# THE MACROECONOMIC EFFECT OF HEALTH FINANCING IN NIGERIA: A PANACEA FOR SUSTAINABLE HEALTH CARE DEVELOPMENT

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**Abstract**

This study examined the impact of macro-fiscal determinants on health financing in Nigeria between 1980 and 2022. Secondary data were sourced from the World Development Indicator (WDI) and the Central Bank of Nigeria (CBN) Statistical Bulletin. Descriptive and econometrics techniques of Block Exogeneity Wald/ VEC granger causality tests and Vector error correction model (VECM) were employed in the analysis of the data. In the short run, the study revealed the existence of a bidirectional causal relationship between health financing and economic growth i.e. (HEF↔ECG). And a uni-directional causal relationship between health financing and fiscal balance i.e. (FIB→HEF). The study found no long-term causal relationship between variables, but positive effects of economic growth and tax revenue on health financing, and negative effects of inflation and debt services. The study concluded that *fiscal balance has greater potential to explain variations in health financing in the long run than the other variables.* This study therefore recommends the generation of health-specific revenues and effective usage of health budget which would probably accelerate the progress towards the achievement of health financing in health sector in Nigeria.

**Keywords:** *Block Exogeneity Wald test, Vector error correction model (VECM), Health financing*

**JEL Classification**: *E60,I11, Q01*

## 1. INTRODUCTION

The intersection of macroeconomic determinants and health financing presents a multifaceted dynamic that profoundly impacts healthcare accessibility, quality, and equity on a global scale. Understanding the intricate relationship between macroeconomic factors and health financing is crucial for formulating effective policies to promote sustainable healthcare systems worldwide and in Nigeria particularly. Despite global efforts to improve healthcare systems, disparities in health financing persist across nations. While some countries allocate substantial resources to healthcare, others struggle to meet basic health needs due to limited financial resources. The disparity in health financing is influenced by various macroeconomic factors such as GDP growth, inflation, unemployment rates, government expenditure, and income distribution. However, the precise nature and extent of these relationships remain ambiguous, necessitating comprehensive research.

Nigeria, like many developing countries, faces significant challenges in health financing, exacerbated by macroeconomic factors. The country's healthcare system struggles with inadequate funding, limited access to essential services, and persistent health disparities. In Nigeria, spending on public health has grown without improving health outcomes as measured by life expectancy at birth, infant mortality, or maternal mortality (Ibikunle, 2019). Since 1998, Nigeria has ranked fourth among Sub-Saharan African nations in terms of maternal fatalities. Compared to other SSA nations, Nigeria had an average of 163.1 million maternal fatalities between 1990 and 2017(WDI). This is a significant number. The Nigerian government allocated 2.64% of its GDP to health in 2000. The amount spent on health care rose to 3.81% in 2005 and 3.9% (or almost 340.45 billion naira) in 2018 (WDI, 2018).

The failure to take into consideration the influence and quantity of macroeconomic factors may be the reason why the Nigerian government has not been able to attain efficiency of production despite a rise in public health expenditure. The capacity of a health system's management unit to produce the greatest number of health service outputs from a given set of inputs is known as the efficiency of production in the Nigerian health sector (Kirigia, 2013). Nigeria's maternal and infant mortality rates continue to be among the highest in sub-Saharan Africa, despite recommendations from the Macro-Economic Commission and African leaders in 2019 for investments totaling 12% of GDP and 15% of the budget to be allocated to health highest possible outputs for health services given a set of inputs (WHO, 2021).

Nevertheless, financing healthcare with robust revenues is not an easy decision when the economic prospects of the country are not impressive (Kirigia & Braum, 2008; Grigorov, 2009). An economy that is explained with bad outlook is unlikely to take pride in easing healthcare provisions for its citizens (Heberger, 2013). This means that having high growth potentials is a precursor to large healthcare financing (Behera & Dash, 2019). In Nigeria, both pooled and unpoled sources of funding are mostly used to support the health sector. The combined financing sources come from donor funding, direct and indirect taxes, and budgetary allocation. The un-pooled sources, on the other hand, account for more than 70% of total health expenditures. These include fees (formal or informal direct payments made to healthcare providers at the time of service), which account for approximately 90% of out-of-pocket payments (OOP), and payments for goods which account for 10% (Lawanson, 2021). However, there are still disparities in healthcare spending between regions and across the health system despite the availability of several methods for financing healthcare. Despite the huge growth and revenue prospects, the healthcare sector remains underfunded, hindering efforts to achieve universal health coverage. Macroeconomic factors such as GDP growth, inflation, government expenditure, and income distribution play pivotal roles in shaping health financing dynamics. However, the specific mechanisms through which these factors influence healthcare funding and accessibility in Nigeria are not well understood. Therefore, there is a need for comprehensive research to examine the intricate relationship between macroeconomic determinants and health financing in the Nigerian context.

Furthermore, while the literature is awash with several studies exploring the impact of health financing on macroeconomic outcomes, this study takes a reverse approach by analyzing the impact of macroeconomic variables on the public healthcare expenditure in Nigeria. This is based on the orientation that the healthcare outcomes respond to the prevailing business cycle in the country. Additionally, despite many articles on the health-expenditure nexus in Nigeria, it was discovered that only a few studies like (Behera& Dash, 2019) emphasized the impact of macro-economic factors on health financing. Moreover, Behera & Dash (2019) submission on the nexus between macroeconomic variables (mostly proxied by the size of economic growth) and health financing share the conclusions that having a high economic growth potentially allows the government to spend generously on healthcare. However, this is not the empirical evidence in Nigeria where periods of economic growth hardly witness expansion in public expenditure on health. It is on this basis that this study intends to investigate the impact of macroeconomic variables on health financing in Nigeria from 1980 to 2022.

## 2. LITERATURE REVIEW

### 2.1. THEORETICAL REVIEW

The health financing transition was propounded by Savedoff and Smith (2011) to describe the major shift that most countries experience from an early period in which health spending is quite low and primarily out-of-pocket to a later period in which health spending is quite high and primarily pooled. It describes how, as countries develop economically, their health expenditure per capita increases while the proportion of out-of-pocket spending decreases. This shift is influenced by factors such as technological advancements, evolving medical practices, and institutional changes in healthcare financing. Notably, the reduction in out-of-pocket expenses is more closely related to a nation's ability to generate general revenues than to income levels alone. Understanding this transition is crucial for policymakers aiming to design equitable and efficient healthcare financing systems that adapt to a country's economic growth and demographic changes.

### 2.2. EMPIRICAL REVIEW

Ogunjimi & Adebayo (2018) estimated the relationship between economic growth and health expenditure in Nigeria for the period 1981-2017. The Toda Yamamoto causality framework was utilized in the study to investigate these linkages. The autoregressive distributed lag (ARDL) model and cointegration were employed to examine whether a long run relationship existed among the variable in the model. The findings of the Toda-Yamamoto causality tests demonstrated a unidirectional causal relationship between real GDP and health expenditure and life expectancy and materiality. They suggested that the Nigerian government should work together to raise health spending to reach the WHO recommended level of 13%.

Onisanwa (2014) investigated the relationship between health expenditure and economic growth in Nigeria covering 1995–2009, in which cointegration and Granger causality tests were deployed in the analysis. Emanated outcomes of the study showed that health expenditure produces health indicators such as life expectancy, which had a positive long-run impact on economic growth in Nigeria.

Ogunleye *et al.* (2017) used ordinary least squares as a complementary technique to the Granger causality. Ogunleye et al. (2017) reported that economic growth is positively correlated with health financing in Nigeria. Again, Lawanson & Umar (2021) including poverty reduction as the transmission channel by which health expenditure causes variation in economic growth. Lawanson & Umar (2021)'s research findings pointed that health contributes positively to economic growth and mitigates the adverse effect of poverty on economic growth in Nigeria.

Guede *et al.* (2021) examined the nexus between economic growth, public expenditure and health financing on the Ivorian productive structure and institutional units. To this effect, the methodology used consisted of developing a social accounting matrix (SAM) and determining the technical coefficients and the inverse matrix. The inverse matrix is the SAM multiplier, an Input-Output method that was used for the health investment expenditure simulations in Excel. The simulation was applied to measure the effects of a shock into the model in terms of increased spending. They found that a 1% increase in public spending on health leads to an additional increase of 0.14% in household income, 0.7% in the income of institutional units and 0.56% in GDP. On the other hand, when the Ivorian economy expands by 0.2%, public health financing tends to increase by 1.5%. The study therefore recommended that healthcare is a key sector of the Ivorian economy where funding should be increased, specifically in the training of health personnel and investment in infrastructure and equipment.

Behera & Dash (2019) probed the macro-fiscal determinants of healthcare financing in 85 low and middle-income countries, including Nigeria. The study employed the panel System Generalized Method of Moments (GMM) model that captures the endogeneity problem in the regression estimation by adopting the appropriate instrumental variables. Findings showed that the elasticity of public health expenditure with respect to macro-fiscal factors varies across the sampled countries. Tax revenue shows a positive and statistically significant relationship with health financing in full sample with coefficient value varying from 0.04% to 0.14%. Fiscal deficit and debt services payment shows a negative effect on health financing in full sample, as well as sub-samples and coefficient value varies from 0.001% to 0.032%. This suggests that the responsiveness of public health financing with respect to tax revenues is strong relative to fiscal deficit and debt service (Behera & Dash, 2019).

Pakdaman *et al.* (2019) identified the effect of macroeconomic fiscal factors on health expenditure in Iran. They used time series data from1995 to 2014 on the macroeconomic fiscal factors on health expenditure in public and private sectors from the Iranian economy. The data were analyzed using two time-series econometric techniques (vector autoregression and granger causality). They showed that health expenditure has a positive bilateral relationship with gross domestic product (GDP) and private domestic consumption expenditure. On the contrary, health expenditure has a negative bilateral relationship with liquidity rate and inflation rate.

Leiter & Theurl (2012) studied the convergence of health care financing (HCF) using time-series data from 1970 to2005 which they collected from 22 OECD countries. They used the public financing ratio (public financing as % of total HCF) and per-capita public HCF as indicators for convergence. By applying different concepts of convergence, they found that HCF is converging across the sampled countries. By implication, the gap between the public spending and private spending of healthcare was found to be close.

Mawejje &. Odhiambo (2022) investigated macroeconomic determinants of fiscal policy in African. The study adopted dynamic causality linkages between fiscal deficits and selected macroeconomic indicators. The research design is based on panel cointegration tests, panel cross-section dependence test, panel error corrections-based Granger causality tests, and panel impulse response functions. Results show that there is long-run feedback causality among fiscal deficits and each variable includes gross domestic product (GDP).

Furceri (2015) examined the determinant and effects of fiscal stabilization for an unbalanced panel of advanced and emerging market economics from 1980 – 2014. The use of time – varying measures of fiscal stabilization overcomes the major limitation or existing studies. The findings of the paper pointed that fiscal stabilization is positively associated with financial deepening the level of economic development. Sfakianaki (2021) probed the impact of macro-fiscal factors and private health insurance financing on public health expenditure for the period of 2000-2017. The researcher applies dynamic econometric methodology to deal with the panel data and assess the impact of several parameters. Findings indicate that gross domestic product, fiscal capacity, tax revenue and population aging have a positive on PHE. Gatauwa Kaijage & Nganga (2020) investigated the intervening effect of selected macro-economic factors on the relationship between fiscal policy using time series modelling. Secondary data was collected from Kenya National Bureau of statistic's report. The finding indicates that foreign aid and grants have an intervening effect on the relationship between fiscal.

Ihuarulam *et al.,* (2021) examined the effects of macro-economic environment tax revenue over the period of 2005-2019. This study empirically investigated how tax revenue is related to selected macro-economic variables. Panel data analysis is employed on six ECOWAS countries data set on tax revenue, gross domestic product inflation, unemployment, trade openness and exchange rate

The result showed that inflation was positively related to tax revenue and statistically significant at 5 percent. A unit increase in inflation led to 0.007 increase in tax measure economic growth was also positive and statistically significant at 5 percent unit.

Mosquera *et al* (2016) investigated the impact of Fiscal policies on the socio-economic determinants of health. They find that there are no simple answers as to how fiscal policies affect those determinants of health.

Okereke & Offierohor (2018) examined Health Financing on economic growth in Nigeria over a period of 1990-2016. It utilized secondary data sourced from the statistical Bulletin of Central Bank of Nigeria. Data on Gross Domestic Product (GDP), Capital Expenditure on Health (CXHE). Human Health & Social Services output investment (HHSS) and Recurrent Expenditure on Health (RXHD) were analyzed using econometric package. Johansson co-integration test, and Error Correction Mechanism (ECM) were employed. The results showed that there is a strong positive correlation between capital expenditure on health and long-term health.

Kabajullizi, *et al.,* (2017) investigated the warfare implications of public health care financing the study using a dynamic computable general equilibrium model, this showed that there is strong correlation between the burden of disease and a country's level of income. Poorer countries tend to suffer more deaths from preventable causes such as communicable, maternal, perinatal and nutritional conditions, compared with high-income countries in low-income countries, the government health expenditure share in the pocket payments for healthcare relatively high (Fatoye 2021). This article demonstrates that the most effective measure is to front land investment in healthcare and generates additional domestic funding for health from a household tax-earmarked health.

Onwujekwe *et al* (2019) indicated that the major defect of a country's health system is the inadequate functioning of the financing system, which is evident through low public spending on health and very high out-of-pocket spending and increased poverty because of spending on health. Health financing is a mechanism in which funds are generated, mobilized and then utilized for health care (Onisanwa, Sunday & Adaji, 2018). This has also been explained by Eboh, Akpata and Akintoye (2016) to include any form of fund pooling that is aimed at the activities to better people's health, such activities can include those for preventive (such as outreach and screening) and curative services.

Therefore, health care expenditure is directly proportionate to a country's total national income, and it also reflects the value and priority a country place on the health of its citizens (Metiboba, 2012). There are various forms of health care financing in Nigeria, which includes tax-based public sector health expenditure, household out-of-pocket health expenditure, private donor funding, communitybased health financing and social health insurance (Awoyemi et al, 2023, Eboh, Akpata & Akintoye, 2016.

Christopuulos & Eleftheriou (2020) investigated the relationship and spill-over effects between health care expenditure and health outcome over the period of 1990-2017. The authors applied spatial econometrics as well as fiscal analytic framework to calculate the fiscal impact of health expenditure. The results indicated that there is a positive relationship between health care expenditure and health outcome

# 3. METHODOLOGY

## 3.1. THEORETICAL FRAMEWORK

Wagner's Law, proposed by Adolph Wagner in the 19th century, suggests that as a nation's economy grows, government spending tends to increase as a percentage of GDP. This leads to increased demand for public goods and services like education, healthcare, and infrastructure. Governments may allocate more budgets to healthcare financing, including public infrastructure, subsidies, insurance expansion, or direct service provision. However, the specific approach varies across countries.

Following the peak cork Wiseman version of Wagner's law, given that government expenditure $E_t$ is a function of national income $Y_t$, Wagner's law states that public expenditure grows at a rate higher than the rate at which output grows:

$$E_t = f_1(Y_t);\ \frac{df_1(Y_t)}{dY_t} > 0,\ \frac{d^2f_1(Y_t)}{dY_t^2} > 0 \qquad 1$$

Comparing the instantaneous growth rates of the variables in Equation (1)

$$\frac{\frac{dE_t}{dt}}{E_t} = \frac{\frac{df_1(Y_t)}{dY_t}}{f_1(Y_t)} \cdot \frac{dY_t}{d_t} > \frac{\frac{dY_t}{d_t}}{Y_t} \qquad 2$$

From Equation (2), we obtain the following:

$$\in_Y^E = \frac{df_1(Y_t)}{dY_t} \cdot \frac{Y_t}{f_1(Y_t)} = \frac{df_1(Y_t)}{dY_t} > 1 \qquad 3$$

where $\in_Y^E$ denotes the national income elasticity of public expenditure equivalent to elasticity of public expenditure with respect to national income whose value is greater than unity indicates that is elastic with respect to national income because of Wagner's law. Equation (3.3) is used as the slope of the line whose equation is based on the Peacock and Wiseman's version which expresses public expenditure on health as a function of the macro and fiscal variables.

## 3.2. MODEL SPECIFICATION

This study investigates the macro-fiscal determinants of health financing in Nigeria. Following the works of Chirwa and Odhiambo (2016) and Behera and Dash (2019), the baseline model is for this study specified as follows:

$$HEF = f\ (MAV, FIV) \qquad 4$$

Where HEF is health financing, MAV is macroeconomic variables, FIV is fiscal variables and f shows the functional relationship. More specifically, while the macro variables used in this study are economic growth (ECG) and inflation rate (INR), the fiscal variables comprise tax revenue (TAR), debt services (DBS) and fiscal balance (FIB). The choice of these variables is theoretically and empirically underpinned by the drivers of health financing in literature. Equation (4) is therefore re-written as:

$$HEF = f\ (ECG, INR, TAR, DBS, FIB) \quad 5$$

Equation 3.5 is the functional form and eqn 6 is after linearization of the functional form

The functional specification of the model in equation 2 is as follows:

$$HEF_t = \beta_0 + \beta_1 ECG_t + \beta_2 INR_t + \beta_3 TAR_t + \beta_4 DBS_t + \beta_5 FIB_t + \mu_t \quad 6$$

Where HEF is health financing, ECG is economic growth, INR is inflation rate, TAR comprise tax revenue, DBS is the debt services and FIB represent fiscal balance. $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, and\ \beta_5$ are the parameters to be estimated and $\mu_t$ is the stochastic error term.

By theoretical standards, an increase in economic activity (or economic growth) increases the disposable incomes of economic agents. This may also increase their expenditure on the real output produced, including expenditure on healthcare products. Similar arguments are held for tax revenues and fiscal balance of the government. Intuitively, an increase in tariff revenues or positive fiscal balance induces the government to spend more on health services. Thus, it is expected that $\beta_1, \beta_2, \beta_5 > 0$ . However, inflation erodes the purchasing power of incomes of economic agents as higher inflation reduces expenditure on health. In addition, elevated levels of debt service carts away the government attention from health financing. This implies that $\beta_2, \beta_4 < 0$.

Vector Error Correction Model (VECM) approach is employed in this study to examine the impact of macroeconomic determinants on health financing in Nigeria. The rationale for this is that The VECM approach tackles endogeneity issues, which are a major hurdle in time series data analysis when it comes to econometric modelling i.e., a VECM model checks for the interaction between variables and treating them as an endogenous variable and a function of variables in lags. This approach also leads to a better understanding of the nature of any non-stationarity among the different variables in the series as well as their long-run equilibriums. One of the inherent benefits of VECM is that it combines the long-run relationship with a short-run adjustment process as it clearly distinguishes between short-run and long-run impacts and responses, thereby providing suitable tool for policy analysis. As such, the vector error correction (VEC)representation of standard VAR i s given as follows:

$$\Delta y_t = \theta + \sum_{i=1}^{n} \beta_i y_{t-1} + \lambda ECT_{t-1} + s_t \quad 7$$

Where Δ is the differencing operator, such that $\Delta y_t = y_t - y_{t-1}$

Where $y_t$ is an (nx1) column vector of the endogenous variables, θ is an (nx1) vector of constant terms, β represent coefficient matrices. $Y_t$ is the 6x1 vector of the variables included in the model ($HEF_t$ , $ECG_t$ , $INR_t$ , $TAR_t$ , $DBS_t$ , $FIB_t$), θ is the 6x1 vector of constant terms and β is the 6x6 matrices which include the interactive coefficients of the variables involved in equation (7).

Furthermore, the VECM framework is made up of six empirical equations, which are described below. Health financing (HEF), Economic growth (ECG), Inflation rate (INR), Tax revenue (TAR), Debt services (DBS) and Fiscal balance (FIB) are all modelled using own lags and exogenous variable lags, with time-specific effects (t) and country-specific fixed effects considered. The models are specified as follows:

$$\Delta HEF_t = \beta_1 + \sum_{k=1}^{p} \beta_{1i}\, \Delta HEF_{t-1} + \sum_{k=1}^{p} \beta_{2i}\, \Delta ECG_{t-1} + \sum_{k=1}^{p} \beta_{3i}\, \Delta INR_{t-1} + \sum_{k=1}^{p} \beta_{4i}\, \Delta TAR_{t-1} + \sum_{k=1}^{p} \beta_{5i}\, \Delta DBS_{t-1} + \sum_{k=1}^{p} \beta_{6i}\, \Delta FIB_{t-1} + \lambda_1 \mathrm{ECT}_{t-1} + \mu_{1t} \quad 8$$

$$\Delta ECG_t = \beta_2 + \sum_{k=1}^{p} \beta_{1i}\, \Delta ECG_{t-1} + \sum_{k=1}^{p} \beta_{2i}\, \Delta HEF_{t-1} + \sum_{k=1}^{p} \beta_{3i}\, \Delta INR_{t-1} + \sum_{k=1}^{p} \beta_{4i}\, \Delta TAR_{t-1} + \sum_{k=1}^{p} \beta_{5i}\, \Delta DBS_{t-1} + \sum_{k=1}^{p} \beta_{6i}\, \Delta FIB_{t-1} + \lambda_2 \mathrm{ECT}_{t-1} + \mu_{2t} \quad 9$$

$$\Delta INR_t = \beta_3 + \sum_{k=1}^{p} \beta_{1i}\, \Delta INR_{t-1} + \sum_{k=1}^{p} \beta_{2i}\, \Delta HEF_{t-1} + \sum_{k=1}^{p} \beta_{3i}\, \Delta ECG_{t-1} + \sum_{k=1}^{p} \beta_{4i}\, \Delta TAR_{t-1} + \sum_{k=1}^{p} \beta_{5i}\, \Delta DBS_{t-1} + \sum_{k=1}^{p} \beta_{6i}\, \Delta FIB_{t-1} + \lambda_3 \mathrm{ECT}_{t-1} + \mu_{3t} \quad 10$$

$$\Delta TAR_t = \beta_4 + \sum_{k=1}^{p} \beta_{1i}\, \Delta TAR_{t-1} + \sum_{k=1}^{p} \beta_{2i}\, \Delta HEF_{t-1} + \sum_{k=1}^{p} \beta_{3i}\, \Delta ECG_{t-1} + \sum_{k=1}^{p} \beta_{4i}\, \Delta INR_{t-1} + \sum_{k=1}^{p} \beta_{5i}\, \Delta DBS_{t-1} + \sum_{k=1}^{p} \beta_{6i}\, \Delta FIB_{t-1} + \lambda_4 \mathrm{ECT}_{t-1} + \mu_{4t} \quad 11$$

$$\Delta DBS_t = \beta_5 + \sum_{k=1}^{p} \beta_{1i}\,\Delta DBS_{t-1} + \sum_{k=1}^{p} \beta_{2i}\,\Delta HEF_{t-1} + \sum_{k=1}^{p} \beta_{3i}\,\Delta ECG_{t-1} + \sum_{k=1}^{p} \beta_{4i}\,\Delta INR_{t-1} + \sum_{k=1}^{p} \beta_{5i}\,\Delta TAR_{t-1} + \sum_{k=1}^{p} \beta_{6i}\,\Delta FIB_{t-1} + \lambda_5 \mathrm{ECT}_{t-1} + \mu_{5t} \quad 12$$

$$\Delta FIB_t = \beta_1 + \sum_{k=1}^{p} \beta_{1i}\,\Delta FIB_{t-1} + \sum_{k=1}^{p} \beta_{2i}\,\Delta HEF_{t-1} + \sum_{k=1}^{p} \beta_{3i}\,\Delta ECG_{t-1} + \sum_{k=1}^{p} \beta_{4i}\,\Delta INR_{t-1} + \sum_{k=1}^{p} \beta_{5i}\,\Delta TAR_{t-1} + \sum_{k=1}^{p} \beta_{6i}\,\Delta DBS_{t-1} + \lambda_6 \mathrm{ECT}_{t-1} + \mu_{6t} \quad 13$$

Estimating the Vector Error Correction Model (VECM) with the variables in first differences and including the long-run relationships as the error correction term in the system is next. Therefore, equations 8, 9, 10, 11,12 and 13 following dynamic VECM is estimated to investigate the Granger causality (Granger, 1969) between the variables as well as examining the impact of Macro-Fiscal Determinants on Health Financing in Nigeria. While the VECM approach is a restriction of VAR. It is used to detect the short-run relationship and to verify the presence of the long-run relationship by means of the significance of ECT. The forecast error variance decompositions (FEVD) and impulse response functions (IRFs) are produced using the generalized Cholesky decomposition method.

### 3.2.1. IMPULSE RESPONSE

Impulse response functions analyze the impact of a standard deviation shock on endogenous variables over time. They show how these variables respond to shocks in other variables, directly affecting each other and transmitting through the dynamic structure of the VECM.

### 3.2.2. VARIANCE DECOMPOSITION

Forecast Error Variance decomposition (FEVD) measures the percentage of forecast error due to individual shocks and other variables, separating endogenous variable variation into component shocks to VECM, providing insight into the relative importance of random innovations.

### 3.3. DEFINITION AND MEASUREMENT OF VARIABLES

***Table 1:*** *Definition and Measurement of Variables*

| Variables | Symbol | Description | Sources | Measurement |
|---|---|---|---|---|
| Health Financing | HEF | The government's expenditure on health care services | World Development Indicators (WDI) | Total expenditure on health as % GDP |
| Macroeconomic Variables | | | | |
| Economic Growth | ECG | An increase in the capacity of an economy to produce goods and services, compared from one period to another | Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS | GDP at constant price. |
| Inflation Rate | INR | Consumer Price Index (CPI), annual variation in % | | CPI, annual variation in % |
| Fiscal Variables | | | | |
| Tax Revenue | TAR | Total tax revenues received as a percentage of GDP. | World Bank's World Development Indicators (WDI) | Million USD and percentage of GDP. |
| Debt Services | DBS | The total debt service includes a portion of the principal and interest for both short- and long-term loans. | | Total debt service (% of GNI) |
| Fiscal Balance | FIB | Revenue (including grants) less costs less net acquisition of non-financial assets equals either a cash surplus or deficit. | | Fiscal Balance as percentage of GDP |

*Source; Author's Compilation*

## 4. DATA ANALYSIS, RESULT AND DISCUSSION

### 4.1 DESCRIPTIVE STATISTICS

Descriptive statistics are used to emphasize the characteristics and composition of the data, as well as how the variables behaved during the research period (Akintunde and Aribatise, 2025). Table 2 presents the results of the descriptive statistics.

***Table 2:*** *Descriptive Statistics of the Variables*

| | HEF ($) | ECG (%) | INR (%) | TAR (%) | DBS (%) | FIB (%) |
|---|---|---|---|---|---|---|
| **Mean** | 68.72 | 3.05 | 16.28 | 8.79 | 34.65 | -5.2 |
| **Stand. dev.** | 26.14 | 5.34 | 72.84 | 2.04 | 12.52 | -4.06 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Minimum** | 17.73 | -13.13 | 5.39 | 4.55 | 11.86 | -11.45 |
| **Maximum** | 119.25 | 15.33 | 14.71 | 11.18 | 42.50 | 2.88 |
| **Skewness** | 1.57 | -0.82 | 2.90 | 3.46 | 5.20 | -12.34 |
| **Kurtosis** | 2.84 | 4.62 | 10.73 | 1.73 | 2.69 | 5.69 |
| **Jaque-Bera stat.** | 27.88** | 9.25* | 108.89** | 12.61* | 44.06** | 18.45* |

Source: Author's computation. *, ** means the statistic is significant at 10% and 5% respectively

Table 2 presents the statistical data for various variables in Nigeria. The average health financing per capita (HEF) is 68.72, with an average household spending N31,291.65 per annum on healthcare. The standard deviation is $26.14, indicating low and high outliers in the HEF series. Economic growth (ECG) is 3.05% ± 5.34%, with a mean growth rate of 5.34%. The business cycle in Nigeria is somewhat volatile, with recent recessions in 2016 and 2020. The skewness value (-0.82) suggests a long-left tail, while the kurtosis of 4.62 implies limited outliers. The Jarque-Bera statistic (9.25) relate that growth series are normally distributed, but significantly at 10%. The average inflation rate (INR) is 16.28%, with a standard deviation of 72.84%. This indicates high frequencies in the computed CPI by the National Bureau of Statistics (NBS), affecting policymakers' stance to target a specific inflation rate and implement policy instruments. Despite fluctuations, the series of inflation is mostly positive, with data points not very far from each other. The mean tax-GDP ratio (TAR) in Nigeria is 8.79%, indicating a low tax culture compared to developed countries. This is largely due to the commercial exploration of crude oil, which has led to a focus on oil revenues over other sources of revenue. The TAR series has a close gap between the minimum and maximum values, indicating limited changes. The mean debt-GDP ratio (DBS) is 34.65%, largely due to Nigeria's fiscal stance since 1999. The DBS series is leptokurtic with outliers, especially in recent decades. The average fiscal balance to GDP ratio (FIB) is -5.2%, indicating that government revenues have been less than government expenditure in Nigeria. This is the current standard in all developed and developing countries, and budget deficits have become the new normal in democratic governments worldwide. The FIB series is vulnerable to large fluctuations, with both minimum and maximum values being negative, indicating persistent negative fiscal balances over the long term.

### 4.2. CORRELATION TEST

The study reveals a strong positive correlation between Health Economic Factors (HEF) and Economic Growth (ECG), indicating that economic growth leads to increased personal expenditure on healthcare. However, this may not necessarily increase HEF if the population expands simultaneously. The relationship between ECG and Inflation Rate (IR) is also positive, suggesting that government taxes can have distortionary effects on prices.

***Table 3:** Correlation Coefficients among the Variables*

| | HEF | ECG | INR | TAR | DBS | FIB |
|---|---|---|---|---|---|---|
| **HEF** | 1.00 | | | | | |
| **ECG** | 0.85 | 1.00 | | | | |
| **INR** | -0.54 | 0.78 | 1.00 | | | |
| **TAR** | -0.61 | 0.58 | -0.81 | 1.00 | | |
| **DBS** | 0.72 | 0.66 | -0.62 | 0.61 | 1.00 | |
| **FIB** | -0.77 | 0.55 | 0.50 | 0.73 | 0.66 | 1.00 |

*Source: Author's computation*

The relationship between ECG and Debt-to-GDP (DBG) is positive, suggesting that periods of output expansion can lead to increased national debt. The study also finds a negative relationship between HEF and Fiscal Inflation Balance (FIB), suggesting that health financing has not significantly benefited from long periods of fiscal deficits in Nigeria. The relationship between INR and DBS is counterintuitive, as public debt is cyclically linked to price levels. The study concludes that macro and fiscal variables are positively correlated, with a mix of positive and negative correlation coefficients, largely explained by economic literature and intuitive arguments from global events.

## 4.3. UNIT ROOT ANALYSIS

The study uses unit root analysis to determine the stationarity properties of variables in a VAR model. The analysis is anchored by Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to confirm mean constancy or reversion in the time series of variables. The results show that INR and ECG are stationary at levels and first difference, while HEF, DBS TAR, and FIB are stationary at first differences. The estimation model excludes I(2) series, ensuring the VAR technique's validity and confirming the stationarity property at 5%.

***Table 4:** Augmented Dickey Fuller (ADF) Test*

| Variable | Augmented Dickey Fuller (ADF)Test | | | |
|---|---|---|---|---|
| | Level | First Difference | 5% critical value | Remarks |
| HEF | -1.7758 | -7.1596** | -2.93500 | I(1) |
| ECG | -2.8726 | -11.9132** | -2.93500 | I(1) |
| INR | -3.0477** | -5.3769** | -2.93500 | I(1) |
| TAR | -2.3117 | -6.7751** | -2.93500 | I(1) |
| DBS | -2.5697 | -6.0370** | -2.93500 | I(1) |
| FIB | -2.5143 | -2.9331** | -2.93500 | I(1) |

*Source: Authors' Computation. ** means 5% level of significance*

***Table 5:** Phillip-Perron (PP) Test*

| Variables | Phillip-Perron (PP) Test | | | |
|---|---|---|---|---|
| | Level | First Difference | 5% criticalvalue | Remarks |
| HEF | -1.7402 | -7.4047** | -2.93500 | I(1) |
| ECG | -3.6887** | -12.8076** | -2.93500 | I(1) |

| | | | | |
|---|---|---|---|---|
| INR | -2.4099 | -5.3453** | -2.93500 | I(1) |
| TAR | -2.3126 | -6.7837** | -2.93500 | I(1) |
| DBS | -2.6000 | -6.6601** | -2.93500 | I(1) |
| FIB | -2.5578 | -7.6239** | -2.93500 | I(1) |

*Source: Authors' Computation. ** means 5% level of significance*

## 4.4. CO-INTEGRATION TEST

Having shown that the variables are integrated of order one, I(1), it is necessary to determine whether the variables co-exist in the long run. In other words, is there a stable and non-spurious (co-integrated) relationship among the regressors in each of the relevant specifications? This was done by using the Johansen and Juselius (1990) co- integration method because it can determine the number of co-integrating vectors for any given number of non-stationary series (of the same order). The Johansen test includes HEF, ECG, INR, TAR, DBS, and FIB.

***Table 6:*** *Unrestricted co-integration test (constant and trend)*

| **HypothesizedNo. of CE(s)** | **Eigenvalue** | **Max-Eigen statistics** | **Trace statistics** | **5% critical level** | **Prob. **** |
|---|---|---|---|---|---|
| None | 0.738193 | 54.94600 | 135.7250 | 117.7082 | 0.0022 |
| At most 1 | 0.546049 | 32.38043 | 80.77904 | 88.80380 | 0.1649 |
| At most 2 | 0.389707 | 20.24646 | 48.39861 | 63.87610 | 0.4869 |
| At most 3 | 0.270119 | 12.90985 | 28.15215 | 42.91525 | 0.6130 |
| At most 4 | 0.215095 | 9.929904 | 15.24230 | 25.87211 | 0.5544 |
| At most 5 | 0.121528 | 5.312398 | 5.312398 | 12.51798 | 0.5521 |

Source: Author's Computation

From table 5 above, the trace test and Max-Eigen statistics indicate one (1) co-integration equation at the 0.05 level, therefore the null hypothesis of no co-integration among the variable is rejected and alternative hypothesis of co-integration is accepted at 5% significance level. Thus, there is co-integration among the variables (HEF, ECG, INR, TAR, DBS, and FIB). This indicates that long run relationship does exists among thevariables in Nigeria. However, this evidence by itself does not identify the dynamics or mechanism by which the variables relate. Such dynamics are captured by vector error correction (VEC) method.

## 4.5. OPTIMAL LAG LENGTH SELECTION

The optimal lag length is an important step in the estimation of VEC model. This stepis very important not only for the OLS estimates of the autoregressive coefficients but also in the dynamic responses. In selecting the optimal lag length, Table 6 below presented several information criteria. The Schwarz Information Criterion (SIC) selected two while the LR test statistic, Final prediction error (FPE), Akaike Information Criterion (AIC) and Hannan-Quinn Information Criterion selected three. This study therefore used the AIC, FPE and HQ information criteria based on the harsher penalty SIC imposes than AIC.

***Table** 7: Lag length Selection Criteria*

| Lag | LogL | LR | FPE | AIC | SIC | HQ |
|---|---|---|---|---|---|---|
| **0** | -716.2409 | NA | 4.90e+08 | 37.03800 | 37.29393 | 37.12982 |
| **1** | -616.8754 | 163.0614 | 19478195 | 33.78848 | 35.58001 | 34.43127 |
| **2** | -585.1453 | 42.30677 | 27759059 | 34.00745 | 37.33458* | 35.20120 |
| **3** | -530.6781 | 55.86384* | 15795920* | 33.06041* | 37.92313 | 34.80512* |
| **4** | -481.2191 | 35.50898 | 19184176 | 32.37021 | 38.76853 | 34.66587 |

*Source: Author's Computation*

## 4.6. VEC GRANGER CAUSALITY (WALD TEST)

The Causality test determines the direction of causality among variables in the VEC model. If a variable is useful for predicting another variable, it is considered to granger cause the other. The results are shown in Table 8.

***Table 8:** Results of VEC Granger causality/Wald Test*

| **Dependent variable** | **Source of causation (independent variable)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | **`Short run** | | | | **Long-run** |
| | ΔHEF | ΔECG | **ΔINR** | **ΔTAR** | **ΔDBS** | **ΔFIB** | **$ECT_{t-1}$** |
| **ΔHEF** | - | 7.58(0.02)** | 5.57(0.06)** | 2.26(0.32) | 2.16(0.33) | 8.90(0.01)** | 17.03(0.07)* |
| **ΔECG** | 8.40(0.01)** | - | 1.74(0.47) | 0.59(0.74) | 2.43(0.29) | 5.02(0.08)** | 13.94(0.17) |
| **ΔINR** | 0.53(0.76) | 0.62(0.73) | - | 0.15(0.72) | 0.53(0.76) | 0.46(0.79) | 4.80(0.90) |
| **ΔTAR** | 2.82(0.24) | 0.85(0.63) | 3.33(0.18) | - | 1.96(0.37) | 1.18(0.58) | 9.61(0.47) |
| **ΔDBS** | 0.81(0.60) | 0.18(0.90) | 4.63(0.09)* | 1.17(0.57) | - | 4.44(0.10) | 14.49(0.15) |
| **ΔFIB** | 1.35(0.30) | 0.52(0.77) | 3.89(0.14) | 0.98(0.61) | 0.16(0.92) | - | 9.29(0.50) |

Source: Authors computation. ** and * represent 5% and 10% significance level respectively.

The study found that ECG, INR, and FIB granger cause health financing (HEF) in the short run, while other variables did not. There was no causal relationship between INR, TAR, and FIB. However, INR granger caused DBS in the short run. The results revealed a bi-directional causal relationship between HEF and economic growth (ECG), and a uni-directional causality between HEF and FIB, ECG and FIB, and DBS and INR. The ECT was used to detect long-run causal relationships, but all error correction terms were not significant at 5%, except for HEF.

## 4.7. VECTOR ERROR CORRECTION MODEL (VECM)

Having confirmed the existence of co-integration among health financing (HEF), economic growth (ECG), inflation rate (INR), tax revenue (TAR), debt services (DBS) and fiscal balance (FIB). a vector error correction model (VECM) method is estimated to verify the interactions/relationship among the variables.

### 4.7.1. IMPULSE RESPONSE

The impulse response function measures the temporal and directional response of an endogenous variable to a change in one of the structural innovations. It measures the time profile of the effect of a shock or impulse on the expected future values of a variable. The order of variables follows from health financing to economic growth (ECG), inflation rate (INR), tax revenue (TAR), debt services (DBS), and fiscal balance (FIB). The impulse response provides a powerful framework for policy analysis, allowing us to analyze and track the impact of entire variables on others in the system. In the first panel, a shock to HEF produces a positive effect on HEF both in the short and long run. The shock to INR and DBS shows a mixed effect on HEF, with alternating falling and rising in INR and DBS to shock in HEF.

The study reveals that a shock to health financing (HEF) has a mixed effect on economic growth (ECG). The first period shows a positive effect, followed by a decline in the third period and a rise in the fourth period. The response to ECG is consistent and less severe, with an average of less than 1%. The shocks to inflation rate (INR), tax revenue (TAR), debt service (DBS), and fiscal balance (FIB) also have mixed effects on ECG. The negative shock to INR shock to ECG initially maintains positive values but later turns positive towards the tail end of the horizon. Higher tax revenue can reduce disposable income, lower consumer spending, and decrease demand, while also limiting inflationary pressures.

The fourth panel in Figure 4.1 shows that a shock to HEF, ECG, INR, DBS, and FIB have a positive effect on TAR in the short and long run. However, FIB has a negative effect on TAR in the first two periods and a negative value in the third period. In the short run, fiscal balance boosts investor confidence, enhances economic stability, increases tax compliance, broadens the tax base, and improves government revenue in Nigeria. In the long run, it reduces government revenue, leads to higher taxes, discourages investment, weakens economic growth, and decreases tax compliance. The fifth panel shows that HEF, ECG, and TAR have a negative effect on DBS, while ECG and DBS have a mixed effect on FIB.

### 4.7.2. FORECAST ERROR VARIANCE DECOMPOSITION

To further analyze the linkages among health financing (HEF), economic growth (ECG), inflation rate (INR), tax revenue (TAR), debt services (DBS) and fiscal balance (FIB) in Nigeria, the variance decomposition derived for VAR was generated and analyzed. Forecast error variance decomposition shows the explanatory variable contribution of the shock to the variables, it provides information about the relative importance of each random innovationaffecting the variables in the model. It also indicates the proportion of the movement in a variable attributable to its own shock versus shocks in another variable. The variance decomposition for each variable with ten period horizons is presented in Table 8 to analyze theforecast error variance for each variable that is attributable to its own shock and the shocks in other variables in the system. The expectation is that a variable’s own shock will contribute morethan any other variable’s shock to its own forecast error variance and the result here is not an exception.

***Table 9:*** *Variance decomposition*
*Variance decomposition of HEF*

| Period | S.E. | HEF | ECG | INR | TAR | DBS | FIB |
|---|---|---|---|---|---|---|---|
| 1 | 9.829409 | 100.0000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 13.50616 | 82.71340 | 5.198620 | 1.064937 | 0.132748 | 1.181824 | 9.708473 |
| 3 | 16.23984 | 74.22998 | 6.754867 | 1.394792 | 0.707158 | 4.041798 | 12.87140 |
| 4 | 17.80038 | 66.79354 | 7.647704 | 1.195495 | 3.256403 | 5.829891 | 15.27697 |
| 5 | 19.00330 | 62.37346 | 7.102177 | 1.183304 | 5.822506 | 7.386200 | 16.13235 |
| 6 | 20.00304 | 59.03819 | 6.503772 | 1.851856 | 8.338935 | 7.735376 | 16.53187 |
| 7 | 20.85034 | 57.35437 | 5.994950 | 2.466377 | 10.00541 | 7.623285 | 16.55561 |
| 8 | 21.56572 | 56.24669 | 5.611119 | 3.143953 | 11.19090 | 7.321984 | 16.48535 |
| 9 | 22.15067 | 55.57315 | 5.324286 | 3.667321 | 12.01301 | 7.059615 | 16.36262 |
| 10 | 22.62189 | 54.96100 | 5.112492 | 4.147760 | 12.68447 | 6.853044 | 16.24124 |

*Variance decomposition of ECG*

| Period | S.E. | HEF | ECG | INR | TAR | DBS | FIB |
|---|---|---|---|---|---|---|---|
| 1 | 3.591444 | 0.019364 | 99.98064 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 4.333006 | 11.60346 | 80.50922 | 2.172732 | 0.077226 | 5.637345 | 1.94E-05 |
| 3 | 4.654801 | 10.15368 | 78.47685 | 2.502152 | 2.945929 | 5.663128 | 0.258261 |
| 4 | 4.819019 | 9.478438 | 76.00853 | 3.895076 | 4.637944 | 5.734002 | 0.246010 |
| 5 | 4.943506 | 9.325803 | 74.06634 | 4.047908 | 6.777890 | 5.540021 | 0.242037 |
| 6 | 5.000312 | 9.115678 | 72.79490 | 4.501581 | 7.763370 | 5.525433 | 0.299034 |
| 7 | 5.029443 | 9.013690 | 72.09467 | 4.458690 | 8.508359 | 5.614391 | 0.310199 |
| 8 | 5.042355 | 9.001842 | 71.73666 | 4.436873 | 8.885196 | 5.625425 | 0.314009 |
| 9 | 5.052728 | 8.997928 | 71.44521 | 4.484236 | 9.136888 | 5.622780 | 0.312954 |
| 10 | 5.059935 | 9.034753 | 71.24193 | 4.523630 | 9.274173 | 5.612103 | 0.313407 |

*Variance decomposition of INR*

| Period | S.E. | HEF | ECG | INR | TAR | DBS | FIB |
|---|---|---|---|---|---|---|---|
| 1 | 10.35260 | 4.171058 | 13.24289 | 82.58605 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 14.03210 | 4.166295 | 15.44121 | 79.91322 | 0.087716 | 0.124572 | 0.266987 |
| 3 | 14.95827 | 3.679823 | 14.53765 | 80.82096 | 0.139693 | 0.316385 | 0.505485 |
| 4 | 15.15768 | 3.715315 | 14.15933 | 79.04061 | 0.373091 | 1.352080 | 1.359577 |
| 5 | 15.50879 | 4.700568 | 13.76746 | 75.69338 | 0.586879 | 2.749106 | 2.502606 |
| 6 | 15.92054 | 6.347835 | 13.21769 | 72.48587 | 0.809115 | 3.461491 | 3.678005 |
| 7 | 16.29850 | 8.349001 | 12.65941 | 69.64022 | 0.988418 | 3.762574 | 4.600381 |
| 8 | 16.60576 | 9.943940 | 12.19789 | 67.46424 | 1.203328 | 3.893501 | 5.297096 |
| 9 | 16.84933 | 11.07987 | 11.84802 | 65.82220 | 1.464383 | 4.000261 | 5.785270 |
| 10 | 17.04328 | 11.81449 | 11.58136 | 64.61402 | 1.780293 | 4.085922 | 6.123913 |

*Variance decomposition of TAR*

| Period | S.E. | HEF | ECG | INR | TAR | DBS | FIB |
|---|---|---|---|---|---|---|---|
| 1 | 1.070029 | 0.040042 | 0.152671 | 2.130765 | 97.67652 | 0.000000 | 0.000000 |
| 2 | 1.446942 | 1.152403 | 0.120965 | 11.26871 | 87.34510 | 0.069699 | 0.043126 |
| 3 | 1.600352 | 3.173120 | 0.501401 | 12.52285 | 83.51018 | 0.254110 | 0.038336 |
| 4 | 1.717430 | 5.456959 | 0.440606 | 14.11026 | 78.45438 | 1.452354 | 0.085433 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | 1.784385 | 8.107017 | 0.413502 | 14.16506 | 75.24685 | 1.941703 | 0.125868 |
| 6 | 1.826363 | 9.072721 | 0.459017 | 14.51835 | 73.69247 | 2.064509 | 0.192935 |
| 7 | 1.852000 | 9.513476 | 0.483528 | 14.72099 | 73.02460 | 2.025000 | 0.232404 |
| 8 | 1.870558 | 9.615199 | 0.502402 | 14.94395 | 72.69114 | 1.988968 | 0.258338 |
| 9 | 1.882919 | 9.691709 | 0.510460 | 15.04214 | 72.51945 | 1.968628 | 0.267617 |
| 10 | 1.891412 | 9.741926 | 0.519192 | 15.09151 | 72.40759 | 1.968830 | 0.270949 |

*Variance decomposition of DBS*

| Period | S.E. | HEF | ECG | INR | TAR | DBS | FIB |
|---|---|---|---|---|---|---|---|
| 1 | 4.403749 | 15.16917 | 0.042121 | 4.838238 | 0.076654 | 79.87381 | 0.000000 |
| 2 | 5.744719 | 8.944321 | 0.451966 | 3.084283 | 1.060419 | 79.54529 | 6.913723 |
| 3 | 6.168952 | 11.54222 | 1.349806 | 3.699953 | 1.683055 | 72.05454 | 9.670425 |
| 4 | 6.565394 | 16.42656 | 2.183585 | 4.807678 | 1.786614 | 63.71366 | 11.08190 |
| 5 | 6.856756 | 19.86051 | 2.486284 | 4.808205 | 2.020105 | 58.60831 | 12.21658 |
| 6 | 7.087443 | 21.49533 | 2.423318 | 4.545351 | 2.638273 | 55.65047 | 13.24726 |
| 7 | 7.322144 | 22.24384 | 2.271264 | 4.807939 | 3.526470 | 53.22666 | 13.92382 |
| 8 | 7.542050 | 22.87566 | 2.145016 | 5.349045 | 4.422947 | 50.90864 | 14.29869 |
| 9 | 7.726391 | 23.65220 | 2.045517 | 5.795575 | 5.164803 | 48.85234 | 14.48956 |
| 10 | 7.874001 | 24.41408 | 1.969935 | 6.096125 | 5.757484 | 47.18461 | 14.57776 |

*Variance decomposition of FIB*

| Period | S.E. | HEF | ECG | INR | TAR | DBS | FIB |
|---|---|---|---|---|---|---|---|
| 1 | 2.395917 | 10.00676 | 0.146140 | 0.241362 | 2.404832 | 38.95790 | 48.24301 |
| 2 | 2.923692 | 14.85155 | 2.222841 | 5.638767 | 2.082408 | 35.48002 | 39.72441 |
| 3 | 3.378067 | 16.29912 | 3.447562 | 12.51762 | 2.105952 | 31.29019 | 34.33956 |
| 4 | 3.652372 | 19.40356 | 3.549423 | 14.19863 | 2.260649 | 28.46684 | 32.12089 |
| 5 | 3.812359 | 21.89195 | 3.304041 | 14.53100 | 2.529559 | 26.54882 | 31.19463 |
| 6 | 3.914814 | 23.64782 | 3.133769 | 14.36595 | 2.836524 | 25.38418 | 30.63176 |
| 7 | 3.985606 | 24.48428 | 3.034237 | 14.30304 | 3.268112 | 24.66037 | 30.24996 |
| 8 | 4.039146 | 24.89390 | 2.960558 | 14.30055 | 3.754528 | 24.17571 | 29.91475 |
| 9 | 4.081493 | 25.10156 | 2.902703 | 14.35238 | 4.242002 | 23.78784 | 29.61351 |
| 10 | 4.114745 | 25.27042 | 2.857935 | 14.39505 | 4.662476 | 23.46253 | 29.35159 |

*Source: Author's Computation*

The study reveals that the forecast error variance of Health Economic Forecasting (HEF) in Nigeria is largely explained by innovations to endogenous variables. HEF, ECG, inflation rate, tax revenue, debt service, and fiscal balance all contribute to HEF variation. The magnitude of HEF decreased from 100% to 54% in the 10th period, while ECG and inflation rate increased from 0.00 percent to 2.4% and 4.1%, respectively. Tax revenue increased from 0.00 percent to 12.6 percent, while debt service and fiscal balance increased from 0.00 percent to 6.8% and 16.2%, respectively.

The study reveals that innovations in endogenous variables in Nigeria's ECG (Economic Commodity Market) have a significant impact on the country's ECG. The magnitude of HEF increases from 0.00 percent in the first period to 9.1% in the 10th period, explaining between 0.00 to 9.1% variation in ECG overtime. The magnitude of ECG reduces from 99.1% in the first period to 71.2 percent in the 10th period, indicating that innovation or shock in ECG has a large impact on itself. Inflation rate and tax revenue also increase, explaining between 0.00 to 4.5 and 9.2 percent variations in ECG overtime. Debt service and fiscal balance also increase, explaining between 0.00 to 5.6 and 0.3 percent variation in ECG overtime. HEF has greater potential to influence inflation rate in both short and long run than other variables.

Panel 4 in Table 8 shows the proportion of forecast error variance in TAR in Nigeria explained by innovations in the endogenous variables considered. The magnitude of HEF increases from 0.04 percent in the 1st period to 9.7 percent in the 10th period. This indicates that HEF explained between 0.04 to 9.7 percent variation in TAR overtime. The magnitude of ECG, INR, DBS and FIB, increased from 0.15, 2.1, 0.00 and 0.00 percent in the 1st period to 0.51, 15.0, 19 and 0.2 percent in the 10th period. This indicates that ECG, INR, DBS and FIB explained between 0.15, 2.1, 0.00 and 0.51, 15.0, 19 and 0.2 percent variations in TAR overtime. The magnitude of TAR decreases from 97.6 to 72.4 percent from the 1st period to the 10th period. This shows that innovation or shock in TAR has a large impact on itself. As revealed by the result, the innovation to HEF explained larger proportion of variation in TAR than other variables.

Furthermore, Panel 5 and 6 shows the proportion of forecast error variance in DBS and FIB respectively in Nigeria explained by innovations in the endogenous variables considered. The magnitude of HEF, ECG and INR from both panels increases from 15.1 and 10.0, 0.00 and 0.1 and 4.8 and 0.2 percent in the 1st period to 24.4 and 25.2, 1.9 and 2.8, and 6.0 and 14.3 percent in the 10th period. This indicates that HEF, ECG and INR explained between 15.1 and 10.0, 0.00 and 0.1 and 4.8 and 0.2 and24.4 and 25.2, 1.9 and 2.8, and 6.0 and 14.3 percent variation in DBS and FIB overtime. Also, TAR's magnitude increases from 0.00 and 2.4 percent to 5.7 and 4.6 percent respectively. This indicates that TAR explained between 0.00 and 2.4 percent and 5.7 and 4.6 percent variation in DBS and FIB overtime.

## 4.8. DISCUSSION OF FINDINGS

The study reveals a bidirectional causal relationship between Health Expenditure (HEF) and Economic Growth (ECG), indicating that increased health investment boosts economic performance and higher health spending. This aligns with Sunday and Adaji's (2018) study, which found robust healthcare financing improves health status in Nigeria. The study also shows a unidirectional causality between HEF and Inflation Rates (INR) and Health Expenditure (INR) and Health Expenditure Balance (FIB) and Health Expenditure Balance (DBS) and INR, indicating that maintaining fiscal balance is crucial for adequate health financing and enhancing economic expansion.

The study found no long-term causal relationship between economic growth, inflation rate, tax revenue, debt services, and fiscal balance to health financing in Nigeria. This suggests that health financing is influenced by other factors, such as political decisions, external aid, or specific health policies, rather than the overall economic environment. Economic growth and tax revenue positively influence health financing in the short, medium, and long run, leading to improved healthcare infrastructure, better services, and overall population health. However, increased inflation rate leads to higher healthcare costs, necessitating more funding and improving infrastructure. Shocks to fiscal balance (FIB) result in lower health budgets, limited access to services, increased out-of-pocket expenses, understaffed facilities, inadequate supplies, poorer health outcomes, and greater health inequities. In the long run, improved health financing boosts workforce productivity, reduces illness-related absenteeism, enhances human capital, attracts investments, and stimulates economic growth. In the short run, increased health financing can drive up healthcare costs, strain public budgets, increase money supply, and potentially contribute to overall inflationary pressures in the economy. A positive fiscal balance stabilizes the economy, controls inflation, attracts investment, strengthens the naira, reduces borrowing costs, and enhances investor confidence, contributing to sustainable economic growth in Nigeria.

In conclusion, the study highlights the importance of fiscal policy in determining health financing and promoting sustainable development.

The study reveals that health finance (HEF) and economic growth (ECG) have a negative impact on development spending (DBS) in Nigeria, reducing workforce productivity and limiting government spending. This strains the country's ability to service debt, leading to higher borrowing costs and potential fiscal instability. Conversely, a positive fiscal balance (FIB) can improve DBS by reducing borrowing needs, improving credit ratings, and allowing more funds for development projects. However, HEF, INR, and TAR negatively affect FIB in the short and long run, reducing public services, increasing borrowing, and widening budget deficits. ECG and DBS have a mixed effect on FIB, with economic growth boosting revenue and improving fiscal balance in the short run. The study also highlights the importance of maintaining fiscal balance for sustaining health financing initiatives in Nigeria.

## 5. CONCLUSION

This study has largely revealed that the relationship among health financing and the various macro-economic determinants in Nigeria are complex either positive or negative in the short and long rn This suggests the existence of short and long run positive effect of economic growth and tax revenue on health financing and mixed effect of inflation rate and debt services on HEF both in the short and long run respectively. And given the direction and strength of potential feedback among health financing, economic growth inflation rate, tax revenue debt services and fiscal balance in Nigeria, this study concluded that FIB better predict ECG and HEF and that INR better predict DBS. The study further concluded that in the short run, a bi-directional causal relationship exists between HEF and ECG which implies that increased health investment boosts economic performance, and a stronger economy enables higher health spending. And that no long run causality exists among the variables.

## 6. RECOMMENDATIONS/ POLICY IMPLICATION

Given the conclusions above, government should increase purchasing power of households' incomes by easing the inflationary pressure in Nigeria. With headline inflation at 33.69% (National Bureau of Statistics, 2024), households increasingly face erosion of the value of their money. On this note, government should implement policies capable of reducing price growth in the country. Also, budgetary allocation of government to healthcare should increase. The federal government should provide necessary priority to healthcare. This is realized if the health sector accounts for at least 15% of the national budget. Doing this will conform to the global standards of countries which consider public healthcare as priority.

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