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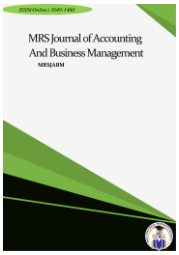

INTERRELATIONSHIP BETWEEN BUDGET DEFICIT AND ECONOMIC GROWTH IN NIGERIA: IS IT INFLATIONARY?

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Abstract: *The focus of the study was to ascertain the interrelationship between budget deficit, inflation and economic growth in Nigeria. Various literatures were reviewed. The study period span from 1991 to 2022. Various econometric tests such as unit root test, cointegration test etc were employed. The study employed vector auto regression model and impulse response function and variance decomposition. The findings from the impulse response and variance decomposition analyses provide valuable insights into the interrelationships between fiscal deficits, inflation, and economic growth in Nigeria. While inflation is primarily driven by its own history, the influence of GDP and employment grows over time, suggesting that fiscal and monetary policies targeting both inflation and economic growth will be crucial for stabilizing the economy in the long run. Base on the findings of the study, the researcher recommend among others that given that inflation is largely self-driven in the short term, it is critical for policymakers to focus on controlling factors that can exacerbate inflationary pressures, such as excessive money supply growth or external shocks.*

Keywords: *Budget deficit, inflation, economic growth, JEL Classification: E03, H63, C32*

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Introduction

The interrelationship between budget deficits and economic growth has been a focal point of economic discourse, particularly in developing economies like Nigeria, where fiscal policy serves as a critical tool for promoting economic stability and growth. A budget deficit occurs when government expenditures exceed its revenues within a fiscal year, necessitating borrowing to bridge the gap. While deficit financing can stimulate economic activity through increased public spending, it also raises concerns about inflationary pressures and long-term economic sustainability. In Nigeria, this issue is particularly pronounced given the nation's dependence on oil revenues, fluctuating fiscal policies, and economic vulnerabilities. Nigeria's fiscal policy has historically been characterized by a reliance on oil revenue to finance budget expenditures. However, the volatility of global oil prices often disrupts fiscal planning, leading to persistent budget deficits. For instance, the oil price collapse of 2014 – 2016 significantly widened the fiscal deficit, compelling the government to resort to domestic and external borrowing. This borrowing was intended to fund infrastructure projects and stimulate economic growth amidst a recession. While these interventions were necessary, they raised questions about the sustainability of such deficits and their inflationary effects on the economy. Empirical studies suggest that prolonged fiscal deficits in Nigeria have often been linked to rising inflation rates, as increased government spending can escalate aggregate demand, leading to higher price levels (Obadan, 2018; Ezeabasili et al., 2012).

The Keynesian perspective argues that budget deficits can promote economic growth by stimulating aggregate demand, particularly during periods of economic downturns or recessions. This theory underpins Nigeria's fiscal expansion strategies, where the government uses deficit financing to fund infrastructure projects, healthcare, and education, aiming to enhance productivity and economic performance. For instance, the Economic Recovery and Growth Plan (ERGP) of 2017–2020 emphasized capital expenditure as a means of revitalizing the economy. However, the effectiveness of deficit financing in Nigeria is often undermined by structural inefficiencies, corruption, and mismanagement, which dilute its growth-inducing potential (Udude, 2014). On the other hand, classical and monetarist theories caution against excessive budget deficits, highlighting their potential to fuel inflation. In

Nigeria, where monetary authorities often resort to printing money to finance deficits, the inflationary effects are amplified. The Central Bank of Nigeria (CBN) frequently adopts monetary tightening policies to mitigate these pressures, but such measures can stifle economic growth by increasing the cost of credit. Empirical evidence from Nigeria shows a strong correlation between budget deficits and inflation, with studies indicating that fiscal imbalances are a significant driver of macroeconomic instability (Onafowokan & Owoye, 2020).

The inflationary effects of budget deficits in Nigeria are further exacerbated by external factors, such as exchange rate volatility and import dependency. Nigeria's high import bills mean that deficit-financed expenditures often leak out of the economy, reducing their multiplier effect. Moreover, deficit financing through external borrowing exposes the country to foreign exchange risks, as repayment obligations increase with currency depreciation. The twin deficits hypothesis, which links fiscal deficits to current account deficits, is particularly relevant in Nigeria, where fiscal imbalances often coincide with trade deficits (Ariyo, 1997). Despite these challenges, budget deficits are not inherently detrimental to economic growth. The impact largely depends on how the borrowed funds are utilized. When deficits are directed toward productive investments, such as infrastructure, human capital development, and technology, they can yield long-term economic benefits. However, in Nigeria, a significant portion of deficit financing is used to service debt rather than fund development projects, limiting its growth-enhancing potential. As of 2023, Nigeria's debt servicing to revenue ratio exceeded 80%, highlighting the fiscal strain caused by excessive borrowing (BudgIT, 2023).

Furthermore, the structure of Nigeria's economy complicates the deficit-growth relationship. The dominance of the oil sector and the underperformance of non-oil sectors create a narrow revenue base, limiting the government's ability to sustain productive deficits. Efforts to diversify the economy through agriculture, manufacturing, and technology have been slow, reducing the effectiveness of fiscal policies aimed at stimulating growth. Studies emphasize the need for fiscal discipline and structural reforms to enhance the efficiency of deficit spending and minimize inflationary risks (Adegbite & Olayemi, 2020). The interrelationship between budget deficits and economic growth in Nigeria is complex, influenced by a myriad of domestic and external factors. While fiscal deficits can drive economic growth by addressing critical infrastructural deficits and stimulating demand, their inflationary effects and long-term sustainability remain significant concerns. Policymakers must strike a balance between leveraging deficits for economic development and maintaining fiscal discipline to avoid macroeconomic instability. This necessitates reforms to enhance public financial management, diversify revenue sources, and ensure that borrowed funds are efficiently allocated toward growth-inducing sectors.

The debate on whether budget deficits are inflationary or growth-enhancing in Nigeria underscores the need for nuanced fiscal strategies tailored to the country's economic realities. While deficit financing remains a viable tool for addressing development challenges, its success hinges on prudent management, transparency, and alignment with broader economic goals. Addressing these challenges is crucial for achieving sustainable economic growth and mitigating the adverse effects of fiscal imbalances on inflation and other macroeconomic indicators.

The persistent fiscal deficits in Nigeria have raised significant concerns about their implications for economic growth and macroeconomic stability. While budget deficits can theoretically stimulate growth by funding critical infrastructure and development projects, their actual impact in Nigeria is mixed. The country has faced challenges such as inefficient allocation of deficit-financed resources, rising debt servicing costs, and inflationary pressures. Empirical evidence suggests that prolonged fiscal imbalances in Nigeria often exacerbate inflation, undermine economic stability, and strain public finances (Ezeabasili et al., 2012; Onafowokan & Owoye, 2020). Nigeria's reliance on oil revenue as a primary source of income further complicates the dynamics of deficit financing. Volatility in global oil prices frequently disrupts fiscal planning, leading to deficits that are financed through borrowing. This reliance on external and domestic debt increases vulnerability to currency fluctuations and interest rate hikes, ultimately reducing the potential growth benefits of deficit spending. Furthermore, a significant portion of Nigeria's budget deficit is directed toward recurrent expenditures and debt servicing, rather than productive investments, limiting its ability to stimulate sustainable economic growth (BudgIT, 2023).

Despite efforts to use fiscal deficits as a tool for economic revitalization, such as during the implementation of the Economic Recovery and Growth Plan (ERGP) from 2017–2020, the intended outcomes are often diluted by corruption, mismanagement, and structural inefficiencies (Udude, 2014). These challenges raise questions about the effectiveness of deficit-financed policies in achieving economic growth without triggering inflationary pressures. The interrelationship between budget deficits, economic growth, and inflation remains poorly understood in the Nigerian context, particularly given the dual objectives of stimulating growth and maintaining macroeconomic stability. The problem lies in determining whether Nigeria's fiscal deficits serve as an engine for growth or a source of macroeconomic instability. Policymakers face the challenge of balancing the immediate need for economic stimulation through deficit spending with the long-term risks of inflation and debt unsustainability. This study seeks to address the critical question of whether Nigeria's budget deficits have an inflationary impact, thereby contributing to economic instability, or whether they can be leveraged effectively for sustained economic growth. Following the introduction, the structure of the study includes a literature review (Section 2), data and methods (Section 3), findings and discussion (Section 4), and a conclusion with policy recommendations (Section 5).

Review of Related Literature

The relationship between budget deficits and economic growth in Nigeria is central to ongoing economic discourse, as it affects fiscal sustainability, macroeconomic stability, and long-term development. A budget deficit occurs when government expenditures surpass revenues within a fiscal year, necessitating borrowing to cover the shortfall. While deficits can serve as a tool for stimulating growth during economic downturns, their effectiveness in Nigeria is subject to significant debate due to the nation's unique structural challenges.

In theory, budget deficits can stimulate economic growth through the multiplier effect, where increased government spending on infrastructure, healthcare, and education raises aggregate demand, boosts employment, and enhances productivity (Keynes, 1936). In Nigeria, fiscal policies often use deficits to

address critical development gaps, particularly in infrastructure and human capital. For example, the Economic Recovery and Growth Plan (ERGP) between 2017 and 2020 utilized budget deficits to fund initiatives aimed at diversifying the economy and addressing infrastructure deficits (BudgIT, 2023). However, empirical evidence linking budget deficits to economic growth in Nigeria has been mixed and context-dependent. Several studies show that Nigeria's budget deficits are primarily financed through domestic and external borrowing, which carries high servicing costs. Oteh and Ugwoke (2020) argue that this borrowing creates a crowding-out effect, where high-interest rates resulting from government borrowing reduce private sector investment. As a result, fiscal deficits often fail to generate sustained economic growth. Moreover, Nigeria's allocation of deficit-financed expenditures is often skewed toward recurrent expenses (e.g., salaries, administrative costs) rather than capital investments. Udude (2014) suggests that this misallocation reduces the potential for deficit financing to stimulate long-term productivity and growth. Inflation further complicates the relationship between budget deficits and economic growth in Nigeria. Studies by Ezeabasili et al. (2012) and Onafowokan and Owoye (2020) show that deficits financed through monetary expansion can lead to inflation. When the government borrows from the central bank or increases the money supply to cover deficits, aggregate demand often exceeds the economy's productive capacity, resulting in price increases (Fisher, 1911). In Nigeria, fiscal expansion, particularly during periods of low oil prices, has been linked to inflationary pressures, as seen in the aftermath of the 2015 oil price crash, where the Central Bank of Nigeria (CBN) resorted to monetizing deficits, exacerbating inflation (CBN, 2023).

The reliance on oil revenues also exacerbates the fiscal challenges in Nigeria. Oil price fluctuations often lead to fiscal shocks, creating periods of excessive deficits and macroeconomic instability. This dependence on a single revenue source limits the effectiveness of fiscal policies and increases the risks associated with deficit financing (BudgIT, 2023). Moreover, Nigeria's public spending structure, which often prioritizes recurrent expenses over capital investments, reduces the long-term effectiveness of budget deficits in fostering sustainable growth. Despite these challenges, some researchers argue that budget deficits can foster economic growth if managed effectively. Key to this is ensuring fiscal discipline, prioritizing capital investments, and diversifying revenue sources. Aigbokhan and Adebayo (2022) suggest that improving tax administration and expanding the tax base could reduce Nigeria's reliance on borrowing, making deficit financing more sustainable. Additionally, addressing corruption and ensuring that deficit funds are efficiently utilized can maximize the growth potential of fiscal deficits.

The relationship between budget deficits and inflation in Nigeria plays a crucial role in macroeconomic stability. When deficits are not managed carefully, they can lead to inflationary pressures, particularly if deficits are financed through monetary expansion. Ezeabasili et al. (2012) found that large fiscal deficits contribute significantly to inflation, especially when financed through central bank borrowing or external loans that increase the money supply. Oyejide (2020) also notes that fiscal deficits, often misaligned with productive investments, contribute to inflation by increasing aggregate demand without boosting output. Structural inefficiencies in Nigeria's public spending further exacerbate inflationary pressures. A significant portion of fiscal deficits is allocated to recurrent expenditures, which do not directly enhance the economy's productive capacity. This misallocation of resources contributes to demand-pull inflation, where increased liquidity drives up prices without a corresponding increase in output. Persistent fiscal imbalances have also led to higher public debt, with debt servicing obligations crowding out public investment. Udude (2014) highlights how the growing debt burden limits the government's ability to respond effectively to economic crises, leaving Nigeria vulnerable to external shocks like oil price fluctuations. However, the relationship between budget deficits and inflation is not always straightforward. During economic recessions, Keynesian economics suggests that deficit-financed government spending can stimulate demand without causing inflation, provided it is directed toward productive investments. In Nigeria, however, fiscal deficits often fail to achieve this due to structural inefficiencies, weak institutions, and corruption, which reduce the effectiveness of deficit spending in stabilizing prices and promoting growth (BudgIT, 2023).

Inflation mediates the relationship between budget deficits and economic growth in Nigeria by influencing key economic variables such as investment and consumption. High inflation erodes household purchasing power, reducing consumption and saving rates. It also creates uncertainty for investors, which discourages long-term investments that are crucial for sustainable growth. In Nigeria, where inflation often exceeds central bank targets, these effects are particularly pronounced, especially for small and medium-sized enterprises (Ezeabasili et al., 2012). Inflation also influences the cost of borrowing. To control inflation, the central bank may raise interest rates, which increases borrowing costs and can stifle private investment, further slowing economic growth. Empirical studies show that inflation-driven monetary tightening often negates the stimulative effects of deficit spending in Nigeria (Udude, 2014). Conversely, if inflation is controlled, deficit spending can enhance growth by increasing productive capacity, particularly when directed toward infrastructure, education, and health. However, Nigeria's deficit spending is often directed toward recurrent expenditures, limiting this potential (BudgIT, 2023).

The mediating role of inflation also highlights Nigeria's structural challenges, including its dependence on oil revenues and vulnerability to external shocks. Fluctuations in oil prices lead to fiscal deficits, often financed through borrowing or monetary expansion, resulting in inflation that undermines economic stability and growth. The COVID-19 pandemic exemplified this dynamic, as fiscal deficits and supply chain disruptions led to inflationary spikes, weakening Nigeria's economic recovery (IMF, 2022). Inflation plays a crucial role in mediating the relationship between budget deficits and economic growth in Nigeria. While deficit spending can stimulate short-term growth, its long-term impact is heavily influenced by inflation. High inflation undermines economic stability, reduces investment, and discourages consumption, while well-managed inflation can support long-term growth by enhancing productive capacity. To mitigate inflationary risks and foster sustainable economic growth, Nigeria needs disciplined fiscal management, targeted deficit spending, and effective monetary policies.

The Structuralist Theory

The Structuralist Theory focuses on the unique challenges faced by developing economies, such as Nigeria, which are deeply influenced by structural imbalances within their economies. It differs from mainstream economic theories like Keynesianism and Monetarism by emphasizing that inflation in developing nations often arises from supply-side constraints rather than demand-side pressures. The theory highlights that in economies dependent on primary commodities (like oil), external factors such as fluctuations in global commodity prices significantly affect domestic inflation and economic stability.

Central to the Structuralist view is the concept of cost-push inflation, where rising production costs often due to external shocks like oil price increases drive up domestic prices. In Nigeria, this is a key factor due to the country's heavy dependence on oil exports. Additionally, the theory stresses the presence of a dual economy, where modern sectors (e.g., oil and industry) coexist with traditional ones (e.g., agriculture). This creates economic imbalances and contributes to inflationary pressures, particularly when global market shifts affect only the modern sector, widening income inequality.

Import dependence is another critical factor, with many developing countries, including Nigeria, relying on imports for goods like food and fuel. Any external shock, such as a devaluation of the currency or global price increases, exacerbates inflation by raising the cost of imports. The theory advocates for industrialization to move away from reliance on primary commodities and create a more diversified economy. Structuralist economists argue that government intervention is essential in addressing these imbalances, as market forces alone are insufficient. They propose targeted policies such as infrastructure investment, industrial policies, and social welfare programs to foster economic growth and manage inflation. However, critics suggest that too much government intervention can lead to inefficiency and corruption.

In conclusion, the Structuralist Theory provides valuable insights into the persistent economic challenges faced by developing countries like Nigeria. It emphasizes the need for active government policies to manage inflation, promote industrialization, and address structural imbalances to foster long-term economic stability.

Empirical Review

The interrelationship between budget deficit and economic growth in Nigeria, particularly in terms of its potential inflationary effects, has been extensively studied in the past few decades. Below, we discuss empirical studies that explore this relationship, focusing on their methodologies, data sources, findings, and recommendations. **Adebayo (2016)** examines the long-run relationship between budget deficits and economic growth in Nigeria from 1980 to 2015. Using time series data, the study employs the Ordinary Least Squares (OLS) method and finds a positive but weak relationship between budget deficits and economic growth. The study suggests that while fiscal deficits contribute to growth in the short term, they lead to inflationary pressures in the long term, particularly through the expansion of the money supply to finance deficits. Adebayo highlights the risks of increasing inflation rates when deficits are financed by borrowing from the central bank and recommends careful fiscal management to avoid such pressures.

Eme (2016) investigates the causal relationship between fiscal deficits, inflation, and economic growth in Nigeria from 1980 to 2015. Using the Granger causality test, the study reveals that budget deficits drive inflation, which in turn negatively impacts economic growth. The study emphasizes the need for fiscal reforms, including reducing deficit spending and controlling inflation, to stabilize the economy and promote sustainable growth. Eme's findings stress the importance of managing public debt to avoid inflationary spiral effects. **Okunade (2017)** analyzes the impact of budget deficits on economic growth in Nigeria from 1985 to 2015. Using the Vector Autoregression (VAR) model, the study concludes that while budget deficits can temporarily stimulate economic growth, they exert long-term negative effects due to inflationary pressures. Okunade suggests that relying on deficit financing through money supply expansion worsens inflation, which subsequently hampers growth, and advocates for fiscal policies that minimize reliance on deficit financing and inflationary practices.

Nwosa and Omojimite (2017) explore the period from 1981 to 2015, utilizing cointegration techniques and error correction models (ECM). They find that budget deficits have a strong inflationary effect, which adversely affects economic growth. The study argues for fiscal consolidation, recommending the reduction of wasteful government spending and improvement of revenue generation, as these steps would reduce inflation and foster long-term economic growth. **Olowofeso (2018)** investigates the relationship between budget deficits, inflation, and economic growth from 1980 to 2016 using cointegration analysis and ECM. The study finds that fiscal deficits significantly contribute to inflation, which in turn hampers economic growth. Olowofeso recommends fiscal discipline, suggesting that government borrowing should be reduced, and deficit financing should be carefully monitored to ensure that it does not lead to uncontrolled inflationary pressures.

Igbokwe and Onyeiwu (2018) apply the Vector Error Correction Model (VECM) to data from 1980 to 2016. Their findings indicate that budget deficits directly cause inflation, which reduces investment and slows economic growth. The study calls for improved fiscal responsibility, suggesting that diversifying the economy and reducing the government's reliance on borrowing could alleviate inflationary pressures and support more stable growth. **Udo (2019)** analyzes data from 1981 to 2017 using the Autoregressive Distributed Lag (ARDL) model. The study finds that while budget deficits have a positive impact on economic growth in the short term, they lead to inflationary pressures that undermine long-term growth. Udo recommends the implementation of both monetary and fiscal policies to prevent excessive deficits and ensure the stability of the economy.

Olayemi and Adeola (2019) use the ARDL model to analyze data from 1980 to 2016. Their study identifies a positive short-run relationship between budget deficits and economic growth, but a long-term negative impact due to inflation. The researchers recommend fiscal reforms, such as reducing borrowing and improving government revenue generation to mitigate the inflationary effects of deficits and promote sustained economic growth. In another study, **Adeoye (2020)** explores the period from 1980 to 2018 using panel data analysis with the Fixed Effect Model (FEM). The study finds that budget deficits tend to increase inflation, which negatively affects long-term economic growth. Adeoye emphasizes the need for fiscal discipline to reduce debt

accumulation and recommends improving revenue collection and reducing excessive public expenditure to ensure fiscal sustainability.

Okoro and Nwosu (2021) examine data from 1990 to 2020 using the Granger causality test. Their study uncovers bidirectional causality, meaning both inflation and budget deficits influence each other. The study stresses the need for comprehensive fiscal and monetary policies to manage inflation and ensure long-term economic stability. It suggests that controlling inflation could be key to curbing deficits and promoting growth. **Adebayo and Olaniyi (2022)** use the Johansen Cointegration approach to analyze data from 1985 to 2021. The study reveals a long-term equilibrium relationship between budget deficits, inflation, and economic performance, showing that inflationary pressures intensify as fiscal deficits increase. Adebayo and Olaniyi call for fiscal reforms aimed at reducing borrowing and controlling inflation, which could help maintain a balanced economic growth trajectory.

Olayemi and Adebayo (2021) use the ARDL bounds testing approach to analyze data from 1980 to 2020. Their study finds a positive correlation between budget deficits and inflation, which depresses long-term economic growth. They recommend reducing public debt through efficient fiscal policies and controlling inflation to prevent long-term economic stagnation. In another relationship, **Adeniran and Alimi (2023)** investigate the long-term relationship between budget deficits and economic growth in Nigeria from 1981 to 2020 using the ARDL model. Their findings suggest that budget deficits have a mixed effect on economic growth, with short-term positive effects but rising inflationary pressures in the long run. The study recommends a balanced fiscal policy that reduces deficits while promoting investment in critical sectors to sustain growth.

Omojola (2023) uses quarterly data from 2000 to 2022 and the OLS technique to examine the impact of fiscal deficit on inflation and economic growth. The study finds a positive relationship between budget deficits and inflation, which negatively affects economic growth. Omojola suggests fiscal consolidation to reduce deficits and mitigate the inflationary impact on growth. Similarly, **Ajao and Omoniyi (2023)** apply panel data analysis from 1999 to 2022 to investigate regional disparities within Nigeria. They find that budget deficits contribute to inflation, particularly in the short term, which negatively affects regional economic performance. The study recommends decentralizing fiscal policy to reduce inflationary pressures and address regional disparities in economic development.

Gap in literature

The relationship between budget deficits, inflation, and economic growth in Nigeria has been extensively explored, the long term effects have not been sufficiently ascertained. while budget deficits may offer temporary economic boosts, their long-term effects inflationary tendencies and its effect on sustainable economic growth remains scantly explored. This forms the thrust of the present study which tends to establish the interaction of budget deficit, inflation and economic growth in Nigeria using vector auto regression, impulse response function and forecast variance decomposition.

3. Methodology

The study utilized macroeconomic time series spanning from 1991 to 2022, sourced from the Central Bank Nigeria Statistical Bulletin and Annual Report, focusing on key variables such as inflation rate, budget deficit, gross domestic product and employment rate which served as a control variable.

Model Specification

There are two models in the study which are specified in the functional forms as

GDP = *f*(BOD, INF, EMP) (1)

INF = *f*(BOD, GDP, EMP) (2)

Where GDP = gross domestic product which is the proxy for Nigerian economic growth, BOD = budget deficit, INF = rate of inflation, EMP = the rate of employment which is serving as the control variable to avoid omission of important variable.

The above equations can be restated in a mathematical form also taken the natural logarithm as;

$$LnGDP = \beta_0 + \beta_1 LnBOD + \beta_2 \text{INF} + \beta_3 EMP + \mu \quad (3)$$

$$INF = \beta_0 + \beta_1 LnBOD + \beta_2 LnGDP + \beta_3 EMP + \mu \quad (4)$$

On apriori, $\beta_1 > 0, \quad \beta_2 < 0, \quad \beta_3 > 0,$

Where, β_0 = Autonomous component or Intercept, β_1 to β_3 are the coefficient of the parameters of the model while μ is stochastic variable or error term.

Therefore, to ascertain the relationship in the model, the study adopted the vector auto regression model (VAR). The generalized form of the VAR model for the objectives are specified as in equations below:

$$\Delta Y_t = \pi Y_{t-1} + \sum_{i=1}^{n-1} \delta_i Y_{t-n} + \psi_{t-n} + \lambda X_t + \mu_t ..... \quad (5)$$

Where

$$\pi = \sum_{l=1}^{n} \psi_t - 1, \ \delta_i = -\sum_{k-i+1}^{n-1} \psi_p + \lambda X_t + \mu_t ..... \quad (6)$$

In the case where coefficient matrix π is of reduced rank, indicated as $r < k$, there exist matrices ψ and δ, both with a rank of r, such that π is the outcome of multiplying ψ by δ, and δY_t has a stationary order of zero ($I(0)$). (Granger 1987 as cited in Odionye & Uma, 2013). Here "r" signifies co-integrating relations, each one column of δ acts as a co-integrating vector. Johansen's method estimates the π matrix using an unconstrained VAR and assesses if rejection indicates a π matrix with diminished rank. The VAR model is favored for its benefits, as it can be readily converted into a vector error correction mechanism (VECM) without running into simultaneity bias. It assists in elucidating, predicting, and projecting economic variable values, as well as examining weak exogeneity and parameter limitations, all without presuming a priori causality among variables. An advantageous feature is its avoidance of deciding a priori which contemporaneous variables are exogenous, treating all variables in the VAR model as endogenous. The general form of the model is:

$$y_{1T} = \varphi + \beta_i \sum_{j-1}^{k} Y_{t-1} + \lambda_i \sum_{j-1}^{k} X_{1T} V_j ..... \quad (7)$$

Where $y_{1T} = 5 \times 1$ vector endogenous variables (i.e $Y_{1t} = BOD_t,\ GDP_t,\ EMP_t,\ and\ INF_t$). φ = 4 x 1 constant vector terms. β = 4x4 is autoregressive coefficient matrix terms, $\hat{\lambda}_i$ = 4x4 represent vector of explanatory variable coefficients while Vj = vector of innovations.

Converting equation (7) into VAR models yields:

$$\Delta BOD_T = \alpha_0 + \alpha_1^1 \sum_{l=1}^{K} \Delta BOD_{T-1} + \alpha_2^1 \sum_{l=1}^{K} \Delta GDP_{T-1} + \alpha_3^1 \sum_{l=1}^{K} \Delta EMP_{T-1} + \alpha_4^1 \sum_{l=1}^{K} \Delta INF_{T-1} + \varepsilon_{1T} \ldots\ldots \quad (8)$$

$$\Delta GDP_T = \alpha_0 + \alpha_1^1 \sum_{l=1}^{K} \Delta GDP_{T-1} + \alpha_2^1 \sum_{l=1}^{K} \Delta BOD_{T-1} + \alpha_3^1 \sum_{l=1}^{K} \Delta EMP_{T-1} + \alpha_4^1 \sum_{l=1}^{K} \Delta INF_{T-1} + \varepsilon_{2T} \ldots\ldots \quad (9)$$

$$\Delta EMP_T = \alpha_0 + \alpha_1^1 \sum_{l=1}^{K} \Delta EMP_{T-1} + \alpha_2^1 \sum_{l=1}^{K} \Delta GDP_{T-1} + \alpha_3^1 \sum_{l=1}^{K} \Delta BOD_{T-1} + \alpha_4^1 \sum_{l=1}^{K} \Delta INF_{T-1} + \varepsilon_{3T} \ldots \quad (10)$$

$$\Delta INF_T = \alpha_0 + \alpha_1^1 \sum_{l=1}^{K} \Delta INF_{T-1} + \alpha_2^1 \sum_{l=1}^{K} \Delta EMP_{T-1} + \alpha_3^1 \sum_{l=1}^{K} \Delta GDP_{T-1} + \alpha_4^1 \sum_{l=1}^{K} BOD_{T-1} + \varepsilon_{4T} \ldots \quad (11)$$

Where "l" represents the lag length, "K" denotes the maximum distributed lag length, α_0, α_1, α_2,... represent the intercept terms, and ε is the error term that is independent and identically distributed.

Converting the VAR equations into VECM specifications corresponds to

$$\Delta BOD_T = \alpha_0 + \alpha_1^1 \sum_{l=1}^{K} \Delta BOD_{T-1} + \alpha_2^1 \sum_{l=1}^{K} \Delta GDP_{T-1} + \alpha_3^1 \sum_{l=1}^{K} \Delta EMP_{T-1} + \alpha_4^1 \sum_{l=1}^{K} \Delta INF_{T-1} + \delta ECM_{T-1} + \varepsilon_{1T} \ldots\ldots \quad (14)$$

$$\Delta GDP_T = \alpha_0 + \alpha_1^1 \sum_{l=1}^{K} \Delta GDP_{T-1} + \alpha_2^1 \sum_{l=1}^{K} \Delta BOD_{T-1} + \alpha_3^1 \sum_{l=1}^{K} \Delta EMP_{T-1} + \alpha_4^1 \sum_{l=1}^{K} \Delta INF_{T-1} + \psi ECM_{T-1} + \varepsilon_{2T} \ldots\ldots \quad (15)$$

$$\Delta EMP_T = \alpha_0 + \alpha_1^1 \sum_{l=1}^{K} \Delta EMP_{T-1} + \alpha_2^1 \sum_{l=1}^{K} \Delta GDP_{T-1} + \alpha_3^1 \sum_{l=1}^{K} \Delta BOD_{T-1} + \alpha_4^1 \sum_{l=1}^{K} \Delta INF_{T-1} + \varphi ECM_{t-1} + \varepsilon_{3T} \ldots \quad (16)$$

$$\Delta INF_T = \alpha_0 + \alpha_1^1 \sum_{l=1}^{K} \Delta INF_{T-1} + \alpha_2^1 \sum_{l=1}^{K} \Delta EMP_{T-1} + \alpha_3^1 \sum_{l=1}^{K} \Delta GDP_{T-1} + \alpha_4^1 \sum_{l=1}^{K} BOD_{T-1} + \lambda ECM_{T-1} + \varepsilon_{4T} \ldots \quad (17)$$

In the equations, α_s denote the parameters for estimation, Δ denotes the difference operator, and ε_t, k are as defined in equations 1 and 2 previously mentioned. The estimated parameters of λ, ψ and δ should all be positively signed (<0). In essence, equations 9 to 13 can be summarized as:

$$y_{iT} = \Phi_i + \Psi_i \sum_{J=1}^{K} y_{t-1} + \Upsilon_i \sum_{j=1}^{K} X_{iT-1} + \xi . ECM_{T-1} + \varepsilon_{iT} \ldots \quad (18)$$

Estimation Procedure

Because the order of integration of a time series is of great importance for time series analysis, we shall use the Augmented–Dickey Fuller (ADF) unit root tests to examine the time series properties of variables of the model.

Unit Root Test

To investigate the properties of the time series data, the study employed the Augmented Dickey-Fuller (ADF) unit root tests. These methods help to examine whether the variables are stationary, thereby ensuring the validity of subsequent analyses. The ADF test equation with a constant can be represented as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{k} \alpha_j \Delta Y_{t-1} + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots (19)$$

Δ denotes the first-difference operator,

Is a random error term assumed to be independently and identically distributed (iid), k represents the number of lagged differences included in the model.

Once the test statistic is calculated, it is compared to the critical values for the Dickey-Fuller test at significance levels of 5% or 1%. If the absolute value of the test statistic exceeds the critical value, the null hypothesis is rejected, confirming that the variable is stationary. Conversely, if the variables are non-stationary at levels but integrated of the same order, this suggests the possibility of cointegration in the model.

Impulse Response Function (IRF)

An impulse response function measures the time profile of the effect of shocks at a given point in time on the (expected) future values of variables in a dynamic system. It makes it possible to view the outcome of effect of shocks say hitting the economy at time t and compare with a base-line profile at time t-1. IRF will therefore be used to know the effect of shock from the relationship between the variables at time t, t_{-1} and t_{+1} (crisis, pre-crisis and post-crisis period) respectively.

Forecast Error Variance Decomposition

Shocks to any variable in the VAR model not only directly affects the variable but is also transmitted to all other endogenous variable through dynamic (lag) structure of the VAR. Variance decomposition will provide information about the relative important of each random innovation in affecting the variables in the VAR model

Where p is the optimal lag length of the VAR, α_{ik} = the adjustment coefficients V_k, t-p = the co-integrating vector, μ = intercepts. The amount of forecast error variance of variable J accounted for by exogenous shock to variable k is given by W_{jk},h

$$W_{jk}, h = \sum_{i=0}^{h-1} \left(e_j \ \sigma e_k\right)^2 / MSE \left[y_{it} \ (h)\right] \ldots (20)$$

where $\left(e_j \sigma e_k\right)^2$ = the variance, h = lag length

Where MSE is the mean square error of an estimator and is one of many ways to quantify the difference between values implied by an estimator and true values of quantity being estimated. It measures the average of the square of the error terms.

Results and Discussions

Descriptive Statistics

Table 1: Descriptive Outcomes

Variables	Mean	Maximum	Std_Dev	Skewness	Kurtosis	J_B Stat.
GDP	53106.03	184165.9	56572.58	0.905576	2.573493	4.616242
BOD	-1413.439	-7880.077	2183.440	-1.747285	4.873990	20.96513***
INF	18.60688	72.80000	16.24466	2.126397	6.527049	40.70178***
EMP	11.98266	13.42000	0.903920	-0.322164	2.446664	0.961787

*Authors' calculation. *** (**) [*] signify the decline of null hypothesis of normal distribution at 1% (5%)[10%] level of significance respectively. GDP designates gross domestic product; BOD stands for budget deficit, EMP represents employment rate, while INF means inflation rate.*

The descriptive statistics highlight the characteristics of GDP, BOD, INF, and EMP in terms of central tendency, dispersion, and distribution shape. GDP has a high mean and median difference, indicating a right-skewed distribution with significant variability. BOD shows a negative mean, reflecting frequent fiscal deficits, and a left-skewed distribution. Inflation has a high mean with considerable volatility, while employment demonstrates stability with minimal variation. Skewness and kurtosis reveal GDP and inflation as skewed with potential outliers, while employment approximates normality. Jarque-Bera tests confirm normality for GDP and employment, but not for BOD and inflation, suggesting the need for advanced econometric techniques for robust analysis.

Unit Root Test

The variables of the study in table 4.2 are tasted for stationarity so as to avert inconsistencies which could have arisen owing to spurious results emanating from non-stationary data used for regression. The summary of these results is shown in table 4.2 as follows:

Table 4.2: Augumented Dickey Fuller Unit Root Test

ADF statistics						
Variables	**Level**	**1st Difference**	**Critical Values**	**Order of Integration**	**P-Value**	**Decision**
BOD	4.856558	-4.216388*	1% -4.2967 5% -3.5684* 10%-3.2184	*I*(1)	0.0120	Reject H_0
RGDP	1.533270	-5.033281*	1% -4.2967 5% -3.5684* 10% -3.2184	*I*(1)	0.0017	Reject H_0
EMP	-0.436888	-2.650282*	1% -2.6443 5% -1.9524* 10% -1.6102	*I*(1)	0.0009	Reject H_0
INF	-2.090282	-5.505487*	1% -3.6701 5% -2.9639* 10% -2.6210	*I*(1)	0.0001	Reject H_0

*Author's computation (*shows the variable is stationary at 5% level of significant)*

The result shows that with the exception of GDP and value of shares traded which are stationary at the level all others variables are integrated of order one, I(1) or so to say stationary at first difference. From the result in table 4.2 above, all the variables included in the model are not stationary at level form but became stationary after their first differences. We pause here to ascertain the nature of cointegration among the variables of the study.

Co-integration Test Result

Utilizing the Johansen co-integration test, hypotheses are examined across various scenarios, ranging from no co-integration to full co-integration. Detailed outcomes are provided in Table 4.3

Table 4.3: Johansen Co-integrating Test Result between the Variables:
TRACE STATISTICTRACE STATISTIC

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.699766	63.97604	47.85613	0.0008
At most 1	0.487315	29.08342	29.79707	0.0603
At most 2	0.284461	9.708679	15.49471	0.3038
At most 3	6.35E-05	0.001842	3.841466	0.9628

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.699766	34.89262	27.58434	0.0048
At most 1	0.487315	19.37474	21.13162	0.0865
At most 2	0.284461	9.706836	14.26460	0.2319
At most 3	6.35E-05	0.001842	3.841466	0.9628

** denotes rejection of the hypothesis at 5% (1%) significance level. L.R and Max-Eigen value test indicates no co-integrating equation(s) at 5% level of significance*

From table 4.3 above, the likelihood statistics and Max-Eigen value did not indicate any presence of co-integrating equation at 5% significance level which implies that there is no evidence of cointegration among variables of the study. This shows that there is no long-run relationship between economic growth, budget deficit, inflation and employment rate Nigeria.

The interpretation of the VAR results is done in line with the interpretation of the variance decomposition following the objectives of the study.

Impulse Response Functions

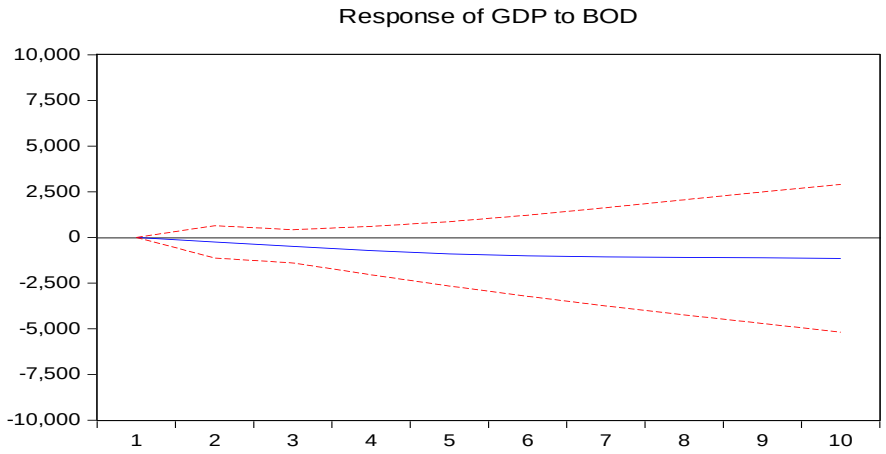


Fig 1: response of GDP to BOD

From the impulse response function as shown in the figure 1, gross domestic product negatively responded to slight increase in budget deficit from the first period to the last period. This implies that continuous increase in the deficit financing over time reduces that rate of growth of the Nigerian economy.

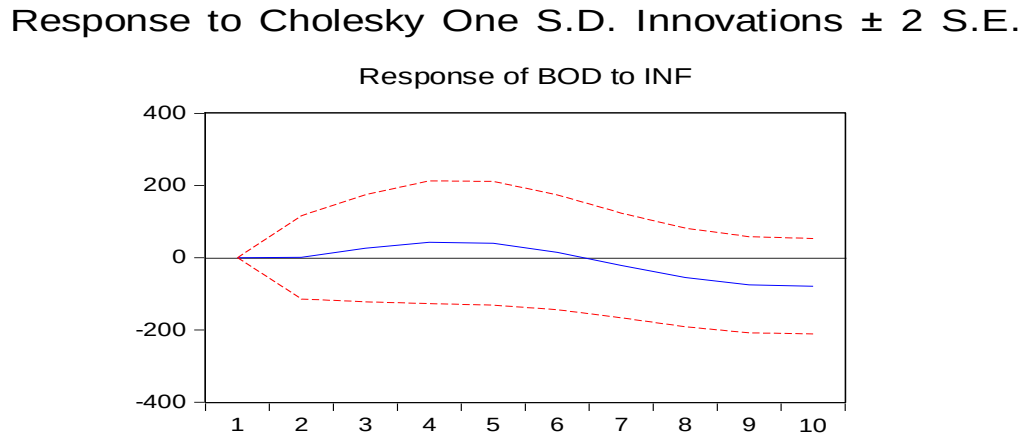
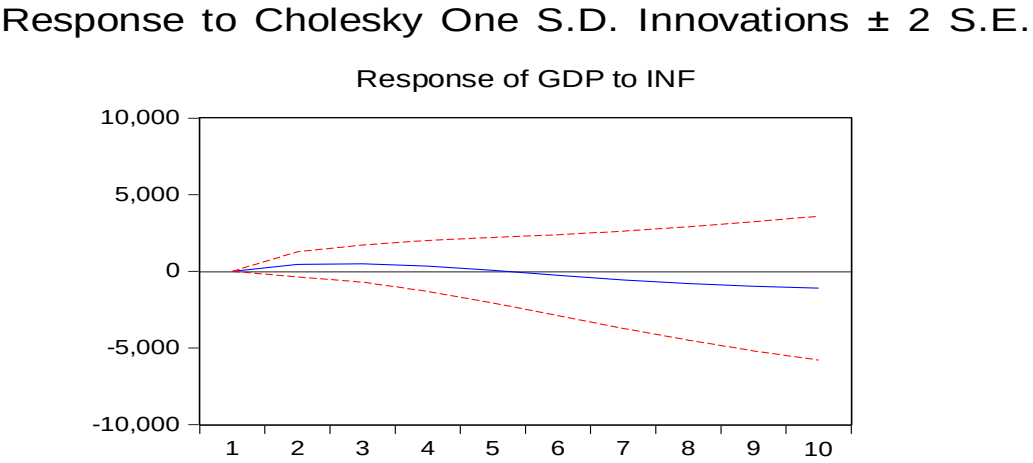


Fig 2: Response of BOD to INF

From figure 2, inflation showed no substantive response to budget deficit flux in the first period, but from the second period, the there is a noticeable positive reaction which continuo to increase till the 5th period when it decreased and showed negative reaction from the 6th down throughout the periods.



GDP showed mixed reactions to variations in inflation. From the 1st period to 3rd period, GDP higher inflation rate triggered positive rise in the value of GDP but from the 4th period inflation increase resulted to decrease in GDP which continuo till it hit negative and remain in the negative region throughout the period.

Variance Decomposition

The variance decomposition helps in explaining how much the forecast error variance of a particular variable is explained by variations in the other variables and the variable itself. Table 4.5 to 4.8 below presents the VDCs for variables of the model.

Table 4.6: Variance Decomposition of GDP

Period	S.E.	GDP	BOD	INF	EMP
1	2251.041	100.0000	0.000000	0.000000	0.000000
2	3049.140	96.12524	0.653355	2.216229	1.005181
3	3994.928	89.43893	1.866394	2.847402	5.847273
4	5153.938	81.92937	3.086356	2.166888	12.81739
5	6519.163	75.74332	3.818918	1.365781	19.07198
6	8031.551	71.46635	4.081599	0.999653	23.45240
7	9633.091	68.77322	4.051451	1.028519	26.14681
8	11287.26	67.15977	3.882617	1.252245	27.70536
9	12981.98	66.20652	3.668776	1.513955	28.61075
10	14724.73	65.61861	3.457284	1.736250	29.18785

The results show that the gross domestic investment show strong endogenity influence on itself implying that the GDP has strong influence on itself both in the short-run and long-run also GDP show strongly exogenous influence implying weak influence on other variables of the model. This means that GDP accounted

for 100% variation of itself in both short run and long run. This is shown in table 4.6 above.

Table 4.7: Variance Decomposition of BOD

Period	S.E.	GDP	BOD	INF	EMP
1	299.0823	6.431805	93.56820	0.000000	0.000000
2	389.1030	3.842467	87.61236	0.000491	8.544685
3	448.6307	5.054049	83.91151	0.337845	10.69659
4	479.9637	7.470292	81.62450	1.085556	9.819649
5	499.3830	9.877293	78.88326	1.638053	9.601395
6	517.2035	11.63022	74.98393	1.607904	11.77795
7	536.3658	12.95830	70.53413	1.655565	14.85200
8	556.2120	14.50802	66.37449	2.513321	16.60417
9	577.5669	17.01311	62.61789	4.030330	16.33867
10	604.5677	21.07210	58.62219	5.383943	14.92177

The forecast variance decomposition for budget deficit, it solely and strongly account for their own fluctuation in the short-run and long- run though it showed a slight decreasing influence, This implies that monetary policy rate is weakly exogenous. However, there is weak impact of budget deficit on gross domestic product especially in the short run. The result is shown in table 4.7 above.

Table 4.7: Variance Decomposition of INF

Period	**S.E.**	**GDP**	**BOD**	**INF**	**EMP**
1	10.45574	1.876549	0.910891	97.21256	0.000000
2	14.13017	3.193528	0.519064	96.03747	0.249934
3	15.21356	3.743657	0.454836	95.15242	0.649085
4	15.48872	4.026748	0.446158	93.86124	1.665853
5	15.67173	4.237336	0.496385	91.89655	3.369728
6	15.87170	4.471923	0.568112	89.66402	5.295945
7	16.05496	4.757227	0.605544	87.78777	6.849463
8	16.19614	5.034281	0.604902	86.58512	7.775696
9	16.29053	5.237279	0.598801	85.97877	8.185149
10	16.34549	5.349037	0.610600	85.72410	8.316261

The table 4.7 presents the variance decomposition of inflation (INF) over a 10-period forecast, showing how various factors contribute to the changes in inflation over time. Initially, inflation is predominantly explained by its own past values, accounting for over 97% of the variance. However, over the next several periods, the influence of other variables such as GDP, BOD (Balance of Payments), and EMP (employment) gradually increases, although inflation remains the dominant factor. By the 10th period, inflation's own past values still account for around 85.7% of the variance, but GDP's contribution rises steadily to around 5.3%, with BOD and EMP having minimal but growing influences. The marginal increase in EMP, particularly towards the later periods, indicates that factors like employment levels and economic activity have a gradually increasing impact on inflation, but inflation remains largely driven by its own dynamics in the short term.

Discussion of Findings

The impulse response functions (IRFs) from the study show several critical insights regarding the interactions between key macroeconomic variables, particularly GDP, inflation, and budget deficit in Nigeria. The response of GDP to a slight increase in budget deficit over time reveals a consistent negative relationship. From the first to the last period, an increase in the budget deficit continues to slow the growth of the Nigerian economy. This finding aligns with previous studies that highlight the negative impact of fiscal imbalances on economic growth, especially in developing economies. For instance, studies such as those by Akinlo (2012) and Iyoha (2014) emphasize that persistent budget deficits often crowd out private investment and increase borrowing costs, leading to slower growth.

The results from the second impulse response function suggest that inflation does not significantly respond to changes in the budget deficit in the first period. However, from the second period onward, inflation starts to exhibit a noticeable positive response, continuing to increase until the fifth period, after which it declines and becomes negative in the later periods. This pattern points to the delayed impact of fiscal imbalances on inflation, with inflation initially remaining stable but eventually being driven up

as the economy adjusts to the pressures created by budget deficits. This finding corroborates earlier research, such as that by Odusola (2004) and Bamidele et al. (2020), who argue that fiscal deficits, especially when financed by printing money or excessive borrowing, contribute to inflationary pressures over time.

The mixed response of GDP to variations in inflation offers another interesting insight. In the first three periods, higher inflation leads to an increase in GDP, but from the fourth period onward, rising inflation results in a contraction in GDP, which persists throughout the remaining periods. This finding suggests that inflation has a non-linear impact on the economy, initially stimulating growth but eventually curbing it as inflation becomes more entrenched. Similar findings have been observed in other studies, such as those by Aghion et al. (2006), which show that low to moderate inflation can stimulate economic activity, but high inflation disrupts investment, reduces the purchasing power of consumers, and ultimately hinders economic growth. The strong endogeneity of GDP, as demonstrated in the analysis, indicates that GDP largely influences its own movements both in the short and long run. The endogeneity of GDP suggests that past economic performance has a significant effect on future outcomes, which is a common finding in macroeconomic models. It also implies that GDP has a weak influence on other variables, such as budget deficit and inflation, which tend to be more responsive to external factors, such as fiscal and monetary policies. This result is consistent with findings in the literature, such as those by Barro (1990) and Blanchard (2000), who argue that the economy is more likely to be driven by its own historical performance than by other external shocks in the short term. The forecast variance decomposition for budget deficit further reinforces the idea of its exogeneity, with the budget deficit accounting strongly for its own fluctuations over both the short and long terms. This suggests that budget deficits are not significantly influenced by other variables like GDP or inflation in the short run. This is consistent with studies such as those by Mendoza and Ostry (2008), which highlight that fiscal policies, particularly deficit financing, are often determined by political decisions and macroeconomic conditions rather than by economic fundamentals in the short term.

Finally, the variance decomposition of inflation shows that, initially, inflation is primarily explained by its own past values, accounting for over 97% of its variation in the first period. However, as the periods progress, the influence of other variables, such as GDP and employment (EMP), becomes more prominent, although inflation remains largely driven by its own dynamics. By the tenth period, inflation's own past values still account for a substantial 85.7% of its variation, with GDP contributing 5.3%. This implies that while inflation has a self-perpetuating characteristic, its long-term behavior is also influenced by broader economic conditions, including employment and GDP growth, albeit to a lesser extent. This finding is supported by the work of Cagan (1956), who argued that inflationary dynamics are driven both by historical inflation rates and broader macroeconomic factors, including growth and employment.

In conclusion, the findings from the impulse response and variance decomposition analyses provide valuable insights into the interrelationships between fiscal deficits, inflation, and economic growth in Nigeria. While inflation is primarily driven by its own history, the influence of GDP and employment grows over time, suggesting that fiscal and monetary policies targeting both inflation and economic growth will be crucial for stabilizing the economy in the long run.

Conclusion and Policy Recommendation

The focus of the study was to ascertain the interrelationship between budget deficit, inflation and economic growth in Nigeria. To capture the response of the variables and their interrelationship, we adopted the vector auto regression (VAR), impulse response functions and variance decomposition for the analysis. Findings of this study revealed that:

1. Gross domestic product negatively responded to slight increase in budget deficit from the first period to the last period.
2. Inflation showed no substantive response to budget deficit flux in the first period, but from the second period, the there is a noticeable positive reaction which continue to increase till the 5th period when it decreased and showed negative reaction from the 6th down throughout the periods.
3. GDP showed mixed reactions to variations in inflation. From the 1st period to 3rd period, GDP higher inflation rate triggered positive rise in the value of GDP but from the 4th period inflation increase resulted to decrease in GDP which continue till it hit negative and remain in the negative region throughout the period.

Base on the findings of the study the following recommendations were made:

1. The negative impact of budget deficits on GDP growth calls for more prudent fiscal management. Policymakers should aim to reduce reliance on deficit financing by focusing on enhancing revenue generation and controlling public spending.
2. The weak exogeneity of the monetary policy rate, as indicated by the model, suggests that the central bank's monetary policies should be adjusted to better influence inflation and GDP dynamics.
3. Given that inflation is largely self-driven in the short term, it is critical for policymakers to focus on controlling factors that can exacerbate inflationary pressures, such as excessive money supply growth or external shocks.

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