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Public Policy and Millennium Development Challenges: Case Study of Africa

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Abstract:

Based on a panel of 50 African countries from 1970 to 2015, this study analyzes the impact of public investments and spending in education and health sectors on GDP per capita growth. I separately modeled for education and health capital, while controlling for governance and demonstrated the importance of investments and expenditures on human capital in countries production capacity accumulation, which in the long run leads sustainable economic growth. Results show a positive relationship between spending in those sectors and the per capita income growth and proves their importance on the continents' combat against poverty.

INTRODUCTION

Real income per capita improvements happen over-time thanks to productivity growth which itself, depends on the combination of performant labor and physical capital. According to Englander and Gurney (1994), high productivity can increase real income per capita. Conditioned by the combination of physical and human capital, real income per capita grows in presence of qualified workforce and quality institutional framework. Defined as people's capacity to work, using their skills, and experiences, human capital has been proven very important by many economic theories and researchers. Skilled and healthy workers are very important to economies because they are the main drivers of growth engines (Mankiw 1994). Since growth depends on the combination of qualified human and physical capital (machines), it's very important to consider human capital accumulation through education and health in Africa.

Mainly driven by investments in education and health, Human capital accumulation explains how sustainable economic prosperity has been achieved overtime in developed countries as they intensively invested in both education and health sectors to build production capacity.

Statistics shows that they heavily invested in those sectors throughout years to reach their current Economic level. In Europe, Data on educational attainment show that, more than four fifths (83.2 %) of the population aged 20–24 and 79.6 % aged 25–54 had completed at least an upper secondary (i.e. level 3 and above), level of education in 2016. Taken per gender, men and women post-secondary school attainment rate are respectively 80.8%, 85.6 % in 2016 (Eurostat 2017). In 2015, health expenditures accounted for nearly 10% of gross domestic product (GDP) in the EU; specifically, countries like Germany, Sweden and France allocated 11% or more of their huge GDP to health spending (Health at a Glance: Europe 2016). These statistics proves investments on human capital to be yielding high returns in terms of GDP growth to rich countries. At the same time developing countries especially in Africa, were not able to yield similar results with their investments on the same index; this explains their severe lack of production capacity which normally should be supplied through sustainable investment in educated and health.

Warmly called "Mother Africa", the black continent is unable to reach sustainable economic growth despite its natural endowments and population immensity, which normally should be its main wealth production factors. Densely populated, African nations would be a huge market to their own products if they succeed self-transforming natural resources their countries are endowed

with, using production capacity. Despite several decades of investment in education and health, the continent still unable to reach sustainable aggregate and per capita GDP growth, because its unable accumulate human capacity needed to transform its own resources.

The African continent is lacking necessary skilled workforce to achieve sustainable growth and overcome income inequality (African Development bank, shows). This situation has been impeding its local firms' competitiveness and its countries' economies modernization. Some studies show that governments investment in vocational and higher education to address skill gap is very critical to their economies, but African continent education statistics still exhibit weaknesses. Over one-fifth of children between the ages of 6 and 11 are out of school, followed by one-third of youth between the ages of 12 and 14. According to UIS data, almost 60% of youth between the ages of about 15 and 17 are not in school (Unesco 2017). Sub-Saharan Africa alone, accounts for 38% of global neonatal deaths, and has the highest newborn death rate (34 deaths per 1,000 live births in 2011) (USAID). Since 2001, some African nations like Botswana, Burkina Faso, Malawi, Niger, Rwanda and Zambia have been allocating 15% of their budgets to healthcare (our-africa.org/health) but the question is still posed about the effectiveness and the real impact of those expenditures on human capital because they still don't grow in production capacity. As education capital is conditioned by investments in health, it's compelling to pay close attention to countries expenditure toward those sectors, to create good conditions to achieve growth. As Pantelis Kalaitzidakis, Theofanis P. Mamuneas, Andreas Savvides and Thanasis Stengos (2001) said it, Human capital accumulation is measured by primary and secondary school enrolment, because they believed those levels are baselines needed by people to join the workforce.

The World Development Goal (MDG) also have pointed out the importance of education and health improvement in the process of human capital accumulation to accelerate tangible economic progress. But despite efforts African nations are still incapable to build capacity to drive their economies to sustainable economic growth. As Governments are responsible to financing those vital sectors, this study aim to understand, why African nations investments efforts still not building human capital production capacity to foster sustainable growth by asking this question: how does expenditure on education, health; investment and other policy intervention affect economic growth in Africa?

To provide a precise explanation to this question, it also would be important to consider some other important factors like governance and public policy that could contribute to economic development. growth could be stimulated if sound public policy intervention and good governance are being applied across the nations. Otherwise they would not lead those important spending to any improvement in production capacity needed to achieve growth.

Covering 50 African countries panel dataset from 1970 to 2015 this empirical study seeks to contribute to literature, by providing African countries with policy advice to achieve sustainable economic growth through human capital stock and investment. To achieve this goal, my study will be assessing the correlation between GDP per capita growth and public spending on vital social sectors like health, education and investment over time across all African nations. It will exhibit the direct and indirect effect of spending on human capital and economic growth, considering investments in general, governance and fiscal balance. In the remaining parts, the paper is structured as follows. Section 2 reviews past literature and different arguments developed on the topic by past authors. The section 3, explains the data sources, its specification and the model used for the analysis. Section 4, provides and interpret empirical results and robustness check to prove results consistency. Section 5 will be explaining the effects of different policy intervention on social indicators and economic growth, giving policy advise to conclude.

2- LITERATURE REVIEW

Many previous studies based their studies on many different aspects of this study. Some authors worked on our topic and find sound outcomes, while some of them have partially covered the topic. Some of them assessed either the effects of improving education or health indicators, or the impact of public spending on growth. Some other authors focused their works on the impact of education on growth, a very important social indicator needed by economies to increase capacity to productivity through capacity quality workforce to nations' economies. Basing their research more on education capital impact on growth some authors ignored the importance of some other social indicators like health as part of stock of human capital that can influence economic outcomes.

The past literature in general find positive, the effects of school enrollment or education on economic growth (Levine & Renelt, 1992; Mankiw, Romer, & Weil, 1992; Sala-i-Martin, 1997).

Coulombe, Tremblay, and Marchand (2004), in their study of 14 OEDC countries (2004) showed that countries benefit 1.5% grow in its per capita gross domestic product, when literacy rate increases by 1% in average. They showed in their arguments a positive correlation between education and economic growth. At the same time, some other researchers considered health as cornerstone to production. It's proven that health is the first condition of production to happen because even educated a sick person cannot be able to work from hospital bed, but at the same time a healthy uneducated people cannot be able to move their economies forward because of lack of skills.

Considering both arguments, one can notice the complementarity of both education and health is necessary to countries to achieve growth. Because countries production capacity is useful only if people are healthy and able to work to achieve their full potential. In consideration to the importance of health indicator in economics, Benhabib and Spiegel, (1994); and Pritchett, (1996) argues that both micro and macroeconomic growth analysis based on education outcomes don't hold because they are not consistent and convincing. So, all outcomes from analysis of impacts of education capital on economic growth raised a lot of important questions. But some researchers like Jones and Olken (2005) critically shows the importance of education capital in growth analysis in the within-country dimension. Because according to him education capital fixed effect always affect outcomes at country level. Krueger and Lindahl (2001), supported and proved their argument that education capital measurement and modeling affects outcomes as they studied, economically heterogeneous countries; some of them are rich some of them are not. They also proved that analysis model also affect results, while some other opinion on the subject consider more health capital. This means that human capital accumulation should be composed by both education and health. Thomas (1998) based his analysis on the impact of health on salary, to show the importance of health capital for human capital stock and growth. He argues that worker's salary difference mostly comes from their health status, because a sick educated worker cannot work harder than a healthy one. He proved the importance of including both education and health indicators in social spending and human capital stock study to achieve good results because both complete each other's.

For Bloom and Canning (2003) using health capital as indicators is important because it has a positive it affect economic growth at individual and macro level. Baldacci, GuinSui, and de Mello (2003) also supported the idea of considering both education and health complementarity

as condition to economic growth by finding positive relation impacts spending on those sectors have on social status and growth.

Like previously cited authors, Anand and Martin (1993), Hojman (1996), Bidani and Ravallion (1997) proved social spending seriously impacting economic outcomes. To Measure health capital some studies used infant mortality or child mortality rate as proxy to highlight public spending contribution to growth through a decrease in infant mortality. However, developing countries like the African one, are still registering high infantile death. Considering this situation, Gupta, Verhoeven, and Tiongson (2003) find the importance of world developing countries to invest in health capital as they find positive, the impact of public spending on health care and the health status of the poor.

From that finding one, can consider investments on health as important and positively effecting economy. However, those investments should be of quality to positively impact economic growth in the long run. Therefore, Investment in medical supplies, medical practices, research, creation of modern medical school could be good way of qualitative investment on health sector. From all the authors arguments, analysis, and comments, the complementarity of education and health capital could be the condition to developing countries to achieve growth in the run. The analysis shows the importance of education in health capital investment because medical doctors need to attend school to provide people with quality health care.

Past literature mixed results on education and health spending effectiveness in improving social indicators have been very difficult to authors because of data unavailability. It's explained by the fact that social expenses statistics and outcomes are very hard to find in international development organizations data bases, where secondary data are collected. Mayer-Foulkes; Miguel & Kremer, (2003) find the interaction between education and health sectors significant spillovers to be hard to find in past literature proving the failure of those authors in explaining the effect of spending and social indicators, which could be due to chosen model or data unavailability. Schultz (1999), find public awareness and the capacity of families to address health issues increased thanks to higher level of education in his studies. He showed how more years of schooling impact health in communities, as high education increases knowledge and awareness on diseases prevention technics. His study found positive the relationship between skills acquired through education and healthiness. Human capital formation can only be complete when its educated and healthy because it enables to solve problems, and overcome other issues related to development and life in general.

According to Barro (1996) better health can help reduce the depreciation of education capital, increasing education positive effect on growth. He also touched a very important point in research making failure to control for some variables seriously impacting social spending effectiveness outcomes. Abed & Gupta (2002); Gupta, Davoodi, & AlonsoTerme´, (2002); Mauro, (1998); Rajkumar & Swaroop, (2002) proved in their studies the importance of institutions and governance in making social spending indicators, and growth relationship to be positive. Considered at the Afican level, good institutional and governance framework is very important, because poor governance has been identified to be causing the failure of social spending to positively affect economic growth.

Rodrik, Subramanian, and Trebbi (2004) emphasized the importance the role of governance in sustaining economic growth. Some few researchers have examined the return effects that social indicators aggregate social spending, can have on economic growth in an integrated system. It came out that these interactions had important effects and have been found significant to studies in which they have been incorporated. For Ranis and Ramirez (2000) modeling explicitly human capital and growth makes finding to be highly statistically significant in both directions in developing countries studies. Gyimah-Brempong and Wilson (2004), have found positive and robust the relationship between expenditure or investment in health capital and growth in both sub-Saharan African and OECD countries.

David N. Weil (2007) in a research on health impacts on economic growth, used micro level estimates to find effect of health on individual outcomes, and approximately build the effect of health on GDP per capita growth. He used different methods to find results on return to health and combine them with cross-country and historical data on height, adult survival rate and age at menarche. His main argument was based on the “proximate or direct effect of health”, in which he assumes that healthier people are always better workers, as they can work harder and longer while thinking more clearly on subjects and find solutions to increase marginal productivity.

From his arguments, he clearly supports micro impact of health on economic growth because he made a connection between workers’ wages earned and their health status. For him, healthier is a worker, more and harder he works, and more he earns. Transposed into a macro framework, he shows that countries will grow more with healthier human capital as they work more, to register more growth in GDP. Based on David Neils (2007) studies, more human capital is healthy, more

it educated and productive it is. This argument means that there is a positive correlation between health and GDP growth.

Instead of looking at health expenditure only some researches like Shankha Chakraborty (2004) looked at the impact of mortality on economic growth while linking it to public investment in health sector. She introduced the endogenous mortality effect on growth in a two-period overlapping generation model that takes government investment on health capital as a condition to the probability of people to survive from the first period to the second. She believes that a high death rate is related to poor public health policy, linking good and efficient public health spending to a decrease in morbidity and mortality.

She also believes that high mortality societies hardly growth economically and discourages savings as life expectancy is very short. She also linked returns on education to high mortality showing that, high mortality to causing reduced returns on education. Regarding pre-cited works on the subject, we can emphasize the importance of investment on health capital to economic growth, because countries don't grow in absence of heathy, educated and abundant human capital.

Economic growth happens only when countries are producing. It is the combination of physical capital and healthy, educated human capital (labor). When mortality is, high productivity would be hurt and there would be lack of consumption market because of high mortality.

However, there are some authors that have not found evidence of an impact of life expectancy on economic or per capita growth. Instead they find an increase in population with an increase in life expectancy. That is that case of Daron Acemoglu and Simon Johnson (2007), in their studies on effects of life expectancy on economic growth, in which they predicted mortality using pre-intervention mortality rates from various diseases and global interventions dates. They exploited important health improvements from years 1940 to find the effects of life expectancy on economic growth and found out that predicted mortality has a significant impact on change in life expectancy from 1940. They also find out that a 1% increase in life expectancy leads to a 1.7 or 2% increase in population using a predicted mortality as an instrument. This shows that life expectancy has a much smaller effect on total GDP and conclude that there is no evidence showing that a large life expectancy increases income per capita.

Some other studies tackled another angle of the relationship between health, mortality and economic growth. That is the case of Peter Lorentzen, John Mcmillan, and Romain Wacziarg (2008), who argued in their research that high adult mortality contributes to economic growth

reduction by shortening time horizons. They conduct their research paying attention to the age pattern of mortality and to endogeneity issues that could happen, and find a relationship between a greater risk of death during the prime productive years and high levels of risky behavior.

They showed in their analysis outputs, how almost the entire African continent growth tragedy is explained by adults' mortality and linked their arguments on how the ongoing AIDS epidemic and its long run forecasted impact has become a serious issue because of the high number of death registered each year since several decades on the mother continent.

They came up with a concept that explains their arguments and especially the direction they are given to their research. It shows malaria, other diseases, climate and geographic features as causing high mortality rate which impact school enrollment because of high infant mortality. It also causes a decrease in fertility because adults mortality rise, and decrease investment because of lack of human capital to produce. All put together would pull economic growth down, because without human capital there will be no production nor growth.

Seema Jayachandran and Adriana Llenas-Muney (2009) showed in their studies on life expectancy and human capital investment in Sri Lanka, that longer life expectancy encourages educational investment as the payout value over time increases. They based their analysis on the sudden drop in maternal mortality in Sri-Lanka from years 1946 to 1953 and find an increase in girls' life expectancy in the country. They also expanded their works on girls' education to see how their school attendance increases relative to boys in areas of high maternal mortality, and find significant results that showed that an extra year of life expectancy would increase both literacy by 0.7 percentage point (2%) and years of education by 0.11or 3%.

During their multi-dimensional work, they respectively used Differences in Differences to analyze health and education. Their analysis showed how a percentage increase in earnings positively affected years of schooling and uncovered improvements in women health thanks to education; because more educated women are healthier able to prevent diseases. It also enables them to find a higher-quality husband and increase their bargaining power in the household at the same time with improvements in controlling birth control using contraceptives methods; The model they developed shows new benefits other than earning from education.

Gabriella Conti, James Heckman, and Sergio Urzua (2010) in their research found education causal effect on health and health-related behaviors. Working on schooling choice impact and post-schooling outcomes, they find out that both schooling and their outcomes are determined in part

by schooling and are influenced family environments. They showed that family background, cognitive, non-cognitive and health status by age 10 and health disparities at age 30, are important factors on labor market. For them selection based on those early life factors explains the difference made by education in poor health. So, education explains differences between adult's outcomes and health status.

Flavio Cunha and James J. Heckman (2006) estimated some evolution of cognitive and non-cognitive skills models and analyzed the importance of family environments in shaping those skills at different level of the child life cycle. The main goal of their study was the analysis and identification of the technology and skill formation which estimate a dynamic factor model to eliminate endogeneity biases and estimate effects on adult outcomes through the scale of the factors. They finally found that children life cycle with cognitive skills affect more at early ages and non-cognitive skills affect more at later ages. They came out with children cognitive and non-cognitive skills multistage production function estimates that are determined by parental investments and environment at different stage of their life. Flavio Cunha, James J. Heckman and Suzanne Schennach (2010) tried to find the elasticity of investment when substituted in one period by stock of skills and later remediation.

They find a serious targeting intervention on children with parental and personal birth endowments using the estimated technologies, and declared substitutability to be decreasing in later in life. Production of cognitive skills means that there was investment in earlier stages of childhood is better than later stages. Investment in early childhood skills is important because the future of a child is built from childhood and parent influence contribute a lot to it. Those authors took it seriously because economic growth is partly related to education and skills. Their analysis proved again the important relationship that exists between education and growth as health also has been proved important. Contrary previously cited authors, some of them linked economic growth to geography.

Nicola Gennaioli, Rafael la Porta, Florencio Lopez-de-silanes and Andey shleifer (2012) in their study investigated the determinant of regional development basing their work on a new data essentially composed by sub-regional regions from 110 countries (74%) of the worlds, and represented 97% of the entire planet Earth GDP. In their cross-regional analysis they argued that favorable geography is associated with high per capita income in regions within countries while they found cultural aspect that is measured by ethnic heterogeneity not explaining the regional

differences. For them lower average temperature and proximity to the ocean, as well as higher natural resource endowments areas, have higher per capita income than other regions within countries. However, some other authors believe that regional growth patterns depend on regional differences in infrastructure, physical human capital, as well as in foreign direct investment (FDI) flows in the regions.

That is why Belton Fleisher, Haizheng Li and min Qiang Zao (2010) find human capital positively affecting outputs and productivity which automatically foster growth in their cross-provincial study in China. Education also played an important role in their outcomes of innovations activities which indirectly affected infrastructure. After conducting a cost benefit analysis of investment in human capital and infrastructure they found that investments in human capital generates slightly higher returns compared to those directed to infrastructures in the developed Chinese eastern regions. From these analysis, we retained the importance of investment in education and health capital compared to other sectors considered as important by business world.

3- DATA AND MODEL

(a) Methodology

This study aim to capture social spending, public and fiscal policy potential impacts on social indicators and growth, applying the endogenous growth econometric model of analysis, and focalizing on four main indicators. To achieve my studies goals, I used, real income per capita growth, total investments, education and health capital as dependent variables in my equations along with a set of independent or explanatory used in previous studies. To measure countries economic performance, I used both current level and the changes in education and health capital as main independent variables in the growth equation because they are considered like the world successful economies engines that enabled developed their production capacity. Basing the study on African nations which generally are more likely not politically stable, I included political stability in all four equations to capture its effect on outputs. To control for the dynamic structure of the existing relationship between social indicators and spending, I appropriately included the lag of spending variables, which consider the dynamic effects of last year investments on current social indicators. I allowed the presence of non-linear effects at some levels of spending and the interaction between both education and health capital.

Analyzing a panel data, I based all four-equation analysis on three models such as fixed-effect (LSDV), random effect(Re), and instrumented variable model (IV/2SLS), without forgetting using robust standard (Robust) errors method to correct potential heteroscedasticity in the analysis. I used fixed effect, to capture the models, specific effects on each country in each year of the panel, decrease heterogeneity distortions, and endogeneity issues related to fixed effects while I used the robust standard error estimator as an alternative. Random effect model (FGLS) estimator at its turn, is used to control for error term autocorrelation in the analysis. Knowing that fixed effect model cannot address all problems in the panel, I included an instrumental variable (IV/2SLS) model to address any endogeneity due to reverse causality that would arise using the lagged of endogenous variable as instrument for the 2sls analysis. An F-test has been conducted to verified the instruments validity. The robustness of my results is checked, by the consistency of results obtained under all four pre-cited estimators, and their moving averages equation outputs.

(i) Growth equation

In this equation, the augmented neoclassical growth framework that includes education, heath capital and a set of macro and institutional control variables, has been adopted to show revenue per capita output, like in Mankiw et al. (1992) augmented growth equation. It goes beyond the one of Solow in which the predicted effects of saving and population growth on income are too large. The equation is as follows: $y = f(S_{k,} hea, edu, \Omega)$.

Where the output y, and inputs $S_{k,}$ he, edu, are respectively representing the GDP per capita, investments, health capital, education capital, while the symbol Ω is the group of control variables that is augmenting the model framework baselines like Mankiw et al (1992) did in their paper, to augment and address the Solow growth model weakness. Those macro and institutional control variables are, trade openness, fiscal balance, inflation rate, and political stability. Considering a possible relationship between revenue per capita growth (y) and both initial and increment in human capital stock (he, edu), I included the variation of health and education capital, in the following equation: $y = f(S_{k,} hea, \Delta hea, edu, \Delta edu, \Omega)$.

Added to the baseline growth model, the following econometric equation has been found:

- $g_{it} = \alpha_{it} + \eta_{it} + \beta_1 . ln(y_{it-1}) + \beta_2 . \eta_{it} + \beta_3 . Sk_{it} + \beta_4 . Edu_{it-1} + \beta_5 . Hea_{it-1} + \beta_6 . \Delta Edu_{it} + \beta_7 . \Delta Hea_{it} + \sum_{m=8}^{n} \beta_{1m} (\Omega^m{}_{it}) + u_{it.}$

A five-year moving average investment $(Mov\_ g_{it})$ have been used as a dependent variable in the second growth equation to account for robustness check and measure the impact of human capital indicators and GDP per capita on countries five years real GDP per capita growth moving average. The equation is as follows:

- $Mov\_g_{it} = \alpha_{it} + \eta_{it} + \beta_1 . ln(y_{it-1}) + \beta_2 . \eta_{it} + \beta_3 . Sk_{it} + \beta_4 . Edu_{it-1} + \beta_5 . Hea_{it-1} + \beta_6 . \Delta Edu_{it} + \beta_7 . \Delta Hea_{it} + \sum_{m=8}^{n} \beta_{1m} (\Omega^m{}_{it}) + u_{it.}$

Where g_{it} denotes the real per capita growth; η_t the country and period fixed effect; $\ln(y_{it-1})$ is the lagged logarithm of per capita income to control for the convergence of the economy to a steady state where growth rate decreases while income per capita increases. The variable Sk_{it} at his turn is the investment ratio that captures it relationship with the stock of physical capital when it increases. Edu_{it}, represents the education capital stock, proxied by the combination of gross primary and secondary school enrolment rate, a very important index to the millennium Development Goals (MDG). It captures the progress of those countries in building human capital or production capacity in terms of quality input in those countries productivity, growth or wealth production process. Edu_{it-1} is the lag of education capital that captures the effects of last year's education capital stock on current economic growth. ΔEdu_{it} is the change in education capital that measure the adjustment in level and quality of productive workforce input. To measure people previous and the variation of current year health condition effect on economic performance, I also included the variable Hea_{it-1}, the lag of stock of health capital, and $\Delta Hea_{it;}$ respectively representing the lag and the change in people health conditions. It is proxied by child under 5-year-old mortality as data on mortality rate and morbidity are unavailable. Child under -5 mortality represents a very important target to the MDG's and is expected to be positive because the sign of mortality rates coefficient is reversed to allow its outputs positive interpretation that correspond to a decrease in child mortality measuring an improvement in health capital. η_{it} is the total population growth rate while $\Omega^m{}_i$ is the set of key determinant growth controls variables like Openness (sum

of total imports and export over real GDP), change in Terms of trade *(ΔTOT)*, inflation rate *(Inflation)* and fiscal balance(Fisc_bal). High-inflation dummy (*Highinf_dummy*) has also been used according to Fischer (1993) and Baldacci et al. (2004) to measure the effect of countries that yearly inflation, rate exceed 20%. Low deficit dummy has also been included to measure the impact of countries with deficit below 3% of GDP, while low deficit fiscal balance *(Lowdefbal)*, an interaction variable obtained multiplying low deficit dummy by fiscal balance controls for any fiscal policy non-linear effect.

(ii) Investment equation

The investment equation aims to measure how human capital affects investment in the panel of countries overtime, like did (1993), Benhabib and Spiegel (1994) and Mauro (1998) in their empirical studies, by adding good investment climate variables. To account for those good business and investments climate, governance indicator is used as proxy while macroeconomic environment is controlled for, using fiscal balance and inflation as proxy. Like Baldacci et al. (2004), the interaction term (low-deficit dummy and fiscal balance) have been included to control for any potential impact of non-linear effect of the countries fiscal balances on investment.

The equation is as follows:

- $I_{it} = \alpha_{2i} + \eta_{2t} + \beta_9 log(y_{t-1}) + \beta_{10}\eta_{it} + \beta_{11}Edu_{it} + \beta_{12}Hea_{it} + \beta_{13}Fisbalance + \beta_{14}lowdefBalance_{it} + \beta_{15}inflation_{it} + \beta_{16}Highinf\_dummy_{it} + \beta_{17}Poorgov\_dummy_{it} + u_{it}$

In this equation, governance have also been used as a dummy together with macro variables already defined in the growth equation, to capture the nature of governance and its impact on investment in those countries.

A five-year moving average investment (Mov_I_{it}) have been used in the second investment equation as a dependent variable for robustness check to the annual investment equation to show the impact of human capital indicators and GDP per capita on a five-year moving average investments. The equation is as follows:

- $Mov\_I_{it} = \alpha_{2i} + \eta_{2t} + \beta_9 log(y_{t-1}) + \beta_{10}\eta_{it} + \beta_{11}Edu_{it} + \beta_{12}Hea_{it} + \beta_{13}Misbalance + \beta_{14}lowdefBalance_{it} + \beta_{15}inflation_{it} + \beta_{16}Highinf\_dummy_{it} + \beta_{17}Poorgov\_dummy_{it} + u_{it}$

(iii) Education Equation

Based on Baldacci et al. (2003) and Gupta et al.(2002b) analysis, the education equation, added to key determinants, like health capital and interaction term with governance, measure the potential effect governance may have on education spending effectiveness**.** A lagged logarithm of education spending has been included to measure the potential effect of previous expenditure on education capital and found to be not significant.

The equation is as follows:

- $Edu_{it} = \alpha_{3i} + \eta_{3t} + \beta_{18}.ln(y_{it}) + \beta_{19}.Pop15_{it} + \beta_{20}.Hea_{it} + \beta_{21}.Urban_{it} + \beta_{22}.Quality_{it} + \beta_{23}.EduSpend_{it} + \beta_{24}.EduSpend_{it-1} + \beta_{25}.EduSpend * Poorgov + \beta_{26}.EduSpend_{it-1} * Poorgov_{it-1}\ \beta_{27}.FemaleEdu_{i,t} + u_{it.}$

A five-year moving average investment (Mov_Edu_{it}) have been used in the second education equation as a dependent variable, for a robustness check to the annual education capital equation, and capture concomitantly, health capital and the income per capita impacts on education capital over five year moving average.

The equation is as follows:

- $Mov\_Edu_{it} = \alpha_{3i} + \eta_{3t} + \beta_{18}.ln(y_{it}) + \beta_{19}.Pop15_{it} + \beta_{20}.Hea_{it} + \beta_{21}.Urban_{it} + \beta_{22}.Quality_{it} + \beta_{23}.EduSpend_{it} + \beta_{24}.EduSpend_{it-1} + \beta_{25}.EduSpend * Poorgov + \beta_{26}.EduSpend_{it-1} * Poorgov_{it-1}\ \beta_{27}.FemaleEdu_{i,t} + u_{it.}$

For this equation, income level is represented by (y) and aims to show how income per capita affects education capital proxied by the addition of both primary and secondary enrolment rate. $ln(y_{it})$ represent the logarithm of the real GDP per capita; $Pop15_{it}$ specifies the school age population which mostly is between 0 to 15 years. Edu_{it-1} denote the lagged education capital to measure last year education outcome impacts on current education capital. Knowing the importance of public health, education could be conditioned by health status, because only healthy people are more likely to invest in education. The variable Hea_{it} represent the health capital proxied under-5 child mortality like in the growth and investment equations, while $Urban_{it}$ is explaining Urbanization which explains the easy access to education in urban areas where people are more likely to invest in children to education quality. $Quality_{it}$ at his turn capture Quality of education, proxied by student class repetition rate, which explains lower education quality as result of high class repetition rate. *(EduSpend)* is the expenditure on education and poor governance*(Poorgov)* is used to capture governance effects on social indicators. As women are children primary nurturers and educators in society, the variable is included to capture how

investing in female education impacts on education capital. It shows a positive correlation with education because an increase in share of female student, increases education capital and proves wrong gender inequality in African societies.

(iv) Health Equation

Based on Baldacci et al. (2003) and Filmer et al. (1998), the health equation started with the general specification to which an interaction term of poor governance and health spending(*HeaSpending)* has been added like in the education equation, to measure potential effect of governance on health capital effectiveness. Here the log of current health spending and the per capita income were found highly significant like it was the case in the education equation with the log of current education spending. The equation takes the following form:

- $Hea_{it} = \alpha_{4i} + \eta_{4t} + \beta_{26}.ln(y_{it}) + \beta_{27}.Fertility_{it} + \beta_{28}Edu_{it} + \beta_{29}Urban_{it} + \beta_{30}HeaSpending_{it} + \beta_{31}\ HeaSpending_{it}*Poorgov_{it} + \beta_{32}\ FemaleEdu_{it} + u_{it}$

To capture the best fit of returns to spending and find past years' effects on the dependent variable, a five-year moving average of Hea_{it} (Mov_Hea_{it}) and the lagged value of all explanatory variables were used in the following health equation, first for a robustness check to the annual education capital equation, and secondly to capture their impacts on health capital over five year moving average. As Deaton (2004), considered stronger, the benefits of investment in health to developing countries, the results were significantly positive as under-5 child mortality would decrease when they increase. The equation takes the following form:

- $Mov\_Hea_{it} = \alpha_{4i} + \eta_{4t} + \beta_{26}.ln(y_{it-1}) + \beta_{27}.Fertility_{it-1} + \beta_{28}Edu_{it-1} + \beta_{29}Urban_{it-1} + \beta_{30}HeaSpending_{it-1} + \beta_{31}\ HeaSpending*Poorgov_{(it-1)} + \beta_{32}\ FemaleEdu_{it-1} + u_{it}$

$ln(y_{it})$ is the Income level per capita proven by past studies to be a crucial variable that determines people health status, Carrin & Politi, (1996); Pritchett &Summers, (1996) because higher is income per capita more people can afford healthcare expenses. *FemaleEdu* is used to see how female education lead institutional factors to affect health capital like in education equation. Female education (*FemaleEdu*) has been identified by studies to be determinant to infants and children, as well as the population health status in general**.** Especially in developing countries like in Africa, women play key role in keeping the family healthy because their education positively affects infants' health but not with fertility rates because more female are educated less fertile they

are. Urbanization (*Urban*) represent the share of the urban population, as urban area is associated with low mortality rate compared to poor rural areas. Schultz (1993) showed mortality rate higher for rural, compared to urban ones to prove that urbanization can be a determinant indicator to population health status. The variable (*Poorgov*) is a dummy variable that takes the value one if the country governance is poor or zero otherwise. It represents poor governance and is proxied by the average of the sum of governance indicators (political stability, voice accountability, corruption control, rule of law and governance effectiveness)**.** (*HeaSpending)* at its turn represent the current health spending.

(b) Data

for this paper 50 African nations panel dataset has been collected from 1975 to 2015 (the list of those countries is in the Appendix). A Five-year moving average data was computed and used as dependent variable to capture the impact of social spending's on the dependent variables 5 year averages and minimize errors that can be present in those variable annual datasets. Data on Governance, macroeconomic and some of the social indicators variables were collected form the World bank development index and IMF's World Economic Outlook databases. Some other social indicators are from Unicef, World health organization, Unesco. The unavailability of social indicators and spending datasets are very limited ad vary from one variable to the other because some countries are missing a lot of data in many area. That is why observations vary between regressions. The difference in sample sizes for the IV estimates is due to instruments data availability as some of them are missing values.

4- EMPIRICAL RESULTS

(a) Main results

The annual and the 5-years moving average growth, investment, education, and health equations are statistically significant in most cases and presented from tables 1- 4.

(i) Growth equation

Both changes in education capital and the level of education capital (lagged education) are found to be statistically significant and positively effecting or contributing to the per capita economic growth, meaning a rise of education capital increases in the growth rate. A 1%-point

increase in education capital level positively affects growth rate. Similar results were found across the different model estimated for the education equation analysis. Both LSDV and robust estimator's results indicate a very high level of significances (1%) while the 2SLS estimator coefficient estimate have a reduced level of significance (5%) due to instruments used, a slight rise in standard errors and a little decline in sample size within the model. Considering those results, it clearly shows endogeneity bias not having any significantly affect all results.

Compared to that of education capital, health capital impacts on growth differs because its significance is a bit reduced (5%) for LSDV and the robust estimators and (10%) for GLS and 2SLS one. Changes in the health capital indicator at his turn, positively affect economic growth with a high level (1%) of significant in all model estimators**.** The rest of variables in the analysis also affect growth. Inflation increases growth in our case because of its annual effect on growth, which is corrected in the second growth table where a five-year moving average dependent variable (GDP per capita growth) was used. In the second table inflation rate is found negative and statistically insignificant. While insignificant fiscal balances don't affect economic performance, 1 percentage increase in inflation rate, increases growth by about 0.1 percentage point because of its high level of significance (1%), even though the ideal inflation rate should be not greater than 2% or 3%. But when it exceeds 10% level, 0.1 percentage point increase would decrease growth. In addition, Investment and openness both greatly impact on growth fiscal balance is insignificant while Governance, negatively affect growth referring to GLS and 2SLS model.

(ii) Investment equation

Health capital results has been found to not affecting investment when education capital not at a high significance level (1%). An increase in education capital of 1 percentage point increases investment-to-GDP ratio. Positive and significant coefficients were produced on education capital by the LSDV, the robust estimator, and the FGLS estimator, but the IV estimator do not. Inflation is significant at 1% level and associated with an increase in investment-to-GDP, while poor governance, representing lower rating governance in those African countries, contributes to the reduction in the investment ratio.

(iii) Education capital equation

Education spending positively affects education capital with a high level of significance (1%) and its current coefficient is 21.67. This means that an increase in education spending will increase education capital by 21.67 points which is a good correlation between both variables. Share of female education also has a strong and positive correlation with education capital because its significant at (1%) level, as an increase in female education rises education capital by 0.75 points.

Because of the crucial role, they play in the family, the more women are educated, more their children attend school. In the second education table, the share of female education is confirmed to be positively correlated with the education capital. At the same time, health capital and current income per capita are positively significant 1% level each, showing an increase in education capital five years moving average. Considering governance as very important in public policy decision making, it has been found to having negative correlation with education capital as an increase in poor governance decreases the five years' education capital moving average by 0.14.

The positive impact of higher education spending on education capital is high in those African countries. In addition, to that, the results are confirming a strong link between health capital and education capital in the moving average education capital in table *4.a*. An increase in health capital which means a decrease in under - 5 child mortality, increase school enrolment that represents education capital by 0.15 point.

(iv) Health capital equation

Health spending has been found to having a positive and significant relationship with health capital. Its negatively significant at 5% level but positively correlated with health capital because its negative sign decreases under -5 child mortality, used to compute health capital. So, an increase in health spending decrease under -5 child mortality by -25.34 point. Its significance is even higher in the robust, FGLS, and IV (2sls) results as its at 1% level. Analyzing its lagged value using a 5-year health capital moving average, a 1 percent increase in health spending, increases its capital by decreasing child under- 5 mortality by -24.92 points.

Urbanization, and current income per capita also have a positive correlation with health capital as they are respectively significant at 10% and 1%, and decreases child mortality by -0.02 and -

0.06 percent points when they are increased by 1%. Understanding the income per capita results one can clearly deduct its negative relationship with child mortality because more money people have more they provide good life condition to their children, which contribute to a decrease in child mortality because they also can afford providing good health care to their family.

Fertility rate in this case is found to also be negatively correlated with child mortality which may be possible when it contributes to decreasing the overall child mortality. In contrast to the statistically significant results in the annual health capital regressions, Poor Governance in the 5-year moving average health capital results, has no effect on health spending in the interaction in LSDV, Robust, and FGLS, but positively impact health capital in IV(2sls) output. It shows that poor governance interaction with health spending have decreased spending, and provoked an increase in child under -5 mortality. So, 1 percent increase in poor governance increases under -5 mortality by 0.33. it confirms the fact that a poor governance is highly associated with poor public policy which will have no effect on child mortality.

5- CONCLUSION POLICY IMPLICATION

The analysis results confirmed a strong relationship between economic growth and education and health capital. The elasticity of both education and health expenses proved themselves to improving growth through their capital stocks. So, 1% increase in economic growth is associated with an increase education capital stock which itself depend on spending. It shows an indirect and positive relationship between growth and social spending. Based on this spending-growth relationship, African countries should review their fiscal policy by increasing investment in health and education sector. They should also strengthen policies in those sectors to increase efficiency and quality in both health education outcomes as they will help the continent to grow in production capacity needed to move their economies toward the MDGs. Efficient Investments, good macroeconomic environment and governance are also very important because investment is positively correlated with growth while bad macroeconomic environment and governance are not. Because countries don't grow when they are inefficiently ruled and they hardly grow under bad governance. Because it negatively affects policy making decision. Results of social spending proved public policy reforms in those sectors to be important to African nations to achieve MDGs though good governance poverty reduction.

Table 1. Growth equation *Dependent variable: Real per capita GDP growth*

	(1)	(2)	(3)	(4)
	LSDV[a]	Robust regression	FGLS	2SLS
Investment	0.053**	0.053**	0.053**	0.003
	(0.021)	(0.023)	(0.021)	(0.046)
Population growth	-10.45	-10.45	-10.64	-53.28*
	(10.39)	(8.325)	(10.26)	(28.23)
Catch-up variable	1.422	1.422	0.068	2.087
	(5.620)	(4.583)	(5.569)	(7.730)
Education capital (t - 1)	0.062***	0.062***	0.051**	0.418
	(0.020)	(0.017)	(0.020)	(0.342)
Health capital (t -1)	0.091**	0.091**	0.071*	-0.704*
	(0.040)	(0.042)	(0.039)	(0.384)
Changes in Education capital	0.022	0.022*	0.017	0.456
	(0.015)	(0.012)	(0.015)	(0.390)
Change Health capital	0.084***	0.084***	0.074***	-0.661*
	(0.027)	(0.030)	(0.026)	(0.370)
Changes in terms of trade	-0.022	-0.022	-0.022	-0.060
	(0.022)	(0.021)	(0.022)	(0.048)
Openness	0.053***	0.053**	0.050**	0.056**
	(0.020)	(0.024)	(0.020)	(0.028)
Fiscal balance	0.059	0.059	0.059	0.134
	(0.101)	(0.094)	(0.101)	(0.163)
Low-deficit fiscal balance	67.71	67.71	67.60	49.32
	(57.73)	(47.88)	(49.75)	(66.79)
Inflation rate	0.088***	0.088***	0.090***	0.069
	(0.022)	(0.027)	(0.022)	(0.048)
High-inflation dummy	-4.808	-4.808	7.636	68.00
	(124.8)	(127.7)	(124.4)	(168.2)
Poor governance dummy	-68.77	-68.77	-100.4***	-240.0**
	(44.63)	(47.94)	(35.59)	(93.50)
Constant	734.5***	734.5***	778.8***	1,049***
	(141.9)	(113.9)	(140.9)	(265.7)
Observations	2,191	2,191	2,191	2,190
Adjusted R-squared	0.006	0.027		
Number of Year	46	46	46	

The absolute value of *t-statistics* in parentheses. I used adjusted R-square in replacement to R-square

[a] Is the baseline regression on the output table

I instrumented endogenous variables: Investments in human capital indicators. The lagged value of Government expenditure in education & health has been used as instrument for the changes in education and health capital, because I assumed that those expenditures affect human capital indicator as government is education and health services primary provider in those African countries represented in my study. *Significant at 10% **Significant at 5% ***Significant at 1% level

Table 1a. Growth equation *Dependent variable: real per capita GDP growth 5 years moving average*

	(1)	(2)	(3)	(4)
	LSDV[a]	Robust regression	FGLS	2SLS
Investment ratio	0.013	0.013	0.010	-0.069
	(0.018)	(0.017)	(0.018)	(0.055)
Population growth	-25.81***	-25.81***	-24.68***	-87.46**
	(8.838)	(7.495)	(8.741)	(34.94)
Catch-up variable	9.359*	9.359*	7.783	12.37
	(4.886)	(4.962)	(4.833)	(8.802)
Education capital (t-1)	0.055***	0.055***	0.060***	0.649*
	(0.018)	(0.013)	(0.017)	(0.374)
Health capital (t-1)	-0.009	-0.0097	-0.046	-1.069**
	(0.034)	(0.033)	(0.034)	(0.475)
Change in education capital	0.061***	0.061***	0.063***	0.747*
	(0.013)	(0.012)	(0.013)	(0.428)
Change in health capital	0.040*	0.040**	0.022	-0.946**
	(0.023)	(0.019)	(0.023)	(0.453)
Change in term of trade	-0.005	-0.005	-0.005	-0.0692
	(0.019)	(0.019)	(0.019)	(0.055)
Trade openness	0.080***	0.080***	0.077***	0.076**
	(0.017)	(0.014)	(0.017)	(0.033)
Fiscal balance	0.115	0.115	0.117	0.197
	(0.088)	(0.096)	(0.088)	(0.183)
Low-deficit fiscal balance	165.3***	165.3***	137.2***	108.3
	(49.90)	(46.77)	(42.45)	(73.82)
Inflation rate	0.064***	0.064***	0.067***	0.027
	(0.019)	(0.019)	(0.019)	(0.053)
High-Inflation dummy	-39.13	-39.13	4.984	94.15
	(109.8)	(95.61)	(109.7)	(194.4)
Poor-government dummy	-80.46**	-80.46**	-69.98**	-258.8**
	(38.15)	(33.64)	(29.65)	(113.2)
Constant	734.2***	734.2***	722.3***	988.9***
	(123.9)	(98.08)	(122.9)	(304.1)
Observations	2,253	2,253	2,253	2,252
Adjusted R-squared	0.030	0.049		
Number of Year	46	46	46	

The absolute value of *t-statistics* in parentheses
I used adjusted R-square in replacement to R-square
[a] Is the baseline regression on the output table
I instrumented endogenous variables: Investments in human capital indicators. The lagged value of Government expenditure in education & health has been used as instrument for the changes in education and health capital, because I assumed that those expenditures affect human capital indicator as government is education and health services primary provider in those African countries represented in my study. *Significant at 10% **Significant at 5% ***Significant at 1% level

Table 2. Investment equation *Dependent variable*: *annual investment ratio*

	(1)	(2)	(3)	(4)
	LSDV[a]	Robust regression	FGLS	2SLS
Population growth	11.01	11.01	12.10	-37.66*
	(10.24)	(9.625)	(9.973)	(22.61)
Edu capital	0.049***	0.049***	0.050***	-0.002
	(0.015)	(0.014)	(0.015)	(0.119)
Health capital	-0.039	-0.039	-0.029	-1.249***
	(0.027)	(0.027)	(0.026)	(0.401)
Catch-up variable	-5.160	-5.160	-6.258	-1.464
	(5.593)	(5.002)	(5.440)	(7.812)
Changes in terms of trade	0.088***	0.088***	0.086***	0.101***
	(0.023)	(0.020)	(0.022)	(0.034)
Openness	0.317***	0.317***	0.320***	0.359***
	(0.019)	(0.019)	(0.018)	(0.029)
Inflation	0.089***	0.089***	0.084***	0.151***
	(0.022)	(0.024)	(0.022)	(0.039)
High-Inflation dummy	-138.8	-138.8	-135.5	-54.63
	(127.1)	(125.4)	(125.3)	(178.4)
Fiscal balance	-0.032	-0.032	-0.057	0.354*
	(0.103)	(0.097)	(0.101)	(0.194)
Low deficit balance	130.5**	130.5*	132.3***	53.20
	(57.76)	(68.10)	(46.74)	(70.49)
Poor-governance dummy	61.99	61.99*	27.12	-31.82
	(43.89)	(32.80)	(31.38)	(55.18)
Constant	422.8***	422.8***	439.1***	1,310***
	(139.4)	(140.3)	(136.2)	(339.1)
Observations	2,253	2,253	2,253	2,253
Adjusted R-squared	0.121	0.138		
Number of Year	46	46	46	

Standard errors or absolute value of *t-statistics* in parentheses
I used adjusted R-square in replacement to R-square
[a] Is the baseline regression on the output table
The endogenous variables have been instrumented: I instrumented Education and health capital by their lagged values, lagged female education and under-15 population share, as they are highly correlated with human capital indicators and likely investment through human capital. Because they directly affect human capital.
*significant at 10% **significant at 5% ***significant at 1% level

Table 2a. Investment equation *Dependent variable: investment ratio 5-years moving average*

	(1)	(2)	(3)	(4)
	LSDV[a]	Robust regression	FGLS	2SLS
Population growth	9.884	9.884	7.551	-23.36
	(9.611)	(12.27)	(9.641)	(18.03)
Education capital	0.082***	0.0819***	0.0847***	0.127
	(0.014)	(0.016)	(0.014)	(0.095)
Health capital	-0.070***	-0.070***	-0.0817***	-0.696**
	(0.025)	(0.020)	(0.025)	(0.320)
Catch-up variable	-19.34***	-19.34***	-16.47***	-6.006
	(5.252)	(3.528)	(5.282)	(6.231)
Change in term of trade	0.061***	0.061***	0.061***	0.064**
	(0.021)	(0.017)	(0.021)	(0.027)
Trade openness	0.097***	0.097***	0.098***	0.114***
	(0.018)	(0.018)	(0.018)	(0.023)
Inflation	0.048**	0.048*	0.057***	0.107***
	(0.021)	(0.024)	(0.021)	(0.031)
High-inflation dummy	-350.1***	-350.1***	-339.3***	-255.1*
	(119.4)	(98.84)	(120.5)	(142.3)
Fiscal balance	-0.065	-0.065	-0.061	0.125
	(0.096)	(0.097)	(0.097)	(0.15)
Low-deficit fiscal balance	57.34	57.34	76.43	60.45
	(54.23)	(41.75)	(49.40)	(56.23)
Poor-governance dummy	-51.41	-51.41	-50.97	-67.68
	(41.22)	(53.30)	(35.89)	(44.02)
Constant	963.3***	963.3***	930.5***	1,187***
	(130.9)	(125.1)	(133.3)	(270.5)
Observations	2,253	2,253	2,253	2,253
Adjusted R-squared	0.030	0.050		
Number of Year	46	46	46	

Standard errors or absolute value of *t-statistics* in parentheses
I used adjusted R-square in replacement to R-square
[a] Is the baseline regression on the output table
The endogenous variables have been instrumented: I instrumented Education and health capital by their lagged values, lagged female education and under-15 population share, as they are highly correlated with human capital indicators and likely investment through human capital. Because they directly affect human capital.
*significant at 10% **significant at 5% ***significant at 1% level. Standard errors or absolute value of *t-statistics* in parentheses. I used adjusted R-square in replacement to R-square

Table 3. Education equation *Dependent variable*: *education capital (primary and secondary school enrolment)*

	(1)	(2)	(3)	(4)
	LSDV[a]	Robust regression	FGLS	2SLS
Health capital	0.022	0.022	0.020	0.68***
	(0.026)	(0.027)	(0.025)	(0.179)
Current per capita income	-0.021	-0.021	-0.030*	0.050*
	(0.018)	(0.017)	(0.018)	(0.030)
Share of under-15 Population	-0.020	-0.020	0.00069	0.106***
	(0.019)	(0.020)	(0.019)	(0.037)
Urbanization	0.007	0.007	-0.001	-0.012
	(0.019)	(0.019)	(0.019)	(0.025)
Repetition rate	-0.011	-0.010	-0.19	1.010***
	(0.165)	(0.112)	(0.150)	(0.340)
Share of female students	0.756***	0.756***	0.766***	0.823***
	(0.015)	(0.027)	(0.015)	(0.023)
Current education spending (in logs)	21.67***	21.67***	15.15***	-151.8***
	(5.928)	(6.094)	(5.618)	(39.10)
Lagged education spending (in logs)	0.009	0.009	-8.504	27.96**
	(6.000)	(5.642)	(5.480)	(10.98)
Poor-governance[b] * current education spending	-0.012	-0.012	0.099	1.575***
	(0.084)	(0.080)	(0.080)	(0.357)
Poor-governance[b] * lagged education Spending	0.112	0.112	0.250***	-0.304*
	(0.086)	(0.087)	(0.080)	(0.167)
Constant	356.7***	356.7***	357.7***	-180.0
	(49.48)	(53.15)	(48.24)	(162.6)
Observations	2,252	2,252	2,252	2,206
Adjusted R-squared	0.544	0.553		0.278
Number of Year	46	46	46	

[a] The baseline regression on the output table

[b] To compare the of effect of spending in all countries different governance styles, I included interactions of poor governance dummy with current spending in education sector and lagged education spending.

[c] Endogenous variables which doesn't directly affect education capital are either likely to affect spending decisions in health sector, or highly correlated with health status, were instrumented in the IV regression; thus, health capital and spending in education are instrumented by fertility rate, a democracy index (voice accountability) and immunization rate.

*significant at 10% **significant at 5% ***significant at 1% level

Table 3a. Education equation *Dependent variable: 5years moving average education capital*

	(1)	(2)	(4)	(4)
	LSDV	Robust regression	FGLS	2SLS
Health capital	0.152***	0.152***	0.146***	1.645***
	(0.025)	(0.030)	(0.025)	(0.231)
Current per capita income	0.061***	0.061***	0.066***	0.181***
	(0.017)	(0.017)	(0.018)	(0.038)
Share of under - 15 population	-0.103***	-0.103***	-0.102***	0.124***
	(0.019)	(0.025)	(0.019)	(0.047)
Urbanization	-0.006	-0.006	-0.006	-0.030
	(0.018)	(0.020)	(0.019)	(0.032)
Repetition rate	0.500***	0.500***	0.710***	1.707***
	(0.157)	(0.140)	(0.155)	(0.439)
Share of female students	0.158***	0.158***	0.161***	0.226***
	(0.014)	(0.015)	(0.015)	(0.030)
Current education spending (in logs)	7.610	7.610	11.43**	-76.78
	(5.663)	(4.858)	(5.654)	(50.50)
Lagged education Spending (in logs)	-0.867	-0.867	5.586	39.78***
	(5.733)	(4.013)	(5.643)	(14.18)
Poor-government * Education Spending	0.454***	0.454***	0.427***	1.152**
	(0.080)	(0.069)	(0.080)	(0.461)
Poor-government* lagged education spending	-0.145*	-0.145**	-0.200**	-0.530**
	(0.083)	(0.060)	(0.082)	(0.215)
Constant	548.1***	548.1***	521.4***	-882.0***
	(47.28)	(49.28)	(51.58)	(210.0)
Observations	2,252	2,252	2,252	2,206
Adjusted R-squared	0.126	0.144		
Number of Year	46	46	46	

Standard errors or absolute value of *t-statistics* in parentheses
I used adjusted R-square in replacement to R-square
[a] The baseline regression on the output table
[b] To compare the of effect of spending in all countries different governance styles, I included interactions of poor governance dummy with current spending in education sector and lagged education spending.
[c] Endogenous variables which doesn't directly affect education capital are either likely to affect spending decisions in health sector, or highly correlated with health status, were instrumented in the IV regression; thus, health capital and spending in education are instrumented by fertility rate, a democracy index (voice accountability) and immunization rate.
*significant at 10% **significant at 5% ***significant at 1% level

Table 4. Health Equation *Dependent variable*: *health capital (under-5 child mortality rate)*

	(1)	(2)	(3)	(4)
	LSDV[a]	Robust regression	Random	2SLS
Current per capita income	-0.068***	-0.068***	-0.059***	-0.050***
	(0.0143)	(0.015)	(0.014)	(0.014)
Urbanization	-0.026*	-0.026	-0.027*	-0.035**
	(0.015)	(0.017)	(0.015)	(0.015)
Share of female students	-0.010	-0.010	-0.013	-0.012
	(0.012)	(0.011)	(0.011)	(0.012)
Current Health spending (in logs)	-25.34**	-25.34***	-21.31***	-25.90***
	(10.42)	(8.311)	(3.997)	(4.974)
Poor-governance *current health spending[b]	0.033	0.033	-0.041	-0.097
	(0.078)	(0.099)	(0.099)	(0.063)
Fertility rate	-126.7***	-126.7***	-137.5***	-145.1***
	(9.026)	(13.50)	(8.508)	(9.105)
Constant	1,606***	1,606***	1,659***	1,709***
	(69.41)	(99.26)	(65.55)	(70.00)
Observations	2,300	2,300	2,300	2,208
Adjusted R-squared	0.073	0.091		0.117
Number of Year	46	46	46	

Standard errors or absolute value of *t-statistics* in parentheses
I used adjusted R-square in replacement to R-square
[a] The baseline regression on the output table
[b] An interaction term of poor governance dummy and health spending has been included to compare spending effect in African different governance environments
[c] To control for endogeneity, health spending is instrumented by the lagged value of spending in the same sector and a democracy term (voice accountability). It has been included because democracy even though it doesn't affect health status directly, it's more likely to affect decision in some countries.
*significant at 10% **significant at 5% ***significant at 1%

Table 4a. Health Equation *Dependent variable*: *Health capital 5-years moving average*

	(1)	(2)	(3)	(4)
	LSDV	Robust regression	FGLS	2SLS
Lagged current per capita income	-0.0355*	-0.0355**	-0.0348*	-0.0258
	(0.0187)	(0.0162)	(0.0187)	(0.0212)
Lagged urbanization	-0.0618***	-0.0618***	-0.0621***	-0.0712***
	(0.0196)	(0.0157)	(0.0197)	(0.0230)
Lagged share of female students	0.0152	0.0152	0.0184	0.0521***
	(0.0152)	(0.0125)	(0.0153)	(0.0171)
Current health spending (in logs)	-24.92**	-24.92**	-17.93*	-4.388
	(12.71)	(10.16)	(9.437)	(7.753)
Lagged Poor governance*current health spending[b]	0.0621	0.0621	0.115	0.331***
	(0.0958)	(0.0531)	(0.0928)	(0.0878)
Lagged fertility rate	-62.73***	-62.73***	-58.54***	-21.00
	(11.66)	(10.27)	(11.61)	(13.79)
Constant	1,416***	1,416***	1,368***	1,077***
	(89.97)	(81.29)	(95.51)	(106.5)
Observations	2,254	2,254	2,254	2,208
R-squared	-0.006	0.014		0.013
Number of Year	46	46	46	

Standard errors or absolute value of *t-statistics* in parentheses
I used adjusted R-square in replacement to R-square

[a] the baseline regression on the output table

[b] an interaction term of poor governance dummy and health spending has been included to compare spending effect in African different governance environments.

[c] to control for endogeneity, health spending is instrumented by the lagged value of spending in the same sector and a democracy term (voice accountability). It has been included because democracy even though it doesn't affect health status directly, it's more likely to affect decision in some countries. *significant at 10% **significant at 5% ***significant at 1%

- Appendix

- *Summary Statistics*

	Observation	Mean	Std. Dev
Population growth	2300	2.63	1.17
Fertility rate	2300	5.82	1.32
Real GDP per capita growth	2015	0.57	0.18
Import	1964	40.41	30.28
Export	1964	29.58	18.13
Urbanization	2296	33.54	17.5
Population-15	2296	43.78	4.3
Immunization rate	1564	67.12	25.31
Governance	831	-2.9	2.5
Corruption control	833	-0.66	0.58
Political stability	832	0.76	0.58
Rule of law	833	-0.74	0.62
Voice accountability	833	0.723	0.7

African the top 5 countries in term of GDP per capita

Country	Ccode	GDP per capita ($)
Equatorial Guinea	GNQ	38700
Gabon	GAB	19300
Botswana	BWA	16900
Algeria	DZA	15000
South Africa	ZAF	13500

African 5 poorest countries in term of GDP per capita

Country	Ccode	GDP per capita ($)
Liberia	LBR	900
Burundi	BDI	800
D.R. Congo	COD	800
Central African Rep.	CAF	700
Somalia	STP	400

LIST OF THE 50 AFRICAN COUNTRIES IN THE SAMPLE

Country name	Country code	Year	Country name	Country code	Year
Algeria	DZA	1975-2015	Liberia	LBR	1975-2015
Angola	AGO	1975-2015	Libya	LBY	1975-2015
Benin	BEN	1975-2015	Madagascar	MDG	1975-2015
Botswana	BWA	1975-2015	Malawi	MWI	1975-2015
Burkina Faso	BFA	1975-2015	Mali	MLI	1975-2015
Burundi	BDI	1975-2015	Mauritania	MRT	1975-2015
Cabo Verde	CPV	1975-2015	Morocco	MAR	1975-2015
Cameroun	CMR	1975-2015	Mozambique	MOZ	1975-2015
Central African Rep.	CAF	1975-2015	Namibia	NAM	1975-2015
Chad	TCD	1975-2015	Niger	NER	1975-2015
Congo, Dem. Rep.	COD	1975-2015	Nigeria	NGA	1975-2015
Congo, Rep.	COG	1975-2015	Rwanda	RWA	1975-2015
Cote d'Ivoire	CIV	1975-2015	Sao Tome & Principe	STP	1975-2015
Djibouti	DJI	1975-2015	Senegal	SEN	1975-2015
Egypt	EGY	1975-2015	Sierra Leone	SLE	1975-2015
Equatorial Guinea	GNQ	1975-2015	Somalia	SOM	1975-2015
Eritrea	ERI	1975-2015	South Africa	ZAF	1975-2015
Ethiopia	ETH	1975-2015	Sudan	SDN	1975-2015
Gabon	GAB	1975-2015	Swaziland	SWZ	1975-2015
Gambia	GMB	1975-2015	Tanzania	TZA	1975-2015
Ghana	GHA	1975-2015	Togo	TGO	1975-2015
Guinea	GIN	1975-2015	Tunisia	TUN	1975-2015
Guinea-Bissau	GNB	1975-2015	Uganda	UGA	1975-2015
Kenya	KEN	1975-2015	Zambia	ZMB	1975-2015
Lesotho	LSO	1975-2015	Zimbabwe	ZWE	1975-2015

References

Romer, P. (1986). Increasing returns and long-run growth. Journal of Political Economy, 94(5), 1002–1037.

Ravallion, M., & Chen, S. (1997). What can new survey data tell us about recent changes in distribution and poverty? World Bank Economic Review, 11(2), 357–382.

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

Mankiw, G., Romer, D., & Weil, D. (1992). A contribution to the empirics of economic growth. Quarterly Journal of Economics, 107, 407–437.

Sala-i-Martin, X. (1997). I just ran two million regressions. American Economic Review, 87(2), 178–183.

Coulombe, S., Tremblay, J., & Marchand, S. (2004). Literacy scores, human capital and growth across fourteen OECD countries. International Adult Literacy Survey Monograph Series. Ottawa: Statistics Canada.

Benhabib, J., & Spiegel, M. (1994). The role of human capital in economic development: Evidence from aggregate cross-country data. Journal of Monetary Economics, 34(2), 143–173.

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

Bloom, D., & Canning, D. (2003). The health and poverty of nations: From theory to practice. Journal of Human Development, 4(1), 47–71.

Baldacci, E., Guin-Sui, M. T., & de Mello, L. (2003). More on the effectiveness of public spending on health care and education: A covariance structure model. Journal of International Development, 15(6), 709–725.

Anand, S., & Martin, R. (1993). Human development in poor countries: On the role of private incomes and public services. Journal of Economic Perspective, 7(1), 133–150.

Bidani, B., & Ravallion, M. (1997). Decomposing social indicators using distributional data. Journal of Econometrics, 77(1), 125–139.

Gupta, S., Verhoeven, M., & Tiongson, E. (2003). Public spending on health care and the poor. Health Economics, 12(8), 685–696.

Schultz, T. P. (1999). Health and schooling investments in Africa. Journal of Economic Perspectives, 13(3), 67–88.

Barro, R. (1996b). Health, human, capital and economic growth. Paper for the Program on Public Policy and Health, Pan American Health Organization and World Health Organization. Washington, DC: Pan American Health Organization.

Mayer-Foulkes, D. (2003). Market failures in health and education investment for Mexico's youth. Human Capital and Economic Growth Working Papers. Washington DC: Pan American Health Organization.

Miguel, E., & Kremer, M. (2003). Worms: Identifying impacts on education and health in the presence of treatment externalities. Econometrica, 72(1), 159–217.

Gupta, S., Davoodi, H., & AlonsoTerme´, R. (2002a). Does corruption affect income inequality and poverty? Economics of Governance, 3(1), 23–45.

Abed, G. T., & Gupta, S. (Eds.) (2002). Governance, corruption, and economic performance. Washington, DC: International Monetary Fund.

Rajkumar, A., & Swaroop, V. (2002). Public spending and outcomes: Does governance matter? World Bank Working Papers No. 2840. Washington, DC: World Bank.

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(2), 131–165.

Ranis, G., & Ramirez, A. (2000). Economic growth and human development. World Development, 28(2), 197–219.

Gyimah-Brempong, K., & Wilson, M. (2004). Health human capital and economic growth in sub-Saharan African and OECD countries. The Quarterly Review of Economics and Finance, 44(2), 296–320.

Nicola Gennaioli, Rafael la Porta, Florencio Lopez-de-silanes and Andey shleifer (2012). Human Capital and Regional Development. The Quarterly Journal of Economics, Volume 128, Issue 1, 1 February 2013, Pages 105–164.

Flavio Cunha James J. Heckman, Susanne M. Schennach (2010). Estimating the Technology of Cognitive and Noncognitive Skill Formation. journal of the econometric society.

David N. Weil (2007). Accounting for the Effect of Health on Economic Growth. *The Quarterly Journal of Economics*, Volume 122, Issue 3, 1 August 2007, Pages 1265–1306.

Shankha Chakraborty (2004). Endogenous lifetime and economic growth. Journal of economic theory

Daron Acemoglu and Simon Johnson (2007) Disease and Development: The Effect of Life Expectancy on Economic Growth. Journal of political Economy, Volume 115 number 6.

Peter Lorentzen John McMillan Romain Wacziarg (2008). Death and development. Journal of Economic Growth, June 2008, Volume 13, Issue 2, pp 81–124.

Seema Jayachandran, Adriana Llenas-Muney (2009). Life Expectancy and Human Capital Investments: Evidence from Maternal Mortality Declines. *The Quarterly Journal of Economics*, Volume 124, Issue 1, 1 February 2009, Pages 349–397.

Gabriella Conti, James Heckman, and Sergio Urzua (2010). The Education-Health Gradient. Am Econ Rev. 2010 May; 100(2): 234–238.

Belton Fleisher, Haizheng Li and min Qiang Zao (2010). Human capital, economic growth, and regional inequality in China. Journal of development Economics. Volume 92 Issue 2, July 2010, Pages 215-231.