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Public debt shocks and macroeconomic stabilization in Nigeria: A new Keynesian approach

■ **Abstract.** The study examined the impact of public debt shocks on Nigeria's macroeconomic stability. This study aimed to evaluate the role of increasing public debt on macroeconomic variables in Nigeria using a New Keynesian approach to evaluate the effect of both external and domestic debt on macroeconomic stability and the impact of debt service on revenue on Nigerian macroeconomic stability. The dynamic stochastic general equilibrium model was adopted as an analytical tool using the Bayesian approach in a Matlab R2021a in a Dynare 4.6.4 environment to determine the influence of public debt shock on macroeconomic stability in Nigeria. It was discovered that a positive relationship exists between output (economic growth) and foreign debt in Nigeria within the period under review. It was also found that debt service to revenue ratio, interest rate, and domestic debt have a negative relationship with output (economic growth). As a result, an increase in external debt will positively impact output (economic growth). In contrast, an increase in the debt service to revenue ratio, interest rate, and domestic debt will have a negative transmission effect on Nigeria's macroeconomic stability. High debt service would impede growth by reducing public resources and productive investment that would otherwise be used to encourage growth. According to this result, external debt is the best option for capital projects rather than domestic debt, which is likely to affect the business environment negatively. This study is practically relevant to government, investors, scholars, and policymakers, especially those around fiscal policy, to guide them in advising the government on where to borrow for its capital projects when needed

■ **Keywords:** domestic debt; dynamic stochastic general equilibrium; external debt; gross domestic product

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■ INTRODUCTION

The primary goal of any developing economy such as Nigeria is to achieve sustainable economic growth while also expanding infrastructure and reducing the poverty level in the society. When the government fails to satisfy these growing needs due to its limited resources, it is forced to accept financial help from both the external and domestic sectors, much of which takes the form of debt. As noted by S.R. Dey & M. Tareque (2020), and A.O. Adetayo (2021), Nigeria has had to and continues to rely on public debt for its savings-investment gap and fiscal deficit since its independence. It is critical to emphasize that foreign and domestic borrowing is not a negative issue for a country, mainly when it generates a better yield than the cost of borrowing. Still, it becomes dangerous if not used properly and responsibly for what such money is borrowed for, primarily to finance a capital project that will positively influence the economy.

Nigeria is suffering economic issues because of its high levels of public debt, which has slowed GDP (Gross Domestic Product) growth, slowed export growth, lowered income per capita, and increased poverty. J. Salmon (2021) noted that raising public debt by one percentage point reduces GDP growth by 0.012% the following year while decreasing yearly average growth over the next five years by 0.028 percentage points. High levels of public debt in Nigeria have contributed to continuous inflation, eroding the purchasing power of the country's citizens. Public debt, which consists of both external and domestic debt, has affected interest rates in Nigeria, which is the cost of borrowing money, and it is thus a severe concern confronting the country that has attracted much attention among policymakers.

M. Shuaibu *et al.* (2021) studied Public Debt and Inflation in Nigeria and claimed that debt is an essential source of revenue for governments in both developed and developing countries. Debt is an essential source of funds in developing countries for bridging the gap between government revenues and expenditures, particularly in countries with fiscal deficits like Nigeria. M. Shuaibu *et al.* (2021) discovered a long-run connection between public debt and unemployment in Nigeria, demonstrating that increasing public debt produces more unemployment. Still, external debt causes more unemployment than domestic debt. External debt, according to A. Yusuf & S. Mohd (2021), is a hindrance to long-term growth while promoting growth in the short term. Domestic debt had a significant positive impact on long-term growth while negatively impacting short-term growth. Debt service payments, both long-term and short-term, reduced growth, confirming the debt overhang effect. This debt crisis affects not only Nigeria but most African countries, as evidenced by A. Ndoricimpa (2020) study on the threshold impacts of public debt on African economic growth. According to the research, the overall sample has a 62-66% debt threshold. Low public debt is determined to be growth-neutral. However, high public debt is proven to be growth negative.

According to S.R. Dey & M. Tareque (2020), external and domestic borrowing, sometimes known as public debt, if properly used, would boost capacity and enhance growth, making debt productive and justifiable for the reason it is acquired. On the contrary, this debt may result in a budget deficit and excessive foreign borrowing, increasing the country's vulnerability to numerous shocks and crises. It

decreases the efficiency of fiscal initiatives and limits the Central Bank's ability to raise interest rates to achieve monetary policy goals due to its influence on the budget deficit and debt.

Even though the potential consequences of high public debt on economic growth pose a severe concern for policymakers and public opinion, empirical studies on public debt shocks and the growth nexus in Nigeria are scarce. The broad objective of this study is to look at the effect of increasing public debt on the macroeconomic variables in Nigeria. Specifically, to explore the impact of external and domestic debt on macroeconomic stability in Nigeria and examine the effect of debt service to revenue on macroeconomic stability in Nigeria.

■ LITERATURE REVIEW

There are several theories in this area of research, such as the Ricardian equivalence theory, the Laffer curve, and many others. Nevertheless, it is essential to look at the two mentioned above. The Ricardian equivalence theory, proposed by David Ricardo in the early nineteenth century, stated that deficits postpone taxation. Tax timing cannot influence an individual's consumption decisions because it does not affect his lifetime budget limitations. The length of consumers' planning horizons determines the significance of this information. Fiscal policy that delays tax collection until after existing taxpayers have died may influence accurate economic decisions (Afonso & Ibraimo, 2020). The core premise (Adetayo, 2021) was that intergenerational benevolence might broaden planning horizons, reinstalling robust versions of Ricardian equivalence.

The Ricardian thesis's collection of implicit and explicit assumptions has lately been explained via theoretical work. Theoretically, both aspects of this claim are doubtful. According to one school of thinking, many parents will leave nothing to their children if fair inferences about preferences, productivity development, and wealth sharing are made (Philip, 2021; Hilton, 2021). The fundamental difficulty is that transfers may not flow from parents to their kids or from kids to parents. Several researchers have investigated models that allow both gifts and inheritances. Typically, there is a set of parameters for which transfers do not occur (Abubakar & Mamman, 2021). Scholars dispute the logic of rejecting preference specifications based on characteristics such as dynamical inconsistency (between members of succeeding generations) or utility stream divergence because they are founded on a priori assumptions. While consistency and convergence are analytically valuable properties, they cannot be justified as fundamental choice axioms.

The Laffer Curve is an economic theory examining tax cuts' effects on public expenditure, revenue, and long-term growth. In 1974, economist Arthur Laffer proposed the Laffer curve or theory. Tax cuts have two consequences on the federal budget, he claims: mathematical and economic. The arithmetic effect is one-to-one and immediate. Every dollar saved in taxes translates into one dollar less in government revenue. It also diminishes by one dollar the stimulating effect of government spending. The economic impact is long-term and compounding. Its impact may be more significant or less than the tax cuts. The Laffer Curve

is a tax hypothesis that proposes an inverted U-shaped relationship between tax rates and government revenue. The best or optimal tax rate for an economy is precisely at the top of the inverted U (Ndoricimpa, 2020).

An examination of the existing literature reveals several trends in the findings. A. Afonso & Y. Ibraimo (2020), P. Burriel *et al.* (2020), and J. Jacobs *et al.* (2020) showed a negative connection between public debt and macroeconomic variables. However, L. Donayre & A. Taivan (2017), S.R. Dey & M. Tareque (2020), and S.K. Hilton (2021) discovered a constructive impact connection between public debt and macroeconomic variables. Some studies, such as A. Imoisi (2021), K.O. Onyele & E.C. Nwadike (2021), and F.F. Adegbie *et al.* (2022), also found mixed results between public debt and indicators of macroeconomics in Nigeria. The general conclusion from these studies is that the results vary depending on various factors such as sample periods, methodology used, estimation techniques, variables used, and countries considered (developing or developed countries). Even though the results have been mixed, some omissions may have prompted additional research in this area. This study separately looked at external and domestic debt and Nigeria's debt service to revenue ratio amidst increasing public debt.

■ MATERIALS AND METHODS

The dynamic stochastic general equilibrium (DSGE) model is applied in this work. The DSGE is based on the micro foundation and price rigidity, among other basic assumptions. This work used the following procedures to solve the New Keynesian Model. The model was log linearized, solving the linear equations derived from the model, and the Bayesian technique was applied to the model. On the other hand, the study used the Euro Area and Global Economy (EAGLE) and European System of Central Bank (ESCB) models 2020 to assess the effects of public debt shocks on Nigerian macroeconomic stability. They modified the EAGLE and ESCB model to account for the country's unique characteristics. The EAGLE and ESCB model is calibrated for Nigeria and considers the rest of the world. On the fiscal side, all the model features improved the government sector, particularly the public debt. In the EAGLE and ESCB model, Income taxation on labour (τ_t^L, in deviation from its steady state τ^L)is assumed as the primary fiscal instrument. It responds to changes in the debt-to-GDP ratio (B_t) from the target (B^*) with the sensitivity of (ζ_B) and the output gap where Y_t and Y^* reflect potential output. More formally, the equation is expressed as below:

$$\tau_t^L - \tau^L = \rho(\tau_t^L - \tau^L) + \zeta_B (B_t/B^* - 1) + \zeta_\gamma (Y_t/Y^* - 1). \qquad (1)$$

For government spending (considered a general expenditure X_t in deviation from its steady state value):

$$X_t - \bar{X} = \rho (X_t - \bar{X}) + \zeta_B^X \log(B_t/B^*) + \zeta_\gamma^X \log(Y_t/Y_*). \qquad (2)$$

The DSGE model must contain a sovereign risk premium to impact the debt level significantly. In a basic DSGE model, the starting level of debt has no effect on the size of multipliers. However, substantial evidence of an obstructive correlation between public debt and output exists. To account for such consequences, this study allows for sovereign default due to the government's inability to raise the necessary cash to pay its debts.

As a result, because the likelihood of sovereign default is inextricably and nonlinearly linked to the level of public debt, the sovereign risk premium reacts to changes in the fiscal outlook. Sovereign default is related to the concept of a fiscal limit in the same way that G. Corsetti *et al.* (2013) do, with default occurring whenever the debt level exceeds the fiscal limit. A stochastic process represents the uncertainty surrounding the political process in the context of sovereign default to compute the budgetary limit. The government cannot raise additional tax revenue by raising tax rates if the tax rate is on the lower side of the Laffer Curve. P. Burriel *et al.* (2020) assume that the probability of default is proportional to the distance between a country's actual debt-to-GDP ratio, B_t, and its debt ceiling, $\bar{B}$. If the debt-to-GDP ratio surpasses the debt ceiling, the government will default with certainty, and the borrower will face a 30% $(1 - \chi)$, recovering just 70% (χ) of the total repayments. According to G. Corsetti *et al.* (2013), P. Burriel *et al.* (2013), and P. Burriel *et al.* (2020), the default probability δ_t is defined by a two-parameter distribution function (F):

$$\delta_t = F \left(B_t / \bar{B}, a_{1,} a_2 \right). \qquad (3)$$

The default probability's lean is determined by α_1 and α_2. The closer the debt-to-ratio gets to the debt ceiling, the faster the default likelihood rises after another rise in public debt. As a result, the Euler equation for a family investing in public debt with a fixed gross interest rate of R_t must be updated to:

$$\lambda_t = \beta E_t \left[\frac{R_t}{\pi_{t+1}} \lambda_{t+1}(1 - \delta_{t+1}(1 - \chi)) \right], \qquad (4)$$

where λ_t is the marginal utility of household consumption, π_{t+1} determines (expected) CPI inflation, and β beta is the discount factor. The interest rate at which households are willing to invest in government debt grows in direct proportion to the likelihood of default. As a result, the government's interest payments must be adjusted accordingly. Equation 5 is built to modify the model equations that are used to compute the rate of return on physical capital investments, such as:

$$R_t^k = \pi_t \left[Q_t \left(1 - \tau_t^k \right)(1 - \bar{\omega}\delta_t(1 - \chi)) + \tau_t^k \delta_t^k \right] / Q_{t-1} - 1. \quad (5)$$

This is the conventional equation for estimating the return on capital private investment in the concept, R_t^k, in the investment adjustment cost, where Q_t is Tobin's Q, δ^k is capital depreciation, τ_t^k the tax rate on capital returns (which implies that capital depreciation is tax-exempt), and π_t is CPI inflation. The term $(1 - \bar{\omega}\delta_t(1 - \chi))$ is non-standard in this equation. It states that when the parameter $\bar{\omega} = 1$, the public sector's default probability overlaps with the private sector's default probability. This means that when the chance of a state default increases, the private sector and households will receive a higher interest rate on private investment to compensate for the (higher) estimated potential losses. In most cases, equation 6 is the Taylor rule, which is written as follows:

$$R_t = \phi R_{t-1} + (1 - \phi)[\bar{R} + \phi_\pi (\pi_t - \pi^*)] + \phi_\gamma \left(\frac{Y_t}{Y_{t-1}} - 1\right). (6)$$

When the forward guidance applies (equation 7), the extra dummy variable $\|_{FG}$ controls for the duration of fixed nominal interests:

$$R_t = (1 - \|_{FG}) \begin{bmatrix} \phi R_{t-1} + (1 - \phi)[\bar{R} + \phi_\pi (\pi_t - \pi^*)] + \\ + \phi_\gamma \left(\frac{Y_t}{Y_{t-1}} - 1\right) \end{bmatrix} + \|_{FG} \bar{R}. (7)$$

The Taylor rule followed monetary authority. The private sector and long-term private debt must be investigated to determine its role, which is reducing in a high-debt economy. Private sectors can only borrow up to the value of their collateral, which is m_t (the loan-to-value ratio, which is thought to be exogenously time-varying) proportion of the predicted discounted value of the household's housing stock ($p_t^h h_t$):

$$b_t^h \leq m_t E_t \frac{p_{t+1}^h h_t}{R_t / \pi_{t+1}}. (8)$$

As a result, a high level of public debt exacerbates private-sector borrowing limits by lowering the value of the housing stock. Long-term loans need an annual repayment of $\gamma \frac{b_{t-1}^h}{\pi_t}$. This lowers the private debt limit since agents refund their debt when the collateral value falls below it. As a result, agents' borrowing limitations are dual and asymmetric in that collateral value only controls borrowing when it is more significant than annual loan payments. In contrast, agents still service their debt when it is less:

$$b_t^h \leq \left\{ E_t \frac{m_t}{R_t / \pi_{t+1}} p_{t+1}^h h_t \text{ if } E_t \frac{m_t}{R_t / \pi_{t+1}} p_{t+1}^h + h_t \geq \gamma \frac{b_{t-1}^h}{\pi_t}. (9) \right.$$

$$\gamma \frac{b_{t-1}^h}{\pi_t} \text{ if } E_t \frac{m_t}{R_t / \pi_{t+1}} p_{t+1}^h h_t < \gamma \frac{b_{t-1}^h}{\pi_t}. (10)$$

As a result, long-term debt functions as a buffer in the economy, restraining the fall in private lending but also delaying the decreasing process. The research has six exogenous shocks, which are presented in the form of equations below:

Technology:

$$\alpha_t = \rho_\alpha \alpha_t + \varepsilon_t^\alpha. (11)$$

External Debt:

$$d_t^{ed} = \rho_e ded_{t-1} + \varepsilon_t^{ed}. (12)$$

Domestic Debt:

$$p_t^{dd} = \rho_d pdd_{t-1} + \varepsilon_t^{dd}. (13)$$

Interest rate:

$$s_t^{sr} = \rho_r s_{rt-1} + \varepsilon_t^{sr}. (14)$$

Output:

$$z_t^y = \rho_y z y_{t-1} + \varepsilon_t^y. (15)$$

Debt Service to Revenue Ratio:

$$rt_t = \rho_{rt} rt_t + \varepsilon_t^{rt}, (16)$$

where: $\varepsilon_t^j \sim$ iiL $(0, \sigma_j^2)$; $j = \alpha, d, p, r, y, rt$. The study is based on the concept of a Small Open Economy. The economy trades with the rest of the world, but it is so small that it does not affect global prices, interest rates, or income, and the study has five optimizing economic agents. The estimated system of equations was derived from the following sources: the results of the decentralized optimization of each agent in the economy, the market clearing condition, and the shock processes. After getting the decentralized optimization of each economic agent, the market clearing condition and the shock processes result in an approximated system of equations. This collection of equations should have a single solution. This demands the same number of equations and endogenous variables. This circumstance is known as the Blanchard-Khan condition. This study also meets this requirement. The DSGE model simulation was achieved using Dynare 4.6.4 in a Matlab R2021a environment. This study used quarterly data from 1981Q2 to 2022Q1. The data was collected from the Central Bank of Nigeria Statistical Bulletin (Annual statistical bulletin, n.d.) and the World development indicators (n.d.).

■ RESULTS AND DISCUSSION

African countries such as Nigeria, Ghana, and Kenya have incredibly high public debt levels (Akhanolu *et al.*, 2014). Even with advances in reducing debt, levels will remain elevated for some time. The negative consequences of excessive debt levels go beyond the impact of decreasing. High debt can magnify and propagate shocks, limiting households and firms' ability to moderate consumption and investment and the government's ability to cushion unfavourable shocks (Sutherland & Hoeller, 2012; Ighodalo *et al.*, 2020).

The Public debt, debt service to revenue ratio, and capital expenditure to deficit in Nigeria have taken different trends, which has a transmission impact on macroeconomic variables in Nigeria. To ensure macroeconomic stabilization, the following indicators are essential to achieving that. From 2012 to 2021, these indicators have taken different trends, as shown in the Figures below (Fig. 1-3):
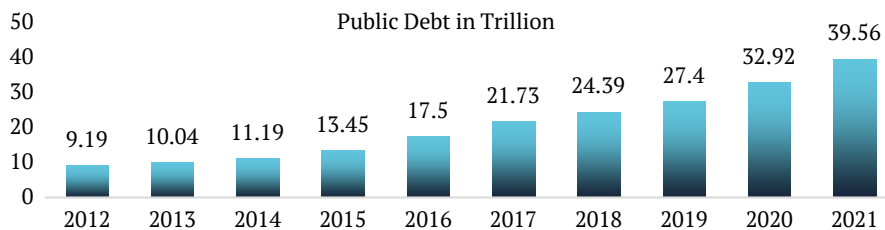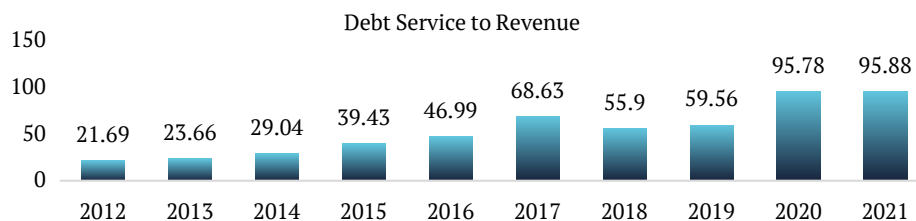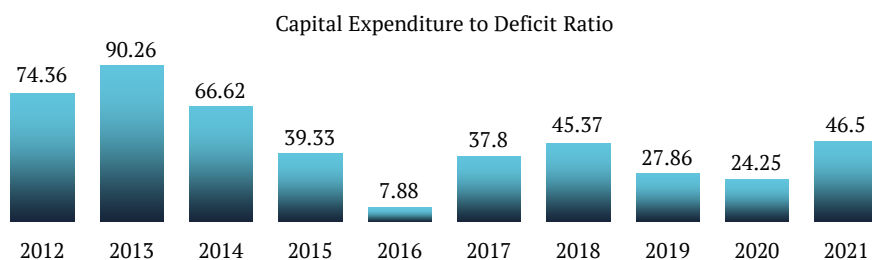

Figure 1. The trend of public debt in Nigeria
Source: made by the authors based on the data Total public debts (2021), Nigerian domestic & foreign debt (2022)

Figure 2. Debt service to revenue ratio
Source: made by the authors based on the data Total public debts (2021), Nigerian domestic & foreign debt (2022)


Figure 3. Capital expenditure to deficit proportion
Source: made by the authors based on the data Total public debts (2021), Nigerian domestic & foreign debt (2022)

This section presents the empirical results of the dynamic stochastic general equilibrium model simulation. Results are obtained using Dynare 4.6.4 on Matlab R2021a to run the codes from the system of equations and the exogenous processes. Model Summary:

The variables in the model: 13
The stochastic shocks in the model: 6
The state variables in the model: 8
The jumpers in the model: 1
The static variables in the model: 4

The New Keynesian school pioneered the DSGE macroeconomic modeling (Alege, 2012; Oye, 2018). The DSGE is based on fundamental assumptions like price rigidity, economic uncertainties, and competition. An essential phase in the DSGE model is impulse response faction output. The main goal is to explain how variables in a model change due to the shocks in the model under investigation. This feature allows us to trace the spread of a single shock within a complicated system of equations, making them handy tools for evaluating economic strategies (Fig. 4).
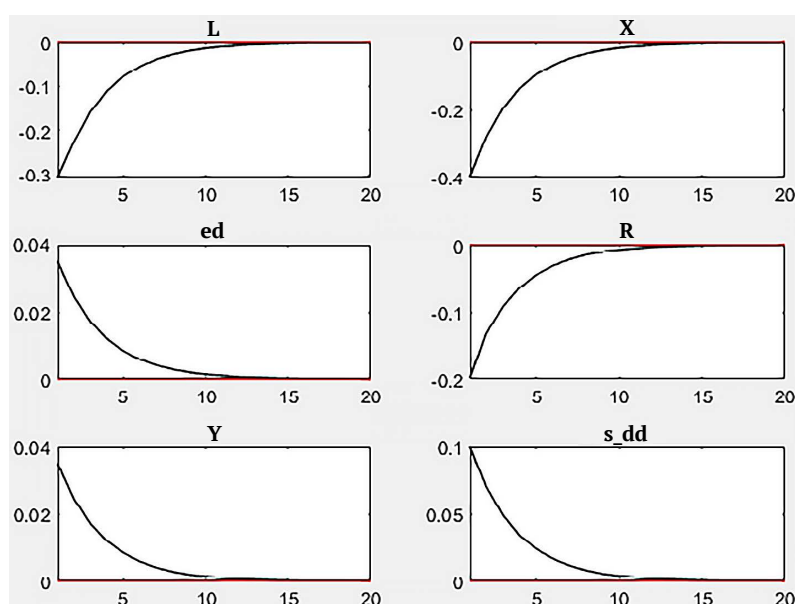
Figure 4. Impulse responses to shock
Note: L – Technology; X – Debt Service to Revenue Ratio; ed – External Debt; R -Interest Rate; Y – Output; dd – Domestic Debt
Source: made by the authors using Matlab R2021a and Dynare 4.6.4

Examining links between Nigeria's public debt shocks and macroeconomic stability entails investigating the direction and magnitude of the relationship between public debt and macroeconomic indicators in Nigeria, such as output (GDP growth rate). Numerical simulation was performed on the system of equations using the first-order Taylor's approximation approach. The simulation was carried out using Dynare software in a Matlab environment. Dynare software outputs in a Matlab environment are given in tabular form.

The covariance matrix quantifies how much two random variables fluctuate in tandem. It calculates the covariance between each column of the data matrix. The dispersion matrix and variance-covariance matrix are other names for the Covariance Matrix. A covariance matrix is valuable for separating structural relationships in a random variable matrix. This can be used for conventional mode variables or to transform other variables. This process was achieved in a Matlab R2021a environment since it is a complex process that cannot be achieved manually (Table 1).

Table 1. Matrix of exogenous shocks

Shocks	eps_ed	eps_dd	eps_r	eps_y	eps_x
eps_ed	0.010000				
eps_dd	0.000000	0.010000			
eps_r	0.000000	0.000000	0.010000		
eps_y	0.000000	0.000000	0.000000	0.010000	
eps_x	0.000000	0.000000	0.000000	0.000000	0.010000

Note: eps: Shocks, ed - External Debt; dd - Domestic Debt; R - Interest Rate; Y - Output; X - Debt Service to Revenue Ratio
Source: calculated by the authors using Matlab R2021a and Dynare 4.6.4 output

The sample moments are the theoretical moments of the sample distribution. Statistics such as production, foreign debt, domestic debt, debt payment to revenue ratio, and interest rate were examined because they are required to verify the results of the numerical simulations in the DSGE model. The result of the theoretical moments is presented in Table 2.

Table 2. Theoretical moments result

Variables	Definition	Mean	Standard Deviation	Variance
X	Debt Service to Revenue Ratio	0.0000	0.4552	0.2072
R	Interest Rate	0.0000	0.1136	0.0129
Ed	External Debt	0.0000	0.0398	0.0016
Y	Output	0.0000	0.0397	0.0016
Dd	Domestic Debt	0.0000	0.0021	0.0000

Source: calculated by the authors using Matlab R2021a and Dynare 4.6.4 output

The degree of correlation of the same variables between two consecutive time intervals is defined as autocorrelation. Statistics are also required to examine the outcomes of numerical simulations in the DSGE model. This study examined output, external debt, domestic debt, debt service to revenue ratio, and interest rate. Table 3 presents the coefficients of the autocorrelation result. The matrix result in Table 4 results from the DSGE model's dynamic simulation.

Table 3. Coefficients of autocorrelation

Variable	Definition	1	2	3	4	5
X	Debt Service to Revenue Ratio	0.5476	0.2447	0.0461	-0.0785	-0.1513
R	Interest Rate	0.5493	0.2456	0.0465	-0.0786	-0.1515
Ed	External Debt	0.5476	0.2447	0.0461	-0.0785	-0.1513
Y	Output	0.5493	0.2456	0.0465	-0.0786	-0.1515
Dd	Domestic Debt	-0.0742	-0.0709	-0.0661	-0.0604	-0.0541

Source: calculated by the authors using Matlab R2021a and Dynare 4.6.4 output

Table 4. Matrix of Correlations

Variables	Debt Service to Revenue Ratio (X)	Interest Rate (P)	External debt (ed)	Output (Y)	Domestic debt (dd)
Debt Service to Revenue Ratio (X)	1.0000	0.0998	-0.995	-0.9937	0.0519
Interest Rate (R)	0.0998	1.0000	0.0000	0.0000	0.0000
External debt (ed)	-0.7950	0.0000	1.0000	0.8986	-0.0522
Output (Y)	-0.8937	-0.7890	0.7986	1.0000	-0.0000
Domestic debt (dd)	0.0519	0.0000	-0.0522	-0.0000	1.0000

Source: authors' computation using Matlab R2021a and Dynare 4.6.4 output

The results demonstrate that output is positively related to external debt. In contrast, debt service to revenue ratio, interest rate, and domestic debt are negatively related to output, which was used to present gross domestic product. As a result, a rise in the debt service to revenue, interest rate, and domestic debt will have a negative transmission effect on Nigeria's macroeconomic stability. It is critical to remember that high debt service would impede growth by reducing public resources and productive investment that would otherwise be used to encourage growth. Lower financing costs can also boost borrowing and investment, allowing the government to lower interest rates to stimulate economic growth. However, when interest rates are high, it discourages borrowing, which has a negative impact on the business environment and can impair economic growth. Furthermore, domestic debt can quickly and severely crowd out private credit.

After an in-depth study of public debt shocks and macroeconomic stabilization in Nigeria, it was discovered that there is a positive relationship between output and external debt, whereas debt service to revenue ratio, interest rate, and domestic debt have a negative relationship with output (economic growth). The implication of increasing the debt service to revenue ratio, interest rate, and domestic debt will have a negative transmission effect on Nigeria's macroeconomic stability. The debt service to revenue ratio quantifies how much of a country's revenue is utilized to pay debt interest and principal. It reflects a country's financial viability and stability and its willingness to spend on public services and development. When a country's debt service to revenue ratio is high, it has some economic implications, such as the inability of a country to invest in productive and development projects. When interest rates rise, enterprises and individuals cut back on their spending. Customers and business owners will increase spending when interest rates decrease dramatically, causing stock prices to go up. This result explained the recent effect of rising interest rates in Nigeria (2010 to 2023).

Given this fact, Nigeria's external and domestic debt has recently been increasing. For example, according to the Debt Management Office (DMO), domestic debt increased to N26.23tn ($63.24bn) due to new borrowings by the government to partially finance the deficit in the 2022 Appropriation, while external debt remained constant at N16.61tn ($40.06bn) from Q1 to Q2 2022, bringing the total public debt to N42.84tn ($103.30bn) as of September 2022. This high public debt profile also transmits government revenue through the debt service to revenue ratio. It is worth noting that as the public debt keeps rising, it also has a transmission effect on Nigeria's debt service to revenue ratio. The implication of increased levels of public debt shifts income from future generations to those alive now, while the cost of servicing that debt increases the burden on current and future taxpayers while providing an opportunity cost that prevents governments from spending in other areas or lowering the tax burden.

J. Jacobs *et al.* (2020) evaluated the link between public debt ratios and economic growth rates in 31 European Union and OECD (Organisation for Economic Co-operation and Development) countries. In the study, panel VAR (vector autoregressive) model, the long-term real interest rate on government bonds was used to transfer shocks in both the public debt-to-GDP ratio and the pace of economic growth. Regardless of the public debt ratio level, the study found no causality between public debt and growth. The study, on the other hand, revealed a relationship between government debt and growth. According to the study, exploring why one country's long-term interest rate remains relatively low despite sizeable public debt while another grows dramatically under comparable conditions is vital. Using the same model, A. Chudik *et al.* (2017) find no evidence for a generally applicable threshold effect in the link between debt and growth. A. Imoisi (2021) used the autoregressive distributed lag (ARDL) bounds test to examine the impact of public debt sustainability in Nigeria within a multivariate framework and discovered a positive and significant impact on public debt both in the short and long run, while interest rates and inflation rates were negative and statistically insignificant. K.O. Onyele & E.C. Nwadike (2021) used the ARDL model to explore the influence of Nigeria's national debt load on economic stability and identified a diminishing impact on economic stability in the long run, with revenue adequacy having a negative and significant impact. All components of the debt burden negatively and substantially influenced economic stability in the short run. In contrast, the exchange rate positively and considerably impacted economic stability in the long term.

In the study by A. Yusuf & S. Mohd (2022) the ARDL Bounds Test for Co-integration was used to examine the growth and fiscal effects of insecurity on the Nigerian economy, focusing on public debt. They discovered that high unemployment, domestic capital formation, foreign direct investment, and government spending on education and security are negatively affected by rising levels of insecurity, slowing growth in both the long and short run. On the other hand, improved health care, equal income distribution, and productive use of public borrowing were positively connected with security and boosted growth in both the long and short run. E.O. Ogbaro *et al.* (2022) used threshold regression methodology to examine Nigeria's nonlinear relationship between public debt and economic growth. They discovered that the debt-to-GDP ratio and the level of corruption have a negative impact on growth, while public debt has a positive and significant impact. A. Akanbi & S.A. Olaoluwa (2022) used the Ordinary Least Square (OLS) approach to study the association between sub-national public debt and economic growth in Nigeria. The study found a positive but non-significant association between Nigeria's sub-national public debt, capital spending, and economic growth, while the sub-national government budget deficit had a negative but non-significant impact on economic growth. F.F. Adegbie *et al.* (2022) used OLS to investigate Nigeria's public debt management and economic growth. The findings suggested that public debt management and actual gross domestic product (RGDP) had a positive significant effect, while RGDP and interest rate had a negative effect.

The findings of this investigation were mixed. The study discovered that output is positively related to external debt, whereas debt service to revenue ratio, interest rate, and domestic debt are negatively related to output. This analysis differs from the previous analyses in that it separates public debt components. This will aid the study in determining the impact of each component

of state debt (both external and domestic debt). This is to determine the true impact of each component of state debt (external and domestic debt) on Nigeria's macroeconomic stability. The dynamic stochastic general equilibrium (DSGE) was also used in this investigation. The DSGE model is beneficial in this study because it describes how external and domestic debt shocks operate as drivers of economic dynamics, which differs from the methods used in the previous studies.

■ CONCLUSIONS

Nigeria has had to rely on debt recently and continues to rely on public debt to manage its savings-investment gap and fiscal imbalance since its independence. Since evaluating how this rising public debt has contributed to macroeconomic stabilization in Nigeria is imperative, the study separately examined both external and domestic borrowing in Nigeria. The study also used the debt service to revenue proportion as one of the variables in the model amidst rising debt and debt service to revenue ratio. The DSGE model was used as an analytical tool in the study to determine the influence of public debt shock on macroeconomic stability in Nigeria. It was discovered that output has a positive relationship with external debt, whereas debt service to revenue ratio, interest rate, and domestic debt have a negative relationship with output. As a result, an increase in the debt payment to revenue ratio, interest rate, and domestic debt will have a negative transmission effect on Nigeria's macroeconomic stability.

Interestingly, it is essential to point out that previous studies also indicated mixed results, similar to this study. It has been discovered that some independent variables are positively related to output, while some are negatively related to output. Others found a negative relationship between the independent variables and output, and some found a positive relationship in Nigeria. The general observation is that the result of such a study has been mixed. This might result from the method used, variables in the model or the scope of the study. These results have implications for the economy. It is imperative to note that high debt service would impede growth by reducing public resources and productive investment that would otherwise be used to encourage growth. According to the study's results, the government should direct the borrowed funds toward diversifying the economy's productive base. This will contribute to long-term economic growth, broadening the income base and increasing the ability to repay the present debt when it becomes due. The study's primary contribution is fiscal measures that stimulate domestic resource mobilization, efficient debt management procedures, and dependence on domestic debt rather than external debt to finance more significant deficits to accelerate growth. It will be interesting to conduct a study that will use the new methods in executing the DSGE model, namely significant data approaches such as Machine Learning, and other derived methods such as the Heterogeneous Agent New Keynesian (HANK).

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■ CONFLICT OF INTEREST

None.

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