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GROWTH EFFECTS OF HEALTH INPUTS AND OUTCOMES IN SUB-SAHARA AFRICAN COUNTRIES (1995-2011)

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ABSTRACT

The study examined the contribution of health inputs and outcomes to growth process in the Sub-Saharan Africa. Panel data of 30 countries from the sub-region from 1995 to 2011was used in a dynamic Generalized Method of Moment (GMM) modeling framework. The study used secondary school enrolment and government expenditure on health as health inputs while child mortality rate was used as a proxy for health outcomes. Results showed that education has statistically significant positive effect on economic growth while both government expenditure on health and mortality rate have statistically significant negative effects. The coefficients of the variables revealed that health (reduction in child mortality rate) is relatively more effective in promoting economic growth than education as an input in the growth process as the effects of health overwhelmingly supersedes the effects of education in the dynamic endogenous growth model estimated. This implies while both education and health care are crucial and important in the growth process, in a situation of resources constraints, emphasis should first be placed on adequate and efficient healthcare delivery and then provision of higher education

Keywords: Human capital, Endogenous growth models, Panel data, GMM, Health input, Health output

JEL Classifications: I13, O41, C33, C2, I15, I12

1. INTRODUCTION

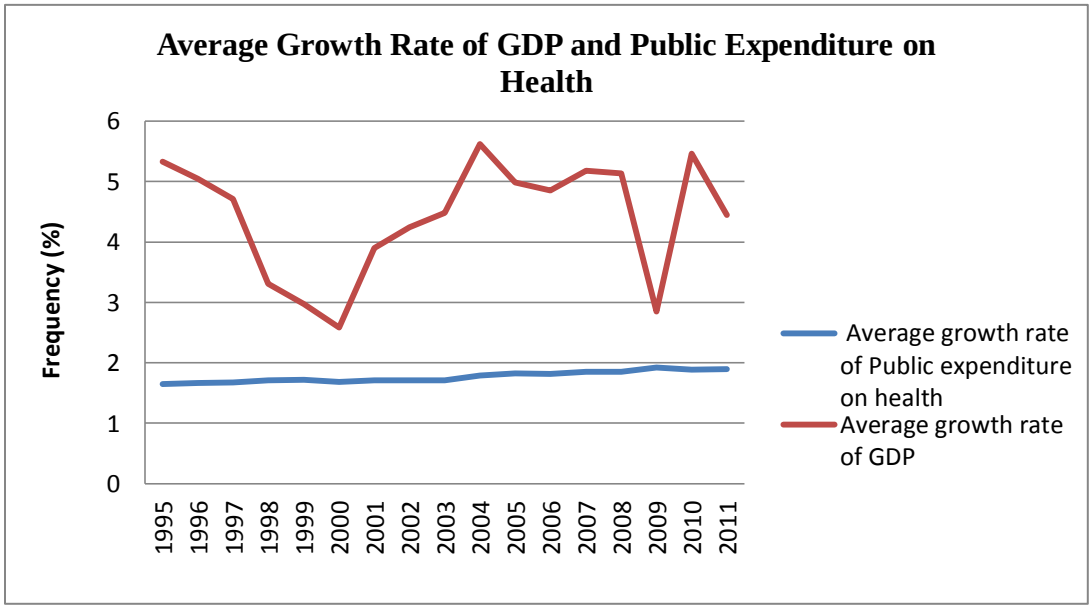
The conventional Solow and Swan model developed in the 1950s emphasis the importance of labor and capital as the two important factors that enhance growth in any economy. It was stated that for an economy to achieve a certain level of growth in a year, there must be an increase in the level of savings and labor participation in such economy. However, their model does not ascribe any role to non-economic variables such as human capital and human health. Also, productivity in such an economy conforms to the law of diminishing returns to scale.

Mankiw *et al.* (1992) illustrates the importance of human capital in enhancing economic growth. According to them, the role of human capital to an economy is indispensable. This is because the ability of any economy to achieve a sustainable economic growth depends on the level of development in its human capital. In the literature, improved human capital performance had been linked to high level of education, innovation, technical progress and research and development. Studies like Barro and Sala -i- Martin (2004), Mankiw *et al.* (1992) and Faisal and Abdul (2011) argued that human capital that is required for enhancing economic growth is the one whose stock increases as a result of better education, better health, and new training and learning activities. A labor force without a minimal level of education and access to modern technology is incapable of maintaining a state of continuous growth. It is therefore concluded that human capital is the input that is associated with human body and brain.

In the same vein, health is also an important determinant of economic performance both at the micro and macro levels and is fundamental to economic growth. Investment in human health is a way to achieving higher levels of labor productivity. This arises from the fact that health is both a direct component of human well-being and a form of human capital that increases individual's capabilities and productivities (Bloom *et al.*, 2004). Few authors have recognized the importance of health and nutrition in the growth process. Among them are Mankiw *et al.* (1992) that cited the importance of considering not only education, but also health and nutrition as conditioning factors to growth. Barro and Sala -i- Martin (2004) examined more systematically the relationship between economic growth and health focusing on the link between wealth and health. In recognizing the importance of health, models of economic growth have been extended to include this factor as a human capital input.

Despite the documentation of the contribution of human capital and improved healthcare system to achieving sustainable growth in the literature, government expenditure to human capital inputs such as education and health in the Sub-Saharan African countries is not encouraging. Figure 1 below shows the average growth rate of GDP and public expenditure on health as a percentage of GDP between 1995 and 2011. It can be deduced from the figure that despite the noticeable fluctuations in the GDP growth rate, public expenditure on health is stable over time. This implies government expenditure to health sector in the region does not increase over the period under consideration. This is evident in the health outcomes such as increase in the child mortality rates, low level of human capital development, inadequate health infrastructures and reduction in peoples access to health care. However, the sub-region has been experiencing improved growth over the years under this condition. For example, the region's growth was estimated at 4.7 percent in 2011 excluding South Africa, the region's largest economy.

Figure-1. Average Growth Rate of GDP and Public Expenditure on Health as a percentage of GDP in Sub-Saharan Africa (1995-2011)



Source: Authors' Computation from World Bank Data.

The remaining economies grew at a robust 5.8 percent which is higher than the developing country average of 4.9 percent. (Africa's Pulse, 2013). This contradicts the literature and calls for investigation.

The study, therefore, intends to examine the contribution of health component of human capital to the growth process in the region. This is crucial because of its policy implication both for design of healthcare policy and development programme geared towards alleviating the health care deficiency in developing countries. Apart from this introductory part, the study is sub-divided into four sections. Section two explains the theoretical framework and examines the empirical literatures while methodology adopted is discussed in section three. Estimation and analysis of results are carried out in section four while section five concludes the study.

2. EMPIRICAL ISSUES

Several authors have attempted to examine the link between health inputs, human capital and economic growth. Soukiazis and Cravo (2007) investigated the links between health, human capital and economic growth using a dynamic panel data approach for a sample of 77 countries for the period 1980-2000. This approach is enhanced by taking into account the feedback effect between human capital (and health) and the different levels of economic development. The study disaggregated sample countries into three main sub groupings according to their per capita income level: low, intermediate, and high income countries. The results shows that human capital and health are found to be important determinants of income. In the high-income countries human

capital is more relevant. In the low-income countries health is more important to differentiate the economies.

Adelakun (2011) evaluated human capital development and economic growth in Nigeria using ordinary least square (OLS). To analyze the relationship, the study used GDP as proxy for economic growth, total government expenditure on education and health, and the enrolment pattern of tertiary, secondary and primary schools as proxy for human capital. The analysis confirms that there is strong positive relationship between human capital development and economic growth and recommended that stakeholders need to evolve a more pragmatic means of developing the human capabilities, since it is seen as an important tool for economic growth in Nigeria.

Gyimah-Brempong (2010) examined the effects of education on several development outcomes in African countries using panel data between 1960 and 2010 from two new data sets. Eclectic set of estimators were employed to estimate the outcomes in the model and development outcomes are measured using growth rate of real GDP per capita, political stability and participation of women in politics. The study found out that education has a positive and significant impact on development outcomes. Also, results indicated that different levels of education affects development outcomes differently. For some development outcomes, primary and secondary education may be more important than tertiary education while for some development outcomes, such as income growth rate, tertiary education may be more important.

In the same vein, Khembo *et al.* (2013) analyzes the impact of human capital on economic growth in Southern African Development Community (SADC) using Ordinary Least Square-Random effects (OLS - RE). GDP per capita was linked to health and educational capital while taking into account the role of labor force and physical capital. The study used panel data from thirteen SADC countries for the growth periods 1990 - 1995, 1995-2000 and 2000-2005. The findings show that education capital had a positive statistically significant effect on GDP per capita whilst health capital had a positive but statistically insignificant effect. Making quality education accessible to all is recommended to policy makers.

Yogo and Douzounet (2012) examines the effect of health aid on health outcomes in Sub-Saharan Africa using a sample of 28 countries during the period of 2000-2010. After solving for endogeneity problem and using instrumental variable approach, the results found out that health aid improves health outcomes in sub-Sahara African countries. More specifically, for each additional unit of health aid, life expectancy increases by 0.14, prevalence of HIV decreases by 0.05 and infant mortality decrease by 0.17.

Gyimah-Brempong *et al.* (2006) investigated the effect of higher education on economic growth in Africa using panel data between 1960 and 2000. The study adopted a modified neoclassical growth equation and a dynamic panel estimator to investigate the effect of higher education on economic growth in African countries. Results showed that all levels of education including higher education, have positive and statistically significant effect on the growth rate of per capita income in African counties. Furthermore, growth elasticity of higher education human capital is about 0.09, an estimate that is twice as large as the growth impact of physical capital

investment. While this is likely to be an overestimate of the growth impact of higher education, it is robust to different specification sand points to the need for African countries to effectively use higher education in growth policies.

In conclusion, going by the above review, it can be deduced that studies on the significance and implication of health inputs and outcomes on economic growth is very scarce in the region. In addition, the results of the relationship between health inputs and economic growth in the sub-Saharan African Countries differ from one country to another. These justified the objectives of this study.

3. METHODOLOGY AND DATA DESCRIPTION

3.1 Model

The study adopted the labor augmented endogenous growth model with a modified Cobb-Douglass production function assuming decreasing return to scale. This approach has been adopted by several authors including Bloom *et al.* (2004), Faisal and Abdul (2011) and Aminu (2011). Aggregate output is specified as:

$$Y_t = A K_t^{\alpha} H_t^{\beta} L_t^{1-\alpha-\beta} \quad (1)$$

Where Y represents the output, K represents physical capital, H stands for human capital and L is the effective labor. After transforming equation (1) into the intensive form, it becomes:

$$y = A k^{\alpha} h^{\beta} \quad (2)$$

Taking logarithm of both sides, equation (2) becomes

$$\ln y = \ln A + \alpha \ln k + \beta \ln h \quad (3)$$

To incorporate health inputs and outputs into equation (3), human capital is decomposed as follows:

$$\ln h = \ln M + \ln N + \ln S \quad (4)$$

where M represents mortality rate, N represents government expenditure on health and S represents school enrolment. Substituting equation (4) into (3), equation (3) above becomes:

$$\ln y = \ln A + \alpha \ln k + \beta_1 \ln M + \beta_2 \ln N + \beta_3 \ln S \quad (5)$$

let $\ln A = \alpha_1$ and writing equation (5) explicitly, it becomes:

$$\ln y_{it} = \alpha_1 + \alpha_2 \ln k_{it} + \alpha_3 \ln M_{it} + \alpha_4 \ln N_{it} + \alpha_5 \ln S_{it} + \epsilon_{it} \quad (6)$$

Where N and S represent health input and M represents health output.

Therefore, equation to be estimated becomes:

$$\ln PGDP_{it} = \alpha_1 + \alpha_2 \ln CAP_{it} + \alpha_3 \ln MORT_{it} + \alpha_4 \ln HEA_{it} + \alpha_5 \ln EDU_{it} + \epsilon_{it} \quad (7)$$

To analyze the significance of health inputs and health outcomes on economic growth using equation (7) above, the study employs the dynamic Generalized Method of Moments (GMM) estimation technique developed by Arellano and Bond (1991). GMM techniques control for unobserved country-specific effects, first-difference non-stationary variables and overcome the endogeneity of the explanatory variables by using instruments and test for the presence of

autocorrelation (Saci *et al.*, 2009). The impact of health inputs and outcomes on economic growth is defined as:

$$y_{it} = \gamma_1 y_{it-1} + \gamma_2 R_{it} + \mu_i + e_{it} \quad 10$$

Where Y is the per capita GDP, *R* represents the explanatory variables, μ represent the unobserved country-level effects and the error terms respectively. Based on the structure of equation (9), the lagged of the dependent variable is correlated with structure μ_i, creating an endogeneity which results in inconsistent estimators. To deal with endogeneity problem from unobserved country-level effects μ_i, the first difference of equation (9) is conducted, resulting in equation (10) below:

$$Y_{it}-Y_{it-1} = \gamma_1 Y_{it-1}-Y_{it-2} + \gamma_2(R_{it}- R_{it-1}) + (e_{it}- e_{it-1}) \quad 11$$

It is evident that after overcoming the endogeneity problem from the unobserved country level effect, μi, a correlation between the lagged dependent variable Y_{it-1} and e_{it-1} arise in addition to a potential correlation between the independent variables, R_{it}. To address these problems, instrumental variables need to be defined. To this end, the study assumes that there is no serial correlation between error terms, and no correlation between the lagged explanatory variables and future error terms. Making these assumptions, the lagged explanatory variables can be used as instrumental variables. The first-differenced explanatory variables are used as instrumental variables.

3.2. Data Description

This empirical study relies on panel dataset collected from World Development Indicator (online) from 1995 to 2012 on 30 Sub-Saharan African countries namely; Benin, Botswana, Burkinafaso, Cameroon, Cape Verde, Central Africa Republic, Chad, Congo Democratic Republic of Congo, Cote D'ivoire, Gabon, Gambia, Ghana, Guinea Bissau, Kenya, Lesotho, Mozambique, Malawi, Mali, Namibia, Niger, Nigeria, Rwanda, Senegal, Swaziland, Sierra Leone, South Africa, Togo, Uganda and Zambia. The criterion used to create the sample was based upon the availability of data, where the candidate countries should have available data on physical capital(measured by gross fixed capital formation), expenditure on health, school enrollment and mortality rate for the period under study. In addition, data on per capita GDP is obtained from the same source. Finding appropriate proxies for health and education capital was relatively based on some general rules following (Gyimah-Brempong *et al.*, 2006) which states that the proxy variables must be comparable across the economies in Sub-Saharan Africa and they must be estimable with data available. The choice of proxies used in this study are based on these criteria.

4. ESTIMATION AND ANALYSIS OF RESULTS

Table 1 below provides information about the descriptive statistics for the dependent and explanatory variables in the model. It can be deduced from table 1 that all the series displayed a high level of consistency as their mean and median values are perpetually within the minimum and maximum values of these series. Moreover, standard deviation which measures the degree of dispersion of the variables from their mean shows that the variables are relatively stable. This is

due to the low values of standard deviation for all the variables as shown in table 1. Furthermore, table 1 shows that four variables namely capital, health, mortality and GDP are leptokurtic (peaked) relative to the normal bell - shaped as kurtosis of these series exceeds three. However, education only has a normal shape as its kurtosis is less than three. Finally, Jarque-Bera statistics shows that the data do not support the supposition that each variable has a normal distribution. This is as a result of the rejection of null hypothesis that each variable has a normal distribution at low probability values.

Table-1. Descriptive Statistics Analysis

	Capital	Education	Health	Mortality	GDP
Mean	20.27410	2.911997	6.645117	1.681792	2.611521
Median	20.53970	2.947893	6.230337	1.649322	2.659210
Maximum	25.08439	4.819421	23.67839	3.099487	3.490733
Minimum	11.64812	0.068658	4.518534	0.734837	1.656703
Std. Dev.	1.942988	0.966950	2.096653	0.369465	0.300556
Skewness	-1.669748	-0.468240	6.087299	0.640353	-0.775205
Kurtosis	8.517562	2.990519	48.58683	4.591691	3.885824
Jarque-Bera	870.0440	18.34568	46568.44	87.29966	66.69190
Probability	0.000000	0.000104	0.000000	0.000000	0.000000
Sum	10177.60	1461.823	3335.849	844.2595	1310.984
Sum Sq. Dev.	1891.377	468.4314	2202.373	68.38862	45.25738
Observations	502	502	502	502	502
Cross Sections	30	30	30	30	30

Table 2 below presents the correlation matrix for the dependent and independent variables. This is done with the view of examining the possible degree of association among the variables. In general, the results in table 2 show that in terms of magnitude, the correlation coefficient is generally low. This implies that there is no evidence of multi-collinearity among the variables. In addition, while some of the variables have positive correlation others like education and mortality and health and mortality have negative relationship.

Table-2. Pair-wise Correlation Matrix

	Capital	Education	GDP	Health	Mortality
Capital	1.000000				
Education	0.191247	1.000000			
GDP	0.255958	0.139502	1.000000		
Health	0.025805	0.270896	-0.007525	1.000000	
Mortality	0.015330	-0.216050	-0.155031	-0.059978	1.000000

In order to determine the effects of health inputs and outcomes on economic growth in the sub-Saharan Africa, three functional forms of estimation techniques were used; pooled ordinary least square (OLS), fixed effect model (FEM) and generalized moment method (GMM). The results are presented in table 3 below. The analysis of health inputs and outcomes under pooled OLS reveals a series of coefficient that are significant at both 1% and 5% respectively except government

expenditure on health and education, which is statistically insignificant. The results of the fixed effects in table 3 for the health inputs and outputs suggest that the explanatory power of the regression(R^2) not satisfactory in all cases. While its value is 0.09 under pooled OLS, it increased to 0.60 under fixed effect. This implies that fixed effect model has a better explanatory power than the OLS. The F-statistics are also significant in both the models.

The results indicate a statistically significant positive relationship between physical capital (proxied by gross fixed capital formation) and per capita GDP under two of the estimation techniques (OLS and fixed effect), with marginal contributions of 0.26 and 0.38 respectively. This implies that one percent increase in capital will lead to 38% (Fixed effect) and 26% (Pooled OLS) increase in the level of output in the economy. The coefficients of the two estimation techniques are significant both at 1% and 5% respectively. A positive relationship exists between the previous and the current level of economic growth. The value of the coefficient is 0.63 and is significant at both 1% and 5% level of significance. This indicates that a change of one percent in the previous level of output will give a corresponding change of about 63% in the current level of output that is attained in the economy.

Education (measured by school enrolment) and Health (measured by government expenditure on health), are the two measures of health inputs used in the study. Results in table 3 below revealed that while there exists a positive and significant relationship between education and economic growth GMM, fixed effect shows a statistically significant negative relationship between the two variables. Pooled OLS result on the other hand is statistically insignificant. Therefore, one percent increase in school enrolment will equally lead to 23.1% (GMM) increase in output level and 65.3 % (fixed effect) fall in the output in the economy. However, the results shows that government expenditure on health has a statistically significant negative effect on the economic growth under fixed effect and GMM estimation results. This implies there exists an inverse relationship between government expenditure on health and economic growth. As a result of this, one percent increase in government expenditure on health will lead to 117% (fixed effect) and 90.8%(GMM estimation) fall in output level in the economy. This result is not surprising because it justifies poor funding of health programmes in the sub-region. For pooled OLS, the result is negative but it is statistically insignificant.

Mortality rate, which is the only measure of health output, has significant coefficients at both 1% and 5% under the three estimation techniques used in the study. The three estimation techniques indicate inverse relationship between mortality rate and economic growth. Results imply that one percent decrease in mortality rate will induce 101% (pooled OLS), 148%(fixed effect) and 262% (GMM estimation) increase in total output.

It can be deduced from GMM estimation results, which is used as a check on the two estimation techniques, that education has positive effect on economic growth while health mortality rate has negative effects. Though health as a human capital indicator has negative effects on economic growth, it is relatively more effective in promoting economic growth than education as an input in the growth process. This is because effects of health (0.90) overwhelmingly

supersedes the effects of education (0.23) from the dynamic endogenous growth model estimated. This supports the findings of authors in the literature (Gyimah-Brempong *et al.*, 2006; Adelakun, 2011; Khembo *et al.*, 2013) (Soukiazis and Cravo, 2007).

Table-3. Regression Model Estimate: Dependent Variable – per capita GDP

Variable	Pooled OLS Result	Fixed Effect Results	GMM Results
C	3.8748	6.4959	
	(2.9970)	(1.9760)	
GDP(-1)			0.6360
			(6.7145)
CAPITAL	0.2648	0.3891	-0.0696
	(5.6354)	(2.8095)	(-1.1206)
EDUCATION	0.1572	-0.6531	0.2315
	(1.5692)	(-4.1874)	(6.7666)
HEALTH	-0.2397	-1.1722	-0.9082
	(-0.9530)	(-2.6717)	(-6.0063)
MORTALITY	-1.0160	-1.4804	-2.6262
	(6.8132)	(-2.3684)	(-4.0714)
R- Squared	0.09	0.60	
Adjusted R Squared	0.08	0.55	
F-Statistics	13.1693	13.91	
	(0.0000)	(0.0000)	
D-Watson Stat.	0.14	0.33	
J-Statistics			24.2978
Instrument Rank			30
No. of Observation	502	502	443
Cross section Included	30	30	30

5. CONCLUSION AND POLICY IMPLICATIONS

The study investigates the impact of health inputs and outcomes as inputs on growth process in Sub-Sahara Africa with focus on 30 purposively selected African countries using dynamic panel GMM model. Evidence gathered from the analysis supports the conclusion that there is an inverse relationship between health outcomes (child mortality rate) and economic growth and a positive relationship between health inputs (education) and economic growth. Health as human capital indicator is relatively more effective in promoting economic growth than education as an input in the growth process as the effects of improved health overwhelmingly supersedes the effects of education in the dynamic endogenous growth model estimated. In addition, results show that the level of economic growth attained previous year plays a significant role on the current growth level. The policy implication is that while both education and health care are crucial and important in the growth process, in a situation of resource constraints, emphasis should first be placed on adequate and efficient healthcare delivery system. This can then be followed by provision of basic education.

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