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Human Capital Development and the Nigerian Economy: A Dynamic Specification

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Abstract
We employed the *autoregressive distributed lag [ARDL]* model. This was estimated based on the *Bound co-integration* technique. We indeed attempted to shed light to relationship between human capital development and economic growth in Nigeria. Thus, while it cannot be concluded that human capital development has significant contribution to economic growth in Nigeria because both variables of education and health were not found to be jointly significant, it can be concluded that education has contributed significantly and positively to economic growth in Nigeria in the long run. The finding thus holds that education is a catalyst for influencing economic growth in Nigeria. This finding is in line with theory. Therefore, policymakers should take imperative steps in embarking on strategic education in Nigeria with emphasis on secondary schools.
Key words: *Human capital, GDP growth, Nigeria, ARDL model, education, health*

1. INTRODUCTION

The classical economists have in the past rationalized the usefulness of stocks of labour, capital and technology as means of enhancing the growth rate of *GDP*. In fact, theory has it that the output of an economy grows in response to larger inputs of capital and labour. However, the growth rate of technology is partly determined by highly educated and healthy workers in that the educated and the healthy brings out the efficient use of such labour and capital resources for greater productivity. Health and education are therefore basic factors to productivity, *GDP* growth and hence an instrument through which an economy can be transformed [Risikat (2009)]. According to Okojie (1995), education supplies the essential human capital which is a necessary condition for sustained economic growth. Indeed, empirical evidence abound that education spur economic performance of countries [OECD (2006)]. Despite the tremendous progress in expanding enrollment and increasing years of schooling since 1960, Nigeria is yet to benefit from such development in terms of incessant and sustainable growth [Fadiya (2008)]. In a World Bank Report, 33% of the relevant age group attended secondary school, only 4% attended tertiary schools in 2002, average spending on tertiary education per student in Nigeria is 529.8% of the Gross National Product (GNP) and government spending on education was only 0.9% of the GNP in 2002 [World Bank (2004)].

Economic growth and development are increasingly driven by the advancement and application of knowledge [Risikat (2009)]. In addition, education and health capitals are the two fundamental instruments in the construction of a knowledge economy [World Bank (2008)]. Yet, the potential of the educational and health system in Nigeria to fulfill this responsibility is frequently thwarted by long-standing problems of funding[5]. The macroeconomic policy of investing in education and health capitals in Nigeria is never prioritized. Such less emphasis has been attributed to the existence of macroeconomic disequilibrium in financial allocation to both the education and health sectors. According to Adamu,

> *"…human capital is key determinant of economic growth. It enhances productivity growth and thereby institute the country's competitive advantage"[Adamu (2002)].*

This human capital[6] need is most evident in OECD countries, where investment in education that make up the knowledge-base of an economy is on the decline [OECD (2001)]. This helps to explain why Nigeria's productivity and national output growth have remained consistently sluggish during a decade of international economic expansion. The growing evidence on the role of human capital in the development process has made social sector investment a veritable instrument for sustainable economic growth and hence vital in increasing the productive capacity of an economy. The research question is, has education funding, health expenditure and school

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[5] This does not mean that Nigeria has never indeed articulated growth strategy that links education and health to economic growth

[6] Human capital is defined in this paper as the totality of educational attainment and health capital

enrolments impacted positively on economic performance in Nigeria? Thus, the study is set out to empirically investigate GDP effects of human capital in Nigeria over the period from 1975 to 2012. Section two of this paper is an overview of the profile of government expenditure on education and school enrolment rates in the country. Section three reviews the findings of related studies. Section four discusses the theoretical framework and the econometric methodology applied in the study. Section five analyzes the empirical results and section six concludes the paper.

2. PROFILE OF EDUCATION EXPENDITURE AND SCHOOL ENROLMENT RATES IN NIGERIA

2.1 Profile of Educational Funding in Nigeria

Government's major sources of funding education in Nigeria are government tax revenue and oil proceeds. For example, in 1992, Federal universities revenues are derived mainly from Federal Government (84%), income generation activities (7%) and student fees (9%) [NUC (2008)]. Student fees only accounted for 2% of aggregate revenues in 1992. According to NUC (2002), the cost of running the Federal University system totaled US$210 million in 1999 with financing coming from the Federal Government. Since the oil crisis in the 80s, the proportion of capital budget allocated to education has been consistently lower than the proportion of recurrent expenditure. As at 1998, capital expenditures on education were 2.3% of GDP and 14.2% of the total expenditures of the three tiers of government [see Amagionyeodiwe and Osinubi (2006)]. This low budgeting persists till 2000 when the Federal Government spends about 2.4% of her Gross National Product (GNP) on education [Hinchliffe (2002) UNESCO (2000)]. However, in 2002, the capital allocation increased to 45% of the total. This is in view of an enormous increase in capital expenditure in the Federal Government's budget. In Nigeria, tertiary education receives a larger share of the education budget. Indeed, most Nigerian governments have over the years increased university subventions at the detriment of investments in primary and secondary education. There are also private sources of educational funding. Currently, private sources of funding education in Nigeria account for about 20% [Adewole (2006), Hinclifte (2003)]. The downturn of the economy in the 80s and the adoption of the structural adjustment policies supported by both the World Bank and International Monetary Fund (IMF) have adversely affected the funds available for education [Adewale et al. (2009)].

Government expenditure on education as a percentage of the *GDP* was 1.5% in 1960 (the era of independence), 1.7% between the period of 1985 to 1987 and 0.7% in 1995, 2.4% of GDP in 2002 and 14.3% of government expenditure [CBN (2007)]. This compares very unfavorably with other developing countries such as Jamaica with 4.9% and 7.5% between the periods, 1985 to 1987 and 1995 to 1997 and Malawi with 3.5% and 5.4% between the periods, 1985 to 1987 and 1995 to 1997 [Risikat (2009), UNDP (2003): 313]. At it were, successive Nigerian governments have undermined the need to invest substantially in the educational sector. This fact can be buttressed from the following budget estimates on the educational sector in Nigeria; 6.3% in 2005, 7.8% in 2006 and 8.7% in 2007 respectively to funding education as against the 26.0% recommended by the United Nations Educational Scientific and Cultural Organization [UNESCO (2005)]s. These suggest that government investment on the educational sector in Nigeria has fallen below the minimum standard of annual budget. Evidently therefore, there is a significant shortfall in educational funding necessary to realize sustainable growth in the country.

2.2. School Enrolment Rates in Nigeria

Enrolments rate at the various levels of educational institutions has often been used as a measure of educational attainment in Nigeria. The adult literacy rate on average improves from 52% to 56.2% between 2003 and 2009. During the same period, the number of pupils per primary school fluctuated between 492 and 26,160. The pupil per teacher ratio in primary schools which was 34 in 1970, increased to 40 in 2009. This showed a negative trend and when compared to the United Nations' minimum standard of 25, one can conclude that the country has not performed adequately in terms of education. In Nigeria, primary education enrolls 81% of the relevant age bracket and graduates 69% of these [Hinchliffe (2002), Onweh (1997)].school drop-out rates have persistently be on the increase and the standard of education in the country have reportedly declined [Onweh (1997)]. Secondary education enrollments grew at roughly 10% annually during the 90s.technical education is substantially neglected by policy makers and oriented to the teaching of traditional hand skills that are often unconnected from labour market requirements. Higher education enrolls a very modest 4% of the relevant age bracket. This level of enrollment compares weakly with South Africa, India, Indonesia and Brazil with 17%, 7%, 11% and 12% respectively (Education Task Force, 2000). However, efforts to expand enrollments are severely constrained by inadequate financing. According to UNESCO Institute for Statistics (2009), net primary enrolment ratio for boys is higher than girls in Nigeria (Appendix 1). The recent data shows that completion rate for boys and girls were 80% and 65% of the relevant age cohort respectively. In particular, the data shows that the completion rate at primary level is 72% of the relevant age cohort and the pupil-teacher ratio in primary education in Nigeria stood at 40.

2.3. Economic Growth Record of Nigeria

The Nigerian economy has had a truncated history of economic growth. In the period 1960 through to 1970, real *GDP* growth rate was 3.1% annually (CBN, 20000). During the oil boom era of 1970 through to 1978, *GDP* grew remarkably and positively by 6.2% annually. The boom in the oil sector snatched labour away from the rural sector to urban centers to the extent that the contribution of agriculture to *GDP,* which was 63 percent in 1960, declined to 34% in 1988 due to neglect of the agricultural sector. It was therefore not surprising that by 1975, the economy had become a net importer of basic food stuffs. However, in the 1980s, *GDP* had negative growth rates. In the period of structural adjustment and economic liberalization, 1988 through to 1997 *GDP* responded to economic adjustment policies and grew at a positive rate of 4.0% (World Bank, 1996). In the years after independence, industry and manufacturing sectors had positive growth rates except for the period of 1980 through to 1988 where industry and manufacturing grew negatively by -3.2% and -2.9% respectively (NBS, 1990). The apparent increase in industry and manufacturing from 1978 to 1988 was due to activities in the mining sub-sector, especially petroleum. Capital formation in the economy has not been satisfactory. Gross domestic investment as a percentage of *GDP,* which was 16.3% and 22.8% in the periods 1965 through to 1973 and 1973 through to 1980 respectively, decreased to almost 14% in 1980 through to 1988 and increased to 18.2% in 1991 through to 1998 (CBN, 2000). A critical examination of the foregoing trend analysis reveals that the Nigerian economy performed adequately during the years directly after independence and into the oil boom years. However, in the 1980s the economy was in a recession. The poor performance of the economy during the 1980s became the result of the IMF-World Bank induced Structural Adjustment Program (SAP) which emphasized privatization, market prices and reduced government expenditures. This program was based on the principle that, as *GDP* per capita falls; people demand relatively fewer social goods and more private goods. Nevertheless, real *GDP* growth rate rebounded to 8.3% during the period 1999 through to 2007, reflecting improved economic policy of *NEEDS* era. The impressive real *GDP* growth rate which was sustained till 2007, further declined to 6.3% in the period between 2008 through to 2010 (CBN, 2012).

3. REVIEW OF RELATED EMPIRICAL STUDIES

Several studies have investigated the economic growth effects of human capital as measured in education. Some of which include, Psaharoupolous (1988), Pencavel (1993), DeMeulmester and Rochet (1995), Jorgenson and Fraumeni (1998), Akram and Pada (2009), Risikat (2009), Wadad and Kamel (2009), Ararat (2007), Bakare (2006), Cutler and Lleras-Muney (2006), Babatunde and Adefabi (2005), Nelson (2005), Self and Grabowski (2004), Ayara (2003), Dowrick (2003), Gylfason and Zoega (2003), Michaelowa (2000), Barro (1990), Romer (1990), Lucas (1988), Denison (1985), Grossman (1999), Dahlin (2005), Heckman and Klenow (1997). Psacharopoulos (1988) estimated the following growth effects of education, Belgium (14%), Denmark (4%), United Kingdom (12%), Germany (2%), Argentina (16.5%), Brazil (3.3%), Chile (4.5%), Colombia (4.1%), Ecuador (4.9%), Honduras (6.5%), Peru (2.5%), Mexico (0.8%), Venezuela (2.4%), Canada (25%), Unites States (15%), Japan (3.3%), Malaysia(14.7%), South Korea (15.9%), Ghana (23.2%), Kenya (12.4%) and Nigeria (16%). Pencavel (1993) acknowledged that correlations exist across countries between economic growth rates and schooling enrollment rates. DeMeulmester and Rochet (1995) found that the education is one of the factors that explain economic growth, but the relationship is not always a direct.

In their view, Akram and Pada (2009) reported a positive relationship between education and economic growth. Risikat (2009) established that there is, indeed a long-run relationship between investment in education and economic growth. Wadad and Kamel (2009) posits that by providing new opportunities and expanding the capabilities of people, government spending on education play an imperative role in ensuring productivity and hence a sustainable economic growth. Ararat (2007) employs a model of endogenous growth and a system of linear and log-linear equations to account for different time lags in the possible impact of higher education on economic growth. The empirical finding in the study reveals an increase in access to higher education brings positive results for the per capita GDP growth in the long term. In an attempt to investigate the growth effects of human capital investment in Nigeria, Bakare (2006) uses secondary educational enrolment as a proxy variable for the growth of human capital in Nigeria. Thus, having employed vector autoregressive error corrections mechanism Bakare's study revealed that there is a significant functional and institutional relationship between the investments in human capital and economic growth in Nigeria. Specifically, the study revealed among other things that 1percent fall in human capital investment led to a 48percent fall in the rate of growth in gross domestic output between 1970 and 2000.

Empirical evidence on the positive effects of education on productivity and growth is well documented in the econometric evidence by Cutler and Lleras-Muney (2006). Babatunde and Adefabi (2005) investigated the long run relationship between education and economic growth in Nigeria between 1970 and 2003 through the

application of Johansen co integration technique and vector error correction methodology. Amongst the major findings revealed in their study is the fact that long run relationship exists between education and economic growth. This was ascertained on the basis of Johansen co integration result. Nelson (2005) developed the accumulation theories and assimilation theories of human capital as the engine of growth in an economy. The first predict a direct effect of education on labour productivity as an explicit factor of production embodied in effective labour. This approach has led to the prediction that it is new investment in education that is significant for economic growth [George and Abdullahi (2005)]. In contrast, the second school of thought explores the relation between the level of education and technological change with major emphasis drawing on the link between human capital and disembodied knowledge as manifested in technology. In terms of growth implications, the former school highlights the role of knowledge accumulation while the later focus more on the stock of human capital.

In a cross-country study, Gylfason and Zoega (2003) found that gross secondary-school enrolment, government expenditure on education relative to national income and expected years of schooling are growth-enhancing. In an empirical study of the long-run relationship between education and economic growth, Self and Grabowski (2004) found that each category of education namely, primary, secondary and tertiary has a casual impact on economic growth in India. To verify whether or not the causal impact of education on growth could vary by gender, the authors further categorize the education variables by gender. In this regard, it was evident that female education at all levels (primary and secondary) has potential for generating income growth while males have a casual impact on growth only at primary level. Dowrick (2003) described both effects as growth and level effects respectively. Indeed, education matters for economic growth and development in both the developed and developing countries. According to Barro (1990), Romer (1990) and Lucas (1988) sustained economic growth depends on the levels of human capital whose stocks increase as a result of better education in form of incremental knowledge, new learning and training strategies. Denison (1985) long establishes the significant effects of education on economic growth for the US economy. When investigating the source of growth in the United States, Denison (1985) reported that the increase in schooling of the average worker explained about one quarter of the rise in per capita-income during the period, 1929 to 1982. The analysis by Griffin and McKinley (1992) supports Denison's view.

Griffin and McKinley argue in favor of development strategies that place a greater emphasis on investments in education. This is because investment in education in some cases economizes the use of physical capital and the exploitation of natural resources. In Grossman's model, higher levels of education are theorized to improve the efficiency of gross health capital investment. The thrust of the model is that individuals with higher education are better at producing health. Thus, optimal stock of health is higher for educated person. Thus, given investment in health generated at less cost for educated persons, higher productivity and earnings is obtained for such individuals, while increase in individual's wage is a direct effect of education [Grossman (1999), Dahlin (2005), Heckman and Klenow (1997)]. Thus, essential is the fact that investment in education raises productivity (both in market and non-market activities). Indeed, individuals have an incentive to invest in themselves through, education and training in order to increase their future earnings. But these investments also have costs associated with the direct outlays on market goods and the opportunity costs of the time that must be diverted from competing uses [Grossman (1999)]. The forgoing does not suggest that the relationship between education and economic growth is always positive. This is the crux of Ayara's empirical study. Ayara (2003) using the standard growth-accounting model provided evidence that was not supportive of the relationship between education and economic growth in Nigeria. The findings suggest that education has not had the expected positive growth impact on economic growth. Indeed, education was found not to be growth-enhancing. In spite of Ayara's findings, a general consensus that still emerges from the review of empirical studies is that there exists a positive relationship between education and economic growth.

4. EMPIRICAL MODEL, METHODOLOGY AND DATA DESCRIPTION

4.1. Dynamic Specification: Long-Run and Short-Run Effects

The empirical model follows the specification in Baum, Caglayan and Ozkan (2005) which links an endogenous variable to two vectors of covariates. Thus,

$$LnGDP(real)_t = \beta_1 + \sum_{i=1}^{N} \beta_2 LnHCT_{it} + \sum\sum_{i=1}^{N} \beta_3 LnSSE_{it} + \sum_{i=1}^{N} \beta_4 LnLIT_{it} + \upsilon_t, t = 1,2,3,...,T \quad (4.1)$$

Where *GDP* denotes the endogenous variable given by real gross domestic product, β_1 is a vector of constants, β_2 and β_3 are vectors of slope coefficients, *HCT* is the health capital as measured by life expectancy in Nigeria, *SSS*[7] is the secondary school enrolment rate in Nigeria, *LIT* is the literacy rate in Nigeria and υ is a vector of white noise residuals. Further, we follow the Pesaran and Shin (1995) *Autoregressive Distributed Lag (ARDL)* modeling technique to estimate both the long-run and short-run effects of educational funding expenditure and school enrolment on *GDP* growth in Nigeria. Taking off from the *ARDL [1, 1]* model which is of the simplest form, we have that:

$$y_t = \lambda + \phi_1 y_{t-1} + \delta_1 z_t + \delta_2 z_{t-1} + \upsilon_t \tag{4.2}$$

The short-run effect of a unit change in the regressor on the regressand is derived by taking the partial derivatives of the *ARDL* model,

$$\frac{\partial y_t}{\partial z_t} = \delta_1 \tag{4.3}$$

The long-run effect of a unit change in the regressor on the regressand is derived by solving for $\bar{y}$ having set $y_t = y_{t-1} = \bar{y}$ and $z_t = z_{t-1} = \bar{z}$ to arrive at:

$$\bar{y}\left[1-\phi_1\right] = \lambda + \left[\delta_1 + \delta_2\right]\bar{z} \tag{4.4}$$

$$\bar{y} = \frac{\lambda}{1-\phi_1} + \frac{\left[\delta_2 + \delta_2\right]}{1-\phi}\bar{z} \tag{4.5}$$

Thus, the long-run effect of a unit change in z_t, the regressor on y_t, the endogenous variable is given by:

$$\frac{\partial \bar{y}}{\partial \bar{z}} = \frac{\delta_1 + \delta_2}{1-\phi_1} \tag{4.6}$$

Inverting the lag polynomial in the regressand from the ARDL (1, 1) model gives the following equation

$$y_t = \left[1 + \phi_1 + \phi_1^2 + \ldots\right]\lambda + \left[1 + \phi_1 L + \phi_1^2 L^2 + \ldots\right]\left[\delta_1 z_t + \delta_2 z_{t-1} + \upsilon_t\right] \tag{4.7}$$

The specification implies that the current values of the regressor have an effect on the current and future values of the regressand. A useful practice has been to reparameterize, so that our *ARDL [1, 1]* model becomes:

$$\Delta y_t = \lambda + \delta_1 \Delta z_t - \left[1-\phi_1\right] y_{t-1} + \left[\delta_1 + \delta_2\right] z_{t-1} + \upsilon_t \tag{4.8}$$

The relevant *ARDL [1, 1] ECM* will now be obtained as:

$$\Delta y_t = \delta_1 \Delta z_t - \left[1-\phi_1\right]\left[y_{t-1} - \left(\frac{\lambda}{1-\phi_1}\right) - \left(\frac{\delta_1 + \delta_2}{1-\phi_1}\right) z_{t-1}\right] + \upsilon_t, \upsilon_t \sim IID\left(O, \sigma^2\right) \tag{4.9}$$

We consider the following log version of the ECM model;

$$\Delta Lny_t = \delta_1 \Delta Lnz_t - \left[1-\phi_1\right]\left[Lny_{t-1} - \left(\frac{\lambda}{1-\phi_1}\right) - \left(\frac{\delta_1 + \delta_2}{1-\phi_1}\right) Lnz_{t-1}\right] + \upsilon_t; \upsilon_t \sim IID\left(O, \sigma^2\right) \tag{4.10}$$

The equilibrium error or deviation is the last term in the square brackets. While a positive error is indicative of a downward correction in the current period given the stability condition on ϕ_1, a negative error generates an upward adjustment. Thus, in light of the over-parameterized *ECM*, the *ECM* structure of our *ARDL [1, 1]* empirical model becomes as dynamically specified below.

$$\Delta LnGDP\left(real\right)_t = \varpi_1 + \sum_{i=1}^{N} \varpi_2 \Delta LnGDP\left(real\right)_{t-i} + \sum_{i=1}^{N} \varpi_3 \Delta LnHCT_{t-i} +$$

[7] The authors used secondary school enrolment and literacy rate in the model because the correlation matrix that was examined for variable selection shows that these variables are highly correlated with *GDP* growth as against primary and tertiary enrolment rates.

$$\sum_{i=1}^{N}\varpi_4\Delta LnSSE_{t-i}+\sum_{i=1}^{N}\varpi_5\Delta LnLIT_{t-i}+$$
$$\varpi_6 LnGDP(real)_{t-1}+\varpi_7 LnHCT_{t-1}+$$
$$\varpi_8 LnSSE_{t-1}+\varpi_9 LnLIT_{t-1}+\upsilon_t \qquad \upsilon_t \sim IID(O,\sigma^2 I) \quad ,$$
$$t=1,2,3,...,T \quad (4.11)$$

4.2. Bound Testing Methodology and Data Sources

As earlier mention in this paper, we utilized the Pesaran and Shin (1995) *Autoregressive Distributed Lag [ARDL]* technique that involves the Bound co-integration technique. The *ARDL Bound* model is preferred due to the fact that it can estimate both long-run and short-run coefficients simultaneously in the same model. Indeed, the usefulness of the *ARDL* technique lies in its applicability irrespective of whether the underlying variables in our model are *I(0) or I(1).* The *ARDL Bound* technique can test for the existence of co-integrating relationship amongst variables in level irrespective of whether the underlying regressor are *I(0), I(1)* or mutually co-integrated. This in effect ignores the conventional unit root and co-integration tests which require the order of integration before an appropriate specification of the error correction model *[ECM]*. In order to estimate co-integration relationship, we employed the Pesaran and Shin (1995) and Pesaran et al[2]. (1996, 2001) technique which is based on the F-statistic or the Wald-test statistic for testing the significance of the lagged levels of the variables in the *ARDL ECM*. Thus, the co-integration test hypothesis is given as follows:

$$H_0 : \varpi_5 = \varpi_6 = \varpi_7 = 0$$
$$H_1 : \varpi_5 \neq \varpi_6 \neq \varpi_7 \neq 0$$

However, the asymptotic distribution of the F-statistic or the Wald-test statistic follows a non-standard distribution. Thus, for the co-integration test, two critical values have been derived by Pesaran et at., (1996; 2001). The lower critical bound assumes all the variables are I(0), implying the absence of co-integration and the upper critical bound assumes that all the variables in our model are I(1), meaning that co-integration exits amongst the variables in the model. Annual series were employed for estimation over the sample period, 1975 to 2010. The data were compiled from the International Financial Statistics (IFS) yearbook of the *International Monetary Fund (IMF), Central Bank of Nigeria's, (CBN)* Statistical Bulletin: Government Finances and *World Bank's Socio-Economic Time-Series Access and Retrieval System [STARS]*.

5. EMPIRICAL RESULTS

5.1. Long-run Coefficients: Discussion and Analysis

The Long-run Bound estimates are reported in Appendix **3**. The results show robust estimates for primary and secondary school enrolment rates in Nigeria. Thus, with the exemption of the literacy rate which failed the test of statistical significance, the coefficients of primary and secondary school enrolment rates passes the significance test at the 1% level. The coefficient of health capital, literacy rate and that of secondary school enrolment are 1.005, 0.279 and 1.075 respectively. All the coefficients are indeed positive while only the coefficients of literacy rate and that of secondary school enrolment are statistically significant with their t-ratios given by 0.882, 9.055 and 3.523 respectively. These indeed, empirically invalidates (validates) the hypothesis that health capital (education) contributes significantly to long run economic growth in Nigeria. The finding with respect to health capital is not surprising given the fact that in Nigeria, life expectancy is very low as it stood at 46 years. However, the coefficient of secondary school enrolment passes the test of statistical significance. This on its part rationalized and hence validates the hypothesis that education contributes significantly and positively to growth rate of *GDP* in Nigeria. The results corroborate the fact that education is an instrument of transformation in Nigeria. The finding holds that education is a significant determinant of economic growth in Nigeria. A significant co-integrating relationship between education and economic growth in Nigeria is thus made apparent.

5.2. Short-run Coefficients: Discussion and Analysis

The short-run estimates are statistically robust compared to the long-run estimates. Econometrically illuminating is the fact that the significance of primary and secondary school enrolments rates under the long-run estimation were maintained under the short-run estimation. According to the results, one percent increase in secondary enrolment rate in Nigeria will induce 1.203% increase in the growth rate of real *GDP*. Also, a percentage increase in the literacy rate induced 0.056% increase in the growth rate of the Nigerian *GDP*. It is obvious that education can enhance economic growth in Nigeria. As it were, education is vital instrument for stimulating the growth rate of output in Nigeria. The short-run results indicate that when the growth rate of *GDP* deviates from its equilibrium level, there will be a feedback mechanism of the preceding year's disequilibrium through long-run changes in literacy rate,

health capital and secondary school enrolment rate towards correcting the misalignment. In this way therefore, an allowance has been made for any short-run divergence in the changes in *GDP* from the long-run target. The results therefore hold in expectation.

The diagnostic results are statistically robust. For example, the *Breusch-Godfrey LM* test statistic and *ARCH* test statistic are all economically meaningful to portray the absence of serial correlation and absence of heteroskedatsicity. Also, the Jacque-Bera test statistic and *Ramsey RESET* test statistic shows evidence of well-behaved residuals and absence of mis-specification. The coefficient of model determination having adjusted for degrees of freedom stood at 92.3%, implying that 92.3% of the total variation in the growth of real output in Nigeria is corrected for within one year of adjustment. Thus, having adjusted for degrees of freedom, the estimated error correction model can be adjudged statistically fit and robust. The F-statistic is 105.2. This is highly significant. This indeed is a re-enforcement of the goodness of fit of the estimated error equation. It implies an overall significance of the estimated *ARDL [1, 1]* model and it goes along extent to indicate the existence of a significant linear long-run correlation between the growth rate of real national output and the level of education in Nigeria.

5.3. Bound Results and Stability Analysis

The Bounds results are presented in Appendix 5. The Bound decision rule is simple. Given that the computed Wald-statistic (8.622) exceeds the upper critical bound (4.540), we rejected the null hypothesis of no co-integration in favor of the alternative of co-integrating relationship between the variables in the study. In this study, we consider the need to test for a structural parameter[8] change in our model following studies by Chow (1960), Klein (1965), Cooley and Prescott (1976), Wichern, Miller and Hsu (1976), Picard (1985), Zivot and Andrews (1992), and Lee and Park (2001). The study applied the Brown, Durbin and Evans (1975) two stability tests based on the cumulative sum of recursive residuals *[CUSUM]* and cumulative sum of the squares of recursive residuals *[CUSUMSQ]* are shown in Appendix 4. Both tests plot the cumulative sum of recursive residuals against the upper and lower bounds of the 95% confidence interval at each point. Stability of results is guaranteed as the plots lied within the unit cycle indicating correct specification of the model. The implication is that there are no structural breaks over the period of policy forecast. In other words, no change is observed in the regression parameters of the estimated model. In effect, there are permanent shift in the level or slope (or both) of the series. The estimated parameters of the relationship thus reflect the optimal decision rules which are capable of integrating knowledge about policy decisions.

6. CONCLUSION

The paper evaluated the role of human capital development in the growth rate of *GDP* in Nigeria. The results of the study uphold the fact that education plays a significant positive role in the growth rate of *GDP* in Nigeria. In particular, the coefficient of secondary school enrolment rate is positive and statistically significant. The contribution of health capital to development of the Nigerian economy was found insignificant. Thus, while it cannot be concluded that human capital development has significant contribution to *GDP* growth in Nigeria because both variables of education and health were not found to be mutually significant, it can be concluded that education contributes significantly and positively to the growth rate of *GDP* in Nigeria in the long run. A significant co-integrating relationship between education and economic growth in Nigeria is therefore made apparent. Our finding that educational funding is catalyst for influencing GDP in this study is in line with theory. This further reinforces the fact that the results reported are of policy significance. Therefore, policymakers should take imperative steps in embarking on strategic education in Nigeria with emphasis on secondary schools.

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[8] This is because ignoring structural changes in an empirical study can lead to false conclusion in the statistical fitness and hence in policy evaluation [see Hamilton (1994): 450]. Thus, an assessment of possible instability of coefficient estimates is therefore relevant in our study which has policy significance.

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APPENDICES

Appendix 1: Human Capital and Growth Indicators in Nigeria

Indicator (s)		Figure (s)	Year(s)
Education			
Adult Literacy Rate (age 15 and above)		56.4% (average)	2009*[1]
• *Male*		62.1%	2009*[1]
• *Female*		50.6%	2009*[1]
Gross Primary School Enrolment		85.2%	2009*[1]
Secondary School Enrolment		6,534,000	2007*[1]
Education Expenditure (%) GDP		8.7%	2007*[1]
Education Expenditures (Total)		2,234,817,240	2008*[1]
Global Competitiveness Index*	Score		Rank/134
Secondary Education Enrollment (%)		32.4	118
Tertiary Education Enrollment (%)		10.2	104
Quality of the Educational System		3.7	60
Extent of Staff Training		3.6	88
Internet Access in Schools		2.4	104
Research and Training Services		4.2	52
Growth Performance		US$ (% World Average)	Year(s)
Real GDP per head		948 (12)	2009**
Nominal GDP per head		1053 (12)	2009**
Nominal GDP per head at PPP		2271 (21)	2009**
Investment Productivity *(ICOR)*		2.3%	2008*[1]
Gross Fixed Investment (%) *GDP*		4.3%	2008*[1]
Gross Fixed Private Investment (%) *GDP*		5.5%	2008*[1]

Source: Own Compilation. Note: * EIU, CIA World Fact book, *[1]*[2] CBN (World Bank), a indicates 5- year average

Appendix 2: Nigerian Education Statistics, [Various Years]

Population (1,000)	**Total**	**Male**	**Female**	**Year**
Preschool Age	13421	6794	6627	2006
Primary School Age	23631	11960	11671	2006
Secondary School Age	20204	10202	10002	2006
Total Population (All Ages)	148093	74019	74074	2007
Net Enrolment Ratio (%)	**Total**	**Male**	**Female**	**Year**
Pre-school NER	10.0	10.3	9.7	2004
Primary School NER	63.4	68.1	58.6	2005
Secondary School NER	25.5	27.7	23.4	2005
Gross Enrolment Ratio (%)	**Total**	**Male**	**Female**	**Year**
Preschool GER	13.5	13.7	13.3	2004
Primary GER	96.2	104.8	87.3	2005
Secondary School GER	32.4	35.6	29.2	2005
Entrance and Transition (%)	**Total**	**Male**	**Female**	**Year**
Primary Net Intake Rate	67.1	72.5	61.5	2004
Primary Gross Intake Rate	107.5	116.3	98.5	2005
Repetition and Completion (%)	**Total**	**Male**	**Female**	**Year**
Primary Repetition Rate	2.9	2.8	3.0	2005
Secondary Repetition Rate	3.6	3.7	3.5	2003
Survival Rate to Grade 5	72.6	71.1	74.6	2003
Primary Completion Rate	75.6	83.2	67.8	2005
School Life Expectancy (Years)	8.0	8.8	7.2	2005
Survival Rate to Last Primary Grade	62.6	61.4	64.1	2003
Teaching Staff	**Pupil/Teacher Ratio**	**%Trained Teachers**	**% Female Teachers**	**Years**
Primary School	37.2	49.8	50.8	2005
Secondary School	40.2	Na	35.7	2005

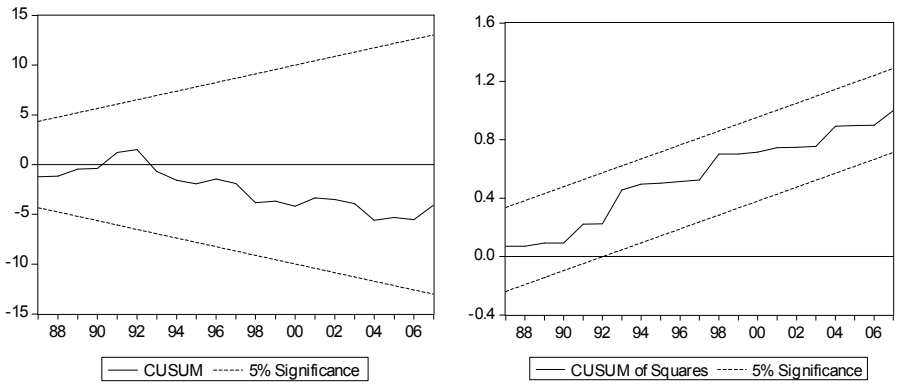
Source: UNESCO Institute for Statistics, Data Centre

Appendix 3: Autoregressive Distributed Lag

ARDL [1, 1] Bound Estimates

Panel A: Long-Run Estimates	
Constant	*1.925 (9.533)****
LnGDP	*1.468 (13.323)****
LnLIT	*0.279 (9.055)**
LnHCT	*1.005 (0.882)*
LnSSE	*1.075 (3.523)****
Panel B: Short-Run Estimates	
$\Delta LnGDP$ ***(-1)***	*1.097 (5.023)****
$\Delta LnLIT$ ***(-1)***	*0.056 (11.382)**
$\Delta LnHCT$ ***(-1)***	*1.096 (1.333)*
$\Delta LnSSE$ ***(-1)***	*1.203 (3.235)****
Panel C: Diagnostic Statistical Results	
Unadjusted R^2	*92.7 %*
Adjusted R^2	*92.3%*
F-statistic [Prob.]	*105.2 [0.0000]*
Newey-West ξ *Statistic [Prob.]*	*1.083 [0.0329]*
Jacque-Bera test statistic	*1.123 [0.0555]*
RAMSEY RESET test statistic	*1.111 [0.593]*
White Heteroskedatsicity test statistic [Prob.]	*1.055[0.2553]*
B-G- LM *Aautocorrelation test statistic [Prob.]*	*0.623[0.0009]*
*Note: * indicates insignificance,* **** indicates significance at the 1% level*	

Appendix 4: Stability Tests Results



Appendix 5: Bound Co-integration Test Results

Level of significance	**Critical Value**		**Computed F-statistic**
	Lower Critical Bound	**Upper Critical Bound**	
1% Significance[t]	4.367	4.540	**8.622***** (5, 19)
5% Significance[t]	3.376	3.646	
10 % Significance[t]	2.141	3.250	

Note: Critical values are taken from Pesaran, et al. (2001), Table Case II, Intercept and no Trend, Page 327. *** indicates co-integration at the 1% significance level and * refer to the number of regressor (t = 6)

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