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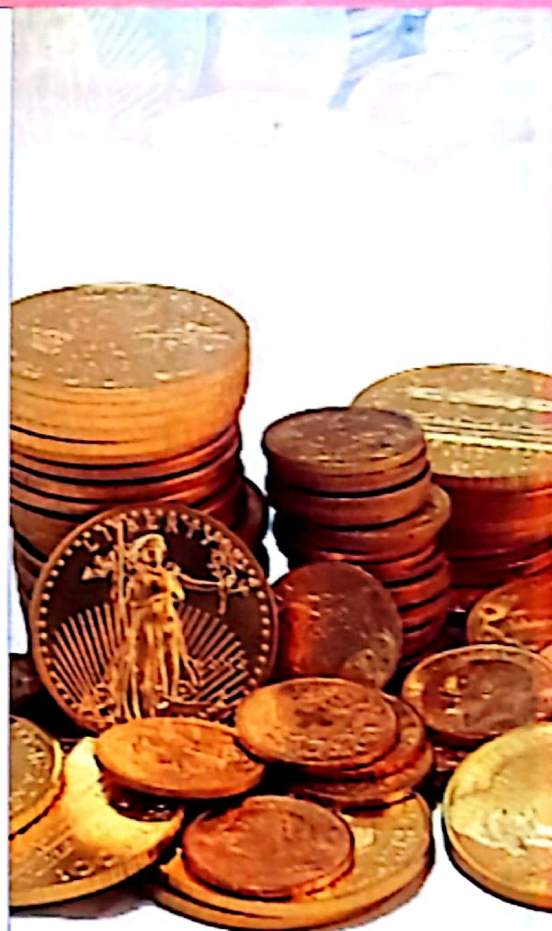
Investigation of Human Resources Accounting in Selected Quoted Firms in Nigeria: By Kumshe, A. M. (PhD) and Imam, A. (PhD):

An Econometric Evidence on Monetary Policy Shocks and Balance of Payments Adjustment in Nigeria: By Umoru, David (PhD) and Tizhe, N. Anna (PhD):

The Causality between Health Capital and Economic Growth in Nigeria: An Application of Cointegration Test: Prof. Allyu, C. U. and Oyerinola, D. S.

Challenges of Agricultural Financing in Jigawa State and the Prospect of Introducing Islamic Banking Products : By Gambo Babandi Gumel PhD and Musa Sani:

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9. **Effects of Characteristics of Audit Committee on Earnings Management in Nigerian Quoted Companies:**
By Eriabie, Sylvester (PhD) and Odia, James, (PhD):.....139
10. **Moderating Effect of Block Holder Ownership on the Relationship between Internal Governance Attributes and IFRS7 Compliance in Nigeria: A Conceptual Paper:** By Ishaq Ahmed Mohammed and Adamu Garba Zango:.....161
11. **Investigation of Human Resources Accounting in Selected Quoted Firms in Nigeria:** By Kumshe, A. M. (PhD) and Imam, A. (PhD):.....182
12. **An Econometric Evidence on Monetary Policy Shocks and Balance of Payments Adjustment in Nigeria:** By Umoru, David (PhD) and Tizhe, N. Anna (PhD):.....198
13. **The Causality between Health Capital and Economic Growth in Nigeria: An Application of Cointegration Test:** Prof. Aliyu, C. U. and Oyerinola, D. S.:.....220
14. **Challenges of Agricultural Financing in Jigawa State and the Prospect of Introducing Islamic Banking Products:** By Gambo Babandi Gumel PhD and Musa Sani:.....240
15. **Foreign Exchange Market Operations in Islamic Framework:**
By Nasir Mukhtar Gatawa, PhD and Abdullahi, Idris:.....255

Chairman Editorial Board: PROFESSOR BAYERO A. S. MUHAMMAD

The Causality between Health Capital and Economic Growth in Nigeria: An Application of Cointegration Test

ALIYU, C. U. AND OYERINOLA, D. S.¹

Abstract

This study investigates the relationship between health capital and economic growth in Nigeria. The study utilized cointegration and Vector Error Correction Model (VECM) to examine the causal direction and long-run relationship between health capital variables such as infant mortality, life expectancy at birth and total expenditure on health (explanatory variables) from 1970-2012 and economic growth proxy by the real GDP (dependent variable.) Multiple regression models were employed. The result emanating from the paper indicates that the relationship between life expectancy at birth, infant mortality and economic growth is negative and significant. However, the study reveals that total expenditure on health has negative and non-significant relationship with the economic growth. The result also shows that there is a strong causal bi-directional relationship running between life expectancy and economic growth. The paper therefore suggests that private sector investment in health should be encouraged. In addition, the policies that will improve life expectancy at birth reduce mortality and enhance the quality of health delivery services and institutions in the country should be rigorously pursued by the government.

JEL Classification: E24, O43, H56

Introduction

Many scholars have acknowledged the importance of health care expenditures in fostering growth in economic literature. Previous studies such as Anyanwu & Erhijakpor (2007), Aghion, Boustan, Hoxby & Vandenbussche (2009), Mitch (2010), Adawo (2011) & Tamang (2011) emphasized majorly on the relationship between education and economic growth. Theoretical and empirical literature such as Heshmati (2001) & Jane (2011) affirmed that there is a strong correlation between health status and individual's level of productivity. Studies such as Mcloskey and Selden (1998), Gerdtham, and Lothgren (2000) insisted on the

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exclusive importance of Gross Domestic Product (GDP) in the modulation of health and education expenditures. In agreement with the above view, Grossman (1972) and Dritsakis (2005) assert that the demand on health sector services and medical care does not consist an end to itself for any consumer of these services, but a necessary precondition in order to ensure the human health as the most desired good. This shows that health care spending enables the citizen to have access to better quality of life and a far-reaching positive impact on the nation's economic development. It has been observed that most of the developed countries attach greater importance to health care spending and other human capital indicators knowing that human capital development is a crucial driver of economic growth.

The importance of health is reminiscent in its role as a means of economic development. However, targeting health as part of development efforts is an effective way to improve welfare in low-income countries such as Nigeria. However, it is paradoxical to note that government budget devoted to health sector remains low in Nigeria. In agreement with the above view, Adebisi (2004) posited that drops in public expenditure in Nigeria have led to the poor performance in the health sector. For example, between 1986 and 1990, health expenditure as a percentage of GDP, in Nigeria, averaged 0.32 per cent and hardly changed between 1995 and 1999 (when it averaged 0.33 per cent). When Nigeria's performance is compared with other African countries, it is observed that in 1990, government expenditure on health as a fraction of GDP was 2.7 per cent against 3.5 per cent in Ghana, 4.3 per cent in Kenya and between 1995 and 1997, 4 per cent in Seychelles (Olaniyi & Adam, 2003 in Adebisi, 2004).

In addition, Adebisi (2004) opined that poor expenditure on health sector in most developing countries is worsened by an inverted nature of health expenditure pyramid. According to Adebisi (2004), about three-quarters of all public expenditure on healthcare for expensive medical care that benefit only a small minority of the population living in the urban areas. A high proportion of the budget for health; 80 to 90 per cent in some countries, is spent on hospitals, almost all of which are located in the cities. Similarly, the United Nations (UN) recommended an average expenditure of 8-10 per cent of the GDP to health sector as a benchmark, but in the recent years, the increase in health expenditures, the GDP rate couple with substantial increase in allocation to health sector because of oil windfall has not translated into quality health in the country. This notion is supported by Bloom, Canning and Sevilla (2001, 2004) in their argument that

causality relationship exists between health, education and economic growth in the sense that higher income levels allow greater access to inputs that improve health, such as food, clean water and sanitation, education, and medical care.

For the health of a nation to be fully guaranteed, it is necessary to formulate and implement policies that will reduce the income margin between the rich and the poor, marginally and efficiently allocate resources between the tiers of health institutions, reduce the trickle-down effect of poverty and promote the purchasing power of the dependent population. Empirical research by Strauss and Thomas (1998) has also established that higher income potentially permit individual and society to afford better nutrition, better healthcare and presumably achieve better health. Therefore, it could be deduced that the income level of the working population greatly determines the quality of healthcare services afforded by the population. Thus, policies that encourage health care accessibility without concurrently addressing the problem of income inequality will ultimately lead to a disproportionate and inequitable distribution of healthcare provisions. Kawachi and Kennedy (1997) further observed that since many health policies that seek to address the health problems of the people do not target a reduction in income inequality, the income ability of the poor has been constantly eroded. Thus, for health policies to be effective they should be targeted at improving the purchasing power of the poor while reducing income inequality.

Further still, in spite of the existence of empirical studies that affirmed positive and significant long run relationship between health and economic growth, the questions that arise from this view are: Is there any causality between health care spending and economic growth in Nigeria? Is there any bidirectional relationship between health capital and economic growth in Nigeria? These questions are paramount in the sense that over the years the country has made huge budgetary allocation to health sector with corresponding increase in the level of GDP coupled with health challenges such as high prevalence rate of communicable and other dreadful diseases like HIV/AIDS, and Malaria fever in few parts of the country, culminating into high morbidity and mortality rates. Consequently, there is a research gap on the extent to which health capital has affected the economic growth of Nigeria. It is against this background that this paper will attempt to solve this basic problem by adopting life expectancy at birth, infant mortality, and aggregate government expenditure on health (both recurrent and capital) as proxies for health capital and Real Gross Domestic Product (RGDP) as proxy for economic growth.

The major objective of this paper is to determine the long run relationship between health capital and economic growth of the Nigerian economy. Therefore, this study is an improvement on some of the existing studies considered for the Nigerian situation, by identifying real GDP as the dependent variable proxy for economic growth and identifying health capital variables with infant mortality, life expectancy at birth and total expenditure on health. In addition, the study has updated previous studies in terms of making more observations on methodological focus on currency and period of coverage as some of the existing published works on Nigerian situation did not adhere to central limit theorem. This paper comprises of six sections as follows: section 1 is the introduction; section 2 is a brief review of theoretical and empirical literatures, section 3 provides the methodology and sources of data while section 4 presents the empirical model specification and hypothesis of the study. Section 5 contains presentation and analysis of data while section 6 discusses the conclusions, policy implications and recommendations.

Literature Review and Theoretical Framework

The importance of health care and education expenditures in promoting economic growth has attracted the attention of different scholars and writers in the growth literatures. Many researchers affirmed positive link between health and economic growth (Hansen and King 1998, Blomqvist and Carter 1997, McCoskey and Selden 1998, Bloom, Canning and Sevilla 2001, and Arora 2001). Most of these scholars agreed that a country's per capita GDP is a major factor promoting health expenditure. On the direction of causation, there is no consensus yet, as there abound mixed results from researchers. In addition, many researchers affirmed the fact that there is positive relationship between health and economic growth. For example, Gallup, Sachs and Mellinger (1998) in Ogundipe and Lawal (2011) found a high relationship between initial levels of health and economic growth, using life expectancy at birth as their basic measure of overall health of the population. In addition, Strauss and Thomas (1998) opined that health explains the variations in wages at least as much as education. Similarly, Lustig (2006) using Panel data 1970-1995 in Mexico found out that health is responsible for approximated one-third of long-term economic growth. In the same vein, Barro (1996a, and b) affirmed that better health could significantly reduce education capital depreciation thereby promoting the impact of education on economic growth.

Furthermore, recent studies such as Dritsakis (2005), Loto (2011), Bakare and Olubokun (2011) and Dauda (2011) among others found out that re-allocation of government expenditure to health sector is significant in explaining the nation's economic growth. On the contrary, researchers such as Musgrave (1996), Pritchett (1996) and others found out that the contribution of health spending measured in terms of infant mortality or child mortality is either inadequate or statistically insignificant to growth. In the same vein, Easterly and Rebelo (1993) and Acemoglu and Johnson (2006) asserted that health does not contribute to increase in productivity and as such it is not an important variable that can affect economic growth.

Furthermore, Rivera and Currias (1999a, 1999b, 2003 and 2004) instrumental variable (iv) estimations are based on a cross-section of 24 OECD countries do find evidence for endogeneity for health care expenditure. They used a panel approach with five-five year averages over the period 1960-1990. For the 17 Spanish regions, they looked at, these yield 85 observations. Results obtained showed that the growth measure was log difference of GDP per employed person between 1960 and 1990 (Rivera and Currias 1999a and b); while the corresponding health measure was log of the share of health expenditure in GDP, with 0.22 to 0.33 and 0.21 – 0.22 coefficient respectively.

Similarly, Anyanwu and Erhijakpor (2005), using data from 47 African countries between 1999 and 2004 observed that health expenditures have a statistically significant effect on infant mortality and under five mortality. The results implied that total health expenditures (as well as the public component) were certainly important contributors to health outcomes. Bokhari, Gai and Tiongson (2006) examined the link between country's per capita income and two health outcomes; under-five mortality and maternal mortality. They found that the elasticity of under-five mortality with respect to government expenditures ranged from -0.25 to -0.42 with a mean value of -0.50 and concluded that, for developing countries, the result implied that while economic growth is certainly an important contributor to health outcomes, government expenditure on health is also another important factor.

Also, Suhrcke, Arce, Mckee and Rocco (2008) in Dauda (2011) dwelled on how health variables have impacted economic outcomes. Their findings of historical studies on health and growth showed that much of today's economic wealth could be attributed to historical gains. This is in line with the findings of Fogel (1994) which indicates that the United Kingdom growth between 1780 and 1980 could be

attributed to improved health variables and nutrition. Similarly, the study conducted by Bloom, Canning and Sevilla (2004) dwelled on health capital and growth and found elasticities of 1.3 and 1.9 respectively, compared with the estimates of Baldacci, Clement, Gupta and Cuis (2004) ranging from 1.4 to 3.2 for different country groups (Ogungbenle, 2010). However, their main growth measure was growth rate of per capita GDP while their health measure was log of life expectancy at birth. Their data covered 104 countries between 1960 -90. The coefficient of 0.04 at 5% level of statistical significance was obtained. In conclusion, their study shows positive human capital relationship with growth (Hartwig, 2008).

Along the same lines, Knowles and Owen (1995) covered 84 countries in their study with their data covering the period of 1960 -1985. Using log difference of GDP per employed person between 1985 and 1960 and health measure log of 80 years minus life expectancy at birth, they obtained 0.381 coefficient at 5% level of statistical significance. In another separate recent study, Knowles and Owen (1997) covering 77 countries with the growth measure of log difference of GDP per employed person between 1960 and 1985 and health measure log of 80 years minus life expectancy at birth, they obtained coefficient of 0.582 to 0.797 indicating that life expectancy is not a statistically significant explanatory variable for productivity growth in HIC.

In the same vein, Dauda (2011) investigated the relationship between health as a component of human capital and economic growth in Nigeria. The study employed annual time series data from 1970 to 2009. The results of the study revealed that health expenditure is positive and statistically significant but the coefficients of the second and third lags are negative and statistically significant. The policy implication of the study is that the Nigerian government should in addition to increasing expenditure on health put in place mechanism to monitor how effectively such funds are utilized for the purpose for which they are meant. Similarly, Ogundipe and Lawal (2011) focused their study on the effects of health expenditure on the Nigerian economic growth using data on life expectancy at birth, fertility rate, capital and recurrent expenditures between 1985 and 2009. The study concluded that improvement on health provision will boost economic development and poverty reduction. Philip (2005) supported the claim that good health can reinforce economic growth by enabling people to be more productive especially in countries that have little corruption, poor health can constrain economic growth because it reduces the quality and quantity of labour. The study

affirms that over the past 50 years, life expectancy has improved and infant mortality declined continuously in all parts of the world, except sub-Saharan African in the 1990s. Gallup, Sachs and Mellinger (1998) in Ogundipe and Lawal (2011) affirm the positive relationship between health and economic growth. The study revealed a strong relationship between initial levels of health and economic growth, using life expectancy at birth as their basic measure of overall health of the population. The study concluded that improved health is associated with faster economic growth.

In addition, Barro and Sala-i-Martin (1995) in their study considered among other things, life expectancy and infant mortality in the growth regressions as a proxy for tangible human capital, complementing the intangible human capital measures derived from secondary schools enrolment, inputs or cognitive tests. Their analysis focused on only one segment of the social spending-social indicator-growth nexus covering 87-97 countries between 1965-85. Also, their study on the first stream concentrated on education capital and focused on the impact of the initial stock of education capital on growth. Their growth measure was growth rate of per capita GDP. Also, their health measure was log of life expectancy at birth. They obtained coefficient of 0.064 at statistically significant at the 5% level. However, their findings revealed that life expectancy has a strong and positive relationship with growth.

Furthermore, this mixed evidence has made researchers such as Gallup, Sachs, and Mellinger (1999) Gretzen (2000), to employ modern analytical techniques and produce new results that suggest a feedback effect between health spending and GDP per capita. In addition, Rivera and Currais (2003) in Bukenya (2009) opined that if the causal relationship runs in both directions, the ordinary estimations used in earlier studies would yield biased and inconsistent estimates of the structural parameters. Thus, the main problem of previous analysis is that they typically suffer from measurement errors when it comes to capturing the individual's health status, heterogeneity of variables, and the possible feedback among them (Dristakis, 2005).

Meanwhile, the focus of many studies is to account for the cross-country patterns of growth. This present paper explores the causal relationship between health capital development and economic growth of Nigerian economy using time series analysis. This means that total public expenditures on health, life expectancy, and real gross domestic product, is expected to have positive sign since an increase in public health expenditure is expected to improve the health of the labour force

and consequently increase their productivity (Bakare and Olubokun, 2011). This implies that improvement in health services will bring an increase in labour productivity thereby increasing output expansion. This process will eventually culminate to increase in aggregate supply and thus sustainable economic development of a country.

The theoretical framework for this study has its basis on the endogenous growth models. This is also known as the neo-classical growth model or new growth theory or Solow-Swan growth model. Endogenous growth model is a term used to sum up the contributions of various proponents to a model of long-run economic growth within the framework of neo-classical economics. This is because it has included a new term, productivity growth. The model was developed in the 1980s as a reaction to criticism of the neo-classical growth model. The theory postulates that policy measures can have an impact on the long-run growth rate of an economy.

In addition, Mankiw, Romer and Weil (1992), described the concept of endogenous growth as the explicit modelling of factors that lead to sustainable long run growth, which is derived from optional behaviour of agents in the model. This implies that the technological spill over effects resulting from investments in research and development, human capital or technological infrastructure ensure a self-feeding growth process in the economy. In the same perspective, Agell, Lindh and Ohlsson (1997), in Yudi and Muhyiddin (2007), proposed that the central idea of the theory of endogenous growth is that production requires more than just direct investments in physical capital and the use of crude labour. It is also important that investments in knowledge and human capital in research and development and in public infrastructure imposing into the model.

The major reason for the adoption of endogenous models is that they built a model of long-run growth without the assumption of fixed proportions in production demonstrating steady state growth. In addition, the model asserted that the long-run rate of growth is determined by an expanding labour force and technical progress. Thus, the model has successfully shunted aside all the difficulties and rigidities, which go into the modern Keynesian income analysis (Jhingan, 2002). This is a clear improvement over Harrod-Dormar model. Although, the endogenous growth models do not assign any important role to government in the growth process, authors like Dar Atul and Amir Khalkhali (2002) pointed out that fiscal policy is very crucial in predicting future economic

growth. That is, endogenous growth models are better because they allow for policy influences on growth and divergent outcomes among countries. In addition, the theory predicts positive externalities and spillover effect from development of a high value added knowledge economy, which is able to develop and maintain a competitive advantage in growth industries in the global economy (Adelowokan, 2012). From the foregoing discussion, the level and composition of government expenditure especially the stock of human capital that includes health capital variables drives growth mainly through innovation.

Methodology and Sources of Data

This paper would rely on time series data on real GDP, total health expenditure and infant mortality sourced from Central Bank of Nigeria (CBN) Statistical Bulletin of various issues and National Bureau of Statistics (NBS) Fact Sheets of various issues. The life expectancy at birth data were obtained from African Statistical Yearbook, various issues produced by the African Development Bank. The discrepancies in the data collected on variables of interest were minimized through thorough crosschecking and comparison of data from various sources. The study has adopted multiple regression models to ascertain the causal relationship between health capital and economic growth in Nigeria. The analysis was conducted using time series data for 1970-2012 and E-views computer package (version 7.0).

Empirical Model Specification and Hypothesis of the Study

The general form for a multiple regression analysis based on the discussions above is given in the form below:

$$RGDP = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \mu \dots\dots\dots (1)$$

Where:

RGDP = Real Gross Domestic Product

β_0 = equation constant

β = coefficient of explanatory variable

X = independent or explanatory variable

Re-arranging equation (1) in line with the model, the equation becomes:

$$RGDP = \beta_0 + \beta_1 HLTX + \beta_2 LE + \beta_3 IMTL + \mu \dots (2)$$

The Causality Between Health Capital and Economic Growth in Nigeria: An Application of Cointegration Test

Given the above general multiple regression function and the proxies for health capital as well as the real GDP proxy for growth rate; the following acronyms suffice;

RGDP = Real Gross Domestic Product (proxy for economic growth rate)

HLTX = Total expenditure on health (proxy for health capital)

LE = Changes in health capital measured in terms of life expectancy at birth (proxy for health capital).

IMTL = Infant Mortality (also a proxy for health capital)

Adopting Mankiw, Romer and Weil (1992) and Lustig (2006) modified standard growth regression equation in line with the objectives of this paper to examine the causal relationship between health capital and economic growth in Nigeria, the equation is resolved below:

$$RGDP f (HLTX, LE, \text{ and } IMTL) = 0 \dots (3)$$

Equation 3 is interpreted as economic growth being a function of set of explanatory variables as provided for by the literatures (Hicks and Streeten 1979, Mankiw, Romer and Weil 1992; Saad and Kalakech, 2009; and Shaista, Abida and Muhammed, 2010).

Hypotheses of the Study

H₀: There is no significant causal relationship between health capital and economic growth.

H₀: There is no bi-directional relationship between health capital and real GDP.

Presentation and Analysis of Data

Unit Roots Tests

The result shown in table 1 examines the statistical properties of Real Gross Domestic Product (RGDP), Life Expectancy (LE), Infant Mortality (IMTL) and Total Government Expenditure on Health (HLTX). The variables were examined for non-stationarity using the Augmented Dickey Fuller (ADF) and Philip- Perron (PP) unit root test. The results obtained from the equation shows that the model is well-behaved and the explanatory power of the model (R-Squared) is very high.

This implies that the explanatory variables in the model explained about 97 per cent of the variations in the RGDP (which is observed in the dependent variable (RGDP), the proxy of the economic growth) and the remaining 13 per cent of variations in economic growth is accounted for by other factors not included in the model. This is judged by the value of the co-efficient of determination R-square (R^2). The test of goodness of fit of the model as indicated by R^2 was properly adjusted by the adjusted R-square of 0.94. This shows that 94 per cent of the variations in real GDP growth can be explained by the variables taken together. The remaining 6 per cent variations can be attributed to other forces outside the model. This suggests that government expenditure has significant effect on the economic growth in Nigeria. Chiawa, Torruan and Abur (2012) reached similar conclusion. In addition, the overall probability (F-statistics) is 5.34, which is greater than 0.05 indicating that the model fit the data relatively well. This F-statistics result properly explains the significance of government expenditure on economic growth in Nigeria within the period under review.

In addition, the results depict no serial auto-correlation problems as reflected in the value of Durbin-Watson statistics of 1.78 (Table 1) which is very close to 2. The results further revealed that the result of the ADF indicated that Infant Mortality (IMTL) variable is statistically significant at first-order difference and life expectancy variable is statistically significant at level. The level of total government expenditure shows very little significance in both the short-run and long run relationships. Furthermore, Phillip-Perron unit root test result indicated that life expectancy and infant mortality were stationary at level, while total government expenditure on health was stationary at the first-order difference. From the above result, it is evident that the null hypothesis of the presence of unit root in the series was rejected.

Their cointegration status is investigated following the approach of Johansen and Juselius (1990). The two likelihood ratio test statistics were utilized to determine the number of cointegrating equations in the model under the assumption of no deterministic trend in the data. Both the results of the maximum Eigen value and trace test indicated that there is a single co-integrating vector at 5% level of significance. This result suggests that there exists a long run relationship among the variables in the model. In addition, the result of the test has rejected the null hypothesis of no cointegrating equation and accepted that of at least 1 cointegrating equation (see Table 2).

Furthermore, Table 3 presents the correlation matrix of the model proxies. The table revealed that life expectancy has positive relationship with economic growth in Nigeria ($R = 0.662$) within the period under review. This shows that a unit in economic growth is attributable to a 0.662 increase in life expectancy. However, the level of increase is fair. The table also reveals that total health expenditure is positively related to economic growth showing that a unit increase in economic growth is caused by 0.879 unit increase in total health expenditure. The table revealed a negative relationship between Infant Mortality and economic growth. This indicates that a unit decrease in economic growth is due to 0.403 decrease in infant mortality.

In addition, Table 1 revealed that the relationship between infant mortality and economic growth is negative and significant (coefficient of IMTL = -1.615, t -value = -5.08). This shows that infant mortality has negative but significant impact on the growth of the Nigerian economy. The probability value of $0.00 < 0.05$ confirms significance of the relationship. The table also indicates that life expectancy was negative and significant (coefficient of LE = -0.867, t -value = -5.39). This revealed that life expectancy has negative significant relationship with the economic growth in Nigeria. However, the probability value of $0.07 > 0.05$ confirms non-significant relationship of the total health expenditure that is equally negatively related with the economic growth of Nigerian economy with coefficient of =1.088 and t -value of -1.880304.

Conclusion, Policy Implications and Recommendations

This paper attempted to analyze the causality between health capital and economic growth in Nigeria using data on life expectancy at birth, infant mortality and total government health expenditure. The paper has affirmed empirically that there is a strong causal bi-directional causality running between infant mortality, life expectancy and economic growth in Nigeria. The result indicated variations of causal relationship between the chosen variables and the economic growth in the country. However, the relationship between life expectancy at birth, infant mortality and economic growth is negative and significant. Surprisingly, total health expenditure has negative but no significant relationship with the growth of the economy. This implies that expenditure on health does not improve human capital development in the country. This may not be unconnected with the mass exodus of health practitioners to developed countries of Europe and Asiatic countries as well as perceived corruption in the

sector. The paper suggest amongst other things that future research can consider why total government spending on health is negatively related with country's economic growth. In addition, the private sector investment in health should be encouraged to complement government initiatives and invariably drive efficiently and effectively economic growth.

In addition, the government should place more emphasis on the policies that will enhance the quality and type of health services and institutions to be provided. This can be achieved by increasing budgetary allocation to health sector to improve the health and social status of the population to impact on aggregate economy. Furthermore, the paper suggests that policies that can improve life expectancy and reduce infant mortality should be the goals of any reasonable government at all levels.

Table 1: Unit Root Test
Dependent Variable: RGDP
Method: Least Squares

Variable	Coefficient	Std. Error	t-statistic	Probability
RGDP				
IMTL	-1.614881	0.317801	-5.081414	0.000
LE	-0.866667	0.160773	-5.390624	0.000
HLTX	-1.088384	0.578834	-1.880304	0.000
R	0.974	F-statistics	5.34	
R-square	0.948			
Adjusted R square	0.944			
Std, error of the estimate	49920.09689			
Durbin- Watson	1.784			

Source: Computation using E-Views 7.0 software by the researcher

Table 2: Cointegration Rank Test (Trace)

Rank	Eigen value	Max-Eigen	0.05 critical value	Probability	Hypothesized
R = 0	0.376087	18.39802	27.58434	0.4623	None
R = 1	0.295480	13.65929	21.13162	0.3936	At most one
R = 2	0.270039	12.27578	14.26460	0.1007	At most 2
R = 3	0.043628	1.739738	3.841466	0.1872	At most 3

Source: Computation using E-Views 7.0 software by the researchers

The Causality Between Health Capital and Economic Growth in Nigeria: An Application of Cointegration Test

Table 3: Correlation Result

	RGDP	LE	HLTX	IMTL
RGDP	1.000			
LE	0.662	1.000		
HLTX	0.879	0.543	1.000	
IMTL	-0.403	0.003	-0.442	1.000

Source: Computation using E-Views 7.0 software by the researchers

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