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Does Foreign Aid In Education Promote Economic Growth? Evidence From Sub-Saharan Africa

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ABSTRACT

This paper examines whether foreign aid in education has a significant effect on growth in Sub-Saharan Africa. Our analysis covers 38 countries over the period 1990-2004 and we control for initial per capita income, inflation, investment, government consumption, openness to trade and institutional quality. We find that (i) aid in primary education has a positive and significant effect on growth; (ii) aid in post-primary education has an adverse effect or at best no significant impact on growth; and (iii) growth increases as aid in primary education as a share of total education aid rises.

Keys-words: Africa, Education, Foreign Aid, Growth
JEL Classification: F35, I25, O55

INTRODUCTION

Without a doubt a literate population is a pre-requisite for economic success. Thus, it is encouraging that in the past few years the international community has increased their resolve to provide universal primary education in developing countries. Specifically, the second of the United Nation's Millennium Development Goals is "to ensure that by the year 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling."(United Nations, 2000, pp. 5). Also, in the 2000 meeting of the *Education for All* (EFA) movement held in Senegal, the EFA identified six goals to be achieved by the year 2015. The second goal on the list is to provide free and compulsory primary education for all.[1] Indeed, in the past decade there has been a substantial increase in the amounts of foreign aid that goes into supporting primary education. For example, aid in primary education from the Development Assistance Committee (DAC) member countries increased from an average of $0.126 million per recipient country in 1993-96 to about $5.57 million in 2000-2004 (OECD, 2006).[2] Furthermore an increasing share of the education aid budget is being allocated to primary education: aid in primary education as a share of total education aid increased from about 13 percent in 1993-96 to about 22 percent in 2000-2004 (OECD, 2006).

This paper analyzes the effect of education aid on economic growth in Sub-Saharan Africa (SSA). We are particularly interested in analyzing the growth effects of aid in primary education. The paper focuses on SSA for the following six reasons. First, educational attainment is lower in SSA than in other regions. For instance, more than 40 percent of the world's out-of-school children (about 46 million children) live in SSA. In addition literacy rates and primary school completion rates for SSA are relatively lower. For example the youth literacy rates and primary school completion rates for SSA, averaged over the period 2000-2004 were 68 percent and 55 percent, respectively (World Bank, 2006). This compares with literacy rates and completion rates of 93 percent and 85 percent for the Middle East, 95 percent and 96 percent for Latin America, and

[1] In March 1990, delegates from 155 countries and representatives from 150 governmental and non-governmental organizations adopted a *World Declaration on Education for all*—to make primary education accessible to all children by the end of the decade.

[2] There are 22 DAC members: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States.

73 percent and 76 percent for South Asia (World Bank, 2006). Second, the effort of the international community to raise literacy rates seems to be more focused on countries in SSA than countries in other regions. For example, over the period 2000-2004, education aid as a share of GDP was about 0.9 percent for SSA and 0.46 percent for non-SSA countries, and aid in primary education as a share of the total aid in education was about 31 percent for SSA and 17 percent for countries outside SSA (OECD, 2006). Third, aid in primary education to SSA has increased substantially over the past decade. Over the period 1990-93 and 2000-2004, the average annual aid in primary education as a share of GDP, from DAC countries increased from 0.012 percent to 0.243 percent. In addition, the average annual aid in primary education as a share of total education aid increased from about 20 percent from 1990-93 to about 31 percent from 2000-2004 (OECD, 2006). It is therefore important to analyze whether the increase in aid has contributed significantly to economic growth in the region. Another reason for focusing on SSA is that foreign aid to the region is expected to increase substantially in the next few years. In 2005, the G8 pledged to raise annual development aid to SSA by $25 billion by 2010—i.e., more than double the levels in 2004. Thus, analyzing the effect of aid in education on growth will provide donors with some guidance on how (e.g., which sectors) to allocate aid. The fifth reason for focusing on SSA is that several studies have found that the determinants of growth have a differential impact for countries in SSA (Easterly and Levine, 1997; Block, 2001, Artadi and Sala-i-Martin, 2003).[3] For example, SSA's growth performance may be different from that of other regions because of its geographical location, colonial heritage or ethnic diversity.[4] Furthermore, some studies have found that aid is less effective in countries that are located in the tropics (Dalgaard et al., 2004; Roodman, 2004). About 92 percent of SSA's territories lie within the tropics (compared with about 3 percent for OECD, 8 percent for North Africa and 60 percent for East Asia), suggesting that the growth effects of foreign aid in SSA may be different from that in other regions. Finally, we focus on SSA because there is a widespread notion among policymakers in the region that the conclusions based on studies of non-SSA countries are not applicable to SSA because countries in the African region are

[3] In many cross-country growth regressions, the 'Africa' dummy is negative and significant.

[4] See Sachs and Warner (1997) for a discussion about how geography affects growth; Acemoglu.et al. (2001) about the effect of colonial heritage on growth; Easterly and Levine (1997) for a discussion about the effect of ethnic diversity on growth.

so different. Therefore, the findings from studies that are based solely on SSA will have more credibility with policymakers in the region.

In linking education aid to growth, we note that the new endogenous growth and augmented Solow models stipulate a positive relationship between education and growth (e.g., Lucas, 1988; Romer, 1990; Mankiw et al. 1992). Furthermore, several empirical studies have found that the stock of human capital and the level of investment in education are positively associated with growth (e.g., McMahon, 1998; Keller, 2006).[5] Education aid provides resources to finance education (e.g., build schools, hire and train teachers, provide textbooks and other school supplies for students) and can therefore improve the quality of education as well as the quantity of educated citizens (e.g., an increase in enrollment rates) in recipient countries.[6] The association between education aid and schooling outcomes is supported by anecdotal evidence from several countries and is also consistent with the empirical findings of Dreher et al., (2006). For example in January 2006, Ghana started implementing the New Partnership for Africa's Development (NEPAD) school feeding program— a program funded by foreign aid which provides each primary school child with a well balanced meal on each school attendance day. Initial results indicate that enrollment has more than doubled and absenteeism has declined substantially since the inception of the program.[7] Dreher et al., (2006) find a positive and robust association between education aid and primary enrollment rates. Thus, we argue that education aid may influence growth in recipient countries by facilitating the accumulation of human capital in these countries.

Our work relates to the voluminous empirical literature that examines the effect of foreign aid on growth. One of the limitations of this literature is that most of the studies employ *aggregate* data on aid. This is problematic because using aggregate data on aid presumes that the effect of aid on growth is the same for all the various categories of aid (e.g., education, physical infrastructure and military aid). The importance of using disaggregate data is well articulated in Harms and Lutz (2004, p. 23) who note that "It is also not surprising that a

[5] See Krueger and Lindahl (2001) for a review of the literature.

[6] Note that if education aid is fungible, then the arguments advanced above do not hold since an increase aid will not translate into an overall increase in expenditure for education. However, Devarajan et al. (1999) find evidence that education aid in SSA is non-fungible, and that aid to the education sector has an almost one-for-one effect on education sector spending in the region. See Jones (2005) for a detailed discussion of aid fungibility in Africa.

[7] Similar programs have been implemented in several developing countries. The overall assessment is that food for education programs has a positive effect on educational outcomes. For more on this issue see Sibanda-Mulder (2004).

variable as aggregate as official development assistance (ODA) does not have a robust effect on growth. In fact, given that ODA comprises of such diverse components as emergency food aid, the building of wells, the construction of airports and the salaries of teachers, it is surprising that some researchers obtained any results at all. …we emphasize the desirability of taking a more disaggregate view with respect to the different components of aid." This view is supported by Clemens et al. (2004) who assert that not taking into account the heterogeneity of aid flows may explain the lack of robustness of the effect of aid on growth found in previous studies.[8] Another caveat of using aggregate data is that it precludes one from identifying the types of aid that enhance growth and development. Such information will help donors determine which sectors to target aid. Indeed, very few studies have used aid data disaggregated by sector to analyze the aid-growth relationship.[9] Our literature review revealed only three of such studies — Asiedu and Nandwa (2007), Rajan and Subramanian (2005) and Clemens et al., (2004). Our work is closely related to Asiedu and Nandwa (2007) who examine the effect of education aid on growth in low and middle income countries. We complement their analysis by focusing on countries in SSA. As discussed above, there are many reasons for focusing exclusively on countries in SSA. Furthermore, unlike Asiedu and Nandwa (2007), we emphasize the importance of primary education in promoting growth.

Our analysis covers 38 countries over the period 1990-2004 and we control for initial per capita GDP, inflation, investment, government consumption, openness to trade and institutional quality. We find that (i) aid in primary education has a positive and significant effect on growth; (ii) aid in post-primary education has an adverse effect or at best no significant impact on growth; and (iii) growth increases as the share of primary education aid in total education aid rises.

The rest of the paper is organized as follows. Section 2 describes the data and the variables included in the regressions, Section 3 presents the empirical analysis, Section 4 discusses the results and Section 5 concludes.

[8] See Harms and Lutz (2004) and Roodman (2007a) for an excellent survey.

[9] A few empirical studies on growth have examined other aspects of aid heterogeneity, such as differentiating between project aid and budget support, bilateral and multilateral aid, and grants versus loans (e.g., Mavrotas, 2005; Odedokun, 2004; Ram, 2003). See Mavrotas (2005) and Mavrotas and Nunnenkamp (2007) for a review of the literature on aid heterogeneity.

2. The Data and the Variables

The analysis covers a panel of 38 countries and five three-year time periods from 1990-1992 until 2002-2004. The years of coverage and the countries included in the analysis are determined by the availability of data. The dependent variable is the GDP per capita growth rate. The data are from the World Bank (2006).

Aid Variables: The measures of aid are the amounts of aid disbursed by DAC countries to the countries in our sample. We consider two measures of aid—aid in primary education and aid in post-primary education. Post-primary aid is the sum of aid in secondary and higher education. The data on education aid disbursement are from the 5-CRS/Aid Activities-Disbursements database, which is part of the OECD Development Assistance Committee (DAC)—Credit Reporting System (CRS).[10] The database has comprehensive information on education projects in developing countries funded by DAC member countries. The data includes information such as the names of the donor and recipient countries, name of the agency implementing the project (includes non-governmental agencies and other agencies such as UNICEF, EC), a description of the project (teacher training, equipment), starting and ending dates of the project, the level of education being funded (primary, secondary or higher), the amount committed by the donor, the year of commitment and the amount of funds disbursed each year. The data are available from 1990-2004. Based on the data, we constructed our variable of interest, which is the amount of aid disbursed to each recipient country every year.[11]

We point out two caveats of the aid data. First, the years of coverage are few—the data are available for only 15 years.[12] Second, the data does not capture all the education aid flows to the various recipient countries—the data are bilateral education aid from DAC countries and do not include data from non-DAC countries and multilateral agencies.[13] We however note that aid from DAC countries constitute over 85 percent of official assistance to developing

[10] The data are available at http://www.oecd.org/dataoecd/50/15/5037782.htm.
[11] Thus, for each year, we calculated the sum of aid disbursements from all the DAC members to each of the recipient countries.
[12] Specifically, data on education aid disbursements are not available prior to 1990.
[13] The DAC/CRS database does not have any figures on education aid from the World Bank and non-DAC countries.

countries, and therefore our analysis captures a bulk of the aid disbursed to the countries included in the sample.[14]

Control Variables: In choosing the control variables, we draw from the large literature on the determinants of growth. Specifically, we draw from the literature that analyzes the robustness of the explanatory variables often included in growth regressions. Rodrik et al. (2004) found that institutional quality has a robust effect on growth and that once institutions are controlled for, measures of geography and openness to trade cease to have a significant effect on growth. Doppelhofer et al. (2004) provided rankings based on the robustness of 32 explanatory variables often included in growth regressions and found that log (initial per capita GDP) ranked first among all the variables. In their influential paper, Levine and Renelt (1992) concluded that the most robust determinant of growth is the ratio of investment to GDP. Thus, based on these three studies we include a measure of institutional quality, log (initial per capita GDP) and investment/GDP as control variables. We note however, that Gomanee et al. (2006) argue that it may be inappropriate to include investment as an explanatory variable in aid-growth regressions. They assert that aid may finance investment and therefore including both investment and aid in the same empirical model leads to double counting and causes the estimated coefficients to be biased. They also note that estimations that omit investment face the potential problem of omitted variable bias. We include investment in our estimations for two reasons.[15] First, the estimated coefficient of investment is positive and significant in all our regressions. Second, for our sample of countries, the average value of aid/GDP is 0.292 percent and the average value of investment/GDP is 19.13 percent (see Table 1). This implies that even if all education aid goes into investment (which is less likely to be the case since education aid comes in various forms, such as technical assistance —e.g., highly qualified teachers from abroad), aid will account for a meager share (about 1.5 percent) of investment. Thus based on our dataset, we argue that the issue of double counting is less of a concern. The model we estimate also takes into

[14] For example, the breakdown of the gross official aid to developing countries in 2004 was 89.7 percent for DAC countries, 8.7 percent for multilateral agencies and 1.6 percent for non-DAC countries (OECD, 2006). The amounts are $92.254 million for DAC countries, $8.971 million for multilateral organizations and $1.6 million for non-DAC countries.

[15] We also run regressions where we excluded investment. The main results did not change.

account the policy environment in the recipient country. Following Burnside and Dollar (2000) and others, we include three policy variables in our regressions — inflation, government consumption/GDP and trade/GDP. Note that the arguments we make for including both investment and education aid in the same regressions pertains to including government consumption in the regressions—education aid as a share of government consumption is about 0.02 for the countries in our sample.

The data on initial per capita GDP, investment, inflation, trade and government consumption are from the World Bank (2006). To measure the quality of institutions, we use the "rule of law" indicator from the *International Country Risk Guide* (ICRG), published by The Political Risk Services.[16] This indicator reflects the impartiality of the legal system and the extent to which the rule of law is enforced. The data ranges from 0 to 6, where a higher rating implies a more impartial legal system. The summary statistics of the variables included in the regressions are reported in Table 1.

3. Empirical Analysis

In this section we discuss our estimation strategy and our empirical results. We also point out some caveats of our estimation procedure, and discuss how we handle these problems.

3.1. Estimation Procedure

In their seminal paper, Hansen and Tarp (2001) asserted that three factors may cause the estimates from aid-growth regressions to be biased: (i) the joint effect of endogeneity of aid flows; (ii) unobserved country specific factors; and (iii) conditional convergence. The authors recommend using the linear dynamic panel General Method of Moments (GMM) estimator proposed by Arellano and Bond (1991) to overcome these potential problems.[17] This estimator often referred to as the "difference GMM" estimator uses lagged levels of first difference of variables as instruments. However, as pointed out by Arellano and Bover (1995), lagged levels are often poor instruments for first differences—thus the difference GMM estimator is said to suffer from the "weak

[16] Burnside and Dollar (2004) also use the ICRG rule of law index to measure institutional quality. For more information about this index, see http://www.prsgroup.com/icrg/icrg.html

[17] The GMM procedure has been used in several studies to examine the effect of education on growth, such as Agiomirginakis et al. (2002) and Gyimah-Brempong et al. (2006).

instruments" problem.[18] Blundell and Bond (1998) proposed a more efficient estimator, the "system GMM" estimator, which mitigates the weak instruments problem. We also note that the simulation results by Kazuhiko (2007) show that the system GMM is less biased than the difference GMM estimator. As a consequence, our preferred estimation procedure is the *more efficient* and *less biased* estimator, the system GMM.

We point out one caveat of our estimation strategy. First, we note that the system GMM estimator is susceptible to a Type 1 error (i.e., producing significant results even though there is no underlying association between the variables involved). This is particularly true when the number of instruments relative to the sample size is large (Roodman, 2007b). Our data set comprise of 38 countries and therefore our empirical analysis may be subject to this problem. Thus, following the recommendations of Roodman (2007b), we report the instrument count for the GMM estimations, test for robustness to reductions in the instrument count and also test for the validity of the instruments. Estimates from the system GMM are inconsistent in the presence of autocorrelation; hence, we report the p-values of the test for autocorrelation. Finally, as another check for robustness, we carry out a fixed-effect estimation.

We carry out our analysis in two steps. We first analyze whether primary education aid and post-primary education aid have a significant effect on growth. We next analyze the importance of primary education aid relative to other types of education aid. Specifically, we test whether for a given level of education aid, growth increases as the share of aid in primary education rises. Note that the objective of this paper is not to find the determinants of growth in SSA. Our goal is to determine whether education aid has a significant impact on growth after controlling for other important determinants of growth. Therefore our discussion will focus more on the aid variables and less on the control variables.

3.2. Estimation Results

Following Hansen and Tarp (2001) and others, we estimate:

$$\Delta y_{it}=\lambda y_{i(t-1)} + \beta\,(aid/GDP)_{it} + \sum_{j=1}^{k} \gamma_j x_{jit} + \alpha_i + \gamma_t + \varepsilon_{it} \qquad (1)$$

[18] We borrow this terminology from Kazuhiko (2007).

where countries are indexed by i and time by t; Δy_{it} is the average growth rate, $y_{i(t-1)}$ is the log of initial per capita GDP, aid/GDP$_{it}$ is foreign aid in education as a share of GDP, x_{jit} are the control variables discussed in Section 2, α_i are the country specific effects, γ_t is a constant term that may change over time and ε_{it} is the random noise. As is standard in the literature, we treat the aid variable as endogenous.[19] In addition, we use all the control variables as additional instruments.

The data for institutional quality are available for 28 out of the 38 countries in our sample. Thus, on the one hand, excluding the measure of institutional quality, INST, from the regressions expands the sample size. The caveat however, is that if institutional quality is an important determinant of growth (which is the case in our estimations), then excluding INST causes the estimates to be biased. Hence, in order to lend more credence to our results, we estimate equation (1) with and without INST.

The results for the system GMM are reported in Table 2 and Table 3. Table 2 shows the regressions where we control for institutional quality and Table 3 shows the regressions where INST is excluded. In regressions (2.1)-(2.3) of Table 2, we do not place any restrictions on the number of lags of the variables that are used as instruments and in regressions (2.4) and (2.5) we limit the lags. Also, in (2.1) and (2.2), we include only one measure of education aid at a time, and in (2.3)-(2.5) we include both measures of aid.

A cursory glance at Table 3 shows that for all the regressions, the p-values confirm the absence of autocorrelation and the validity of the instruments. In (2.1), the estimated coefficient of Primary Education Aid/GDP, PrimAid, is positive and significant at the one percent level: all else equal, a one percentage point increase in the Primary Education Aid/GDP will increase growth by about 2.128 percentage points. To provide a better sense of the growth effect of aid in primary education, we illustrate our result using two countries: Guinea Bissau which is the largest recipient of aid as a share of GDP and Nigeria, the smallest recipient. The average values of PrimAid over the period 1990-2004 for Guinea-Bissau and Nigeria are 0.450 and 0.001, respectively. Thus the results from (2.1) indicate that an increase in PrimAid from the level of Nigeria to the level of Guinea-Bissau (i.e., about 2.5 times the standard deviation) will raise the average

[19] We also run regressions where we treated the policy variables and the measure of institutional quality as endogenous, however, the main results did not change. To conserve on space, we do not report these regressions.

growth rate by about 0.956 percentage points.[20] Result (2.2) shows the estimations where we include only Post-Primary Education Aid/GDP, Post-PrimAid. The estimated coefficient of Post-PrimAid is not significant, suggesting that aid in post-primary education has no significant effect on growth. In (2.3) we examine whether the positive relationship between aid in primary education and growth hold when we include both measures of aid in the regressions. The estimated coefficient of Post-PrimAid remains positive and significant at the one percent level, confirming the previous result that aid in primary education is associated with higher economic growth. Furthermore, the estimated coefficient of Post-PrimAid remains negative but is now significant at the one percent level: a one percentage point increase in Post-PrimAid will decrease growth by about 1.457 percentage points.

Our discussion so far has focused on the regressions (2.1)-(2.3) where the number of lags of the instrumenting variables is unrestricted. For example, the number of instruments employed in regression (2.3) is 28, which is quite large since the sample size is 28.[21] As pointed out earlier, the large number of instruments may produce inaccurate estimates. Thus, as a robustness check, we run regressions where we limit the instrument count by restricting the number of lags of the variables that are used as instruments. Columns (2.4) and (2.5) show the results where we restrict the number of lags of the instrumenting variables to three and two, respectively. There are two noticeable points. First, there is a substantial decline in the number of instruments, from 28 to 15, about a 50 percent decrease. In addition, the estimated coefficients of PrimAid and Post-PrimAid retain their signs and remain significant at the one percent level, a strong indication that the previous results are robust.

We next focus on the regressions where we exclude the measure of institutional quality (Table 3). Note that the sample size and the number of observations increase from 28 and 135, respectively, to 38 and 187. Here again, the estimated coefficient of primAid is positive and significant at least at the five percent level in all the regressions. Also, the estimated coefficient of post-primary education is negative and significant at the one percent level in regression (3.3), significant at the 10 percent level in regression (3.4) and insignificant in regressions (3.2) and (3.5). Thus, in summary, the results from the system GMM estimations suggest that aid in primary education enhances

[20] Note that 0.956=2.128*(0.450-0.001).

[21] Stata recommends that the number of instruments should not exceed the sample size.

economic growth in SSA, whereas aid in post-primary education has an adverse effect on growth or at the very best, does not have a significant growth effect. This conclusion is consistent with the results for the fixed effects estimations presented in Table 5.

We next analyze the importance of primary education by testing whether for a given level of education aid, growth increases as aid in primary education as share of total education aid rises. Table 5 reports the results for the system GMM as well as the fixed effects estimations. Columns (5.1)-(5.3) show the estimations that take into account the quality of institutions in recipient countries and regressions (5.4)-(5.6) exclude the measure of institutional quality. Also, for the system GMM regressions, we report the results where the number of instruments is unrestricted (regressions (5.1) and (5.4)) and the results where we limit the number of lags of the variables used as instruments to three (regressions (5.2) and (5.5)). As shown in Table 5, the estimated coefficient of (Primary Aid/Total Education Aid) is positive and significant at least at the five percent level in all the estimations. Thus, we find a positive and robust relationship between the share of aid in primary education and growth.

Finally, we turn our attention to the control variables. Specifically, we summarize the performance of the control variables in the various regressions. The sign and significance of the estimated coefficients of the log (initial per capita GDP) is not consistent across estimations—thus, we do not find evidence of convergence in our sample of countries. With regards to the policy variables, the estimated coefficient of inflation is negative and significant at least at the five percent level in all the regressions, openness to trade does not display a consistent relationship with growth, and the estimated coefficient of government consumption is not insignificant in most of the regressions. The estimated coefficient of investment and the measure of institutional quality is positive and significant at least at the five percent level in all the regressions. Thus in summary, our results suggest that lower inflation, high investment and good institutions promote growth. This result is consistent with that of previous studies, in particular, Levine and Renelt (1992) and Rodrik et. al. (2004).

4. Discussion of Results

In this section we provide plausible explanations for our main results: (i) aid in primary education has a positive and significant effect on growth; (ii) aid in post-primary education has an adverse or at best no significant impact on growth; and (iii) growth increases as the share of aid in primary education rises.

Result (i) is intuitive and consistent with the predictions of the endogenous growth models: primary education enhances growth through many channels such as increased literacy, a reduction in fertility and mortality rates, and higher labor productivity (Ainsworth et al., 1996; Appiah and McMahon, 2002). Our result is also consistent with that of several empirical studies that find a positive relationship between primary education and growth in Africa (e.g., Gutema and Bekele, 2004; Gyimah-Brempong et al., 2006).

In contrast to Result (i), Result (ii) is counter-intuitive and contradicts the predictions of the endogenous growth models. We however note that the results are consistent with several empirical studies. For example, Gutema and Bekele (2004) find that post-primary education does not have a significant effect on growth in SSA, Bairam and Kulkolkarn (2001) find that higher education does not have a significant effect on growth for East Asia, and Lau et al. (1991) find that secondary education has an adverse effect on growth for South Asia. We provide four plausible explanations why post-primary education may have an adverse effect or not contribute significantly to growth in SSA. The first reason is high unemployment—the growth enhancing effect of education on growth can be realized only if educated labor is employed. We note that in many countries in SSA, the unemployment rate for post-primary school graduates, particularly, secondary school graduates are quite high. For example, the unemployment rate for secondary school graduates in Tanzania, Uganda and Zimbabwe in 2001 was about 11 percent, 12 percent, and 29 percent respectively (cf., Al-Samarrai and Bennell, 2003). The second reason is low quality education—the quality of education may be so low that more years of schooling provides less or no additional skills and therefore may not translate into an increase in human capital. The third plausible reason for the negative relationship between post-secondary education and growth is that educated people are employed in sectors of the economy where productivity is low and/or that the highly educated engage in socially unproductive activities. In many SSA countries, people with higher education typically take jobs in the public sector. For example, Gersovitz and Paxton (1995) find that from 1986-88 in Cote d'Ivoire, about 50 percent of the workers between the ages of 25 and 55 that had received some post-primary education worked in the public sector. Several studies have also shown that the public sector in many African countries is inefficient and unproductive and that public sector employees tend to engage in rent-seeking activities (e.g., Stein, 1994; Kiltgaard, 1997; Owusu, 2005 and 2006). Prichett (2001) argues

persuasively that the highly educated in many developing countries prefer government employment because the public sector is the fertile ground for engaging in rent seeking and unproductive activities, which tend to yield very high private returns but negative social returns, thereby lowering overall growth. Indeed, Betherlemy et al. (2000) find that rent seeking activities among the educated in SSA reduces income growth by about 0.9 percentage points annually. The fourth plausible explanation is that a lack of complementary inputs may prevent educated labor from being productive and operating at their maximum potential. Clearly, complementary inputs, such as physical capital and technology are scarce in SSA countries.

Result (iii) —i.e., the positive association between the share of aid in primary education and growth is intuitive and may be partly explained by the fact that in economies that are in the initial stages of development, primary education (which implies a higher literacy rate, a reduction in fertility and mortality rates and better health) generates higher social returns and contributes more to growth than higher education. This assertion is consistent with the empirical results of Petrakis and Stamatakis (2002) who find that primary education contributes more to growth in less developed countries whereas higher education is more relevant for growth in more developed economies.

5. Conclusion

This paper has examined the effect of aid in education on economic growth in Sub-Saharan Africa. We find that aid in primary education has a positive and significant effect on growth; aid in post-primary education has an adverse or at best no significant impact on growth; and that growth increases as the share of aid in primary education rises. With regards to policy, our results suggest that increasing aid in primary education will benefit countries in SSA in two important ways: promote economic growth and also help with the attainment of the second Millennium Development Goal of achieving universal primary education by the year 2015. Furthermore, policymakers need to address the factors that prevent aid in post-primary education from contributing significantly to growth. This includes making available complementary inputs that will enhance the productivity of the populations that have a higher education and enacting policies to reduce unemployment among secondary school graduates.

REFERENCES

Ainsworth, M., Beegle, K., & Nyamete, A. (1996). The impact of women's schooling on fertility and contraceptive use: a study of fourteen sub-Saharan African countries. *The World Bank Economic Review*, 10 (1), 85-122.

Acemoglu, J., Johnson, S. & Robinson, J.A. (2001). The colonial origins of comparative development: an empirical investigation. *American Economic Review*, 91 (5), 1369-1401.

Al-Samarrai, S., & Bennell, P. (2003). Where has all the education gone in Africa? Mimeo. Available: http://mpra.ub.uni-muenchen.de/128/1/MPRA_paper_128.pdf .

Agiomirgianakis, G., Asteriou, D. & Monastiriotis, V. (2002). Human Capital and Economic Growth Revisited: A Dynamic Panel Data Study. *International Advances in Economic Research*, 8 (3), 177-187.

Appiah, E. N., & McMahon, W.W. (2002). The social outcomes of education and feedbacks on growth in Africa. *Journal of Development Studies*, 38 (4), 27-68.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application of employment equations. *Review of Economic Studies*, 58 (2), 277-297.

Arellano, M., and Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error Component Models. *Journal of Econometrics*, 68 (1), 29-51.

Artadi, E. V., & Sala-i-Martin, X. (2003). *The economic tragedy of the XXth century: growth in Africa*. NBER Working Paper No. 9865, NBER, Cambridge, MA.

Asiedu, E. & Nandwa, B. (2007). On the impact of foreign aid in education on growth: how relevant is the heterogeneity of aid flows and the heterogeneity of aid recipients? *Review of World Economics*, 143 (4) 631-649.

Bairam, E., and K. Kulkolkarn (2001). *Human capital, production and growth in East Asia*. University of Otago Discussion Paper no. 0106. Available: http://eprints.otago.ac.nz/291/01/DP0106.pdf

Berthelemy, J., Pissarides, C & A. Varoudakis (2000). Human capital and growth: the cost of rent seeking activities. In M. S. Oosterbaan, T. R. van Steveninck &

N. van der Windt (Eds.), *Economic growth and its determinants*, Dordrecht: Kluwer Academic Press.

Block, S. A. (2001). Does Africa grow differently? *Journal of Development Economics*, 65 (2), 443-467.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115-143.

Burnside, C., & Dollar, D. (2000). Aid, policies, and growth. *American Economic Review*, 90 (4), 847-68.

Burnside, C., & Dollar, D. (2004). *Aid, policies, and growth: revisiting the evidence*. World Bank Policy Research Working Paper No. 3251, World Bank, Washington D.C.

Clemens M. A., Radelet, S., & Bhavnani, R. (2004). Counting chickens when they hatch: the short term effect of aid on growth. Center for Global Development Working Paper No. 44.

Dalgaard, C., Hansen, H., & Tarp, F. (2004). On the empirics of foreign aid and growth. *Economic Journal*, 114 (496), 191–216.

Devarajan, S., Rajkumar, A.S., & Vinaya S. (1999). *What does aid to Africa finance*? World Bank Policy Research Paper No. 2092. World Bank, Washington, D.C.

Dreher, A., Nunnenkamp, P., & Thiele, R. (2006). *Does aid for education educate children? evidence from panel data*. Kiel Working Paper No. 1290.

Doppelhofer, G., Sala-i-Martin, X., & Miller, R. (2004). Determinants of long-term growth: a Bayesian averaging of classical estimates (BACE) approach. *American Economic Review*, 94 (4), 813-835.

Easterly, W., & Levine, R. (1997). Africa's growth tragedy: politics and ethnic divisions. *Quarterly Journal of Economics*, 112 (4), 1203-1250.

Easterly, W., Levine, R., & Roodman, D. (2004). New data new doubts, a comment on Burnside and Dollar's aid, policies and growth (2000). *American Economic Review*, 94 (3), 774-780.

Gersovitz, M., & Paxton, C. (1995). *The revenues and expenditures of African governments: modalities and consequences*. Mimeo.

Gomanee, K., Girma, S., & Morrissey, O. (2006). Aid and growth in Sub-Saharan Africa: accounting for transmission mechanisms, *Journal of International Development*, 17 (8), 1055-1076.

Gutema, P., & Bekele, M. (2004). Does schooling promote economic growth? *African Development Review*, 16 (2), 363-385.

Gyimah-Brempong, K., Paddison, O., & Mitiku, W. (2006). Higher education and economic growth in Africa. *Journal of Development Studies*, 42 (3), 509-529.

Hansen, H. & Tarp, F. (2001). Aid and Growth Regressions. *Journal of Development Economics*, 64 (2), 547-70.

Harms, P., & Lutz, M. (2004). *The macroeconomic effects of foreign aid: a survey*. University of St. Gallen Working Paper No. 2004-11.

Jones, K. (2005). Moving money: aid fungibility in Africa," *SAIS Review*, 25 (2), 167-180.

Kazuhiko, H. (2007). Small sample bias properties of the system GMM estimator in dynamic panel data models, *Economic Letters*, 95(1), 32-38.

Keller, K.R.I. (2006). Investment in primary, secondary and higher education and the effects on economic growth. *Contemporary Economic Policy* 24 (1): 18-34.

Kiltgaard, R. (1997). Cleaning up and invigorating the civil service. *Public Administration and Development*, 17 (5), 487–509.

Krueger, A., & Lindahl, M. (2001). Education for growth: why and for whom? *Journal of Economic Literature*, 39 (4), 1101-1136.

Lau L. J., Jamison, D.T., & Louat, F.F. (1991). *Education and productivity in developing countries: an aggregate production function approach*. World Bank Working Paper Series No. 612, World Bank, Washington D.C.

Levine, R., & Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *American Economic Review*, 82 (4), 942-963.

Lucas, R. E., Jr., (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3-42.

Mankiw, N.G., Romer, D., & Weil, D. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics* 107 (2), 407-438.

Mavrotas, G., (2005). Aid heterogeneity: looking at aid effectiveness from a different angle. *Journal of International Development*, 17(8), 1019-1036.

Mavrotas G. & Nunnenkamp, P. (2007). Foreign aid heterogeneity: issues and agenda. *Review of World Economics*, (forthcoming).

McMahon, W. (1998). Education and growth in East Asia. *Economics of Education Review*, 17(2), 159-172.

Odedokun, M., (2004). Multilateral and bilateral loans versus grants: issues and evidence. *World Economy*, 27(2), 239-263.

OECD, (2006). http://www.oecd.org/dataoecd/50/15/5037782.htm.

Owusu, F. (2005). Livelihood strategies and performance of Ghana's health and education sectors: exploring the connections. *Public Administration and Development,* 25 (2): 157–174.

Owusu, F. (2006). Differences in the performance of public organizations in Ghana: implications for public-sector reform policy. *Development Policy Review*, 24 (6): 693-705.

Petrakis, P.E., & Stamatakis, D. (2002). Growth and educational levels: a comparative analysis. *Economics of Education Review*, 21 (2), 513-521.

Prichett, L. (2001). Where has all the education gone? *World Bank Economic Review*, 15(3), 367-91.

Ram, R. (2003). Role of bilateral and multilateral aid in economic growth of developing countries. *Kyklos*, 56(1), 95-110.

Rajan, R., & Subramanian, A. (2005). *Aid and growth: What does the cross-country evidence really show*? NBER Working Paper No. 11513, NBER, Cambridge, MA.

Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9 (6): 131-165.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98(5), S71-S102.

Roodman, D. (2004). *The anarchy of numbers: aid, development, and cross-country empirics*. Center for Global Development Working Paper No. 32.

Roodman, D. (2007a). *Macro aid effectiveness research: a guide for the perplexed*. Center for Global Development Working Paper No. 135.

Roodman, D. (2007b). *A short note on the theme of too many instruments*. Center for Global Development Working Paper No 125.

Sachs, J., & Warner, A. (1997). Sources of slow economic growth in African economies. *Journal of African Economies*, 6 (3), 335-376.

Sibanda-Mulder, F. (2004). *Improving food and nutrition security through food for education programs in Africa*. Mimeo. Available: http://www.ifpri.org/2020africaconference/program/day2summaries/sibandamulder.pdf .

Stein, H. (1994). Theories of institutions and economic reforms in Africa. *World Development,* 22(12), 1833–1849.

United Nations (2000). United Nations millennium declaration. A/RES/55/2. Mimeo. Available: http://www.un.org/millennium/declaration/ares552e.pdf.

World Bank (2006). *World Development Indicators on CD rom*.

Table 1. Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Primary education aid/GDP (%)	0.099	0.181	0	1.001
Post-Primary education aid/GDP (%)	0.112	0.302	0	3.4
Primary Education Aid/Total Education Aid (%)	25.648	26.151	0	100
Total Education Aid/GDP (%)	0.292	0.449	0	3.624
GDP per capita growth	0.399	3.234	-11.333	7.5
Log (initial per capita GDP)	7.273	0.794	6.116	9.254
Trade/GDP (%)	68.866	34.110	18	184
Investment/GDP (%)	19.127	8.874	3.667	61.33
Government consumption/GDP (%)	14.436	5.339	4	34
Log (1+Inflation)	0.158	0.441	-0.607	4.485
Institutional quality	2.941	1.163	0.639	6

[a] GDP per capita is in constant 1990 dollars.

Table 2. Effect of Aid in Education on GDP per Capita Growth Systems GMM Two-Step Estimations: Regressions Include a Measure of Institutional Quality

Variables	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)
Primary education aid/GDP (%)	2.128*** (0.000)		2.264*** (0.000)	3.301*** (0.000)	2.625*** (0.003)
Post-Primary education aid/GDP (%)		-0.424 (0.499)	-1.457*** (0.000)	-2.732*** (0.000)	-2.011*** (0.000)
Control Variables					
Investment/GDP (%)	0.131*** (0.000)	0.152*** (0.000)	0.164*** (0.000)	0.136*** (0.000)	0.145*** (0.001)
Log (1+Inflation)	-1.496*** (0.000)	-1.946*** (0.000)	-1.607*** (0.000)	-1.882*** (0.000)	-1.932*** (0.000)
Trade/GDP (%)	-0.010 (0.233)	-0.015 (0.196)	-0.010 (0.170)	-0.017* (0.066)	-0.009 (0.417)
Government consumption/GDP (%)	-0.129*** (0.001)	-0.079** (0.043)	-0.125*** (0.002)	-0.008 (0.849)	-0.039 (0.426)
Log (Initial per capita GDP)	0.154 (0.605)	0.042 (0.893)	0.137 (0.612)	-0.139 (0.702)	-0.141 (0.710)
Institutional quality	1.168*** (0.000)	0.801*** (0.000)	1.066*** (0.000)	0.700*** (0.000)	0.831*** (0.000)
Constant	-3.962** (0.025)	-2.589 (0.114)	-4.076** (0.015)	-1.905 (0.334)	-2.601 (0.219)
Observations	135	135	135	135	135
Number of countries	28	28	28	28	28
No of lags of variables used as instruments	unrestricted	unrestricted	unrestricted	Three	Two
Number of instruments	21	21	28	19	15
Hansen test of joint validity of instruments (P-value)	0.596	0.582	0.336	0.695	0.651
Test for serial correlation, AR(2)	0.727	0.646	0.740	0.545	0.631

[a]P values are in parentheses. * denotes significant at 0.10; **significant at 0.05 and *** significant at 0.001.

Table 3. Effect of Aid in Education on GDP per Capita Growth Systems GMM Two-Step Estimations: Regressions do not include a Measure of Institutional Quality

Variables	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)
Primary education aid/GDP (%)	3.810*** (0.000)		3.174*** (0.000)	2.323*** (0.009)	1.960** (0.031)
Post-Primary education aid/GDP (%)		-0.237 (0.282)	-0.479*** (0.000)	-0.439* (0.084)	-0.204 (0.634)
Control Variables					
Investment/GDP (%)	0.128*** (0.000)	0.136*** (0.000)	0.147*** (0.000)	0.133*** (0.000)	0.132*** (0.000)
Log (1+Inflation)	-1.723*** (0.000)	-2.201*** (0.000)	-2.026*** (0.000)	-2.149*** (0.000)	-2.251*** (0.000)
Trade/GDP (%)	-0.002 (0.786)	-0.002 (0.813)	-0.003 (0.523)	-0.002 (0.731)	0.004 (0.634)
Government consumption/GDP (%)	-0.148*** (0.000)	-0.069 (0.153)	-0.070*** (0.002)	-0.068 (0.174)	-0.096* (0.059)
Log (Initial per capita GDP)	0.781*** (0.009)	0.211 (0.458)	0.349*** (0.009)	0.469 (0.189)	0.379 (0.311)
Constant	-5.560*** (0.003)	-2.265 (0.173)	-3.642*** (0.000)	-4.243** (0.047)	-3.647* (0.097)
Observations	184	184	184	184	184
Number of countries	38	38	38	38	38
No of lags of variables used as instruments	unrestricted	unrestricted	unrestricted	Three	Two
Number of instruments	20	20	34	18	14
Hansen test of joint validity of instruments (P-value)	0.246	0.427	0.239	0.637	0.208
Test for serial correlation, AR(2)	0.572	0.790	0.566	0.620	0.657

[a]P values are in parentheses.* denotes significant at 0.10; **significant at 0.05 and *** significant at 0.001.

Table 4. Effect of Aid in Education on GDP per Capita Growth Fixed Effects Estimations

Variables	(4.1)	(4.2)	(4.3)	(4.4)
Primary education aid/GDP (%)	2.841** (0.036)		3.027** (0.027)	2.959* (0.053)
Post-Primary education aid/GDP (%)		-0.507 (0.497)	-0.735 (0.323)	-2.374* (0.096)
Control Variables				
Investment/GDP (%)	0.116*** (0.003)	0.119*** (0.003)	0.111*** (0.005)	0.141** (0.047)
Log (1+Inflation)	-1.726** (0.020)	-2.050*** (0.006)	-1.768** (0.017)	-1.753** (0.024)
Trade/GDP (%)	0.042* (0.057)	0.050** (0.034)	0.049** (0.035)	0.054** (0.031)
Government consumption/GDP (%)	-0.112 (0.172)	-0.129 (0.119)	-0.117 (0.153)	-0.033 (0.702)
Log (Initial per capita GDP)	-3.277* (0.054)	-2.053 (0.214)	-3.155* (0.065)	-5.212** (0.011)
Institutional quality				0.847** (0.015)
Constant	20.742* (0.090)	11.891 (0.318)	19.629 (0.110)	29.952** (0.036)
Observations	184	184	184	135
Number of countries	38	38	38	28
R-squared	0.224	0.202	0.230	0.327

[a]P values are in parentheses. * denotes significant at 0.10; **significant at 0.05 and *** significant at 0.001.

Table 5. Effect of the Share of Aid in Primary Education on GDP per Capita Growth

Variable	(5.1) System GMM	(5.2) System GMM	(5.3) Fixed Effects	(5.4) System GMM	(5.5) System GMM	(56.6) Fixed Effects
Primary education aid/Total education aid (%)	0.014*** (0.000)	0.080*** (0.000)	0.027** (0.022)	0.016*** (0.000)	0.064*** (0.000)	0.024** (0.016)
Total Education Aid/GDP (%)	-0.301 (0.369)	-0.959*** (0.000)	-0.515 (0.517)	0.317*** (0.005)	-0.292 (0.388)	0.132 (0.815)
Investment/GDP (%)	0.187*** (0.000)	0.225*** (0.000)	0.169** (0.021)	0.140*** (0.000)	0.149*** (0.000)	0.149*** (0.001)
Log (1+Inflation)	-1.490*** (0.000)	-1.314*** (0.000)	-1.559** (0.049)	-1.476*** (0.000)	-1.713*** (0.000)	-1.472* (0.052)
Trade/GDP (%)	-0.015** (0.017)	-0.015* (0.079)	0.038 (0.153)	-0.002 (0.764)	0.002 (0.811)	0.028 (0.259)
Govt. consumption/GDP (%)	-0.040 (0.210)	-0.090* (0.064)	-0.033 (0.722)	-0.052*** (0.007)	-0.068 (0.141)	-0.071 (0.420)
Log (Initial per capita GDP)	-0.392** (0.033)	-0.272 (0.318)	-3.644 (0.111)	0.391* (0.055)	0.394 (0.291)	-3.002 (0.127)
Institutional quality	0.777*** (0.000)	0.851*** (0.001)	0.897** (0.011)			
Constant	-0.827 (0.512)	-3.579 (0.116)	18.682 (0.247)	-4.427*** (0.003)	-5.579** (0.029)	18.169 (0.201)
Observations	130	130	130	172	172	172
Number of countries	28	28	28	38	38	38
Number of lags of variables used as instruments	unrestricted	Three		unrestricted	Three	
Number of instruments	28	19		34	18	
Hansen test of joint validity of instruments (P-value)	0.290	0.694		0.176	0.289	
Test for serial correlation, AR(2)	0.832	0.351		0.764	0.418	
R-squared			0.311			0.225

[a]P values are in parentheses. * denotes significant at 0.10; **significant at 0.05 and *** significant at 0.001.