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Financing Goal 1 of the MDGs in Africa: Some Evidence from Cross-Country Data

Abebe Shimeles

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Financing Goal 1 of the MDGs in Africa: Some Evidence from Cross-Country Data

Abebe Shimeles[1]

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(1)Abebe Shimeles is Principal Research Economist at the African Development Bank, Tunisia. The author is grateful to Ali .G. Ali for sharing his insights on the "optimal" aid allocation model used in the paper. Earlier version of this paper has been presented at UNECA seminar series in November 2007. Recent version of the paper was also presented at the ADB seminar in May 2009.

Abstract

This study explores the role of development assistance to finance the required growth to reduce extreme poverty by half in 2015 in Africa. The study utilizes the financing gap and "optimal" aid allocation models to explore the implications of efficient aid utilization and global-aid allocation on total aid required to meet goal 1 of the MDGs. The findings suggest that efficiency in the utilization of development assistance by recipients, or optimal disbursement of aid by donors would take the Africa region a long way in reaching the target without additional assistance. This evidence provides empirical support to the recent debate on aid-effectiveness in particular and reforming aid architecture in general.

Keywords: Financing gap models, optimal aid allocation model, Incremental Capital-Output Ratio, elasticity of poverty with respect to growth.

1. Introduction

Foreign aid continues to be one of the most contentious issues in the development circles. Here are a few screaming headlines concerning mainly Africa:

"Extreme poverty—defined by the World Bank as incomes of less than US$1 per day—can be eliminated globally by the year 2025, through carefully planned development aid" ***Jeferry Sachs***, "Ending poverty: Economic possibility of our time", 2005.

"The promise of a Big Solution to a very Big Problem is an outlier in the practice of economics where usually economists study marginal changes to existing systems or policies to generate marginal improvements. No serious economist that I know of is proposing a Big Plan to triple US per capita income, or to end poverty in the US" ***William Easterly***, "The Big Push De javou" *Journal of Economic Literature*, 44(1):2006.

"Aid has not only often failed to meet its objectives; it has also rarely dealt with the underlying issues of poverty and weak societies…. Often, aid has left recipient populations unstable, distracted and more dependent" ***President Paul Kagame***, *Financial Times*, May 7 2009

In Africa, most experts agree that MDGs are stretch targets without significant boost in the quantity and quality of aid, resurrecting the Big-push approach to development. For example, Sachs et al (2004) argued in their high profile report that African countries in general need a doubling of aid to unlock low-equilibrium traps that is caused mainly by low level of savings and indivisibilities in some key investments at the threshold. This has further fuelled the debate on the nexus between aid and growth on the one hand, and growth and poverty on the other. Some of the critiques (e.g. Easterly's (2006)) adopt a more cautious approach to development finance, while others question the existence of poverty traps in Africa (e.g. Kraay and Radatz, 2006). As the debate among academics continues, the practitioners in the development community, including the UN, and premier institutions such as the World Bank and the IMF use the attainment of the MDGs as their benchmark for development assistance, as reflected in the outcome statements of the series of G8 meetings since 2005.

The question remains how sensitive are such results to assumptions about growth-poverty projections, efficiency or productivity of aid and improvements in the overall institutional environment.

This study attempts to explore the aid-growth-poverty nexus in some detail using cross-country framework. Specifically, it is concerned with the following: What is the state of the financing gap to secure a growth rate consistent with the attainment of goal 1 of the MDGs in 2015 in Africa? What is the role of development assistance or aid in filling some of these gaps? How sensitive is estimates of financing gap to assumptions about productivity/efficiency of investment/aid? Does donor behavior matter in this regard?

There is a large literature on the link between aid and growth where some reported a strong link between aid and growth irrespective of country-circumstances, and some others found no

correlation at all[1]. In the middle we find some who argue that aid may be effective mainly if there are good policies and institutions (Collier and Dollar, 1999). The growth-poverty link is left as self-evident. If aid can promote growth, it is assumed that it will certainly reduce poverty. In this study we attempt to establish the nexus from aid to growth and to poverty in order to reflect further on the role of efficient utilization of aid by recipients and better re-allocation by donors.

This paper extends existing studies on aid-growth-poverty nexus in the following ways. First, unlike previous studies (e.g. Devarajan et al, 2002), we use growth-poverty link derived from an elasticity that varies until the target period (2015). Most studies so far used a constant elasticity, which certainly has overstated significantly the growth required to meet the MDGs. For instance, the average rate in real GDP growth required to meet the MDGs falls from the widely accepted 7% to 4.5% if elasticities of poverty are allowed to vary over time (see Bigsten and Shimeles, 2007).

Secondly, we allow the basic parameter that links aid and growth (the Incremental Capital Output Ratio) to respond to factors that improve total productivity of a country in the areas of political stability, property rights, investment risk, and other indicators of good economic governance.

Third, we allow donor preference to be guided only by poverty reduction objectives to capture if aid reallocation matters to financing needs to reach the MDGs at the country as well as continental level.

The key finding of this paper is that a typical African country may not need additional aid to reduce poverty by half in 2015 if efficiency of aid utilization is improved and (or) aid is optimally distributed to minimize global poverty. Not surprisingly, quality of institutions is part of the story in dramatically improving the efficiency of aid utilization (or investment in broad sense), to which African governments and their leaders have a big leverage. These results imply that the current drive to reform the aid architecture in general and aid-effectiveness in particular could have large impact on the financing needs of goal 1 of the MDGs in Africa.

The next section outlines the models and approaches used to capture the aid-growth-poverty nexus and data sources, section 3 discusses the results and Section 4 concludes the paper.

[1] Example, White, 1998; Alesina and Dollar 2000; Burnside and Dollar 2000a, 2000b, 2004; Hansen and Tarp, 2000, 2001; Lensik and White, 2001; Easterly et al, 2003, Rajan and Subramanian, 2008. See also Roodman (2007) for some of the important drawbacks of cross-country empirics on aid and growth.

2. Methodology and Data Sources

2.1. Financing gap model

In order to apply the financing gap model[2], there are two important policy parameters whose calibrations determine the basic results. The first is the amount of growth required to reach the MDGs, which is driven by the elasticity of poverty with respect to growth[3]. The second is the amount of aid flows needed to support such growth, which is mainly driven by the Incremental Capital Output Ratio (ICOR) parameter. Accurate representation of these two parameters and a test of their sensitivity to different assumptions hopefully provide robustness to our results. With regard to the first, we use analytical results in the growth-poverty nexus based on Lorenz functions for a sub-set of African countries for which we have the requisite data.

Following Kakwani (1991) and Datt (1998), the Lorenz function is the basic building block for analyzing the growth rate required to halve poverty[4] by 2015 with the following properties:

$$L = L(p, \pi) \qquad L'(p) > 0,\ L''(p) > 0 \qquad (1a)$$

$$P = P(\mu / z, \pi) \qquad (1b)$$

Where, L is the share of the bottom p percent of the population in aggregate consumption, π is a vector of parameters of the Lorenz curve estimable from a specific functional form that characterize income distribution. P is a poverty measure obtained from the slope of the Lorenz curve at poverty line z, per capita income μ, and parameters of the Lorenz function.

There are two frequently used functional forms to capture Lorenz curves: the general Quadratic Lorenz function (Villasenor and Arnold, 1989) and the Beta Lorenz function (Kakwani, 1980) for which there is a widely available freeware (POVCAL)[5] to estimate the underlying parameters and poverty indices commonly used in the development literature (see also Datt, 1998 for further details). Once the parameters of the Lorenz function are estimated it is possible to use established results to compute the amount of growth required reaching MDGs without changes in income distribution, and alternatively the amount of reduction in inequality needed to reach MDGs without growth. The combination of these two scenarios provide what is known as pro-poor growth scenarios where we have at one extreme a growth process that leaves inequality unchanged (mildly pro-poor)[6] and on the other extreme a redistribution process where a certain percentage of income from each individual is raised in a form of tax and distributed equally

[2] A rich discussion of this model with its severe limitation is found in Easterly (1999)
[3] The methodological section on growth-poverty nexus draws heavily from Bigsten and Shimeles (2007)
[4] We use the Foster, Greer and Thorbecke (1984) indices of poverty, which among suggested in the literature, meet most of the desirable properties. See Haggenars (1987) for an excellent review of the literature on the measurement of poverty.
[5] www.worldbank.org/html/prdph/lsms/tools/povcal

[6] See for example Bigsten and Shimeles (2003) for a review of different approaches to measuring pro-poor growth.

among all individuals (a strongly pro-poor). To operationalize this, we use the well-known result that the slope of the Lorenz curve at poverty line, *z* and per capita income μ_0 is:

$$L'(P_0) = \frac{z}{\mu_0} \qquad (2)$$

Which thus implies that:

$$P_0 = L'^{-1}(\frac{z}{\mu_0}) \qquad (3)$$

At half of P_0, the Lorenz function would be:

$$\frac{P_0}{2} = P_* = L'^{*-1}(z/\mu_*) \qquad (4)$$

Thus, to compute the per capita income level μ_* consistent with poverty level $0.5*P_0$ without a change in the Lorenz curve, one only needs to use equation (3) and (4) such that:

$$\frac{L(P_0)}{L(P_*)} = \frac{\mu_0}{\mu_*} \qquad (5)$$

Since thee LHS of equation (5) and the numerator on the RHS are known parameters, it is possible to compute the cumulative growth required to reach MDGs by 2015 assuming that the Lorenz curve remains unchanged. Analogously, we can evaluate the amount of inequality reduction required to meet MDGs if growth does not occur at all. Following Kakwani (1993), we know that the slope of the Lorenz curve at which poverty is half its original level without a change in mean per capita income must satisfy the condition:

$$L'^*(P_0/2) = z/\mu_0 \qquad (6)$$

In addition, (6) can be rewritten as:

$$L'^*(P_0/2) = \frac{z}{\mu_0(1+\beta)} = L'(P_0/2) - \lambda\{1 - L'(P_0/2)\} \qquad (7)$$

Using equations (6) and (7), we can solve for λ, which is proportional change in the Gini index needed for a certain growth rate β. Actually, equation (6) and (7) can generate a set of per capita income and Gini index consistent with headcount ratio at half the original poverty level, which may be termed as coordinates of an iso-poverty curve (e.g. Bigsten and Shimeles, 2003, ECLAC et al, 2002). For a given λ, it can be shown that the Gini coefficient of the new Lorenz curve is given by:

$$G(Y^*) = (1-\lambda)G(Y) \qquad (8)$$

Where G(Y) is the original Gini coefficient (observed from the data), which is defined over a vector *Y* representing the structure of income (ranked from the poorest to the richest), and *Y** is a vector that represents the simulated income distribution consistent with poverty level at MDG target poverty level.

The relations between β and λ then form the core of the growth-inequality nexus to meet the MDGs. The set up given in equations (6) and (7) allows for the consideration of several

scenarios to reach the MDGs. Apart from the extremes, for instance, one can work out the rate of change in the Gini coefficient required to meet the MDGs if the economy follows a historical growth trend up to 2015. Or alternatively it is possible to compute the growth rate required to sustain a certain degree of worsening of income distribution in light of achieving the MDGs.

It should also be noted that the relationship between poverty inequality and per capita income is not monotonic. It is possible for poverty to decline when the Gini coefficient remained unchanged, or even slightly increased! Similar relationship also applies with respect to growth in per capita income or consumption. Thus, it is not admissible to hold the elasticity of poverty with respect to either income or the Gini coefficient constant. Following Datt (1997), both elasticities vary with the parameters of the Lorenz curve and poverty levels. In light of this, our estimates of the GDP growth rate required to reach the MDGs is based on elasticity measures that vary until the target period.

The link between growth required to reducing poverty by half in 2015 and aid is established through the Two-Gap model. Four decades ago, Chenery and Strout (1966) developed a theoretical framework to put the role of foreign aid in the perspective of promoting economic growth in recipient countries. This framework popularly known as the Two-gap model of economic growth stipulated that developing countries face two constraints for steady growth arising out of the concept of 'resource-gap': the saving constraint (because domestic savings fall short of the desired investment rate dictated by the efficiency of capital) and the foreign exchange constraint (because export earnings fall short of the desired level of imports).

The model therefore argued that foreign aid could be made available to the tune of the gap to fill one of the two binding constraints (domestic savings or foreign exchange). This approach has remained entrenched even to this very day in the lending and foreign aid policy of the World Bank since the onset of the Decades of Structural Adjustment programs. The two-gap model devises an allocation rule for each recipient country on the basis of the binding resource constraint prevailing. The exercise is therefore mainly meant to come up with a total amount of aid needed to promote economic development in poor countries. Following Easterly (2003), the Two-Gap model states that targeted economic growth depends on investment as a share of GDP, adjusted by ICOR (to measure whether investment is of high or low quality). Formally this can be stated as[7]:

$$g = \frac{(I/Y)}{\sigma} \qquad 9(a)$$

$$I/Y = A/Y + S/Y \qquad 9(b)$$

Where I is required investment, Y is output (GDP), g is target GDP growth, A is aid and S is domestic savings. The parameter σ is known as ICOR, which measures the efficiency or quality of investment[8].

Obtaining a "good" estimate of ICOR has been notoriously challenging so far (see for example, Easterly, 1999, 2003 for an excellent account of it and critique of the two-gap model). The best

[7] This result can also be obtained by invoking the neo-classical Harrod-Domar growth model. See also Agenor (2006) for an excellent synthesis of the Two-Gap model.

[8] It is possible to allow for a parameter to capture leakages in the translation of aid into investment.

one can do is work out the sensitivities of aid required to alternative specifications of ICOR, possibly derived from a correlation weight with institutional quality. It is very much likely that ICOR can respond to shifts in key macroeconomic climates and institutions.

In this paper ICOR is estimated in two alternative ways. The first, and most common, approach is to take an average of ICOR over a long period for each country based on equation (9a). The second is to fit a regression equation of equation (9a) with complex lag structure of error components to capture transitory shocks such as equation (10)

$$g_{it} = a + \beta(I/Y)_{it} + \alpha_i + u_{it}$$
$$u_{it} = \varepsilon_{it} + \rho\varepsilon_{it-1} \qquad (10)$$

Predicted values of g from equation (10) are used to compute the ICOR[9]. Equation (10) also allows for unobserved country-specific effects that are invariant over a long period. On the basis of estimates of ICOR and target growth rate to meet the MDGs obtained from Lorenz functions, we can generate the total amount of investment or finance required to support such growth rate. We then compute the 'resource-gap' as the difference between required investment rate and actual investment rate for each country. Since by assumption aid is the source of financing such gaps, it is possible to get the extra aid flows needed to meet the MDGs. This approach has been the basis of most of the influential reports on financing MDGs in recent years.

2.2. "Optimal" aid allocation model

The Financing Gap model discussed in the foregoing assumes that total aid flows into a country are more or less given exogenously so that any of initial conditions or subsequent economic changes does not affect its flows. In addition, the aid-growth link is established in the Financing Gap model through investment, while it is possible to obtain elasticity values directly[10]. In light of this, we introduce a simple model of aid-allocation that does rely on the empirical properties of aid-growth nexus to examine the optimal aid flow that can be a basis for the debate on how much aid can play in reducing poverty faster in the African continent. Using the insights of Collier and Dollar (1999) the optimal aid allocation can be viewed as an outcome of donor's objective to minimize poverty in each recipient country[11]. Given the following definition of variables;

P=aggregate poverty in the African continent
P_i =poverty in the i^{th} country
β_i = population share of i^{th} country;
μ_i = mean per capita income in country i

[9] Note that the parameter α_i can be regarded as representing long-term" growth for each country.
[10] This brings into the picture the aid-growth nexus, which is one of the most extensively researched topics in the aid literature. There are theoretical possibilities for aid not to have any impact on long term growth or even can be a hindrance (e.g. due to diminishing returns of aid, or nature of growth dynamics; see, Berthemley, 2006). Thus, it would be sensible to use a framework that is based on the empirical relationship between growth and aid.
[11] Other works that used optimal aid allocation model in the context of this study include Trumball and Wall (1994); Sawada et al (2008).

z_i = *the poverty line*
m_i = *the Gini coefficient that measures income inequality*
Y_i = *real GDP in ith country*
A_i = *aid as a percentage of GDP received by each country,*
$\bar{A}$ = *the total aid allocated in a particular year in say dollars*

We may write the objective of donors as:

Minimize :

$$P = \sum_{i=1}^{n} \beta_i P_i(z_i / \mu_i, m_i) \qquad (11)$$

Subect :

$$\overline{A} = \sum_{i=1}^{n} A_i Y_i$$

The specification of the poverty function in (11) is following the literature on the measurement of poverty that defines poverty to be a function of mean per capita income, the poverty line and the measure of income distribution.[12] The population share is entered into the aggregate poverty function by invoking one of the desirable properties of the popular poverty measures, which is additive decomposability across sub-groups (see Foster et al, 1984 and Foster and Shorrocks, 1991). Thus, global poverty is a sum of poverty in each country weighted by its population share. The first-order condition underlying (10) is given by:[13]

$$\frac{\partial L}{\partial A_i} = \beta_i \frac{\partial P_i}{\partial A_i} - \lambda Y_i = 0 \qquad (12)$$

We can rewrite [12] as:

$$\left[\beta_i \frac{\partial P_i}{\partial \mu_i} \frac{\partial \mu_i}{\partial A_i} \right] = \lambda Y_i$$

$$\beta_i \left[\left(\frac{P_i}{\mu_i} \right) \left(\frac{\partial P_i}{\partial \mu_i} \frac{\mu_i}{P_i} + \frac{\partial P_i}{\partial m_i} \frac{m_i}{P_i} \frac{\mu_i}{m_i} \frac{dm_i}{d\mu_i} \right) \frac{\partial \mu_i}{\partial A_i} \right] = \lambda Y_i \qquad (13)$$

$$\beta_i P_i \eta_i \varphi_i A_i^{-1} = \lambda Y_i$$

[12] See Ravallion (1992), Kakwani (1991) .
[13] We note that the second-order condition for minimum implies that the second-derivative of the poverty function with respect to mean per capita income to be negative. This is fair since the rate at which poverty declines with respect to growth in mean per capita income is diminishing assuming other things constant.

Where,

$$\eta_i = \frac{\partial P_i}{\partial \mu_i}\frac{\mu_i}{P_i}$$

$$\phi_i = \frac{\partial \mu_i}{\partial A_i}\frac{A_i}{\mu_i}$$

Rearranging (13), summing over i, and using [12], we can solve for λ as:

$$\lambda \overline{A} = \sum_{i=1}^{n} \beta_i P_i[\eta_i]\varphi_i$$

$$\Rightarrow \lambda = \frac{\sum_{i=1}^{n} \beta_i P_i[\eta_i]\varphi_i}{\overline{A}} \qquad (14)$$

Inserting the value of λ obtained in (14), we can solve for the optimal A_i^* as follows:
Let:

$$q_i = \beta_i P_i[\eta_i]\phi_i$$

$$w_i = \frac{q_i}{\sum_{i=1}^{n} q_i} \Rightarrow$$

$$0 \prec w_i \prec 1, \sum_{i=1}^{n} w_i = 1 \Rightarrow$$

$$A_i^* y_i = w_i \overline{A}$$

So that the total aid allocated to a given country depends on the value of w_I, which among other things depends on the level of poverty, the population share of the country among aid receiving countries and the responsiveness of poverty to a change in per capita income growth. It is also easy to compute the rate of change in global aid required to reach a target level of poverty. Using the basic results above, targeted rate of reduction in global poverty would be:

$$\frac{dP}{P} = \frac{1}{P}\left[\sum_{i=1}^{n} \beta_i p_i \frac{\partial p_i}{\partial A_i}\frac{A_i}{p_i}\frac{dA_i}{A_i}\right] = \frac{1}{P}\left[\sum_{i=1}^{n} \beta_i p_i \phi_i\right]\frac{d\overline{A}}{\overline{A}} \qquad (15)$$

Equation (15) states that the rate of change in global aid needed to reduce poverty by a certain rate, say half, depends primarily on current level of poverty and the responsiveness of poverty to aid. The higher initial poverty and the lower the responsiveness of poverty to aid, the higher is the aid requirement.

To operationalize the frameworks set out in this section, we compiled data on basic macroeconomic indicators from WDI (2007), on institutions from International Country Risk Guide (1984-2004), and other regional and geographic data from the Barro-Lee (1997) data set.

The data source to compute the growth rate required to meet MDGs and associated elasticities is fully explained in Bigsten and Shimeles (2007).

3. Discussion of results

Table (1) and (2) provide a profile of aid flow to Africa for the period 1960-2004. Accordingly, there has been a steady rise in the flow aid to Africa, from 5% as a share of GDP in the 1960s to 15% in the early 2000. The notable change is the share of aid in total investment over the last forty years. It has increased from 40% in the 1960s to nearly 80% in the early 2000, suggesting perhaps the role foreign aid plays in financing development in Africa.

There are some clear patterns on the flow of aid to Africa in the last four decades. In general, poorest countries received proportionately higher aid than richest (relatively speaking) countries within the continent, perhaps indicating donor preference to support poor economies. On the other hand, also, we notice a larger share of aid going to *Island* countries, compared to *land-locked* countries, which may be explainable by national interests of donor countries. The general pattern of aid flow seems to be a little mixed with respect to institutional quality. Countries with better sense of democratic accountability, stable government, good socio-economic condition, better investment profile, less corruption, and ethnic tension seem to have received relatively larger aid during the period under study. Where as, countries with high degree of internal and external conflict, strong presence of the military and religious groups in politics, relatively chaotic countries also received better aid. Thus, donors seem to favor both aspects of institutional spectrum, which may be explainable by the desire to avert humanitarian crisis somewhere as well as promote development elsewhere.

In short, the aid-growth relationship that one attempts to find from cross-country regressions already exhibits a strong presence of simultaneity bias, which prevents sensible generalizations on whether or not, aid promotes growth in Africa. That is an identification problem arises in the direction of causation as depicted in Figure 2 where aid flows have increased in times of economic decline as well as recovery.

The first set of results based on the Financing Gap model indicates that Africa's total aid need to be doubled to reduce extreme poverty by half in 2015 (Table 3). This finding is consistent with the current thinking of the Big-Push approach to development financing, particularly for the African continent. However, how robust is this result? Based on an estimating equation given in (10), the value of ICOR has changed substantially. On the average, the ICOR fell from 6 to 4 (an improvement of 33%) when a different estimation method was used (Table 4). The regression based estimate of ICOR could be regarded as "an ideal ICOR" for a typical country in the continent to attain controlling of course for country-level effects which could reflect better the quality of investment in Africa (see also Easterly, 2003). In this case, current aid flow is sufficient for Africa to be able to reduce extreme poverty by half in 2015. The implications of such divergent results are interesting for the debate on scaling up aid to Africa.

The driving workhorse of the Big-Push paradigm is the belief that African countries are stuck in low-equilibrium trap that can only be broken through massive injection of capital and technology. Our result points out to the possibility that if current aid flow is sustained, then, it

would be sufficient to support the growth rate required to cut poverty by half! Or in other words, even when this estimate may not accurately reflect the quality of investment in Africa, efforts to improve efficiency of investment and thus foreign aid could take the continent a long way in reaching the MDGs.

One of the often-emphasized topics in the recent literature on growth in Africa is the issue of quality of economic and political institutions. Given that institutions are quasi-endogenous, that is, are shaped by collective choices and decisions at the highest level of government, it can be argued that it is possible for African countries to enhance the quality of governance with a lot of good will and perhaps less effort. If that can happen, it is possible to get reasonable progress in total productivity, a variable closely associated with ICOR.

To reflect the role of institutions in affecting ICOR, we ran a regression of ICOR on the average of a set of indicators of institutional quality based on data provided by ICRG (International Country Risk Guide). The variables that capture institutional quality are bureaucratic quality, democratic accountability, government stability, socio-economic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, law and order, religion in politics and ethnic strife. For each country we took a long-term average covering the period 1980-2004, hoping to capture the sustained quality of overall institutions that support productivity of investment. Other control variables used in the regression include dummies for petroleum-producing economies, islands, and land-locked countries. The result as reported in Table 5 is revealing. A 10% improvement in the quality of overall institutions could lead to a 1.3% decline in the value of ICOR in a typical case, a result which is quite interesting on its own right[14]. ICOR has also geographic sensitivity. Comparatively speaking petroleum-producing countries are inefficient, while countries that are land-locked and Island seem to be doing well in investment utilization.

Figure (2) also reports an interesting association between indicator of governance and total productivity growth obtained from a simple growth accounting model estimated for a large number of African countries for the period 1960-2002. We note that countries with better institutions exhibit higher level of productivity growth and thus lower ICOR. Thus, it would be worthwhile to examine the challenges of improving the quality of institutions in Africa, and how foreign aid can be deployed to meet that end.

As it is, resource gaps estimated on the basis of ICOR has its own limitations, which have been discussed in Section 2. It would be interesting to know how the optimal aid-allocation model performed in the African context and perhaps use the results as a guide for research in the aid-growth nexus. It was mentioned in Section 2 that the strength of the optimal aid-allocation model is that it allows explicitly for aid-growth nexus that could be drawn from empirical evidence. If for instance, it is found that aid does not have any significant impact on either long-term growth or poverty (e.g as in Rajan and Subramanian, 2008), then, there is no point in spending effort to compute the additional aid needed to reach a certain target growth rate. Rather the point worth putting in some effort would be in understanding why aid cannot bring about growth. Secondly,

[14] Index of institutional quality gets better as it increases in value.

this approach takes into account donors' preference while in the Financing Gap models supply of aid is exogenous to the model.

The first challenge one confronts in using the optimal-aid allocation model is to find a significant relationship between long-term growth and aid. One of the serious problems in the empirical literature is the simultaneity bias that plagues cross-country data on aid and growth. That is, it is not easy to disentangle the effect of aid on long-term growth, since the supply of aid itself is partly a function of long-term growth. In the context of Africa, Figure (2) provides a vivid picture where aid in general has been rising over time as a share of GDP, while growth had a cyclical trend, mostly on a downward direction, to a certain extent supporting the simultaneity bias argument. In such a situation, one has to resort to system equation approach where both aid and growth appear as dependent variables in different specifications, or use instruments for aid that are not correlated with growth but are correlated with aid alone. All of these methods have been attempted in the literature. Some used for instance Colonial history, geography and other exogenous variables that are correlated with aid but not with economic growth to disentangle the supply side from the growth-effect model and others use lags of the explanatory variables, including the dependent variable itself to instrument for the endogenity of aid flows.

To illustrate the endogenity problem, consider Table (6), which reports results from a regression of log per captia on log aid using Random-effects model where unobserved country-specific effects are controlled for. The coefficient associated with aid is negative and significant implying that more aid is bad for growth[15]. As expected, this could be either true, or largely driven by the simultaneity bias we have discussed above. To resolve this issue, we resorted to quintile regression method, which among other things reduces the data to a relatively homogenous group as dictated by the level of quintile. In our case, since the level of economic development drives aid, we conducted the regressions by income decile and found a positive relationship between aid and long-term growth in each case. While further work is warranted to examine in detail whether our result is robust, it is sufficient for the purpose of operationalizing our model.

On the basis of the coefficient on aid obtained from the quintile regressions, Table (7) reports optimal share of aid for African countries for which we have the prerequisite information. It is useful to note that the model stipulates that if the objective of donors is to minimize poverty in Africa, more aid should go to countries with high initial (current) poverty, and those that can utilize aid efficiently for the purposes of growth and can make maximum impact on poverty. These three sets of conditions as well as share of population would drive the optimal aid allocation rule. As reported in Table (8) the optimal aid allocation rule and the actual aid flows have significant divergence. Poverty efficient aid-allocation explains only about 20% of current aid flow (Figure 3), while in the rest of cases aid allocation is driven by other factors. This takes us back to the current issue on aid-architecture where donors are urged to focus on development and recipients are advised to use aid-efficiently.

Finally, it is important to notice the tension between efficient utilization of aid and high initial poverty in driving the optimal-aid allocation. Research has shown that countries with high initial poverty tend to have low elasticity of poverty with respect to growth and as Table (7) showed also not significantly higher efficiency in aid utilization. Thus, being poor currently alone does

[15] The same result holds when the dependent variable is growth

not warrant more aid, it has to be accompanied by high utilization of aid for growth and poverty reduction.

4. Conclusions

This paper attempted to examine the financing of growth targeted at reducing extreme poverty by half in 2015 by African countries. It employed the Financing Gap model and a simple model of optimal aid allocation to explore the issues. Preliminary results suggest that the financing gap critically depends on the parameters driving the target growth rate and the quality of investment in the case of the Financing Gap model. Results show that the total aid needed to ensure the growth target consistent with the reduction of extreme poverty by half ranges from the doubling of current aid to the sufficiency of current aid. Such divergent results point out to the importance of improving the quality of investment in Africa, which partly could be determined by the overall political and economic institutions. Our estimate for instance suggests that a 10% improvement in the overall quality of institutions could lead to an improvement in the value of ICOR by about 1.3%.

Thus, reforms directed at good governance go a long way in improving the quality of investment to generate more growth. With regard to the issue of aid and growth, the paper used a model of optimal aid allocation where the link between aid and growth was the crucial link to compute the resources needed to minimize poverty in Africa. The model predicts that donors would prefer to give more aid to countries with high initial poverty and efficient at translating aid into growth and growth into poverty reduction. A comparison of actual aid allocation with simulated ('optimal') one indicated that only a small part of aid allocation is consistent with the objective of reducing poverty in Africa. This further reinforces the legitimacy of the current debate to reform the aid architecture! A couple of heuristic estimates on the link between aid and growth suggest that at least for the sample of countries covered in the regressions aid has a potential to promote short term (Table 9) as well as long-term growth (Table 10).

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Table 1. Profile of Aid in Africa by key characteristics

	Decadal Averages				
	1960-1970	1971-1980	1981-1990	1991-2004	1960-2004
Aid and Government (aggregates)					
Aid(% of central government Expenditures)	22.03	34.21	38.95	29.93	34.82
Aid(% of GDP)	5.34	8.73	13.4	14.61	11.07
Aid(% of gross capital formation)	40.08	46.76	76.57	79.59	63.67
Aid by special characteristics					
Aid (% of GDP)					
petroleum exporting countries	5.49	9.81	9.48	12.79	9.6
non-petroleum exporting countries	5.32	8.61	13.77	14.78	11.22
Aid per-capita (current USD)					
Petroleum exporting countries	5.18	24	43.07	47.95	39.22
non-petroleum exporting countries	8.44	28.97	59.01	55.94	30.31
Geography					
Aid (% of GDP)					
Island	12.51	14.22	18.07	15.07	15.06
landlocked	4.06	7.67	8.95	9.15	7.7
Others	4.6	8.09	14.6	17.24	11.9
Aid per-capita (current USD)					
Island	15.81	52.19	88.12	66.81	58.33
landlocked	8.44	36.71	66.57	53.09	42.1
Others	6.83	22.19	48.01	54.02	33.33
Region					
Aid (% of GDP)					
North	5.36	8.44	10.44	10.45	9.31
East	5.53	8.4	14.744	19.49	13.11
Central	6.2	6.64	8.32	8.51	7.44
South	5.03	10.69	10.35	10.37	9.27
West	4.74	9.11	18.31	18.72	13.45
Aid per-capita (constant USD)					
North	5.92	25.4	50.53	41.68	31.21
East	8.3	21.31	57.76	61.02	39.5

Central	8.84	23.7	40.2	38.93	27.98
South	9.29	46.63	77.76	71.16	51.88
West	7.92	26.6	56.42	54.7	37.6

Source: authors' computations based on data from OECD/DAC various years

Table 2. Profile of aid by Investment Risk and Bureaucratic Quality (top and bottom Quantiles)

Classification by	Decadal Averages				
	1960-1970	1971-1980	1981-1990	1991-2004	1980-2004
Aid (% of GDP)					
Democratic Accountability					
Best	*N.A*	*N.A*	14.81	13.07	11.44
Worst	*N.A*	*N.A*	12.71	15.44	9.79
Government Stability					
Best	*N.A*	*N.A*	13.03	18.37	11.88
Worst	*N.A*	*N.A*	8.43	10.46	8.09
Socio-Economic Conditions					
Best	*N.A*	*N.A*	11.09	12.07	13.12
Worst	*N.A*	*N.A*	11.74	12.4	11.19
Investment Profile					
Best	*N.A*	*N.A*	15.08	13.76	10.14
Worst	*N.A*	*N.A*	14.02	10.65	9.02
Internal Conflict					
Best	*N.A*	*N.A*	9.81	15.33	9.99
Worst	*N.A*	*N.A*	14.03	15.99	11.58
External Conflict					
Best	*N.A*	*N.A*	13.34	16.23	9.83
Worst	*N.A*	*N.A*	14.41	14.84	11.92
Corruption					
Best	*N.A*	*N.A*	16.75	14.25	17.45
Worst	*N.A*	*N.A*	18.45	16.88	9.886
Military in Politics					

Best	*N.A*	*N.A*	17.57	13.1	9.46
Worst	*N.A*	*N.A*	16.59	17.59	12.14
Religion in Politics					
Best	*N.A*	*N.A*	11.78	10.48	9.25
Worst	*N.A*	*N.A*	15.14	18.9	12.01
Law and Order					
Best	*N.A*	*N.A*	13.62	15.24	9.45
Worst	*N.A*	*N.A*	16.44	11.38	10.23
Ethnic Tension					
Best	*N.A*	*N.A*	12.92	15.25	11.27
Worst	*N.A*	*N.A*	3.37	14.49	8.41
Aid per-capita (in constant 1995 USD)					
Democratic Accountability					
Best	*N.A*	*N.A*	65.92	54.92	35.38
Worst	*N.A*	*N.A*	46.44	45.84	26.17
Government Stability					
Best	*N.A*	*N.A*	44.66	57.42	31.3
Worst	*N.A*	*N.A*	36.4	43.45	41.05
Socio-Economic Conditions					
Best	*N.A*	*N.A*	51.23	46.68	35.43
Worst	*N.A*	*N.A*	64.21	67.15	46.2

….contd.

Classification by	Decadal Averages				
	1960-1970	1971-1980	1981-1990	1991-2004	1980-2004
Investment Profile					
Best	*N.A*	*N.A*	52.3	50.8	30.05
Worst	*N.A*	*N.A*	59.96	51.44	40.3
Internal Conflict					
Best	*N.A*	*N.A*	49.68	60.21	38.93
Worst	*N.A*	*N.A*	52.77	51.24	36.4
External Conflict					
Best	*N.A*	*N.A*	67.7	68.74	35.8
Worst	*N.A*	*N.A*	71.25	52.24	34.7
Corruption					

Best	*N.A*	*N.A*	76.32	55.82	46.22
Worst	*N.A*	*N.A*	59.4	51.34	29.99
Military in Politics					
Best	*N.A*	*N.A*	94.48	54.5	28.4
Worst	*N.A*	*N.A*	51.36	43.55	32.03
Religion in Politics					
Best	*N.A*	*N.A*	47.24	43.77	29.26
Worst	*N.A*	*N.A*	101.74	69.63	49.93
Law and Order					
Best	*N.A*	*N.A*	61.25	51.79	31.88
Worst	*N.A*	*N.A*	41.15	43.16	22.91
Ethnic Tension					
Best	*N.A*	*N.A*	45.68	61.42	34.55
Worst	*N.A*	*N.A*	52.84	42.88	25.33
Aid flow (by per-capita GDP Quintiles-GDP per-capita in constant 1995 USD)					
Poorest	5.28	11.55	15.98	21.5	15.19
Richest	6.65	6.51	4.3	2.38	4.39

Source: author's computations based on data from International Country Risk Guide and OECD/DAC

Table 3: Financing target growth rates to reduce poverty by half in 2015: mean ICOR's

Country Name	Annual growth rate in per capita consumption required to meet MDGs	Population Growth (average: 1980-2004)	GDP Growth Rate required to meet MDGs(%)	ICOR (average 1980-2004)	Savings as % of GDP(average 1980-2004) %	Investment (average 1980-2004) % of GDP	Aid % of GDP (average 1980-2004)	Investment required (ICOR*GDP growth)	Additional aid required (% of GDP)
Algeria	1.02	2	3	9	32	28	0	28	0
Egypt, Arab Rep.	0.5	2	3	6	21	22	5	15	-7
Morocco	0.66	2	3	5	21	23	3	13	-10
Tunisia	0.76	2	3	7	23	27	2	18	-9
Benin	3.7	3	7	4	6	16	11	30	14
Botswana	2.36	2	5	5	38	28	5	22	-5
Burkina Faso	3.01	3	6	7	11	19	14	41	22
Burundi	2.05	2	4	5	8	13	20	22	9
Cameroon	1.32	3	4	4	16	18	5	14	-5
Cape Verde	3.1	2	5	8	18	27	26	42	16

Central African Republic	4.94	2	7	5	6	11	13	39	28
Chad	3.9	3	7	3	1	15	13	19	4
Comoros	3.7	2	6	6	6	17	22	38	21
Congo, Dem. Rep.	4.2	3	7	5	4	9	10	35	26
Congo, Rep.	3.6	3	7	7	13	28	7	47	19
Cote d'Ivoire	0.84	3	4	6	10	13	5	23	10
Eritrea	4	2	6	10	13	25	28	65	40
Ethiopia	4.24	3	7	4	11	15	12	26	11
Gabon	2.5	3	5	7	25	29	2	39	10
Gambia, The	3.11	3	7	6	13	20	24	39	19
Ghana	1.9	3	5	4	11	16	9	18	3
Guinea	3.8	3	7	5	11	17	10	36	19
Guinea-Bissau	4	3	7	7	0	26	49	44	19
Kenya	1.86	3	5	7	16	18	7	36	19
Lesotho	3.4	1	5	11	34	44	11	55	11
Madagascar	1.9	3	5	5	5	13	11	24	11
Malawi	2.23	3	5	4	0	15	23	22	7
Mali	4.8	3	7	7	10	21	18	50	30
Mauritania	2.07	3	5	7	14	21	23	30	9
Mauritius	2.7	1	4	5	24	24	2	19	-5
Mozambique	1.89	2	4	5	1	20	31	20	0
Namibia	2.4	3	5	7	25	20	4	40	19
Niger	2.85	3	6	4	5	12	15	27	15
Nigeria	3.43	3	6	7	19	19	1	42	23
Rwanda	1.06	2	3	4	10	15	20	12	-3
Sao Tome and Principe	3.6	2	6	13	-15	28	72	72	44
Senegal	1.8	3	4	4	5	15	13	20	5
Seychelles	2.3	1	3	5	19	27	7	17	-9
Sierra Leone	4.1	2	6	3	3	10	19	18	8
South Africa	0.67	2	3	6	20	19	0	17	-2
Sudan	3.8	2	6	3	7	15	5	18	4
Swaziland	1.73	3	5	7	20	22	4	33	10
Tanzania	3.41	3	6	6	5	20	18	41	21
Togo	3.9	3	7	4	9	18	10	31	13
Uganda	4.44	3	8	4	5	14	12	29	15

Zambia	4.03	3	7	5	3	14	20	34	20
Zimbabwe	2.33	2	5	6	13	17	4	26	9
Average	2.76	3	5	6	12	20	14	31	11

Source: author's computations (see text for data sources)

Table 4: Financing target growth rate to reduce poverty by half in 2015 regression based ICOR

Country Name	Annual growth rate in per capita consumption required to meet MDGs	Population Growth (average: 1980-2004)	GDP Growth Rate required to meet MDGs(%)	ICOR (average 1980-2004)	Savings as % of GDP(average 1980-2004) %	Investment (average 1980-2004) % of GDP	Aid % of GDP (average 1980-2004)	Investment required (ICOR*GDP growth)	Additional aid required (% of GDP)
Algeria	1.02	2	3	4.00	32	28	0	13	-15
Benin	3.7	3	7	2.83	6	16	11	20	4
Botswana	2.36	2	5	6.34	38	28	5	29	2
Burkina Faso	3.01	3	6	3.37	11	19	14	19	0
Burundi	2.05	2	4	1.87	8	13	20	8	-5
Cameroon	1.32	3	4	3.24	16	18	5	12	-6
Cape Verde	3.1	2	5	7.99	18	27	26	42	16
Central African Republic	4.94	2	7	1.30	6	11	13	9	-2
Chad	3.9	3	7	2.72	1	15	13	19	4
Comoros	3.7	2	6	6.36	6	17	22	38	21
Congo, Dem. Rep.	4.2	3	7	5.00	4	9	10	35	26
Congo, Rep.	3.6	3	7	3.95	13	28	7	27	-1
Cote d'Ivoire	0.84	3	4	2.11	10	13	5	9	-5
Egypt, Arab Rep.	0.5	2	3	4.57	21	22	5	12	-10
Eritrea	4	2	6	4.61	13	25	28	29	4
Ethiopia	4.24	3	7	2.48	11	15	12	17	1
Gabon	2.5	3	5	3.34	25	29	2	18	-11
Gambia, The	3.11	3	7	3.16	13	20	24	21	1
Ghana	1.9	3	5	2.40	11	16	9	11	-5
Guinea	3.8	3	7	3.22	11	17	10	21	4
Guinea-Bissau	4	3	7	3.16	0	26	49	21	-4
Kenya	1.86	3	5	2.90	16	18	7	14	-4
Lesotho	3.4	1	5	6.45	34	44	11	31	-13
Madagascar	1.9	3	5	1.22	5	13	11	6	-7
Malawi	2.23	3	5	4.23	0	15	23	22	7
Mali	4.8	3	7	2.96	10	21	18	22	1
Mauritania	2.07	3	5	3.63	14	21	23	17	-4

Mauritius	2.7	1	4	5.05	24	24	2	19	-5
Morocco	0.66	2	3	3.64	21	23	3	9	-14
Mozambique	1.89	2	4	5.11	1	20	31	20	0
Namibia	2.4	3	5	2.85	25	20	4	15	-5
Niger	2.85	3	6	1.31	5	12	15	8	-4
Nigeria	3.43	3	6	2.61	19	19	1	16	-3
Rwanda	1.06	2	3	2.64	10	15	20	9	-6
Sao Tome and Principe	3.6	2	6	12.81	-15	28	72	72	44
Senegal	1.8	3	4	2.42	5	15	13	11	-4
Seychelles	2.3	1	3	5.12	19	27	7	17	-9
Sierra Leone	4.1	2	6	0.14	3	10	19	1	-9
South Africa	0.67	2	3	2.44	20	19	0	7	-12
Sudan	3.8	2	6	2.65	7	15	5	17	2
Swaziland	1.73	3	5	3.94	20	22	4	18	-4
Tanzania	3.41	3	6	3.23	5	20	18	20	0
Togo	3.9	3	7	2.25	9	18	10	16	-2
Tunisia	0.76	2	3	4.42	23	27	2	12	-15
Uganda	4.44	3	8	3.29	5	14	12	26	11
Zambia	4.03	3	7	1.54	3	14	20	10	-4
Zimbabwe	2.33	2	5	2.18	13	17	4	10	-6
Average	2.76	3	5	4	12	20	14	31	-1

Source: author's computations (see text for data sources)

Table 5: OLS estimate of ICOR and quality of institutions in Africa: average 1984-2004- robust statistics

Dependent variable: mean ICOR value	Coefficient	p-value
Average quality of institution	-0.302604***	[3.51e-05]
Country is landlocked	-0.628996***	[0.00436]
Country is an island	-0.854016***	[4.31e-07]
Petroleum exporting	-0.24841	[0.259]
Constant	4.961975***	[0]
F-value	10.97	
Observations	437	

*** p<0.01, ** p<0.05, * p<0.1

Source: author's computations (see text for data sources)

Table 6: per capita –versus aid: Random effects model

Variables	
Log of aid per capita	-0.067
	(3.82)**
Quality of institutions	-0.006
	(5.32)**
Initial GDP	0.636
	(3.72)**
Initial life expectancy	0.097
	(2.85)**
Constant	-1.053
	-0.7
Observations	338
Number of country code	23
Absolute value of z statistics in parentheses	
* significant at 5%; ** significant at 1%	

Source: author's computations (see text for data sources)

Table 7:Qunitile regression of log per capita GDP on aid for African countries: 1960-2004

	Poorest	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Richest
Log of aid per capita	0.216	0.326	0.3231	0.1729	0.1828	0.1988	0.326	0.3253	0.2646	-0.0226
	(8.38)**	(15.05)**	(8.23)**	(4.44)**	(5.56)**	(4.59)**	(4.09)**	(4.99)**	(7.07)**	-1.09
Period Dummy	0.144	-0.0456	-0.0637	-0.0614	-0.0622	-0.1073	-0.1913	-0.1882	0.0236	0.489
	(2.04)*	-0.86	-0.77	-0.8	-1.03	-1.38	-1.44	-1.78	-0.42	(12.09)**
Quality of institutions	-0.005	-0.0126	-0.0071	-0.007	-0.0068	-0.011	-0.0139	-0.0249	-0.0256	-0.0212
	-1.39	(5.86)**	(2.19)*	(2.30)*	(2.82)**	(3.52)**	(2.67)**	(6.03)**	(13.19)**	(4.22)**
Constant	-0.037	0.7649	0.8238	1.6071	1.4977	1.6563	2.1208	3.0297	3.7492	1.7206
	-0.13	(3.59)**	(2.24)*	(4.29)**	(4.95)**	(4.22)**	(2.98)**	(5.90)**	(14.56)**	(5.85)**

Absolute value of z in parenthesis, *significant at 5%, ** significant at 1%

Source: author's computations (see text for data sources)

Table 8: Comparison of optimal aid-allocation with actual aid-allocation in selected African countries (1981-2001)

	Optimal aid allocation	Actual allocation of aid (1980-2001)	Difference
Algeria	0.006269	0.006902	-0.00063
Botswana	0.003247	0.003332	-8.4E-05
Burkina Faso	0.032026	0.022668	0.009359
Burundi	0.01653	0.015976	0.000554
Cameroon	0.040722	0.016922	0.0238
Central Africa Rep.	0.006217	0.007848	-0.00163
Cote d'Ivore	0.032835	0.025085	0.007749
Egypt	0.115578	0.105456	0.010123
Ethiopia	0.144033	0.116317	0.027716
Gambia	0.002346	0.010335	-0.00799
Ghana	0.065927	0.02533	0.040596
Kenya	0.043311	0.057107	-0.0138
Lesotho	0.003296	0.006762	-0.00347
Madagascar	0.044595	0.021091	0.023503
Malawi	0.018178	0.044144	-0.02597
Mali	0.016172	0.023193	-0.00702
Mauritania	0.004045	0.011562	-0.00752
Morocco	0.005574	0.053604	-0.04803
Mozambique	0.032228	0.1002	-0.06797
Namibia	0.002448	0.004239	-0.00179
Niger	0.039349	0.022528	0.016821
Nigeria	0.157203	0.006026	0.151176
Rwanda	0.034269	0.020776	0.013493
Senegal	0.017421	0.030691	-0.01327
South Africa	0.004887	0.011281	-0.00639
Swaziland	6.43E-05	0.003423	-0.00336
Tanzania	0.037471	0.155556	-0.11808
Tunisia	0.000177	0.015135	-0.01496
Uganda	0.039552	0.017483	0.02207
Zambia	0.011808	0.029079	-0.01727
Zimbabwe	0.022221	0.00995	0.012271
Total	1	1	

Source: author's computations (see text for data sources)

Table 9: GMM estimate of effect of aid on per capita GDP growth in selected African countries

Dependent variable (Growth in per capita GDP)	Coefficient	Z-value
Growth in lagged per capita GDP	0.528	4.53***
$(\text{Change in aid/GDP ratio})_{t-1}$	.002	2.05**
$(\text{Change in aid/GDP ratio})^2_{t-1}$	-.000047	-1.68*
Period 3 (1987)	.007	0.4
Period 5 (1993)	-.075	-2.42**
Period 6 (1996)	-.027	-0.54
Period 7 (1999)	0.0023	0.03
Period 8 (2001)	-0.003	-0.04
Sargan's over-identification test (p-value)		0.5741
AR1		-1.86
AR2		0.34

Other control variables include the 12 indicators of economic and political governance.
*significant at 10%, ** significant at 5%, *** significant at 1%

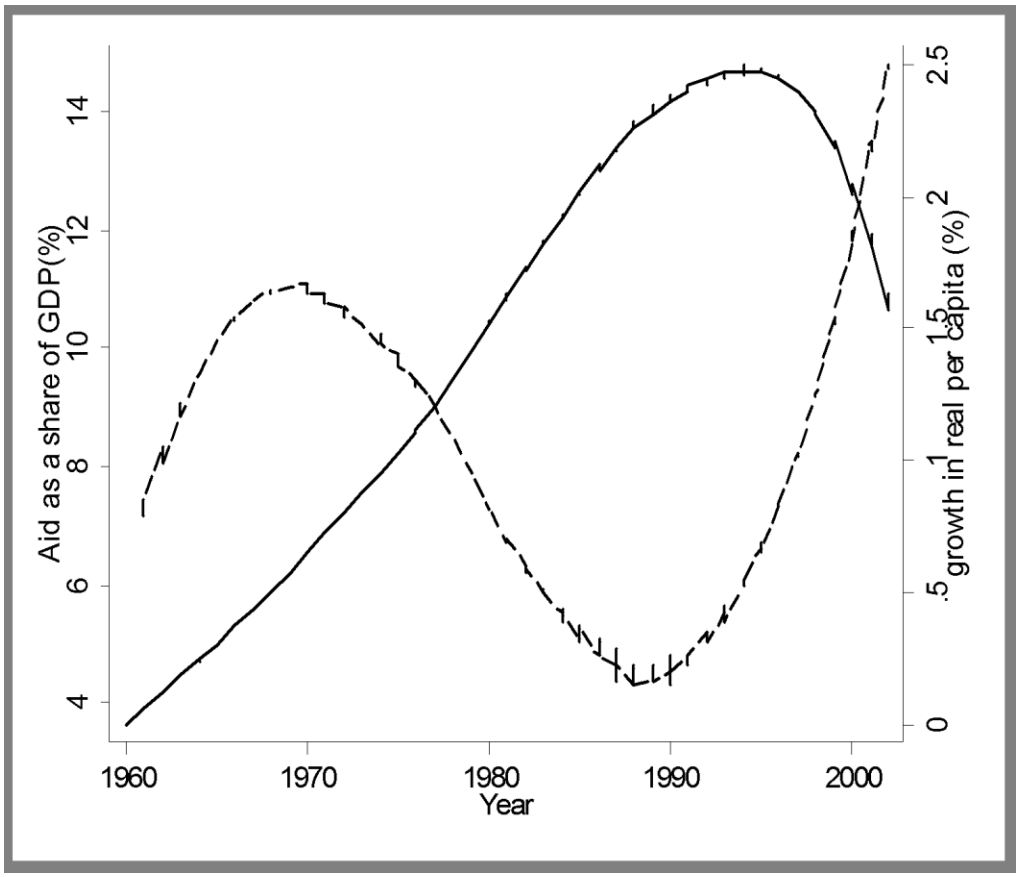
Table 10: Probit estimate of correlation between aid and stability of growth*

Long term aid flow (average 1960-2004)	-0.167
	(3.18)**
(Long term aid flow)^2 (average 1960-2004)	0.006
	(3.29)**
Bureaucratic quality	0.143
	-0.89
Democratic accountability	-0.294
	(2.25)*
Government stability	0.139
	1.62
Socio-economic conditions	0.105
	1.06
Investment profile	-0.143
	-1.61
Internal conflict	-0.018
	-0.24
External conflict	-0.272
	(4.63)**
Corruption	0.39
	(2.28)*
Military in politics	0.41
	(4.24)**
Religion in politics	0.131
	-1.27
Law and order	-0.007
	-0.05
Ethnic tension	0.26
	(2.00)*
Constant	1.181
	-1.29
Observations	164

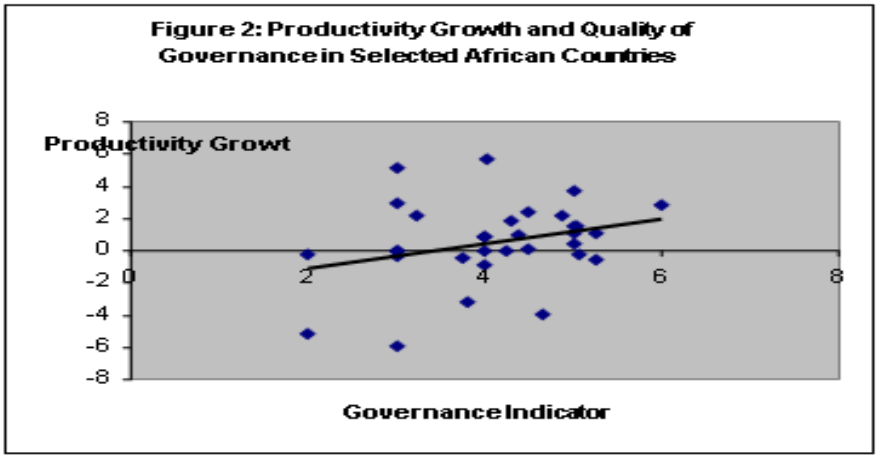
**Using the classification by Berthelemey (2006), a dummy is constructed for a country that experienced stable growth at least once during 1960-2004.*

Source: author's computations (see text for data sources)

Figure 1: Aid as a share of GDP and real per capita growth in Africa: 1960-2004

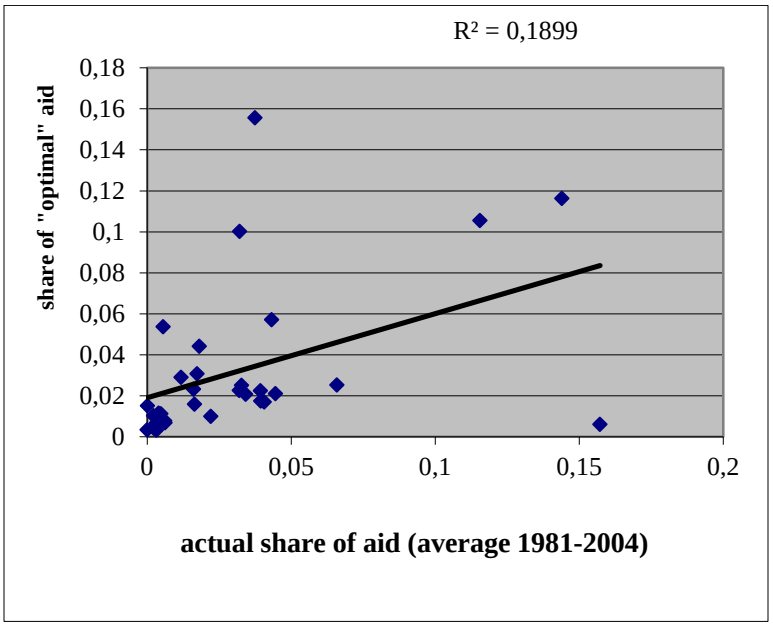


Source: author's computations (see text for data sources)



Source: author's computations (see text for data sources)

Figure 3: optimal aid vs actual aid allocation in selected African countries



Source: author's computations (see text for data sources)

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African Development Bank
Angle de l'avenue du Ghana et des rues Pierre
de Coubertin et Hédi Nouira
BP 323 –1002 Tunis Belvédère (Tunisia)
Tel.: +216 71 333 511 – Fax: +216 71 351 933
E-mail: afdb@afdb.org – Internet: www.afdb.org