An Interactive Effect of Human Capital Variables and Economic Growth in Nigeria

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Abstract: The study examines the interactive effects of the relationship between human capital investment components and economic growth in Nigeria for the period of 1986 – 2014. Although, various studies have focused on the relationship between human capital and economic growth all over the world but there is still a missing gap on the joint influence of human capital investment components on economic growth particularly in Nigeria. The study employs secondary annual data on education expenditure; health expenditure; real gross domestic product and gross capital formation obtain from the Central Bank Statistical bulletin, 2014 and analyze using Fully Modified Ordinary Least Squares (FMOLS) technique. The results of the study show that there is positive and significant relationship between the interactive effects of human capital components and growth in Nigeria. The study educates the government and policy makers on the importance of policy mix in terms of how human capital development enhances growth in Nigeria than embarking on the use of one policy instrument. The paper therefore contributes to knowledge by providing information on the interactive effects of education and health on growth in Nigeria.

Keywords: Human Capital; Growth; Interactive Effect; Fully Modified Ordinary Least Squares (OLS)

JEL Classification: H51; I22; O40

1. Introduction

Over the years, investments in education and health services as a way of enhancing human capital development has been one of the cogent factors that determining the pace of growth in developing countries and in particular Nigeria. Therefore, the roles play by human capital development has been debated extensively in the theoretical and empirical literature (Solow, 1956; Barro, 1991). Thus, the availability of education and health services to people is one of the major ways of improving the quality of human resources. It provides an economy with healthy

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trained human resources required for economic growth and development (Bloom & Canning, 2003). It is one of the key determinants of economic performance both at the micro and macro levels and an uninterrupted component of human well-being that increases the individual's capabilities (Bloom & Canning, 2003).

In the literature, studies have commented on the contribution of human capital to economic growth. In the theoretical literature, human capital in terms of investments in education and health services has been claimed as a major contributor to growth (Solow, 1956; Barro, 1991; 1997; Mankiw, Romer & Weil, 1992). Likewise, studies have enormously assessed the contributions of education and health expenditure in the empirical literature. However, these studies have divergent opinions. In Nigeria, studies like Ojo and Oshikoya (1995), Garba (2002), Adamu (2003), Dauda (2010) and Mba, Mba, Ogbuabor and Ikpegbu (2013) concluded that expenditure on education and health as measure of human capital positively influenced growth. Meanwhile, it has been argued that government expenditure on health and primary education enrollments has negative influence on growth (Lawanson, 2009; Jaiyeoba, 2015). The divergence opinion on the relationship between human capital investment and economic growth has made the documented literature inconclusive.

More so, these studies either theoretical or empirical have also left unresolved the interactive effect of the relationship among public expenditure on education, health and growth in Nigeria. Yet, the empirical literature has unable to identify the robust mechanisms through which education and health contribute to economic growth. The thrust of this study therefore is to examine the interactive effect of the relationship between education and health as measures of human capital and economic growth in Nigeria between 1986 and 2014. This enables the economists, scholars, policy makers and government to distinguish between individual effect and interactive effect of the relationship between human capital measures and growth in Nigeria. The study contributes to existing literature by modeling the interactive effect using endogenous growth model.

The rest of this paper is divided into four sections. Section two contains the review of literature while the methodology is presented in section three; section four is the empirical result while section five is devoted to conclusion and recommendations.

2. Literature Review

Human capital refers to the stock of competencies, skills, knowledge and personalities attribute embodied in individuals which facilitate their ability for the creation of personal, economic and social value (OECD, 2001), labour is one of the factors of production and can also be referred to as workforce.

Ojo and Oshikoya (1995) examined the determinants of long-term growth in selected African countries using the framework of endogenous growth model between 1971 and 1991. The study found human capital as the most relative important factor influencing long-term growth in African countries. Similarly, Loening (2005) evaluated the impact of human capital on economic growth using error correction mechanisms for the periods of 1951 to 2002 and found that better-educated labour having a positive and significant impact on economic growth in Guatemala. Adamu (2003) determined the impact of human capital formation on economic growth in Nigeria between 1970 and 2000 using cointegration and error correction mechanisms. The study found that investment in human capital in form of education and training lead to economic growth.

Gyimah-Brempong, Paddison and Mitiku (2006) investigated the effect of higher education human capital on economic growth in African countries using dynamic panel data with a modified neoclassical growth equation. They found education has positive and significant effect on growth in African countries and claimed that growth elasticity of higher education human capital is twice as large as the growth impact of physical capital investment. Nabil, Simon and Yu (2007) examined the dynamic effects of public investment in human capital in the Canadian context of population ageing using a computable overlapping-generations model (OLG). The study found a significant effect of a tax-financed increase in public spending on education had a crowding-out effect in the short run while higher education contributed immensely to human capital accumulation in the long run and this also had negative effects of population ageing.

Lawanson (2009) examined the role of education and health in human capital investment and economic growth in Nigeria using ordinary least squares technique and found that human capital enhances economic growth in Nigeria while government expenditure on health and primary education enrollment had negative effects on growth. Dauda (2010) investigated the relationship between human capital formation and economic growth in Nigeria used the endogenous growth model. The study used employed enrolment in the different levels of education, primary, secondary and tertiary as proxies for human capital and found long-run positive relationship between human capital formation and economic growth in Nigeria with a feedback effects.

Amassoma and Nwosa (2011) studied the causal nexus between human capital Investment and economic growth in Nigeria for sustainable development in Africa at large between 1970 and 2009 using a Vector Error Correction (VEC) and Pairwise granger causality methodologies. The findings of the Vector Autoregression (VAR) model and pairwise estimate reveal no causality between human capital development and economic growth. Also, the study identified that labour mismatch is an issue that government needs to reckon with in order to accelerate and sustain economic growth. Oluwatobi and Ogunrinola (2011)

examined the relationship between human capital development and economic growth in Nigeria using augmented Solow model and found that there exists a positive relationship between government recurrent expenditure on human capital development and the level of real output, while capital expenditure is negatively related to the level of real output.

Adelakun (2011) conducted a study on human capital development and economic growth using OLS technique and found that there was a positive relationship between government expenditure on education and health as well as pattern of enrolment in primary, secondary, and tertiary institutions in enhancing economic growth in the long run. Adawo (2011) examined the contributions of primary education, secondary education and tertiary education to economic growth in Nigeria using an econometric model and found that health expenditure contributed to growth while secondary school input and tertiary institutions dampen growth.

Isola and Alani (2012) examined the contribution of different measures of human capital development to economic growth in Nigeria. The study found that though little commitment had been accorded health compared to education, empirical analysis showed that both education and health components of human capital development are crucial to economic growth in Nigeria. Adelowokan (2012) examined the effect of education and health expenditures on economic growth in Nigeria between 1970 and 2010 using a static regression model. He also established the long-relationship between human capital spending and economic growth using the Engle-Granger two-step cointegration procedure. The study found that public investment and public consumption (in education and health) exerted positive influence on economic growth, while, private investment exerted negative effect on economic growth in Nigeria. Similarly, the study showed that there was long-run relationship between economic growth and expenditure on education and health in Nigeria.

Akbari, Moayedfar, and Jouzaryan, (2012) investigated the effect of human capital on the economic growth of Iran in the long run and the short run using the auto-regressive distribution lag model. The study showed that there was positive and significant effect of human capital on the economic growth of Iran. Onyeagu and Okeiyika (2013) investigated the interaction between foreign direct investment and human capital on growth in Nigeria and tried to ascertain the long run sustainability of Foreign Direct Investment (FDI) induced growth process using error correction mechanism. They found that FDI in Nigeria, had a negatively significant relationship to growth in the long run, meaning that the contribution of FDI in Nigeria is small and human capital had negative significant effects on growth in the long-run and claimed that this was due to shortage of skilled labour in the country.

Linda (2013) investigated the relationship between human capital development and economic growth using simple production function to estimate the human capital impact on labour productivity and found that female human capital has positive impact on labour productivity during the period of study. Eric (2013) focused on human capital as a driver of economic growth for developing countries. He argued that this has led to undue attention on school attainment. Then, he noticed that the attention that has been shifted to issues of school quality in developing countries have been much less successful in closing the gaps with developed countries. The study concluded that without improving school quality, developing countries will find it difficult to improve their long run economic performance.

Mba, Mba, Ogbuabor and Ikpegbu (2013) evaluated the relevance of human capital development on Nigerian economic growth using Ordinary Least Squares technique. They found a strong positive relationship between human capital development and economic growth using primary school enrolment, public expenditure on education and health, life expectancy and stock of physical capital to proxy human capital. Mehrara and Musai (2013) investigated the causal relationship between education and GDP in developing countries by using panel unit root tests and panel cointegration analysis for the period 1970-2010. The study showed a strong causality from investment and economic growth to education in these countries. Yet, education does not have any significant effects on GDP and investment in the short- and long-run. Ogujiuba (2013) examined the relationship between economic growth and human capital development and found that investment in human capital in the form of education and capacity building at the primary and secondary levels impact significantly on economic growth, while capital expenditure on education was insignificant to the growth process.

Eigbiremolen and Anaduaka (2014) employed the augmented Solow human-capital-growth model to investigate the impact of human capital development on national output using quarterly time- series data from 1999-2012. The study found that human capital development, in line with theory, exhibited significant positive impact on output level. This implied that human capital development is indispensable in the achievement of sustainable economic growth in Nigeria, as there is an increase in economic performance for every increase in human capital development. Lastly, Jaiyeoba (2015) empirically investigated the relationship between investment in education and health in Nigeria, using time series data from 1982 to 2011 using trend analysis, the Johansen cointegration and ordinary least square technique. Empirical findings however indicated that there is a long-run relationship between government expenditure on education, health and economic growth.

In summary, evidence from the literature showed that education and health are crucial for economic growth. However, studies have only examined the individual effect of education and health components of human capital while the issue of their

interactive effects on economic growth has not been resolved. This study intends to fill this vacuum.

3. Methodology

In order to examine the interactive effect betweenhuman capital variables and economic growth in Nigeria, the study employed endogenous growth model and adapted the model equation formulated by Mankiw et al (1992) in line with augmented neoclassical model. The Cobb-Douglas production function of Mankiw et al (1992) model has been written in the following form:

$$Y = K^{\alpha} H^{\beta} (AL)^{1-\alpha-\beta}$$

1

Where Y represents aggregate output, K is the physical capital, H is human capital and A is a technical efficiency index and L is labour. L and A grow at constant rates and has exogenous rates n and g, respectively. The two variables are also prone to decreasing returns to scale, that is $\alpha + \beta < 1$. Transforming equation (1) and end up with an equation on income per worker as follows:

$$\ln \frac{Y}{L} = \ln A + gt - \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n+g+\delta) + \frac{\alpha}{1-\alpha-\beta} \ln(s_k) + \frac{\beta}{1-\alpha-\beta} \ln(s_h)$$

2

Where s_k :the ratio of investment to product, s_h :human capital investment, n, g and δ: the growth rate of labour, technology and depreciation rate of capital respectively and t: time.

Let $\frac{Y}{L} = y$, $gt - \frac{\alpha+\beta}{1-\alpha-\beta} = 0$, $n + g + \delta = 0$ (this implies that the growth rate of labour,

technology and depreciation rate of capital are constant over the period of study), $\frac{\alpha}{1-\alpha-\beta} = a_1$,

$\frac{\beta}{1-\alpha-\beta} = a_2$ and $\ln A = a_0$. Substituting these into equation (2), we have:

$$\ln y = a_0 + a_1 \ln s_k + a_2 \ln s_h$$

3

From equation (3), decompose human capital investment into education (ED) and health (HE), it becomes:

$$\ln y = a_0 + a_1 \ln ph + b_1 \ln ED + b_2 \ln HE$$

4

Where $s_k = ph$ is the physical capital. Also, in order to capture the interactive effect of human capital components, equation (4) becomes:

$$\ln rgdp = a_0 + a_1 \ln ph + b_1 \ln ED + b_2 \ln HE + b_3 \ln(ED*HE)$$

5

Specifying equation (5) in econometric model, we have:

$$\ln rgdp = a_0 + a_1 \ln ph + b_1 \ln ED + b_2 \ln HE + b_3 \ln(ED*HE) + \varepsilon \quad {}_6$$

Equation (6) is the estimated econometric model that captures the interactive effect of the relationship between human capital components and growth in Nigeria.

Education and health are proxied using government expenditure on education and health respectively, the physical capital is proxied with total government capital formation, while the real gross domestic product (*rgdp*) is the proxy for economic growth. Data on these variables were sourced from Central Bank Statistical bulletin, 2014. The data were analyzed using appropriate econometric techniques.

4. Empirical Analysis

4.1. Pre-Estimation Test

4.1.1. Correlation Matrix Analysis

In the empirical literature, studies have shownthat testing of the correlation among the variables of estimates would make the researchers to detect whether the variables have high multicollinearity among themselves. As a result, the parameter estimates could be contradictory with what would be expected, because of the unpredictable effect of multicollinearity (Agung, 2009; Hamsal, 2006). However, Iyoha (2004) argued that multicollinearity among variables occurred when the result of the correlation coefficient is above 0.95. In line with this explanation, we conducted a correlation matrix among the variables used in this study and detected that there was strong correlation between ED*HEi.e. government expenditure on education and health(r= 0.98). In order to avoid multicollinearity among the independent variables, we then dropped government expenditure on education in our analysis as shown in the result of the fully modified OLS. The results of the correlation among other variables were reasonable as presented in table 1 below.

Table 1. Correlation Matrix

	RGDP	ED*HE	ED	HE	PH
RGDP	1				
ED*HE	0.8966	1			
ED	0. 4095	0.9848	1		
HE	0.9195	0.9047	0.9126	1	
PH	0.9248	0.8306	0.9216	0.9403	1

Source: Author, 2015

4.1.2. Time series Properties

To avoid spurious results the study Augmented Dickey Fuller Test to test for the unit root problem in the variables. The result of the stationarity test showed that all the variables were stationary at first difference using five percent significant level as shown in table 2 below. Having established that the variables were stationary at first difference, we tested whether the said variables have long run co-movement using Johansen cointegration test.

Table 2. Unit-Root Test Result by Augmented Dickey Fuller Method

Variables	Level	First Difference	Order of Integration
Log(ED)	0.4015	-6.5989	I(1)
Log(HE)	0.6225	-8.3136	I(1)
Log(RGDP)	6.0190	-2.3773	I(1)
Log(PH)	1.1520	-30794	I(1)
Log(ED*HE)	0.7341	-7.3954	I(1)

Source: Author, 2015

The result of the cointegration test showed that there were three cointegrating vectors based on the Eigen values and Trace statistics since the hypotheses of no cointegration were rejected at 5% level for both tests using Mackinnon-Haug-Michelis (1999) p-values as shown in table 3.

Table 3. Johansen Cointegration Result (Long-Run Co-Movement Result)

Rank	*Trace Statistic*	*0.05 Critical Value*	*Max-Eigen Statistic*	*0.05 Critical Value*
R=0	214.18	69.82	94.75	33.88
R ≤1	119.43	47.86	81.06	27.58
R ≤ 2	38.37	29.80	26.14	21.13
R ≤ 3	12.23	15.49	10.21	14.26
R ≤ 4	2.02	3.84	2.02	3.84

Source: Author, 2015

After investigating the long run relationship among the variables, we estimated the short run dynamics of the variables using Error Correction Mechanism (ECM). The ECM shows the speed of convergence towards equilibrium which must be negative and significant.

Table 4. Short-Run Estimated Result

Dependent Variable: RGDP				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
ECM(-1)	-0.549777	0.266513	-2.062850	0.0497
Δ(ED*HE)	-0.063821	0.024462	-2.608974	0.0151
ΔED	77.59104	15.20085	5.104389	0.0000
ΔED(-1)	-82.46012	35.03001	-2.353985	0.0267
ΔHE	-103.3641	31.72338	-3.258293	0.0032
ΔPH	0.385818	1.221758	0.315790	0.7548
ΔRGDP(-1)	1.459307	0.365804	3.989316	0.0005
ΔHE(-1)	39.19674	23.16420	1.692125	0.1031
R-squared	0.987270	Durbin-Watson stat		2.167691

Adjusted R-squared	0.976506		

Source: Author, 2015

The result in table 4 showed that the variables would converge to long-run relationship after sixteen (16) years movement among the variables as shown by the negative and significant coefficient of error correction term (ECM).

4.2. Interactive Relationship between Human Capital Components and Economic Growth in Nigeria

Having established the long-run co-movement among the variables, we employed fully modified Ordinary Least Squares(FMOLS) technique to establish the long-run relationship among the variables as shown in table 5 below.

Table 5. Fully Modified Least Squares (FMOLS) Result

Dependent Variable: ΔLOG(RGDP)				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
ΔLOG(ED* HE)	0.468042	0.133771	3.498829	0.0015
ΔLOG(PH)	0.752995	0.091857	8.197465	0.0000
ΔLOG(HE)	-0.632780	0.272861	-2.319058	0.0276
C	2.680502	0.418178	6.409949	0.0000
R-squared	0.929184	Mean dependent var		7.693312
Adjusted R-squared	0.908065	S.D. dependent var		2.318477
S.E. of regression	0.253284	Sum squared resid		1.860428
Long-run variance	0.064034			

Source: Author, 2015

The estimated result above showed that the explanatory variables explained approximately 91 percent of the total variations in the growth of the Nigerian economy. This result showed that the model has high goodness of fit. The long-run variance was less than unit which indicated that the estimators of the model had minimum variance and hence, efficient, sufficient and best linear and unbiased.

The coefficient of the health expenditure was negatively signed and statistically significant at 5 percent level. The negative sign indicated that a unit percent increase in health expenditure would lead to 0.63 percent decrease in growth of the country. This result was not in conformity with the theoretical preposition but was in line with the work of Lawanson (2009) and Jaiyeoba (2015). A plausible explanation for this is that expenditure on health alone in Nigeria does not have the required positive multiplier effect.

The coefficient of the interactive variable was positively signed and statistically significant at 5 percent level. The positive relationship exhibited by the interactive human capital variable showed that a percent increase in the combination of both education and health as a means of enhancing human capital would lead to approximately 0.47 percent increase in growth of the economy. This result was in conformity with theoretical propositions that increase in human capital investment would lead to increase in economic growth (Solow, 1956; Barro, 1997; and Mankiw, Romer & Weil, 1992) and empirical findings also supported the theoretical underpinning (Ojo & Oshikoya, 1995; Garba, 2002; Adamu, 2003; Dauda, 2010; Mba *et al*, 2013; Eigbiremolen & Anaduaka, 2014). The implication of this result is that government should invest in both education and health simultaneouslyin Nigeria so that human capital investment can enhance growth as expected.

5. Conclusion and Recommendations

There are large records of studies which propose the imperative and positive effect of human capital on economic growth. The effect, however, differs significantly among various studies depending on the model, the data and the case country. Studies which are based on growth calculation methods result in less powerful effect of human capital on the output while cross-country studies in which Solow's adjusted method is used suggest a more powerful effect of human capital. Finally, empirical studies of endogenous growth imply the crucial effect of human capital on economic growth in different countries.

The results of this study which are based on the neoclassical model, also, confirm the positive and significant interactive effect of human capital components on the growth of Nigeria. According to the results of this study, the interactive effect of human capital affects long-run economic growth in Nigeria.

Based on the findings of this study, the following recommendations are made that government should increase allocation tothe education and health sectors in the country; government should also increase health care facilities in the country and motivate the health personnel with good remuneration to guarantee increased productivity in the sector and enhance the standard of education by motivating and retraining the teachers at all levels while increasing education infrastructural facilities.

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