Economic Growth and Human Capital Development: The Case of Nigeria

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There can be no significant economic growth in any country without adequate human capital development. In the past decades, much of the planning in Nigeria was centered on the accumulation of physical capital for rapid growth and development, without due attention recognition of the important role played by human capital in the development process. The paper examines empirically the relationship between economic growth and human capital development using Nigerian data. The basic macroeconomic variables of concern derived from the literature review are: Growth rate of real gross domestic product (RGDPG), capital expenditure (CE) on education, recurrent expenditure (RE) on education, real gross capital formation (RGCF) was used to proxy physical capital formation, enrolments into primary (PRYE), post-primary (PPE) and tertiary (TERE) educational institutions were used to proxy human capital development. With the aid of Econometric Views (E-Views, version 3.1), the model was estimated using annual data from 1970-2003. The application of the cointegration theory incorporating the error correction mechanism was explored.

It is found that investment in human capital, through the availability of infrastructural requirements in the education sector accelerates economic growth. The physical capital formation proxied by real gross capital formation is correctly signed and statistically significant at 1 per cent level of significance. It indicates that it has a significant impact on Nigeria's economic growth. The paper recommends among others, that the Government should continue to encourage primary and post-primary enrolments as this would add up to improve the low adult literacy level which remains at 57.0 per cent. Also, teachers' salaries and improved working conditions in educational institutions should be accorded high priority by the Government. Finally, the efforts of Government in increasing primary school enrolment through the free compulsory Universal Basic Education should be sustained and made free up to the end of the junior secondary school.

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I. Introduction

No country has achieved sustained economic development without substantial investment in human capital. Several studies have evolved to analyze the channels through which human capital can affect growth (surveys include Barro and Salai-i-Martin, 1995; and Temple, 1999). Many of the literature emphasized the complementary relationship between human and physical capital, noting how imbalances in these two stocks, as well as human capital externalities, can affect economic growth. The highly educated, such as scientists and technicians, appear to have a comparative advantage in understanding and adapting new or existing ideas into production processes.

Human capital development has been described as an end or objective of development. It is a way to fulfill the potentials of people by enlarging their capabilities, and this necessarily implies empowerment of people, enabling them to participate actively in their own development. Human capital development enhances the skills, knowledge, productivity, creativity and inventiveness of people. Thus, human capital development is people and not goods or production-centred strategy of development. Essentially, it is the empowerment of people to identify their own priorities and implement programmes and projects of direct benefit to them. This in turn implies the active participation of people in the development process and the consequent need to evolve institutions that permit and indeed encourage that participation.

We hypothesize in this paper that there can be no significant economic growth in any country without adequate human capital development. In the past, much of the planning in Nigeria was centered on the accumulation of physical capital for rapid growth and development, without due attention to the important role played by human capital in the development process. This hypothesis shall be confirmed through empirical investigation, adopting the technique of cointegration on identified macroeconomic variables from the literature.

People are assets - in fact a country's most valuable assets. It is essential for human development that these assets be deployed sensibly. A defective

incentive system can result in a waste of human resources and often, too, in a higher incidence of poverty and greater inequality in the distribution of income. It is not enough to use existing resources wisely, we must also add to the existing resources through human capital formation.

The Federal Government reform agenda, which is anchored on the National Economic Empowerment and Development Strategy (NEEDS) document, indicated that adult literacy rate of at least 65.0 per cent could be attained by 2007. The NEEDS recognizes the centrality of human capital development in achieving economic growth. It was described as a vital transformational tool. Therefore, the strategy aims at empowering the citizenry to acquire skills and knowledge that would prepare them for the world of work.

In order to justify further the critical importance given to the development of human capital in Nigeria, the objective of this paper is to examine empirically the relationship between economic growth and human capital development using Nigerian data. This will be undertaken with a view to proffering some policy recommendations for the Government in order to improve the human capital development situation in Nigeria and achieve ultimately higher economic growth.

Following the introduction, the paper is divided into four parts. Part 2 covers the theoretical discussions and literature review, while Part 3 highlights some stylized facts about the current situation. Part 4 empirically investigates the impact of human capital development on economic growth, and highlights the findings. Part 5 ends with recommendations and conclusion.

II Theoretical Discussions and Literature Review

Theoretical Discussions

The neoclassical theory of growth developed by Solow (1956) focused macroeconomists' attention throughout the 1960's and 1970's on tangible (physical) capital formation as the driver of economic growth. However, the theory showed that, because of decreasing marginal returns in substituting

physical capital for labour, the accumulation of capital would not indefinitely support a steady rate of growth in labour productivity. The recent literature on "endogenous economic growth" emerged primarily as an attempt to encompass the sources of technological progress and, hence, of sustained productivity growth within the general equilibrium framework of neoclassical growth theory. This literature has evolved to provide several distinct explanations of the process of economic growth, each of which carried particular empirical and policy implications:

- Romer's so-called "AK model" generates sustained growth by assuming that technological change is the unintended result of specializing firms' investments. The creation of capacity to produce more and more specialized intermediate products is assumed to work like Adam Smith's division of labour principle, but at the aggregate level.

- The resulting externalities yield increasing returns to cumulative investment and, thus, the production of goods can avoid the decreasing returns to rising capital-intensity that the neoclassical model posited.

- These externalities imply that the competitive equilibrium growth path does not coincide with that which could be achieved in an optimally planned economy.

The latter conclusion was reached by virtually all the theoretical analysis based upon successive formulations that belong to the family of "endogenous growth models". It carries the implication that growth performance might be improved by public policy action.

Subsequent endogenous growth models have flushed out the process of technological change through the explicit introduction of human capital and/or knowledge:

- Lucas (1988) considers human capital to be another input in the production function, not fundamentally different from physical capital,

but only formed by workers through certain activities (principally education or on-the-job training). By assuming constant returns to human capital formation - on the argument that workers' knowledge "spills over" - the model can achieve a positive steady-state of growth rate in labour productivity.

- A second line of analysis shifts attention away from treating human capital as a direct input to the production of goods; instead, it focuses upon modeling other important activities pursued by skilled labour, especially innovation. Technological change resulting from Research and Development (R&D) investment that creates a greater variety of goods, or improves the quality of existing goods and services is the main form of innovation recognized by the endogenous growth literature following Romer (1986, 1990).

This latter line of analysis brought out the significant point that when human capital is modeled as a factor affecting innovation, the long-run rate of productivity growth is positively affected by the human capital stock's level; whereas, in the Lucas (1988) model, the rate at which human capital is accumulated, relative to the existing stock, was seen as the critical determinant of productivity growth. The early growth models (Harrod, 1939), (Domar, 1946) and (Solow, 1956) explained the long-run growth path of advanced capitalist economies in terms of accumulation of capital and technological progress. The sole concern was the growth in income. From a developing country perspective, the relevance of the model is limited to the extent that increased accumulation of capital is a basic condition for the growth of economies.

The early development theories accepted the importance of structural transformation in the process of economic development, (Lewis 1956, Fei and Ranis 1956). These models through stylized facts of development also explained the importance of attaining structural transformation in the developing economies. The development economics received an added thrust with the publication of Sen (1973, 1984, 1985). Sen divided the whole concept of development in terms of commodities and capabilities. He emphasized the

importance of capabilities over commodity approach. He admits that GNP is a measure of the amount of the means of well being that people have, but it does not tell us what people involved are doing to succeed in getting out of their means, to their ends. From the writings of Sen, one can really make the case that development achievement can not be a matter only of quantification of the income alone, but has to incorporate the actual achievement themselves.

The past developments in the growth theory (Romer, 1986) try to incorporate some of the development variables like human capital, into the growth framework. Thus, the growth theorists' started acknowledging the importance of human capital as an important macroeconomic variable in the growth equation. Recent empirical cross country study (Young, 1994) also acknowledge the importance of increased labour force participation, improvement in education and inter-sector transfer of labour from agriculture, which were earlier part of the development thinking. Thus, there has been an increased tendency of convergence between growth economics and development economics.

There have also been attempts to empirically relate these two concepts of economic growth and human capital development (Ranis and Stewart, 2001). This study focuses on the two-way relationship between economic growth (EG) and human capital development (HCD). The study views HCD as the central objective of human activity and EG as potentially very important instrument for advancing it. At the same time, achievements in HCD themselves can make a critical contribution to EG. There are, thus, two distinct causal chains examined. One runs from EG to HCD, as the resources from national income are allocated to activities contributing to HCD. The other runs from HCD to EG indicating how, in addition to being an end in itself, human capital development helps increase national income. This framework will act as an analytical base for this paper. However, this paper will be examining only one chain, which run from HCD to EG. The investigation will focus on whether HCD via increased public expenditure on social sector activities, gross capital formation and enrolments into primary, post-primary and tertiary institutions leads to higher EG.

Literature Review

The literature of endogenous growth theory has stimulated economists' interest in the empirical evidence available from cross-country comparisons, bearing on the main-level relationships between human capital formation and the growth rate of real output. The growth models view human capital as an input to the production function and predict that growth rate is positively related to the stock of education. Early studies of the effects of human capital on growth, such as Mankiw, Romer, and Weil (1992) and Barro (1991), were based on data sets pertaining to a very diverse array of (more than 100) countries during the post-1960 era. They used narrow flow measures of human capital such as the school enrolment rates at the primary and secondary levels, which were found to be positively associated with output growth rates. Barro reported that the process of catching up was firmly linked to human capital formation: only those poor countries with high levels of human capital formation relative to their GDP tended to catch up with the richer countries. Barro and Sala-i-Martin (1995), among many others, have also included life expectancy and infant mortality in the growth regressions as a proxy for tangible human capital, complementing the intangible human capital measures derived from school inputs or cognitive tests considered; their finding is that life expectancy has a strong, positive relation with growth.

A recent survey by Krueger and Lindahl (1998) from the econometric studies of cross-country growth equations shows more robust results. This contrasts with the evidence from the micro literature of education on income. When allowances are made for measurement errors, the change in stock measures of education is positively correlated with economic growth. Secondly, the evidence with respect to the positive effect of the level of human capital stock on growth rates is much stronger, but the size of this effect varies across countries. Two other well-established results that emerged from the cross-country studies examined by Krueger and Lindahl are: (a) the greater effect of secondary and higher education on growth, compared with primary education, and (b) the seemingly insignificant, or even negative, effect of female education on the growth of output. With respect to the latter, they corroborated Barro (1991) findings in suggesting that the insignificant effect of female

education may be a result of gender discrimination in some countries' labour markets. The argument is that females receive education in these countries but are discouraged from participating in the labour market and, thus, cannot contribute directly to the growth of output.

While there is persuasive evidence about the positive relation between initial human capital levels and output growth and (weaker) empirical support for the relation between changes in human capital and growth, it is not at all clear that this implies a causal relationship running from human capital to growth. Motivated by the fact that schooling has increased dramatically in the last 30 years at the same time that the "productivity slowdown" became manifest in many of the higher income economies, Bils and Klenow (2000) suggest that the causal direction may run from growth to schooling. That relationship would be predicted by a Mincerian model in which high anticipated growth leads to lower discount rates in the population, and so to higher demands for schooling. Of course, both variables might be driven by other factors. From the results of different empirical tests, Bils and Klenow conclude that the channel from schooling to growth is too weak to explain the strong positive association found by Barro (1991), and Barro and Lee (1993), as described above. But, they argue, the "growth to schooling" connection is capable of generating a coefficient of the magnitude reported by Barro. Lucas (1988) includes human capital as an additional input in the production of goods, while retaining the other features of the neoclassical growth model. In the model, the labour force can accumulate human capital, which is then used together with physical capital to generate the output of the economy. In one version of the model, human capital is acquired through time spent in an (non-productive) educational process, introducing a trade-off for workers between employing time to produce output and using it to gain further human capital that will increase their marginal productivity when working in subsequent periods. In another version of the model, human capital is gained by the workers through on-the-job training, and so the time employed working increases their productivity later on. The accumulation of human capital involves a sacrifice of current utility in the form of less current consumption in the case of education, or a less desirable mix of current consumption goods when on-the-job training is considered.

In the Ramsey (1997) models, the equation describing physical capital accumulation is sufficient to determine the dynamic evolution of output. To specify the growth path when human capital is included, it is necessary to consider an additional sector where the growth of human capital takes place. Given that physical capital still has diminishing returns, the required assumption for the model to exhibit a positive growth rate of output per worker in the steady state is that the "technology" for generating human capital has constant returns. This means that the growth of human capital is assumed to be the same for a given level of effort whatever the level of human capital attained. With this assumption, the rate of output growth (per worker) is positive and increasing in the productivity of education or on-the-job training in the creation of human capital.

Azariadis and Drazen (1990) model the mechanism of human capital transmission across generations in the more plausible framework of an overlapping generation model (Lucas followed Ramsey in the simplifying assumption that households, as well as firms, live infinitely). In these models agents inherit the human capital accumulated by the previous generation; they then decide how much time to devote to training a young graduate in acquiring further skill in technology that increases labour quality, thereby, affecting their marginal productivity when older. Since a given generation deciding its own human capital investment does not take into account the inter-temporal spill-over effect upon the human capital endowment of future generations, there is a technological externality that can result in constant or increasing returns to human capital at the social level. This state of affairs could be ascribed to the impossibility of contracting with the future generations, and sometimes is described as allocation inefficiency due to "incompleteness of markets". The source of this problem affecting human capital investment is, therefore, rather different from the set of conditions previously seen to impair the allocative efficiency of markets that do exist.

Acemoglu (1998) has offered a formal demonstration of how positive spill-over effects (pecuniary externalities) created by workers' educational and training investment decisions can give rise to macro-level increasing returns in human capital. His model supposes that workers and firms make their

investments in human and physical capital, respectively, before being randomly matched with one another. The direct consequence of random matching is that the expected rate of return on human capital is increasing in the expected amount of (complementary) physical capital with which a worker will be provided. Similarly, the return on physical capital is increasing in the average human capital that the firms expect the workers to bring to the job. Hence, an increase in education for a group of workers induces the firms to invest more in tangible assets, thereby increasing the return to all workers in the economy. Through a similar argument, the model is seen also to imply that there are "social increasing returns" in physical capital.

In the early 1990s pioneering econometric studies (based on international panel data for a widely diverse array of countries during the post-1960 era) provided empirical support for the conclusion that human capital formation was among the factors that significantly affected the aggregate level of economic growth.

- They found that success in the process of catching up internationally in terms of GDP growth was positively related to the overall social rate of human capital formation.

- Furthermore, the poor countries that were tending to catch up with the higher income economies were restricted to those that were maintaining levels of investment in formal education which were high in relation to their respective GDP levels.

More recent econometric studies have yielded three robust empirical findings:

- There is only weak empirical support for the hypothesis that changes in the human capital stock affect growth rates.

- There is strong statistical support for the hypothesis that the relative level of the stock of human capital (in relation to the labour force or aggregate output) has a positive effect on growth rates.

- The magnitude of the "level effect" of the human capital stock is itself far from uniform across the distribution of economies; the impact on growth rates does not vary linearly with the relative size of the stock but, instead, becomes proportionately smaller among the economies where the average educational attainment is already high.

The broad interpretation of these findings in the context of recent growth models is that raising the general level of educational attainment interacts positively with other forces - among them the accumulation of complementary physical capital and the application of new technologies. Higher human capital intensity thus permits countries to accelerate their productivity growth rate and narrow the relative size of the per capita real income gaps separating them from the leading economies.

Maintaining a high average level of educational attainments, and correspondingly high rates of investment in other forms of human capital (e.g. health, internal spatial and occupational mobility), would appear to serve as a *stabilizing* force - although not a guarantee - against continuing secular decline in a country's relative per capita income position. Most of the theoretical literature on economic growth focuses on the role that investment in formal education plays in modern economies.

III. An Overview of Human Capital Development in Nigeria*

Education affects every individual of a country. The general consensus has been that there is a high positive relationship between a rise in educational expansion and economic development. The old 6-5-2-3 inherited from the colonial masters was replaced with the 6-3-3-4 education system in 1977. This means that pupils will spend six years to get primary education, six years in secondary school (three years of junior secondary and three years of senior secondary education) and four years of higher education.

In Nigeria, the Federal government is principally responsible for the tertiary

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* *This section benefits from Central Bank of Nigeria (2002).*

institutions. However, several State governments also fund this level of education. Indeed, with the approval of the eight new universities, the number of the nation's private universities has risen to 23, funded by private individuals. Secondary education is mainly a State government responsibility though there are some federal secondary schools. Primary education is a local government responsibility, but there exist also a National Primary Education Commission (NPEC) that draws up the curricula for the schools in this category. There has also been collaboration by corporate bodies, individuals, religious organizations, international agencies, non-governmental organizations (NGOs) and community-based organizations (CBOs) with the three tiers of government. The level of expansion in the educational system from 1980 to 2003 is as indicated in Table 2.

The enrolment in primary school was 12.2 million in 1980, declining thereafter to 11.5 million in 1987. Since 1988, both enrolment and number of primary schools have increased progressively to 26.3 million and 52,815, respectively, in 2003. The student-teacher ratio in primary school which stood at 35 in 1980 rose to 44 in 1986, declining thereafter to 36 in 1990. From there it rose to 60 in 1995 declining afterwards to 53 in 2003 (Central Bank of Nigeria, 2004). When compared to the United Nations stipulated minimum of 25, it is seen that Nigeria has not performed well.

Post-primary enrolment was 1.9 million in 1980; it rose to 3.4 million in 1984. By 1989, enrolment had declined to 2.7 million, rising afterwards to 2.9 million in 1990. From 1990, post-primary enrolment had risen steadily, reaching 7.1 million in 2003. In the same manner, the number of schools rose from 6,001 in 1990 to 11,918 in 2003. The student-teacher ratio increased from 28 in 1980 to 38 in 1984. It rose to 40 in 1995, declined to 37 in 1996. In 2003, the ratio fell to 38 compared to 40 recommended by the National Policy on Education (Central Bank of Nigeria, 2004). This is a noticeable improvement, which should be sustained. The number of universities was 13 in 1980; it rose to 16 in 1981 and 28 in 1987. In all, the number of tertiary institutions increased from 104 in 1988 to 202 in 2003. Similarly, total enrolment rose from 219,119 in 1988 to 1.3 million in 2003.
According to Central Bank of Nigeria [2004:165], enrolments into primary

schools throughout the country are as follows: 24,895,446 in 2000; 27,384,991 in 2001; 29,575,790 in 2002; 26,292,370 in 2003 and 28,144,967 in 2004. The percentage enrolments into the three levels of education (primary, secondary and tertiary) relative to the country's population indicate that for primary, it increased from 21.6 per cent in 2000 through 2001 to 24.2 per cent in 2002. However, it declined to 20.8 per cent in 2003 and, thereafter, rose to 21.7 per cent in 2004 (Table 1).

Table 1: Comparing the School Enrolment Levels with Nigeria Population (Per cent)

	2000	2001	2002	2003	2004
Primary	21.6	23.1	24.2	20.8	21.7
Secondary	5.5	5.9	6.1	5.6	5.2
Tertiary	0.9	1.0	1.0	1.0	0.3

Source: Central Bank of Nigeria Annual Report and Statement of Accounts, 2004, P.165.

Table 2
Educational Development In Nigeria (1980-2000)

Year	Number of Educational Institutions			Enrolment		
	Primary	Post-Primary[1]	Tertiary[2]	Primary	Post-Primary	Tertiary
1980	35,875.0	3,218.0	13.0	12,206,291.0	1,877,057.0	57,742.0
1981	36,683.0	4,969.0	16.0	14,026,819.0	2,473,673.0	74,607.0
1982	37,611.0	5,603.0	19.0	14,964,143.0	2,880,280.0	87,066.0
1983	37,888.0	5,894.0	24.0	15,308,384.0	3,334,644.0	104,683.0
1984	38,211.0	6,190.0	27.0	14,383,487.0	3,402,665.0	116,822.0
1985	35,281.0	5,876.0	24.0	13,025,287.0	2,995,578.0	126,285.0
1986	35,433.0	5,730.0	24.0	12,914,870.0	3,094,349.0	135,783.0
1987	34,266.0	6,092.0	28.0	11,540,178.0	2,934,349.0	150,613.0
1988	33,796.0	6,044.0	104.0	12,690,798.0	2,997,464.0	219,119.0
1989	34,904.0	5,868.0	118.0	12,721,087.0	2,723,791.0	307,702.0
1990	35,433.0	6,001.0	122.0	13,607,249.0	2,901,993.0	326,557.0
1991	35,446.0	5,860.0	124.0	13,776,854.0	3,123,277.0	368,897.0
1992	36,610.0	6,009.0	130.0	14,805,937.0	3,600,620.0	376,122.0
1993	37,812.0	6,162.0	133.0	15,911,888.0	4,150,917.0	383,488.0
1994	38,000.0	6,300.0	133.0	16,683,560.0	4,500,000.0	202,534.7
1995	39,677.0	6,452.0	138.0	17,994,620.0	5,084,546.0	391,035.0
1996	41,660.0	6,646.0	138.0	19,794,082.0	5,389,619.0	689,619.0
1997	43,951.0	7,311.0	138.0	21,161,852.0	5,578,255.0	862,023.0
1998	45,621.0	7,801.0	138.0	22,473,886.0	5,795,807.0	941,329.0
1999	47,902.0	8,113.0	144.0	23,709,949.0	6,056,618.0	983,689.0
2000	48,860.0	8,275.0	144.0	24,895,446.0	6,359,449.0	1,032,873.0
2001	49,343.0	8,275.0	142.0	27,384,991.0	6,995,394.0	1,136,160.0
2002	47,694.0	8,351.0	178.0	29,575,790.0	7,485,072.0	1,249,776.0
2003	52,815.0	11,918.0	202.0	26,292,370.0	7,091,376.0	1,274,772.0
2004	65,627.0	13,333.0	215.0	28,144,967.0	7,091,376.0	6,745,186.0

[1] This includes secondary, technical/vocational schools and teacher training colleges.
[2] This includes polytechnics/colleges of technology, colleges of education and universities. However, data from 1980-1987 are for universities alone

Sources: 1. CBN, Nigeria's Principal Economic and Financial Indicators 1970-1990.
2. CBN Annual Report and Statement of Accounts (various issues).

The data in Table 1 above shows that the proportion of primary school enrolments to the country's population remains abysmally low. Inadequate funding of education generally may not be the only problem. There is the cultural dynamics to it. What do you do with a parent (probably a petty trader, a

farmer, an artisan, etc.), who believes that it is better for the ward to assist him/her in his/her professional line, rather than going to school that is largely under-funded and unaffordable? In addition, the observed wide disparity between the number of primary, post-primary school enrolment and the tertiary education enrolment is attributable to high drop-out rate that cuts across the three levels of education (CBN 2002: 100-101). Other likely factors are economic, demographic, socio-cultural and religion.

The expansion in the educational system was accompanied by structural defects, inefficiency and ineffectiveness, which affect Nigeria's level of human capital development and utilization. There is also the problem of inadequate funding and poor infrastructure and facilities for learning. Nigeria's educational system tends to produce more graduates who lack the technical skills for employment than those the economy requires to remain vibrant. The core development related disciplines such as agriculture, engineering, and information and communication technology (ICT) do not attract many students, as most students go for arts and business-oriented courses. This inadequacy and lopsided educational system resulted in decreasing technical skills and threats of social insecurity by jobless youths. Other problems include inadequate resource input and consequent low output and overdependence on government as an employer of labour. Available data show that adult literacy, which was 50.1 per cent in 1989, rose to 55 per cent in 1993 and 1994. It remained at 57 per cent from 1995 to 2003. This data indicate that about 43 per cent of Nigerians are illiterate, compared to 40 per cent in China, 33 per cent in Zimbabwe, 23 per cent in Indonesia and less than 20 per cent in Brazil and Mexico (Adenuga, 2002).

IV. Empirical Investigation of the Impact of Human Capital on Economic Growth

Methodology and Data Source

Following the review of other empirical works, the basic macroeconomic variables of interest derived from the earlier review are: real gross domestic product (RGDPG), capital expenditure on education (CE), recurrent

expenditure on education (RE), real gross capital formation (RGCF) to proxy physical capital formation, enrolments into primary (PRYE), post-primary (PPE) and tertiary (TERE) educational institutions to proxy human capital development. The coverage for each of the variable spanned 1970 to 2003. This is to ensure enough data points for the econometric analysis. We would have introduced labour force; however, data on this variable were not available in sufficient manner for estimation.

With the aid of Econometric Views (E-Views, version 3.1), the model is estimated using annual data from 1970-2003. The statistics were compiled from various issues of the Central Bank of Nigeria (CBN) Annual Report, CBN Statistical Bulletin, December 2003, CBN-Nigeria: Major Economic, Financial and Banking Indicators, September 2004, Federal Office of Statistics (now National Bureau of Statistics (NBS)) Economic and Statistics Review (various issues).

Estimation procedure follows the two steps procedure of Engle and Granger (1987), Granger (1986) and Hendry (1986). The ordinary least squares method (OLS) was adopted as the estimation technique.

The application of the cointegration theory incorporating the error correction mechanism was explored. The process examined the time series characteristics of the selected variables, to overcome the problems of spurious correlation often associated with non-stationary time series and generate long-run equilibrium relationships concurrently. The variables were examined in logarithmic forms to help in achieving linearity. The data series were tested for stationarity using the Augmented Dickey Fuller (ADF) test as the starting point to assess the order of integration.

Model Specification

Given the foregoing discussion, the following model is specified in order to determine the impact of human capital formation on economic growth in Nigeria. The functional form is:

RGDPG = f (CE, RE, RGCF, PRYE, PPE, TERE)---------- (1)

Where:
RGDPG = Growth rate of real gross domestic product
CE = capital expenditure on education
RE = recurrent expenditure on education
RGCF = real gross capital formation
PRYE = primary education enrolment
PPE = post-primary education enrolment
TERE = tertiary education enrolment

The turn-out from the discussed institutions would have been preferred as a proxy for human capital development, but for inadequacy of data. Thus, it is proxied by the three components of enrolments in educational institutions. The inclusion of these three variables separately affords the opportunity to examine their individual impact on the economic growth process.

Taking the natural logarithmic of both sides of equation (1) gives:

$$LRGDPG = a_0 + a_1 LCE + a_2 LRE + a_3 LRGCF + a_4 PRYE + a_5 LPPE + a_6 LTERE + U \text{ ----------} (2)$$

The a's are the coefficients to be estimated and their *a-priori* expected signs are that all the coefficients are positively related to RGDPG, while U is the random error.

Table 3: Results of Unit Root Tests

Variable	ADF-Test Statistics with Constant	Critical Value at 1%	Order of Integration
ΔLRGDP	-4.0734	-3.6576	I(0)
ΔLCE	-4.2434	-3.6576	I(0)
ΔLRE	-4.7868	-3.6576	I(0)
ΔLRGCF	-4.3291	-3.6576	I(0)
ΔLPRYE	-4.8507	-3.6576	I(0)
ΔLPPE	-4.5418	-3.6576	I(0)
ΔLTERE	-5.9268	-3.6661	I(1)

From the static regression of the model using the explanatory variables at their levels, the residuals were generated and the linear combination of the variables was confirmed to be I(0) implying that these variables are cointegrated.

Table 4: Result of the Unit Root Test for the Residual

Variable	ADF-Test Statistics with Constant	Critical Value at 5%	Order of Integration
ECM	-3.1909	-2.9558	I(0)

With these results, we proceed to specify the short run dynamic equation. The short-run dynamics is specified as an error correction model (ECM) incorporating the one period lagged residual from the static regression. The autoregressive distributed lag technique was used with a maximum lag of 2 to obtain an over-parameterized equation. Finally, through sequential reduction, a parsimonious result was obtained, (Table 5).

Table 5: Parsimonious Regression Result

Dependent Variable: DLRGDP				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.153700	0.087218	1.762255	0.0903
DLCE	0.557602	0.097002	5.748363	0.0000
DLRGCF	0.676772	0.262005	2.583056	0.0160
DLPRYE(-1)	-2.166887	1.275068	-1.699428	0.1017
DDLTERE(-1)	-0.768280	0.334231	-2.298648	0.0302
ECM(-1)	-0.436383	0.118371	-3.686567	0.0011
R-squared	0.675661	Mean dependent var		0.239217
Adjusted R-squared	0.610793	S.D. dependent var		0.678279
S.E. of regression	0.423155	Akaike info criterion		1.289827
Sum squared resid	4.476496	Schwarz criterion		1.567373
Log likelihood	-13.99232	F-statistic		10.41595
Durbin-Watson stat	2.321825	Prob(F-statistic)		0.000017

Analysis of Findings

The above result indicates an R^2 of 0.68, which shows that the model explains about 68 per cent of the variations in RGDPG. It is found that the parameter estimates for human capital development lagged one year (proxied by PRYE and TERE) are negatively signed and the t-statistic are statistically significant at about 10 and 5 per cent levels, respectively. It indicates that the variables have significant negative impact on Nigeria's economic growth. The capital expenditure on education (CE) is correctly signed and statistically significant at 1 per cent. This empirically shows that investment in human capital, through the provision of infrastructural facilities in the education sector

accelerates economic growth. The physical capital formation proxied by real gross capital formation is correctly signed and statistically significant at 1 per cent level of significance.

Considering primary education enrolment (PRYE), the result is against the expected positive relationship between this variable and RGDPG, though its coefficient is statistically different from zero at about 10 per cent. For tertiary education enrolment (TERE), the coefficient of its one year lag is negatively related to economic growth, but the t-statistic is statistically significant at 5 per cent. The ECM is negative as expected, and significant at 1 per cent level of significance. Therefore, the model is able to correct any deviations from the long-run equilibrium relationship between RGDPG and the explanatory variables. At 2.32, the Durbin Watson statistics does not suggest any evidence of autocorrelation.

The other diagnostic results are as presented below:

Summary of Diagnostic Tests for the Model

Test	F-Statistic	Probability
Jarque-Bera Normality	0.9325	0.6274
Breusch-Godfrey (B-G)	1.0241	0.3749
White Heteroskedasticity	0.4549	0.8997
Ramsey Reset	1.5857	0.2264

The outcome of the diagnostic tests as shown above is satisfactory. The Jarque-Bera test for residual normality assumptions is not violated, therefore the inference is valid. The result showed that the error process could be described as normal. The B-G is found to have stronger statistical power. The B-G test result indicated the absence of serial correlation. Also, the absence of white heteroskedasticity and specification error was validated. The results of the test suggest that the model is well specified and robust for policy analysis.

Further tests were done to examine the model for stability by examining the *recursive residuals* of the estimate. Figure 1 shows that in 1993 the recursive

residual went beyond the ± 2 s. e. bounds. The 1998 figure was also close to the bounds. However, in general the residuals were within the bounds. The *cusum of squares* tests gives a better result as the values were within the 5 per cent bound (Figure 2). The tests thus far support the view that the model is relatively stable as shown below:

Figure 1: Recursive Residuals

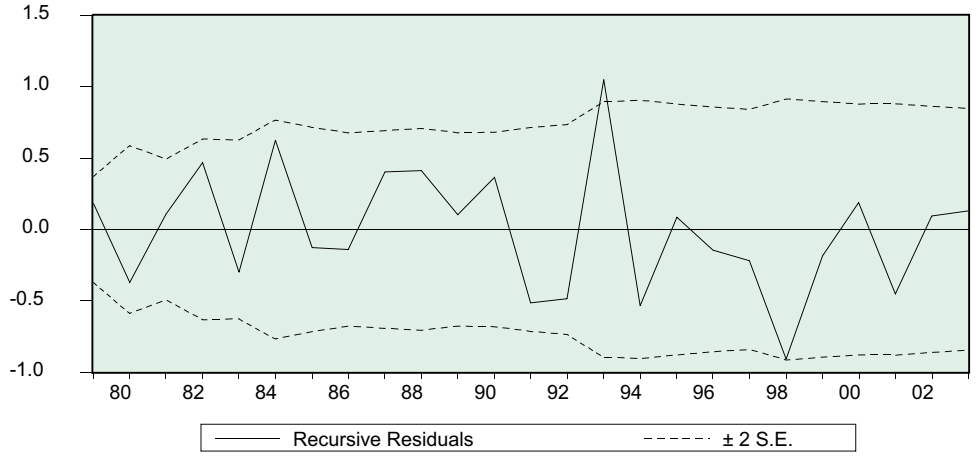
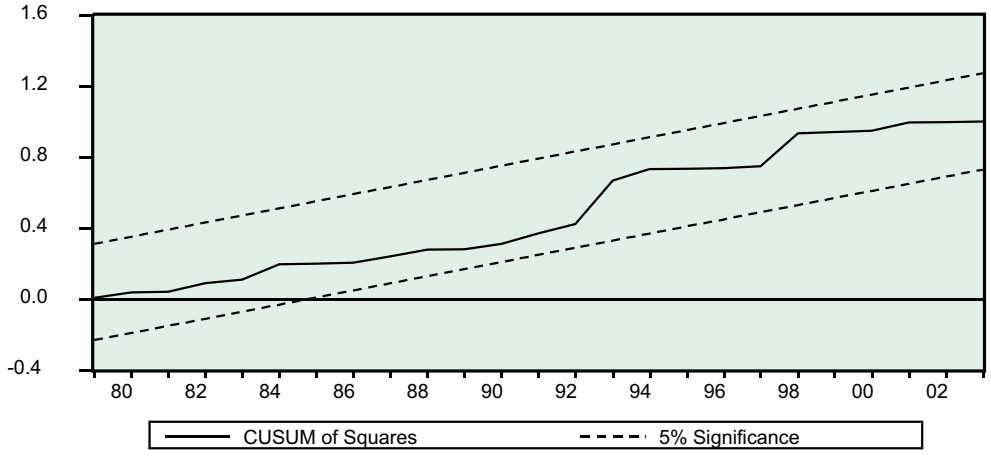


Figure 2: Cusum of Squares Test Result for Stability



Economic Implications and Policy Relevance

The empirical findings have shown that there is a long-run relationship between economic growth and human capital development, at least in the Nigerian context. This indicates that investment in human capital accelerates economic growth due to its positive impact on labour productivity.

The R^2 of 0.68 from the parsimonious model in Table 5 indicate that about 68 per cent of the systematic variation in RGDPG is explained by the four variables taken together. The implication is that Government should consider investment spending in the education sector as critical to enhancing the efficiency of labour, increasing productivity and the quality of education, and by implication, economic growth. A one per cent change in RGCF would increase the RGDPG by about 0.68 per cent. While a one per cent increase in CE will culminate into 0.56 per cent increase in RGDPG. This finding indicates the need for continuous improvement in infrastructure in the educational institutions in the country in order to enhance the effectiveness and efficiency in the sector. In a similar vein, a one per cent rise in PRYE lagged one year and TERE lagged one year will decrease RGDPG by 2.17 per cent and 0.77 per cent, respectively. For tertiary education enrolment lagged one year, the result shows that the parameter estimate is not correctly signed although statistically significant. This is not surprising due to a longer period that is required for the impact of graduates to be felt on economic growth in terms of their contribution to national productivity. Other problem remains the poor manpower-mix of the tertiary graduate turnout, which most times do not reflect the true manpower needs of the country. This has led to the perpetuation of skill gaps among most graduates from the tertiary institutions compared to the general needs of the economic sectors.

V. Recommendations and Conclusion

Recommendations

- The government should continue to encourage primary and post-primary enrolments as this effort would add up to improve the low adult literacy level which remains at 57.0 per cent.

- Government should continue to provide the enabling environment by ensuring macroeconomic stability that will encourage increased investment in human capital by the private sector.

- Incessant closure of tertiary institutions due to strikes, cult activities, and excesses of student unions, etc. should be addressed by the relevant authorities.

- Teachers'/lecturers' salaries and improved working conditions in educational institutions should be accorded high priority by the Government.

- To increase physical capital formation in the education sector, Government should increase spending on social and economic infrastructure in order to enhance the efficiency of the labour force and enhance productivity, and by implication, economic growth.

- The efforts of Government in increasing primary school enrolment through the free compulsory Universal Basic Education should be sustained and made free up to the end of the junior secondary school.

Conclusion

The paper has explored empirically the relationship between economic growth and human capital development in Nigeria, using cointegration and error correction techniques. It reveals that investment in human capital, in the form of education and capacity building through training, impacts positively on economic growth.

In conclusion, Nigeria can only reposition herself as a potent force through the quality of the products from the primary, secondary and tertiary school systems, and by making her manpower relevant in the highly competitive and globalized economy through a structured, well-funded and strategic planning of her educational institutions.

References

Acemoglu, D. (1998). "Why Do New Technologies Complement Skills? Directed Technical Change and Wage Inequality", *Quarterly Journal of Economics,* Vol. 113 (November), pp. 1055-89.

Adenuga, A. O. (2002). "Educational Expenditure and Performance in Nigeria (1970-2000)", *Proceeding of the Annual Conference of the Nigerian Economic Society:* Human Resources Development in Africa, University of Ibadan.

Azariadis, C. and A. Drazen (1990). "Threshold Externalities in Economic Development", *Quarterly Journal of Economics,* Vol. 105 (May), pp. 501-26.

Barro, R. (1991). "Economic Growth in a Cross Section of Countries", *Quarterly Journal of Economics,* Vol. 106, pp. 407-443.

Barro, R. J. and J. W. Lee (1993). "International Comparison of Educational Attainment", *Journal of Monetary Economics,* Vol. 32.

Barro, R. and X. Sala-I-Martin (1995). *Economic Growth*, (New York: McGraw Hill).

Barro, R. and J. W. Lee (1996). "International Measures of Schooling Years and Schooling Quality", *American Economic Review, Papers and Proceedings*, Vol. 80, No. 2. May, pp.218-223.

Bils, M. and P. Klenow (2000). "Does Schooling Cause Growth?", *American Economic Review,* Vol. 90 (December), pp. 1160-83.

Central Bank of Nigeria (2002). *The Changing Structure of the Nigerian Economy and Implications for Development,* Abuja.

Central Bank of Nigeria (2004). Annual Report and Statements of Account, 31st December.

Domar, E. (1946). "Capital Expansion, Rate of Growth and Employment", *Econometrician,* Vol. 14, pp. 137-147.

Engle, R. F. and Granger, C. W. J. (1987). "Cointegration and Error Correction: representation, estimation and Testing. *Econometrica.* Vol. 55, pp. 251-76.

Fei, J. C. H. and Ranis, G. (1956). "Development of the Labour Surplus Economy, Theory and Policy", Homewood, Illionis, Yale university Press.

Granger, C. W. (1986). "Development in the Study of Cointegrated Economic Variables", *Oxford Bulletin of Economic and Statistics* Vol. 48, No. 3, pp. 213-28.

Griffin, K. and McKinley, T. (1992). "Towards a Human Development Strategy", *Review of Economics and Statistics 70, No. 6.*

Harrod, R. F. (1939). "An Essay in Dynamic Theory", *Economic Journal,* Vol. 49, No. 139, pp.14-33.

Hendry, D. F. (1986). "Econometric Modeling with Co-integrated Variables: An Overview. *Oxford Bulletin of Economics and Statistics,* Vol. 48, No. 3, pp. 201-12.

Krueger, A. and M. Lindahl (1998). "Education for Growth in Sweden and the World", Industrial relations Section, *Working Paper No. 411* (Princeton, New Jersey: Princeton University).

Lewis, A. (1956). "Economic Development with unlimited supplies of Labour", *Manchester School Studies,* Vol. 22. pp. 139-191.

Lucas, R. (1988). "On the Mechanics of Economic Development" *Journal of Monetary Economics,* Vol. 22 (July), pp. 3-42.

Mankiw, G., D. Romer and D. Weil (1992). "A Contribution to the Empirics of Economic Growth", *Quarterly Journal of Economics,* Vol. 107, pp. 407-437.

National Planning Commission, (2004). *National Economic Empowerment and Development Strategy (NEEDS)*, Chapter Ten: "The Social Charter: Human Development Agenda", (Abuja: The NEEDS Secretariat), February, pp. 98-99.

Ramsey, B. (1997). "The Distribution of Human Capital and Economic Growth", *Journal of Economic Growth,* Volume 2 (March), pp.93 - 124.

Ranis, G. and Stewart, F. (2001). "Growth and Human development: Comparative Latin American Experience", *Centre Discussion Paper,* No. 826, Economic Growth Centre, Yale University.

Romer, P. M. (1986). "Increasing Returns and Long-Run Growth", *Journal of Political Economy,* Vol. 94 (October), pp. 1002-1037.

_____, (1990). "Endogenous Technological Change", Journal of Political Economy, Vol. 98 (October), pp. S71-S102.

Sen, A. K. (1973). "On the Development of Basic Income Indicators to Supplement GNP Measures", *Economic Bulletin for Asia and Far East,* United Nations, 24.

_____, (1984). "Resources, Values and Development", Oxford University Press, London.

_____, (1985). "Commodities and Capabilities", Amsterdam, North Holland.

Solow, R. (1956). "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics,* Vol. 70, No. 1, February, pp. 65-94.

Temple, J. 1999. "The New Growth Evidence", *Journal of Economic Literature*, Vol. 37 (March), pp. 112-156.

Uwatt, B. U. (2002). "Human Resource Development and Economic Growth in Nigeria, 1960-2000", *Proceeding of the Annual Conference of the Nigerian Economic Society:* Human Resources Development in Africa, University of Ibadan.

Young, A. (1994). "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience", *Quarterly Journal of Economics,* Vol. 110, August, pp.641-680.