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18 July 2019

THE HUMAN CAPITAL – ECONOMIC GROWTH NEXUS IN SSA COUNTRIES: WHAT CAN STRENGTHEN THE RELATIONSHIP?

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Abstract: The World Bank has recently placed increasing emphasis on the role of human capital development in facilitating economic development in the Sub-Saharan African (SSA) region. Our study examines the impact of human capital on economic growth for a selected sample of 9 SSA countries between 1980 and 2016 using a panel econometric approach. Interestingly enough, our empirical analysis shows an insignificant effect of human capital on economic growth for our selected sample. These findings remain unchanged even after adding interactive terms to human capital which are representative of government spending as well as foreign direct investment. Nevertheless, we establish a positive and significant effect of the interactive term between urbanization and human capital on economic growth, a result which emphasizes the importance of developing urbanized, 'smart', technologically-driven cities within the SSA region as a platform towards strengthening the impact of human capital- economic growth relationship.

Keywords: Human capital, economic growth; Sub-Saharan Africa (SSA) countries; foreign direct investment (FDI); Government spending; Urbanization.

JEL classification codes: C13; C23; C51; J24; O47.

1. INTRODUCTION

As the world economy is currently transitioning into the fourth industrial revolution, the role of human capital specialization within industrial organizations and labour markets has been of global priority. International organizations such as the International Monetary Fund (IMF) and the World Bank are placing increasing emphasis on the importance of human capital development in achieving a sustainable future, especially in the Sub-Saharan African (SSA) region. In 2018, the World Bank launched the Human Capital Project which is essentially a global effort designed to accelerate and strengthen the accumulation of human capital by encouraging more effective policies and investments (World Bank, 2018). Indeed, the theme of the 2019 World Development Report (WDR, 2019) is 'The changing nature of work' which emphasizes on investing in human capital through public policy as a means of addressing the changing skills requirements and new business models dictated by accelerated innovations in technology. More recently, the World Bank (2019) reported success stories for a handful of SSA countries (i.e. Ethiopia, Lesotho, Madagascar, Zambia, Mali, Mauritania, Mozambique and Tanzania) which have achieved recognisable improvements in health facilities, education quality, school nutrition and fertility control.

In view of these acclaimed success stories for SSA countries, it is quite disconcerting to observe that the fruits of these human development projects have not translated into higher economic growth rates. According to the IMF's regional outlook, the SSA region has been the worst performing region globally, with average economic growth reducing from approximately 4.75 percent in 2010 to 2.4 percent in 2018 (IMF, 2019). Against this background, the purpose of this paper is to answer the following research question: What can aid human capital development to spur economic growth in SSA countries? Whilst the literature is flourished with academic studies conducted for industrialized economies on the subject matter (Ljungqvist (1993), Tallman and Wang (1994), Lee and Lee (1995), Fernandez and Rogerson (1996), Agiomirgianakis et al. (2002), Dias and Tebaldi (2012), Ramos et al. (2012), Qadri and Waheed (2014), Teixeira and Queiros (2016), Fan et al. (2016), Ahsan and Haque (2017), Siddiqui and Rehman (2017), Zhu and Li (2017) and Diebolt and Hippe (2019)), to the best of our knowledge, the studies of Gyimah-Brempong and Wilson (2004), Hakeem (2010), Ogundari and Awokuse (2018) and Ibrahim (2018) suffice as the only available empirical works that have attempted to address this research question for SSA countries.

Gyimah-Brempong and Wilson (2004) employ an augmented Solow model for a panel of 21 SSA and 22 OECD countries and employ three measures of human capital (ratio of healthcare expenditure to GDP, child mortality rate and average years of educational attainment) in their analysis. The authors uncover a positive and significant relationships between all human capital measures and economic growth amongst both groups of countries. On the other hand, Hakeem (2010) investigates whether financial development (proxied by private credit, domestic credit, liquid liability and broad money) can stimulate the existing relationship between human capital (proxied by educational attainment) and growth in 14 SSA countries. Interestingly enough the authors find that whilst financial development has had little effect on economic growth by itself, its interaction with human capital is what has stimulated economic growth in these SSA countries. More recently, Ogundari and Awokuse (2018) investigate the human capital-growth nexus for 35 SSA countries using a host of proxy variables for health (proxied by life expectancy) and education (proxied by average years of schooling and government expenditure on schooling). The author's show that despite all human capital proxies exerting a positive and significant effect on economic growth, the contribution of the health proxies are larger than that of the education counterparts. In similarity to Hakeem (2010), the work presented by Ibrahim (2018) investigates the interactive effect between financial development and human capital in stimulating economic growth in 29 SSA countries. Using the teacher-pupil ratio to proxy human capital, the authors uncover a negative relationship between human capital and growth and this relationship turns positive once an interactive term between human capital and financial development is introduced in the estimated regressions.

Our study contributes to this growing literature by examining the relationship between human capital and economic growth for 16 SSA countries and is distinguishable from previous works in two ways. Firstly, our study goes beyond investigating the enhancing impact of financial development on human capital contribution to economic growth and further considers other plausible 'interactive variables' such as government size (Lin (1998), Jung and Thornecke (2003), Annabi et al. (2011), Dissou et al. (2016)), foreign direct investment (Noorbakhsh et al. (2001), Cleeve et al. (2015), Yu and Liu (2016)) and urbanization (Coulombe (2003), Bertinelli and Zou (2008), Kumar and Kober (2012), Fluckiger and Ludwig (2018)). Secondly, our study goes beyond the traditional use of schooling (Hakeem (2010), Ahsan and Haque (2017), Siddiqui and Rehman (2017)), life expectancy (Kunze (2014), Ogundari and Awokuse (2018)) and expenditure on health (Gyimah-Brempong and Wilson (2004), Aka and Dumont (2008), Wang (2011), Piabuo and Tieguhong (2017)) as measures of human capital and uses the recently released human capital index (HCI) provided by the Penn State World tables which is considered a superior measure in capturing multidimensional facets of human capital (Feenstra et al., 2015). To the best of our knowledge, no other study has employed this index in investigating the human capital-growth nexus hence reflecting the novelty of our study. Moreover, no other study, as far as we are concerned, has examined the interactive effects of government size, external capital inflows and urbanization on human capital contribution to economic growth. Consequentially, our study offers a fresh policy perspective on the subject matter, not only for SSA countries, but towards the general literature as a whole.

We structure the remainder of the study as follows. The follow section of the paper provides an overview of human capital development in the SSA region. The third section of the paper presents the literature review of the study. The empirical framework of the study is outlined in the third section whilst the empirical findings of our study are presented in section four. The study is concluded in the fifth section of the paper along with the associated policy implications derived from our findings.

2. AN OVERVIEW OF HUMAN CAPITAL DEVELOPMENT IN THE SSA REGION

Despite boasting high returns to education, the Sub Saharan Africa (SSA) region has a predominantly weak human capital base, which is a result of the low school enrolment rate, high pupil teacher ratio and high adolescent dropout in many countries in the region. This is the result of inadequate institutions and support mechanisms for education and skill development, which limits access to institutions of training and learning. Notably, a region with a greater amount of educational attainment has more skilled and productive workers to facilitate economic growth and transformation (Baah-Boateng 2013). Human capital affects the structure of national production and the technological level such that economies endowed with more educated people are able to improve local technologies and the use of new technologies requires a high-quality workforce (Adelakun, 2011). Further, the absorption of advanced technologies from developed economies is made possible by the abundance of well-educated human resources.

Table 1 shows the average enrolment rates for primary, secondary and tertiary education in SSA and other regions. With reference to Table 1, SSA has the lowest school enrolment rates compared to other regions, which is an indication of poor or weak human capital base. The average net primary school enrolment rate for the period 2007-2017 is remarkably low in SSA at 76%. This is in comparison to other regions namely European Union at 97%, East Asia and the Pacific at 96%, OECD members at 96% and South Asia at 89% (World Bank, 2019). This also applies to average secondary and tertiary enrolment over the period where SSA has much lower percentages of 32% and 8% respectively compared to other regions with EU at 91% and 66%.

Table 1: School enrolment 2007 - 2017

Region	Average school enrolment, primary (%)	Average school enrolment, secondary (%)	Average school enrolment, tertiary (%)
European Union	97	91	66
East Asia & Pacific	96	76	34
OECD members	96	88	69
South Asia	89	56	19
Sub-Saharan Africa	76	32	8

Source World Bank (2019)

Table 2 further presents statistics from SSA and other regions on various aspects that affect human capital. From 2007 to 2017, the average number of years of secondary schooling achieved by the average person aged 15 years and over in SSA was estimated at 6 years, which is similar to Pacific and OECD members and slightly lower than European Union and South Asia. This indicates that strides have been made in SSA in providing secondary schooling. However, the average pupil-teacher ratio for both primary and secondary for the same period is quite high for SSA at 41 for primary and 22 for secondary school, as shown on Table 3. This is relatively high compared to other regions, with European Union having the least at 13 and 12 respectively. Only South Asia has average pupil-teacher ratio for secondary education which is higher than SSA. Table 2 also shows that SSA has the highest average of adolescents out of school over the period, with 36% of lower secondary school age out of school. This is followed by South Asia at 22%. The rest of the regions have very small percentages of adolescents out of school of 10% or less. The implication of these statistics is that human capital development in SSA is negatively affected, hence the result is a weak human capital base.

Table 2: Secondary education, pupil teacher ratio and adolescent's dropout 2007-2017

Region	Average secondary education, duration (years)	Average pupil-teacher ratio, primary school	Average pupil-teacher ratio, secondary school	Average adolescents out of school (% of lower secondary school age)
European Union	6,5	13	12	3
Caribbean small states	5	19	16	10
East Asia & Pacific (excluding high income)	6	18	16	10
East Asia & Pacific	6	18	16	10
OECD members	6	16	14	3
South Asia	7	36	27	22
Sub-Saharan Africa (IDA & IBRD countries)	6	41	22	36

Source World Bank (2019)

Since the SSA countries have limited resources, the available educational and training institutions often lack adequate teachers/trainers and the necessary tools and equipment to undertake effective teaching and training towards building productive human capital base. The quality of education and training offered in the SSA countries is also compromised as the teachers and available teaching tools and equipment tend to be overstretched by high number of pupils and students. This coupled with low salaries causes the teachers to be poorly motivated, thereby further affecting negatively the quality of education offered. Countries in Sub Saharan Africa also face the challenge of high rates of school dropouts, which is often associated with the problem of poverty. UNESCO (2012) reports that 42% of African school children drop out before the end of primary education with Angola amongst the countries recording very high dropout rate between 68% and 72%. Many poor African families find it difficult to support their children, particularly girls, beyond the basic level of education. This is reflected in the wider gap between enrolment rates in primary and secondary levels of education in African countries.

Access to education has been largely constrained by inadequate training institutions in many SSA countries. This contrasts with countries for example in South-east Asia such as Malaysia, South Korea and Singapore who focused their priorities and commitments towards the education sector to boost the supply and quality of human capital base of the countries. Many countries in Sub Saharan Africa are among the least developed countries (LDCs) of the world with low income. Hence, they are unable to provide enough academic and training institutions to absorb the increasing number of people who seek access to education and training. The state of underdevelopment of many countries in Africa is not only due to lack of capital but more importantly because they lack adequate knowledge and skills to enhance productivity and increase national output (Baah-Boateng 2013). Even though the implementation of Poverty Reduction Strategy Programmes (PRSPs) in developing countries in recent years has triggered some degree of expansion in human capital investment in Africa, the rate of expansion is still slow and the level remains low relative to some countries in East Asia such as Malaysia and South Korea (Baah-Boateng 2013). It is also interesting to note that many African countries face difficulty in retaining trained human resource on the continent and this continues to be a major setback to the development of human capital in many countries. It is estimated for a number of African countries that over 30% of its highly skilled professionals are lost to the OECD countries (Carrington and Detragiache, 1998) about 50 million (or one-third of all world) migrants are from Africa (IOM 2000).

3. EMPIRICAL FRAMEWORK

3.1 Theoretical model

Even though the origins of dynamic growth theory are embedded within the Neoclassical growth theory as popularized by Solow (1965) and Swan (1965), the Neoclassical economists had placed strong emphasis on exogenous growth factors and had virtually ignored the contribution of human capital development in the economic growth process. On the other hand, endogenous growth theorists, led by Rommer (1986) and Lucas (1988), augmented the Solow (1965) model with human as well as physical capital and were able to identify a number of endogenous factors responsible for growth such as human capital development, increasing returns to scale, innovation, trade openness and research and development. In following the theoretical underpinnings articulated in Rommer (1986), Lucas (1988) and Mankiw et al. (1992), our theoretical framework incorporates for both physical and human capital into the production function:

$$Y_t = AK_t^{\alpha}(\Xi_t H_t L_t)^{1-\alpha} \tag{1}$$

Where Y_t is output production, A is the level of technology, k_t, is the physical capital stock, l_t is the stock of labour, h_t is the measure of the average quality of workers, Ξ_t is the fraction of time that households spend working such that ΞHL denotes the effective human capital for the entire economy. Following, Becker and Tomes (1979), Becker et al. (1990) and Asteriou and Agiomirgianakis (2001) we assume that each household comprises of 'working' adults and 'schooling' children, with the latter using the fraction of household time not spent on working (i.e. $1 - \Xi_t$) being used for education purposes. Each household thus faces the following family utility function:

$$U_{i,t} = \sum_{t=0}^{T} e^{-pt}\left[\frac{c_t^{1-\sigma}}{1-\sigma} + n_i(1-\Xi_t)\right] \tag{2}$$

Where c_t denotes the consumption of the composite good, n denotes the number of children in each household and $n(1 - \Xi_t)$ denotes the time all children spend on educating and developing themselves. Ultimately, households want to maximize their utility function subject to the physical capital accumulation (equation 3) and human capital accumulation (equation 4) constraints i.e.

$$K_{t+1} - K_t = AK_t^{\alpha}(\Xi_t H_t L_t)^{1-\alpha} - c_t \quad (3)$$

$$H_{t+1} - H_t = \phi H_t(1 - \Xi_t)\, n_t - xp_x n_t \quad (4)$$

Where ϕ is the average educational productivity parameter, x is the purchased schooling units, and p_x is the price per unit of education. Our Lagrange problem is therefore to maximize the utility function (equation (2)) subject to the physical capital accumulation (equation (3)) and human capital accumulation (equation (4)) i.e.

$$U_{i,t} = \sum_{t=0}^{T} e^{-pt}[\frac{c_t^{1-\sigma}}{1-\sigma} + n_i(1 - \Xi_t)]$$

$$+ \lambda_{1,t}\, AK_t^{\alpha}(\Xi_t H_t L_t)^{1-\alpha} - c_t$$

$$+ \lambda_{2,t}\, \phi H_t(1 - \Xi_t)\, n_t - xp_x n_t \quad (5)$$

Asteriou and Agiomirgianakis (2001) provide a detailed solution for Lagrange equation (5), of which the authors find that over the steady-state equilibrium, the growth rate of human capital (γ_H), the growth rate in physical capital (γ_K) and the economic growth rate (γ) are equal i.e.

$$\gamma_H = \gamma_K = \gamma \quad (6)$$

And the sector that really drives the economy is the production of human capital i.e.

$$\gamma_H = \frac{\phi n_i - B - 2p}{1 - 2\alpha - \sigma} \quad (7)$$

From equation (7), it can be observed that an increase on the exogenous ability of each child, ϕ, results in an increase on the growth rate of human capital, which in turn, increases the growth rate of physical capital accumulation as well as economic output.

3.2 Empirical model and estimation process

Our baseline econometric specification is obtained by log-linearize our endogenous growth function (1) into the following long-run estimation equation:

$$y = \beta_0 + \beta_1 k + \beta_2 h + \beta_3 l + e_t \quad (8)$$

Where β_0, β_i and e_t are the intercept, regression coefficients and disturbance terms, respectively. Note that the lower-case letters denote the natural logarithm transformation of the variables. We further augment regression (8) to include other control variables such as government size (g) and trade openness (x), hence providing us with the following augmented growth regression i.e.

$$y = \beta_0 + \beta_1 k + \beta_2 h + \beta_3 l + \beta_4 g + \beta_5 x + e_t \quad (9)$$

From the above, regressions (8) and (9) represent our empirical growth regressions which are to be estimated using the dynamic OLS (DOLS) and fully modified (FMOLS) techniques described in Kao et al. (1999) and Pedroni (2000), respectively. Considering that equations (8) and (9) can be compactly written as the following panel cointegration regressions:

$$y_{it} = \alpha_i + x_{it}'\beta + u_{it} \quad (10)$$

Where y_{it} is economic growth, β is a $k \times 1$ vector of slope parameters of growth determinants, α_i are the intercepts, x_{it}' are integrated processes of order I(1) for all i such that:

$x_{it}' = x_{it-1} + e_{it}$ (11)

The FMOLS estimator is constructed by making corrections for endogeneity and serial correlation to the traditional OLS estimator i.e.

$$\hat{\beta}_{FMOLS} = [\sum_{i=1}^{N}\sum_{t=1}^{T}(x_{it} - \hat{x}_i)']^{-1} \times [\sum_{i=1}^{N}(\sum_{t=1}^{T}(x_{it} - \hat{x}_i)\hat{y}_{it}^{+} - T\hat{\Delta}_{eu}^{+})] \quad (12)$$

Where $\hat{y}_{it}^{+} = y_{it} - \hat{\Omega}_{ue}\hat{\Omega}_e^{-1}\Delta x_{it}$, $\hat{\Delta}_{eu}^{+} = \hat{\Delta}_{eu}\hat{\Omega}_e^{-1}\hat{\Omega}_{ue}$ and $\hat{\Delta}_{eu}$ and $\hat{\Delta}_{eu}$ are kernel estimates of Δ_{eu} and Δ_e. On the other hand, the DOLS estimator, $\hat{\beta}_{DOLS}$, uses the past and future values of Δx_{it} in equation (10) as additional regressors and is obtained by running the following dynamic panel regression:

$$y_{it} = \alpha_i + x_{it}'\beta_D + \sum_{j=-q}^{q} c_{ij}\Delta x_{it+j} + \dot{v}_{it} \quad (13)$$

Where:

$$\dot{v}_{it} = v_{it} + \sum_{/j/>q}^{q} c_{ij}e_{it+j} \quad (14)$$

Kao et al. (1999) demonstrated that $\hat{\beta}_D$ has the same limiting distribution as $\hat{\beta}_{DOLS}$. In our study, the above-described FMOLS and DOLS cointegration framework is coupled with the panel cointegration test of Kao (1999). In outlining the Kao (1999) cointegration test, we assume the residual terms obtained from a panel regression, e_{it}, can be expressed as:

$$e_{it} = \rho\, e_{it} + \sum_{j=1}^{n} \Phi_j \Delta e_{it-j} + v_{itp} \quad (15)$$

And from equation (19) the null hypothesis of no cointegration is given as:

H_0: $\rho = 1$ (16)

Kao (1999) suggests that the no cointegration null hypothesis can be tested using the following modified ADF-type test statistic:

$$t_{kao} = \frac{t_{adf} + \sqrt{6N}\sigma_v/(2\sigma_{ov})}{\sqrt{\sigma_{ov}^2/(2\sigma_v^2) + 3\sigma_v^2/(10\sigma_{ov}^2)}} \sim N(0,1) \quad (17)$$

Where $t_{adf} = \frac{(\rho-1)[\sum_{i=1}^{N}(e_i' Q_i e_i)]^{\frac{1}{2}}}{s_v}$.

4. DATA AND EMPIRICAL RESULTS

4.1 Empirical data and unit root test

Our study relies on a total of 9 time series variables to conduct our empirical analysis, namely; GDP growth percentage, y_t, capital stock at constant 2011 US$ prices (k_t), the number of people employed (l_t), the human capital index based on years of schooling and returns to education (h_t), share of government consumption in GDP (g_t), share of merchandise exports in GDP (x_t), an interactive term between government size and human capital (g_t*h_t), an interactive term between foreign direct investment and human capital (FDI_t*h_t) and an interactive term between urbanization population and human capital ($urban_t$*h_t). All variables have been transformed into their natural logs for empirical purposes. Our panel time series are collected over annual frequencies spanning over the period 1980–2016 for 9 SSA countries, namely; Angola, Botswana, Swaziland, South Africa, Zimbabwe, Namibia, Mauritius, Lesotho and Mozambique) which gives a total of 333 observations for empirical use. A comprehensive summary of the time series used in our study is presented in Table 1 below.

Table 3: Data source and descriptive statistics

Data series	Symbol	Source	Mean	s.d.	Min.	Max.
Dependent variable						
GDP growth (annual %)	y	World bank data	1.40	0.93	-4.03	3.29
independent variables						
Human capital index	h	Penn World Table 9.0	0.59	0.26	0.05	1.03
Number of persons engaged	l	Penn World Table 9.0	0.34	1.47	-2.12	2.90
Share of gross capital formation in economic output	k	Penn World Table 9.0	0.22	0.10	0.04	0.68
Share of government expenditure in economic output	g	Penn World Table 9.0	0.18	0.07	0.03	0.44
Share of exports in economic output	x	Penn World Table 9.0	0.23	0.15	0.03	0.85
interactive variables						
Interactive effect between government size and human capital	g*h	Authors own computation	-1.20	0.58	-3.43	-0.25
Interactive effect between foreign direct investment and human capital	FDI*h	Authors own computation	1.12	1.56	-5.33	4.08
Interactive effect between urbanization and human capital	urban*h	Authors own computation	2.01	0.26	1.29	2.42

Notes: The foreign direct investment (FDI) and urbanization (urban) time series used to construct the interactive terms are obtained from the World Bank database.

Prior to utilizing our selected time series for empirical purposes, it is important to determine the integration properties of variables since the FMOLS and DOLS cointegration techniques are only compatible with series integrated of order I(1). Table 2 provides the Levin et al. (2002) (LLC hereafter) and the Im et al. (2005) (IPS hereafter) unit root tests performed on our time series variables with an intercept as well as with an intercept and a trend. In their levels, the LLC tests fail to reject the unit root null hypothesis in all cases with the exception of the human capital variable (with an intercept and intercept and trend) and the government size variable (with intercept only). On the other hand, the IPS tests fail to reject the unit root hypothesis for all series with the exception of the capital variable (with an intercept and trend). Nevertheless, when these tests are performed on the first differences of the series all tests statistics reject the unit root hypothesis at all levels of significance for all variables regardless of whether tests include an intercept or an intercept and trend. We thus conclude on all observed series being mutually integrated of order I(1) and are deemed suitable for FMOLS and DOLS estimators.

Table 4: Panel unit root test results

	LLC		IPS	
	intercept	intercept and trend	intercept	intercept and trend
Panel A: Levels				
y	-0.66	-0.97	0.32	0.41
h	-2.43***	-4.13***	0.13	-0.97
l	1.54	-1.44	1.60	0.11
k	-0.61	-1.45	-0.54	-1.95*
g	-1.90**	-1.46	-1.22	0.20
x	-0.53	-0.26	-0.26	-0.80
g*h	-0.36	-1.18	-0.29	0.34
FDI*h	-0.26	-1.26	-0.69	-1.07
urban*h	-0.27	-0.02	-0.48	-0.39
Panel B: First differences				
Δy	-4.02***	-3.06**	-6.23***	-6.25***
Δh	-3.34***	-9.51***	-3.10***	-6.73***
Δl	-5.77***	-5.20***	-10.04***	-9.56***
Δk	-9.62***	-8.53***	-11.26***	-10.25***
Δg	-7.21***	-5.97***	-8.87***	-7.84***
Δx	-8.24***	-6.73***	-10.01***	-8.62***

Δg*h	-7.44***	-6.21***	-8.85***	-7.68***
ΔFDI*h	-8.19***	-6.08***	-9.86***	-7.88***
Δurban*h	-6.21***	-5.46***	-2.23**	-4.97***

Notes: ‘***’, ‘**’, ‘*’ represent 1%, 5% and 10% critical levels, respectively.

4.2 Baseline Empirical results

Table 5 presents our FMOLS and DOLS estimates from two endogenous growth specifications, the first representing a simplified dynamic endogenous growth specification consisting of human capital, labour employment and capital investment whereas the second augments the first by including other control variables such as government size as well as trade openness. As should be firstly observed from the first column of the results reported in Table 5, the impact of human capital on economic growth is insignificant in all four estimated regressions. Notably this evidence is contrary to that obtained for previous SSA economies as found in Gyimah-Brempong and Wilson (2004), Hakeem (2010), Ogundari and Awokuse (2018) and Ibrahim (2018). However, as conveniently explained in the recent study of Ahsan and Hauqe (2017) the relevance of human capital on generating economic growth in a region is contingent on the level of development. Henceforth, economies should attain a certain level of development before reaping the economic rewards of human capital development. Another controversial finding are the insignificant estimates obtained for the investment variable which according to dynamic growth theory is considered the ‘engine of dynamic economic growth’. However, we are not entire startled by our findings as a similar insignificant estimate on the investment variable has been previously established in the works of Mothuthi and Phiri (2018) and Phiri (2019) for the South African economy. As explained by these authors, a greater part of Africa’s investments are not ‘Greenfield investments’ but are rather mergers and acquisitions. Notably, the remaining growth determinant variables such has labour employment, government size and trade openness produce their expected positive and statically significant estimates. Moreover, the adjusted R^2 values associated with the regressions lie between 0.95 and 0.97 which implies that between 95 and 97 percent of variations in economic growth are explained by our chosen growth determinants.

Table 5: Baseline regression results

	y = f(h, l, k)		*y = f(h, l, k, g, x)*	
	FMOLS	DOLS	FMOLS	DOLS
h	-0.09	0.17	0.18	0.32
	(-0.16)	(0.23)	(0.39)	(0.37)
l	1.43	1.25	1.55	1.56
	(6.77)***	(4.91)***	(8.15)***	(6.06)***
k	0.07	0.02	0.11	0.15
	(0.66)	(0.12)	(1.23)	(1.02)
g			0.61	0.70
			(5.13)***	(4.05)***
x			0.29	0.52
			(3.68)***	(9.89)***
Obs	333	333	333	333
adjR^2	0.95	0.97	0.96	0.97
Kao cointegration test	-3.85 (0.00)***		-3.68 (0.00)***	

Notes: '***', '**', '*' represent 1%, 5% and 10% critical levels, respectively.

4.3 The interactive effect between fiscal size and human capital on economic growth

In light of our previous findings of an insignificant impact of human capital on economic growth obtained from our estimated baseline regressions, the next step in our empirical analysis is to determine which factors could 'interact' with human capital to significantly influence economic growth. To address this, we firstly introduce an interactive term between government size and human capital in our endogenous growth regressions. As can be observed from the reported results in Table 6, whereas the control variables retain their same coefficient signs and significance levels as in the baseline regression estimates, the findings from the interactive terms are quite mixed. While the interactive term produces a negative coefficient on the interactive term between government and human capital, the significance of these estimates varies between the DOLS and FMOLS estimators. Nevertheless, our results differ from those reported in Jung and Thornecke (2003), Annabi et al. (2011) and Dissou et al. (2016) which observe a positive interactive effect of government and human capital on economic growth. However, as argued by Biza et al. (2015), government size in African countries tend to crowd out the positive effects of investments on economic growth. Moreover, the observation of negative coefficient estimates on the interactive term between government size and human capital could be a reflection of high levels of corruption and fiscal inefficiency in improving the quality of human capital within the SSA region (Varvarigos and Arsenis (2015) and Dutta et al. (2017)).

Table 6: Regression results with interactive term between government size and human capital

	y = f(h, l, k, g*h)		***y = f(h, l, k, g, x, g*h)***	
	FMOLS	DOLS	FMOLS	DOLS
h	1.06	-0.24	-0.88	-2.48
	(1.61)	-(0.25)	(-1.05)	(-1.73)
l	1.50	1.42	1.49	1.48
	(7.27)***	(5.11)***	(7.72)***	(6.59)***
k	0.10	0.08	0.10	0.31
	(1.04)	(0.53)	(1.15)	(1.84)
g			0.88	1.28
			(4.03)***	(3.89)***
x			0.31	0.44
			(3.92)***	(3.38)***
g*h	-0.66	-0.33	-0.65	-1.28
	(-2.67)***	(-0.31)	(-1.50)	(-2.11)**
obs	333	333	333	333
adjR^2	0.95	0.96	0.96	0.98
Kao cointegration test	-3.51 (0.00)***		-3.59 (0.00)***	

Notes: ‘***’, ‘**’, ‘*’ represent 1%, 5% and 10% critical levels, respectively. t-statistics reported in ().

4.4 The interactive effect between FDI and human capital on economic growth

Having found that fiscal size in SSA countries do not have interactive effects with human capital in promoting economic growth, we next examine whether foreign direct investment may create a positive and significant influence on human capital contribution to economic growth. In particular, traditional endogenous growth theory speculates on FDI exerting spillover effects into an economy via technological effects, transfer of skills and other channels of human capital augmentation (de Mello, 1997, 1999). We therefore expect to find positive interactive effects between FDI and human capital on economic growth. Table 7 presents empirical estimates of our growth specifications inclusive of an interactive term between FDI and human capital, and as before the results are rather vague. In particular, whilst we are able to obtain the expected positive estimates on the interactive term between FDI and human capital, only one regression (i.e. DOLS estimates on the non-augmented endogenous growth regression) produces a statistically significant estimate at a 10 percent critical level. Altogether, these results are not altogether convincing of significant interactive effects between FDI and human capital in boasting economic growth in our sample of SSA countries. Explanations for these findings have been previously provided by Blomstrom and Kokko (2003) who argue that FDI levels in the SSA region have been historically low and the foreign presence in these countries lowers the average dispersion of a sectors productivity. In other words, the realization of the spillover effects from FDI within the economy is dependent on the ability and motivation of local firms to engage in investment and to absorb foreign knowledge and skills and this would require a certain level of competiveness and educational attainment within domestic markets.

Table 7: Regression results with interactive term between FDI and human capital

	*y = f(h, l, k, FDI*h)*		*y = f(h, l, k, g, x, FDI*h)*	
	FMOLS	DOLS	FMOLS	DOLS
h	0.18	-0.46	0.23	1.97
	(0.37)	(-0.37)	(0.51)	(1.14)
l	1.23	0.70	1.37	1.10
	(5.75)***	(1.37)	(6.74)***	(1.39)
k	0.18	0.17	0.18	0.21
	(2.02)*	(0.82)	(2.22)**	(0.81)
g			0.35	0.04
			(2.90)***	(0.11)
x			0.25	0.43
			(3.43)***	(1.75)*
FDI*h	0.03	0.18	0.04	0.03
	(0.78)	(1.92)*	(0.90)	(0.26)
obs	333	333	333	333
adjR^2	0.95	0.96	0.96	0.98
Kao cointegration test	-2.41 (0.01)**		-2.33 (0.01)**	

Notes: '***', '**', '*' represent 1%, 5% and 10% critical levels, respectively. t-statistics reported in ().

4.5 The interactive effect of urbanization and human capital on economic growth

In continuing with our search for a significant interactive term with human capital which could produce a desirable positive effect on economic growth, we turn to urbanization as a candidate variable. Bertinelli and Zou (2008) argue that urbanization results in a better skill-matching between workers and firms, as well as providing a better environment for learning in the sense of improving human capital development. Furthermore, Kumar and Kober (2012) argues that urbanized areas educes transaction costs and economies of scale, which allows for specialization of amongst firms, which in turn, leads to lower production costs. Moreover, Fluckiger and Ludwig (2018) argue that human capital is highly concentrated in urbanized, skill-intensive sectors in developing and emerging economies and hence the interaction between urban areas and human capital will most likely accelerate economic productivity in these urbanized areas. Table 8 presents the empirical findings of the regressions estimated with an interactive term between urbanization and human capital. This time around, we obtain encouraging results as the interactive term produces a positive and highly statistically significant coefficient estimates. Our findings remain robust to the different estimators and regression specifications. All-in-all, our empirical finds support our contention that urbanization has an enhancing effect on human capitals contribution towards economic growth in SSA countries.

Table 8: Regression results with interactive term between urbanization and human capital

	y = f(h, l, k, urban*h)		***y = f(h, l, k, g, x, urban*h)***	
	FMOLS	DOLS	FMOLS	DOLS
h	6.11	3.04	4.78	1.80
	(3.04)***	(1.59)	(2.65)***	(0.75)
l	1.13	1.60	1.28	1.69
	(5.02)***	(9.72)***	(6.28)***	(7.97)***
k	0.11	0.09	0.15	0.08
	(1.19)	(1.53)	(1.74)	(1.20)
g			0.57	0.34
			(5.05)***	(2.76)***
x			0.25	0.16
			(3.31)***	(1.82)*
urban*h	1.49	1.06	1.22	1.74
	(3.09)***	(2.32)**	(2.82)***	(8.32)***
obs	333	333	333	333
adjR^2	0.95	0.96	0.96	0.98

Kao cointegration test	-2.71 (0.01)**	-2.19 (0.01)**

Notes: '***', '**', '*' represent 1%, 5% and 10% critical levels, respectively. t-statistics reported in ().

5. CONCLUSIONS

The objective of this paper was to examine possible avenues in which policymakers in SSA countries can align themselves with the World Bank's agenda of developing human capital for a sustainable future. Using the newly developed human capital index of the World Penn State Tables 9.0, we provide panel estimates of augmented growth regressions for 10 SSA countries using annual data collected between 1980 and 2014. Our baseline regression estimates provide very weak evidence substantiating the positive effect of human capital on economic growth for our sample of SSA countries. In expanding on our analysis, we further augment our growth regressions with three interactive terms representative of government expenditure, foreign direct investment and urbanization effects on human capital. Out of the three interactive terms, only the one between urbanization and human capital produces a positive and significant effect, whereas the remaining two interactive terms are either produce a negative (government spending) or insignificant (foreign direct investment) effect.

Three main policy insights can be drawn from our study. Firstly, the sole pursuit of human capital projects in SSA countries may not prove to be fruitful in terms of stimulating future economic growth in the region. Whilst improvements have been generally noticed in human capital development in the SSA region over the last couple of years, without building proper supporting structures these improvements will not translate to sustainable future growth. Secondly, current government spending structures in SSA countries, though significant for economic growth, nevertheless appear to 'crowd out' human capital contribution to economic growth. Developing stringent public policy expenditure projects aimed at improving the future productivity capacity of human capital needs to take priority within SSA countries. Thirdly, policymakers within the SSA countries need to focus beyond depending on spillover effects from foreign direct investment towards human capital in their mission improve economic growth rates in the region. Lastly, governments in SSA countries need to place increasing emphasis on developing urbanized populations which can support human capital development objectives.

REFERENCES

Adelakun O. (2011), "Human capital development in Nigeria", *European Journal of Business and Management*, 3(9), 29-39.

Agiomirgianakis G., Asteriou D. and Monastiriotis V. (2002), "Human capital and economic growth: A dynamic panel data study", *International Advances in Economic Research*, 8(3), 177-187.

Ahsan H. and Haque E. (2017), "Threshold effects of human capital: Schooling and economic growth", *Economics Letters*, 156, 48-52.

Aka B. and Dumont J. (2008), "Health, education and economic growth: Testing for long-run relationships and causal links", *Applied Econometrics and International Development*, 8(2), 101-110.

Annabi N., Harvey S. and Lan Y. (2011), "Public expenditures on education, human capital and growth in Canada: An OLG model analysis", *Journal of Policy Modeling*, 33(6), 852-865.

Asteriou D. and Agiomirgianakis G. (2001), "Human capital and economic growth: Time series evidence for Greece", *Journal of Policy Modeling*, 23(5), 481-489.

Baah-Boateng W. (2013), "Human capital development: the case of education as a vehicle for Africa's economic transformation", *Legon Journal of International Affairs and Diplomacy*, 7(1), 31-55.

Becker G., Murphy K. and Tamura R. (1990), "Human capital, fertility and economic growth", *Journal of Political Economy*, 98(5), 12-37.

Becker G. and Tomes N. (1979), "An equilibrium theory of the distribution of income and intergenerational mobility", *The Journal of Political Economy*, 87(6), 1153-1189.

Bertinelli L. and Zou B. (2008), "Does urbanization foster human capital accumulation?", *The Journal of Developing Areas*, 41(2), 171-184.

Biza R., Kapingura F. and Tsegaye A. (2015), "Do budgets deficits crowd out private investment? An analysis of the South African economy", *International Journal of Economic Policy in Emerging Economies*, 8(1), 71-82.

Blomstrom M. and Kokko A. (2003), "Human capital and inward FDI", CEPR Discussion Paper 3762.

Carrington W. and Detragiache E. (1998), "How big is the brain drain?", IMF Working Paper No. 98/102, July.

Cleeve E., Debrah Y. and Yiheyis Z. (2015), "Human capital and FDI inflow: An assessment of the African case", *World Development*, 74, 1-14.

Coulombe S. (2003), "Human capital, urbanization and Canadian provincial growth", *Regional Studies*, 37(3), 239-250.

de Mello L. (1997), “Foreign direct investment in developing countries and growth: A selective survey”, *Journal of Development Studies*, 34, 1-34.

de Mello L. (1999), “Foreign direct investment-led growth: Evidence from time series and panel data”, *Oxford Economic Papers*, 51, 133-151.

Dias J. and Tebaldi E. (2012), “Institutions, human capital, and growth: The institutional mechanism”, *Structural Changes and Economic Dynamics*, 23(3), 300-312.

Diebolt C. and Hippe R. (2019), “The long-run impact of human capital on innovation and economic development in the regions of Europe”, *Applied Economics*, 51(5), 542-563.

Dissou Y., Didic S. and Yakautsava T. (2016), “Government spending on education, human capital accumulation, and growth”, Economic Modelling, 58, 9-21.

Dutta N., Kar S. and Saha S. (2017), “Human capital and FDI: How does corruption affect the relationship?”, *Economic Analysis and Policy*, 56, 126-134.

Fan Q., Goetz S. and Liang J. (2016), “The interactive effects of human capital and quality of life on economic growth”, *Applied Economics*, 48(53), 5186-5200.

Feenstra R., Inklaar R. and Timmer M. (2015), “The next generation of the Penn World Table”, *American Economic Review*, 105(10), 3150-3182.

Fernandez R. and Rogerson R. (1996), “Public education and income distribution: A dynamic quantitative evaluation of education-finance reform”, *The America Economic Review*, 88(4), 813-833.

Fluckiger M. and Ludwig M. (2018), “Geography, human capital and urbanization: A regional analysis”, *Economic Letters*, 168, 10-14.

Gyimah-Brempong K. and 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.

Hakeem M. (2010), "Banking development, human capital and economic growth in Sub-Saharan Africa", *Journal of Economic Studies*, 37(5), 557-577.

Ibrahim M. (2018), "Interactive effects of human capital in finance-economic growth nexus in Sub-Saharan Africa", *Journal of Economic Studies*, 45(6), 1192-1210.

Im K., Pesaran H. and Shin Y. (2003), "Testing for unit root in heterogeneous panels", *Journal of Econometrics*, 115(1), 53-74.

Jung H. and Thornecke E. (2003), "The impact of education expenditure on human capital, growth, and poverty in Tanzania and Zambia: A general equilibrium approach", *Journal of Policy Modeling*, 25(8), 701-725.

Kao C. (1999), "Spurious regression and residual-based tests for cointegration in panel data", *Journal of Econometrics*, 90(1), 1-44.

Kao C., Chiang M. and Chen B. (1999), "International R&D spillovers: An application of estimation and inference in panel cointegration", *Oxford Bulletin of Economics and Statistics*, 61(51), 691-709.

Kumar A. and Kober B. (2012), "Urbanization, human capital, and cross-country productivity differences", *Economic Letters*, 117, 14-17.

Kunze L. (2014), "Life expectancy and economic growth", *Journal of Macroeconomics*, 39(A), 54-65.

Lee D. and Lee T. (1995), "Human capital and economic growth Tests based on the international evaluation of educational attainment", *Economics Letters*, 47(2), 219-225.

Levin A., Lin C. and Chu C. (2002), "Unit root tests in panel data: Asymptotic and finite-sample properties", *Journal of Econometrics*, 108(1), 1-24.

Ljungqvist L. (1993), "Economic underdevelopment: The case of a missing market for human capital", *Journal of Development Economics*, 40(2), 219-239.

Lin S. (1998), "Government education spending and human capital formation", *Economic Letters*, 61(3), 391-393.

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

Mankiw G., Romer D. and Well D. (1992), "A contribution to the empirics of economic growth", *The Quarterly Journal of Economics*, 107(2), 407-437.

Mothuthi G. and Phiri A. (2018), "Inflation-growth nexus in Botswana: Can lower inflation really spur growth in the country", *Global Economy Journal*, 18(4), 1-11.

Noorbakhsh F., Paloni A. and Youssef A. (2001), "Human capital and FDI inflows to developing countries: New empirical evidence", *World Development*, 29(9), 1593-1610.

Ogundari K. and Awokuse T. (2018), "Human capital contribution to economic growth in Sub-Saharan Africa: does health status matter more than education?", *Economic Analysis and Policy*, 58, 131-140.

Pedroni P. (2000), “Fully modified OLS for heterogeneous cointegration panels”, Williams College Department of Economic Working Papers No. 2000-03.

Phiri A. (2019), “Does military spending nonlinearity affect economic growth in South Africa”, *Defence and Peace Economics*, 30(4), 474-487.

Piabuo S. and Tieguhong J. (2017), “Health expenditure and economic growth – a review of the literature and an analysis between the economic community for Central African States (CEMAC) and selected African countries”, *Health Economics Review*, 7(23), 1-13.

Qadri F. and Waheed A. (2014), “Human capital and economic growth: A macroeconomic model for Pakistan”, *Economic Modelling*, 42, 66-76.

Ramos R., Surinach J. and Artis M. (2012), “Regional economic growth and human capital: The role of over-education”, *Regional Studies*, 46(10), 1389-1400.

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

Siddiqui A. and Rehman A. (2017), “The human capital and economic growth nexus: in East and South Asia”, *Applied Economics*, 49(28), 2697-2710.

Solow R. (1956), “A contribution to the theory of economic growth”, *The Quarterly Journal of Economics*, 70(1), 65-94.

Swan T. (1956), “Economic growth and capital accumulation”, *Economic Record*, 32(2), 334-361.

Tallman E. and Wang P. (1994), “Human capital and endogenous growth evidence from Taiwan”, *Journal of Monetary Economics*, 34(1), 101-124.

Teixeira A. and Queiros A. (2016), “Economic growth, human capital and structural change: A dynamic panel data analysis”, *Research Policy*, 45(8), 1636-1648.

Varvarigos D. and Arsenis P. (2015), “Corruption, fertility, and human capital”, *Journal of Economic Behaviour and Organization*, 109, 145-162.

Wang K. (2011), “Health care expenditure and economic growth: Quantile panel-type analysis”, *Economic Modelling*, 28(4), 1536-1549.

Yu S. and Liu Z. (2016), “The impact of foreign direct investment and human capital on economic growth: Evidence from Chinese cities”, *China Economic Review*, 37, 97-109.

Zhu S. and Li R. (2017), “Economic complexity, human capital and economic growth: empirical research based on cross-country panel data”, *Applied Economics*, 49(38), 3815-3828.