Public Health Expenditure and Health Indicators on Productivity in Nigeria

Edward Perekebina Agbai
Dept. of Management, Emmanuel University, Raleigh, NC, USA
Email: edwardagbai@gmail.com +16393174266

Adesanya Shina Joshua
Dept. of Economics, Benson Idahosa University, Edo State. Nigeria
Email: shina_jos4luv@yahoo.com +2347036728070
ORCID ID: 0009 – 0003 – 2356 – 6808.

King Oluwashindaralayemi Shina
Benson Idahosa University, Edo State. Nigeria
Email: shinakingoluwashindaralayemi@gmail.com

DOI: 10.56201/ijefm.v8.no5.2023.pg104.123

ABSTRACT

Health as a human capital affects productivity directly through its impact on labour productivity. The study employs econometric techniques to verify the time series properties and the relationship among public health expenditure, maternal mortality rate, prevalence rate, and productivity in Nigeria. The Dickey-Fuller Generalized Least Squares (DF-GLS) test was used to ascertain the order of integration of the time series. The empirical results showed that there exists a long-run relationship among the variables. Also, the findings revealed that the maternal mortality rate has a negative insignificant effect on productivity in the short run. The study thus recommends that further study should be carried out to ascertain the cause of the negative relationship between public health expenditure and productivity in Nigeria. The government should increase public health expenditure; improve facilities for maternal healthcare to increase productivity in Nigeria.

Keywords: *Health, Expenditure, mortality rate, Labour, Productivity*

Background to the Study

Health is a core prognostic indicator of the quality of human capital, a basic factor for productivity. Consistent with the foregoing, health is a public good, and demand and supply cannot be left alone with individuals and private investors. In line with the above, there is a need for the government to play a pivotal role in delivering good, qualitative, accessible and affordable healthcare services. According to Barro (1996), "health is a capital productive asset and an engine of economic growth." The impact of health on workers' productivity shows a correlation between health and total output. Healthy workers are more productive at work and

lose less time from work because they are under the weather (Oni, 2014). Data available from the year 2000 to the present date shows that the government in Nigeria have not made a significant effort in increasing the level of public expenditure on health. Statistics show that in advanced economies an average of over 6.3 per cent of GDP is spent on public healthcare. On the other hand, in Nigeria, public health expenditure is about 4.1 percent of the country's GDP as against the 4.6 per cent African average.

With these, Nigeria's overall health sector performance outcomes have not been so encouraging. For emphasis, let's look at the 2017 budget for healthcare in the US, Switzerland and Nigeria. Ifijeh (2017), reports that, in the 2017 national budget of 7.298 trillion naira, only 4.17 per cent was allocated to health. To be specific, the Federal Government in their budget plans to spend 304 billion naira on the healthcare of over 180 million Nigerians, amounting to 1688 naira per citizen for a whole year. Whereas on healthcare the United States will spend about $7,000 per citizen, while Switzerland will spend about $6,000 per citizen. Little wonder that Nigeria has one of the worst health statistics in the world.

Statement of Problem

Health is central to the wellbeing of every individual in a country and its provision is seen as a key element to promote broad-based economic growth and development. Moreover, in Nigeria, an estimated average of over fifty million naira was expended in the health sector annually in a couple of years back (Federal Ministry of Health, 2005). However, the health status of Nigerians is consistently ranked low amongst other nations of the world. This was among the smallest in the world. In 2003, Nigeria's life expectancy rate was estimated to be 47.9 years and it fell to 47 years in 2011. Also, the National Bureau of Statistics (NBS) reports show that health indicators for infant mortality, maternal mortality and life expectancy over the past decades in Nigeria have worsened. One million Nigerian children die annually before the age of five and the main causes of death are attributed to neonatal causes, communicable diseases, malaria and pneumonia (NBS, 2006).

Research Questions

The research work will examine the following questions:

i. What is the effect of public health expenditure on productivity in Nigeria?
ii. What effect does the maternal maternity rate have on productivity in Nigeria?

Objectives of the Study

The broad objective of the study is to examine the impact of public health expenditure on labour productivity in Nigeria. The specific objectives of this work include to:

i. Analyze the effects of public health expenditure on productivity in Nigeria.
ii. Investigate the impact of maternal mortality rate on productivity in Nigeria.

Productivity

One of the universal definitions of productivity is that it is a quantitative relationship between output and input (Iyaniwura and Osoba, 1983), (Antle and Capalbo, 1988). According to Prokopenko (1987), despite the category of trade and industry, production and economic system, this explanation is generally acknowledged because it suggests what productivity is,

and it remains the same as long as the basic idea is the connection linking the quantity and quality of goods and services created and the number of resources used during their production.

Olaoye (1985) observed that the concept of productivity can be viewed from two dimensions: namely total factor productivity (TFP) and partial productivity. Total Factor Productivity is defined as the correlation between output created and the combination of inputs: which implies the total of basic resources which are capital, labour and natural resources. Total Factor Productivity is also known as Multi-Factor Productivity (Eatwell and Newman, 1991). Partial Productivity, on the other hand, can be seen from a point of view where output is connected to any factor input which implies that there will be various definitions of productivity concerning the inputs involved in the production process. For instance, when output is linked to per man-hour or per labour unit, this is known as labour productivity which is a type of partial productivity.

Nigeria Employers' Consultative Association, NECA (1991) posits the importance of labour productivity. At the national level, labour productivity is also known as human productivity. It is the kind of productivity that affects directly the work force of the population size: Labour Productivity = Gross Domestic Product/Working Population one reason why emphasis is being placed on labour productivity is possibly because labour is a common key resource. The phrase labour productivity is the ratio of total output gotten to the amount of labour spent in a given period. This implies that the amount of output attained per man hour or by each worker is labour productivity. In line with this, partial productivity is merely to satisfy the theoretical interest.

Conclusively, efficiency and effectiveness are major components of productivity. According to Lawlor (1985), productivity tells us how an economy or organization effectively actualized five goals: effectiveness, objectivity, efficiency, progressive trend and compatibility. Productivity is also linked with the value of yield; contribution and the related process between both. A relevant part is the significance of the working population and working conditions which increases productivity and quality of life. It is also observed that effectiveness can act as the numerator while efficiency can be the denominator and that rising productivity can increase the quality of life.

2.2.2 Public Expenditure on Health

Health, according to WHO (1996), is a complete state of physical, mental and social well-being and not merely the absence of illness. Strauss and Thomas (2001) noted a healthy population would contribute more to productivity compared to an unhealthy one. Thus, when a population is unhealthy, several ma-hours will be lost due to the inability of the sick to be productively engaged. It is a well-known fact that better health welfare has a positive impact on the citizens through the generation of social returns to the populace. This provides clarification on the essence of why developed human capital is suitable for participation in enhanced productivity and economic activities. Also, improved health status will reduce work absenteeism and lessen the burden of disease which culminates in low-cost healthcare provision, better health care coverage and management of available resources (Basta, *et al*. 1979).

Healthcare expenditures are defined based on their prime purpose of health improvement, irrespective of the main function or activity of the body which provides or pays for the related health services. World Bank (2016) describes health expenditure as the provision of preventive and curative health services, nutrition activities, family planning services and health emergency

aids. It however does not include the provision of sanitation and water. According to World Health Organisation (2015) healthcare spending can be defined as an amount of ultimate consumption of health goods and services as well as capital investment expenditure in healthcare infrastructure. Thus, consumption of healthcare involves investment spending in health goods and services by individuals, provision of personnel and infrastructure for healthcare and improvement in healthcare infrastructure by the government. Thus, the government makes provisions for healthcare personnel and facilities while the individuals make use of these healthcare facilities to enhance their health status.

Public expenditure on health involves overheads on health care services which are solely financed by public funds. Public funds are finances provided by the state, local government schemes as well as community security schemes. Public capital formation on health consists of investment in health care facilities that are financed publicly as well as capital transfers to the private sector for the construction of hospitals and healthcare equipment. World Health Organization (WHO, 2013), states that the following comprises public health expenditure recurrent and capital expenditure from government budgets, external borrowings and grants which include donations from non-government organizations and international agencies as well as compulsory health insurance finances.

2.3 Theoretical Review

2.3.1 Endogenous Growth Theory

The endogenous growth model was developed by Romer (1990) and Lucas (1988) to explain the income divergence between poor and rich nations. As noted by Barro (1990), this model did not assume that physical capital accumulation was the dominant factor in determining growth. Instead, they rejected the neoclassical position of diminishing returns to capital and the prediction of the steady-state income divergence. Practically, the endogenous growth model did not only predict that higher levels of investment in physical capital and labour can sustain higher levels of growth, but also investment in knowledge and human capital, research and development and also in public infrastructure. Human capital according to this school of thought is considered in the form of skilled labour, which could be augmented by education, training, and investment in health.

With the extended concept of capital, education and health, the endogenous growth model hypothesizes constraints to the factors that can be accumulated, while the long-run growth is determined by parameters of the model and not by technological innovation or population growth. From this viewpoint, the model supports that any temporary change in the economic environment can generate permanent effects which opens up the possibility of fiscal policy to have a long-run effect on growth. In other words, in the endogenous growth model, labour cannot be regarded as a single input but decomposed into skilled and unskilled labour. By breaking the linked between economic growth, physical capital accumulation and diminishing returns, the endogenous growth model has been able to account for the income divergence between the rich and the poor nations. To this extent, Romer (1990) emphasized that economic growth depends on the stock of human capital, which in turn is determined by growth. The human capital stock is endogenized and so, its effects on growth are more dynamic than thought by the neoclassical school.

Since the endogenous growth model holds human capital as the most influential factor of production, it suggests that human capital can be obtained through education, training and

health investments. They, therefore, advocated that government policies are immensely important in affecting the rate of accumulation through research and development as well as appropriate investment in health and education to ensure an abundant supply of high-quality human capital.

2.3.2 Wagner Law of Increasing State Activities

The law of increasing state activities developed by Wagner is one of the foremost theories which describe government expenditure patterns. Wagner's law of increasing state activities is aimed at systematically explaining the share of national income that accrues to the government in an economy. The theory simply states that a functional relationship exists between increases in public sector activities and the growth of an economy (Bhatia, 1967). According to Wagner's law, an increase in the 'bigness' of government is attributed to a rise in the per capita income of the economy which necessitates higher spending. Musgrave (1969) describes Wagner's law in relative terms. He suggests that the size of the public sector will grow in tandem with increases in the per capita income of the economy.

Wagner's theory of increasing government activities emphasizes the long-term growth of government expenditure not the short-term increases of government spending. Also, the theory is not concerned with the system of increases in government expenditure. It is, however, focused on past government expenditure patterns. As a result of this, the actual magnitude of the relationship between the relative increase in government spending and the time taken is not fixed. In light of this, it is difficult to predict the rate of future increases in public expenditure. Essentially, the theory stipulates that government spending will eventually rise at a rate less than the growth rate of national income even if the public expenditure growth rate is higher than in the past.

2.2.3 Keynesian Theory of Public Expenditure

The Keynesian school of thought is of the opinion that public expenditure contributes positively to the growth of an economy. Consequently, a rise in government spending will result in an increase in investment, profits, and employment via the multiplier effect on aggregate demand. Hence, government spending influences the aggregate demand which aggravates a rise in output based on the expenditure multiplier. Therefore, Keynes's postulations are that:

i. The expansion of the functions of government activities brings about an increase in government spending on its regulatory and administrative activities in the economy.
ii. The expansion of the industrialized society will heighten political pressure for social development and engineer the need for social consideration allowances on the conduct of the industry.

The increase in government spending will be greater than the proportionate rise in national income and hence, the size of the public sector will expand relatively.

2.4 Empirical review

Some research work and past studies have shown the correlation between public health expenditure and economic productivity. Some of the work reviewed show that there is a positive significance between public health expenditure and productivity while some other

studies showed that there is a positive insignificance relationship between health expenditure and economic growth. Hamoudi and Sachs (1999) did research work using the augmented Solow growth model on health expenditure and economic growth in Pakistan, considering the duration between 1973 and 2003. The co-integration analysis used involved the error correction model (ECM). The result showed that in both the short-term and long-run there was a significant relationship among the variables. In addition, there is a direct relation between GDP per capital and health expenditure.

Gallup, Sachs and Mellinger (1998) examine the effect of health on economic growth using the life expectancy rate to determine in general the health of the population. They observed a positive significant relationship between health and economic growth. They recommended that good health will increase productivity. Similarly, Lustig (2006) in his research on the relationship between health and economic growth in Mexico, used the variables life expectancy, infant mortality rate, maternal mortality rate and under-five mortality rate as health indicators. The annual series data used was from 1970 to 1995. He observed that in the long run, one-third of economic growth is due to good health.

In the same vein, Philips (2005) did a study with several countries over 50 years on the impact of health on economic growth. Using life expectancy and infant mortality rate as health indicators, he observed that there is an increase in life expectancy and a decrease in infant mortality rate in most countries expects Sub-Saharan Africa in the 1990s. He also noted that good health can increase economic productivity because healthy people are more productive, particularly in countries where corruption is not an issue. On the other hand, poor health can hinder economic growth because it can affect labour negatively. As well, in a study done in India, World Bank (1993) evaluated the effect of Gross Domestic Product GDP and Health Expenditure on Infant Mortality rate. They used state rank data over the period 1980 to 1999. The research showed that both per capital public expenditure on health and per capital GDP is negatively significant to infant mortality rate, although the outcome was observed not to be generally accepted because of the alternative specification of the model.

Maduka et al (2016) observed that government health spending, health outcomes, and the growth of the economy in Nigeria follow a causality approach and examined the relationship which exists among government health expenditure, health outcomes, and the growth of the economy in Nigeria. The period considered for this research is between 1970 and 2013. Toda and Yamamoto (1995) used the modified WALD statistic (χ2distribution) test for causality while ADF and KPSS were used for the unit root test. The Johansen technique was used to carry out the cointegration test. The outcome of the test showed that there is a long-run relationship among the variables. From the causality test, they observed that public health spending has an indirect relationship with economic growth, but this is through health outcomes which are life expectancy and mortality rate. From the study, it was suggested that government should always look out for health outcomes that will help increase economic growth through health care spending.

Nasiru and Usman (2011) did a study on the effect of health expenditure on economic growth in Nigeria, using the Granger causality test and ARDL and they covered the time range between 1980 and 2010. They observed that there is a causality relationship in one direction and also find out that there is a long-run relationship between health spending and economic growth. The direction of causality was not shown. It was also observed that there is a significant relationship between economic growth and health variables. From the findings, it was suggested that government should invest in health because this can lead to growth in the

economy. In addition, they also find out that health differences between countries play a major role in various economic growth.

Research done by Olarinde and Bello (2012) on public healthcare spending, institutions and health sector service deliverables used the co-integration analysis test and observed that there is a long-run relationship among the variables and also the direction of causality between the variables. It was discovered in both the short and the long run that government healthcare spending and the value of institutions have a positive effect on the sector performance outcome. Similarly, it also shows the importance of institutions to positive health segment outcomes and how it affects development and growth. In addition, the findings from this research are in line with the theoretical expectation that good institutions are connected to positive health.

Baldacci (2004) did a study on the significance of health expenditures. This research was done with the use of panel data which was generated from one hundred and twenty developing countries within the period 1975-2000. He discovered that delayed health expenditure does not have impact on economic growth while healthcare spending within a period has a positive impact on productivity within the considered period. He deduced from his findings that the positive impact of health expenditure on growth and productivity is not a stock effect but a flow. Research by Aguayo-Rico and Irish (2005) determine the effect of health on the growth of the economy of several countries which include 16 American countries, 13 European countries, 11 Asians countries and 12 African countries, between the years 1970-1990. The technique used was the ordinary least square (OLS), and it was observed that there is a significant relationship between health variables and economic growth.

Riman and Akpan (2010) examined the impact of public health expenditure, poverty and health status, in Nigeria. To carry out their empirical analysis, they used the Vector Error Correction Model (VECM) and Granger causality test. From their study they discovered a bi-directional relationship between life expectancy rate and poverty rate in Nigeria. Furthermore, the research shows an insignificant relationship between health status and government health spending in the long run. On the other hand, there exist a significant long run relationship between health status and poverty. In their recommendations, they suggested that to improve health status, poverty level has to be reduced to make increase in healthcare spending significant and they also mention the need to encourage adult literacy.

Odubunmi et al (2012) using the multivariate co-integration test, did a study on the effect health care spending and economic growth in Nigeria using the annual data between 1970 and 2009. They observed that there is a long run relationship among the variables. The variables used for the analysis are economic growth, health expenditure, foreign aids, total saving and population. They observed that there is an inverse relationship between foreign aids and health expenditure, and this can be ascribed to poor allocation of funds to the health sector or some diversion of foreign aids to other uses.

Yaqub et al (2013) examined the effects of public health expenditure on infant and under-5 mortality rates and life expectancy. They adopted the two-stage-least squares regression technique as well as the ordinary least squares method. Their findings should that public health spending is positively related to infant mortality and under-5 mortality rates. However, when they introduced governance indicators into the model, public health expenditure was found to have a negative impact on infant mortality and under-5 mortality rates. They affirmed that when corruption level declines and that the value of corruption perception index improves, health status would improve provided infant mortality and under-5 mortality rates decline and life expectancy rate improves. They advocated that mere increases in public health spending would not improve health status, but the issue of corruption should be dealt with.

Mehrara and Musai (2011) carried out a cross-country analysis of the nexus between public health expenditure and gross domestic product. They took a sample of eleven oil exporting countries. The study employed the panel co-integration analysis as well as panel unit root testing techniques. The findings revealed that oil revenue and economic growth are strongly related to public heath expenditure in the selected oil exporting countries. Public health expenditure was found to have an insignificant impact on economic growth both in the short term and long term. The results also revealed that highly oil dependent countries are susceptible to oil revenue shocks. They therefore recommended that to safe guide the health sector governments should not base their public health expenditures on oil revenues.

Wilhelmson and Gerdtham (2006) reviewed the impact of investment in maternal newborn health on economic growth. They suggested the use of more all-encompassing maternal newborn health measures that incorporate the health of both the newborns and mothers; and other aspects of ill-health apart from death which include measures of sickness absenteeism, mental health, quality of life and functional limitations. Mizushima (2008) analysed the impact of public health funding and aging population on savings and economic growth rate. He used a growth model to demonstrate that an increase in the rate of life expectancy will result in an increase in economic growth.

Lucian et al (2010) examined the relationship between economic growth and health. They used the findings of some existing works and applied them on the recent data. Their objective was to discover whether the economic growth rates of members of European Union is linked to the growth rates of various diseases. Their findings revealed that there is a positive relationship between the health of population and economic growth. They also found out that causality runs from economic growth to growth rates of diseases. Rivera and Currais (2003) studied the impact of investment in health on productivity. They considered investment in health a crucial determinant of human capital development. Their findings showed that a positive relationship exists between public health expenditure and economic growth.

Bloom et al (2004) examined the effects of good health on output. They adopted production models and incorporated health and work experience to account for human capital. Their key findings showed that good health positively and significantly impacts on aggregate output. The impact of average work experience on output was found to vary a little across countries. Work experience differentials were found to account for little deviations in economic growth rates. In addition, their findings revealed that the effects of education on national output are in conformity with microeconomic estimates of the effects of individual education on income earnings. In Pakistan, Akram et al (2011) investigated the effects of different health indicators on economic growth for the period 1972 to 2006. They employed co-integration analysis, error correction modeling technique and the Granger causality method. Their results showed that the health indicators impact positively on per capita gross domestic product in the long term. Also, the results revealed that health indicators Granger cause per capita gross domestic product. It was however, found that health indicators do not have any significant impact on per capita gross domestic product in the short run. Their findings indicate the effects of health indicators on economic growth are a long run phenomenon but in the short-term health indictors have no significant impact on economic growth.

Bloom and Canning (2008) provided a descriptive analysis of how healthy populations can be more productive because of their stronger physical energy and mental alertness. They asserted that individuals which are healthier can impact positively on the economy in four ways. Foremost, they will be more productive at work and thus be able to earn more income. Second, they could spend longer time in the labour force before retirement because people who

are less healthy are likely to retire early or take leaves. Third, they will acquire more education in order to enhance their productivity level. Lastly, they will save more money for retirement in anticipation for a long life thereby making more funds available for investment purposes and economic growth. Thus, health plays a vital role as a source of human welfare and a determinant of productivity growth.

Methodology

Theoretical Framework

The hypothetical structure of this work is patterned after the augmented growth model by Mankiw, Romer & Weil (1992). Their model is same as the Solow (1956) growth model but augmented with human capital. The idea was to augment the Solow growth model to include the accumulation of human capital. The model assumes that countries have the same rate of efficiency growth. The initial level of growth efficiency is assumed to differ randomly from one country to another. This is as result of local factors such climatic conditions, and this can be used to justify the error term. Their work avoids the presumption of the Solow model that cross country variation in labour productivity is largely by appealing to variations in technologies.

The model expressed output (Y) as a function of physical stock of capital (K), human capital (H), quantity of labour (L) and the coefficient of technical progress (A). This is expressed in functional as:

$$Y_t = f(K, H, AL) \quad \text{.....(1)}$$

Using the Cobb Douglas production model and a world consisting of i = 1,…n countries, equation (1) can be represented as:

$$Y_{it} = K_{it}^{\alpha} H_{it}^{\beta} (AL)_{it}^{1-\alpha-\beta} \quad \text{.....(2)}$$

Where: $0< \alpha < 1$; $0< \beta < 1$ and $\alpha + \beta < 1$.

Mankiw, Romer and Weil (1992) assumed that households save a fraction s_k of their income to invest in physical capital and a fraction s_h to invest in human capital. And that human capital also depreciates in the same way as physical capital. The depreciation rates for physical capital is given by δ_k and human capital, δ_h, where $\delta_k = \delta_h = \delta$. Population growth rate is n and technology growth rate is g. When equation (2) is transformed into output per capita and solved, we have the steady state of output per labour (productivity) as follows:

$$y_{it} = A_{it} k_{it}^{\alpha} h_{it}^{\beta} \quad \text{.....(3)}$$

Where:

$$k_{it} = \left(\frac{s_k^{1-\beta} s_h^{\beta}}{n+g+\delta} \right)^{\frac{1}{1-\alpha-\beta}} \quad \text{.....(4)}$$

$$h_{it} = \left(\frac{s_k^{\alpha} s_h^{1-\alpha}}{n+g+\delta}\right)^{\frac{1}{1-\alpha-\beta}} \quad \text{.....(5)}$$

By substituting expression (4) and (5) into (3), output per labour in steady state becomes:

$$y_{it} = A_{it}\left(\frac{s_k}{n+g+\delta}\right)^{\frac{\beta}{1-\alpha-\beta}}\left(\frac{s_h}{n+g+\delta}\right)^{\frac{\alpha}{1-\alpha-\beta}} \quad \text{.....(6)}$$

Mankiw, Romer and Weil (1992) assumed that $A_{it} = \bar{A}e^{g}$ and that countries differ according to technology level (initial level, $\bar{A}$) but they share the same common technology growth rate, g. Taking the log of both sides in equation (6) yields the following expression:

$$\ln y_{it} = \ln \bar{A}_{it} + g_{it} + \frac{\beta}{1-\alpha-\beta}\ln\left(\frac{s_k}{n+g+\delta}\right)_{it} + \frac{\alpha}{1-\alpha-\beta}\ln\left(\frac{s_h}{n+g+\delta}\right)_{it} \quad \text{..... (7)}$$

Since $\bar{A}$ is unobserved it can be captured by the error term. Hence, equation (7) can be rewritten in econometric form as:

$$\ln y_{it} = g_{it} + \frac{\beta}{1-\alpha-\beta}\ln\left(\frac{s_k}{n+g+\delta}\right)_{it} + \frac{\alpha}{1-\alpha-\beta}\ln\left(\frac{s_h}{n+g+\delta}\right)_{it} + \varepsilon_t \quad \text{.....(8)}$$

Equation (8) represents output per labour (productivity) in logarithm form. The coefficients of the physical capital and human capital inputs are elasticity parameters. The model shows that investment in physical and human capital results in increased productivity. Thus, the augmented Solow model gives output per labour as depending on the rate of technical change, capital stock and human capital (Mankiw, Romer & Weil, 1992). In empirical applications, the basic Solow model has been modified to obtain the augmented Solow growth model where the rate of growth of output for a given country depends not only on technical change, capital and labour but also on policy variables like trade, fiscal policy and monetary policy (see, Ologun, 2003; Easterly & Levine, 2001).

3.3 Model Specification and Methodology

Based on the theoretical framework, we specify the functional model for productivity as follows: $GDPL = f(PHE, MMR, HPR, LER)$ .....(9)

Where: GDPL = Gross Domestic Product per labour (Productivity), PHE = Public health expenditure, MMR = Maternal mortality rate, HPR = HIV/AIDs prevalence rate, and LER = Life expectancy rate

For empirical analysis, the functional model can be expressed in econometric form as:

$$GDPL_t = \alpha_0 + \alpha_1 PHE_t + \alpha_2 MMR_t + \alpha_3 HPR_t + \alpha_4 LER_t + \mu_t \quad \text{.....(10)}$$

Where: $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ *and* α_5 are the long-run parameter elasticity estimates.

μ_t= Error term

The a priori signs of public health expenditure and life expectancy rate are expected to be positive while infant mortality rate, maternal mortality rate and HIV/AIDs prevalence rate are expected to be negative. Symbolically, the a priori expectations are: $\alpha_1, \alpha_5, \alpha_4 > 0$; $\alpha_2, \alpha_3 < 0$.

The Error Correction Model (ECM) associated with the long-run estimates is specified as:

$$\Delta GDPL_t = \rho + \partial \Delta PHE_t + \emptyset \Delta MMR_t + \tau \Delta HPR_t + \pi \Delta LER_t + \sigma ecm(-1) + \varepsilon_t \text{..(11)}$$

Here, $\partial, \emptyset, \tau, \pi \; and \; \theta$ are the short-run dynamic coefficients of the convergence of the model to equilibrium; Δ denotes differencing, σ is the coefficient of adjustment expected to be negative.

3.4 Methods of Data Analysis

The study adopts the co-integration analysis. This involves unit root tests, co-integration test and error correction modeling. The initial co-integration analysis test done is to carry out a unit root test for every variable in the model. The unit root test determines whether the variables are stationary at levels or first differences. Most economic time series are difference stationary. In general, a regression involving the levels of these non-stationary series will produce misleading results, with conventional Wald tests for coefficient significance spuriously showing a significant relationship between unrelated series (Phillips, 1986). According to Engel and Granger (1987), the regression of two non-stationary variables on each other produced spurious and inconsistent parameter estimates.

Elliott et al. (1996) projected a simple adjustment of the ADF tests in which the data are detrended so that independent variables are taken out of the data prior to running the test analysis. They define a quasi-difference of Y_t that depends on the value a representing the specific point alternative against which we wish to test the null hypothesis:

$$d(Y_t|a) = \begin{cases} Y_t & if\ t = 1 \\ Y_t - aY_{t-1} & if\ t > 1 \end{cases} \text{.....(12)}$$

Next, consider an OLS regression of the quasi-differenced data $d(Y_t|a)$on the quasi-differenced $(X_t|a)$:

$$d(Y_t|a) = d(X_t|a)'\delta(a) + \mu_t \text{.....(13)}$$

Where: $X_t$contains either a constant, or a constant and trend, and let $\hat{\delta}(a)$ be the OLS estimates from this regression.

All that we need now is a value for a. Elliott et al (1996) recommend the use of $a = \bar{a}$ where:

$$\bar{a} = \begin{cases} 1 - \frac{7}{T} & if\ X_t = \{1\} \\ 1 - \frac{13.5}{T} & if\ X_t = \{1, t\} \end{cases} \text{.....(14)}$$

We now define the *GLS detrended data,* Y_t^d using the estimates associated with the $\bar{a}$ as:

$$Y_t^d = Y_t - X_t'\hat{\delta}(a) \text{.....(15)}$$

The Augmented Dickey-Fuller (ADF) test constructs a parametric correction for higher-order correlation by assuming that the Yseries follows an $AR(p)$ process and adding p lagged difference terms of the dependent variable $Y$to the right-hand side of the test regression given as:

$$\Delta Y_t = \alpha Y_{t-1} + X_t'\delta + \beta_1 \Delta Y_{t-1} + \beta_2 \Delta Y_{t-2} + \ldots + \beta_p \Delta Y_{t-p} + V_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(16)$$

Then the DF-GLS test involves estimating the standard ADF test equation (16) after substituting the GLS de-trended $Y_t^d$for the original $Y_t$and we have:

$$\Delta Y_t^d = \alpha Y_{t-1}^d + \beta_1 \Delta Y_{t-1}^d + \beta_2 \Delta Y_{t-2}^d + \ldots + \beta_p \Delta Y_{t-p}^d + V_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(17)$$

Note that since the $Y_t^d$are detrended, we do not include the $X_t$in the DF-GLS test equation. As with the ADF test, we consider the t-ratio for $\hat{\alpha}$ from this test equation. While the DF-GLS t-ratio follows a Dickey-Fuller distribution in the constant only case, the asymptotic distribution differs when you include both a constant and trend. Elliott et al. (1996) simulated the critical values of the test statistic in this latter setting for $T = \{50, 100, 200, \infty\}$. Thus, the null hypothesis is rejected for values that fall below these critical values.

This study employs both the residual based test – the Engel-Granger approach and the Johansen multivariate co-integration test. The Engel-Granger approach tests the residual for stationarity test. If the residual is stationary, then co-integration is established. Also, the multivariate Johansen co-integration test is carried out to ascertain whether long run relationship exists among the variables in a model. Johansen (1991, 1995) developed a Vector Autoregressive (VAR) based cointegration tests to determine the long run relationship.

Consider a VAR of order p: $Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_p Y_{t-p} + BX_t + \varepsilon_t \ldots\ldots\ldots(18)$

Where: Y_t is a k-vector of non-stationary I(1) variables, $X_t$is a d-vector of deterministic variables, and $\varepsilon_t$is a vector of innovations. We may rewrite this VAR as:

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + BX_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(19)$$

Where: $\Pi = \sum_{i=1}^{p} A_i - I$ and $\Gamma_i = -\sum_{j=i+1}^{p} A_j$

From the foregoing, the Granger representation theorem asserts that if the coefficient matrix Π has reduced rank r < k, then there exist k x r matrices α and β each with rank r such that $\Pi = \alpha\beta' and\ \beta' Y_t$ is integrated of order zero, I(0). Here, r indicates the number of cointegrating relations also referred to as the *cointegrating rank* and where each column of β represents the cointegrating vector. The elements of α indicate the adjustment parameters in the Vector Error Correction (VEC) model to the long run equilibrium. Thus, the Johansen co-integration test is to estimate the Π matrix from an unrestricted VAR model and to test whether the restrictions implied by the reduced rank of Π can be rejected or not. Thus, the variables must be integrated of the same order and co-integrated before they can be used for error correction modeling.

The Error Correction Model (ECM) is used to establish the short-run dynamics of a regression model. It is a means of reconciling the short-run behaviour of an economic

variable with its long-run behaviour. The Granger representation theorem (Granger, 1981 and 1986) establishes formally the theoretical basis of error correction modeling. According to the theorem, if Y_t and X_t' are cointegrated, then there is a long run relationship between them. Let's consider the following regression model: $Y_t = \beta X_t' + \mu_t$……(20)

Where: Y_t is the dependent variable; X_t' is a set of explanatory variables and μ_t is the residual. The Error Correction Model involves using the lagged residual to correct for deviations of actual values from the long-run equilibrium values. Thus, the residual from equation (20) is given as:

$$\widehat{\mu_t} = Y_t - \beta X_t' \text{……(21)}$$

Where: $\widehat{\mu_t}$ is integrated of order zero, i.e. I(0).

Assume that Y_t is integrated of order one, i.e. $Y_t \sim I(1)$ and $X_t' \sim I(1)$. If there exist a scalar β such that $(Y_t - \beta X_t') \sim I(0)$ then Y_t and X_t' are said to be cointegrated. Since, Y_t and X_t' are assumed to be cointegrated, the error correction model can be specified as follows:

$$\Delta Y_t = \beta \Delta X_t' + \alpha \hat{\mu}_{t-1} \text{……(22)}$$

Using the ECM symbol, equation (22) may be rewritten as:

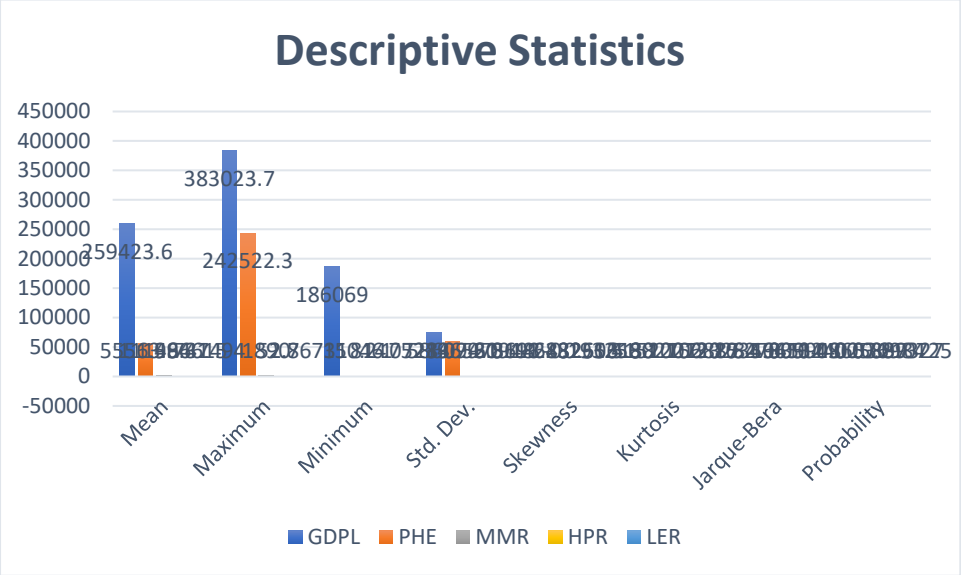
$$\Delta Y_t = \beta \Delta X_t' + \alpha ECM(-1) \text{……(23)}$$

This results from differencing the non-stationary series Y_t and X_t' before using them for the regression but adding an error correction term – a period lagged residual, $\hat{\mu}_{t-1}$. α is the error correction coefficient. This is expected to be negative and significant to rightly correct for any deviations of actual values from the long-run equilibrium values. Specifically, if actual equilibrium value is too high, the error correction term will reduce it and vice versa.

3.5 Sources of Data - Descriptive Statistics

The data sources include the publication of the Central Bank of Nigeria annual reports, annual publications of National Bureau of Statistics (NBS) and World Bank Development Indicators. Descriptive statistics show the summary of data and other basic characteristics within the series. The descriptive statistics for variables of the study are reported in Fig 1.

Fig.1: Descriptive Statistics



Source: Author's Computation (2022)

4.6 Presentation and Interpretation of Regression Results

Since long-run co-integration relationships have been established among the variables, the Error Correction Model (ECM) was estimated using the Ordinary Least Squares regression method. The results of the Error Correction model are presented in Table 6 below.

Table 4.8: Estimated Coefficients of the Short Run Dynamic Error Correction Model

Dependent Variable: DLOG(GDPL)				
Regressor	Coefficient	Standard Error	T-Ratio	Probability
DLOG(MMR)	-0.597286	0.329150	-1.814631	0.0896
DLOG(HIV)	-0.056909	0.047458	-1.199151	0.2491
DLOG(LER)	5.742168	1.919207	2.991948	0.0091
DLOG(PHE)	0.007598	0.008552	0.888426	0.3883
ECM (-1)	-3.30E-06	9.89E-07	-3.337465	0.0045
C	-0.019617	0.013620	-1.440313	0.1703
*R-**Squared** 0.7381*			*R-Bar-Squared* 0.6334	
F-Statistic 7.0468 (0.0010)			*DW-Statistic* 1.9103	

(Source: Author's computation using Eview 8.0)

The coefficient of determination of the Error Correction Model, R-squared (R^2) is about 0.74 and the adjusted R-squared ($\bar{R}^2$) is 0.63. The R-squared implies that about 74 percent of the systematic variations in first difference of the log of gross domestic product per labour are explained by the regressors in the short run equation. The adjusted R-squared indicates that

about 63 percent of the systematic changes in the dependent variable are attributable to the explanatory variables. Hence, the explanatory power of the model is high. The F-statistic has a value of 7.05 with an associated probability value less than 0.01. This implies that the overall goodness of fit of the model is significant at the 1 percent level. Thus, all the independent variables do collectively account for variations in the dependent variable in the short run.

The signs of all the estimated coefficients (public health expenditure, maternal mortality rate, HIV/AIDs prevalence rate, life expectancy rate and investment) in the ECM conform to their theoretical expectations. The coefficient of the first difference of the log of public health expenditure DLOG(PHE) is positive but insignificant even with 10 percent level of significance. Its coefficient is 0.008 with a t-value of 0.89. The t-statistic failed the significance test at the 10 percent level. Therefore, public health expenditure has a positive insignificant impact on productivity in the short run. The coefficient of the first difference of the log of maternal mortality rate DLOG(MMR) is negative and significant at 10 percent level of significance. It has a coefficient of -0.60 and t-statistic of -1.81. Its p-value is 0.09. The coefficient passed the statistical test of significance at the 10 percent level. Hence, if the maternal mortality rate increases by 1 percent, labour productivity will fall by about 0.6 percent in the short run. The implication is that maternal mortality rate has a significant adverse impact on labour productivity in the short run in Nigeria.

The first difference of log of HIV/AIDs prevalence rate DLOG(HPR) is negatively signed which conforms to its a priori expectation. Its elasticity coefficient is -0.06 with a t-value of -1.20. It failed the test of statistical significance at the 10 percent level. Thus, HIV/AIDs prevalence rate has no significant adverse effect on productivity in the short run. The elasticity of labour productivity with respect to life expectancy rate is positive and significant. Its coefficient is 5.74 and it has a t-value of 2.99 with a p-value of 0.01. This magnitude of t-statistic passed the significance test at the 1 percent level of significance. Hence, should life expectancy rate fall by 1 percent labour productivity will also fall by 5.74 percent in the short run. It follows that life expectancy rate has a significant positive impact on productivity in the short run in Nigeria.

The coefficient of adjustment of the ECM is correctly signed. That is, it is negative and significant at the 1 percent level. Thus, it will rightly act to correct any deviation of real gross domestic product per capita from its long-run equilibrium value. Its coefficient is –3.3E-06. This implies that the coefficient of adjustment will correct the previous disequilibrium of gross domestic product per capita at the rate of 3.3E-04 percent annually. This however shows a rather slow adjustment process to the long run equilibrium. A cursory look at the Durbin Watson statistic of approximately 1.91 depicts absence of autocorrelation in the error correction model. Having analyzed the short-run dynamics of the Error Correction Model, we estimated its associated long run model using the Ordinary Least Squares regression technique. The results of the estimated long run model are presented in Table 7 below.

Table 4.9: Estimated Coefficients of the Long Run Model

Dependent Variable: GDPL				
Regressor	Coefficient	Standard Error	T-Ratio	Probability
LOG(PHE)	-0.023461	0.011384	-2.060832	0.0550
LOG(MMR)	-0.747623	0.272026	-2.748353	0.0137
LOG(HIV)	-0.082326	0.047158	-1.745747	0.0989

LOG(LER)	3.377329	1.002668	3.368344	0.0036
LOG(INV)	0.050152	0.022756	2.203864	0.0416
C	-20.35695	5.544095	-3.671826	0.0019
R-Squared 0.9779				*R-Bar-Squared*
0.9714 *F-Statistic* 150.56(0.000)				*DW-*
Statistic 1.7927				

Source: Author's computation using Eview 8.0

The overall goodness of fit for the long run model is quite impressive compared to its short run model. The R-squared (R^2) and the adjusted R-squared ($\bar{R}^2$) are approximately 0.98.and 0.97 respectively. The R^2 indicates that about 98 percent of the systematic variations in gross domestic product per labour are accounted for by the independent variables in the long run equation. While the $\bar{R}^2$ shows about 97 percent of the systematic variations in the dependent variable are attributable to the independent variables. The unexplained variations in the dependant variable are about 3 percent based on the adjusted R-squared coefficient. The F-statistic is 150.6 with a p-value less than 0.0001. It indicates that the model is highly significant as a whole passing the test of significance at the 1 percent level. This indicates that there is a log-linear relationship between the dependent and each independent variable in the model. The Durbin Watson statistic of approximately 1.79 indicates absence of serial correction in the long run model.

The signs of all the estimated coefficients of the explanatory variables in the long-run model conformed to their a priori expectations except for public health expenditure whose sign turned out negative. The elasticity of productivity concerning public health expenditure (PHE) is negative and significant. Its elasticity coefficient is -0.023 with a t-value of -2.06. The t-statistic passed the significance test at the 10 percent level. This indicates that 1 percent rise in public health expenditure will lead to a fall in productivity by about 0.02 percent annually in the long run. Contrary to expectation, public health expenditure does have a significant adverse effect on productivity in the long run in Nigeria. The coefficient of log of maternal mortality rate LOG(MMR) is negative. It is significant at 1 percent level of significance. It has a coefficient of -0.75 and a t-statistic of -2.75. Its p-value is 0.01. The coefficient passed the statistical test of significance at the 1 percent level. The implication is that the maternal mortality rate has a negative significant impact on productivity in the long run. That is, a fall in maternal mortality rate by 1 percent will raise labour productivity by 0.75 percent in the long run in Nigeria.

4.7 Test of Hypotheses

Based on the regression results of the estimated long-run impacts of the explanatory variables, we can test the validity of the hypotheses presented in chapter one of this research. The estimated long-run coefficient of public health expenditure is negative and significant at the 10 percent level. Hence, we fail to accept the null hypothesis that there is no significant relationship between public health expenditure and productivity in Nigeria. The estimated long-run coefficient of maternal mortality rate is negative and significant at the 1 percent level. Therefore, we fail to accept the null hypothesis that there exists no significant relationship between maternal mortality rate and productivity in Nigeria.

Summary of Findings

The Dickey-Fuller Generalized Least Squares (DF-GLS) test was used to ascertain the order of integration of the time series. The Engel-Granger (residual-based) and multivariate Johansen co-integration tests were used to determine the long-run relationship between the dependent and the set of independent variables. The Error Correction Model (ECM) was used to model the short-run impact of the public health expenditure, health indicator variables and investment on productivity in Nigeria. The empirical results showed that all the variables are integrated of order one, that is, they are all difference stationary. Also, there exists a long-run relationship among public health expenditure, maternal mortality rate and productivity in Nigeria. In the short run, the multiple regression results showed that public health expenditure has a positive insignificant impact on productivity in Nigeria. Also, the findings revealed that the maternal mortality rate has a negative significant effect on productivity in the short run. In the long run model, the regression results showed that public health expenditure has a negative significant impact on productivity in Nigeria. However, the findings revealed that maternal mortality rate have negative significant impact on productivity in the long run.

5.2 Recommendations

Based on the empirical findings of this research, the following recommendations have been proffered:

1. Government should reconsider the proportion of its annual budget set aside for public health expenditure to improve its effect on human productivity in Nigeria. The government should ensure that money budgeted for the health sector is judiciously expended in the health sector and misappropriation of funds should be eradicated.
2. The government should improve health care facilities especially for maternal health care to reduce maternal mortality rate and engender increased labour productivity in the country. Adequate pre-natal and post-natal health care services should be provided for pregnant and nursing women in Nigeria. This will help ameliorate the maternal mortality rate and enhance labour productivity in the country.

5.3 Conclusion

The findings of this study showed that public health expenditure has a positive and insignificant impact on productivity in the short term. However, the results revealed that public health expenditure has a long-run significant adverse impact on productivity in Nigeria. These findings suggest that public health expenditure in Nigeria has not yielded the desired results. Thus, there is a need for a proper review of public health expenditure to ensure a positive effect on labour productivity in Nigeria. In addition, the maternal mortality rate was found to have a negative significant effect on productivity both in the short term and long term in Nigeria. This indicates that the maternal mortality rate plays a significant role in labour productivity in Nigeria. In this vein, an increased maternal mortality rate will reduce labour productivity both in the short run and long run in Nigeria. These findings suggest that higher investment levels will increase the productivity level of the country both in the short term and in the long term. Thus, for the Nigerian economy to continually sustain increased productivity and economic

growth, it should provide the needed environment for businesses and investment to strive effectively.

5.4 Contribution to Knowledge

This study has shown that public health expenditure has a negative significant effect on human productivity in the long term in Nigeria. Consequently, this finding provides an important opportunity to make further research into examining why public health expenditure plays a negative significant role in determining human productivity in the long term in Nigeria.

References

Aguayo-Rico, A. & Irish, A. (2005). Empirical evidence of the impact of health on economic growth. *Issues in Political Economy*, Vol.14.

Akram, N. P, Khan, I.H & Mohammad (2008): The long-term impact of health on economic growth in Pakistan. *Journal of business, social sciences and development Economics, Islamabad, Pakistan, ISSN: 0030-9729 Winter Volume 47, Issue 4.*

Baldacci, E.B. (2004): The impact of poor Health on Total factor productivity. *The Journal of Development Studies vol 42 (6), pp 918-938.*

Barro, R.J (1996): Health and economic growth; Mimeo. Cambridge, MA: Harvard University

Basta, S., Karyadi, S., & Scrimshaw, N. (1979): Iron deficiency anemia and productivity of adult males in Indonesia. *American Journal of Clinical Nutrition, Vol. 32, pp. 916-925*.

Bhatia, H.L. (1967): Public Finance 25th edition. Vikas Publishing House PVT Limited. New Delhi. India

Bloom, D. & Canning, D. (2008): Population Health and Economic Growth. World Bank Working Paper No: 24.b

Bloom, D.E., Canning, D. & Sevilla, J. (2004): The Effect of Health on Economic Growth: A production function approach. World Development, vol 32(1): pp 1- 13.

Easterly, W. & R. Levine (1997): Africa's growth tragedy: policies and ethnic divisions. *Quarterly Journal of Economics, vol. (1) 12 pp 1203-1250*.

Eatwell, J.M. & Newman, P. (1991): The New Palgrave: A Dictionary of Economics. Vols. 3, 4. & 12, Macmillan, Tokyo.

Elliott, G. T., Rothenberg, J. & Stock, J. H. (1996): Efficient tests for an autoregressive unit root. *Econometrica*, 64, 813-836.

Engle, R. F., & Granger, C. W. J. (1987): Co-integration and error correction: Representation, estimation and testing. *Econometrica*, 55, 251-276.

Granger, C. W. (1981): Developments in the study of cointegrated economic variables. *Oxford Bulletin of Economics and Statistics, vol. 48(3), pp 213-228*.

Granger, C. W. (1981): Some properties of time series data and their use in econometric model specification. *Journal of Econometrics*, vol. *1(6), pp. 121-130*.

Hamoudi, A. A., & Sachs, J. (1999): Economic consequences of health status: A review of the evidence. CID Working Papers Series No. 30

Johansen, S. (1991): Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica*, vol. 59, pp.1551–1580.

Johansen, S. (1995): Likelihood-based inference in cointegrated vector autoregressive models. Oxford: Oxford University Press.

Lawlor, A. (1985): Productivity improvement manual, Aldershot, United Kingdom.
Lucas, R. E (1998): Phase of capitalist development. Oxford, Oxford University Press
Lucian, U., Straciuc O., Maghiar, T. & Ciprian, T. (2009): Relationship and causality between economic growth rate and certain diseases in the European Union.
Lustig, N. (2006): Investing in health for economic development: The case of Mexico. UNUWIDER Research Paper No. 2006/30.
Maduka, Madichie, & Ekesiobi, (2016): Health care expenditure, health outcomes and economic growth Nexus in Nigeria; *Unified Journal of Economics and International Finance, 2(1), 1-10.*
Mankiw, N. G., D. Romer & D. N. Weil (1992): A contribution to the empirics of economic growth. *Quarterly Journal of Economic,* vol. 107, pp 407-437.
Mehrara, M. & Musai, M. (2011): Granger causality between economic growth in oil exporting countries. *Interdisciplinary Journal of Research in Business*, vol. 1(8), pp 103-108.
Mizushima, A (2008). Population aging and economic growth: The effect of health expenditure. *European University Institute*, ISSN: 1725-6704.
Musgrave, A. R (1969). *Fiscal system*. Yale University Press, New Haven
Nasiru, I. & Usman, H. M (2012). Health expenditure and economic growth nexus: An ARDL approach for the case of Nigeria, Department of Economics, Gombe State University.
NECA, (1991). Role of management in productivity in Nigeria. In Umeh, P.O.C.; Umeba, P.O.F. and Ekezie
Odubunmi, A. S., Saka, J. O., & Oke, M. D., (2012). Testing the cointegrating relationship between health care expenditure and economic growth in Nigeria. *International Journal of Economics and Finance. 4(11).*
Olaoye, A. O. (1985). Total factor productivity trends in Nigeria manufacturing. *Nigerian Journal of Economics and Social Studies, 27(3), 31 - 345.*
Olarinde, M. O, & Bello, A. A. (2014). Public healthcare expenditure and health sector performance in Nigeria: Implications for sustainable economic development. *Journal of Economics and Finance, 4(3) 3-552.*
Ologun, E. D. (2003). A test of the neoclassical theory of economic growth using cointegration and error-correction modeling: the Nigerian case; University of Benin.
Oni, L. B. (2014): Analysis of the growth impact of health expenditure in Nigeria. *Journal of Economics and Finance, 3(1), 77-84.*
Outpia, I. J. (1991). Productivity and Growth in Indian manufacturing Centre for Policy Research, Oxford University Press, Delhi.
Phillips, P. C. B. (1986). Understanding spurious regressions in econometrics; *Journal of Econometrics*, *3 311-340.*
Prokopenko, J. (1987): "Productivity Management: A Practical Handbook" International Labour Organization, Geneva.
Riman, H. B. & Akpan, E.S. (2010): Causality between Poverty, Health Expenditure and Health Status: Evidence from Nigeria using VECM. European.
Rivera, B. & Currais, L. (2003): The Effect of Health Investment on Growth: A Causality Analysis. International Advances in Economic Research, vol. 9 (4), pp 312-323.
Romer P. (1990), "Endogenous Technical Change" *Journal of Political Economy, vol. 98, pp. 15*
Solow, R. M. (1956): A contribution to the theory of economic growth; *Quarterly Journal of Economics*, 70 pp. 65-94.

Strauss, J., & Thomas, D. (1998): "Health, Nutrition and Economic Development." *Journal of Economic Literature 36: 766-817.*

Wilhelmson, K., Gerdtham, U. (2006): Impact on Economic Growth of Investing in Maternal–Newborn Health. Moving towards Universal Coverage Issues in Maternal–Newborn Health and Poverty; ISBN: 978 92 4 159450 9.

World Bank (1993): Investing in Health, World Development Report; Oxford University Press: New York, NY.

World Bank (2016): World Development Indicators; Washington, DC.

World Health Organization (2013): Statistical information system. World Health Organization, WHO: Geneva.

World Health Organization (2015): World Health Organization (WHO) Global Health Observatory data: Life expectancy. Geneva, Switzerland.

Yaqub, J., Ojapinwa, T.V. & Yussuff, R.O. (2010): Public Health Expenditure and Health Outcome in Nigeria: The Impact of Governance; *European Scientific Journal vol. 8, No.13 PP.189 -201.*