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RESEARCH ARTICLE

HEALTH, EDUCATION AND ECONOMIC GROWTH: EVIDENCE FROM SUB-SAHARAN AFRICA (DYNAMIC PANEL ANALYSIS)

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ABSTRACT

The economic performance in Sub-Saharan Africa has been insignificant, particularly in comparison with other developing regions like East Asia. Using a panel data for 19 Sub-SaharanAfrican countries for the period 1995-2014, this study investigates the relation of health and education sector investment on the Economic growth of the SSA Countries. Employing the theoretical model based on an augmented Solow growth model; by using the newly developed panel ARDL co-integration econometric strategy. The result shows that health investment has not significantly driven economic performance whereas Education spending is negatively affect performance of sub-Saharan Africa. Accounting for the effect life expectance at the birth, however resulted in a significant positive effect on economic growth. Researcher further found that, the obverse seems rather plausibly the case, as economic growth significantly increases life expectancy in the countries. The results suggest that, other factors affecting growth in the region would indirectly improve on the health status of the population of SSA.

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INTRODUCTION

Spending in health and Education is comprised important in social objectives development because a good quality of human capital increases a laborer's skills, productivity and value of life. Besides, throughout their effect on productivity, human capital accumulation has been shown to be a fundamental determinant of economic growth; and higher economic growth also allows more investment in human capital. Therefore, connections between economic growth and human capital accumulation through education and health is established. The nexus between education, health and growth is important, especially in the African countries where the level of education, health and social well-being is far behind that of other regions of the world. Moreover, the majority of sub-Saharan African countries have poor performance in key development indicators like GDP per capita, life expectancy at birth and education enrolment etc. For these reasons health and education in the Millennium Development Goals (MDGs), were given considerable preference. Following the MDGs, developing countries are encouraged to increase their investment in schooling and health as their impact on social welfare, poverty reduction and productivity are well-known. Now day's government ofsub-Saharan, especially Ethiopia Expanding human capital (spending on education and health sector) and improving human development outcomes is still a central pillar strategy of Growth and Transformation Plan. The Government has been taking measures to improve the human resource development as healthy, productive, and trained human resource is essential for the implementation of government policies, strategies and programs. The main ingredients of this pillar are higher education and adult education, better primary health care, better and closer access to safe water and sanitation facilities, uncertain the spread of HIV/AIDS and other infectious diseases, better food security and nutrition, and housing conditions (GTP1). *Compared to previous* studies (Gyimah Bempong and Wilson, 2004; Kidanemariam *et al*., 2013), These empirical investigation differs in the following ways: First, in contrast with the other studies that focus only on education, the study use both education and health indicators in sub-Saharan Africa Economy to assess the impact of health and education sector spending on growth. For each human capital component, the researcher use both stock and investment indicators. Second, unlike Gyimah-Bempong and Wilson (2004) who compare growth an effect of health in African countries to those in OECD countries, this study focuses on a large sample of sub-Saharan Africa and compares the education growth effect and the health growth effect on growth of Economy. Third, the researcher makes use of the ARDL panel time sires analysis in order to complete a cross-section analysis. This analysis deals with endogeneity problems and unobserved specific effects that arise in standard growth regressions. Moreover, dynamic panel results allow testing for the robustness ofCross-sectional

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findings. This paper empirically examines the long-run relationships and the causal links between education investments (E), health investments (H) and economic growth (G) in sub-Saharan Africa.

Health, Education and Economic growth

The seminal papers on endogenous growth theory highlight the importance of human capital in the development and economic growth process. For instance, in their endogenous growth model, Lucas (1988) and Roomer (1990) take into account human capital through education stock for the former; with technology and research and development (RandD) for the later. In this study, health education proxy for human capital is considered as a positive externality on capital productivity and its accumulation favorably influences economic growth and welfare of a community.Alternatively, human capital is the stock of knowledge, competence, health, training, including creativity and other investments, embody the ability to perform labor tasks more productively.Besides, humancapital formation refers to the process of acquiring and increasing the number of people who have the skills, good health, education and experience that are critical for economicdevelopment. Although human capital is comprehensive, many theories explicitly connect investment in human capital development to education and occult the other aspects, mainly stock and investment in health. However, health also plays an important role in human capital accumulation and is closely connected to education. For instance, a healthy population is easy to educate and the efficiency of people to produce human capital is also high. Inversely, an increase in education involves the enhancement of health conditions as qualified people have a more responsible behavior.

Mankiw *et al*. (1992), Barro and Sala-i-Martin (1995) find a positive association between initial endowment levels of education and subsequent growth rates, found that education has significant effect on growth. Maksymenko and Rabani (2011) also find that education has a significant positive effect on growth in both India and South Korea by using co-integration analysis. Dessus (2001) pragmatic -for 83 countries over the period from 1960 to 1990- found that education quality measured by pupil-teacher ratio, government expenditures on education and access to educational facilities are significantly correlated with economic growth. Barro and Salai-Martin (1995; 2004) also tried to prove the effect of primary, secondary, and tertiary school attainment (by sex) on economic growth. They got an insignificant effect of primary education of males and females on economic growth. But they found significant relationship for males' secondary and tertiary education. They also analyzed the role of educational attainment on the convergence theory. Their result proves that countries with relatively low initial GDP grow faster when they have higher levels of human capital in the form of educational attainment.

Study design and methodology

Econometric *Methodology*

To determine the impact of health and education sector investment on economic growth of sub-Saharan Africa, a least square regression analysis was carried out on panel a time series data. The essence was to test the relationship between the variables whether positive or negative and if significant or not (Elbadwi, 1992). To prevent the emergence of spurious results, a panel unit root test was carried out in order to test for stationarity and to determine the order of integration. While a co integration test was carried out to detect if there exists a long run or/ and short run relationship between health and education sector investment and economic growth in the sub-Saharan Africa economies. The model was developed from (Kweka and Morrissey, 1999). Based on neoclassical economic growth theories the relationship between economic growth and health can be specified after taking natural logarithm on both sides as follows

$$lnRGDP_1=lnHE_t+lnEE_t+lnliexp+lnGCF_t+lnLT_t++U_t \quad 1.2$$

where ln GDP is log real GDP per capita (constant 2000 US$), lnLhE is the natural logarithm spending in health proxy of human capital health, ln EEX is log education expenditure (current US$) as human capitaleducation; Liexp is life expectance at birth as percentage and it has been included as a controlling variable, ln LFis the log of total labor force, and GCF is gross capital formation as annual growth rate. Then the panel model can be modified as fallows

$$Ln\ (RGDPi,t)= \alpha i+\ \beta i.\ ln(HEi,t)\ +\ £i.\ ln(EEi,t)\ +\ ¥i.\ ln(GCFi,t)+ ¥i.ln(LTi,t\ )+hLnliep+\varepsilon i,t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$\varepsilon i,t= \rho i\varepsilon i,t\text{-}1 + \omega i,t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.1)$$

Whereas εi, t is the disturbance from the panel regression and ρi shows the autoregressive vector of residuals in the i^{th}cross countries . The model parameter αiallows for the possibility of the country specific fixed-effects and the coefficient of βiallows for the variation across individual countries.

Panel Unit Root Tests

The studies dataset has time dimension of 20 years which composes a time series greater than 20 and therefore, existence of unit roots in variables cannot be ruled out. Eberhardt, M. (2011). Advocates application of macro panel estimation techniques if time dimension is greater than 20. To confirm the presence of unit root, the researcher employ three different yet popular tests: Levin *et al*. (2002) (LLC), Im *et al*. (2003) (IPS) and Maddala and Wu (1999) (MW) tests. The LL tests are based on homogeneity of the autoregressive parameter, while the IPS tests are based on heterogeneity of autoregressive parameters. Thus, no pooling regressions are associated with IPS tests. MW tests, on the other hand, are based on Fisher type unit root tests that are not restricted to the sample sizes for different samples (Maddala and Wu, 1999).

Co integration Analysis

After investigating stationarity of the RGDP, E, EE, GCF and LT, the researcher will able to use Panel ARDL approach, panel co integration to find long run relationship. It is due to ability of Panel ARDL approach to accommodate variables with different levels of stationarity. In this case one variable may be I(0) while other maybe I(1).

Panel ARDL Co integration Approach

In addition to ARDL in time series analysis, Pesaran has contributed to panel data context of ARDL. As Pesaran and Smith (1995) provided mean group estimator of dynamic panels for large number of time observations and large number of groups. In this method separate equations are estimated for each group and examined the distribution of coefficients of these equations across groups. It provides parameter estimates by taking means of coefficients calculated by separate equations for each group. It is one extreme of estimation because it just makes use of averaging in its estimation procedure. It does not consider any possibility of same parameters across groups. Panel ARDL model can be specified as follows

We consider an *ARDL* (*p, q*1*, q2…. qK*) model with fixed effects and deterministic time trends. For ease of exposition we assume $p = q1 = q2 = \ldots = qk = 1$

$$\mathrm{Ln\ RGDP}_{it} = \alpha i + \delta t + \pi i \mathrm{LnRGDP} i,t-1 + \sum_{k=1}^{k}\sum_{i=1}^{p} £i.\mathrm{in}(\mathrm{H}i,t) + \sum_{k=1}^{k}\sum_{i=1}^{p} €\mathrm{in}(\mathrm{EE}i,t) + \sum_{k=1}^{k}\sum_{i=1}^{p} \beta \mathrm{in}(\mathrm{GCF}i,t) + \sum_{k=1}^{k}\sum_{i=1}^{p} \theta \mathrm{in}(\mathrm{LT}i,t) + U_{i,t} \quad \ldots\ldots (3)$$

$i = 1,2\ldots N$, $t = 1,2\ldots T$. The subscript *i*refers to the i^{th} country and*t* indexes the t^{th} time series observation. The error term *uit*is assumed to beindependently and identically distributed across *i*and *t* with mean 0 and variance , instead of estimating the trend coefficient one may consider it as an irritation parameter, and instead work with the cross- section ally demeaned form of the first difference of the model.First differencing and cross-section ally demeaning (3) yields

$$\Delta \mathrm{LRGDP}_{it} = +\pi i \Delta \mathrm{LnRGDP}\, i,t-1 + \sum_{k=1}^{k}\sum_{i=1}^{p} £i.\Delta\ln(\mathrm{H}\, i,t) + \sum_{k=1}^{k}\sum_{i=1}^{p} €\Delta\ln(\mathrm{EE}\, i,t) + \sum_{k=1}^{k}\sum_{i=1}^{p} \beta\Delta \mathrm{in}(\mathrm{GCF}\, i,t) + \sum_{k=1}^{k}\sum_{i=1}^{p} \theta\Delta\ln(\mathrm{LT}\, i,t) + \Delta U_{i,t} \quad \ldots\ldots (3.1)$$

Whereas $\Delta \mathrm{LRGDP}_{it} = \Delta \mathrm{LRGDP}_{it} - \frac{1}{N}\sum_{i=1}^{N} \mathrm{LnRGDP}i,t$, $\pi i \Delta \mathrm{LnRGDP}\, i,t - 1 = \Delta \mathrm{LnRGDP}i,t - 1 - \frac{1}{N}\sum_{i=1}^{N} \mathrm{LnRGDP}i,t-1$, we can obtain the rest of the demeaning form by using the same procedures and with$t = 2; 3\ldots T$, $\Delta = 1 - L$ and L denoting the lag operator. Note that (3.3) is free both of the incidental parameter αi and the irritation parameter δ.

Pesaran and Smith (1997) suggested pooled mean group (PMG) estimator of dynamic panels for large number of time observations and large number of groups. Pesaran, Shin and Smith (1997, 1999) added further in PMG estimator and extended it. Pooled mean group estimator considers both averaging and pooling in its estimation procedure, so it is consider as an intermediate estimator. PMG estimator allows variation in the intercepts, short-run dynamics and error variances across the groups, but it does not allow long-run dynamics to differ across the groups.In addition to PMG and MG, Dynamic Fixed Effects (DFE) is will also be used to estimate the co integrating vector. DFE specification controls the country specific effects, estimated through least square dummy variable (LSDV) or generalized method of moment (GMM).

RESULTS AND DISCUSSIONS

Empirical results

This section undertakes a comprehensive econometric exercise to evaluate the relation of investment on health and education on the economic performance of Sub-Saharan Africa. The main empirical analysis of the study concerns the estimation of the growth model specified in Equation (1.2) while controlling life ex using various estimators as outlined in the preceding chapter. The basic growth model includes the logarithm of lagged income (real GDP per capita), population health capital, and education capital as well as other control variables in life expectancy at birth and labor work force load with the empirical growth literature. The basic strategy therefore, is to predict growth of Sub-Saharan African countries using health and education indicators and vice versa. Since researcher dealing with macroeconomic variables that spans over a relatively long period, and hence are often found to be not stationary, I first take panel unit root tests to evaluate their order of integration. Next, apply panel co-integration tests to ascertain whether there are long-run relationships amongst the variables of interest. In the final step, researcher estimate the long-run and short-run relationships using the relevant and efficient techniques.

Panel Unit root Test

Researcher starts the application of panel unit root tests to verify whether or not the variables are not stationary. Even if several authors have proposed unit root tests based on different sets of assumptions. In this study however, I settle on 3 distinct panel unit root tests on the variables over 1995-2014: Levin-Lin-Chu's (LLC) t*, Im-Pesaran-Shin'scW, and Maddala and Wu's $\chi 2$ statistics. Among these tests, LLC, tests are based on the common unit root process assumption that the autocorrelation coefficients of the tested variables across cross sections are identical. However, the IPS and ADF-Fisher $\chi 2$ tests rely on the individual unit root process assumption that the autocorrelation coefficients vary across cross sections. In all the test specifications, I include deterministic time trend. In the LLC, IPS and ADF-Fisher tests, cross-sectional means are subtracted in order to minimize problems arising from cross-sectional dependence. The Schwarz-Bayesian information criterion (BIC) is used to determine the country-specific lag length for the ADF regressions, with a maximum lag of 3 regarding the LLC and the IPS tests the test results are presented in Table 1 and 2. Generally, the test results show evidence of nonstationarity of most variables under consideration. The LLC, IPS test confirms that all the variables are no stationary except Life expectance at birth and. ADF-Fisher tests also indicate that all the variables except Liexp and Rgdp are non-stationary and also Rgdp stationary with trend in LLC and IPS tests. Thus, in comparison with the LLC, the evidence on the nonstationarity of these variables is mixed. The evidence provided, thus, may suggest the variables contain unit roots. It must, be emphasized that, the cross-sectional averages were subtracted from each series (demeaning) prior to applying the LLC, IPS and ADF-Fisher tests,

Panel Co-integration Testing

In order to avoid the spurious regression problem, a co-integration test is required. Table presents three variants of panel cointegration in this study. The Pedroni and Kao tests use the Bayesian information criterion (BIC) to automatically select the appropriate lag length. The Pedroni and Kao tests are based on the residuals of the long-run static regression. Deterministic time trends are included in all specifications. All tests are derived under the null hypothesis of nocointegration, any strong support for the presence of co-integration, particularly when logarithm of real GDP was taken as the dependent variable. As we take into account cross-sectional dependencies.

Table 1. panel unit root test (llc and IPs)

	LLc-tests		IPS test	
	Without trend	With trend	Without trend	With trend
Variable name	At their levels T[p]-values			
lnRGDPt	0.8308[0.799]	3.5607[.002]*	1.4467[.1258]	2[.0224]
lnHEt	0.0636[0.4746]	.979[.637]	1.176[.8802]	.86[.804]
lnEE	0.511[.3045]	0.8090[.2093]	1.8035[.8607]	.5010[.6918]
LNlF	.4326[.6474]	2.0439[.0205]*	2.0622[0.9804]	2.88[.002]l.2
LnLExp	25.90[0.00]*	No need	19.876[.000]*	
lnGCF	0.79[0.2146]	1.46[.102]	.383[.6707]	.5680[.2580]
	At their first difference			
DlHEt	4.0464[.000]**		4.022[.000]**	
DlEEt	3.4688[.003]**		4.5454[.000]**	
DGCF	8.5066[.000]**		8.491[0.000]**	

Table 2. Fisher type of Unit root test

At their level			
Variable	statistics	Without trend	With trend
rgdp	Inverse chi-square P	46[.000]**	
	Inverse normal Z	1.814[.0349]**	
	Inverse logit,t(54) L*	1.8499[.0349]**	
	Modified inverse chi squared Pm	4.126[.000]**	
Lnhee	Inverse chi-square P	10.699[.953]	19.254[.503]
	Inverse normal Z	1.100[.861]	1.000[.8619]
	Inverse logit,t(54) L*	.1178[.5549]	.11787[.754]
	Modified inverse chi squared Pm	1.706[.9293]	.1178[.54449]
Lnee	Inverse chi-square P	15.25[.7617]	15.25[.7617]
	Inverse normal Z	1.124[.866]	.67924[.869]
	Inverse logit,t(54) L*	1.290[.893]	0.6482[.745]
	Modified inverse chi squared Pm	.7503[.7735]	..689[.7546]
Lnlf	Inverse chi-square P	44.725[.0012]**	
	Inverse normal Z	.3197[.6254]	
	Inverse logit,t(54) L*	.7333[.625]	
	Modified inverse chi squared Pm	3.9153[.000]**	
lngcf	Inverse chi-square P	15.156[.764]	10.699[.108]
	Inverse normal Z	.784[.2518]	.578[.7182]
	Inverse logit,t(54) L*	0.6155[.27704]	.255[.6920]
	Modified inverse chi squared Pm	1.2688[.10023]	.7658[.7781]
lnlexp	Inverse chi-square P	385.04[0.000]**	
	Inverse normal Z	14.175[0.000]**	
	Inverse logit,t(54) L*	32.1791[0.000]**	
	Modified inverse chi squared Pm	57.78186[.000]**	
	At first difference		
	Statistics	Without trend	With trend
dlhee	Inverse chi-square P	58.2989[.000]***	No need
	Inverse normal Z	4.7035[0.000]***	No need
	Inverse logit,t(54) L*	4.0922[.000]***	No need
	Modified inverse chi squared Pm	6.055[0.000]***	No need
dlee	Inverse chi-square P	69.913[0.000]***	No need
	Inverse normal Z	5.279[0.000]***	No need
	Inverse logit,t(54) L*	5.8518[0.000]***	No need
	Modified inverse chi squared Pm	7.89200[0.000]***	No need
dgcf	Inverse chi-square P	147.563[0.000]***	No need
	Inverse normal Z	9.725[0.000]***	No need
	Inverse logit,t(54) L*	12.9571[0.000]***	No need
	Modified inverse chi squared Pm	20.169[0.000]***	No need

** shows variables are stationary at their level form, whereas **** shows they are stationary at first difference at all level of significance and "D" difference form of variables

However, it seems as though, real GDP causes health investments greatly other than the reverse, as all the various test statistics reject the null hypothesis of no cointegration. Overall the results appear to suggest that the variables are co-integrated

Estimation and discussion of long run variables

Since I have established a unique cointegrating relationship amongst the variables some variables now let me use panel data estimation methods to investigate the relation health and education sector investment on economic growth in SSA. Potential reverse causality between economic growth and education investment which is peroxide by secondary school enrolment is also addressed.

To ensure robustness of the analysis, researcher present the results of alternative estimation strategies. To reduce biases and inconsistencies associated with the presence of a lagged dependent variable, researcher first apply the system GMM (SYS-GMM) estimator instead of fixed effects (FE) or difference GMM. Nevertheless, the relatively large time series in this study would also require an estimator which will provide more efficient estimates of the coefficients. Thus, aside the system GMM estimator, we use the dynamic OLS (DOLS) and the maximum-likelihood estimator (MLE) for the error correction model. The DOLS approach involves estimating a static long-run relation augmented by leads and lags of the first-differenced explanatory variables[1]. Though this strategy improves the efficiency of the long-run estimates,

Table 3. panel cointgration tests results

Panel conintgration tests	Dependent.v.panelCoitgtration.test		Dependent variable panel co-intgration tests
	LnRGDP		LnHE
Pedroni	Penel-v	1.146[0.125]	3.37[0.025]**
	Penel-rho	2.256[.167]	3.256[.467]
	Penel-PP	3.256[.1673]	1.456[.2670]
	Penel- ADF	2.455[0.0001]**	1.4555[0.78001}
	Group-rho	3.16[0.9945]	1.46[0.24945]
	Group-pp	2.567[0.489]	1.467[0.3489]
	Group-ADF	2.76[0.000]**	2.45[0.956]
Kao	T	-1.46[0.45]	3.45[0.000]**

Notes: Test results were generated by Eviews and Stata module. Pedroni's Panel statistics are weighted. Dep. var. of coint. reg. = dependent variable of the co-integrating regression.

Table 4. Panel Co-integration Estimation Results for RGDP

	SY-GMM		PMG	MG	DFE
Dependent variable	RGDP		DRGDP	DRGDP	DRGDP
Convergent coefficients	0.231[0.045]		0.96[0.046]	0.256[0.056]*	0.252[.024]
Long run coefficients	lnhee	0.9526[.198]	0.926[0.196]	-0.1306[0.89]	0.4674[0.052]**
	lnee	0.32[0.006]	0.326[0.006]**	0.1086[0.084]*	0.9085[0.004]**
	lnlf	0.250[0.16]	-2.331[0.156]	-1.154[0.197]	0.3765[0.691]**
	lngcf	0.317[0.165]	0.1567[0.997]	0.043[0.190]	0.452[0.1439]
	lnliexp	0.243[0.057]	0.043[0.003]**	0.074[0.300]	0.284[0.030]**
Short run coefficients	Dlhee	0.395[0.00]***	0.99[0.00]	1.026[0.069]*	0.4896[0.375]
	Dlee	0.69934[0.869]	0.0126[0.992]	0.166[0.027]**	0.035[0.723]
	Dllf	0.0089[0.869]	0.042[0.137]	11.256[0.00]**	0.00181[0.986]
	Dlgcf	0.076[0.1890]	-0.5645[0.878]	-0.017[0.756]	10.43[0.2986]
	Dlliexp	1.325[0.456]	-0.569[0.785]	1.8299[0.032]**	-0.469[0.689]
Housman test X^2			14.4[.000]**		

Notes: All equations include a constant country-specific term. Values [ ] are and probability values. For DFE estimates, the standard errors are heteroskedatic consistent. SYS-GMM generates instruments 1606 180observations. the speed of adjustment for SYS-GMM equals one minus the coefficient on the lagged dependent variable (0.076). Hansen test is the test of over identifying restrictions (the null hypothesis is that the instruments are valid).***, and ** indicate significance at the 1% and 5% levels respectively

it does not capture the short-run behavior[2]. Because of these the pooled mean group (PMG) estimator which uses the panel extension of the single equation autoregressive distributed lag (ARDL) model[3]. One advantage of using this strategy is that the error correction representation in the ARDL provides information about the contemporaneous impacts and the speed of adjustment towards equilibrium following a shock. Moreover, while the long-run coefficients are assumed to be homogeneous (that is, identical across panels), the short-run coefficients are allowed to be heterogeneous (that is, country-specific). The results are presented in Table 4. The long-run and short-run estimates based on different estimation strategies are reported in each column of the Table 4 the magnitudes of the long-run coefficients denote the elasticity's of output with respect to each variable in the model.

The SYS-GMM estimates of the coefficients are usually taken to represent short-run impacts, while the long-run impacts are approximated by the short-run coefficients divided by one minus the coefficient on the lagged dependent variable. The results suggest that only school enrolment which is negative sign and life expectance at birth are significant, all the other variables have no significant impact on the economic performance in SSA, albeit they obtained the anticipated signs. However, the coefficient on the lagged value of LIEXP has the expected sign and highly significant. It seems the SYS-GMM underestimates the short-run impacts of health on economic growth and overestimates its long-term effects, in comparison with the other estimators. In particular, the results indicate life expectance at birth significantly improves the economic performance of SSA by approximately 2.5 percent as the former increases by a percentage point. The last three columns provide the pooled mean group (PMG), mean group (MG) and dynamic fixed-effects (DFE) estimates.

DISCUSSION

Acemoglu and Johnson (2006) pointed out that, although health improvements are a valuable goal within itself, they do not have a significant effect on economic growth. The results in this study extend their findings in which investigate that positive and significant impact on economic performance of SSA including life expectancy at birth but their sheer is very small. An important point of these study is try to take into account the indirect effect of health on economic growth, in which improvements of health improves school enrolment which affect education positively and improves life expectance at the birth . It is expected that, using a single equation to capture the influence of health on economic growth would capture the labor force participation which build positive effect on growth. Furthermore, though the study attempts to establish some linkage between education and health, it only captures the contemporaneous effect of the former on the latter. Conceptually, more educated individuals are more productive (and obtain higher earnings). Also if children with better health and nutrition attain higher level of education and are less likely to play truant and drop out of school early, then improved health in young people would contribute to future productivity.Thus, the health effects in the macroeconomic sense may have long time lags, given that the average worker may have been several years or more which invariably makes the macroeconomic relationship difficult to estimate. This assertion is line with the empirical literature. Moreover, if good health is also linked to longer life, healthier individuals would have more incentive to invest in education and training, as the rate of depreciation of the gains in skills would be lower (Strauss and Thomas, 1998). However, this study had the established a careful indirect effect of health on economic growth through education. More importantly, these study used life expectancy to test the linkage between health capital and growth over a number of samples in a panel data context which is supported by McDonald and Roberts (2002). The results in this study somewhat corroborate their findings. Their results for 19 Less Developed Countries have the coefficients 0.9525, -0.32, 0.25, 0.3187 and 0.243 for, education, health labor force load, gorse capital formation and life expectance at birth respectively. However, they used total years of education as the proxy for education while we secondary school enrollment to improve the quality of education. Though, our results suggest that health capital is really important relative to education capital.

Conclusion and policy implication

In this study, researcher use the augmented Solow growth model and applied the newly developed panel cointegration estimation strategy to test the relationship between health snd education sector investments on economic growth in SSA for the period 1995 to 2011, alongside some other key determinants of economic growth.Generally, the estimation results of different estimation strategies are quite consistent. Most importantly is the result on the effect of health which does not significantly affect economic growth in SSA but the effect of Education in most of estimation method positively and significantly affect the growth. Nevertheless, improvements in the economic performance have the potential of increasing health status and consequently life expectancy in the countries. In view of the intriguing results analyzed and considering the economic status of SSA, policymakers should divert their attention and policies to invest more in the public health system as well as providing subsidized and quality education to help the poor greatly. Majority of the population in SSA are considered poor and hence constrained in the expenditures of health care in the event of sudden diseases and ailments. Thus, improving on the efficiency of the public health system as well as providing it at affordable costs would help the poor to access health care, which invariably would improve their health status and consequently life expectancy. This would also have the advantage of reducing the effect of diseases on the cognitive abilities of children who in the long-run can train through school to enhance their human potentialities, and consequently improving per capita income through increased productivity and wages. Also, such policies are expected to help affected individuals who cannot afford the full cost of purchasing antiretroviral drugs and access health care frequently would potentially prolong their life spans and consequently contribute their quota in national development.

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