Determinants of Multilateral Official Development Assistance: Evidence from a Panel Study of Countries in Sub-Saharan Africa

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ABSTRACT

Countries in Sub-Saharan Africa are some the poorest and least developed in the world, with deplorable health and education levels. One way intended to promote better living standards has been through development aid. This study examines the determinants of multilateral aid inflows to sub-Saharan Africa to determine whether it is directed to the least developed countries. I use panel data about 22 countries in sub-Saharan Africa from the 1995-2004 period to estimate a regression model in which I treat multilateral aid inflows as a proportion of GDP as the dependent variable, and proxies for health levels, education and institutional quality as explanatory variables. My analysis yields some evidence, especially in panel regressions with time-fixed effects, in support of the hypothesis that countries with poorer health and education levels receive more multilateral aid as a proportion of their gross domestic products. The corruption level, as measured by the International Country Risk Guide, however, appears to be an unimportant factor in the allocation of multilateral ODA.

I. Introduction

Sub-Saharan Africa is home to some of the poorest and least developed countries in the world. According to the 2006 edition of the United Nations' annual Human Development Index (HDI), only three of the world's 38 least developed countries lay outside of this wretched region. The average HDI score of sub-Saharan countries was 0.472, well below the world average of 0.741 and pitiful in comparison with the OECD average of 0.923 and Norway's top score of 0.965.[1] Poor living standards, illiteracy, malnutrition and widespread disease are too often the norm south of the Sahara. Clearly, encouraging development in this region is a task of utmost importance and great urgency.

One way intended to promote better living standards has been through development aid. In most scholarly and policy discussions, the terms *aid*, *development aid* and *foreign aid* refer to Official Development Assistance (ODA), data about which are collected and published by the Development Assistance Committee (DAC) of the OECD. According to the Committee's criteria, financial assistance is classified under ODA if it is disbursed by official agencies, has the promotion of economic development and welfare as its main objective, and involves grants or concessional loans[2] with at least a 25 percent grant element (Cassen et al., 1994). Based on the identity of the immediate donor, ODA can be classified as bilateral or multilateral. Bilateral assistance is administered by agencies of donor governments, whereas multilateral aid is funded by wealthy countries and allocated by international financial institutions, such as the World

[1] The Human Development Index (HDI) is a composite index that measures countries' development achievements based on the inhabitants' life expectancy at birth, the adult literacy rate, the combined gross enrollment ratio for primary, secondary and tertiary schools, and GDP per capita measured in purchasing power parity (PPP) US dollars. The maximum score attainable is 1. (Source: United Nations Development Programme, *Human Development Index 2006*.)

[2] Concessional loans offer more generous terms than those obtainable on the world's capital markets. See Cassen et.al: *Does Aid Work?*, p.2 for a brief, yet insightful, discussion.

Bank, the Regional Banks, or the United Nations Development Programme. About a third of all ODA inflows are multilateral.[3]

If multilateral aid is effective in promoting human development, it is crucial that it be allocated to the countries which need it most. This study examines the determinants of multilateral aid inflows in sub-Saharan Africa to determine whether it is directed to the least developed countries – those with the worst health and education levels.

I apply a multiple regression on panel data from the 1995-2004 time period to tease out the importance of individual factors on the provision of multilateral aid to sub-Saharan countries. In particular, I examine the effects of education and health levels, along with institutional quality and population size, on the amount of total multilateral ODA inflows as a proportion of GDP into 22 countries in sub-Saharan Africa. I use adult literacy rates, extrapolated from a UNESCO data set, as proxies for education levels; life expectancy at birth and the infant mortality rate, as given by the World Bank's World Development Indicators, as a proxies for health levels; and the International Country Risk Guide measure of corruption within the political system as a proxy for institutional quality.

I hypothesize that, if multilateral aid is directed to the least developed countries, lower inflows of multilateral ODA as a proportion of total GDP will be associated with higher adult literacy rates, a longer life expectancy at birth, and with lower infant mortality rates. Given many multilateral agencies' increased focus on fighting corruption and on the implementation of good policies, one would expect a negative association between higher corruption levels and the amount of aid received. The population

[3] *Assessing Aid: What Works, What Doesn't and Why*. A World Bank Policy Research Report. Oxford University Press, International Bank for Reconstruction and Development / The World Bank, 1998. Box 1: Defining Aid, p. 6

explanatory variable controls for possible bias towards less populous countries, which has been documented by some aid allocation studies.

My analysis yields some evidence, especially in time-fixed effects regressions, supportive of the hypothesis that countries with poorer health and education levels receive more multilateral aid as a proportion of their gross domestic products. The corruption level, as estimated by the International Country Risk Guide, on the other hand, appears to have a statistically insignificant effect on the allocation of multilateral ODA.

In this paper, I will first examine the relevant economic studies in the Literature Review section to provide background information about my study, and to put my contribution into the context of other research that has already been undertaken. After describing my variables and their origins in the Data Sources section, I will then, in the Methodology section, introduce and briefly discuss my regression model. Afterwords, I will run the regressions, discuss the results, and point out the shortcomings of my analysis in the Results section. Finally, in the concluding section, I will summarize my findings and point out possible directions for future research.

II. Literature Review

We can classify economic research papers about foreign aid into two broad categories – those that deal with the question of aid effectiveness, and those that examine its allocation. Although this paper makes a contribution to the aid allocation literature, it will be enlightening to review literature on aid effectiveness first, as the question of effectiveness is crucial for deciding what kind of aid, and how much of it, should be allocated to individual recipients.

The effectiveness of foreign aid is the subject of much debate in development economics. Some economists argue that aid does not significantly increase economic growth rates or improve human development indicators (e.g., Boone, 1996). Others, on the contrary, believe it does, especially when the recipient country implements appropriate policies (e.g., Burnside and Dollar, 2000). Still others would argue, for example, that the effects of bilateral and multilateral aid are markedly different – while one type may promote growth and development, the other one may not (Ram, 2003; Cassen, 1994; Sender, 1999).

In a study of ODA data from 1971 to 1990, Boone (1996) found that most foreign aid had no significant impact on basic development measures such as infant mortality or primary schooling ratios, although some particular programs (immunization and research, for instance) could be effective. His results imply that most foreign aid is consumed rather than invested, and that aid receipts increase the size of the government without influencing health indicators. These discouraging findings constitute, in Boone's opinion, strong evidence of government failure, whose incentives to improve human development indicators are insufficient, aid inflows notwithstanding.

In a widely cited study, Burnside and Dollar (2000) find that aid has a positive impact on economic growth in developing countries with good fiscal, monetary and trade policies, but is rather ineffective when policies are poor. They interpret foreign aid as an income transfer, which can be invested to produce growth, or dissipated in unproductive government expenditure. Their findings indicate that one way to increase the effectiveness of aid would be to make it more systematically conditional on the quality of the recipient countries' policies.

Ram (2003) criticizes their methodology and argues against constraining the regression coefficients of bilateral and multilateral aid to be equal, as Burnside and Dollar have done. He finds that, if the coefficients for the effects of bilateral and multilateral aid on economic growth rates are separate and unconstrained, the estimated parameters change significantly. The bilateral aid parameters are estimated to be positive, whereas the estimated effect of an increase in multilateral aid is negative. Both parameters are sizeable, suggesting that there is a dramatic difference between the effects of the two aid components on growth rates. These unequal effects of bilateral and multilateral development assistance could not have been picked up by Burnside and Dollar (2000), as their regression equation assumed that the effects of aid did not differ across the two categories.

Ram suggests that the positive effects of bilateral aid on growth derive from a better understanding by the donors of the recipients' needs. He refers to Cassen (1994) who argues that specific technical skills, linguistic and personal affinities, similar institutional structures, long-standing commercial interaction, and the ability to render appropriate technical assistance make bilateral donors particularly well-placed to assist developing countries.

The negative growth effects of multilateral aid may, according to Ram, derive from overly stringent 'structural adjustment' requirements imposed by multilateral agencies. Sender (1999), for example, argues that the free-market policies prescribed by institutions such as the World Bank and the IMF, both of which advocated a minimalist and non-interventionist role for the state, were too demanding in requiring that "these same ineffectual states should attempt a range of other complex tasks, including the

immediate and simultaneous implementation of fiscal discipline, financial deepening, privatization, good governance, democratization, and the liberalization of capital flows." Ram's findings thus suggest that these agencies would be well-advised to review the conditions under which they award aid.

In addition to possible disparities in effectiveness, there are differences in donors' motivations. A large body of economic research indicates that bilateral aid is more likely to be influenced by the donors' self-interest considerations than multilateral assistance. Ruttan (1989) notes that, according to economic self-interest arguments, bilateral aid promotes exports from and employment in the donor country. From a political or strategic point of view, foreign aid can, Ruttan points out, strengthen the political commitment of the recipient country to the donor. Maizels and Nissanke (1984) analyzed aid flows from DAC donors during the 1969-70 and 1978-80 time periods, and found that the recipient need model, in which aid is granted to compensate for a shortfall in the recipient's domestic resources, provides a reasonable explanation for the distribution of multilateral aid but fails to explain bilateral aid inflows. Bilateral aid allocation is, according to their study, better explained by the donor interest model, in which countries provide assistance to safeguard their trade, investment, political and security interests.

Alesina and Dollar (2000) focus on bilateral aid flows and conclude, as Maizels and Nissanke (1984) would predict, that the pattern of aid giving is, to a significant extent, influenced by political and strategic considerations. "An inefficient, economically closed, mismanaged non-democratic former colony politically friendly to its former colonizer, receives more foreign aid than another country with a similar level of poverty, a superior policy stance, but without a past as a colony," they contend.

Many other researchers have explored the allocation of development aid in a variety of econometric studies. Ridell (1999), for example, notes that although, in recent years, donors have given high priority to using aid to solve Africa's poverty problems, it seems that the amount of aid provided does not reflect the continent's needs and that the gap between aid needs and aid provided is widening. Large gaps remain, Ridell argues, between the donors' proclaimed support for poverty reduction and actual sectoral aid allocations.

Wall (1995) finds that total net ODA allocations per capita are negatively correlated with per capita income but are not correlated with either infant mortality or political and civil rights. In their recent working paper, Bandyopadhyay and Wall (2006) look at aid allocation during the post-Cold War era. They find that aid has been negatively related to per capita income and positively related to infant mortality, political and civil rights, and government effectiveness. Neither of these studies, however, draws a distinction between bilateral and multilateral aid allocation. I have tried to correct for this deficiency in my study, which focuses exclusively on the allocation of multilateral ODA. Rather than using a per capita measure, as Wall (1995) does, I have followed the methodology used by Burnside and Dollar (2000), and looked at multilateral aid as a proportion of gross domestic product.

Turning to institutional quality, Alesina and Weder (2002) find no evidence that the level of corruption in a country, as measured by the International Country Risk Guide, reduced receipts of bilateral or multilateral aid during the 1974-1994 period or more recent subperiods. They also examined the impact of aid receipts on corruption levels, and tentatively found that an increase in aid led to more corruption. This result is

consistent with the 'voracity effect' hypothesis proposed by Tornell and Lane (1999), according to which "the receipt of foreign aid induces powerful groups to increase appropriation rates, leading to a dissipation of the revenues and no gain in welfare."

This study contributes to the literature on foreign aid allocation by examining the effects of several determinants, such as health, education and corruption levels, on the size of multilateral aid inflows as a proportion of the gross domestic product of sub-Saharan countries. It can thus provide additional evidence in support of, or against, the results found by the aforementioned studies.

I will now proceed to specify what variables I employ in my panel regression analysis, and from which sources I obtained their values.

III. Data Sources

This study examines the effects of education and health levels, as well as of institutional quality and population size, on the amount of total multilateral Official Development Assistance received as a proportion of gross domestic product in 22 countries in sub-Saharan Africa.

The analysis focuses on the 1995-2004 time period for several reasons. First of all, for public policy purposes, it is more informative to look at recent data, as they offer an insight into what the current practices are, and a good starting point for policy recommendations. Secondly, this time period begins after the end of the Cold War and thus avoids the problems associated with foreign aid allocation for political and strategic purposes in a bipolar world.[4] Finally, covering a relatively short time span of ten years

[4] Khadka (1997) provides an interesting case study of aid donor motivations before and after the Cold War in Nepal. Even though Nepal is not a country in sub-Saharan Africa, the study provides valuable insight

reduces the risk of encountering significant differences in the way relevant variables are measured.

Data on multilateral aid inflows (the *Aid/GDP* variable; see the regression function in the section on methodology) come from the Development Assistance Committee (DAC) of the OECD. They are available from the "DAC 2a: Official Development Assistance (ODA) – Disbursements by recipient and type" dataset in the OECD's online statistical database (*OECD.STAT*), and are denominated in millions of constant 2004 US dollars. Amounts are adjusted for aggregate income by dividing the multilateral inflows by the country's GDP, as given by the World Bank.[5] ODA datasets provided by the OECD have been widely used in academic studies, including Maizels and Nissanke (1984), Boone (1996), and Alesina and Weder (2002), among others.

Life expectancy at birth and infant mortality rates (for the *Health* variable), population size (for the *Population* variable) are taken from the World Development Indicators, an online database of country statistics administered by the World Bank. Infant mortality rates concern newborns who die in their first year of life and are expressed in deaths per 1000 live births. If life expectancy or infant mortality figures are not available for a specific year, they are extrapolated from the available data.[6]

Adult literacy rates (for the *Education* explanatory variable) were obtained using a dataset published by the United Nations Educational, Scientific and Cultural Organization (UNESCO). The dataset included estimates and projections of adult

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into the differences in foreign aid allocation policies pre- and post-Cold War. Much of Khadka's analysis can be applied to other developing countries, including those in sub-Saharan Africa.

[5] More specifically, as given by the World Bank's World Development Indicators, an online database of country statistics.

[6] Missing life expectancy and mortality rate figures for a specific year were extrapolated using a simple linear function (y=ax+b) which connected the two closest points for which data was available. The extrapolated figures correspond simply to the appropriate points on the resulting straight line.

illiteracy rates for population aged 15 years and above, classified by country and gender at five year intervals for the 1970-2015 time period. The relevant estimates for the time period my study examines were those for the years 1995, 2000 and 2005. Adult literacy rate were calculated simply by subtracting the given adult illiteracy rate from the full literacy rate of 100%. Figures for the years in between these three years were extrapolated using a simple linear approximation that connected points for which specific estimates were given.[7]

Although extrapolation may allow one to estimate the values of variables, whose time series are incomplete, it should be used with caution, as it can create additional methodological problems. If the extrapolated estimates, for example, do not match the true values of a variable, extrapolation can be a source of bias or inconsistency in estimating the regression coefficients. Moreover, extrapolation can give rise to artificially high correlations between the values of a variable over time, which can reduce the usefulness of time-fixed effects panel regressions.

I obtained figures for the *Institutions* variable from the International Country Risk Guide (ICRG) database, which provides extensive time series on country-specific risk indicators. According to Alesina and Weder (2000), the ICRG provides "the most frequently used measure of corruption in academic research," and covers a larger number of countries than alternative indicators. The ICRG's description of the corruption variable states that it is "a measure of corruption within the political system that is a threat to foreign investment by distorting the economic and financial environment, reducing the efficiency of government and businesses by enabling people to assume positions of

[7] In other words, for each country, I used two linear functions of the form y=ax+b to extrapolate literacy rates – one for the 1995-2000 period (extrapolating figures for years 1996, 1997, 1998 and 1999), and the other one for 2000-2005 (to extrapolate rates for 2001, 2002, 2003 and 2004).

power through patronage rather than ability, and introducing inherent instability into the political process."[8] The variable is measured on a six point scale. A high score indicates a low level of corruption.

TABLE 1 – CORRELATIONS BETWEEN MULTILATERAL AID AS A PROPORTION OF GDP AND THE EXPLANATORY VARIABLES

	Explanatory Variable				
Time period	**Life Expectancy**	**Mortality Rate**	**Literacy Rate**	**Absence of Corruption**	**Population Size**
1995	-0.4147	0.1602	0.1032	0.0066	-0.2093
2004	-0.1192	0.5565	-0.3287	-0.0045	-0.3411
10 year average (1995-2004)	-0.4978	0.0020	-0.1778	0.0816	-0.3762

Source: Multilateral aid amounts were obtained from OECD.STAT. Gross domestic product, life expectancy and population size figures, as well as mortality rates, were taken from the World Banks's World Development Indicators. Literacy rates were obtained from a UNESCO dataset. The absence of corruption variable comes from the International Country Risk Guide (ICRG).

A naïve look at basic statistics provides some preliminary indications of a small-country population bias and of a tendency to allocate more aid to countries with high life expectancies and a low mortality rate. *Table 1*, above, provides correlations between the multilateral aid as a proportion of GDP variable and the explanatory variables for the years 1995 and 2004, as well as for the 1995-2004 ten-year averages, as listed in *Table B.1* in *Appendix B*. These basic correlations suggest that multilateral ODA per GDP has a moderately strong negative correlation with population size (ρ_{1995} = -0.2093; ρ_{2004} = -0.3411; ρ_{AVG} = -0.3762), a sizeable negative correlation with life expectancy (ρ_{1995} = -0.4147; ρ_{2004} = -0.1192; ρ_{AVG} = -0.4978), and a positive, albeit variable, correlation with the mortality rate (ρ_{1995} = 0.1602; ρ_{2004} = 0.5565; ρ_{AVG} = 0.0020). The correlations of multilateral aid as a proportion of GDP with the absence of corruption indicator and with

[8] International Country Risk Guide (ICRG) database, online, accessed through the Princeton University Library

literacy rates change signs across the three time periods examined. The correlations with the absence of corruption variable, furthermore, are too weak to be suggestive.

One should keep in mind, however, that each of these correlations may be affected by the other determinants and that a more sophisticated regression analysis needs to be undertaken to estimate the hypothesized effects.

So far. I have described the character, origins and units of the dependent and independent variables used in my study. I have also pointed out some limitations to their use, especially those derived from the use of extrapolated estimates where exact values are unavailable. In the next section, I explain the methodological framework in which these variables will be put to use. I shall specify my panel regression function, discuss the importance of country- and time-fixed effects, and present my research hypothesis.

IV. Methodology

In this study, I use panel data about 22 countries in sub-Saharan Africa, listed in *Appendix A*, from the 1995-2004 period to estimate a regression model in which I treat multilateral aid inflows as a proportion of GDP as the dependent variable, and proxies[9] for health levels, education and institutional quality as explanatory variables. The explanatory variables represent hypothesized determinants of the allocation of multilateral aid. Because the aim of my analysis is to estimate the effect of these determinants on the amount of multilateral ODA received by countries, adjusted for aggregate income, in sub-Saharan Africa, I use the following regression equation:

[9] A proxy variable is, according to Wooldridge (2003), an observed variable that is related but not identical to an unobserved explanatory variable in a multiple regression analysis. Using proxies is a way to overcome, or at least mitigate, the omitted variables bias.

$$\ln(\frac{Aid_{it}}{GDP_{it}}) = \beta_0 + \beta_1 Health_{it} + \beta_2 Education_{it} + \beta_3 Institutions_{it} + \beta_4 \ln(Population_{it}) + e_{it}$$

where the subscript *i* indexes countries, *t* indexes time (year in question) and *e* is the error term. The dependent variable *Aid/GDP* represents the amount of multilateral aid received by the country as a proportion of its gross domestic product. On the right-hand side of the equation, $\beta_0, \beta_1, \ldots, \beta_4$ are regression coefficients to be estimated. *Health* represents the inhabitants' health level and is proxied for by either their life expectancy or the country's infant mortality rate. *Education* is the country's inhabitants' education level as measured by the adult literacy rate, and *Institutions* stands for institutional quality, proxied for by a measure of corruption within the country's political system, whose high values indicate low prevalence of corrupt practices, and vice versa. Finally, the log of *Population* variable serves to control for a possible population bias.

Note that the dependent variable and one of the explanatory variables are in the logarithmic form. The proposed regression equation thus combines the features of log-linear and log-log models. Coefficient β_4 represents an elasticity[10] - namely, the ratio of the percentage change in *Aid/GDP* to the percentage change in a country's population. Coefficients β_1, β_2 and β_3, on the other hand, measure the proportional change in *Aid/GDP* in response to a unit change in the *Health*, *Education* and *Institutions* variables, respectively. In particular, a unit change in, for instance, *Education* is associated with a $100 \times \beta_2$ percent change in *Aid/GDP*.

[10] Elasticity, in general, is a measure of the (proportional) responsiveness of the dependent variable to proportional changes in the independent variable.

I will examine the role of country-fixed and time-fixed effects on the panel regression. Time-fixed effects are a way of accounting for the influence of global business cycles, as was done in Burnside and Dollar (2000), and for potential changes in the multilateral donors' inclination to provide aid. They are introduced by modifying the error term e_{it} to include a time-specific intercept α_t: $e_{it} = \alpha_t + \varepsilon_{it}$. Country-fixed effects can account for individual characteristics of the countries in the sample that could affect their receipts of multilateral aid, regardless of the values of the explanatory variables. These effects can be introduced into the error term e_{it} through a country-specific intercept γ_i: $e_{it} = \gamma_i + \varepsilon_{it}$. In some regressions, I will include both time- and country-specific effects: $e_{it} = \alpha_t + \gamma_i + \varepsilon_{it}$. In all of the above cases the time- and country-specific intercepts can be correlated with the explanatory variables, but the following has to hold:

$$E[\varepsilon_{it} | Health_{it}, Education_{it}, Institutions_{it}, \ln(Population_{it})] = 0 \text{ for all } i \text{ and } t.$$

Life expectancy at birth and adult literacy rates certainly do not capture all aspects of what they proxy for - health and education levels, respectively. These statistics are used by the United Nations Development Programme in their calculations of the HDI index, and seem to provide reasonable approximations.[11] Life expectancy figures are, furthermore, relatively easy to extrapolate for years in which data is not available. One drawback of using life expectancy data is that it tends to remain relatively stable over time and its coefficient can thus be difficult to estimate in a panel regression with time-fixed effects. Because of this, a more volatile variable – in particular, the infant mortality rate - was introduced as an alternative proxy for health levels.

[11] Although, one should add, the HDI's education component also factors in combined gross enrollment ratios for primary, secondary and tertiary schools.

The motivating question underlying my research is whether multilateral aid is allocated to the countries which need it most – those with the worst health and education levels. If this is indeed the case, one would expect a longer life expectancy at birth and greater adult literacy rates to decrease the amount of aid received ($\beta_1 < 0$; $\beta_2 < 0$). Negative coefficients for β_1 and β_2 would be consistent with Maizels and Nissanke (1984) who claimed that the recipient need model explained multilateral aid allocation. If we used infant mortality rates instead of life expectancy as a proxy for health levels, we would expect coefficient β_1 to be positive ($\beta_1 > 0$), as higher mortality rates would be associated with more multilateral aid.

In light of the multilateral agencies' increased focus on reducing corruption, one may expect more corrupt countries to receive less aid, other things equal ($\beta_3 > 0$). Such a finding would be at odds with the results obtained by Alesina and Weder (2002), who found no evidence that higher corruption levels decreased the amount of aid received.

Previous research indicates that there has been a bias in aid allocation towards less populous countries ($\beta_4 < 0$). In their analysis of aid allocation, Burnside and Dollar (2000), for instance, find that population has a large negative coefficient, suggesting that aid goes disproportionately to smaller countries.

There are, of course, limitations to the proposed methodology. Some of the variables, such as literacy rates and the corruption measure, are difficult to measure exactly. Furthermore, figures for some years are obtained by a linear extrapolation from the available data. The figures used in my study may thus not correspond to the true values, although they are likely to be reasonably close. In addition, the use of extrapolated estimates can lead to artificially high correlations between the values of

some variables over time. Especially in panel regressions with time-fixed effects, it could reduce the usefulness of coefficient estimates, due to multicollinearity.

Another shortcoming of my methodology concerns the possible endogeneity of explanatory variables.[12] There may, for example, be a factor that is correlated with both multilateral aid receipts and one of the explanatory variables. Not including this factor in the regression could be a source of omitted variable bias.

Furthermore, a reverse causality problem can arise in my regression analysis. Especially if aid is effective, it is conceivable that some of the explanatory variables are influenced by multilateral ODA inflows. For instance, to the extent that multilateral development aid receipts lead to an improvement in education levels, literacy rates may rise as a result. It may then be unclear whether higher literacy rates are a cause or a consequence of increased aid receipts.

If Boone's (1996) finding that foreign aid does not significantly improve development indicators is correct, however, then we can rule out the potential causal effect on multilateral ODA inflows on the independent variables, and the reverse causality problem disappears. Burnide and Dollar's (2000) observation that good fiscal, monetary and trade policies are a prerequisite for aid effectiveness, would lead us to a similar conclusion, to the extent that countries in sub-Saharan Africa generally suffer from poor governance. Finally, Ram (2003) notes that multilateral aid receipts are negatively correlated with economic growth rates, which may also suggest that multilateral ODA is lacking in effectiveness – an observation which reduces the risk of reverse causality.

[12] Wooldridge (2003) defines an endogenous explanatory variable as one that is, for whatever reason, correlated with the error term.

V. Results

I first ran six panel regressions – two with country-fixed, two with time-tixed effects and the last two with both - using the model outlined in the Methodology section.

The resulting coefficient estimates and robust standard errors, as well as some additional statistics such as the number of observations and the adjusted R^2 are summarized in *Table 2* below:

TABLE 2 – PANEL REGRESSION RESULTS (DEPENDENT VARIABLE: LOG (MULTILATERAL AID AS A PROPORTION OF GDP))

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
Constant	4.3863 (21.7264)	- 26.094 (22.1595)	17.673** (2.322)	14.4197** (1.592)	- 135.31** (60.527)	-192.56** (68.741)
Health:						
Life expectancy	0.09558** (0.02428)		- 0.05296** (0.02196)		0.03567 (0.0463)	
Mortality rate		- 0.00034** (0.00013)		0.00356* (0.00213)		- 0.00038** (0.00013)
Education:						
Literacy rate	0.0043 (0.03508)	- 0.0505 (0.0382)	-0.0203** (0.0037)	-0.01754** (0.0039)	0.09055 (0.0753)	0.11558 (0.0967)
Institutional quality:						
Absence of Corruption	- 0.1132 (0.08699)	0.04902 (0.0714)	0.01656 (0.1439)	- 0.03398* (0.1502)	- 0.1832* (0.10255)	- 0.01783* (0.10368)
Population:						
Log(Population)	0.00212 (1.4605)	2.318 (1.4756)	-0.3114** (0.09399)	- 0.29103** (0.0855)	8.3631** (3.919)	11.856** (4.108)
Country-fixed effects	Yes	Yes	No	No	Yes	Yes
Time-fixed effect	No	No	Yes	Yes	Yes	Yes
Observations	217	217	217	217	217	217
Adjusted R^2	0.8284	0.8032	0.1958	0.1879	0.8363	0.8353

Notes: Asterisks indicate that the coefficients are significantly different from 0 at the *10% or at the **5% significance level.

The country-fixed effects regressions did not yield, with the only exception of the two *Health* variables, any statistically significant coefficients. The literacy rate and absence of corruption coefficients changed signs across the two regressions. The

estimated elasticity of *Aid/GDP* in response to a change in a country's population had a positive sign. This result would have indicated that the population bias towards less populous countries, demonstrated by studies such as Burnside and Dollar (2000), did not hold, but the estimate was, unfortunately, not statistically significant at either the 10 or the 5 percent level.

The coefficients of *Health* variables, however, were both statistically significant at the 5 percent level, but did not have the expected signs. In regression (1), a one year increase in the average life expectancy lead to a 9.6 increase in *Aid/GDP*, while in regression (2), a 10 percent rise in the mortality rate was associated with a very minor, 0.35 percent, increase in the amount of multilateral ODA received as a proportion of total GDP. In both regressions, the adjusted R^2 values were in the vicinity of 0.815 for both country-fixed effects regressions, suggesting a fairly good fit.

The following two time-fixed effects panel regression yield some noteworthy results, which largely conform to my research hypothesis and where most of the estimated coefficients are statistically significant at the 5 percent level.

In regression (3), an additional year of life expectancy is associated with a 5.3% decline in multilateral *Aid/GDP* receipts. A 10 percent rise in the literacy rate, moreover, leads to a 20.3% fall in *Aid/GDP*. Finally, a doubling of a country's population predicts a 31% decrease in multilateral aid receipts as a proportion of national income.

The results of regression (4) indicate that a 10 percent increase in the mortality rate leads to a 3.6% increase in *Aid/GDP*, and that a 10 percept rise in the literacy rate is associated with a 17.5% decrease in the receipt of multilateral aid as a proportion of GDP. If the population of a country doubles, *Aid/GDP* is expected to decrease by about 29%.

These results are, to a considerable extent, consistent with my hypothesis. Countries with poorer health and education levels seem, indeed, on average to receive less multilateral Official Development Assistance as a proportion of their gross domestic products. Furthermore, it appears that there is a fairly strong bias towards providing more aid to countries with smaller populations – a result that is in line with previous findings, such as those in Burnside and Dollar (2000).

In the case of the *Institutions* proxy – the absence of corruption variable -, however, my hypothesis does not hold. Its coefficient changes signs across the two time-fixed effects regressions. Furthermore, it is not statistically significant in regression (3) and only significant at the 10 percent level in regression (4). To the extent that such a result might indicate that multilateral donors do not factor the perceived level of corruption into their aid allocation decisions, these estimated coefficients could validate Alesina and Weder's (2002) findings that corruption does not reduce foreign aid receipts.

Although the two time-fixed panel regressions yield statistically significant coefficients, their adjusted R^2 is very low – only around 0.19. Such low values indicate that the panel regression overall does not fit the sample data well, and that other factors – perhaps country-specific qualities that remain constant across time – might be important.

The results are, nevertheless, very telling. Without taking into account the presumably large influence of country-fixed effects, we find that the results of regressions (3) and (4) are supportive, on a statistically significant level, of the research hypothesis.

The final two regressions summarized in *Table 3* combine country- and time-fixed effects. The only coefficient that is statistically significant at the 5 percent level in

both regressions (5) and (6) is the estimated elasticity of *Aid/GDP* in response to changes in Population. In regression (5), if a country's population doubled, *Aid/GDP* would rise eightfold, whereas in regression (6), the doubling of a country's population is associated with an eleven-fold increase. Not only do these coefficients not support the small-country bias hypothesis, the elasticity also seems unrealistically high. In regression (6), the mortality rate coefficient is statistically significant at the 5 percent level, and indicates that a 10 percent increase in a country's mortality rate would lead to a very meager, 0.38 percent, decrease in *Aid/GDP*. The life expectancy and literacy rate coefficients are not statistically significant in either equation, but they have the expected signs. The absence of corruption coefficient is significant at the 10 percent level in both regressions, and it indicates that a one point increase on the International Country Risk Guide scale would lead to an 18.3% decrease in *Aid/GDP* in regression (5), but only a 1.8% decline in regression (6). The combined country- and time-fixed effects regressions display a very good fit to the sample data, as their adjusted R^2 statistics hover around 0.84.

Across the six panel regressions discussed above, one coefficient that was often not statistically significant and tended to change signs is that of the absence of corruption variable. I have therefore decided to drop it from the regression model and to reestimate the model. As before, I ran six regressions with various combinations of country-fixed and time-fixed effects. The results are summarized in *Table 4*, which follows:

TABLE 3 – PANEL REGRESSION RESULTS AFTER THE EXCLUSION OF INSTITUTIONAL QUALITY
(DEPENDENT VARIABLE: LOG (MULTILATERAL AID AS A PROPORTION OF GDP))

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
Constant	- 11.344 (20.278)	- 19.54 (20.124)	17.758** (2.2359)	14.204** (1.116)	- 136.599** (64.0597)	- 188.694** (78.884)
Health:						
Life expectancy	0.0872** (0.0231)		- 0.0526** (0.0214)		0.03241 (0.0524)	
Mortality rate		- 0.00035** (0.00012)		0.00358** (0.00213)		- 0.000353** (0.000125)
Education:						
Literacy rate	- 0.0102 (0.0346)	- 0.0455 (0.0372)	- 0.02011** (0.004)	- 0.0179** (0.00419)	0.05376 (0.0795)	0.0774 (0.1005)
Population:						
Log(Population)	1.0244 (1.365)	1.90677 (1.3537)	- 0.3158** (0.0883)	- 0.2815** (0.0699)	8.5672* (4.1298)	11.742** (4.709)
Country-fixed effects	Yes	Yes	No	No	Yes	Yes
Time-fixed effect	No	No	Yes	Yes	Yes	Yes
Observations	217	217	217	217	217	217
Adjusted R^2	0.8277	0.8039	0.1997	0.1916	0.8333	0.8324

Notes: Asterisks indicate that the coefficients are significantly different from 0 at the *10% or at the **5% significance level.

Regressions (1) and (2) include only country-fixed effects. Only the *Health* variable coefficients are statistically significant at the 5 percent level. Their signs, however, do not conform to my research hypothesis. In regression (1) a one year rise in average life expectancy is associated with an 8.7% increase in *Aid/GDP*. A ten percent rise in the mortality rate is associated, in regression (2), with an 0.35% decrease in the amount of multilateral aid received in proportion to GDP. The literacy rate coefficients are not statistically significant but have the hypothesized sign. If a country's literacy rate increased by 10 percent, *Aid/GDP* would go down by 10.2% or a much more significant 45.5%, in regressions (1) and (2) respectively. The estimates of *Aid/GDP*'s elasticity with respect to a country's population, while not statistically significant, have a positive

sign, indicating that populous countries tend to receive more multilateral ODA as a proportion of their national income. This is at odds with Burnside and Dollar's (2000) finding of a small-country population bias. The adjusted R^2 is around 0.81 for both regressions, suggesting a good fit.

The following two time-fixed effects panel regressions (3) and (4) are remarkable because all of their coefficient estimates are statistically significant at the 5 percent level. The results, furthermore, correspond quite closely to the research hypothesis: Countries with worse health and education levels tend to receive more *Aid/GDP*. Furthermore, there are also indications of a population bias in favor of less populous countries. In regression (3), an additional year of average life expectancy lead to a 5.3 percent decrease in *Aid/GDP*, and a ten percent rise in the literacy rate yields a 20.1 percent fall in multilateral aid as a proportion of the gross domestic product. If a country's population doubled, it would receive 31.6 percent less *Aid/GDP*. In regression (4), a ten percent rise in the mortality rate leads to a 3.6% fall in multilateral ODA received as a proportion of GDP, and a ten percent rise in the adult literacy rate is associated with a 17.9% fall in *Aid/GDP*. The doubling of a country's population would decrease *Aid/GDP* by about 28.2 percent. The overall fit of the time-fixed effects regressions is very poor. The adjusted R^2 only reaches about 0.195. That, however, does not mean that the results are not important. Most likely, the low fit of the regression indicates that country-fixed effects, not included in these regressions, explain a great deal of the sample variance. Still, we can conclude that, without accounting for the large country-fixed effects, the time-fixed effects panel regressions yield statistically significant results, which are, for the most part, consistent with the research hypothesis.

Regressions (5) and (6) combine country- and time-fixed effects. Estimates of the population elasticity of *Aid/GDP* are statistically significant at the 10 or 5 percent level in both equations, and they indicate a rather implausibly large multilateral aid allocation bias in favor of countries with large populations. In regression (5), the doubling of a country's population would lead to a 8.5-fold increase in *Aid/GDP*, and in regression (6), the increase would be almost 12-fold. Needless to say, these findings are not consistent with Burnside and Dollar's (2000) observation that less populous countries receive, *ceteris paribus*, more foreign aid than more populous ones. *Health* variables do not have the expected signs, although only the mortality rate coefficient is statistically significant. Regression (5) suggests that, if the life expectancy of a country's inhabitants went up by one year, one would expect *Aid/GDP* to rise by 3.2 percent, whereas regression (6) indicates that a ten percent rise in the mortality rate is associated with a 0.35 percent decline in multilateral ODA receipts in proportion to GDP. The literacy rate coefficient, which in both cases has a sign opposite to that which was expected, is not statistically significant in either regression. According to regression (5), a ten point increase in the literacy rate would yield a 54 percent increase in *Aid/GDP*, whereas in regression (6), the increase would amount to as much as 77 percent. The combined country- and time-fixed effects regressions appear to explain a great deal of variation in the data, as the adjusted R^2 is as high as approximately 0.83 for both.

Overall, it appears that the panel regressions with both country- and time-fixed effects provide the best fit to the sample data. The estimated coefficients, however, were mostly not statistically significant and only rarely supported the research hypothesis. Regressions where only time-fixed effects were included yielded statistically significant

results that, by and large, conformed to the research hypothesis. The adjusted R^2 statistic was, however, relatively low and indicated a rather poor fit without including country-fixed effects.

In light of these results, it seems appropriate to conclude that the analysis provides at least some evidence that confirms the research hypothesis. In other words, there is some evidence – especially in the time-fixed effects regressions - that, in sub-Saharan Africa, more multilateral Official Development Assistance as a proportion of GDP is allocated to countries with lower health and education levels. Corruption, however, does not seem to be a significant factor in aid allocation decisions. The lack of clear-cut results and statistical significance in regressions that include country-fixed effects, can be attributed to the relatively low number of observations, given the multitude of regressors.

These findings give some support to Maizels and Nissanke's (1984) conclusions, according to which the needs of the recipient country explained the amount of multilateral aid received. The apparent lack of importance of corruption prevalence in multilateral ODA allocation is consistent with Alesina and Weder (2002) who argued that corruption did not affect the amount of aid a country received.

My analysis, however, has a number of shortcomings. The most obvious one is the potential for omitted variable bias. My regression equations included only a limited number of explanatory variables, and it is entirely possible that some factors correlated with the included variables have been left out, thus causing a correlation between the error term and the explanatory variables. Such omitted variables bias could be a possible source of bias and inconsistency in the estimated coefficients. The income level of a given country, for example, could be correlated with the other explanatory variables.

A country with a higher standard of living, as measured by the aggregate income proxy, could also have a lower mortality rate, a greater life expectancy, and a higher literacy rate. The coefficients for the current explanatory variables would then, at least to some extent, be picking up the effects of income variation across countries in addition to what they really are supposed to measure. The inclusion of an additional income explanatory variable based on the gross domestic product could, nevertheless, be problematic in its own right, since GDP is already included in the denominator of the dependent variable.

Another issue that could arise in connection with my regression equations is the problem of reverse causality. Throughout my analysis, I have assumed that the variation in allocated multilateral ODA was caused by the differences in the explanatory variables. The causation could, however, plausibly run the other way. Some of the explanatory variables could be affected by aid receipts - especially if multilateral aid is effective in promoting economic and human development. An increase in received multilateral ODA could, in this scenario, improve the country's inhabitants' health levels, leading to lower mortality rates.

Especially in regressions which include country-fixed effects, the number of observations is relatively small compared to the number of regressors. This leads to inconclusive results and a lack of statistical significance in some regressions.

Finally, one should remember that the values of some variables, most notably the mortality rate, life expectancies and literacy rates, were not available for every year in the 1985-2004 time period, and were extrapolated using a straight line approximation. To the

extent that the real values of these variables different from the extrapolated estimates, my regression coefficients may have exhibited some bias or inconsistency.

VI. Conclusion

This panel study of 22 countries in sub-Saharan Africa examined the effects of a number of determinants – health and education levels, institutional quality, and population size – on the amount of multilateral Official Development Assistance the countries received during the 1985-2004 time period. I tested the hypothesis that countries with lower health and education levels would receive more multilateral ODA as a proportion of their GDP. I also examine the role of corruption, used as a proxy for institutional quality, in allocating multilateral ODA. Given the increased attention that many multilateral agencies, most notably the World Bank, have been paying to the issues of governance in recent years, I expected higher corruption levels to be associated with lower receipts of multilateral aid.

To the extent that multilateral aid is effective but possibly dissipated by corrupt institutions, - both contentions are a matter of much disagreement among development economists and their examination is beyond the scope of this paper -, such a result would indicate sensible allocation decisions on the part of multilateral agencies.

The regression results indicate that a model with both country- and time-fixed effects provides the best explanation, in terms of how good a fit the regressions provide, for the allocation of multilateral ODA. The estimated coefficients, however, are mostly not statistically significant and thus do not provide much useful information about the effect of specific factors on multilateral ODA allocation. In many cases, furthermore, they did not exhibit signs consistent with my research hypothesis. These inconclusive and

statistically insignificant results can be attributed to the relatively low number of observations, combined with a multitude of regressors.

In regressions where only time-fixed effects were included, however, the obtained coefficients were statistically significant and had the expected sign, but the adjusted R^2 statistic was too low for a reasonably good fit, indicating a large role for country-fixed effects. These results provide, without accounting for the extensive country-fixed effects, at least some empirical support for the research.

All in all, my analysis yields some evidence in support of the hypothesis that countries with poorer health and education levels receive more multilateral aid as a proportion of their gross domestic products. The corruption level, as measured by the International Country Risk Guide, however, appears to be an unimportant factor in the allocation of multilateral ODA.

The shortcomings of my analysis include the low number of observations, the potential presence of omitted variable bias, issues of reverse causality, and the possible imprecision of coefficient estimates based on extrapolated values of explanatory variables. These imperfections represent, in my view, an opportunity for further research. One could, for example, try to obtain a greater number of observations as well as more accurate, rather than merely extrapolated, values of the explanatory variables, or include additional regressors to deal with omitted variable bias, and then redo the panel regression analysis to obtain more conclusive results. One could also undertake a more detailed study of the decision-making processes in the multilateral agencies themselves to ascertain whether multilateral ODA is allocated based on health and education variables,

or whether any correlations with these regressors are a by-product of some other decision rule.

Appendix A

List of the 22 countries used in the study:

Botswana
Burkina Faso
Cameroon
Congo
Congo, Democratic Republic of
Cote d'Ivoire
Ethiopia
Gambia
Ghana
Guinea-Bissau
Kenya
Malawi
Mali
Mozambique
Namibia
Niger
Nigeria
Senegal
South Africa
Sudan
Uganda
Zambia

Appendix B

TABLE B.1 – TEN-YEAR AVERAGES FOR THE 1995-2004 TIME PERIOD (part 1/2)

Country	Life Expectancy (years)	Infant Mortality Rate (deaths per 1000 live births)	Life Expectancy (years)
Botswana	44.95	69.30	44.95
Burkina Faso	46.80	101.35	46.80
Cameroon	47.70	88.05	47.70
Congo	51.50	81.00	51.50
Congo DR	42.35	129.00	42.35
Cote d'Ivoire	47.20	114.00	47.20
Ethiopia	42.50	116.60	42.50
Gambia	54.65	92.45	54.65
Ghana	57.00	67.70	57.00
Guinea Bissau	44.35	133.80	44.35
Kenya	49.10	75.75	49.10
Malawi	40.95	222.25	40.95
Mali	47.60	125.35	47.60
Mozambique	43.05	124.40	43.05
Namibia	53.35	50.75	53.35
Niger	43.55	162.35	43.55
Nigeria	44.15	109.40	44.15
Senegal	55.20	80.70	55.20
South Africa	50.10	49.50	50.10
Sudan	55.70	65.70	55.70
Uganda	45.20	85.85	45.20
Zambia	38.55	102.00	38.55

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TABLE B.1 – TEN-YEAR AVERAGES FOR THE 1995-2004 TIME PERIOD (part 2/2)

Country	Literacy Rate (%)	Absence of Corruption (ICRG index)	Population Size	Multilateral ODA / GDP (mn, constant 2004 USD)
Botswana	76.66	3.00	2,459,766.27	2,119.16
Burkina Faso	23.59	2.25	11,213,747.70	7,907.54
Cameroon	70.50	2.25	14,691,635.00	7,169.93
Congo	73.47	3.21	3,389,118.70	8,926.86
Congo DR	60.70	1.10	49,933,094.00	7,957.17
Cote d'Ivoire	43.07	2.66	16,450,020.20	9,540.18
Ethiopia	38.67	2.00	63,443,014.00	10,571.47
Gambia	36.10	3.13	1,295,764.40	16,468.23
Ghana	69.68	2.55	19,672,487.40	9,312.21
Guinea Bissau	37.91	2.00	1,354,540.60	44,547.89
Kenya	81.68	2.21	30,344,799.60	6,408.27
Malawi	59.68	2.72	11,345,694.00	35,536.30
Mali	25.30	2.43	11,546,408.30	22,032.71
Mozambique	81.63	2.88	17,694,947.10	25,860.71
Namibia	81.63	2.93	1,854,863.20	5,005.41
Niger	15.79	1.51	11,634,515.40	18,913.67
Nigeria	63.08	1.35	116,261,930.00	1,490.55
Senegal	36.96	2.85	10,231,006.60	14,815.84
South Africa	85.01	3.44	43,036,512.40	329.95
Sudan	56.92	1.18	32,496,055.80	2,059.47
Uganda	66.36	2.15	24,109,492.20	13,441.09
Zambia	77.53	2.61	10,561,399.50	48,854.05

Source: Life expectancy, infant mortality rate and life expectancy figures were taken from the World Bank's World Development Indicators.

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