CHAPTER THREE

# HEALTH EXPENDITURE, LABOR PRODUCTIVITY AND ECONOMIC GROWTH IN NIGERIA: A STRUCTURAL VAR APPROACH

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## Abstract

This study investigated the relationships among health expenditure, labor productivity and economic growth in Nigeria. Secondary data from 1986-2022 were used to analyze these relationships with the help of the structural vector autoregressive (SVAR) model, which revealed long-term relationships between health expenditure, labor productivity and economic growth in Nigeria. The study also revealed that in the short run, health expenditure has a positive but insignificant relationship with labor productivity, and labor productivity in the short run has a positive but statistically insignificant relationship with economic growth in Nigeria. Additionally, the variance decomposition analysis shows that health expenditure is a more significant predictor of economic growth than labor productivity in the short run, with labor productivity being more responsive to health investments than to economic output during the same period. It was concluded that health expenditures in Nigeria have positive potential for increasing labor productivity; however, the impact is negligible because of inadequate health care expenditures. Emergent from the above findings and conclusions, it is recommended that, as a matter of urgency, the government should increase investment in the health sector, and in addition to increasing investment, there is a pressing need to improve the efficiency of resource allocation in the health sector. This should involve a concerted effort by the Ministry of Health, the Bureau of Public Procurement, and anticorruption agencies to minimize wastage, corruption, and mismanagement of funds.

***Keywords:*** Health expenditure, Labor productivity, Economic growth

## 1. Introduction

Economic growth is the central focus of most economies, especially developing countries, as it promotes higher national income, job creation, and poverty reduction. However, achieving sustainable economic growth requires the effective management of both human and natural resources. One of the critical pathways through which economies can grow is by investing in human capital—namely, education and health—which enhances labor productivity and, in turn, stimulates economic growth. As Todaro and Smith (2009) observe, human capital refers to the knowledge, skills, and health possessed by workers that contribute to economic production. Therefore, improvements in human capital, particularly through health expenditures, are essential for enhancing labor productivity, which drives long-term economic prosperity.

In recent years, the relationship between health expenditure and economic growth has gained considerable attention in empirical research. Theoretically, healthier workers are more productive, and they contribute more effectively to the economy by working longer, producing higher-quality output, and requiring fewer sick days (Piabuo & Tieguhong, 2017; Sahnoun, 2018). Additionally, higher public health spending often correlates with improved healthcare services and health status, which ultimately boosts labor efficiency and increases overall national productivity. This relationship is particularly pertinent in developing countries such as Nigeria, where health infrastructure remains underdeveloped and public health expenditures are often insufficient.

The significance of health expenditure in promoting economic growth is supported by a growing body of empirical research. Scholars such as Sarpong et al. (2018) highlighted the positive link between health and labor productivity, noting that investments in health enhance workforce capabilities and increase economic output. In line with this, Agenor (2008) and Mekdad, Dahmani, and Louaj (2014) emphasized that health, alongside education, constitutes a major driver of innovation and economic growth. As a result, the Nigerian government's spending on healthcare is an important aspect of the nation's development strategy, intended to improve workforce productivity and drive economic growth.

Nigeria, with its abundant human resources, should theoretically be a model of economic growth driven by high labor productivity. However, the country continues to face issues of underemployment, poor healthcare infrastructure, and low productivity, which hinder its economic potential. Recent reports by the World Bank (2020) rank Nigeria among countries with low human capital performance, revealing significant gaps in both healthcare provision and labor productivity. Although government spending on health has increased in recent years, as shown by Central Bank of Nigeria (CBN) data, the outcomes in terms of labor productivity and economic growth remain limited. This disconnect suggests that the effects of health expenditure on labor productivity and growth are either underexplored or inadequately addressed by existing policies. Furthermore, much of the literature on Nigeria focuses primarily on education as the key driver of human capital, while the crucial role of health in shaping labor productivity remains understudied.

This study, therefore, aims to explore the transmission effect of health expenditure on economic growth through labor productivity in Nigeria. It also aims to bridge this gap by investigating how health investments translate into economic growth through the channel of labor productivity. Specifically, this relationship is analyzed via a structural vector autoregression (SVAR) approach, which allows for the investigation of both short- and long-term dynamics between these variables. By focusing on Nigeria's health expenditure, labor productivity, and economic growth, this study contributes to the existing body of knowledge and provides policy insights aimed at improving human capital development and achieving sustainable economic growth in the country. This study also hopes to provide valuable insights for policymakers to better align health expenditures with productivity gains and growth outcomes in Nigeria.

## 2. Literature Review

### *Theoretical Framework*

**Neoclassical Growth Theory:** Neoclassical growth theory, particularly Solow's model (1956), attributes economic growth to the accumulation of physical capital, labor force expansion, and technological progress. Solow's model uses a Cobb–Douglas production function to show how these factors contribute to aggregate output. When both labor and capital grow at the same rate, the economy grows through the interaction of labor, capital, and technical change. The model posits that growth depends heavily on technological progress (exogenous in Solow's framework). However, education and health improvements, as forms of human capital investment, can significantly augment the labor force's effectiveness, thereby fostering economic growth. The incorporation of human capital into Solow's model has led to a broader understanding of how education and health spending—important elements of public expenditure—affect labor productivity and growth. The augmented Solow model, developed by Mankiw (1992) and others, introduces human capital into the growth equation, highlighting how investments in human capital (education and health) can increase productivity. This model underscores that human capital is critical for long-term economic development, enhancing labor productivity and fostering technological innovation.

**Wagner's Law of Increasing State Activities:** Wagner's Law, propounded by Adolph Wagner in 1883, posits that as economies develop, the role of government, particularly expenditures, increases. Wagner argued that economic development increases the complexity of legal and social relationships, which in turn requires expanded government involvement in providing public services, including education and health. Wagner suggested that as societies become wealthier, public demand for services such as education, health, and welfare increases, leading to greater government spending. This theory aligns with the idea that health expenditure increases with economic development, as governments seek to provide services that enhance the population's productivity, including improving healthcare. Wagner's Law implies a direct relationship between national income growth and public sector expansion, which is crucial for this study on health expenditure and its impact on labor productivity.

This research is grounded in both Neoclassical Growth Theory and Wagner's Law. Neoclassical theory highlights the role of human capital (particularly education and health) in enhancing productivity and fostering economic growth. In this framework, health investments are essential for labor productivity, which drives long-term growth. Wagner's Law complements this by explaining why governments increasingly invest in sectors such as health as economies grow, thereby promoting greater human capital development and, in turn, productivity and growth. Together, these theories suggest that health expenditure is not merely a social investment but a critical economic strategy. Public investment in health can lead to a more productive workforce, enhancing the overall growth trajectory of the economy.

### *Empirical Review*

The empirical works on human capital expenditure and labor productivity have focused primarily on the positive relationship between investments in health and education and improvements in labor productivity. Several studies confirm that investments in human capital, particularly in health and education, lead to improvements in labor productivity. Gul, Khan & Ajmair (2022) reported a positive correlation between human capital and labor productivity in Pakistan and recommended that the government enhance human capital development to increase productivity. In a similar vein, Wijaya (2019), who focused on Indonesia, and Samargandi (2018), who examined Middle East and North African countries, identified government expenditure as a key determinant of labor productivity in both the short and long run. These studies highlight that human capital investments, especially in education and health, play a crucial role in boosting labor productivity, which in turn enhances overall economic growth.

In Nigeria, Okowa and Vincent (2017) reported a positive relationship between tertiary enrollment and labor productivity, suggesting that higher education plays a significant role in enhancing worker efficiency. Similarly, Ugwu et al. (2020), Olayemi (2012) and Oluwatoyin & Fagbeminiyi (2010) demonstrated that government spending on education and health positively impacts labor productivity in the long run, although capital expenditures on education were found to have little effect. A recurrent theme is the distinction between the long-term and short-term effects of human capital investments on labor productivity. Awotunde (2018), examining the effects of government expenditure on health and education in Nigeria, reported that the impact of health expenditure on labor productivity takes approximately three years to materialize, whereas education expenditure impacts labor productivity variably over time. In the short run, labor productivity may decline before rising again as the benefits of education investment take effect. Mbaleki (2020) also demonstrated that government expenditures on health and education in South Africa positively and significantly affect labor productivity in both the short and long run, except for defense spending, which has a negative effect.

The literature generally supports the view that labor productivity is a critical driver of economic growth, although its effects can vary depending on the sector and the quality of human capital. Ngutsav and Ijirshar (2018) showed that labor productivity in the agricultural and service sectors significantly contributes to economic growth, but its role in the manufacturing and oil and gas sectors remains limited. This suggests a need for targeted policies that improve productivity in high-growth sectors while addressing structural challenges in less productive industries. Onyema and Nyenke (2019) further emphasized the role of healthcare in shaping labor productivity, showing how poor health services can constrain productivity, thereby limiting economic growth. Addressing these health challenges is crucial for improving workforce efficiency and driving sustainable economic development.

## 3. Methodology

This study adopted an ex post facto research design. The data used for this study are time series data obtained from secondary sources about the study variables. The variables include real gross domestic product (GDP), labor productivity (LAP), and government expenditure on health (GXH). The data were collected from the Central Bank of Nigeria (CBN) for all variables except for labor productivity, which was obtained from the National Bureau of Statistics. The study used the Granger causality test, which was used to examine the relationships among health expenditure, labor productivity and economic growth, whereas the SVAR, impulse response and variance decomposition estimates traced the instantaneous effects and the transmission mechanism. ADF and Ng-Perron tests were used to test for the presence or otherwise of unit roots in the variables.

### *Theoretical Model*

This study adopted Solow's neoclassic growth model (Solow, 1956, 1970). The production functions may be expressed as follows:

$$Y = f(A, K, L) \qquad 1$$

where Y = output, A = level of technology, K = capital stock, and L = labor quantity.

Equation (1) can be rewritten as

$$Y_t = A_t F(K_t L_t) \qquad 2$$

where Yt = aggregate real output,
K = capital stock,
L = labor,
A = efficiency factor, and
t = time dimension.

This proportion led to the formulation of the augmented Solow model using the Cobb–Douglas production function by incorporating human capital into it. Therefore, following Mankiw et al. (1997), the augmented Solow model is written as:

$$Y_{(t)} = K_{(t)}\ a\ H_{(t)}\ b\ (A_{(t)}\ L_{(t)})^{1-a-b} \qquad 3$$

where H = stock of human capital *and* $b < 1$ = decreasing returns to capital.

This study, however, adopts the model specified implicitly by Mankiw et al. (1992), Ayara (2002) and Uwatt (2002) as follows:

$$Y_t = A_{(t)}\ K^{a1}\ L^{a2}\ H^{a3} \qquad 4$$

where H is human capital and is accounted for by the variables Education and Health. $a_1 + a_2 + a_3 = 1$ (assuming constant returns to scale), whereas the other variables are as defined earlier.

Taking the natural log of both sides of the equation produces a linear equation in levels of the form:

$$LnY = a_0 + a_1\ LnK + a_2 LnL + a_3 LnH + e \qquad 5$$

where Y is the real GDP as a proxy for economic growth, K is real gross capital formation, L is labor productivity, and H is human capital where government expenditures on education and health are used as proxies.

***Model Specification***

From the above theoretical model, the following variables were used to estimate different relationships meant to achieve the objectives of the study. The general relationship is as follows:

$$RGDP = f(GFCF, LAB, GXE, GXH, TBL, HCE) \qquad 6$$

where GDP = real gross domestic product (proxy for economic growth), GFCF = gross fixed capital formation, LAP = labor productivity, GXE = government expenditure on education, GXH = government expenditure on health, TBL = trade balance (as an additional variable to include the external sector), and HCE = household consumption expenditure.

To achieve the objective of the study, the SVAR model was adopted since it seeks to establish the contemporaneous and shock effects of the variables of interest.

The generic form of the SVAR is given by:

$$A_0 Z_t = A_1 Z_{t-1} + \xi_{it} \qquad 7$$

Where

$A_0$ = $nxn$ matrix of contemporaneous effects of the endogenous parameters

$Z_t$ = $nx1$ Column vector matrix of estimable endogenous variables

$A_1$ = $nxn$ matrix of lagged estimable endogenous variables

$Z_{t-1}$ = $nx1$ Column vector matrix of lagged estimable endogenous variables

$\xi_{it}$ = $nx1$ column vector of the error term in the system

The transmission channel sought to be traced here is centered around the notion that increased government expenditure on health (GXH) triggers an improvement in the level of labor productivity (LAP), which in turn positively affects economic growth (GDP). Thus, by following the Cholesky pattern of ordering from the most exogenous to the least exogenous variables, equation (1) can be rearranged to become:

$$Z = \left[GDP, LAP, GXH\right] \qquad 8$$

However, to maintain the transmission channel of $\left[GXH \longrightarrow LAP \longrightarrow GDP\right]$, which shows that as the government spends more on health, it should translate to having a healthier population with higher labor productivity that will increase the level of national output in the economy. Equation (8) can be rewritten as follows with a sign of *prime (‘),* indicating that the equation remains the same when reversed.

$$Z = \left[GXH, LAP, GDP\right]' \qquad 9$$

By taking the log of the model, the following is obtained:

$$Z = \left[\ell GXH, \ell LAP, \ell GDP\right]' \qquad 10$$

Thus, the equation can be expressed in matrix form as:

$$\begin{bmatrix} 1 & -\vartheta_{12}^{0} & -\vartheta_{13}^{0} \\ -\vartheta_{21}^{0} & 1 & -\vartheta_{23}^{0} \\ -\vartheta_{31}^{0} & -\vartheta_{32}^{0} & 1 \end{bmatrix} \begin{bmatrix} \ell GDP_t \\ \ell LAP_t \\ \ell GXH_t \end{bmatrix} = \begin{bmatrix} \vartheta_{11}^{1} & \vartheta_{12}^{1} & \vartheta_{12}^{1} \\ \vartheta_{21}^{1} & \vartheta_{22}^{1} & \vartheta_{23}^{1} \\ \vartheta_{31}^{1} & \vartheta_{32}^{1} & \vartheta_{33}^{1} \end{bmatrix} \begin{bmatrix} \ell GDP_{t-1} \\ \ell LAP_{t-1} \\ \ell GXH_{t-1} \end{bmatrix} + \begin{bmatrix} V_{1t} \\ V_{2t} \\ V_{3t} \end{bmatrix}$$

4.41

Where

$A_0$= 3 x 3 matrix that captures the contemporaneous effects

$Y_t$= 3 × 1 column vector matrix of the estimable endogenous variables

$A_1$= 3 × 3 matrices of the estimable endogenous variables

$V_t$ = 3 × 1 column vector of the matrix of the error terms in the model

However, it may be difficult to use SVAR to estimate the above model since it has been overparameterized. Therefore, there was a need to use the recursive approach where restrictions have been imposed on the parameters of the $A_0$ matrix on the basis of institutional knowledge to resolve the issue of identification in the SVAR model. Accordingly, by imposing restrictions on the recursive approach, we arrive at a triangular contemporaneous matrix as follows:

$$\ell GDP_t = lags + v_{1t} \qquad 11$$

$$\ell LAP_t = \ell GDP_t + lags + v_{2t} \qquad 12$$

$$\ell GXH_t = \ell GDP_t + \ell LAP_t + lags + v_{3t} \qquad 13$$

Thus, rewriting the RHS of equation (8) and setting it equal to the matrix of error terms yields:

$$A_0 = \begin{bmatrix} 1 & 0 & 0 \\ -\vartheta_{21}^0 & 1 & 0 \\ -\vartheta_{31}^0 & -\vartheta_{32}^0 & 1 \end{bmatrix} \begin{bmatrix} \ell GDP_t \\ \ell LAP_t \\ \ell GXH_t \end{bmatrix} = \begin{bmatrix} V_{1t} \\ V_{2t} \\ V_{3t} \end{bmatrix} \qquad 14$$

Recall that $Ay_t = A_1^S y_{t-1} + \dots + A_P^S y_{t-p} + C^s x_t + Bu_t$ and that $\xi_t = \beta\mu_t$
.

However, $$\beta = \begin{bmatrix} \delta_1^2 & 0 & 0 \\ 0 & \delta_2^2 & 0 \\ 0 & 0 & \delta_3^2 \end{bmatrix} \qquad 15$$

This implies that $\beta$ is a unit variance and, as such, var ($\mathfrak{y}_t$) =1. Consequently, by setting $A_0 = \beta$, equation (14) can be rewritten as:

$$A_0 = \begin{bmatrix} 1 & 1 & 1 & 1 \\ -\vartheta_{21}^0 & 1 & 1 & 1 \\ -\vartheta_{21}^0 & -\vartheta_{21}^0 & 1 & 1 \end{bmatrix} \begin{bmatrix} \ell GDP_t \\ \ell LAP_t \\ \ell GXH_t \end{bmatrix} = \begin{bmatrix} \delta_1^2 & 0 & 0 \\ 0 & \delta_2^2 & 0 \\ 0 & 0 & \delta_3^2 \end{bmatrix} \begin{bmatrix} \mu_{1t}\ell GDP \\ \mu_{2t}\ell LAP \\ \mu_{3t}\ell GXH \end{bmatrix} \qquad 16$$

One distinct characteristic of the SVAR, as opposed to the conventional VAR, is that it distils out spillovers in errors. This ensures that the errors are uncorrelated and is expressed as follows:

$$[\cdot][\cdot] = \begin{bmatrix} \delta_1^2 & o & o \\ o & \delta_1^2 & o \\ o & o & \delta_1^2 \end{bmatrix} \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \end{bmatrix} \qquad 17$$

Thus, distilling out the spillover effects of errors, equation (16) becomes:

$$\begin{bmatrix} 1 & 1 & 1 \\ -\vartheta_{21}^{0} & 1 & 1 \\ -\vartheta_{31}^{0} & -\vartheta_{32}^{0} & 1 \end{bmatrix} \begin{bmatrix} \mu_{1t}\ell GDP \\ \mu_{2t}\ell LAP \\ \mu_{3t}\ell GXH \end{bmatrix} = \begin{bmatrix} \delta_1^2 & 0 & 0 \\ 0 & \delta_2^2 & 0 \\ 0 & 0 & \delta_3^2 \end{bmatrix} \begin{bmatrix} \ell GDP_t \\ \ell LAP_t \\ \ell GXH_t \end{bmatrix} \qquad 18$$

This implies the following:

$$A_0 \xi_t = \beta \mu_t \qquad 19$$

Consequently, the initial impulse or variance forecast can be specified in matrix form as:

$$\xi_t = A_0^{-1}\beta\mu_t = \begin{bmatrix} \xi_t^{\ell GDP} \\ \xi_t^{\ell LAP} \\ \xi_t^{\ell GXH} \end{bmatrix} = \begin{bmatrix} a & 0 & 0 \\ b & c & 0 \\ d & e & f \end{bmatrix} \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \end{bmatrix} \qquad 20$$

where $a$ is the response of $lGDP_t$ to its own shocks**;**
***b*** is the response of $lLAP_t$ to shocks in $GDP_t$;
***c*** is the response of $lLAP_t$ to own shocks;
***d*** is the response of $lGXH_t$ to shocks in $GDP_t$;
***e*** is the response of $lGXH_t$ to shocks in $lLAP_t$;
***f*** is the response of $lGXH_t$ to own shocks;

## 4. Results and Discussion

***Descriptive Statistics***

A summary of the descriptive statistics of the variables captured in this study is presented in Table 1.

**Table 1 Descriptive Statistics**

| | RGDP | GXE | LAP |
|---|---|---|---|
| Mean | 43373.80 | 201.7276 | 352.1854 |
| Median | 38777.00 | 82.39000 | 343.5800 |
| Maximum | 77799.70 | 771.4600 | 718.1400 |
| Minimum | 17180.50 | 2.080000 | 13.52000 |
| Std. Dev. | 21365.69 | 236.5310 | 208.9246 |
| Skewness | 0.265102 | 1.060342 | 0.064016 |
| Kurtosis | 1.435785 | 2.794480 | 1.785649 |
| Jarque-Bera | 4.205488 | 6.998459 | 2.298687 |
| Probability | 0.122121 | 0.030221 | 0.316845 |
| Observations | 37 | 37 | 37 |

***Sources:*** Authors' computations via E-views 10

Table 1 presents the descriptive properties of the series used in the analysis. The table clearly shows that the real gross domestic product has a mean value of ₦ 43,373.80 billion with a maximum value of ₦77,799.70 billion and a minimum value of ₦17,180.50 billion. The Jarque–Bera statistic value of 4.205 is not statistically significant at the 5% level. This implies that the series is normally distributed. Similarly, Household Consumption Expenditure (HCE) had a mean value of 33,875.02, a maximum value of 130,077.6 and a minimum growth rate value of 82.73000. The Jarque–Bera statistic value of 5.90 is statistically significant at the 5% level, implying that the series is not normally distributed.

Additionally, the table shows that government expenditures on health (GXH) had a mean value of ₦119.1757 billion, a maximum value of ₦711.2800 billion and a minimum value of ₦0.0400 billion. The Jarque-Bera statistic value of 38.01 is statistically significant at the 5% level. This suggests that the series is also not normally distributed. Furthermore, the variable Labor Productivity (LAP) had a mean value of 352.1854 and a maximum value of 718.1400 and a minimum value of 13.52000. The Jarque–Bera statistic value of 2.29 is statistically significant at the 5% level of significance, which implies that the series is normally distributed.

***Unit Root Test Results***

The results of the estimated unit root test are displayed in Table 2.

**Table 2: Augmented Dickey–Fuller Unit Root Test Results**

| Variables | At level | Prob. Value | First Difference | Critical Values | | | Prob. Values | Order of Cointegration |
|---|---|---|---|---|---|---|---|---|
| | | | | 1% | 5% | 10% | | |
| RGDP | -1.227493 | 0.6514 | -6.685617 | -3.639407 | -2.951125 | -2.614300 | 0.0000 | I(1) |
| GXH | -2.486468 | 0.1273 | -10.78795 | -3.632900 | -2.948404 | -2.612874 | 0.0000 | I(1) |
| LAP | -3.476746 | 0.0147 | | -3.632900 | -2.948404 | -2.612874 | | I(0) |

***Source:*** Extract from E-views 10 outputs. Note:

These critical values are computed from Mackinnon (1996), and if the probability value of a particular variable is less than the critical value, then this implies that the said variable is stationary at the specific level of concern. This study adopted the 5% level of significance.

From the results in Table 2, all the variables were found to be stationary at the 1st difference except for Labor Productivity, which was found to be stationary at all levels. To validate the results of the test, the Ng–Perron test was employed, and the results are presented in Table 3.

**Table 3: Unit Root Test Results (Ng-Perron)**

| **Levels** | **MZa** | **MZt** | **MSB** | **MPT** |
|---|---|---|---|---|
| LNRGDP | -0.61495 | -0.31136 | 0.50633** | 17.2253 |
| LNGXH | 0.86334 | 0.78792 | 0.91264** | 57.4189 |
| LNLAP | 0.67526 | 1.20441 | 1.78364 | 191.960 |
| **1st Difference** | **MZa** | **MZt** | **MSB** | **MPT** |
| LNRGDP | -26.0786 | -3.61085 | 0.13846 | 0.93993 |
| LNGXH | -6.62255 | -1.79447 | 0.27096 | 3.78498 |
| LNLAP | -0.60160 | -0.35168 | 0.58459** | 20.7526 |

**Source:** Extract from E-views 10 outputs. Note: ** denotes Stationarity at the 5% level of significance

The Ng-Perron results revealed that all the variables were stationary at all levels except for labor productivity, which became stationary after the 1st difference.

***The Contemporaneous Response of Economic Growth to Changes in Government Health Expenditures through Labor Productivity in Nigeria***

In line with the objective of the study, the SVAR model was used to explore the contemporaneous response. The indicators used were real gross domestic product, government expenditures on health and labor productivity.

***Lag selection criteria***

Before the SVAR, which examines the response of economic growth to changes in labor productivity through government expenditures on health in Nigeria, was estimated, the optimal lag length was estimated, and the results are presented in Table 4.

**Table 4: Optimal Lag Selection Criteria**

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | -66.06556 | NA | 0.011668 | 4.062680 | 4.197359 | 4.108609 |
| 1 | 31.48026 | 172.1397* | 6.40e-05* | -1.145898* | -0.607182* | -0.962180* |
| 2 | 37.70877 | 9.892336 | 7.65e-05 | -0.982869 | -0.040117 | -0.661363 |
| 3 | 44.88627 | 10.13295 | 8.82e-05 | -0.875663 | 0.471125 | -0.416370 |

* indicates lag order selected by the criterion

**Source: Author's Computation via E-Views 10**

Table 4 shows that the results of the sequential modified LR test statistic, final prediction error, the Akaike information criterion, the Schwarz information criterion and the Hannan–Quinn information criterion indicate that Lag 1 is the optimal lag length for the study. Lag 1 was therefore used for the SVAR model estimation. Given the results of the lag length criterion, the Johansen cointegration test was conducted, and the results are presented in Table 5.

**Table 5: Unrestricted Cointegration Rank Test (Trace)**

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None* | 0.272698 | 32.70156 | 29.79707 | 0.0424 |
| At most 1* | 0.259780 | 17.55709 | 15.49471 | 0.0359 |
| At most 2 | 0.082899 | 3.028816 | 3.841466 | 0.0818 |

***Source:*** Extracts from E-views Output

The result of the unrestricted rank test (Trace) revealed the existence of 2 cointegrating equations among the series. The null hypothesis of no cointegration among series was therefore rejected, in favor of the alternate hypothesis. This finding highlights the presence of a long-run relationship among the variables.

**Table 6: Result of the Unrestricted Cointegration Rank (Maximum –Eigenvalue) Test**

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None* | 0.272698 | 31.14446 | 21.13162 | 0.0029 |
| At most 1* | 0.259780 | 17.52828 | 14.26460 | 0.0495 |
| At most 2 | 0.082899 | 3.028816 | 3.841466 | 0.0818 |

***Source:*** Author's Computation Using E-views 10

The result of the unrestricted cointegration rank (maximum–eigenvalue) reveals the existence of 2 cointegrating equations among the series. This suggests the presence of a long-run relationship among the variables used in the model. The contemporaneous structural parameters were estimated to ascertain the short-term relationships among the variables. The results are shown in Table 7.

**Table 7: Estimated Contemporaneous Structural Parameters**

| | RGDP | LAP | GXH |
|---|---|---|---|
| RGDP | 1 | 0 | 0 |
| LAP | -0.019403 (0.4541) | 1 | 0 |
| GXH | 0.252330 (0.5152) | -0.396626(0.8744) | 1 |

*Probability values are in parentheses.*
***Source:*** Extracts from E-views Output

The estimated contemporaneous structural parameters show that government expenditures on health had a negative and statistically insignificant effect on labor productivity in Nigeria in the short run during the period of this study. This means that a 1% increase in the contemporaneous impact of government expenditure on health would lead to a 0.39% reduction in labor productivity in Nigeria within the study period. This may be attributed to the fact that government investment in the health sector of the economy was too small to have a perceptible effect. This could have led to a lower health workforce and a high level of absenteeism and low productivity. Again, the estimated contemporaneous structural parameters showed that labor productivity had a negative and statistically insignificant effect on economic growth in Nigeria in the short run. This implies that a 1% increase in the contemporaneous impact of labor productivity led to a reduction in economic growth of 0.02% in Nigeria.

***Diagnostic tests***

Before the impulse responses and variance decompositions were analyzed, diagnostic tests were performed. First, the VAR residual serial correlation test was conducted, and the results are presented in Table 8.

**Table 8: VAR residual serial**

| Lag | LRE* stat | Df | Prob. | Rao F-stat | df | Prob. |
|---|---|---|---|---|---|---|
| 1 | 6.448014 | 9 | 0.6944 | 0.712409 | (9, 58.6) | 0.6953 |
| 2 | 10.48297 | 9 | 0.3128 | 1.197367 | (9, 58.6) | 0.3141 |

| Lag | LRE* stat | Df | Prob. | Rao F-stat | df | Prob. |
|---|---|---|---|---|---|---|
| 1 | 6.448014 | 9 | 0.6944 | 0.712409 | (9, 58.6) | 0.6953 |
| 2 | 19.50554 | 18 | 0.3613 | 1.107430 | (18, 59.9) | 0.3680 |

***Source:*** Extracts from E-views Output

Table 8 shows the results of the VAR residual serial correlation LM test, and the results indicate that both the LRE* statistic and the Reo F statistic are not statistically significant, which leads to the conclusion of no serial correlation in the SVAR. That is, the successive errors in the SVAR model are not correlated with each other. Second, VAR residual heteroskedasticity tests with cross terms were conducted, and the results are presented in Table 9.

**Table 9: VAR Residual Heteroscedasticity Tests (Including Cross Terms)**

| Chi-sq | df | Prob. |
|---|---|---|
| 191.2152 | 162 | 0.0581 |

***Source:*** Extracts from E-views Output

Table 9 shows the VAR residual heteroskedasticity test (including cross-terms) results. The results indicate that the chi-square values are not statistically significant, implying that heteroskedasticity is not present in the SVAR model.

### *Impulse Response Functions*

The impulse response function (IRF) shows the response of each variable in the system to shocks from the system variables. To further buttress how shocks in health expenditures impact economic growth through labor productivity in Nigeria, impulse response functions were estimated, and the results are presented in Figure 1.

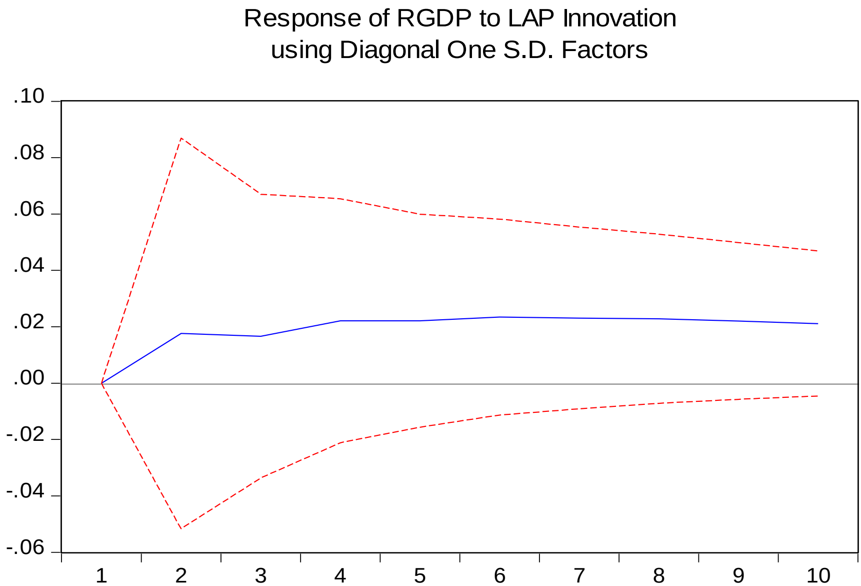


**Figure 1:** Impulse response of the real gross domestic product

The impulse response function graph provides valuable insights into the relationship between economic growth and innovations in labor productivity. From the initial period analyzed, it becomes evident that real gross domestic product (GDP) experiences a notable uptick in response to innovations in labor productivity. This increase serves as a testament to the pivotal role that advancements in labor efficiency play in driving overall economic expansion. Notably, this positive effect persists over the entire forecast period of 10 years. Such sustained growth within the positive region indicates not only an immediate impact but also a lasting influence of increased labor productivity on economic performance. This suggests that investments or policies aimed at boosting productivity can lead to continuous economic growth over the long term. Furthermore, the findings from the impulse response function graph offer justification for prioritizing initiatives that aim to improve labor productivity.

The impulse response function of labor productivity to innovations in government expenditures on health was estimated, and the results are presented in Figure 2.

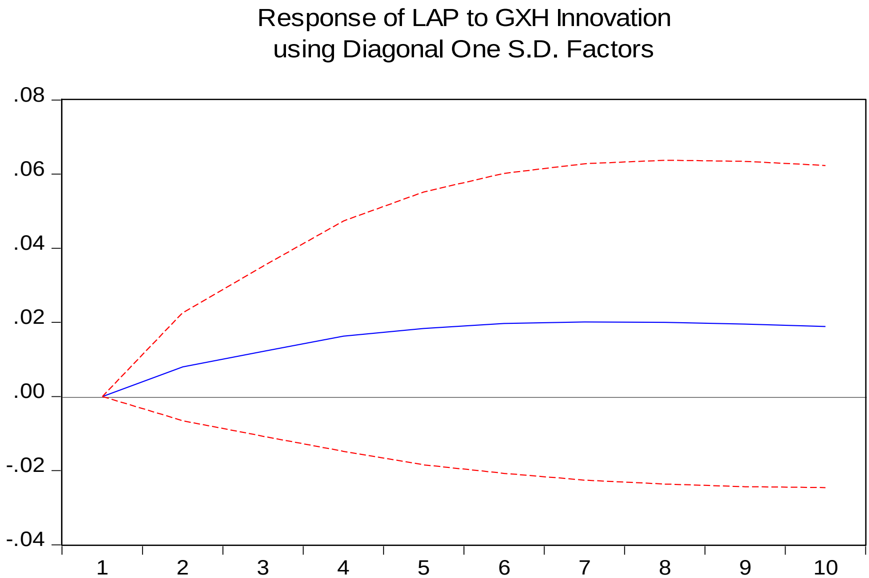


**Figure 2:** Impulse Response of Labor Productivity

The impact of government expenditures on health on labor productivity is quite notable. When subjected to innovations equivalent to one standard deviation, the resulting impulse response is positive. This means that there is a tangible increase in labor productivity following such expenditures. Moreover, this positive response persists over time, indicating a sustained and potentially long-term benefit to productivity levels. This observation explains the significant role that investments in health can play in enhancing overall productivity within an economy. ".

***Forecast Error Variance Decomposition***

The forecast error variance decomposition (FEVD) provides information about the proportion of movements in a sequence due to its own shocks and the shocks due to other variables in the system. The FEVD was estimated, and the results are presented in Table 10.

**Table 10: Variance decomposition of RGDP**

| Period | S.E. | RGDP | LAP | GXH |
|---|---|---|---|---|
| 1 | 0.246518 | 100.0000 | 0.000000 | 0.000000 |
| 2 | 0.253635 | 96.39640 | 0.618326 | 2.985276 |
| 3 | 0.265834 | 91.18911 | 1.115545 | 7.695348 |
| 4 | 0.272276 | 87.15106 | 1.893986 | 10.95495 |
| 5 | 0.278338 | 83.53395 | 2.606543 | 13.85951 |
| 6 | 0.282776 | 80.94764 | 3.348759 | 15.70360 |
| 7 | 0.286455 | 78.88704 | 4.030861 | 17.08209 |
| 8 | 0.289334 | 77.32584 | 4.669627 | 18.00454 |
| 9 | 0.291687 | 76.08317 | 5.244726 | 18.67210 |
| 10 | 0.293600 | 75.09515 | 5.760721 | 19.14413 |

***Source:*** Extracts from E-views Output

The variance decomposition results reveal that own shocks to real gross domestic product were dominant from the first period to the tenth period. However, it declined from 100% from the first period to 75.09% in the tenth period, meaning that the variables of labor productivity and government expenditure on health were predictors of economic growth in Nigeria within the study period. A unit change in labor productivity in the second period accounted for approximately 0.62% of the forecast error variance of RGDP in the second period, and the results increased significantly to 5.76% in the tenth period. For government expenditures on health, a unit change in government expenditures on health was able to explain approximately 2.99% of the forecast error variance of RGDP in the second period, and the results increased significantly to 19.14% in the tenth period. This implies that government expenditure on health was a better predictor of economic growth in Nigeria than labor productivity was a weaker predictor within the period under study.

**Table 11: Variance decomposition of labor productivity**

| Period | S.E. | RGDP | LAP | GXH |
|---|---|---|---|---|
| 1 | 0.041785 | 0.021119 | 99.97888 | 0.000000 |
| 2 | 0.067224 | 0.067867 | 98.52966 | 1.402473 |
| 3 | 0.085998 | 0.064944 | 97.08496 | 2.850095 |
| 4 | 0.100251 | 0.060972 | 95.22004 | 4.718984 |
| 5 | 0.111368 | 0.055738 | 93.41581 | 6.528455 |
| 6 | 0.120284 | 0.051173 | 91.68523 | 8.263600 |
| 7 | 0.127555 | 0.047330 | 90.13313 | 9.819539 |
| 8 | 0.133568 | 0.044205 | 88.76265 | 11.19314 |
| 9 | 0.138581 | 0.041679 | 87.57863 | 12.37969 |
| 10 | 0.142789 | 0.039638 | 86.56410 | 13.39627 |

**Source: Extracts from E-views Output**

The variance decomposition results revealed that own shocks to labor productivity are dominant from the first period to the tenth period. However, it declined from 99.97% from the first period to 86.54% in the tenth period, indicating that real gross domestic product and government expenditures on health were predictors of labor productivity in Nigeria. The results also revealed that a unit change in real gross domestic product in the first period accounted for approximately 0.021% of the forecast error variance of labor productivity in the first period, and the results increased gradually to 0.039% in the tenth period. Similarly, the shocks of government expenditures on health accounted for 1.40% of the forecast error variance of labor productivity in the second period, and the results increased significantly to 13.39% in the tenth period. The implication is that government expenditures on health are a better predictor of labor productivity.

**Table 12: Variance decomposition of government expenditures on health**

| Period | S.E. | RGDP | LAP | GXH |
|---|---|---|---|---|
| 1 | 0.630661 | 0.170779 | 0.275199 | 99.55402 |
| 2 | 0.677837 | 0.155124 | 4.177469 | 95.66741 |
| 3 | 0.755044 | 0.134313 | 6.353798 | 93.51189 |
| 4 | 0.792646 | 0.123753 | 9.091652 | 90.78460 |
| 5 | 0.827250 | 0.114700 | 11.11545 | 88.76985 |
| 6 | 0.851940 | 0.108503 | 12.97886 | 86.91264 |
| 7 | 0.872580 | 0.103580 | 14.49955 | 85.39687 |
| 8 | 0.889026 | 0.099831 | 15.81210 | 84.08807 |
| 9 | 0.902711 | 0.096840 | 16.91319 | 82.98997 |
| 10 | 0.914037 | 0.094456 | 17.85006 | 82.05549 |

**Source:** Extracts from E-views Output

The variance decomposition results revealed that own shocks to government expenditures on health are dominant from the first period to the tenth period. However, it declined from 99.55% in the first period to 82.05% in the tenth period, indicating that real gross domestic product and labor productivity are predictors of government expenditures on health. The results also revealed that a unit change in real gross domestic product in the first period accounted for approximately 0.17% of the forecast error variance in government expenditures on health in the first period, and the results decreased gradually to 0.09% in the tenth period. For labor productivity, a unit change in labor productivity explained approximately 0.28% of the forecast error variance of government expenditures on health in the first period, and the results increased significantly to 17.85% in the tenth period. The implication is that labor productivity was the strongest predictor of government expenditures on health in Nigeria within the study period.

## 5. Conclusion and Policy Recommendations

The study concludes that while health expenditure positively affects labor productivity over the long term, its short-term impact on economic growth is minimal and even negative in some cases. This suggests that the current level of government investment in health is insufficient to generate immediate gains in productivity, likely because of inefficiencies in the allocation and utilization of resources within the health sector. These inefficiencies result in a lower health workforce, high absenteeism rates, and reduced productivity, which in turn dampens economic growth. Despite these short-term challenges, the study's impulse response function analysis demonstrates that improvements in labor productivity- driven by better health outcomes—have a sustained, positive influence on economic growth over a longer horizon. Additionally, the variance decomposition analysis shows that health expenditure is a more significant predictor of economic growth than labor productivity in the short run, with labor productivity being more responsive to health investments than to economic output during the same period. Therefore, this study underscores the importance of strategic and long-term investment in health and labor productivity as crucial components for achieving sustained economic prosperity in Nigeria.

To effectively harness the potential of health expenditures to increase labor productivity and drive economic growth, policymakers should focus on several key areas. First, the Nigerian government, through both federal and state agencies, particularly the Ministries of Health and Finance, should prioritize long-term investments in the health and human capital sectors. These investments must be sustained over time to ensure that the benefits of improved health translate into increased labor productivity and, subsequently, economic growth. The current study reveals that the short-term impacts of health expenditure may be limited, but the long-term effects are crucial for driving productivity. Therefore, it is essential to allocate a stable and increasing budget to health programs, with funding continuity guaranteed over multiple years. The government should implement multiyear strategic health plans that align with the nation’s broader development goals, ensuring that health spending contributes directly to improving labor productivity and boosting the economy.

In addition to increasing investment, there is a pressing need to improve the efficiency of resource allocation in the health sector. This should involve a concerted effort by the Ministry of Health, the Bureau of Public Procurement, and anticorruption agencies to minimize wastage, corruption, and mismanagement of funds. The study suggests that poor management of health resources has contributed to the weak short-term impact of health expenditure on labor productivity. To address this, policymakers should introduce more stringent procurement and financial tracking systems to ensure that allocated funds are used effectively. The use of digital financial management systems can promote transparency, whereas regular audits and public disclosure of health expenditures can foster accountability, helping to ensure that funds reach their intended targets and produce measurable improvements in health outcomes.

Furthermore, regular monitoring and evaluation of health expenditure and its impact on labor productivity and economic growth should become a core part of the policy framework. The National Bureau of Statistics, in collaboration with the Ministry of Health and independent research institutions, should develop robust, data-driven frameworks to monitor the outcomes of health spending. Continuous monitoring allows policymakers to track the effectiveness of their investments, identify areas needing improvement, and adjust strategies in response to real-time data. This approach will not only enhance the transparency of health spending but also enable more targeted interventions that maximize the productivity and growth impact of health sector investments.

Finally, increased investment in research and innovation within the health sector is crucial for developing the technologies, methodologies, and interventions needed to drive productivity and economic growth. The Ministry of Health, working in partnership with universities and research institutions, should foster an environment that encourages public–private collaborations to promote healthcare innovation. Grants and incentives for research in healthcare can stimulate the development of new solutions that enhance productivity and health outcomes. Moreover, collaboration with international organizations and the adoption of best practices in healthcare delivery can significantly improve the quality of health services in Nigeria, further boosting labor productivity and contributing to long-term economic growth.

## References

Abubakar, S. A. (2020). The impact of human capital development on economic growth in Nigeria. *Lapai International Journal of Management and Social Sciences*, 12(1), 218-228.

Agenor, P. R. (2008). Fiscal policy and endogenous growth with public infrastructure. *Oxford Economic Papers*, 60(1), 57–87.

Aggray, N., Luvanda, E., & Shitundu, J. (2010). Human capital and labor productivity in East African manufacturing firms. *Current Research Journal of Economic Theory*, 2(2), 48-54.

Akaakohol, B. M., & Ijirshar, V. U. (2018). Human capital development and economic growth in Nigeria. *Lafia Journal of Economics and Management Sciences*, 3(1), 95-116.

Anvari, E., Ahangari, A. M., & Jafari, E. (2020). The role of government health and education expenditure on economic growth in Iran and OPEC countries. *Iran Economic Review*, 24(4), 1079-1098.

Awotunde, I. (2018). Capital accumulation and labor productivity growth in Nigeria. *International Journal of Economics and Financial Research*, 4(6), 171-179.

Central Bank of Nigeria. (2022). *Statistical bulletin*. Abuja, Nigeria: Federal Government Press.

Gul, S., Khan, A. G., & Ajmair, M. (2022). Relationship between human capital and labor productivity. *Pakistan Social Sciences Review*, 6(2), 663-677.

Keji, S. A. (2021). Human capital and economic growth in Nigeria. *Future Business Journal*, 7, 49.

Kelani, F. A., Odunayo, H. A., Ozegbe, A. E., & Nwani, S. E. (2019). Health status, labor productivity, and economic growth in Nigeria. *Journal of Economics, Management and Trade*, 23(1), 1-12.

Krokeyi, W. S., & Niyekpemi, B. O. (2021). Human capital and economic growth nexus in Nigeria. *Journal of Global Economics and Business*, 2(6), 31-49.

Makwe, E. U., Oladele, A. O., & Tubolaye, E. (2020). Human capital investment and economic growth in Nigeria: An econometric analysis, 1981-2019. *Journal of Economics and Sustainable Development*, 11(18), 47-58.

Mbaleki, C. I. (2020). Government size, labor productivity, and economic growth in South Africa (Master's thesis, Nelson Mandela University). *Nelson Mandela University*.

Ngutsav, A., & Ijirshar, V. U. (2018). Labor productivity and economic growth in Nigeria: A disaggregated sector analysis. *Lafia Journal of Economics and Management Sciences*, 3(1), 95-116.

Ngutsav, A., Akighir, D. T., & Iorember, P. T. (2017). Education financing, labor productivity, and economic development in Nigeria. *International Journal of Advanced Studies in Economics and Public Sector Management*, 5(1), 23-36.

Ntilu, L. C. (2022). An analysis of the contribution of human capital to economic growth in South Africa (Master's dissertation, North-West University).

Okwu, A. T., Nissi, M., Owolabi, T. J., & Adejola, D. K. (2022). Government education expenditure and human capital development in Nigeria: An empirical investigation. *Journal of Economics and Allied Research*, 7(2), 207-222.

Olayemi, S. O. (2012). Human capital development and industrial productivity in Nigeria. *International Journal of Humanities and Social Sciences*, 2(16), 298-307.

Oluwatoyin, A. M., Adegboye, F. B., & Fagbeminiyi, F. F. (2015). Public health expenditure and health outcomes in Nigeria. *International Journal of Financial Economics*, 4(1), 45-56.

Onyema, J. I., & Nyenke, C. U. (2019). Health care, health status, and labor productivity in Nigeria. *KIU Journal of Social Sciences*, 5(2), 49-58.

Piabuo, S., & Tieguhong, J. C. (2017). Health expenditure and economic growth—A review of the literature and an analysis between the Economic Community for Central African States (CEMAC) and selected African countries. *Health Economic Review*, 7, Article No. 23. https://doi.org/10.1186/s13561-017-0159-1.

Sahnoun, M. (2018). Does health expenditure increase economic growth? Evidence from Tunisia. *Romanian Economic Journal*, 21, 126-144.

Samargandi, N. (2018). Determinants of labor productivity in MENA countries. *Emerging Markets Finance and Trade*, 54(5), 1063-1081.

Sarpong, B., Nketiah-Amponsah, E., & Owoo, N. (2018). Health and economic growth nexus: Evidence from selected sub-Saharan African (SSA) countries. *Global Business Review*, 21(1), 1-20. https://doi.org/10.1177/0972150918778966.

Shafuda, C. P. P., & De, U. K. (2020). Government expenditure on human capital and growth in Namibia: A time series analysis. *Economic Structures*, 9(1), 21-34.

Todaro, M. P., & Smith, S. C. (2009). *Economic development* (9th ed.). Pearson Education Limited.

Ugwu, E., Odoh, I., Efuntade, O., & Ehinomen, C. (2020). Health outcome and labor productivity in Nigeria. *Social Science Review*, 1(1), 157-165.

Umoru, D., & Yaqub, J. O. (2013). Labor productivity and health capital in Nigeria: The empirical evidence. *International Journal of Humanities and Social Science*, 3(4), 199-221.

Wijaya, A. (2019). The impact of trade openness on labor productivity: Evidence from Indonesia. *National Graduate Institute for Policy Studies*.

World Bank. (2020). *World Bank Development Indicator Nigeria Data*. Retrieved from https://data.worldbank.org/country/NG on October 10, 2020.