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Foreign aid and mobilization of growth factors in sub-Saharan Africa

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Abstract

This study addresses the macroeconomic effect of foreign aid on the factors of growth. Specifically, we examine the effects of foreign aid on capital investment (human capital, physical capital) in sub-Saharan Africa. Our methodological approach evaluates the effect of disaggregate aid (aid for infrastructure and aid for education) on capital investment. To test our postulate, we make use of panel data of 37 sub-Saharan African states over the period 2000-10. The results of the regressions show that foreign aid positively and significantly affected the physical capital accumulation in the countries under review. The effect of aid for infrastructure is less important in post-conflict environments than in stable environments. Concerning the impacts of aid on human capital, we find that aid enhances enrolment in primary education. We also note that there is no statistical difference between stable countries and post-conflict countries in terms of the effectiveness of aid for education.

Keywords: foreign aid, physical capital, human capital, panel data, Africa

JEL classification: C23, F35, H54, J24

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Acronyms

FDI	foreign direct investment
GDP	gross domestic product
LDCs	less developed countries
LLKE	Local Linear Kernel Estimator
ODA	official development assistance

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1 Introduction

It has been fifty years since the first official development assistance (ODA) programmes were instituted, and the question of the effectiveness of foreign aid remains an unresolved issue. Many papers have been written on the macroeconomic impact of aid, but controversial results have been reported. The papers that have identified significantly negative effects of aid ignore the characteristics of the beneficiary countries such as a post-conflict situation, shocks vulnerability, etc. (Easterly 2008; Moyo 2009).

In trying to assess the effectiveness of foreign assistance, most studies focus on the impact of aid flows on growth and poverty. However, very little empirical evidence of the effect of foreign aid on the factors of growth actually exists. This study seeks to fill the gap observed in literature and analyses the ways in which aid can be made more effective in sub-Saharan Africa (SSA).

According to some observers, SSA has been a major recipient of aid for decades, yet has exhibited very poor economic growth performance. A variety of factors have contributed to poor performance in SSA, including a lack of political will to push through major reforms (e.g., improving governance, tackling corruption, land reform) and a lack of resources for financing investment (UNECA 2005). Nevertheless, UNECA (2005) argues that for a substantial increase in resources for SSA, especially to finance needed investments, an additional US\$25 billion per annum in aid would be required by 2010 with a further US\$25 billion per annum increase by 2015. The central question to this paper is: would increased aid improve the factors of growth in SSA? This paper formulates its response to this question by assessing the effectiveness of Africa's aid, specifically accounting for the impact on human and physical capital investment. The choice of these factors is explained by the fact that in the last 15 years, international aid donors have shifted their focus dramatically towards education, health and infrastructure. The share of social sector support in total aid rose from 33 per cent to 60 per cent from 1990-94 to 2000-04 alone. Moreover, according to Easterly (2007), despite the failures of aid to promote growth, it could create opportunities for poor individuals by helping them to fill some particular needs in the area of education, health and infrastructure.

The main hypothesis of the study is that foreign aid would be more effective in terms of physical capital investment and human capital investment in a post-conflict environment. Our hypothesis comes from the fact that in African post-conflict countries, there are more challenges to the mobilization of growth factors. Post-conflict situations are characterized by economic opportunities for recovery and the political incentive for reform and change. The opportunities provided by the need to rebuild the collapsed economy should make aid particularly effective in the first post-war decade. Following Collier and Hoeffler (2002), post-conflict countries are defined as countries that have experienced civil war in the two last decades and recorded some incidents of rebellion.¹

To test our postulate, we make use of a panel data of 35 SSA states over the period 2000-10. The specificity of this paper is to use disaggregated data on aid recently made available by the World Bank. This is done in two steps: (a) to assess the effect of aid for infrastructure on physical capital investments, and (b) to evaluate the effect of aid for education on human capital investment.

¹ See Appendix for a further discussion of the definition of 'post-conflict' country.

The remainder of the paper is organized as follows: section 2 provides a brief overview of the relevant literature on the impact of aid on factors of growth in developing countries, focusing on education and infrastructure as major outcomes. Section 3 establishes some stylized facts. Section 4 outlines the empirical model and discusses the data. Some policy implications are considered in section 5.

2 Literature review

Most aid effectiveness literature has focused on broad questions of aggregate aid and its relationship with economic growth, usually with very inconclusive results (Burnside and Dollar 2000). A closer look at the effect of sector-specific aid on sector-specific outcomes may be the key to unravelling the mysteries of aid's real impacts, allowing us to better identify causal chains and to reduce the likelihood of problematic intervening variables (Michaelowa and Weber 2004). So, by understanding the effect that aid monies directed towards primary education and infrastructure have on the measurable outcomes of primary education, we can understand whether this type of aid is accomplishing its intended purpose.

This study, therefore, investigates the macroeconomic effect of foreign aid on factors of growth, namely physical and human capital, in selected SSA countries. For this purpose, the literature review will be done in two steps. First, we evaluate the impact of foreign aid on human capital formation, and, second, we highlight the link between foreign aid and physical capital investment.

2.1 Foreign aid and human capital formation

The literature on the effectiveness of aid to education is still very recent. The limited literature on education aid effectiveness may be viewed from two opposite perspectives: those who evaluate the general economic outcomes of aid such as economic growth and those who look at educational outcomes as an outcome of interest or dependent variable. Theoretically, to be considered effective, educational foreign aid must either positively impact on a country's economy or improve certain educational outcomes (Christensen et al. 2010).

Those who look at economic outcomes most often use increases in gross domestic product (GDP) as a broad measure of effectiveness, suggesting that educational foreign aid should stimulate economic growth as it provides human capital (Asiedu and Nandwa 2007; Pritchett 2001). Since nearly all aid is intended to alleviate poverty, though direct or indirect mechanisms by enhancing economic growth, such a question has a logical foundation. However, these studies seldom find a positive correlation between education aid and growth.

Following new trends in sector-specific aid evaluations, most recent scholars have evaluated aid's impact on specific measurable of education outcomes, assuming that a too broad-based look at education's effect on GDP allows for excessive error potential. Most often, enrolment rates are considered to be the dependent variable for these studies, both because they relate to the MDGs and because they have the best global availability (Christensen et al. 2010). Initial studies by Michaelowa and Weber (2007, 2008) and Dreher et al. (2008) find fairly tentative positive correlations between aid for education and education outcomes, suggesting that aid does have some positive influence on school enrolments.

However, these conclusions suggest that the relationships were not substantively significant, and data availability issues make the findings somewhat tentative. Both sets of authors

acknowledge the flaws of the OECD-CRS database of aid data and their potential effect on results. Furthermore, due to data availability, both studies looked at the effect of all education aid on primary school enrolment, instead of just the effect of primary school aid on enrolment. While secondary and tertiary education projects may be expected to have some spillover effects on primary school enrolments, they may also introduce distorting noise into the models. Attempting to address this issue, Michaelowa and Weber (2008) look at the effects on education outcomes of aid disaggregated by the level of schooling. Results here are largely inconclusive, although the most significant positive effects were recorded for secondary education levels. The effect of primary-only education aid was notably insignificant. Again, the fact that OECD/CRS data do not capture many large development projects funded by multilateral development banks constrained the analysis and results. Some recent studies (Aiglepierre and Wagner 2010; Riddell 2012) show the positive contribution that aid has made to education in aid-recipient countries, the most tangible outcome of which is the contribution that aid makes to expanding enrolments, especially of basic education.

All these papers indicate a positive relationship between aid and human capital. However, they do not address the specificity of the SSA countries. Our study follows a comparative perspective while focusing on the difference between African post-conflict countries and stable countries.

2.2 Foreign aid and physical capital investment

The relationship between aid and public investment has also received notable attention in such literature. Most studies support the hypothesis that foreign aid raises the level of public investment in recipient countries (Lensink and Morrissey 1999; Hansen and Tarp 2000, 2001; Mavrotas 2003). Levy (1987), using data based on 39 least developed countries, concludes that much of the aid transferred to developing countries finances investment and that a one point increase in aid to income ratio leads to a 0.86 point increase in investment ratio.² Hansen and Tarp's (2000) survey of seven studies (published between 1972 and 1998) provides a positive estimate for the impact of investment on aid.

However, there are studies that report the existence of heterogeneity in the relationship between aid and public investment across aid-recipient countries. For example, Easterly (1999) reveals that out of 88 aid-recipient countries analysed over a thirty-year period (1965-95), aid had a negative impact on public investment in 36 countries, a negative but insignificant impact in 17, a positive impact in 23 and an insignificant impact in 12 countries. Nonetheless, these results should be considered with some caution, given that Easterly (1999) uses a simple ordinary least squares (OLS) model without allowing for potential sources of bias. Contrary to the results of Easterly (1999), Dollar and Easterly (1999), Gomanee et al. (2005) obtain evidence of a highly significant positive effect of aid on physical investment. On average, an increase in aid of one percentage point raises the investment share in GDP by about 0.53 percentage points. As a result, aid is more important both in terms of magnitude and significance.

Recent theoretical exercises give further weight to the need for modest expectations regarding the magnitude of the possible impact of foreign aid on physical investment. In particular,

² The estimated coefficient of 0.86 is found for total ODA including technical assistance. When estimates are run with aid net of technical assistance, the estimated coefficient is 0.96. These findings represent an argument in favour of the importance of aid disaggregation in evaluating the impact of aid on development outcomes.

Rajan and Subramanian (2008) have contributed to this literature. Based on a standard neoclassical production function framework, and assuming that aid increases only physical capital investment, they estimate that the overall increase in the growth rate resulting from aid inflows of 10 per cent of GDP may lie only in the range of 1–2.5 per cent, depending on the share of aid that is invested and productivity impacts.

In a recent study, Gyimah-Brempong and Racine (2010) use panel data and the local linear kernel estimator (LLKE) to investigate the effects of aid on physical capital investment in developing countries. Specifically, they investigate the robustness of the relationship between aid and physical capital investment in the less developed countries (LDCs) using two different measures of aid and five measures of the policy environment. They find that external aid has a positive and significant impact on physical capital investment given the support of the sample data they use. This effect is robust to the measurement of aid as well as the policy environment. However, the character of the positive relationship between aid and investment varies with the combination of the aid measure and the policy environment. They find that conditional on aid inflows, the better the policy environment, the higher the investment rate, all things being equal.

3 Empirical analysis

This section is designed to assess the effectiveness of disaggregated aid in improving human and physical capital. Data used cover a sample of 37 SSA countries³ over the period 2000–10. Data are drawn from African Development Indicators of the World Bank 2011. Both the interest and dependent variables are in logarithm. The first part of this section provides graphical evidences on the relationship between disaggregated aid and human and physical capital. The second part relates to econometric analysis.

3.1 Graphical evidences

A naïve analysis of data reveals some stylized facts which corroborate the existent empirical literature. These facts are presented in this subsection. The first part sheds light on the correlation between aid allocated for infrastructure and investments in physical capital while the second one is devoted to the relationship between aid for primary education and investments in human capital measured by the primary completion rate.

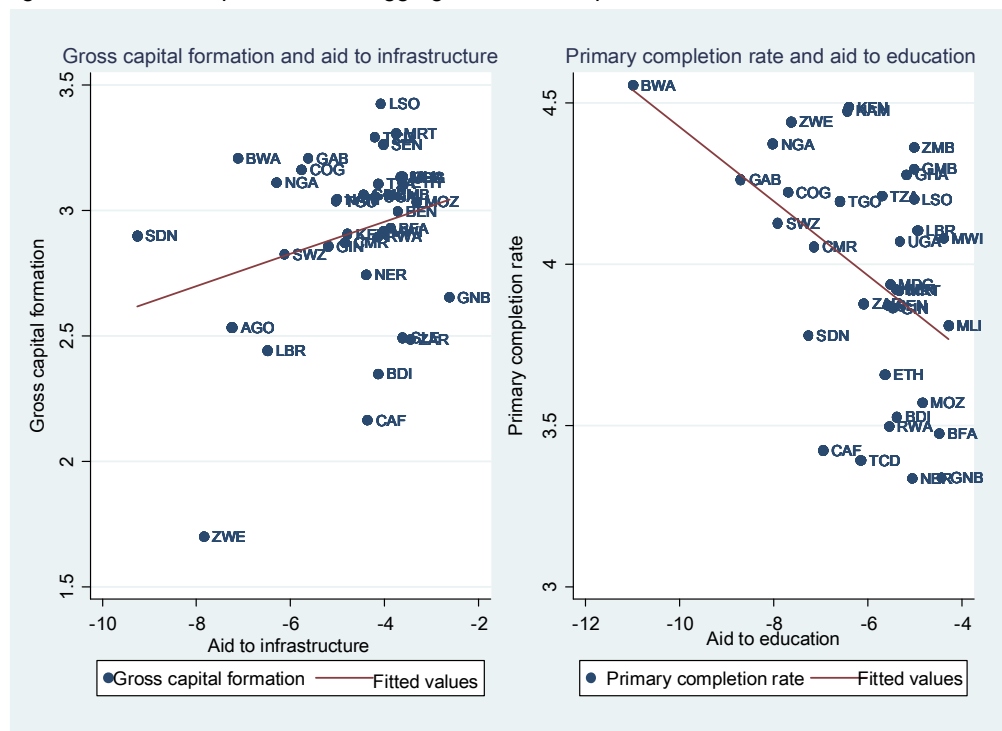
Correlation between aid for infrastructure and investments in physical capital

According to Rioja (2003), in most developing countries, infrastructure such as airports, harbours, roads, hydroelectric barrages, potable water adduction and so forth are funded through foreign aid. In these countries, domestic saving is devoted to infrastructure maintenance while the building of new infrastructure is funded through foreign aid. In this light, Figure 1 shows the correlation between aid for infrastructure and investment in physical capital (measured by the gross capital formation) in selected SSA countries (left panel). With regard to this figure, countries in the far right-hand side are those that receive more aid. This is the case for Guinea-Bissau, Mauritania; Lesotho, to name a few. Despite a great heterogeneity of situations, this figure exhibits a positive relationship between aid for infrastructure and physical capital. Thus, with the exception of an outlier such as Sudan, countries that receive more aid are more likely to exhibit high level of investments in physical

³ See Table A1 in the Appendix.

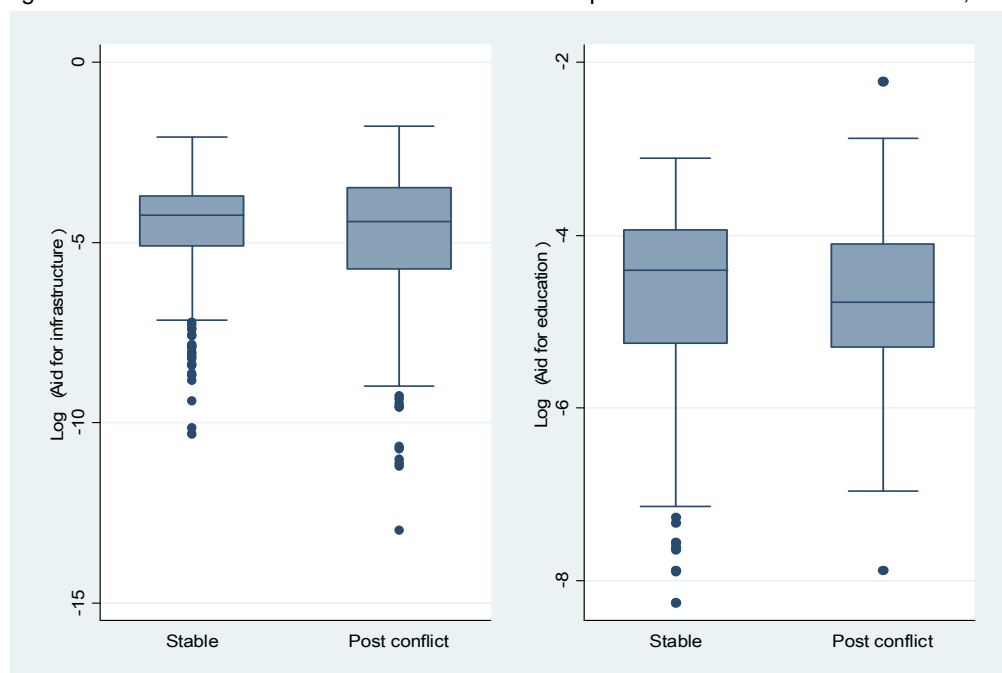
capital. Moreover, when comparing stable states and post-conflict states, Figure 2 shows that the median of the distribution of aid for infrastructure in stable countries is higher than that of post-conflict countries. However, the difference is very slight and therefore not as informative as needed.

Figure 1: Relationship between disaggregate aid and capital investment in SSA, 2000-10



Source: Authors' computation based on data from African Development Indicators (2011).

Figure 2: Aid for infrastructure and education in African post-conflicts and stables countries, 2000-10



Source: Authors' computation based on data from African Development Indicators (2011).

Correlation between aid for education and investment in human capital

The strategy to accelerate the development of primary education that took place during 2000 in Dakar was based on a prior earmarking of foreign aid to education. External resources should serve to complement domestic resources in order to meet the Millennium Development Goals (MDGs) in terms of education and to facilitate the take-off of countries. Doing so, aid allocated to the education system focuses on increasing the stock of education at the primary level.

In SSA as a whole, foreign aid allocated to the promotion of universal education seems to be more effective with regard to the evolution of school enrolment rate in primary education. Figure 1 (right panel) sheds light on the relationship between aid for primary education and primary school completion rates. As this figure shows, countries on the far right-hand side (such as Guinea-Bissau, Mali, Malawi) have received greater amounts of aid and, as the negative regression line suggests, more aid seems to be targeted to countries with a low rate of primary completion. This is consistent with the MDG objective of achieving universal education goal by 2015. Using the existent political environment as a framework, Figure 2 suggests that post-conflict countries receive less aid for education.⁴ Nonetheless, as shown by the - test of sample means, there is no statistical difference between stable countries and post-conflict countries.

To sum up, the graphical evidence suggests that the allocations of aid for education and for infrastructure both seem to be correlated with the level of physical and human capital of the recipient country.

3.2 Methodology

This section empirically assesses the effect of disaggregated aid on factors of growth in SSA countries.

Modelling the relationship between aid for infrastructures and physical capital investment

Following Mavrotas (2003), Séverine (2004), Gyimah-Brempong and Racine (2010), our baseline specification is as follow:

$$Invest_{it} = \rho + \phi Invest_{it-1} + \rho_1 Aidifra_{it} + \rho_2 Saving_{it} + \rho_3 fdi_{it} + \rho_4 gdppc_{it} + \rho_5 inf_{it} + \rho_6 Gov_{it} + \tau_i + \tau_t + v_{it} \quad (1)$$

where *Invest* is the investment in physical capital captured by the gross fixed capital formation in percentage of GDP, GDP per capita and saving rate as a percentage of GDP refer to internal sources of funding while foreign direct investment (FDI) in percentage of GDP and aid for infrastructure in percentage of GDP are the external sources of funding. *Gov* is the quality of governance measured by the control of corruption. This variable is included in order to account for specific effects related to the institutional quality. Time effects are also included in the regression to capture factors that change over time but affect all countries in the same way. The dependent variable and the variable of aid are all in logarithm.⁵ The

⁴ We have to mention that Figure 2 shows a comparison between the median of the distribution of aid within the sample of stable countries and the median of the distribution of aid within the sample of post-conflict states.

⁵ Although these variables are initially in percentage of GDP, they do not have the same scale. Then the logarithm is used not only to interpret the coefficients in terms of elasticity, but also to reduce the scale discrepancy.

estimates of the dynamic model presented above with the OLS estimator are inconsistent, since the lagged dependent variable is introduced alongside country fixed effects. This bias is of concern because of the short temporal dimension of the dataset used. The system GMM estimator must therefore be implemented. The equations in levels and the equations in first differences are combined in a system and estimated with an extended system GMM estimator, which allows for the use of lagged differences and lagged levels of the explanatory variables as instruments (Blundell and Bond 1998).⁶ The GMM estimations control for the endogeneity of aid and other explanatory variables. We use the Windmeijer's finite sample correction to ensure that the standard-errors estimates are consistent in the presence of any pattern of heteroscedasticity and autocorrelation within the panel. The Hansen overidentification test ensures that the exclusion restrictions are valid. The estimation uses annual data for the period 2000-10 and is run for a sample of 37 SSA countries.

Modelling the relationship between aid for education and human capital investment

Following Aiglepiere and Wagner (2010), Gyimah-Brempong and Asiedu (2008), Dreher et al. (2008), Michaelowa and Weber (2006), the equation of human capital is as follows:

$$Edu_{it} = \gamma_0 + \gamma_1 Aidedu_{it} + \gamma_2 gdppc_{it} + \gamma_3 Ptr_{it} + \gamma_4 Gov_{it} + \eta_i + \eta_t + \nu_{it} \quad (2)$$

where *Edu* is the primary completion rate. Explanatory variables include teacher-pupil ratio, GDP per capita, governance measured by the control of corruption and aid for primary education. One could also include public spending in education. However, it is likely that a huge part of spending in education is funded through aid allocated to education. Nevertheless, we control for the spending effect using the GDP per capita. While including governance, we control for potential mismanagement of foreign aid and institutional quality. In the same vein, we add the teacher-pupil ratio to control for the potential effect of the class size on the primary completion rate. In fact, a low number of teachers per pupils may discourage school attendance and therefore lower the primary completion rate. In order to compare post-conflict states and stable states, we add to the regression an interaction term between aid and the conflict dummy. Descriptive statistics are presented in Table 1. Equation (2) is estimated using the GMM system.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std dev.	Min	Max
Log (Primary completion rate)	198	3.985095	0.3643673	2.995591	4.62762
Log (Gross capital formation)	272	2.961262	0.3412686	1.63077	4.089718
Log (Aid for education %GDP)	272	-6.048947	1.524548	-12.39085	-3.720698
Log (Aid for infrastructures %GDP)	272	-4.689779	1.518109	-10.72163	-2.070016
Log (GDP per capita)	272	5.980466	0.8410682	4.419943	8.347507
Control of corruption	272	-0.6436892	0.523828	-1.483793	1.249669
Pupil teacher ratio	272	36.09447	23.42561	0	100.2365
Gross saving %GDP	272	16.62848	16.35843	-40.215	142.2254
Foreign direct investment %GDP	272	4.447245	5.890339	-4.972515	46.8288
inflation	272	10.15872	12.74694	-12.38013	120.5073
Conflict	272	0.3198529	0.4672791	0	1

Source: see text.

⁶ This paper uses the two-step system GMM estimator.

4 Results and discussion

We start our discussion by presenting the mean comparison test which helps to compare (i) the amount of foreign aid between stable countries and post-conflict countries; and (ii) the level of endowment in terms of human capital and physical capital between stable countries and post-conflict countries. Then, we present the direct effects of aid allocated for infrastructure on physical capital investment. Finally, we show the regression results of the direct effect of aid allocated for education on human capital investment.

One of the main results drawn from the mean comparison test (see Table 2) is that aid to infrastructure is mainly allocated to post-conflict countries while those countries record poor performance in terms of human capital and physical capital investment. Furthermore, according to the T-test of sample mean, there is no statistically significant difference between stable states and post-conflict states in terms of the amount of aid received for human capital investment.

Table 2: T-test for differences in the sample mean between post-conflict states and stable states

Variables	Gross capital formation		Primary completion rate		Aid for infrastructure, % GDP		Aid for education, % GDP	
	Post-conflict	Stable	Post-conflict	Stable	Post-conflict	Stable	Post-conflict	Stable
Mean	16.68397	21.2572	43.74982	59.04196	0.0248653	0.0169867	0.0141596	0.0129951
Difference	4.573225		15.29214		-0.0078787		-0.0011645	
T-statistic	5.7686		6.3328		-2.5587		-0.7596	

Source: see text

4.1 Direct effects of aid for infrastructure on physical capital investment in SSA

For several years now, many African countries have singled out the development of infrastructure as a priority. This is obvious when we look at their respective development plans. However, financing infrastructure remains an unsolved problem. Due to the region's low domestic saving, foreign aid helps compensate for the gap between saving and investment. Thus, with respect to the sample of SSA countries recorded in this study, aid for infrastructure does impact both positively and significantly on physical capital. In other words, a 10 per cent increase of aid improves the level of infrastructures by 0.4 per cent (see Table 3: column 1). Furthermore, the results also show that a 10 per cent raise in FDI increases the level of infrastructures by 0.21 per cent. In the same vein, an investment in infrastructure is negatively correlated with inflation. This outcome confirms the results by Jacquet and Charnoz (2003), and is explained by the fact that building infrastructure constitutes the core of the reconstruction process. The objective of attracting private capital for funding infrastructure is indispensable with respect to reconstruction. In this light, foreign aid and FDI contribute to the restoration of power stations, telecommunications infrastructure, public buildings, water and transport services, etc.

When political environment is accounted for, the estimates show that aid for infrastructures has an adverse effect on public infrastructure in post-conflict states, contrary to stable countries. Indeed, a 10 per cent increase of aid leads to a 0.9 per cent decrease in the level of infrastructure (see Table 3: column 3). To conclude, aid for infrastructure has a positive and significant effect on investment in physical capital in SSA countries. However, a

disaggregated analysis shows that this effect may change depending on the political environment of the country.

Table 3: Foreign aid and factors of growth, Dynamic panel data, GMM system two steps

	(1)	(2)	(3)	(4)
Dependent variable in log	Gross fixed capital formation	Primary completion rate	Gross fixed capital formation	Primary completion rate
Lagged dependent variable	0.849*** (0.102)	0.926*** (0.0782)	0.757*** (0.133)	1.028*** (0.0926)
Log(aid for infrastructures %GDP)	0.0444** (0.0218)		0.0734** (0.0363)	
Log(aid for education %GDP)		0.0597*** (0.0183)		0.0818* (0.0444)
Log(aid for infrastructures %GDP)*conflict			-0.0938* (0.0494)	
Log(aid for education %GDP)*conflict				-0.0972 (0.0825)
Post-conflict dummy			-0.531* (0.298)	-0.482 (0.490)
Gross saving %GDP	0.00324 (0.00257)		0.00173 (0.00301)	
Teacher/pupil ratio		0.00211*** (0.000709)		0.00257** (0.00107)
Foreign direct investment %GDP	0.0212** (0.00852)		0.0114 (0.0113)	
Log(GDP per capita)	-0.0934 (0.196)	0.0892** (0.0453)	0.0308 (0.156)	0.0373 (0.0577)
Inflation	-0.00310*** (0.00108)		-0.000824 (0.00212)	
Control of corruption	-0.0410 (0.0899)	0.0176 (0.0367)	0.0941 (0.364)	0.0983 (0.0792)
Constant	1.146 (1.278)	0.0820 (0.224)	0.912 (0.974)	0.0903 (0.427)
Time effect	Yes	Yes	yes	yes
Observations	276	199	276	199
Number of id	37	35	37	35
Arellano-Bond AR(2) Test	0.36	0.58	0.20	0.63
Hansen OID test	0.67	0.58	0.33	0.70
Number of instruments	25	29	29	32

Note: Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1.

Source: See text.

4.2 Effects of foreign aid on human capital investment in SSA countries

Table 3 (column 2) presents the results of the effects of aid to primary education on human capital investment as measured by the primary completion rate, suggesting that there is positive effect of aid for primary education on the primary completion rate. Specifically, a 10 per cent increase of aid induces 5.9 per cent increase in the primary completion rate. This effect remains when we control for the political environment of the country (stable/post-

conflict). However, as it can be seen with the coefficient of the interaction term, the effectiveness of aid to primary education does not differ between the stable and the post-conflict countries. Thus the main objective of aid allocated for education in post-conflict countries—that is, getting pupils to return to school, keeping them in attendance and teaching them the basics—is far from being realized. This situation may be explained by the fact that quantitative and qualitative objectives set up by aid agencies do not match the priorities and commitment of post-conflict countries. On the other hand, the obtained results are justifiable by the lack of resources and bad governance of allocated funds, which suggests aid allocated to education is used for other than its intended purpose. This result is quite striking as it conforms to previous studies using aggregate aid (see Gyimah-Brempong and Asiedu 2008; Collier 2007).

4.3 Robustness checks

We run two robustness checks. First, we include a non-linearity in the model in order to test whether the effect of aid is the same at all level of foreign aid, and second, we removed outliers from the regression. In this vein, five countries are excluded, notably, Sudan, Congo DRC, Zimbabwe, Liberia and Botswana.

Table 4: Foreign aid and factors of growth, robustness checks

	(1)	(2)	(3)	(4)
Dependent variable in log	Gross fixed capital formation	Primary completion rate	Gross fixed capital formation	Primary completion rate
Lagged dependent variable	0.849*** (0.102)	0.926*** (0.0782)	0.757*** (0.133)	1.028*** (0.0926)
Log(aid for infrastructures %GDP)	0.0444** (0.0218)		0.0734** (0.0363)	
Log(aid for education %GDP)		0.0597*** (0.0183)		0.0818* (0.0444)
Log(aid for infrastructures %GDP)*conflict			-0.0938* (0.0494)	
Log(aid for education %GDP)*conflict				-0.0972 (0.0825)
Post-conflict dummy			-0.531* (0.298)	-0.482 (0.490)
Gross saving %GDP	0.00324 (0.00257)		0.00173 (0.00301)	
Teacher/pupil ratio		0.00211*** (0.000709)		0.00257** (0.00107)
Foreign direct investment %GDP	0.0212** (0.00852)		0.0114 (0.0113)	
Log(GDP per capita)	-0.0934 (0.196)	0.0892** (0.0453)	0.0308 (0.156)	0.0373 (0.0577)
Inflation	-0.00310*** (0.00108)		-0.000824 (0.00212)	
Control of corruption	-0.0410 (0.0899)	0.0176 (0.0367)	0.0941 (0.364)	0.0983 (0.0792)
Constant	1.146 (1.278)	0.0820 (0.224)	0.912 (0.974)	0.0903 (0.427)
Time effect	Yes	Yes	yes	Yes

Table 4 con't

Table 4: Foreign aid and factors of growth, robustness checks (con't)

	(1)	(2)	(3)	(4)
Dependent variable in log	Gross fixed capital formation	Primary completion rate	Gross fixed capital formation	Primary completion rate
Observations	276	199	276	199
Number of id	37	35	37	35
Arellano-Bond AR(2) Test	0.36	0.58	0.20	0.63
Hansen OID test	0.67	0.58	0.33	0.70
Number of instruments	25	29	29	32

Note: Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1.

Source: See text.

Table 4 shows the results. Looking at columns (1) and (2), we observe that the results still hold after removing the outliers. Furthermore, columns 3 and 4 of the table show that the non-linearity holds only for infrastructure. In fact the accumulation of physical capital increases with aid up to a ceiling of 48 per cent of the GDP. This is clearly beyond our sample as the higher value of aid within the sample stands at 16 per cent of the GDP.

5 Conclusion

The issue of aid effectiveness has always been a major concern in the international development literature. While some studies find no correlation between aid and economic growth, others observe that it has helped to enhance some factors of growth in Africa, and that more could be done if aid resources were allocated to pro-poor sectors. This has led donors to redirect aid to Africa mainly towards education, health and infrastructure. A question that may arise is, therefore, whether this policy had the expected effect on wellbeing. The question becomes more prevalent with Moyo's (2009) recent argument that aid is ineffective, thus reviving the debate on the issue. Although studies which support this point of view are limited, the scarce disaggregated data on aid that are available have stressed the controversy. Given the availability of recent data on disaggregated aid, it becomes possible to add more evidence to this debate.

In this sense, this paper assesses the effectiveness of disaggregated aid in terms of its impact on the factors of growth. We evaluate how aid for infrastructure and aid for education, respectively, affect human and physical capital investment in SSA. Moreover, we are able to separate the effects, shedding more light on post-conflict countries and stable ones.

Making use of an instrumental variable methodology on a panel data of 37 SSA countries over the period 2000-10, three main results emanate from the study. First, aid for infrastructures positively and significantly affects physical capital investment at the threshold of 5 per cent. Second, aid for education is positively and significantly associated to the increase of human capital investment. Finally, the results suggest that while aid for infrastructure is less effective in post-conflict countries, there is no significant difference between stable countries and post-conflict countries with regard to the effectiveness of aid to education. In line with our empirical observations, improvements in the management of aid are necessary and could revolve around the following points (i) increasing the volume of aid allocated to SSA countries and (ii) to strengthening the volume of aid allocated for investments in infrastructures in stable countries.

Appendix

Table A1: List of countries

Post-conflict states	Stable states		
Angola	Benin	Malawi	Zimbabwe
Burundi	Botswana	Mali	
Central African Republic	Burkina Faso	Mauritania	
Chad	Cameroon	Mozambique	
Congo, Dem. Rep.	Ethiopia	Namibia	
Congo, Rep.	Gabon	Niger	
Guinea-Bissau	Gambia, The	Nigeria	
Liberia	Ghana	Senegal	
Rwanda	Guinea	Swaziland	
Sierra Leone	Kenya	Tanzania	
Sudan	Lesotho	Togo	
Uganda	Madagascar	Zambia	

Source: Authors' computation based on data from African Development Indicators (2011).

Table A2: Data description and sources

Log(Primary completion rate)	% of students completing the last year of primary school	World Bank (2011) African development indicators
Log(Gross capital formation)	Outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plants, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and 'work in progress'.	- ditto -
Log(aid for primary education %GDP)	Aid disbursement to primary education; basic life skills for youth and adults and early childhood education	- ditto -
Log(aid for infrastructures %GDP)	Aggregate total for transport and storage; communications; energy; banking and financial services; business and other services	- ditto -
Log(GDP per capita)	Constant 2000 \$	- ditto -
Control of corruption	Perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests	World Governance Indicators
Teacher/pupil ratio	Ratio is the number of pupils enrolled in primary school divided by the number of primary school teachers (regardless of their teaching assignment)	World Bank (2011)
Gross saving %GDP		- ditto -
FDI %GDP		- ditto -
Inflation	Consumer price index	
Conflict	1 if post-conflict state	Authors, based on Collier & Hoeffler (2002)

Source The authors.

Discussion of the ‘post-conflict’ definition

The term ‘post-conflict’ or ‘post-conflict situations’ is usually used when a war or violent conflict has ended, be that in the form of an armistice, a peace treaty, military victory, a negotiated settlement or an external intervention. However, there is no accepted definition of what constitutes a situation, country or society of ‘post-conflict’ (Kurtenbach and Wulf 2012). According to Nkurunziza (2008), the concept of post-conflict refers to the period following the end of a conflict in a given country. Despite its apparent simplicity, this concept has two definitional problems. The first is the determination of the beginning of a post-conflict period. It is often impossible to determine the precise date when a conflict is supposed to have ended. Even after the signing of a peace agreement by belligerents, low-intensity hostilities might continue. Nkurunziza uses two major events to determine the beginning of a post-conflict period. The first is the immediate period following a landmark victory by either of the warring parties. This could be the fall of the capital city, seat of political power, following a long protracted war. The second major event used to determine the official end of a war is the date of signature of a comprehensive agreement between the warring parties. Even though such an agreement does not necessarily end all acts of violence, it reduces them dramatically. Hence, it is easier to take the date of the signature of a ceasefire agreement as the end of the conflict and the beginning of the post-conflict period. For example, the recent war in Burundi officially ended when the government signed a comprehensive ceasefire agreement with the main rebel group on 29 November 2003, even though some sporadic violence by another small rebel group persisted until the middle of 2008.

Once the beginning of the post-conflict period is identified, the next question is how to determine its end. If the name of post-conflict is justified on the ground that countries emerging from civil war have specific characteristics that differentiate them from peaceful countries, a post-conflict period should end, in theory, when the specific attributes inherited from the conflict cease to have influence. In reality, however, it is impossible to say exactly when a country returns to normalcy from its post-conflict state. Hence, the post-conflict period is arbitrarily defined as the 10-year period following the end of a conflict (see, for example, Collier and Hoeffler 2002). In the same vein, Junne and Verokren (2005) identify post-conflict as a ‘conflict situation in which open warfare has come to an end. Such situations remain tense for years or decades and can easily relapse into large-scale violence’.

Following these definitions, post-conflict countries in this study are defined as countries known to have experienced civil war in the two last decades and those that record some pockets of rebellion. Based on this definition and the characteristics of political instability in Africa during the two last decades, we identify 12 African countries⁷ in the situation of post-conflict. Post-conflict is a dummy variable which takes 1 if the country is post-conflict state.

⁷ Angola, Burundi, CAR, Chad, DRC, Ivory Coast, Liberia, Uganda, Sierra Leone, Rwanda, Guinea Bissau, Sudan.

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