.229211
S.E. of regression	5.158342	Akaike info criterion		6.128978
Sum squared resid	13277.64	Schwarz criterion		6.170869
Log likelihood	-1539.503	F-statistic		4.479055
Durbin-Watson stat	1.681220	Prob(F-statistic)		0.001453

REGRESSIONS 3A

OLS - OUTLIERS (GAB, RWA & ZMB) ARE EXCLUDED - 1 YEAR LAG PERIOD (only lags are included)

Dependent Variable: GR
 Method: Least Squares
 Date: 05/11/06 Time: 12:10
 Sample: 2 427
 Included observations: 426

Newey-West HAC Standard Errors & Covariance (lag truncation=5)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.266240	0.586075	-2.160543	0.0313
ACLAG1	-0.002313	0.019528	-0.118424	0.9058
FDIGLAG1	0.193740	0.041606	4.656521	0.0000
APLAG1	0.007428	0.003490	2.128387	0.0339
R-squared	0.066860	Mean dependent var		0.101430
Adjusted R-squared	0.060227	S.D. dependent var		5.122351
S.E. of regression	4.965705	Akaike info criterion		6.052333
Sum squared resid	10405.77	Schwarz criterion		6.090403
Log likelihood	-1285.147	F-statistic		10.07889
Durbin-Watson stat	1.739165	Prob(F-statistic)		0.000002

OLS - OUTLIERS (GAB, RWA & ZMB) ARE EXCLUDED - 1 YEAR LAG PERIOD

(variables and their lags included)

Dependent Variable: GR
 Method: Least Squares
 Date: 05/07/06 Time: 16:25
 Sample: 2 427
 Included observations: 426

Newey-West HAC Standard Errors & Covariance (lag truncation=5)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.638890	1.565453	-0.408119	0.6834
AC	-0.052117	0.028902	-1.803197	0.0721
ACLAG1	0.038869	0.031854	1.220225	0.2231
FDIG	0.013557	0.064626	0.209782	0.8339
FDIGLAG1	0.180479	0.069844	2.584022	0.0101
P	-0.171516	0.324505	-0.528547	0.5974
AP	0.014912	0.006489	2.298187	0.0220
APLAG1	-0.004519	0.006926	-0.652512	0.5144
R-squared	0.073704	Mean dependent var		0.101430
Adjusted R-squared	0.058192	S.D. dependent var		5.122351
S.E. of regression	4.971078	Akaike info criterion		6.063751
Sum squared resid	10329.46	Schwarz criterion		6.139891
Log likelihood	-1283.579	F-statistic		4.751360
Durbin-Watson stat	1.752120	Prob(F-statistic)		0.000037

OLS – OUTLIERS (GAB, RWA & ZMB) ARE EXCLUDED – 1 YEAR LAG PERIOD
 (variables and their lags included; separate policy index is excluded)

Dependent Variable: GR
 Method: Least Squares
 Date: 05/11/06 Time: 12:27
 Sample: 2 427
 Included observations: 426

Newey-West HAC Standard Errors & Covariance (lag truncation=5)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.288024	0.601360	-2.141854	0.0328
AC	-0.047501	0.026882	-1.767039	0.0779
ACLAG1	0.044331	0.029522	1.501629	0.1339
FDIG	0.014721	0.063899	0.230373	0.8179
FDIGLAG1	0.183356	0.069623	2.633557	0.0088
AP	0.013581	0.005753	2.360764	0.0187
APLAG1	-0.005840	0.006678	-0.874407	0.3824
R-squared	0.072553	Mean dependent var		0.101430
Adjusted R-squared	0.059273	S.D. dependent var		5.122351
S.E. of regression	4.968224	Akaike info criterion		6.060297
Sum squared resid	10342.28	Schwarz criterion		6.126920
Log likelihood	-1283.843	F-statistic		5.463013
Durbin-Watson stat	1.751216	Prob(F-statistic)		0.000019

OTHER REGRESSIONS

POOLED REGRESSIONS

REGRESSIONS THAT DO NOT INCLUDE THE POLICY INDEX VARIABLE SEPARATELY IN THE MODEL

1. NO TIME LAG

Estimation Command:

=====
 LS(N) GR C AC FDIG AP

Estimation Equation:

=====
 GR = C(1) + C(2)*AC + C(3)*FDIG + C(4)*AP

Substituted Coefficients:

=====
 GR = -1.027827343 - 0.01054640243*AC + 0.1746622909*FDIG + 0.008508216354*AP

Dependent Variable: GR
 Method: Least Squares
 Date: 03/24/06 Time: 20:00
 Sample: 2 452
 Included observations: 451

Newey-West HAC Standard Errors & Covariance (lag truncation=5)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.027827	0.566259	-1.815120	0.0702
AC	-0.010546	0.018212	-0.579083	0.5628
FDIG	0.174662	0.040054	4.360631	0.0000
AP	0.008508	0.003127	2.720824	0.0068
R-squared	0.060731	Mean dependent var		0.136515
Adjusted R-squared	0.054427	S.D. dependent var		5.086089
S.E. of regression	4.945742	Akaike info criterion		6.043761
Sum squared resid	10933.78	Schwarz criterion		6.080226
Log likelihood	-1358.868	F-statistic		9.633957
Durbin-Watson stat	1.743770	Prob(F-statistic)		0.000004

2. FIXED EFFECTS REGRESSIONS & F-TESTS

Estimation Command:

```

=====
LS(N) GR AC FDIG AP DBEN DBWADBFA DBDI DCMR DCAF DTCD DDRC DCOG DCIV
  DDJI DERI DETH DGHA DKEN DLSO DMWI DMLI DNER DNGA DZAF DTZA DTGO
  DUGA DZWE
  
```

Estimation Equation:

```

=====
GR = C(1)*AC + C(2)*FDIG + C(3)*AP + C(4)*DBEN + C(5)*DBWA + C(6)*DBFA + C(7)*DBDI +
C(8)*DCMR + C(9)*DCAF + C(10)*DTCD + C(11)*DDRC + C(12)*DCOG + C(13)*DCIV + C(14)*DDJI
+ C(15)*DERI + C(16)*DETH + C(17)*DGHA + C(18)*DKEN + C(19)*DLSO + C(20)*DMWI +
C(21)*DMLI + C(22)*DNER + C(23)*DNGA + C(24)*DZAF + C(25)*DTZA + C(26)*DTGO +
C(27)*DUGA + C(28)*DZWE
  
```

Substituted Coefficients:

```

=====
GR = -0.02630573725*AC + 0.1105528247*FDIG + 0.01018834152*AP + 1.374462291*DBEN +
1.006022924*DBWA + 1.691910481*DBFA - 0.869324837*DBDI - 1.792474407*DCMR -
0.8391609535*DCAF + 0.8556711381*DTCD - 4.868692682*DDRC - 1.551296809*DCOG -
3.611786116*DCIV - 2.549063893*DDJI - 0.7034879715*DERI + 0.1915386544*DETH +
0.5239966202*DGHA - 1.000333333*DKEN + 1.398680561*DLSO - 0.3349793827*DMWI +
0.6175224303*DMLI - 2.935013021*DNER - 0.7039696133*DNGA + 0.1254971158*DZAF +
0.3324889379*DTZA - 0.0446197943*DTGO + 2.526298783*DUGA - 1.67651376*DZWE
  
```

Dependent Variable: GR
 Method: Least Squares
 Date: 03/24/06 Time: 20:31
 Sample: 2 452
 Included observations: 451

Newey-West HAC Standard Errors & Covariance (lag truncation=5)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AC	-0.026306	0.026648	-0.987162	0.3241
FDIG	0.110553	0.047547	2.325105	0.0205
AP	0.010188	0.004984	2.044155	0.0416
DBEN	1.374462	1.184718	1.160160	0.2466
DBWA	1.006023	1.663461	0.604777	0.5457
DBFA	1.691910	0.786369	2.151548	0.0320
DBDI	-0.869325	1.849511	-0.470030	0.6386
DCMR	-1.792474	1.838188	-0.975131	0.3301
DCAF	-0.839161	1.129550	-0.742916	0.4579
DTCD	0.855671	1.227904	0.696855	0.4863
DDRC	-4.868693	1.756293	-2.772141	0.0058
DCOG	-1.551297	1.251868	-1.239185	0.2160
DCIV	-3.611786	0.872750	-4.138398	0.0000
DDJI	-2.549064	2.725588	-0.935234	0.3502
DERI	-0.703488	1.996224	-0.352409	0.7247
DETH	0.191539	1.065646	0.179740	0.8574
DGHA	0.523997	1.014882	0.516313	0.6059
DKEN	-1.000333	0.568180	-1.760592	0.0790
DLSO	1.398681	1.588329	0.880599	0.3790
DMWI	-0.334979	0.884561	-0.378696	0.7051
DMLI	0.617522	1.306572	0.472628	0.6367
DNER	-2.935013	1.268343	-2.314053	0.0211
DNGA	-0.703970	1.318352	-0.533977	0.5936
DZAF	0.125497	0.330006	0.380287	0.7039
DTZA	0.332489	1.167202	0.284860	0.7759
DTGO	-0.044620	1.527488	-0.029211	0.9767
DUGA	2.526299	0.671555	3.761866	0.0002
DZWE	-1.676514	1.262609	-1.327817	0.1850
R-squared	0.171266	Mean dependent var		0.136515
Adjusted R-squared	0.118368	S.D. dependent var		5.086089
S.E. of regression	4.775595	Akaike info criterion		6.024988
Sum squared resid	9647.069	Schwarz criterion		6.280245
Log likelihood	-1330.635	Durbin-Watson stat		1.949751