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## Article

# Human capital variables and economic growth in Nigeria

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## Human Capital Variables and Economic Growth in Nigeria: An Interactive Effect

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**Abstract:** Various studies have focused on the relationship between human capital and economic growth all over the world. However, there is still a missing gap on the joint influence of human capital investment components on economic growth particularly in Nigeria. This study therefore examines the interactive effects of the relationship between human capital investment components and economic growth in Nigeria for the period of 1986 – 2014. The study employed secondary annual data on education expenditure, health expenditure, real gross domestic product and gross capital formation obtained from the Central Bank Statistical bulletin, 2014. The data were analyzed using Fully Modified Ordinary Least Squares (FMOLS) technique. The results of the study showed that there was positive and significant relationship between the interactive effects of human capital components and growth in Nigeria. The study concluded that the interactive effect of the human capital variables was also in conformity with the theoretical proposition that increase in human capital will enhance growth as stipulated in the modified Solow growth model by Mankiw, Romer & Weil (1992).

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

**JEL Classification:** E23

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### 1. Introduction

Since the emergence of the new growth theory in the 1980s, investments in education for human capital accumulation have been identified as a key determinant of long-run growth. Further, the role of human capital in economic development has been a frequent argument in the theoretical and applied literature. The belief of policy makers that human capital is a key contributor to economic development has led, virtually everywhere in the developing world, to the provision of investment in education and health. However, human capital is recognized as a mediator of national development in all countries of the world. 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 trained human resources required for economic growth and development (Bloom & Canning, 2003). Prior to the Second World War (1939-1945), the literature argued that the relationship between education and economy was insignificant and subsequent studies confirmed that the economy depended on education to foster economic growth (Schultz, 1961; Denison, 1962).

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In addition, health is regarded as being fundamental to economic growth and development. It is one of the key determinants of economic performance both at the micro and macro levels and a direct component of human well-being that increases the individual's capabilities (Bloom & Canning, 2003). Health is a form of human capital (Grossman, 1972). Also, literature has argued that population quality is the crucial factor of production and emphasized the merits of investing in education and health (Schultz, 1992; Bloom & Canning, 2000; 2003). In the effort to enhance the contribution of human capital to economic growth among the emerging economies, the United Nations Millennium Development Goals (MDGs) argued that a reduction by three-quarters in maternal mortality, halting the spread of HIV/AIDS, malaria and other major diseases by 2015 will be completely indefinable for Sub-Saharan African countries like Nigeria if sufficient attention is not paid to health expenditures. Akin to this, eradicating illiteracy is also one of the objectives of the (MDGs) that will turn into a mirage if adequate attention is not given to educational expenditure by the federal government.

In the literature, studies have commented on the contribution of human capital to economic growth over the years. In the theoretical literature on growth and development, human capital in terms of education and health 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, Lawanson (2009) argued that government expenditure on health and primary education enrollments have negative influence on growth. Despite the numerous studies on the relationship between human capital and economic growth that are theoretically backed-up with a significant positive relationship; some studies like Lawanson (2009); and Jaiyeoba (2015) using Nigerian data were against these assertions. Moreover, 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 been unable to identify 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 will enable 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 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) in their study found that literacy rate is positively related to per capita output growth, using other indices such as school enrolment, they found out that the sign of the coefficients were theoretically plausible also in the Zimbabwean economy. Arora (2001) in his study discovered that there is a cointegrated relationship between health and income; innovations in health according to him lead to economic growth and not vice versa.

Garba (2002) carrying out a cross-country analysis using regressions showed that there is positive correlation between educational attainment and economic growth and development.

Loening (2002) investigated the impact of human capital on economic growth through the application of error correction mechanisms. He examined two different channels by which human capital is expected to influence growth. The result revealed that a better educated labour force appeared to have positive and significant impact on economic growth via factor accumulation as well as on evaluation of total factor productivity.

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 result indicated that investment in human capital in form of education and training can lead to economic growth because of its impact on labour productivity.

Gyimah-Brempong, Paddison and Mitiku (2006) investigated the effect of higher education human capital on economic growth in African countries using panel data over the 1960–2000 period, a modified neoclassical growth equation, and a dynamic panel. They found that all levels of education human capital, including higher education human capital, have positive and statistically significant effect on the growth rate of per capita income in African countries. Their result differs from those of earlier research that find no significant relationship between higher education human capital and income growth. They also claimed that the growth elasticity of higher education human capital is twice as large as the growth impact of physical capital investment. While this is likely to be an overestimate of the growth impact of higher education, it is robust to different specifications and points to the need for African countries to effectively use higher education human capital in growth policies.

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 decisions of time allocation between learning, working and leisure activity are endogenously determined in the model and react differently to tax policy changes. Learning time and public expenditures on education both improve human capital accumulation and effective labour supply. The simulation results indicated that a tax-financed increase in public spending on education may have significant crowding-out effects in the short run. In the long run, however, higher education incentives may increase the rate of human capital accumulation which in turn could mitigate the negative effects of population ageing. Furthermore, economic and welfare effects analysis shows that the impact depends on the distortions implied by alternative tax instruments and the productivity of public expenditures on education.

Lawanson (2009) in his work used an ordinary least squares model to estimate the role of education and health in human capital investment and economic growth in Nigeria. He found that on the average, human capital actually enhances economic growth in Nigeria although, the government expenditure on

health and primary education enrollment have negative coefficients which are inconsistent with a priori expectation.

Dauda (2010), in his study on human capital formation and economic growth in Nigeria used the endogenous growth model in his investigation into their relationship, she 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 mechanism.

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. The study recommends the need to increase budgetary allocation to the education and health sector and the establishment of sound and well-functioning vocational institute needed to bring about the needed growth in human capital that can stimulate 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. In this regard, policy-makers in conjunction with employers and individuals need to update information on the real labour market value of different qualifications, in order to help them navigate through the increasingly complex education system and make the optimal kinds of educational investment decisions needed to propel economic growth.

Oluwatobi and Ogunrinola (2011) examined the relationship between human capital development efforts of the Government and economic growth in Nigeria. They seek to find out the impact of government recurrent and capital expenditures on education and health in Nigeria and their effect on economic growth. The data used for the study are from secondary sources while the augmented Solow model was also adopted. The dependent variable in the model is the level of real output while the explanatory variables are government capital and recurrent expenditures on education and health, gross fixed capital formation and the labour force. The result shows 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. It evaluates human capital using the GDP as proxy for economic growth; total government expenditure on education and health, and the enrolment pattern of tertiary, secondary and primary schools as proxy for human capital. He concluded that there is 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. These variables were proxied by school enrolment at various levels. Other variables included physical capital formation, and health measured through total expenditure on health. In all primary school input, physical capital formation and health were found to contribute to growth. Secondary school input and tertiary institutions were found to dampen growth.

Isola and Alani (2012) examined the contribution of different measures of human capital development to economic growth in Nigeria. The study used data from Nigeria and adopted the growth account model which specifies the growth of GDP as a function of labour and capital. The model also included a measure of policy reforms. Based on the estimated regression and a descriptive statistical analysis of trends of government commitment to human capital development, 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 results obtained from the estimation of the model under study are indicative of positive and significant effect of human capital on the economic growth of Iran. Thus, it is hoped that the results obtained from this study can attract the attention of authorities to the development and improvement of the human capital of the country.

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. The study claimed that this was due to shortage of skilled labour in the country. Linda (2013) investigated the common opinion on the positive relationship between human capital development and economic growth using simple production function to estimate the human capital impact on labour productivity. The study proxied human capital with average years of schooling from 2000 – 2010 and human capital stock and found that female human capital has positive impact on labour productivity during the period 2000 – 2010.

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. Developing countries have made considerable progress in closing the gap with developed countries in terms of school attainment, but recent research has underscored the importance of cognitive skills for economic growth. He claimed that attention has been shifted to issues of school quality and, in that area developing countries have been much less successful in closing the gaps with developed countries. Without improving school quality, developing countries will find it difficult to improve their long run economic performance.

Mba, Mba, Ogbuabor and Ikpegbu (2013) examined the relevance of human capital development on the growth of the economy using the ordinary least squares (OLS) technique. In the study, the GDP was used as a proxy for economic growth; Per Capita Real Gross Domestic Product, primary school enrolment, public expenditure on education and health, life expectancy and stock of physical capital as proxy for human capital. The study found that there was a strong positive relationship between human capital development and economic growth.

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. A three-variable model is formulated with capital formation as the third variable. The results 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. It means that it is the capital formation and GDP that drives education in mentioned countries, not vice versa. Therefore the findings of the paper supported the point of view that it is higher economic growth that leads to higher education growth. It seems that as the number of enrollments rise, the quality of education declines. Moreover, the formal education systems are not market oriented in these countries. This might be the reason why huge educational investments in these developing countries fail to generate higher growth. By promoting practice-oriented training for students particularly in technical disciplines and matching education system to the needs of the labor market, it will help create long-term jobs and improve the country's future prospects.

Ogujiuba (2013) examined empirically the relationship between economic growth and human capital development. The study made use of secondary data and examined the time series characteristics of the variables selected, to avoid the problems of spurious correlation often associated with non-stationary time series to concurrently generate long-run equilibrium relationships. In order to achieve linearity, logarithmic calculations were used to examine the variables. Generally, the estimation of the model showed that the variables included in the model provided basic information on the nature of impact on economic growth. Findings also showed 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. The paper recommends that educational institutions in Nigeria should be re-structured for quality schooling at the primary, secondary and tertiary levels. In a competitive and globalized economy, this will require strategic planning, increase in capacity utilization by the education sector and rebasing of growth fundamentals.

Eigbiremolen and Anaduaka (2014) employed the augmented Solow human-capital-growth model to investigate the impact of human capital development on national output, a proxy for economic growth, using quarterly time- series data from 1999-2012. The study showed 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. Their results further revealed a relatively inelastic relationship between human capital development and output level.

Jaiyeoba (2015) empirically investigated the relationship between investment in education and health in Nigeria, using time series data from 1982 to 2011. The paper employed 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. The variables: health and education expenditure, secondary and tertiary enrolment rate and gross fixed capital formation appear with the expected positive signs and are statistically significant (except government expenditure on education and primary enrolment rate). The findings of this work have strong implications on education and health policies and considering that they are of great debate in the country. Therefore, the study recommends that in order to accelerate growth and liberate Nigerians from the vicious cycle of poverty, the government should put in place policies geared towards massive investment in the education and health.

In conclusion, 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

The human capital theory places emphasis on investment in humans than in physical capital because the human capital works on the physical capital through adequate skill being acquired to operate the physical capital in place. This prepares the country for a better future since the productive capacity of individuals is improved, thus economic growth will be enhanced. The productivity in an economy depends on the level of efficiency of labour and capital inputs. Increase in investment in human capital will bring about the efficient use of labour and capital resources. The framework adopted in this study is similar to that of Dauda (2010), Adelakun (2011), Mba *et al* (2013), Eric (2013) and Jaiyeoba (2015). These works rely on Solow (1956) and Mankiw *et al* (1992). Solow (1956) attempts to explain long-run economic growth by looking at capital accumulation, labour or population growth, and increases in productivity, commonly referred to as technological progress. Hence, this study 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:

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

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:

$$\ln \frac{Y}{L} = \ln A + gt - \frac{\alpha + \beta}{1 - \alpha - \beta} \ln(n + g + \delta) + \frac{\alpha}{1 - \alpha - \beta} \ln(s_k) + \frac{\beta}{1 - \alpha - \beta} \ln(s_h) \quad 2$$

Where  $s_k$  : the ratio of investment to product,  $s_h$  :human capital investment,  $n$ ,  $g$  and  $\delta$ : 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:

$$\ln y = a_0 + a_1 \ln s_k + a_2 \ln s_h \quad 3$$

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

$$\ln y = a_0 + a_1 \ln ph + b_1 \ln ED + b_2 \ln HE \quad 4$$

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

$$\ln rgdp = a_0 + a_1 \ln ph + b_1 \ln ED + b_2 \ln HE + b_3 \ln(ED * HE) \quad 5$$

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 shown that 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\*HE i.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**

	<b>RGDP</b>	<b>ED*HE</b>	<b>ED</b>	<b>HE</b>	<b>PH</b>
<b>RGDP</b>	1				
<b>ED*HE</b>	0.8966	1			
<b>ED</b>	0.4095	0.9848	1		
<b>HE</b>	0.9195	0.9047	0.9126	1	
<b>PH</b>	0.9248	0.8306	0.9216	0.9403	1

Source: Author, 2015

#### 4.1.2. Time series Properties

To ward off the spurious results the study tested the variables for unit root problem using Augmented Dickey Fuller Test. 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**

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

<i>Rank</i>	<i>Trace Statistic</i>	<i>0.05 Critical Value</i>	<i>Max-Eigen Statistic</i>	<i>0.05 Critical Value</i>
<b>R = 0</b>	214.18	69.82	94.75	33.88
<b>R ≤ 1</b>	119.43	47.86	81.06	27.58
<b>R ≤ 2</b>	38.37	29.80	26.14	21.13
<b>R ≤ 3</b>	12.23	15.49	10.21	14.26
<b>R ≤ 4</b>	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				
<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
ECM(-1)	-0.549777	0.266513	-2.062850	0.0497
$\Delta(ED*HE)$	-0.063821	0.024462	-2.608974	0.0151
$\Delta ED$	77.59104	15.20085	5.104389	0.0000
$\Delta ED(-1)$	-82.46012	35.03001	-2.353985	0.0267
$\Delta HE$	-103.3641	31.72338	-3.258293	0.0032
$\Delta PH$	0.385818	1.221758	0.315790	0.7548
$\Delta RGDP(-1)$	1.459307	0.365804	3.989316	0.0005
$\Delta HE(-1)$	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: $\Delta \text{LOG}(\text{RGDP})$				
<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
$\Delta \text{LOG}(ED*HE)$	0.468042	0.133771	3.498829	0.0015
$\Delta \text{LOG}(PH)$	0.752995	0.091857	8.197465	0.0000
$\Delta \text{LOG}(HE)$	-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; 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 simultaneously in Nigeria so that human capital investment can enhance growth as expected.

## 5. Conclusion

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:

- Government should increase allocation to the 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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