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Macroeconomic Determinants of Human Capital Development and Economic Growth in

Sub-Saharan Africa (SSA) Countries

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Abstract

Evidence from recent literature gesticulates that macroeconomic determinants arising from the slow level of human capital development contribute to the sluggish growth of developing nations which in turn truncates the anticipated growth trajectories of African countries (evidence from Sub-Saharan African countries). On this note, this study investigated the impact of macroeconomic determinants of human capital development on economic growth in Sub-Saharan Africa (SSA) countries. The study used annual time series data spanning from 1980 to 2022 and sourced from the regional SSA 2022 edition database out of African countries' economic blocs. Panel Autoregressive Distributed Lag (PARDL) approach and Panel VAR Granger causality model were used as estimation techniques for the study. Results showed that government expenditure on health and education, labour force, as well as school enrolment, exhibits a profound positive influence on the real gross domestic product (RGDP) in the SSA region while the inflation rate was less pronounced statistically. The result of ECM-1 showed that about 86% of the adjustment from short-run to long-run is very high. This implies that disequilibrium errors that occurred in the previous year are corrected in the current year. Results of the VAR Granger causality test showed that RGDP is necessary for enhancing macroeconomic determinants like government expenditure on health and education just as enhanced government expenditure on health and education is needed to sustain growth in the SSA region. While no causal relationship exists between the inflation rate and RGDP and labour force exhibits a unidirectional relationship without feedback. Based on the findings, the study, therefore, recommends improvement in the educational system through increased expenditure, to ensure sustainable healthcare financing that will improve health facilities and reduce the burden of health spending inequality most especially in rural communities as well as the rate of unemployment should be reduced to the barest minimum as against applicants seeking employment all these while. An increased labour force would do more to improve the economic growth of the region. These among other things would lead to the growth sustainability of SSA countries if properly harnessed by the policymakers.

Keywords: **Economic growth, Human capital development, PARDL, SSA, VAR-Granger**

JEL Classification: Q4, I, C13, R2, C13

(I) Introduction

What is human capital development to a layperson? Briefly, we could say that human capital development is a process of acquiring and increasing the number of persons who have the skills, education, and intuition experience that could go a long way to improve the output growth of any economy. Given this, we could purportedly conclude that any country in the World cannot overemphasize the importance of human welfare because of its contributions to economic performance arising from the growth trajectory of human capital development's components such as labour force participation, health, education, skills-social and communication, and among others (Appleton & Francis, 2001). However, the issue of the low ebb of economic performance and growth of sub-Saharan African countries has become so worrisome and thereafter resulted in a series of debates among scholars due to the low level of human capital development that contributes to the sluggish growth of developing nations which in turn truncating the anticipated growth trajectories of African countries (sub-Saharan Africa countries inclusive). Hence, this has further necessitated a call for a wide range of both theoretical and empirical research among the continent's scholars. However, it was on this that human capital development has been well articulated and identified in the

literature both theoretically and empirically as an important catalyst for sustainable economic growth and development (Diaconu & Popescu, 2019). Still, in most of the sub-Saharan Africa region, human capital has not been effectively used in salvaging the African economic problems.

In the same vein, the majority of the third-world countries including sub-Saharan African countries are blessed with abundant natural resources (factor endowment), but they are languishing arising to the inadequacy of skilled personnel to harness these resources. Efficient and effective human resources will produce good and resourceful personnel that will generate good governance and turn the economic fortune of a nation. However, some empirical works showed that the index of human welfare which incorporates income, education, and health indicates that Africa's level of human development is the lowest in the World (Adeyinka & Fadile, 2020). The low level of economic growth in most of the sub-Saharan African countries is majorly caused by their inability to develop their human capital (Odonkor, 2019).

Further, profound investment in human capital development in terms of health and education became imperative towards the growth of sub-Saharan African countries as against the recent ebb in economic growth due to low level and imperfections of educational system, and healthcare delivery in the region. Again, human capital development develops more skills and also places more emphasis on increased government expenditure on education and healthcare development (HDI, 2021). Because the importance of quality education and health services in attaining high and efficient human capital cannot be over-emphasized. Succinctly to say that education increases the knowledge in labour services while healthcare services support human healthiness to work for higher production in any sector of the economy.

In a related development, the empirical study further gesticulates that human capital development and economic growth can only be achieved and sustained through massive investment in education (Chukwunonso, 2015). Given the above, education has become one of the major components of human capital development in society as of this 21st century, simply because it increases the skills and competencies of individuals as well as their productivity. A laborers' productivity is important for the wage he will be receiving. Thus, improved productivity will allow him to earn a higher wage and increase his income. A higher income will allow people to have access to better food, proper health care, and clean water, among others. A higher income can, therefore, improve some of the things people value as having a good life. Better to say that, the higher the level of educational attainment, the higher the level of workers' efficiency, and the higher the level of workers' income earnings (Akinsokeji & Akinlo, 2019).

The majority of African countries as evidenced in the sub-Sahara Africa region are still characterized by poor human capital development as well as inadequate linkage of foreign technology. That is, technology efficiency that could aid massive investment in human capital in the region is relatively scarce. These could be evident from an inadequate level of education, and an inefficient, unresourceful, irresponsible, and untrained labour force that could respond to the disequilibrium caused by the adoption of technology from advanced economies. These are among the problems that consistently affect the output growth performance of sub-Saharan African countries. Besides, the productivity level of African countries (sub-Sahara Africa region inclusive) is very low compared with those of the advanced nations as well as even with the growth rate of emerging and developing Asia and Latin America which are the third World Continents like Africa.

In addition to the problem encountered in the region is that there seems to be an absence of robust human capital development as a result of the shortfall in allocating a reasonable portion of their annual estimate to education and health sectors which are the ultimate proxies for human capital development. Therefore, human capital development has over the years been employed to improve macroeconomic problems such as quality education, quantitative healthcare delivery, higher literacy level, and better labour force participation in most advanced economies, but this is not evident in sub-Saharan African countries. Above all, a low level of human capital development leads to low productivity and a high level of income inequality in most African countries. Hence, the slogan that says the rich become richer and the poor become poorer often manifested in most of the developing nations as well as in the sub-Saharan Africa region (IMF, 2016)

Extant literature on the relationship between macroeconomic determinants of human capital development and economic growth are many in both developed and developing countries (sub-West Africa bloc of SSA region inclusive) but could not provide solutions to the persistent sluggish economic performance that lead to low-level and imperfections of macroeconomic determinants of human capital development in SSA region, apart from the fact that they are on country-specific. Some of these studies includes (e.g. Akinola and Bokana (2017), Odonkor (2017), Lawanson (2015), Novignon, Olakojo, and Novignon (2012), Olanrewaju, Idowu, and Abimbola (2013), Castro-Leaf, Dayton, Demery, and Mehra, (2000), Long (2010), Oketch (2006), Msweli (2015), Emmanuelle, Maria and Luiz (2005) and; Grenado, Gupta, and Hajdenberg (2010). Besides, most of these studies used panel OLS and co-integration analysis compared to the panel autoregressive distributed lag (PARDL) approach and VAR Granger causality model by this present study

Given the full-scaled scenarios of the foregoing, the broad objective of this study is to examine the impact of macroeconomic determinants of human capital development on economic growth in the sub-Saharan Africa region using pooled data spanning from 1980 to 2022 and sourced from regional SSA 2022 edition database out of West Africa (ECOWAS) economic blocs. The study focused on four different countries out of the West Africa economic bloc (ECOWAS). There are; Nigeria, Senegal, Ghana, and Cote-de Voire to represent other SSA regions. However, to achieve this broad objective, the study considered some research questions like what are the nature of the relationship between macroeconomic variables of human capital development and economic growth? and also; what is the direction of causality between macroeconomic variables of human capital development and economic growth? The significance of the study at this present time could not be farfetched to the recent ebb and sluggish economic growth due to low levels and imperfections of macroeconomic determinants of human capital development such as educational system, healthcare delivery labour force participation, inflationary rate and amongst others in the region. Findings from the study shall help the region's stakeholders and policymakers most especially in the health and education sectors in conjecturing the quantum of resources that the SSA region should commit to human resources development for possible enhancement of economic growth.

The study is structured as stated in what follows. Following this introductory section is section two which presents the literature review. Section three deals with the methodology used for the study while section four dwells on the analysis and discussion of results. Finally, section five concludes and provides policy recommendations for the study.

(II) Review of Literature

Theoretical Framework

The theoretical bases of this study are rooted in some related theories that are reinforced by some empirical works that support the relationship between human capital development and economic growth. Some of these theories are discussed here:

Lucas Endogenous Growth Model

Lucas (1993) merely modified the endogenous growth model earlier developed by Uzawa (1961). The Uzawa growth model explained long-term economic growth as a consequence of human capital accumulation. Lucas agreed that the process of production depends on human capital. The model assumed human capital to be a product of investment in education. Lucas however drew a line of demarcation between the internal and external effects of human capital for the internal effect, Lucas posits that individual workers undergoing training become more productive while the external effect is associated with a situation where the worker not only becomes useful to his employer but helps to increase the productivity of capital and that of the workers in the economy. According to Lucas, it is the investment in human capital and not physical capital that has spill-over effects that increase the level of technology. For firm i, the output based on Lucas's position will take the form

$$Y_i = A\ (k_i).\ (H_i).\ H^e \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where: A= technical coefficient, K_i = physical input, H_i = human capital input, H_i = the economy's average level of human capital, e = degree of external effects from human capital on each firm's productivity. While a constant return to scale is assumed for this model to thrive.

Human Capital Theory

Human capital theory was developed by Becker in 1962 and Rosen in 1976. The basis of this formulated theory is to put the individual workers on the right path and they have to set their skills or abilities which they can improve on or accumulate through training, education, problem-solving skills, mental health, and personal resilience. The theory also talks much about the focus aspect of human capital on investment in education and health sectors of the economy of any nation, in a bid to increase the productivity and efficiency of an individual workforce, increasing the level of their cognitive skills as well as to increase the general wellbeing and living standard of an individual in a country or region as the case may be. Other scholars like Schultz in 1961 expressed educational investment as a form of investment. He also has the notion that people invest in education or to increase their stock of human capabilities which can be formed by combining innate abilities with investment in human beings according to Babalola, 2000. Human capital theorists have established that basic literacy enhances the productivity of workers in low-skill occupations. They further state instruction that demands logical and analytical reasoning that provides technical and specialized knowledge increases the marginal productivity of workers in high-skill professions and positions. Moreover, the greater the provision of schooling society and consequently, the greater the increase in national productivity and economic growth.

Review of Empirical Literature

Emmanuelle, Maria, and Luiz (2005) examined the effect of health and education spending on human capital in poor countries. The study used a panel data set for 120 selected developed countries between 1975 and 2004 using an integrated approach to analyze their findings. The result of their findings reveals that health spending has a positive and significant immediate impact on health capital. Results also revealed that health contributes to the accumulation of education capital, with an elasticity of about 1.3, meaning that an increase in health capital of 10% would raise education by 13%. Also, included in their findings is that higher income levels and greater human capital reinforce each other and contribute to a virtuous circle of growth and higher human capital. Finally, both education capital and health capital contribute positively to output growth.

Grenado, Gupta, and Hajdenberg (2010) worked on the cyclical behavior of public spending on education and health in 150 countries both from developed and developing countries between 1987 and 2007. They used panel data while regression analysis was employed to analyze the data collected. The result of the findings revealed that education spending and health are pro-cyclical in developing countries and cyclical in developed countries. According to their findings, they are pro-cyclical during the positive output gap and cyclical during the negative output gap; therefore, the higher the degree of cyclicality, the lower the level of human development.

Chukwunonso (2012) in his study “Social Spending and Human Development in Selected West African Countries”, found out that health expenditure is significant in explaining development in the short and long runs. The study found that for continuous development of human capital in the selected countries, there must be increased funding of the health sector. The study also showed that educational expenditure cannot be felt in the short run. The study therefore recommends that the government should increase education expenses both the capital and current expenditures to enable the poor to send their wards /children to school at an affordable subsidized fee.

Emanuelle, Maria, and Luiz (2003) estimated the relationship between government spending on health care and education and selected social indicators using a latent variable model. The findings were based on 100 countries across the world. Findings from the study suggest that public expenditure is an important determinant of the social outcome as evidenced by education in society. The study concludes that investing in basic education will reduce illiteracy levels and increase access to public social services.

McMahon (1998) examined the relationship among human capital, government expenditure, and social indicators in some Asia countries. Panel data and regression analysis were used to process the collected data. The study indicates the significance of human resource development through education in attaining rapid per capita economic growth in East Asia. The study tested separate contributions of primary, secondary, and higher education and how these differ between enrolment and rate of public investment at all levels. Results of the findings showed that human capital is central to the growth process of an economy. The study found that education, democratization, and political stability influence rates of investment in physical capital. The study concludes that since most countries had universal primary Education (UPE) early, the rate at which secondary education expanded is necessary for successful human capital development very significant in attracting high rates of investment and high

per capita growth. Post-primary and higher education expenditures are more significant after enrolments are enlarged and adequate /effective teaching is involved.

Oketch (2006) assesses the role human capital plays in enhancing a region's economic productivity in Africa. Panel data was collected from 33 African countries and ordinary regression analysis was used to process the data. The result of the findings identified bi-directional links between resource development generated from formal schooling and economic growth on one hand, and between investment in physical capital and growth on the other hand, if suffix it all to accept the hypothesis that both human and physical capital investments are necessary, if Africa is to attain industrial development. It further establishes a statement that, human resource development is a determinant of investment in physical capital which contributes significantly to per capita growth in an economy.

Msweli (2015) studied human capital development in South Africa and Botswana. Secondary data were collected from the two countries while regression analysis was used to process the data. The study provides an analysis of human capital development factors that contribute to differences in the human capital index score of the two countries. It compared Botswana and South Africa on the four pillars of the human capital index: education, health and wellness, workforce employment, and enabling environment. In his analysis, education captures access, quality of education, and educational attainment. The result showed that both countries have negative index scores even though Botswana has a higher score than South Africa. The study advised the African government on the brain drain which has reduced the already low quality of skilled manpower available in African countries.

Lan, Jamison, and Luat (1991) in their cross-country study of fifty-eight developing countries from 1960-1986, panel data was used and regression analysis was employed to process the data. Their study was to estimate an aggregate production function with the average educational attainment of the labour force (a proxy for human capital). Results revealed that the influence of human capital on economic growth is not the same in all countries. While a positive relationship exists between human capital and growth in some countries, but negatively related in other cases. Findings from the study showed that primary education had an estimated negative effect in Africa, the Middle East, and North Africa, while it has significant effects in South Asia and Latin America and a positive and significant effect only in East Asia.

Long (2010) revealed the extent to which the rate of return to labour was directly related to human capital. The study estimated the attractions in the effect of education attainment and college quality on three cohorts of students observed between 1970 and 1995 in the United States of America. Panel data was used and regression analysis was also employed to process the data. The result of the findings established that educational attainment and college quality raise earnings. The study stressed the remarkable changes in the education of the US population, there are increasing effects of education attainment on voter registration as well as increasing effects of college quality on delaying marriage and childbearing.

Hong-Sang and Erik (2003) examined the impact of public expenditure on human capital. The study used a multi-sector Computable General Equilibrium model to analyze their findings. The model is applied and calibrated to two highly indebted poor countries, Zambia and Tanzania. Their findings showed a significant positive relationship between education expenditure and economic growth. The result of stimulation suggested that a well-targeted pattern of educational expenditure can effectively be used to reduce poverty alleviation in the countries studied and even in economies.

Novigron, Olakojo, and Novigron (2012) examined the effects of public and private healthcare expenditure on health status in sub-Saharan Africa. The study covered forty-four countries in sub-Saharan Africa with the use of panel data from 1995 to 2010. Fixed and random effect panel data regression models were fitted to determine the effect of healthcare expenditure and health status. The result shows that healthcare expenditure significantly influences health status by improving life expectancy at birth, and reducing death and infant mortality rates, also, both public and private health care spindly showed a strong relationship with health status.

Olaniyan, Onisanwa, and Oyinlola (2013) examined the long-run economic relationship between healthcare expenditure and gross domestic product (GDP) for 32 sub-Saharan African countries between 1995 - 2009 panel unit roots and Co-integration techniques were employed to find out whether there is a long-run relationship between income and GDP in the countries under investigation. It also tests the mean reversion and Co-integration properties among health expenditure and GDP, health care expenditure, total population above age 65, and population below age 15, etc., the result shows that there is a co-integration relationship among health care expenditure, GDP, and other measures of health outcome. Results showed that healthcare

expenditure and most of its determinants are non-stationary and they are linked in the long run. The result also indicates that the elasticity is below unity for sub-Saharan African countries, it is significantly lower than 1, which shows that health care is a necessity good.

Castro-Leaf, Dayton, Demery, and Mehra (2000) investigated the impact of public spending on curative healthcare in some sub-Sahara African countries, these countries are Ghana, Guinea, Cote d'Ivoire, Madagascar, Tanzania, and South Africa. The study used panel data and regression analysis to its objectives. Their findings revealed that public spending benefits mostly the rich, more than the poor. The study recommended that the constraints that prevented the poor from enjoying or taking advantage of public spending must be addressed if public health services are to be effective in ensuring human capital development.

Olanrewaju, Idowu, and Abimbola (2013) studied the long-run economic relationship between healthcare expenditure and Gross Domestic Product (GDP) for 32 sub-Saharan African countries (1995-2009). The study used panel co-integration as an estimation technique. The result showed a long-run relationship between income and GDP in these countries.

Pablo and Enrique (2011) investigated the containment of healthcare expenditure in the US as one of the major challenges facing public policymakers in developing countries. The study considered the significant differences in the cross-country level of healthcare expenditure. Schultz (1999) studied the macroeconomic estimates based on household surveys of the productive payoff in sub-Saharan Africa to nutrition and health. He found a strong indication that health limitations are a costly burden on the productive potential of adults in Africa. One of the human capital constraints that has shown development in sub-Saharan Africa is the low levels of health care. He later found that the balance of benefits over costs for public health programs focused on child nutrition, child survival, and adult morbidity in Africa appears, but the evidence of cost-effective programs is scant and the specific program design requires further study.

Elibar and Gunnarson (2008) examined the efficiency and reform options in government spending on health care and education in Croatia. The study used data development analysis. The analysis finds evidence of significant inefficiencies in Croatia's spending on health care and education related to inadequate cost recovery and weak competition in the financing mechanisms and weakness in targeting public subsidies on health care and education. The study therefore recommended that rationalizing the network of hospitals would allow Croatia to significantly improve the efficiency of healthcare spending and thus generate budgetary savings in the medium to long term. The recommendation on reform measures to increase the efficiency of Government spending on health and education in Croatia include; increasing the role of the private sector in the provision of health care services, strengthening incentives for general practitioners to reduce referrals, and rationalizing the hospital network.

Boaz, Salawa, and Wachilonga (2014) investigated the relationship between education financing and human capital investment in Kenya. The objectives of the study were to establish the performance of students who got public financing and also to establish the performance of students who got private financing. The study focused on the financing options available for human capital investment as well as secondary school level as it has been discovered that, level countries benefit most from this level, as it is mainly knowledge base which is the requirement for achievement of skills at a higher level. Questionnaires were administered in 20 secondary schools in Kenya to collect data which was analyzed descriptively using measures of central tendencies. The result of the study revealed that private funds had the highest contribution to human capital investment in secondary schools compared to other forms of funding. The study, therefore, recommended that the government should continue to support secondary education through timely remittance of funds and employment of teachers to realize increased capital investment.

Lawanson (2015) assesses the relevance of educational and health components of human capital in economic development. The study used panel data from sixteen West African countries between 1980 and 2013. Linear regression analysis was also used to process the data. The study emphasized much on the trends in health, and education and their contributions to the economic growth of the region. Results revealed that both the education and health components of human capital significantly influence economic growth in the West Africa region. Findings showed that health had a stronger impact on the economy rather than education. The study recommended that increased resources and policy initiatives to motivate and enhance access to both health and education by the population should be pursued by policymakers.

Odonkor (2017) studied the impact of human capital on economic growth in Ghana from 1970-2010. It employs ordinary least squares regression (OLS) to estimate the model and the data. The results of his findings show that capital and recurrent

expenditure in health and education yields a negative relationship with the GDP, while labour force and life expectancy rates yield a positive relationship with the GDP. Among the various recommendations in the study are; that there should be a proper disbursement, implementation, and monitoring of disbursed funds for research and development, revision of school curriculum, proper implementation of allocated funds for the health sector, and proper training of medical personnel.

Akinola and Bokana (2017) based their study on the relationship among human capital, higher education enrolment, and economic growth in sub-Saharan African countries between 1980 and 2013. Twenty-two countries across the four economic blocks were chosen in the study. Panel data was used while OLS was employed to analyze the data. The result showed that SADC countries perform better among the four blocks. The study also discovered that the enrolment rate of higher education in SSA has a very weak relationship with economic growth in all study blocks. The study therefore recommended that a given high-priority policy should be put in place by all the governments in the blocs to increase higher education budgets and financing, to maintain sustainable economic growth through the contribution and coordination of home-based human capital.

(III) Methodology

Data Sources and Variables

The study relied on sub-Saharan Africa (SSA) regional pooled annual time series data spanning between 1980 and 2019. The data were sourced from the World Bank, World Development Indicator, and IMF (2022) edition of the SSA database out of African countries economic blocs

Model specification

This study hinges on the work of Odonkor (2017) and Emmanuelle, Maria, and Luiz (2005) as put forward by the theoretical exposition of Lucas (1993) and theories developed by Becker (1962); and Rosen (1976). However, their works were adopted as given thus;

$$RGDPgr = f(MDHCD).....(2)$$

Where; RGDPgr = Real gross domestic product growth rate; and MDHCD = Macroeconomic determinants of human capital development

$$RGDPgr = f(SENROL, GEXEDU, GEXHE, LABF, INFR).....(3)$$

Based on equation (3), the operational and explicit forms of the model can be expressed as:

$$\mathrm{RGDPgr}_t = \gamma_0 + \gamma_1 \mathrm{SENROL}_t + \gamma_2 \mathrm{GEXEDU}_t + \gamma_3 \mathrm{GEXHE}_t + \gamma_4 \mathrm{LABF}_t + \gamma_5 \mathrm{INFR}_t + \psi_t \ldots\ldots (4)$$

Where; RGDPgr_t means Real gross domestic product growth rate in the country at time t; SENROL_t = school enrollment; GEXEDU_t = government expenditure on education; GEXHE_t = government expenditure on health; LABF_t = Labour force; INFR_t = Inflation rate

a-priori, it is expected that; $\gamma_1 > 0; \gamma_2 > 0; \gamma_3 > 0; \gamma_4 > 0; \gamma_5 < 0$

Estimation Techniques

Panel Unit Root Test

A co-integrating relationship exists between non-stationary series if there is a stationary linear combination between them. Therefore, one needs to test the stationarity of the time series first. Augmented-Dickey-Fuller (ADF) is used to determine whether or not the series is stationary. The unit root test can be carried out under the null hypothesis $y = 0$ against the alternative hypothesis of $y < 0.$

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Panel ARDL Approach to Co-integration

According to Pesaran, Shin, and Smith (1999), a new technique can be used to derive consistent and efficient estimates of the parameter in a long-run relationship between integrated and stationary variables in a panel data structure. However, a pooled mean group (PMG) was introduced which is a good alternative to other estimates for panels such as dynamic OLS and FMOLS (Shine, 1998). The PMG characteristics are that it allows the short-run coefficients such as the intercepts, the speed of adjustment to the long-run equilibrium values, and error variances to be heterogeneous country by country, while long-run slope coefficients are homogeneous across countries.

The second technique introduced by Pesaran, Shin, and Smith (1995) is a mean group (MG), which calls for estimating separate regression for each country and calculating the coefficients as weighted means of the estimated coefficients. All coefficients vary and are heterogeneous in the short and long runs. It is also to note that the necessary conditions for the consistency and validity of this approach are to have a sufficient large time-series dimension of data.

Cross-Sectional Dependence

The Bootstraps approach of computing the parameter estimates is used in this study to capture the cross-sectional dependence. Because bootstrapping has been identified as a remedy for the presence of the common factor. The test requires that T > N, once this condition is not violated, we can conveniently test for cross-sectional dependence in the residuals developed by Westerlund (2007) that takes care of any expected cross-sectional dependence. Afterward of the model estimation, we test for cross-sectional dependence to ascertain if the presence of a common factor affects the panel co-integration test result. Above all, if all variables are not integrated of order I(I) which is the condition for applying the Wester-Lund panel co-integration test. Hence, the Panel Auto Regressive Distributed (PARDL) approach became imperative.

Granger-Causality Procedure

As put forth by Granger (1969), a causality test was applied for the study to ascertain the short-run causality relationship among the variables as well as if historical values of one variable can forecast or predict the relationship among other variables. For instance, if variable M Granger causes another variable N, then the past value of M should contain information that is useful in predicting N, over and above the information contained in the past value of N alone. Thus, the mathematical formulation is based on linear regression modeling of the stochastic process as given:

$$M_t = a_0 + a_1 M_{t-1} + \ldots + a_p M_{t-1} + b_1 N_{t-1} + \ldots + b_p N_{t-p} + \Pi_t \ldots\ldots\ldots\ldots (5)$$

$$N_t = c_0 + c_1 N_{t-1} + \ldots + c_p N_{t-1} + d_1 M_{t-1} + \ldots + d_p M_{t-p} + \Sigma_t \ldots\ldots\ldots\ldots (6)$$

Here we assume that Π_t and Σ_t is uncorrelated. A unidirectional causality exists when from N to M if the estimated coefficients on the lagged N in the first equation are statistically different from zero as a group and the set of estimated coefficients on the lagged M are not statistically different from zero and vice versa (Gujarati, 2012).

(IV) Analysis and Discussion of Results

Panel ARDL estimation results are presented here to capture the nature of the relationship between macroeconomic variables of human capital development and economic growth

Descriptive Analysis

Table 1: Descriptive Statistics of Variables

Variables	Obs	Mean	Std. Dev.	Min	Max
RGDPgr	1285	2.234	6.5232	-49.245	38.235
SENROL	1285	12.2335	18.232	20.432	92.430
GEXEDU	1285	3.31851	3.4315	7.3482	53.322
GEXHE	1285	4.15623	2.2123	8.6345	16.232

LABF	1285	10.2344	7.3025	5.4243	50.1481
INFR	1265	58.4514	45.573	-38.736	3383.12

Source: Author's Computation

Table 1 shows the descriptive statistics of variables used in the model which includes mean, standard deviation, minimum, and maximum value respectively. As reported in Table 1, the inflation rate of 58.4514 recorded the highest mean value while the real gross domestic product growth rate has the lowest mean value of 2.234. A critical examination of the standard deviation of the variable of interest showed that SENROL (18.23) and INFR (45.57) exhibited very high variability performance in the region while other variables; RGDPgr (2.234), GEXEDU (3.43), GEXHE (2.21) and LABF (7.30) have low standard deviations values. This implies that these variables showed very low variability performance in the SSA region.

Correlation Analysis

Table 2: Correlation Statistics

	RGDPgr	SENROL	GEXEDU	GEXHE	LABF	INFR
RGDPgr	1.0000					
SENROL	0.0073	1.0000				
LABF	0.0775	0.4083	1.0000			
GEXEDU	-0.0843	0.2345	-0.0269	1.0000		
GEXHE	0.0765	0.4083	-0.0226	0.2541	1.0000	
INFR	-0.0570	-0.0579	0.0941	-0.0241	-0.0440	1.0000

Source: Author's Computation

Correlation analysis of Table 2 indicates the possible direction and magnitude of the relationship between pairs of variables in the model. A cursory look at Table 2 showed that a positive relationship exists between RGDPgr and other variables such as SENROL, LABF, and GEXHE with a correlation coefficient of 0.007, 0.078, and 0.077 respectively while an indirect relationship exists between RGDPgr and few variables such as GEXEDU (-0.084) and INFR (-0.057) in the model. Summarily from the correlation analysis, there seems no likelihood of multi-collinearity presence among the explanatory variables, as evidence from weak magnitude interrelationship between pairs of variables in the model.

Panel Unit Root Test

Table 3: Panel Unit Root Test Result

	@ level			**@ 1st Diff.**			
Variables	**LLC**	**IPS**	**BT**	**LLC**	**IPS**	**BT**	**Integr. order**
RGDPgr	-11.345*	-13.123*	-3.516*	-16.202*	-25.322*	-21.211*	I(0)
SENROL	1.0426	2.1002	2.213	-12.122*	-9.212*	-6.834*	I(1)
LABF	-3.313*	-1.854*	-1.313	-15.015*	-18.536*	-18.652*	I(0)
GEXEDU	-0.552	0.143	-0.916	-14.461*	-13.322*	-17.249*	I(1)
GEXHE	-2.354	-0.673	-1.135*	-1563*	-14.479*	-18.481*	I(1)
INFR	-5.234*	-7.375*	-7.944*	-20.632*	-25.812*	-22.733*	I(0)

(*) connote rejection of unit root at (5%) significance level

Source: Author's Computation

Results of the panel unit root test using Levin-Lin-Chu (LLC), Im-Pesaran-Shin (IPS), and Breitung test (BT) are presented in Table 3. Panel unit test results indicate that RGDPgr, LABF, and INFR were stationary at level I(0) while other variables including SENROL, GEXEDU, and GEXHE became stationary at the first difference I(1). Suggesting they all retain innovative shock passed on to them for a short period. Summarily, the panel unit root conducted in the study indicates that series in the model are integrated of mixed order, that is, I(0) and I(1) while none of them are stationary at I(2). This calls for the use of a panel Auto-regressive distributed lag (PARDL) approach as suggested by Pesaran, Shin & Smith (2001).

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Estimation of Panel ARDL Approach

The estimation result of panel ARDL is presented for combined sub-Saharan African countries sampled in the study. Notably, the pooled mean group estimation is preferred based on the result of Hausman test (1978) as given thus:

Table 4: Hausman 1978 Test:

Null hypothesis	Diff. in coefficients not systematic
Test statistic (Chi^2)	3.76
Prob. value	0.6395

Source: Author's Computation

This test compared pooled mean group with mean group estimation results under the null hypothesis that the difference in coefficient is not systematic. Table 4 indicates that the chi-square statistics stood at 3.76 with prob. value of 0.640. This implies that there isn't enough evidence to reject the null hypothesis that the difference in coefficient between the mean group and pooled mean group estimation is not systematic. Hence, the pooled mean group is valid for the study upon the applicability of panel ARDL estimation as presented thus:

Combined Estimation

Table 5: Panel ARDL Estimation Result

Dep Var: D(RGDPgr)

LONG RUN ESTIMATE				
Var.	**Coefficient**	**Std. error**	**Z-test**	**Prob.**
SENROL	0.0113	0.0124	0.91	0.364
GEXEDU	-0.3110	0.0698	-3.02	0.003
GEXHE	0.0543	0.1087	0.32	0.452
LABF	0.0378	0.0199	2.00	0.045
INFR	0.0009	0.0006	1.63	0.102
SHORT RUN ESTIMATE				
Var.	**Coefficient**	**Std. error**	**Z-test**	**Prob.**
ECT	-0.84643	0.1143	-7.72	0.000
C	1.6593	0.2374	8.25	0.000
D(SENROL)	-0.5080	0.6357	-0.64	0.420
D(GEXEDU)	-2.4350	3.6141	-0.98	0.325
D(GEXHE)	23.7413	25.229	0.98	0.325
D(LABF)	0.0456	0.2602	0.17	0.756
D(INFR)	-0.0192	0.0483	-0.87	0.325

Source: Author's Computation

Table 5 indicates estimation results for short and long runs coefficient, z-test, and prob value for investigating the impact of macroeconomic determinants of human capital development on economic growth in the sub-Saharan Africa region. A critical look at the table showed that 0.011 school enrolment ($p>0.05$), 0.054 government expenditure on health ($p>0.05$), 0.038 labour force ($p<0.05$), and 0.0009 inflation ($p>0.05$) exerts a positive influence on real GDP growth rate while -0.311 government expenditure on education ($p<0.05$) exhibits negative influence on real GDP growth rate all in the long run in sub-Saharan Africa region. Notably on the short run estimate, is the result of the error correction term (ecm-1) that is correctly signed and

statistically significant at a 1% confidence interval (prob value of 0.0000 p< 0.05). The result indicates the existence of cointegration among the variables; government expenditure on education, government expenditure on health, school enrolment, labour force, inflation rate, and real GDP growth rate. Surface from the result is that the absolute value of the coefficient of ECM (0.8643) implies that about 86% of the disequilibrium in the level of economic growth is adjusted towards equilibrium annually. The result could also imply that if the growth rate in the region exceeds its long-run relationship with other variables in the model, the growth rate will adjust downwards at a rate of 86% per year. The short-run results indicate that the lagged value of government expenditure on health and labour force exerts a positive influence while other variables such as government expenditure on education, school enrolment and inflation rate exhibited negative impact on real GDP growth rate in the region.

Further, blocked estimations are conducted in this study on four countries out of West Africa economic bloc (ECOWAS). There are, Nigeria, Senegal, Ghana and Cote-de Voire to represent other SSA countries.

Blocked Estimation

Table 6: Panel ARDL Estimation Result
Dep Var**:** D(RGDPgr)

LONG RUN ESTIMATE				
	Nigeria	**Senegal**	**Ghana**	**Cote-de Voire**
Variable	Coefficient	Coefficient	Coefficient	Coefficient
SENROL	0.03381	0.36789	0.014605	0.34674
GEXEDU	0.32939	-0.3632	-0.5342	-0.16237
GEXHE	0.32939	0.00562	0.52323	0.34983
LABF	-0.0792	0.6293	0.02317	0.14673
INFR	0.03973	0.10356	-0.32454	-083432
SHORT RUN ESTIMATE				
	Nigeria	**Senegal**	**Ghana**	**Cote-de Voire**
Variable	Coefficient	Coefficient	Coefficient	Coefficient
ECT	-0.8546*	-0.75342*	-0.77564*	-0.9645*
C	6.9949*	4.9357*	5.5623*	9.3546*
D(SENROL)	0.4819	0.2569	0.4634	-0.4523
D(GEXEDU)	-0.2096	1.3425*	0.7354*	-0.5835
D(GEXHE)	-0.2310	-0.96573	-0.3103	-0.6207
D(LABF)	0.25861*	-0.5834	-0.3634	0.2436
D(INFR)	-0.0447	-0.2435*	0.4534	-04638**

Source: Author's Computation

Notes: * (**) indicates significant level @ 1% and 5% respectively

A cursory look at Table 6 showed the short and long runs coefficient, z-test, and prob value of blocked panel ARDL estimates. In the long run, the result indicates that SENROL exhibits a positive impact on the real gross domestic product growth rate in all the sampled countries in the region. Including Nigeria (0.0338), Senegal (0.3678), Ghana (0.0147) and Cote-de Voire (0.3467). These are also similar to long-run combined results. GEXEDU exerts a positive influence in Nigeria (0.3294) but showed a negative effect on the real gross domestic product growth rate in Senegal (-0.3632), Ghana (-0.534), and Cote-de Voire (-0.1623). It is noteworthy in the estimate that GEXHE exerts a positive influence in all the sampled countries in the region: Nigeria (0.3293), Senegal (0.0056), Ghana (0.5232), and Cote-de Voire (0.3498). These results are in tandem with the long-run combined result. Labour force participation had Nigeria (-0.079) but exhibits positive influence for other countries like Senegal (0.6293), Ghana (0.0232), and Cote-de Voire (0.1467) on the real gross domestic product growth rate in sub-

Saharan countries. The inflation rate had a positive impact in Nigeria and Senegal (0.039) while Ghana (-0.325) and Cote-de Voire (-0834) exerted a negative effect on RGDPgr in the region.

Further in the estimate, the ecm (-1) from the short-run analysis indicates that about 85.5%, 75%, 77.5%, and 96.5% of the short-run inconsistencies are corrected and incorporated into long-run dynamic annually in Nigeria, Senegal, Ghana, and Cote-de Voire respectively having the prob value greater than 0.05 significant speed of adjustment at 5% level of significance. It is startling to note that government expenditure on health assumed a negative effect on RGDPgr all through for the sampled countries in blocked estimates contrary to the combined result having positive influences. The most interesting also to note here is that school enrolment exerts a positive influence on RGDPgr in all the countries sampled except Cote-de Voire had a negative effect. Government expenditure on education exerts a negative effect in Nigeria and Cote-de Voire but showed positive influence and statistically significant in Senegal and Ghana in the short run blocked estimation. Labour force participation in the economic activities in the region had statistically significant and positive in Nigeria but insignificant in Cote-de Voire while other countries exhibit negative effect on RGDPgr.

Further, estimation result of PVAR Granger causality test is presented for combined sub-Saharan Africa region blocks under Western Africa. Results are presented thus:

Combined Estimation

Table 7: PVAR Granger Causality / Block Exogeneity Wald Test

RGDPgr				
Excluded	**Df**	**Chi-sq.**	**Prob.**	**Decision**
RGDPgr → SENROL	2	0.71098	0.4914	Accept
RGDPgr → GEXEDU	2	4.43058	0.0121**	Reject
RGDPgr → GDGGHE	2	0.71733	0.4882	Accept
RGDPgr → LABF	2	0.61960	0.5686	Accept
RGDPgr → INFR	2	0.7574	0.5375	Accept
SENROL → RGDPgr	2	1.89324	0.0784**	Reject
GEXEDU → RGDPgr	2	3.68457	0.0181**	Reject
GDGGHE → RGDPgr	2	0.61850	0.7341	Accept
LABF → RGDPgr	2	0.16032	0.9231	Accept
INFR → RGDPgr	2	3.53328	0.1709	Accept

Source: Extracted from regression output

Notes: * (**) indicates significant level @ 1% and 5% respectively

Table 7, shows the result of the VAR Granger causality test conducted for the region. The result indicates evidence of rejection of null hypotheses for GEXEDU and RGDPgr does not granger cause each other in both cases for a combined estimate in the SSA region. Hence, a bi-directional causality relationship exists between GEXEDU and RGDPgr. There is no evidence of rejection of null hypotheses at a 5% level of significance for other variables such as GEXHE and RGDPgr in both cases. That is no causal relationship existed. The result further showed that a uni-directional causality relationship exists from SENROL to RGDPgr without feedback. Summarily, the result showed that an increase in the gross domestic product growth rate is necessary for enhancing government expenditure on education just as enhanced government expenditure on education is needed to improve economic growth in the SSA region. While a uni-directional relationship running from RGDPgr to other variables without feedback and statistically insignificant. That is, they exhibited zero predictive content or power for RGDPgr within the study period.

Discussion of Results

Here we relayed myriads of empirical analysis results. Firstly, the influence of school enrolment on economic growth indicates an insignificant and negative coefficient (-0.5080) in the short run but assumes an insignificant positive effect (0.0113). This

implies that a unit increase in school enrolment will lead to an increase of about 0.51% reduction in the economic growth of the region in the short run. By implication, this indicates that the resources meant for productive activities might have been wrongly invested in the enrolment of students in the region to cover up educational finances needed, which in turn reduces the financial capacity for the maintenance and expansion of productive capacity and afterward, reducing the growth of the region's economy. This result was incongruent with the work of Boaz, Salawa & Wachilonga (2014). While same measure of school enrolment increase would possibly lead to about a 0.011% increase in sub-Saharan countries' economic growth in the long run. This result implies that students who acquire skills and knowledge through education will do more to enhance their educational capability to add and raise people's productivity in terms of creativity and innovation as well as entrepreneurship and technological advances that will possibly enhance productivity and labour delivery of the growth of economy according to the empirical studies of Akinola and Bokana (2017).

Secondly, the government expenditure on education exhibits a negative influence on RGDPgr in sub-Saharan countries both in the short and long runs having coefficients of -2.435 and -0.3110 respectively. This signifies that a unit increase in government expenditure on education will lead to about 2.44% and 0.311% decrease in output growth of the region respectively in the short and long runs. This result implies that government expenditure on education should adequately be taken care of by the policymakers to give opportunity to the less privileged citizens to access educational institutions, for possible provision of opportunities to create new ideas, innovations, technological advances, and diverse skills. The irony of these findings is that most of these countries sampled in the region and others suffered greatly from brain drain, even after they had spent much for human capital accumulation as a result of a lack of economic opportunities. Besides, corruption and mismanagement have also hampered the educational system which has caused the inability of many to continue their educational pursuit while some could not even attain elementary education. Above all, most of these countries lack innovation and development of technologies that can enhance output growth in the region. This was in agreement with the work of Elena (2014) but not in tandem with the study conducted by Adelakun (2011)

Thirdly, government expenditure on health exhibits a positive insignificant influence on RGDPgr in the region both in the short and long runs with coefficients of about 23.741 and 0.054 respectively. This implies that a unit increase in government expenditure on health will lead to an increase of about 23.7% and 0.05% respectively. Government expenditure on health can increase access to a better provision of health opportunities to the people most especially the rural areas and thereby contribute to economic performance. Increased health expenditure will also improve the health of the labour force and consequently increase productivity which in turn contributes to economic growth. Further, good health enhances learning ability and cognitive development which enables the economy to recover investment in education. Above all, it also aids more human capital accumulation which enhances employment of experienced human capital and aids knowledge transfer, since good health enables human capital to perform mental and physical productive activities effectively and efficiently in the society. These findings are in concordance with studies of Emanuelle, Maria, and Luiz (2003); Olaniyan, Onisanwa & Oyinlola (2013).

(V) Conclusion and Policy Recommendations

The study concludes based on the combined countries selected in the West Africa bloc that there is a long relationship between government expenditure on education and economic growth while other variables on human capital development components like school enrolment, labour force, inflation, and government expenditure on health exhibit insignificant long run impact on the economic growth of SSA region. The study also concludes that an increase in gross domestic product growth rate is necessary for enhancing government expenditure on education just as enhanced government expenditure on education is needed to improve economic growth in the SSA region, while other variables exhibited zero predictive content or power for RGDPgr within the study period. Succinctly conclusion of this study is that in the long run estimate, human capital development does not contribute to an increased level of economic growth in sub-Saharan African countries in this present study. Based on the findings, the study therefore recommends improvement in the educational system through increased expenditure, to ensure sustainable healthcare financing that will improve health facilities and reduce the burden of health spending inequality most especially in rural communities as well as rate of unemployed should be reduced to the barest minimum as against applicants

seeking employment all these while. Because, an increased labour force would do more to improve economic growth of the region. These among others things would lead to growth sustainability of SSA countries if properly harnessed by the policymakers.

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