Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.5, No.5, 2014

Human Capital and Economic Growth: A Three Stage Least Squares Approach

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Abstract
This paper examines the role of government investment in human capital on economic growth of the Nigerian economy. Using time series data from 1980 – 2010, the paper adopted the Ordinary Least Squares(OLS) and 3 Stage Least Squares analytical technique, in an Augumented Human Capital Solow theoretical framework. The study found that human capital alongside with technological development and population growth has a positive relationship with growth of the Nigerian economy. The model confirmed that adequately trained and employed population enhances the growth of the economy It further revealed that the Nigerian experience does not support Solow's hypothesis of high population growth/low productivity relationship. When Solow's full employment assumption is relaxed, high population growth rather enhances productivity. The study also found that education has the greatest marginal impact on life expectancy. Although the private sector benefits maximally from an educated population, she may not invest adequately in human capital development. However, both the rent-seeking and non-rent seeking behaviour of economic agents are estimated to impact positively on economic growth of Nigeria directly or indirectly. The study therefore recommends an urgent need for government to strategically shift her investments towards the continuous development of effective and efficient human capital. This will serve as the foundation for an effective development of an organized private sector.
Key Words: Government Investment, Human Capital, Economic Growth, Life expectancy, Rent-Seeking and non-Rent- Seeking behaviour.

1.Introduction

The introduction of human skills and knowledge as a component of capital in the production system is traceable to the classical economist, Adam Smith. To him, the talents and skills acquired by residents of a country is part of the country's capital stock because it increases the wealth of the nation and the citizenry. Building on Smith's earlier work, Thomas Malthus in his dynamic growth model explains that each country converges toward a stationary per capita income. In this model, when incomes exceed the equilibrium level, death rates fall and fertility rises, and vice versa. In the nineteenth century, this hypothesis failed the empirical test; globally fertility rate fell rather than rose as incomes grew during the period. In response to the failure of the Malthus hypothesis, the neoclassical growth model explained the growth process avoiding Malthus linkage with population and the economy. To them, the growth process adjusts to the rate of investment in physical capital and not in population growth. Therefore, physical capital stock grows more slowly when per capita income exceeds its equilibrium level and more rapidly when per capita income is below equilibrium (Becker, 1994).

Empirical evidence from the later part of the 19th century till date flawed both the early classical and neoclassical theory of growth, given the fact that countries with relative capital base diverged in growth status overtime. As a result, in the early 1960s, human capital theory surfaced in the literature of the neoclassical economists; Solow (1957), Schultz (1961), Grossman (1972) etc. providing its linkage with economic growth and the inter country development divergences. In an earlier attempt to explain inter-country growth differences, the Solow-Swan growth theory emphasized that the rate of growth of any economy is a function of technological accumulation. Solow however ignored the fact that technology is driven by human capital; on its own, it has no capacity to transmit to economic growth. Technology is engineered, developed, and improved upon by human capital. Therefore, human capital remains the bedrock of sustainable development. However, with Solow's breakthrough on what could be called the modern growth theory, the search for a comprehensive growth theory began.

Schultz (1961) who is best known for his pioneering works on education or formal schooling argued that education is an investment good and not consumption good as earlier believed. His estimates of social rates of return on education proved to be significantly high. According to him, there are five ways of developing human capital, thus; the provision of health facilities which affect the life expectancy, strength, vigour and vitality of the people, the provision of on-the-job training which enhances the skill of labour force, improving education at the primary, secondary and higher levels, enhancing the study and extension programmes for the adults, and provision of adequate migration facilities to individuals adjusting to better job opportunities.

Becker (1965) provided an analytical framework for understanding investments in education, on-the-job training, vocational training and other forms of human capital. The subsequent emergence of the endogenous growth theory by the works of Lucas (1988), Mankiw, Romer and Weil (1992) awakened the debate on the role of human capital as a determinant of economic growth. In some of these models, human capital induces growth by stimulating technological advancement and by enhancing labour productivity. Empirical evidence such as Lucas (1988) and the economic reality of the Asian Tigers corroborate the fact that human capital is a major driver of economic growth and macroeconomic performance of any nation (Durlauf, Johnson, and Temple 2004).

However, public expenditure on education and training is not an end on itself. The goal of investment in public education is to create the aggregate skills and attitudes needed for higher levels of productivity and growth. Whether or not such goals would be achieved will depend, not only on the amount of resources invested but also on the efficiency with which the inputs are managed. What then is human capital? Kwon (2009) defined human capital "… as creator, who frames knowledge, skills, competency, and experience originated by continuously connecting between 'self' and 'environment'".

According to Thomas (2008) "the term "human capital" emphasizes the importance of people to organizational success and the need to transform the way employees and organizations interact. Malhotra (2003) defines human capital as "the combined knowledge, skill, innovativeness, and ability of the nations' individuals to meet the tasks at hand, including values, culture and philosophy. This includes knowledge, wisdom, expertise, intuition, and the ability of individuals to carry out value creating tasks and goals". Adelakun (2011) defines human capital as "the abilities and skills of human resources". The United Nation Economic Commission for Africa (UNECA) (1990) gave a broad definition. She defined human capital as the "knowledge, skills, altitudes, physical and management effort required to manipulate capital, technology, and land among other things, to produce goods and services for human consumption".

Each of the integrals of human capital; education and health, has been proven to have a remarkable impact on economic growth. For instance, education has a strong impact on labour productivity, the rate of innovation, healthy living and technological improvements. Increase in stock of knowledge raises productivity in both market and nonmarket (household) sectors. This increased productivity is transmitted to increased wages, improved access to health products, which ultimately leads to higher growth and to a general improvement on the aggregate living standard. Duflo (2000) estimates that in Indonesia, any additional school built per 1,000 children leads to an increase in wages of 1.5 to 2.7%.

However, health as a component of the stock of human capital is both a means and an end. It is a means, because its availability generates more earnings while an end, because it is considered as wealth. Also health is both demanded and produced by consumers. Grossman (1972) argued that it is both consumption and an investment good. It is a consumption commodity because it enters into the individual's utility function and an investment commodity because it determines the availability of time for both market and nonmarket activities. Increase in the aggregate stock of health determines total amount of time to be spent earning money.

Health do not only improve growth by making more market time available for the workers to generate income, it also increases healthy practices resulting to a reduction in the mortality rate and also reduces the fertility rate, contributing to voluntary population control. And as Solow (1957) argues, a higher population growth is negatively related with labour productivity. Ranis, Gustav and Stewart (2000) found that out of the eight economic growth-lopsided nations in 1960-70, all of them moved through the vicious cycle of low economic growth/low human development. Across countries, economic history has a large record of 'massive divergence' in economic growth and development over the several centuries. Across the globe, in the three-four centuries ago, economic indices would show all countries to be relatively poor, if their living standards were assessed in today's economic reality (Durlauf, Johnson and Temple, 2004). Even though, the growth rate of those economies compared in present terms were low, the resulting growth was sustained over time, culminating into increased productivity, output, and a steady rise of the per capita income at the aggregate level. Compared to other nations of Africa and some Asian countries, even though, their economies also grew, it was never consistent or sustained and in most cases, the macroeconomic performance resulted into negative growth.

Pritchett (1997) argued that even in the absence of national accounts data, we can almost be certain that rapid productivity growth was never sustained in the poorer regions of the world'. Parente and Prescott (2000) advanced reasons for the disparity. He argued that although countries have equal access to the same stock of knowledge, "they do not all make equally efficient use of this knowledge …" therefore the gap between the rich and poor gets wider. Interestingly, Jorgenson and Fraumeni (1994) revealed that the US's investment in human capital, between 1948 and 1984, was almost 300% the size of investment in physical capital. Consequently, in the same period, the value of productivity associated to human capital exceeded that of physical capital by over 900%. Thus, the exclusion of human capital in national and public accounts greatly underestimates the true

levels of investment and wealth in an economy. And without a proper estimation of a nation's asset, human capital inclusive, it will be difficult to know whether the economy is on a sustainable path of growth or not. Undoubtedly, increase in national income and per capita income cannot be explained in isolation of the quality of manpower and health status of the populace.

At a conceptual level, increases in a person's stock of knowledge or human capital are assumed to raise his productivity in the market sector of the economy, where he produces money earnings, and in the nonmarket or household sector, where he produces commodities that enter his utility function. Therefore, Grossman (1972) also included health as a durable capital stock that produces an output of healthy time. A population of unskilled and unhealthy citizens surely earns lesser than a population of skilled citizens. The differences among developed and developing nations can better be explained by differences in the endowments of human capital, rather than physical capital. This underscores the reason why the 'Asian Tigers' in the past three decades allocated between 25-35% of their annual budgets to the education sector. The Chinese Analyst, Yasheng (2009) argued that the true success factor for Chinese growth is the huge investments made in human capital development, according to him "… much of that was made in the 1950s, 1960s and 1970s". Therefore, the idea that China succeeded because of its infrastructures is a misplaced argument. It is education that will pay-off in the long run, once a nation has the relevant growth in human capital, then infrastructure will be self-financed by the growth.

Pissarides (2000) advanced illuminating reasons why an economy may be highly educated but fall short of converting this capital to the overall development of her economy. Human beings are involved in rent-seeking activities. "… unlike physical capital, human capital responds to incentives that raise its own private return and that sometimes the higher private rate of return is not derived from growth-enhancing activities. Individuals may seek to extract economic rents from others, or from institutions, instead of putting their efforts into creating new wealth". This is premised on the assumption that rent-seeking activities are not capital intensive. On the contrary, active physical capital produces goods that contribute directly to output growth. One of the challenges of using macro data in this kind of study is the difficulty in identifying the mechanisms that differentiate between the incentives that are growth-enhancing from those that encourage rent-seeking behaviours. He argued further that even if we identify mechanisms which are able to distinguish between these incentives, it is difficult to identify and test the validity of these mechanisms.

2.Statement of the Research Problem

An identified gap in this area of study is the empirical estimation of the ***'rent seeking behaviour'*** of economic agents which has been the bone of contention among the optimistic and the pessimistic school on the impact of education on growth (Pissarides, 2000). Unfortunately, there is scarcity of literature in Nigeria that modelled the relevance of this rent-seeking behaviour to justify government's involvement in funding human capital. Given this gap in literature, this study is empirically set to determine the effect of this rent-seeking behaviour on the growth of the Nigerian economy. Also, it seeks to test the validity of the Solow's high population, low productivity hypothesis using Nigeria to generalize for economies with high unemployment rates. To the best of our knowledge, no study reviewed has looked at Solow's growth hypothesis from this perspective. This is relevant especially in this work where Human Capital Augmented Solow Model is the theoretical framework. Only the work of Barro (2000), (a panel work comparing Organization for Economic Co-operation and Development (OECD) and developing countries) adopted the use of three stage least squares (with a special focus on the education aspect of human capital).

Thus this study is timely given the recent debate that the concept of human capital is generating among economists and policy makers and considering the fact that over the years, the Nigerian government has so much under-invested in the education sector (less than ten percent of budgetary allocation to the education sector) and recently recognizing the role of the human capital on the growth of the aggregate economy has led the government at all levels to implement several reforms aimed increasing the revenue of the sectors with a view to improving on the growth of the aggregate economy.

3.Research Questions

1. What is the trend of government expenditure on education and health over the years?
2. How does government investment in education and health spur economic growth in Nigeria?
3. How does population growth affect productivity in the Nigerian economy?
4. To what extent does the public/private sector contribute to the growth of the Nigerian economy?

4.Research Objectives

The specific objectives of this paper include:

1. To examine the trend of government expenditure on the education and health sectors in Nigeria over the years.
2. To find out how government expenditure on education and health spur economic growth in Nigeria.
3. To consider the effect of population growth on productivity in Nigeria.
4. To examine the degree to which public/ private sector contribute to the growth of the Nigerian economy.

5.Research Hypotheses

The hypotheses designed for this study are stated in its null form as follows:

H_{01}: There is no statistically significant relationship between real government expenditure on education and economic growth.

H_{02}: There is no statistically significant relationship between real government expenditure on health and the economic growth.

H_{03}: Population growth is not statistically significantly related to productivity.

H_{04}: The public/ private sector is not statistically significantly related to economic growth.

6.Theoretical Review

Hypothetically, what exactly is the role of human capital in economic growth and development of a nation? Note that historically, growth theories are traceable to the classical economists.

6.1*The Classical Model*

The classical model is the earliest attempt to explain the growth differences of nations. The model is a short run growth model which assumes that capital explains the differences in the growth divergences of nations looking at the three markets (the labour market, output market and money market) of a hypothetical economy. The classical model set up five equations thus:

$L^d(W/P) = L^s(W/P)$ …….. 1

$L^d = L^s$ …….. 2

$Y^s = f(\acute{K}, L)$ ……..……. 3

$Y^d = c(R-\pi, y) + i(R- \pi)$ …….. 4

$(M/P) = \mu Y$ ……. 5

From the recursive model above, W, P, L, Y, and R are endogenous, while M, $\acute{K}$, and π are exogenous. From the classical model above, equations 1, 2, 3, 4, determine real wage W, employment L, output Y, real interest rate R, and the price level P, respectively while equation 5 determines nominal variable P from where we can deduce nominal wage.

There are two basic features of the classical model that distinguishes it from other growth models, the Keynesians inclusive. The 'classicals' assume that there is full employment in the system i.e the demand for labour equals its supply; there is full employment in the system as such the market clears. Secondly, the real variables are all determined independent of the nominal money stock, the money stock play no role on real variables; therefore, the system exhibits money neutrality.

The above model sets up a platform for an empirical understanding of sources of growth divergences across nations. It is evident in the model that growth is determined by two factors; capital and labour. The stock, utilization, and productivity of these factors explain why some nations do better than others. However, this theory gives justification to the inclusion of physical capital (represented by savings in our model) and labour (represented by unemployment rate) into the growth equations.

6.2 *The Neoclassical Model*

Neoclassical growth theory examines the determinant of long-term economic growth. The 'Neoclassicals' reveal significant contributions from technical progress (through accumulation of factor inputs such as physical capital and labour), defined as an exogenous factor. Solow (1957) and Swan (1956) demonstrated this. At the heart of the neoclassical model lies an aggregate production function exhibiting constant returns to scale in labour and reproducible capital.

Consider the model below:

$Y = F(K, L)$ …… 6

Where Y is output (or income), K is the stock of capital, and L the labour force. The function expresses the output Y under a given state of knowledge, with a given range of available technological techniques, and a given array of different capital, intermediate goods and consumption goods.

With constant returns to scale, output per worker i.e. labour productivity defined as $y \equiv Y/L$ will depend on the capital stock per worker (i.e. capital intensity) $k \equiv K/L$. Under the assumption of constant returns to scale, the relationship between each unit of labour with capital in production does not change with the quantity of capital or labour in the economy.

The aggregate production function possesses diminishing returns on the accumulation of capital i.e., each additional unit of capital used by a worker produces a decreasing amount of output. The Cobb-Douglas function expresses the relationship:

$Y = L^{1-\alpha} K^{\alpha}$, $0 < \alpha < 1$.

Alternatively the per worker production function can be written as: $y = f(k) = k^{\alpha}$

In other words, labour productivity can increase only if there is capital deepening (i.e. if capital intensity increases). The crucial tenet of the neoclassical model is that, under the decreasing returns on capital, output per worker does not increase indefinitely. Assuming:

i. people save a constant fraction(s) of their gross income y;
ii. the constant fraction δ of the capital stock disappears each year as a result of depreciation;
iii. the rate of population growth is n, and population growth will cause the capital stock per worker k to fall at the annual rate nk; then the net rate of increase in k can be written by the following equation as:

$dk/dt = sf(k) - (n+\delta)k = sk^{\alpha} - (n+\delta)k$ …… 7

While the decline in the capital stock per worker due to depreciation and population growth is proportional to the capital stock, the growth of per worker capital through saving is constrained by decreasing returns on capital in production. When the marginal product of capital per worker falls to a sufficiently low level, gross investment will be just sufficient to maintain the existing stock of capital. Hence, the capital stock per worker will, in the long term, converge asymptotically to k*, defined by the equation below:

$sk^{\alpha-} (n+\delta)k^* = 0$ …….. 8

In this steady-state equilibrium, output and the capital stock will both continue to grow, but only at the rate of population growth. The basic weakness of this model is its inability to account for empirical evidence of long-term growth.

Using this framework, Solow (1957) demonstrated that an attempt to account for decades of US economic growth produced an astonishing residual of approximately 85%. Solow attributed most of the residual to technological change. Accordingly, we can modify the neoclassical model by supposing that there is a productivity (or technology) parameter; A in the aggregate function that reflects the current state of technological knowledge, therefore the function becomes; $Y = f(A, K, L)$.

Assuming that productivity increases smoothly over time at a constant growth rate g,

$Y = A_0 e^{gt} K^{\alpha} L^{1-\alpha}$ …… 9

From this, it follows that growth in income is determined by productivity growth g and the growth of capital per worker. Hence, even if the capital stock and the labour force grow at the same rate, output per worker will increase provided that the rate of technical progress is higher than zero (Huggins and Izushi, 2004).

In the traditional neoclassical growth models of Solow (1957) and Swan (1956), the output of an economy grows in response to larger inputs of physical capital and labour. In this model, the role of human capital in the growth process is silent, it is not even considered as a growth determinant. However, it is assumed that the economy under this model obeys the law of diminishing returns to scale. This model hypothesizes that as the capital stock increases, the economy's growth rate decreases, and in order to sustain the growth process of the economy, the economy must take advantage of technological innovations and developments. By this conclusion, Solo and Swan treats technology as exogenously determined outside the system. The scholars also negated the fact that technology has no capacity to drive itself; it is human capital that invents, innovates and sustains technology. Also, the East Asian development experience (over four decades of continuous growth) of the 20th century questioned the validity of the exogenous growth model.

The primary postulation of the standard neoclassical growth theory is the convergence concept, i.e. the incomes of poorer nations would converge with those of wealthier ones in the future. This conclusion is based on the basic assumption that output in an economy is driven by three principal factors; labour, capital and technology. When labour and capital are highly mobile across the international routes, higher returns in a region to either factor will induce migration toward that region, thereby leading to convergence. This theory assumes diminishing returns to both capital and labour, such that increases in output are smaller with each subsequent

increase in either of the factors. As a result, convergence in income is expected to occur across countries. Therefore, wealthier economies are expected to grow more slowly and poorer economies more rapidly, due to both diminishing returns and migration of factors toward economies with higher return (Jena, Philipson & Sun, 2010).

Given the post-World War patterns in income disparities which practically opposed this hypothesis, the search for a sufficient growth theory to explain these disparities continued. It was on this basis that a new school of thought emerged; the endogenous growth model, championed by the works of Romer (1986) and (1990). An important contribution of this model to the growth theory is the introduction and inclusion of human capital into the production function to explain the variation in growth of countries. The endogenous growth model struck out the proposition of the universality of the law of diminishing-returns to-scale with respect to capital accumulation. In realistic terms, if a firm invests in capital, and employs healthy, educated and skilled manpower, because of labour efficiency on the use of capital and technology, there will be an increase in the marginal productivity of labour. Therefore, there will be no slowing down of the economy; the economy will rather record increasing growth. Proponents of this model argue that the impact of the enhanced human capacity will rather lead to a shift in the production function and thus leading to increasing returns to scale rather than decreasing growth rates. Therefore, technology and human capital are determined inside the system i.e. there are "endogenous" to the system.

The addition of technology as an input into the growth process principally differentiates the neoclassical from the classical model. In our model scientific and technical journal articles (UNESCO approved) is used as a proxy for scientific and technological capacity of Nigeria since there is no up to date data on government expenditure on research and development.

6.3 *Frankel-Romer Model: AK Approach to Endogenous growth*

Romer's two seminar papers (1986 and 1990) have its theoretical origin in Frankel's (1962) AK model. Frankel assumed that each firm j in the economy has a production function expressed as:

$Y = \bar{A}j\ Kj^{\alpha}\ \ Lj^{1-\alpha}$ …….. 10

Where Kj and Lj are the firm's own employment of capital and labour. He then extended this production function to the whole economy, assuming that all firms face the same technology and the same factor prices, and will hire factors in the same proportions, which obtains:

$Y = \bar{A}K^{\alpha}\ L^{1-\alpha}$ ……... 11

To endogenise the productivity parameter $\bar{A}$, Frankel assumed that it is a function of the overall capital/labour ratio:

$\bar{A} = A(K / L)^{\beta}$ because in many respects the stock of knowledge depends on the amount of capital per worker in the economy. This is based on the idea that technological knowledge is itself a kind of disembodied capital good. Frankel made another assumption, that although $\bar{A}$ is endogenous to the economy (i.e. related to changes in K and L), it was taken as given by each firm, because the firm would only internalise a negligible amount of the effect that its own investment decisions have on the aggregate stock of capital. When $\alpha + \beta = 1$, equation 11 becomes $Y = AK$. This form of model is referred to as the AK model.

Diminishing returns on the accumulation of capital play a crucial role in limiting growth in neoclassical models like the Solow-Swan model. However, in the Romer model, output grows in proportion to capital because of the effect of knowledge creation activities that counteract diminishing returns. In his 1986 paper, Romer extended Frankel's model by introducing a lifetime utility function:

$w=\int_0^{\infty} e^{-pt}\, u\,\{c(t)\}dt$ …….. 12

Where c(t) is the time path of consumption per person, u(.) is an instantaneous utility function exhibiting positive but diminishing marginal utility, and ρ is a positive rate of time preference. Romer assumed a production function with externalities of the same sort as considered by Frankel, and examined the case in which labour supply per firm was equal to unity (i.e. L=1) and the rate of depreciation δ was zero. If it is supposed that the productivity parameter $\bar{A}$ reflects the total stock of accumulated capital NK where N is the number of firms, then the equation becomes; $\bar{A} = A(NK)^{\beta.}$

In a steady-state growth, consumption and output grow at the same rate g, expressed as:

$g=(N^{1-\alpha}\ A\alpha - \rho)/\varepsilon$ …… 13

If $\alpha + \beta = 1$, then this indicates that the larger the number of firms N, the more externalities there will be in producing new technological knowledge and therefore the faster the representative firm and the economy will grow.

As shown above, the AK approach introduces a specific relationship between technological progress and capital accumulation by assuming that knowledge is a sort of capital good and productivity increases with capital per labour. However, accumulation of knowledge is still external in the relationship since the approach does not explicitly express how knowledge creation is remunerated (Huggins and Izushi, 2004). Interestingly, the recognition of knowledge as a capital good in the endogenous growth theory gives credence to human capital theory. In our model, we use various education and health indicators to proxy human capital.

7.Methodological and Empirical Review of Literature

Isola and Alani (2012) examined the correlation between expenditures on education and health services, and economic growth in Nigeria for the period 1980-2010. Using OLS estimation technique, the model adopted the growth account model which specifies the growth of GDP as a function of labour and capital and also included a measure of policy reforms (SAP). The empirical analysis showed that education, measured by adult literacy rate, and health, measured by life expectancy, had positive relationship with economic growth. Empirical analysis showed that both education and health components of human capital development are crucial to economic growth in Nigeria. Campbell (2011) examined the linkage between higher education, human capital development and economic growth using a simple data descriptive analysis for the time period 1981-2008. In her opinion, higher education is a prerequisite for the production of highly competent experts, which in turn, contributes to the development of organizations and the economy at large. Higher education in any nation is expected to play an important and increasing role in the development of human capital; therefore, the paper insists that higher education remains the foundation for human capital development and economic growth of any nation.

Adelakun (2011) used the Ordinary Least Square method to evaluate the relationship between human capital development and economic growth in Nigeria for the period, 1985-2009. The study found out that human capital development (captured by primary, secondary and tertiary school enrolments, total government expenditure on health and on education) is significantly related to economic growth in Nigeria.. The model revealed that all the regressors accounted for 99% variations in the gross domestic product (GDP) of Nigeria. Total government expenditure on health, secondary and primary school enrolment were not individually significant statistically. However, the study recorded a positive relationship between GDP and primary school enrolment, even though it was still not statistically significant. This study has a few shortcomings that could result to invalidating the parameter estimates. Firstly, there is a tendency of a violation of the normality condition of OLS given that the sample size is small (<30). Secondly, out of the five regressors used to estimate human capital development, only two comply with a priori expectation, four are statistically insignificant. To worsen it, an R^2 of 99.4% could be a suspicious pointer to a high problem of multicollinearity. And finally, given the non-stationary nature of time series data, using the OLS method to model this kind of econometric relationship could result to a spurious estimate, thereby making the parameter estimates invalid for policy purposes.

Omojimite (2011) analysed the effectiveness of the education sector in meeting the human capital needs for economic development in Nigeria using a descriptive analysis on a time-series data from 1970-2005. The analysis found out that there is inadequate funding of the education sector. The data analysis revealed among others; that the returns to education are higher for low income countries than high income countries, the absolute amounts allocated to the sector since 1970 were far below the UNESCO minimum standard, Nigeria occupied the bottom position in 2009 in the medium HDI group of countries, indicating that the country's education sector has a low capacity to produce the required human capital for any meaningful development, Nigeria in Sub-Sahara Africa is still at the very early stages of building the technological capacity required for sustainable development.

Olusegun (2011) examined the impact of human capital formation on economic growth in Nigeria using cointegration and error correction approach for the period 1975-2008. The results confirm a positive long run relationship between human capital formation and economic growth. The author therefore recommended that government should increase its expenditure on education, health and any other social and economic infrastructure that will enhance the productive capacity of labour. Dauda (2010) carried out an empirical investigation on the relationship between investment in education and economic growth in Nigeria, using Johansen cointegration technique and error correction method for the period 1977 to 2007. The empirical analysis indicates a long-run relationship between investment in education and economic growth and the error correction coefficient is both statistically significant and plausible in signs. By policy implication, the study suggests that unless a concerted effort is made by policy makers to enhance educational investment, accelerate growth and development would remain a mirage.

Manuelli and Seshadri (2010) evaluated the role of human capital in addressing the question of divergence in the wealth of nations. This cross sectional study of 10 countries adopted the Ben-Porath model (augmented to

incorporate an early childhood sector). The study captures the idea that nutrition and health care are important determinants of early levels of human capital, and those inputs are, basically, market goods. Nurudeen and Usman (2010) analysed the relationship between government expenditure and economic growth in Nigeria. Using co-integration and error correction methods in a time series data for the period 1970-2008, the authors employed a disaggregated analysis, disaggregating total government expenditure into capital and recurrent expenditure. The results reveal that government total capital expenditure, total recurrent expenditures, and government expenditure on education have negative effects on economic growth, on the contrary, rising government expenditure on transport and communication and health results to an increase in economic growth. However, because of the long-run convergence established in the cointegration analysis, the authors recommended among others; an increase both in capital expenditure and recurrent expenditure of government, including expenditures on education, as well as ensuring that funds meant for the development of these sectors are properly managed. Secondly, government should increase its investment in the development of transport and communication, in order to create an enabling environment for business to strive. Thirdly, government should raise its expenditure in the development of the health sector since it would enhance labour productivity and economic growth.

Ujunwa (2009) examined the impact of human capital development on long-run economic growth in Nigeria, applying OLS to a time series data for the period 1981-2007. Using GDP per capita growth rate as dependent variable, primary education enrolment, post-primary education enrolment, tertiary education enrolment, capital expenditure on education, recurrent expenditure on education, and fixed gross capital formation, all as a proportion of GDP as independent variables. The regression result suggests that human capital development has a positive link with long-run economic growth although the indicators were not significant. The paper therefore recommended, adequate funding and revitalization of Nigerian educational system, raising educational level to create a quality work force, and reforming of the educational curriculum to reflect industry needs of the nation.

Hanushek and Woessman (2007) examined the role of education in promoting economic well-being, with a particular focus on how educational quality affects economic growth. The study concludes that there is strong evidence that the cognitive skills of the population – rather than mere school attainment – are powerfully related to individual earnings, to the distribution of income, and ultimately to economic growth. International comparisons incorporating expanded data on cognitive skills reveal much larger skill deficits in developing countries than generally derived from just school enrolment and attainment. Bloom, Canning, and Chan (2006) examined the impact of tertiary education on economic growth in 103 countries (843 observations) covering a period from 1960-2000 using panel non-linear instrumental regression. The study suggests that increasing tertiary education may be important in promoting faster technological catch-up and improving a country's ability to maximize its economic output. They inferred that Sub-Saharan Africa's current production level is about 23% below its production possibility frontier, indicating that given this shortfall, increasing the stock of tertiary education by one year would shift out Africa's production possibility frontier and increase the rate of convergence to that frontier, resulting in a 0.63% point boost to income growth in the first year and an income gain of roughly 3% after five years. This article challenges the belief that tertiary education has little role in promoting economic growth.

Fu, Dietzenbacher, and Los (2005) measured the contribution of human capital to sectorial output growth in China using a two-step model combining the Lucas endogenous growth model and the input-output model applied to a panel model for the period 1996-2004. The study shows that an increase in the average level of human capital in the secondary sector yields a direct output growth in the sector. The input-output model which examines the indirect effects of direct output growth shows that a direct output growth in the secondary sector (which consists of manufacturing industries) yields more than a proportionate growth in output in the entire economy. By implication, this study suggests that even policy efforts geared at improving human capital performance across sectors of the economy will ultimately lead to growth of the aggregate economy.

Barro (2000) analysed the determinants of economic growth and investment focusing on education as the major component of human capital in a panel of about 100 countries observed from 1960 to 1995 in a three-stage least square analytic technique. Using average years of schooling as education indicator the author concluded that growth is positively related to the starting level of average years of school attainment of adult males at the secondary and higher levels. The results also suggest an important role for the technological diffusion in the development process.

Appleton and Teal (1998) examined Africa's achievements in the formation of human capital, and its impact on economic growth and welfare in a cross sectional analysis. The authors noted that even though Africa has made commendable efforts in raising the literacy rate and school enrolments and improving health, the human capital formation in the case of both education and health in Africa are still lower comparable to those in other

developing nations. Mankiw, Romer and Weil (1992) re-examined the implications of the Solow growth model for convergence in the standard of living of nations. Using a natural regression model fitted into data for the period 1960-1985 comprising of 98, 75 and 22 countries for 3-samples respectively, the evidence shows that international differences in income per capita is best understood using the augmented Solow growth model. In this model, the authors suggest that differences in savings, education and population growth explain most of the variations in cross-country per capita income.

8.Government Expenditure on Education in Nigeria (Stylized Facts)

If government investment in education and health is key to sustainable growth as argued in economic literature, then it is worthwhile reviewing the trend over the years. It is clear that the Nigerian government has not met up with the 26 per cent minimum budgetary allocation to the education sector as recommended by UNESCO. The education sector has been grossly under-funded in Nigeria. The 2012 budgetary allocation of ₦400.15billion representing 8.43 per cent of the total budget CBN (2010) contrary to the UNESCO recommendation is abysmal. According to a breakdown of the 2012 budget, 82 per cent and 18 per cent were allotted to both recurrent and capital expenditure respectively. While Nigeria spends less than 9 per cent of her annual budget on education, Abayomi (2012) reveals that Botswana spends 19 per cent, Swaziland 24.6 per cent; Lesotho 17 per cent, South Africa 25.8 per cent, Cote d'Ivoire 30 per cent, Burkina Faso 16.8 per cent, Ghana 31 per cent, Kenya 23 per cent, Uganda 27 per cent, Tunisia 17 per cent, and Morocco 17.7 per cent).

From 1980 till date, empirical data show that government investment in education and health in Nigeria has been on a continuous decrease in real terms. For instance, in 1980, government expenditure in education was ₦3123.26m. From 1982-1999 (a period of twenty years) real government expenditure in education decreased continually in this manner; -36.5, -7, -17, -13.5, -4, 25.4, -41.7, 38, 64.1, 8.93, -42.65, -47.04, 174.38, 12.56, 7.08, 20.50, -2.44, and 3.97 (figures are in percentages). From 2000-2012, however, the allocation recorded a gradual percentage increase in the following order; 4.67, 10.03, -28.87, 88.18, -29.39, 18.04, 22.85, 33.73, 8.48, 1.8, -19.44, 4.93, 46.11, and 22.47% respectively. In 2000, government expenditure in education increased by four per cent, it also recorded a continuous increase from 2004-2008, however, it took a down-turn in 2009 and grew again from 2010-2012; 5%, 46%, and 23% respectively (Computed from CBN, 2010, Data). Given the continuous increase in inflation and sectoral price differences, while the government ensures a continuous increase in the budgetary allocation to both the education and health sectors, in real terms, this allocation have been on a continuous decrease. Empirical evidence in education expenditure shows that the government is far away from complying with the 26% minimum budgetary allocation to education as advocated by UNESCO.

9.Government Expenditure in Health (Stylized facts)

Heads of State in Africa met from 26-27 April 2001 at a special summit to address the exceptional challenges of HIV/AIDS, tuberculosis and other related infectious diseases. At this meeting, the governments committed to allocating at least 15% of their total annual government budgets to the health sector. Since 2001, a number of countries have made progress in increasing their domestic funding towards the Abuja 15% target. The World Health Organization states that only Rwanda and South Africa have reached 15%, while the African Union Commission reports that six AU member states have met the 15% benchmark – Rwanda (18.8%), Botswana (17.8%), Niger (17.8%), Malawi (17.1%), Zambia (16.4%), and Burkina Faso (15.8%). The health sector was not spared either, in 1980, the government allocated ₦609.61m in real terms to the sector. From 1981 to 2012, the sector recorded an initial percentage growth of 595.6% and gradually decreased in the following manner; -23.3, -18.47, -15.06, -4.32, 26.73, -42.83, 17.05, 44.4, 2.14, -39.22, -68.33, 95.48, -12.96, 15.62, 5.74, -7.34, -19.11, 35.53, -20.40, 97.55, 45.32, -38.88, 50.65, 15.06, 43.11, -4.21, 13.61, -4.06, 9.81, 30.80 and 34.27 respectively (Computed by author from CBN Data).

10.Economic Growth in Nigeria (GDP per employed worker)

There are various indicators of growth and many authors have chosen them based on various reasons. Generally, the various indicators could be compressed into GDP and GNP. Conventionally, GDP is most popularly used; however, the form of GDP used depends on the objectives set to be achieved by the author and the nature of the work carried out. In various works we see researchers using GDP nominal values, real GDP, GDP per capita and most recently GDP per person employed, which the author has argued in line with Durlauf , Johnson and Temple (2004) and Jones (1997) that it is a better measure of productivity and growth. Therefore, in this analysis, the focus is on economic growth measured by GDP per person employed. In the early years of the review period, the economy barely grew. From 1981-1999, the economy recorded almost consistent negative growths for a period of fourteen years. For instance, in 1981, the economy recorded a negative growth of -11%, -3% in 1982, -9% in

1983, -6.2% in 1984, -0.1% in 1986, -0.2% in 1987, -3% in 1991, -2% in 1992, -0.7% in 1993, 2% in 1994, 3% in 1995, 0.1% in 1997, -0.12 % in 1998, and 2.3% in 1999. Not until the early 2000s till date did the economy grow consistently; it recorded scanty growth of 7% in 1985, 4% in 1988 and 1989 respectively, and 2% in 1990 and 1996 respectively (Computed from World Bank Data Base).

11.Government Expenditure on Human Capital: The Sub-Saharan African Experience

Out of the six selected sub Saharan African countries, Nigeria seems to be the worst performer with respect to allocation of resources to the education sector. In this period under review 1998-2010, Nigeria allocated 5.5%, 3.3 %, 9.6%, 5.9%, 10.8%, 6.5%, 6.6%, 6.6 , 8.5 , 7.4, 6.1, 5.0, and 4.7% respectively (budgetary allocation as a percentage of total government expenditure) to the education sector. The health sector felt relatively better than the education sector, for instance, between 1998-2010, the Nigerian government made these budgetary allocation as percentages of total government expenditures in the following order annually; 7.1, 5.4, 4.2 , 3.2, 3.1, 5.1, 7.8, 6.4 , 7.1 , 9.2, 7.7, 5.9, and 4.4% respectively(CBN, 2010). Despite the underinvestment in human capital as revealed above, productivity and growth in the Nigerian economy has been on a consistent increase. For instance within the period 1998-2010, except for the initial negative growth; -0.3 and -2.5% recorded between 1998-1999; the economy grew afterwards in the following order; 2.3% in 2000, 5% in 2001, 17.7% in 2002, 7.6% in 2003, 7.9% in 2004, 2.6% in 2005, 3.5% in 2006, 4.2% in 2007, 3.1% in 2008, 4.4% in 2009, and 4.9% in 2010(Computed by from World Bank Data Base).

Cote d'Ivoire's budgetary allocation to education was 15.9% in 1998, 20.6% in 1999, 20.8% in 2000, 23.2% in 2001, 22.6% in 2002, 21.8% in 2003, 22.1% in 2004, 21.8% in 2005, 20.8% in 2006, 21.7% in 2007, and 24.6% in 2008. Its performance in the health sector is not encouraging, not until 2009 and 2010 did its allocation to the health sector hit 6.8%; it has always ranged from 4.8 to 6.6. However, the impressive allocation to the education sector has not reflected in productivity and growth performance of the nation (World Bank Data Base, 2013).

Ghana is rated by this study as the best performer in investment in human capital; education and health simultaneously. Available data from 2004 till 2010 show that the Ghanaian government allocated between 22.5 to 27.6 percentages of her total expenditure to the education sector. This is a commendable effort to be lauded and emulated by other Sub-Saharan African nations. Her investment in the health sectors has been impressive. In the review period it has been 10.1% in 1998 and 1999 respectively, 8.3% in 2000, 9.8% in 2001, 9% in 2002, 8.7% in 2003, 11.6% in 2004, 15.2% in 2005, 14.8% in 2006, 15.4% in 2007, 12.2% in 2008 and 2009 respectively and 12.1% in 2010. Little wonder why her macroeconomic performance also resulted into consistent positive growths in productivity; 1.51% in 1998 and 1999 respectively, 0.63% in 2000, 1.49% in 2001, 1.67% in 2002, 2.09% in 2003, 2.45% in 2004, 3.04% in 2005, 3.19% in 2006, 3.67% in 2007, 5.49% in 2008, 0.92 % in 2009 and 5.02% in 2010. The above experiences has shown that it is difficult for a country to invest massively in both human capital and not record phenomenal and consistent growth rates in productivity and overall economic growth(World Bank Data Base, 2013).

For a period of six years that data was made available for public analysis, Kenya did not perform badly either. In 2000 and 2001, the government allocated to the education sector 25.8 and 22.6% respectively, 22.1% and 29.2% in 2004 and 2005 respectively and 17.9% in 2006. Her allocation to the health sector has also been under-invested like other Sub-Saharan African countries. The health allocations has been considerably reduced from 8.8% in 1998, to 8.3% in 1999, but slightly increased to 10.5 and 9.2 percentages in 2000 and 2001 respectively, to 8.3% in 2002, and considerably reduced to 8.2 in 2003, to 7.9% in 2004, to 7.6% in 2005, to 7.5% in 2006, to 7.2% in 2007, to 6.1%in 2008, and 7.1% in 2009, and to 5.9% in 2010. The macroeconomic performance did not show a good a reasonable growth in productivity, in fact, in the base year 1998, the economy recorded zero growth, negative growths in six periods and positive growths that never grew beyond 4.17% in 2007.

South Africa's commitment to the education sector shows a decreasing trend in this review period. In 1999, she committed 22.2% of her budgetary resources to the education sector, and gradually, it started going down to 18.1 in 2000, 23.4% in 2001, 18.5% in 2002 and 2003 respectively, 18.1% in 2004, 17.9% in 2005, 17% in 2006, 17.1%in 2007, 16.2% in 2008, 16.9% in 2009, and 19.2 % in 2010. The economy also recorded five periods of negative growth and even where positive growths were recorded, they were stunted growth ranging between 0.36 to 3.31 percentages. Also, available data for Uganda shows a positive commitment to both the education and health sectors. She invested 18.3, 18.9 , and 15% of her total government expenditure in the education sector in 2004, 2009 and 2010 respectively. Her productivity and growth indices were also positive throughout the period under review ranging from 0.98 to 7.27%(Computed from World Bank Data Base)

12.Methodology

This study adopted the Human Capital Augmented Solow Model as presented by Mankiw, Romer, and Weil (1992) as the theoretical framework. This framework posits that the rate of human capital accumulation can affect the steady-state level of output per effective worker. The implication is that the higher the human capital accumulation and savings rate, the higher will be the level of output per effective worker. Therefore, countries who invest in education are predicted to have higher income levels than those who do not, for any given investment rate in physical capital.

12.1 ***The Model***

The systems model is implicitly stated as follows:

Growth Equation: Gdpwt = f(Gdpwt-1, Rget, Ogdpt, Ngdpt, Stjt, Pgt) …….. 24

Education Equation: Pset = f(Pset-1, Mrt, Uert, Pgt, lnogdpt, lnngdpt) …….. 25

Health Equation: Let = f(Rght, Pset,, Stjt, Mrt) ……... 26

However, since the function is non-linear a log transformation is carried out such that the function becomes;

$\ln Gdpwt = \ln\beta 1t + \beta 2\ln Gdpwt\text{-}1 + \beta 3\ln Rget + \beta 4\ln Ogdpt + \beta 5\ln Ngdpt + \beta 6\ln Stjt + \beta 7\ln Pgt + vt$ ….. 30

$\ln Pset = \ln\beta 8t + \beta 9\ln Pset\text{-}1 + \beta 10\ln Mrt + \beta 11\ln Uert + \beta 12\ln Pg + \beta 13\ln Ogdpt + \beta 14\ln Ngdpt + \mu t$ .. 31

$\ln Let = \ln\beta 15t + \beta 16\ln Rght + \beta 17\ln Pset + \beta 18\ln Stjt + \beta 19\ln Mrt + \pi t$ …… 32

Where lnGdpwt, lnPset, lnLet, are endogenous variables, lnGdpwt-1, lnRget, lnOgdpt, lnNgdpt, lnStjt, lnPgt, lnPset-1, lnUert, lnLet-1, lnRght are exogenous variables and used as instruments in the two-stage least squares (with a constant added to instrument list making it a total of eleven instruments) before estimating the system three-stage least squares. B1, β8, and β15, are pre-determined and vt, μt, & πt are stochastic terms, and ln indicate log operators (See table 2 for definition of variables).

This study's a-priori expectation is presented below:

Equation 30; Growth Equation: $\beta 2, \beta 3, \beta 4, \beta 5, \beta 6, \beta 7 > 0$,

Equation 31; Education Equation: $\beta 9, \beta 12, \beta 13 > 0, \beta 10, \beta 11, \beta 14, < 0$

Equation 32: $\beta 16, \beta 17, \beta 18, > 0, \beta 19 < 0$

12.2 ***Estimation Technique***

This study employs time series data for Nigeria for the period, 1970-2010. It applies the Ordinary Least Square (OLS) and systems three-stage least squares (3SLS) analytical technique using E Views 7.1. The OLS regression technique would form the basis for further employment of other techniques where the assumptions of the OLS are violated.

13. Discussion of Results and Conclusion.

Firstly, the OLS multi regression result for the three equations system's model establishes the violations of the assumptions of the classical linear regression model (heteroscedasticity, normality and exogeneity, serial correlation); therefore this paper adopted an alternative econometric technique (the 3-Stage Least Squares) that controls for the observed violations. It is agreed in literature that where the problem of heteroscedasticity is established, the OLS estimator is no longer efficient; Gujarati and Porter (2009) added "not even asymptotically". In scenarios where there is the issue of heteroscedasticity and serial correlation among the residuals the three-stage least squares econometric technique performs better. The Jarque-Bera statistic shows that the residual is not normally distributed in the three equations. We could infer that one of the variables added to the equation lnStj which has five missing values (thereby reducing the number of observations to 26) could be the reason for the non-normality of the residuals in growth and health equations. If the complete sample period of 31years is used, the normality test result could align with the central limit theorem. For the growth, education and health equations, the Breusch-Pagan-Godfrey (BG test) and White's tests of heteroskedasticity show the presence of heteroscedasticity in the residuals at 5 percent significant level.

Instrumental variables were used to eliminate the correlation between the right-hand side variables and the disturbances. The Ramsey RESET (Regression Specification Error Test) showed that the model was correctly specified. The Instruments Validity Tests using the J-Statistics shows that the model is correctly specified and the instruments are invalid.

The data was sourced from the World Bank, Central bank of Nigeria Statistical Bulletin, 2010, National Bureau of Statistics 1980 and the growth indices were author's calculation.

The endogeneity test shows that both the growth and education equation may be exogenous. On the contrary, the endogeneity test for the health equation reveals the presence of endogeneity. The orthogonality C-tests proved all instruments to be exogenous and therefore satisfies the orthogonality condition, in exception of lnMr which is detected to be endogenous and therefore exempted from the list of valid instruments.

The general fitness of the model is quite impressive in the systems model explaining 99 percent, 51 percent and 99 percent of the variations in growth and the human capital sectors of the economy. It is interesting to note that all the regressors have plausible signs in compliance with the a priori expectations. However, four out of the sixteen total regressors were not statistically significant; this may be related to unobserved data or estimation errors.

The 3SLS systems model show that real government expenditure on education, public and private sectors contribution to GDP, scientific and technical journals, population growth and first year lag of GDP per worker impacts positively and significantly on the aggregate growth of the Nigerian economy. The model shows that population growth has the highest impact on growth and productivity; as can be seen from the above result, its elasticity is 1.56. It is not unusual to assume that growth in the previous period enhances growth in the present period. Also revealing is the fact that real government expenditure in education, oil sector GDP and non-oil sector GDP increases the growth performance of the economy.

An interesting aspect of this work is the productivity and population growth relationship as empirically estimated. This model shows that contrary to the Solow hypothesis that high population growth reduces productivity, in the case of Nigeria; high population growth enhances productivity by 156 percent and is highly significant at 99 percent confidence interval. This result can be justified by comparing and understanding our definition of productivity vis a vis Solow's definition as put forward in this work. Productivity as defined in this work is output per worker employed (Y/L) where L stands for employed workers, on the other hand, Solow (1956) used per capita income (Y/L) as a measure of productivity where L stands for labour force under the assumption of full employment. Per capita income and output per worker can only converge when the full employment assumption of Solow holds. In Nigeria where there is double digit unemployment, using GDP per capita as a measure of productivity is potentially biased. Therefore, the positive relationship between population growth and productivity as hypothesized in this study is conditional on the adequate education of the teeming population and the utilization of this developed man-power through gainful employment especially in the productive sectors of the economy.

The education equations show that primary school enrolment of the past year (pse1), population growth (pg), and oil sector GDP (ogdp) impacts positively on the present primary school enrolment, however, mortality and unemployment rate (uer), non-oil sector GDP (ngdp) has negative impact on primary school enrolment. Even though only unemployment and mortality rates are significant in the education equation, the researcher upholds this result given its satisfaction with the a priori expectation. The regression estimate also show that population growth has the highest impact on primary school enrolment i.e. a percentage increase in primary school enrolment of the past period, population growth, oil sector GDP leads to a 30 percent, 62 percent and 10 percent increase respectively in primary school enrolment of the present period. It is normal to assume the result to take this form. Education begets more education, as more kids are enrolled into schools; other parents whose wards are qualified for enrolment but have not yet done so are encouraged to doing so. Also, as the population grows, for a knowledge-oriented economy, primary school enrolment naturally surges up.

However, mortality and unemployment rate and non-oil sector GDP has a negative relationship with primary school enrolment. The study indicates that a percentage increase in mortality rate, unemployment rate and non-oil sector GDP reduces primary school enrolment by 44 percent, 11 percent and 6 percent. As more and more children die (under-five mortality) as a result of the poor management and development of the health sector, primary school enrolment suffers minimal enrolment. Primary school enrolment is basically for children and not adults, except in a few exceptional cases of adult education. However, adult primary education is not captured along in this data. This results show that high mortality and unemployment rate is the greatest challenge to primary school enrolment in Nigeria. It is quite simple to also expect unemployment to hinder primary school enrolment. Parents who are unemployed or are more involved in the informal sector of the economy bother less about enrolling their wards in school; they are more concerned with hustling for food and shelter. Little wonder why in almost all geopolitical zones of the country, children are victims of street hawking and begging! It is not unusual to see teenagers in Nigeria who cannot express themselves in simple official English.

The non-oil sector/primary school enrolment relationship raises an urgent alarm on the need for a massive government's investment on the education sector. Remember that the non-oil sector GDP is used here as a proxy for private sector participation in the economy. The empirical estimates have shown that the private sector is not likely to contribute significantly to the training and education of the masses. Infact, the private sector has a negative impact on primary school enrolment; as estimated, a percentage increase in non-oil sector GDP decreases primary school enrolment by 5 percent. Please note that this result does not suggest a constraint on the activities of the private sector, rather it shows that even if the private sector decides to invest massively in education, it will still not be adequate to power the entire economy for sufficient growth.

This result is quite understandable; the private sector finds it 'extremely' difficult, in some cases impossible, to train her employees or allow them for further academic trainings at the expense of the organization; principally because of the rent-seeking behaviours of economic agents. Individuals trained by organizations can decide any day never to work for such organizations especially as they find greener pastures elsewhere except in cases where there is a binding contract between the sponsoring organization and the potential trainees involved, in most cases you still see those beneficiaries leaving the organizations at the expiration of such contracts. Also, the private sector complains of inefficient man-power being produced by our academic institutions over the years. If tertiary graduates are inefficient for the operations of the private sector, investing in education especially at that level is a misplaced priority for any private operator who is a profit maximizer (which most of them are).

The estimation of the health equation shows that real government expenditure on health (rgh), primary school enrolment, scientific and technical journals exacts a positive impact on life expectancy but a negative relationship with mortality rate. This result also complies with the a priori expectation, and all the regressors are significant at 99 percent confidence interval except real government expenditure on health. It therefore follows that a percentage increase in real government expenditure on health, primary school enrolment, scientific and technical journals increases life expectancy by 0.1 percent, 4.3 percent, and 2.7 percent respectively but a percentage increase in mortality rate reduces life expectancy by -28 percent. Therefore, education holds the greatest impact on life expectancy in Nigeria. This is plausible, as real government expenditure on health increases (capital and recurrent), health workers are better prepared and funded to save lives. It is no surprise that education (even at the primary level) has the greatest impact on life expectancy; medical practitioners must be adequately educated and trained to meet up with the global demands on the provision of health care. Also note that the variable 'scientific and technical journals' is used as a proxy for technology given the non-availability of data on research and development. Therefore, technological advancement impacts positively on life expectancy at birth.

The test of research hypotheses shows that real government expenditure on education, real government expenditure on health exerts a significant marginal impact on economic growth in Nigeria. Population growth exerts a significant marginal impact on productivity. The public sector contributes significantly to the growth of the Nigerian economy. The argument of the pessimist school that individual's rent-seeking behaviour is enough to justify government's non participation in educating the populace is not tenable in Nigeria. Therefore government's expenditure on education is growth enhancing and is justifiable. Also, private sector exerts a significant marginal impact on the growth of the Nigerian economy. Interestingly, the result shows that the private sector influences the growth of an economy to a double degree compared to the growth associated with the activities of the public sector.

Table 1: Summary of OLS Diagnostic Tests for the 3-Equation Model

OLS Equations	R^2	Adjusted R^2	F-Stats	Prob(F-Stats)	Total no of Regressors	Total Number of significant Regressors	B-G Correlation LM Test	Serial JB Test	White Heteroskedasticity Test
Growth	0.996	0.995	793.4	0.000	6	1	NHSC	NNDR	H
Education	0.698	0.619	8.85	0.000	6	1	NHSC	NDR	H
Health	0.996	0.996	1577	0.000	4	4	NHSC	NNDR	H

The total number of regressors included in the table excludes the constant term
NHSC implies no higher order serial correlation
NNDR implies not normally distributed residual
NDR implies normally distributed residual
H implies the presence of heteroscedasticity in the equation

Tale 2: Systems Three Stage Least Squares Result

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	3.554995	0.377976	9.405349	0.0000
C(2) $\ln Gdpw_{t-1}$	0.234301	0.046448	5.044379	0.0000
C(3) $\ln Rge_t$	0.024452	0.008947	2.732880	0.0083
C(4) $\ln Ogdp_t$	0.137377	0.029066	4.726342	0.0000
C(5) $\ln Ngdp_t$	0.262832	0.019788	13.28236	0.0000
C(6) $\ln Stj_t$	0.031344	0.018466	1.697352	0.0949
C(7) $\ln Pg_t$	1.563304	0.145883	10.71616	0.0000
C(8)	4.558164	4.379583	1.040776	0.3022
C(9) lnPse	0.300568	0.175767	1.710041	0.0925
C(10) lnMr	-0.437725	0.450315	-0.972043	0.3350
C(11) lnUer	-0.113976	0.038339	-2.972837	0.0043
C(12) lnPg	0.620464	0.364968	1.700050	0.0944
C(13) lnOgdp	0.104453	0.123864	0.843287	0.4025
C(14) lnNgdp	-0.059687	0.151524	-0.393911	0.6951
C(15)	4.913714	0.039733	123.6696	0.0000
C(16) lnRgh	0.001295	0.001160	1.116412	0.2688
C(17) lnPse	0.042883	0.007470	5.740624	0.0000
C(18) lnStj	0.026929	0.002376	11.33455	0.0000
C(19) lnMr	-0.275227	0.005668	-48.56062	0.0000

GrowthEquation: lnGdpw=c(1)+c(2)*lngdpw1+c(3)*lnrge+c(4)*lnogdp+c(5)*lnngdp+c(6)*lnstj+c(7)*lnpg
R-squared 0.995765 Mean dependent var 13.31362
Education lnpse=c(8)+c(9)*lnpse1+c(10)*lnmr+c(11)*lnuer+c(12)*lnpg+c(13)*lnogdp+c(14)*lnngdp
R-squared 0.629737 Mean dependent var 4.503986
Health Equation:
lnle=c(15)+c(16)*lnrgh+c(17)*lnpse+c(18)*lnstj+c(19)*lnmr
R-squared 0.995224 Mean dependent var 3.848371

Table 3 Data Definition, Measurement and Sources

Variable	Description	Source
Gdpw	**GDP per person employed (constant 1990 PPP $) Converted to naira using official exchange rate (N157) as at April 30, 2013**	**The World Bank**
Ggdpw	**Growth rate of GDP per person**	**Author's computation**
Rge	**Real Total Government Expenditure on Education (millions)**	**Government expenditure on education -CBN Statistical Bulletin, RGE – Author's computation**
Grge	**Growth rate of real Total Government Expenditure on Education**	**Author's computation**
Rgh	**Real Total Government Expenditure on Health (millions)**	**Government expenditure on Health - CBN Statistical Bulletin, RGH – Authors computation**
Grgh	**Growth rate of real Government Expenditure on Health**	**Author's computation**
Ogdp	**Oil Sector GDP (millions)**	**CBN Statistical Bulletin 2010**
Ngdp	**Non-oil Sector GDP (millions)**	**CBN Statistical Bulletin 2010**

Pg	**Population growth (annual %)**	**The World Bank**
Le	**Total Life expectancy at birth (years)**	**The World Bank**
Gle	**Growth rate of life expectancy**	**Author's computation**
Mr	**Mortality rate, under-5 (per 1,000 live births)**	**The World Bank**
Pse	**We use Primary School enrolment (% gross) as proxy for school enrolment. Data for 1996 and 1997 are not available; the author used the average of 1994 & 1995, 1995 & 1996 and to generate data for 1996, 1997 respectively.**	**The World Bank**
Gpse	**Growth rate of Primary school enrolment**	**Author's computation**
Stj	**Scientific and technical journal articles (UNESCO approved) is used here as proxy to measure scientific and technological capacity of Nigeria since there is no up to date data on government expenditure on R&D (These figures are in hundreds)**	**World Bank. Note that data for 1980, 1982-1985 were not available; therefore they are treated as missing values in our estimation.**
Gstj	**Growth rate of Scientific and technical journal articles**	**Author's computation**
Uer	**Unemployment Rate (percentages)**	**National Bureau of Statistics 1980 unemployment data is not available, so it was treated as a missing value.**

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