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Monetary policy implications of the new fiscal regime in Nigeria: A simulation study

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ABSTRACT

In this policy research, we examine the effects of the new fiscal regime [the signing of the new Finance Act 2023, the setup of a tax reform committee, and the removal of fuel subsidy] on the Nigerian economy and its implication for fiscal and monetary policy coordination in Nigeria. We explore these by estimating a macro-econometric model, which comprises a fiscal rule, monetary policy rule, and a Phillips curve relation to simulate the impacts of the regime on fiscal, macro and monetary fundamentals in Nigeria. We find in the model estimation that (a) lower public debts can be achieved faster through a reduction in expenditure than by an increase in revenue, (b) inflation in Nigeria is driven by demand and supply-side factors, (c) the monetary policy instrument does not possess stabilizing power over the economy. The forecasting analyses show that the contractionary fiscal regime that raises the revenue by about 75 per cent will instantaneously clear out the fiscal deficit and lead to significant reductions in public debts but at the cost of higher inflation. We suggest sufficiently reducing the monetary policy rate to the optimal value obtained from the structural model, and coordination of demand management and supply-side policies by both the monetary and fiscal policy authorities in Nigeria.

Motivation for the study

The current structure of the political economy of Nigeria indicates the proposition of a series of reforms to the fiscal system in Nigeria, which includes the signing into law of the Finance Act 2023, the removal of fuel subsidy and the setup of a tax advisory and implementation committee by the current administration. The Finance Act proposes several public finance reforms to harmonize lofty fiscal and macroeconomic goals, such as making the tax administration more effective, promoting fiscal stability, digital economy, and inclusive growth [1]. Some of the changes brought forth by the Finance Act 2023 include custom duty of 0.5 per cent imposed on goods imported from non-African countries, an increase in the rate of tertiary education tax from 2.5 per cent to 3 per cent of companies' assessed profits, a 10 per cent capital gains tax on proceeds of disposed digital assets; provision for an excise tax (whose rate is at the behest of the President) on all services rendered within Nigeria, and other fiscal reforms.¹ Informed by the current challenges facing the tax system in Nigeria (e.g. multiple taxations, high incidence of tax evasion, high cost of tax administration, low accountability of tax revenue, and absence of synergy between monetary and fiscal policy), the Presidential Tax Committee is set up and guided by the following terms of reference to ensure the efficiency of the tax collection process, ensure transparency in the reporting process, drive

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¹ See the PwC's Insight Series: "Nigeria's Finance Act 2023" <https://www.pwc.com/ng/en/assets/pdf/nigeria-finance-act-2023.pdf>.

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voluntary compliance and foster proper utilization of tax proceeds. The Committee's mandate involves a bid to raise the proportion of tax to GDP of Nigeria to about 18 per cent by 2026 from its current 10.9 per cent while ensuring that the goal of sustainable growth is not jeopardized.²

The foregoing tax reforms and the withdrawal of subsidy on fuel consumed by Nigerians are predicated on the need to significantly upscale government revenue to fund expenditure in critical areas, thereby putting the economy on a growth pedestal (see [2] for indications of fiscal policy instruments as stimulants for economic activities). The reason is not far-fetched. The country has gone through several years of deficit financing, which is about ₦11.3 trillion in the 2023 budget, and high debt and high cost of debt servicing (in the 2023 budget, debt servicing alone accounts for nearly one-third of the estimated spending). However, evidence-based research is crucial to guide Nigeria's fiscal and monetary policy authorities for this policy decision to be properly targeted. Hence, the central motivation for this study is the pervasive nature of the macroeconomic impacts of the new fiscal regime and its potential distortions of the economy (see [3–5] for relevant literature), which may call for redirecting monetary policy to deal with the potential mess i.e. coordination of monetary and fiscal policies ([6] shows that different policy mixes affect macroeconomic fundamentals differently given that each authority takes action on its objectives and mandates, which may contend with other's). Hence, this study conducts simulations on the would-be impacts of the actions of the fiscalists on the critical fiscal and macroeconomic variables in Nigeria and scenario analyses to guide the responses of the monetary policy authority whose macroeconomic objectives (such as price stability) may be threatened by the proposed regime change. This study is therefore important for effective national policy design and harmonization in Nigeria.

This policy research is therefore interesting given the pervasive nature of the drive to raise revenue from taxes and subsidy removal, which may, on the one hand, be justifiable in the face of the current rising national debts and fiscal deficits, but also on the other hand, be undesirable for its potential distortionary impacts on the economy such as crowding-out effects on private investment and consumption, higher inflation and inflation volatility, among others [7–9]. While a higher tax rate/base can imply higher government revenue, it can also have negative effects, especially on employment and output, which may show that increased tax rates may not be optimal during recessions [4,5].³ Furthermore, the impacts of fiscal policy on macroeconomic fundamentals may depend on several factors, including the state of the economy [i.e. whether the economy is in a recession or expansion [10], the type of taxation [11], and the monetary policy response [3].⁴ In essence, as policymakers are concerned with optimal public spending through adequate taxation policies consistent with the country's economic growth target, the need to consider adverse effects such as inflation and macroeconomic instability is also relevant. Therefore, a broad policy design that encompasses both fiscal and monetary policies is called for [12].

Consequently, this study explores two core contributions: one, the demonstration of the macroeconomic effects of the new fiscal regime, and two, the proposition of alternative policy options to guide the regime change while seeking policy coordination between the fiscalists and the monetarists. The study builds its contribution on the extant literature as follows. An example is the study of Marattin et al. [13], which explores models of monetary and fiscal policy rules to study the connection between instruments of taxation and optimal monetary policy and conducts simulations with varying values of tax instruments while holding others constant. Importantly, the study finds that the type of tax instrument deployed and the economic shocks, such as price stickiness, determine the monetary policy response. The study by Claus [14] compares the effectiveness of value-added tax and interest rates hindering business cycles and concludes that the latter is a better stabilization instrument. The argument is that varying the interest rate only affects savings and investment in the current period, whereas the effect of changes in VAT takes a longer time to have an effect (although a greater effect) on savings and investment decisions.

We therefore explore the study's contributions with an econometric analysis of a structural model constructed for Nigeria following previous studies such as Olofin, Olubusoye, Mordi, Salisu, Adeleke, Orekoya and Adebisi [15], Olofin, Salisu and Tule [16], and Olofin, Adebisi, Salisu, Olubusoye, and Adenuga [17] that have employed similar partial equilibrium macroeconomic models to determine the optimal monetary policy response in Nigeria. We build a macro-econometric model for this purpose for Nigeria, which contains a fiscal rule equation that models the behaviour of the fiscalists and the connection between public debt, budget deficit, and debt servicing. The simultaneous equation model also contains the monetary policy rule, which is an equation for rendering the behaviour of the monetary authority in setting the monetary policy instrument in line with the level of inflation and output gap in the economy. The model also includes Phillip's curve equation for connecting the demand-side and supply-side factors determining inflation. With these connections firmly established, the macro-econometric model becomes useful to tie the connection between macro variables and the basis to conduct scenario analyses. These simulations provide insights into the new fiscal regime's likely macroeconomic impacts and reveal the implications of alternative policy directions. In other words, this study offers scientific-based policy options for coordinating fiscal and monetary policies while harmonizing the macroeconomic policy objectives such as fiscal balance, sustainable growth, and price stability in Nigeria.

² See the Bloomberg article: <https://www.bloomberg.com/news/articles/2023-07-07/tinubu-sets-up-tax-committee-in-bid-to-drive-nigeria-revenue>. See also <https://statehouse.gov.ng/news/president-tinubu-sets-up-committee-on-tax-reforms/>.

³ [40] find strong evidence of a negative nexus between tax rates and countries' economic growth path, especially in countries with a prevalence of corruption.

⁴ The study of the macroeconomic impacts of taxation by Dabla-Norris & Lima [15] is instructive in its distinction between the effects of tax base and tax rate, the contrast between personal and corporate income, amid other peculiarities. The study shows for a sample of ten OECD countries that are expanding the tax base (compared to a hike in tax rate) in a period when the government is trying to close the fiscal deficit gap and reduce the country's debt stock (i.e. the period of fiscal consolidation) leads to a decline in output and employment.

Following this section, we provide supporting background evidence with intuitive facts in Section 2 and present the literature review in Section 3. In Section 4, we explain the methodology and highlight the data requirements and sources, while in Section 5, we present the findings with a discussion. The concluding remark comes in Section 6.

Stylized facts

This section provides the background for studying Nigeria's fiscal and monetary policy regimes and their macroeconomic implications. Table 1 presents some relevant summary statistics for fiscal variables – government revenue, government expenditure, and public debts (see also Figs. 1-5). The total revenue for Nigeria grew consistently from N2,985 billion in the 2000–2005 period to about N9,702 billion in the 2011–2015 period and experienced a decline to N8,817 billion in the 2016–2021 period. On the other hand, government expenditure has been continually rising across the entire subperiods, rising astronomically from N1,201 billion between 2000 and 2005 to N8,706 billion between 2016 and 2021. More elaborately, Fig. 1 further reveals that public expenditure has been outpacing public revenue since 2020. This may not be unconnected with the surge in fiscal stimulus measures since the COVID-19 pandemic without a corresponding increase in income during the same period.

The revenue accrued to the central government of Nigeria is broadly divided into oil and non-oil revenue sources such as income from agriculture, manufacturing and services sectors. Over the years, the oil components have dominated Nigeria's income generation until recently, in 2021, when the non-oil sectors appear to generate the most revenue; while oil revenue was N4,358 billion, non-oil revenue for the same year was about N6,397 billion (see Fig. 2). The recency of this change in the revenue structure is apparent in the average values in Table 1, which shows that oil revenue is still far above non-oil revenue. For instance, the former was about N2,453 billion and the latter a paltry N531 billion between 2000 and 2005. A similar scenario played out till the 2011–2015 period when the oil revenue stood at around N6,867 billion, and the non-oil revenue for the same period was far less than one-half the former at about N2,834 billion. However, the gaps are narrowing recently as the nation received about N4,496 billion in revenue from crude oil, and N4,321 billion from other sources. We would expect the contribution of oil to the nation's treasury to continue to decline in the coming years as the government pushes for tax reforms to obtain more income from value-added taxes, excise duties, company taxes, and others.⁵

The new tax reform, which largely has at its core raising the revenue base of the economy, may be justified on the back of the expenditure concerns and the debt management issues in the country. For instance, in Table 1 and Fig. 3, we notice an astronomical increase in recurrent expenditure over the years, which appears to attest to the increase in the responsibilities of the government over time. Although capital expenditure (N2,522 billion in 2021) is far lower than recurrent expenditure (N9,145 billion in 2021), the former is also rising and may be expected to continue to rise as the government continue to spend on infrastructures, national security, and other nation-building projects. Similarly, both domestic and external debts have been rising, as shown in Fig. 4, at least since the year 2015 depicted in the chart. Between 2015 and 2021, domestic debts increased by about 118 per cent and external debts increased by a far larger magnitude of about 650 per cent. The proportion of national income spent on debt serving has also increased (see Fig. 5 for pictorials). Hence, the drive to draw more revenue from taxes may not be out of place, judging by the present perspective.

The proposed action of the fiscalists should be expected to impact the economy with likely implications for the monetarist policymakers whose policy objective may have been distorted. The foregoing leads us to explore the background issues around macroeconomic and monetary variables in Nigeria in Table 2 and Figs. 6-10. We show consistent increases in the level of economic activities measured with either nominal GDP or the GDP that controls for price fluctuations. For instance, the average GDP at current market prices rose from N13,460 billion in 2000–2005 to N40,309 billion in 2006–2010 and N135,500 billion in 2016–2021. There has also been a substantial increase in the GDP at constant prices over the same period, with real GDP growing from an average of N31,669 billion in 2000–2005 to about N70,003 billion in 2016–2021 (see also Fig. 6). The story obtained from the data appears to suggest that both government expenditures and the level of economic activities are rising. Hence, the Wagner's Law may be obtainable in Nigeria. Hence, since Nigeria is an emerging economy that is still expanding, more government interventions in terms of public expenditure may be required, and by implication, the need for more revenue to ensure a balanced budget.

Based on current realities, household consumption and gross fixed capital formation (as a measure of investment) have risen (see Table 2 and Fig. 7). While consumption increased by about 45 per cent between 2015 and 2021, investment increased by a far higher magnitude of about 313 per cent during the same period, and the average values for a wider scope in Table 2 attest to these. The concern for the economy is that the new tax regime could impact the level of economic activities by distorting consumption and investment through an increase in the rate and/or base of consumption tax and corporate taxes in Nigeria. There is also the concern for inflation, where a number of corporate and indirect taxes can be pushed to consumers through higher prices of goods and services. This could complicate a delicate situation, particularly since Nigeria has grappled with double-digit inflation figures for several years. Thus, if the new tax regime contributes to the economy's inflationary pressures, the monetarists' key macroeconomic objective (i.e., price stability) becomes threatened. This situation may become messier as the maximum lending rate is already too high, and further raising of the monetary policy rate to counter inflation may stifle investment. These, therefore, call for action from the monetary policy authority in Nigeria to prepare policy measures to deal with the potential consequences of the newly proposed tax regime. Hence, this study offers guidance in this regard.

⁵ Currently, the non-oil revenue, which comprises largely the company income tax and value-added tax, involves a 30 per cent rate on companies' profits and a VAT rate of 7.5 per cent at each stage of production for goods and services.

Table 1
Summary statistics of fiscal variables.

	2000–2005	2006–2010	2011–2015	2016–2021
Total revenue	2985.449 [1477.262]	6341.491 [1225.875]	9702.559 [1645.364]	8817.783 [1935.128]
Total expenditure	1201.918 [388.317]	3055.457 [880.935]	4815.804 [261.583]	8706.587 [2419.397]
Oil revenue	2453.595 [1347.680]	4973.821 [1238.593]	6867.617 [1911.983]	4496.129 [1063.641]
Non-oil revenue	531.864 [151.331]	1367.674 [463.851]	2834.931 [408.435]	4321.653 [1228.874]
Capital expenditure	352.002 [110.767]	861.856 [224.285]	900.625 [127.212]	1667.393 [682.493]
Recurrent expenditure	859.017 [333.254]	2066.836 [666.913]	3517.515 [231.689]	6491.073 [1960.075]
Domestic debt	1217.857 [234.876]	2804.609 [1115.248]	7204.065 [1235.751]	14,326.86 [2938.013]
External debt	3711.705 [862.931]	538.776 [104.079]	1408.077 [488.008]	9101.489 [4538.865]
Debt servicing	2.777 [1.5616]	0.819 [1.1489]	0.338 [0.287]	1.233 [0.465]

Note: The mean values are presented with standard deviations in square brackets. The data on government finances (revenues, expenditures, and debts) are in billions of Naira. Debt servicing is expressed as a proportion of gross national income (as obtained from the World Bank's World Development Indicators). With the exception of the debt servicing variable, the rest of the fiscal variables are sourced from the National Bureau of Statistics.

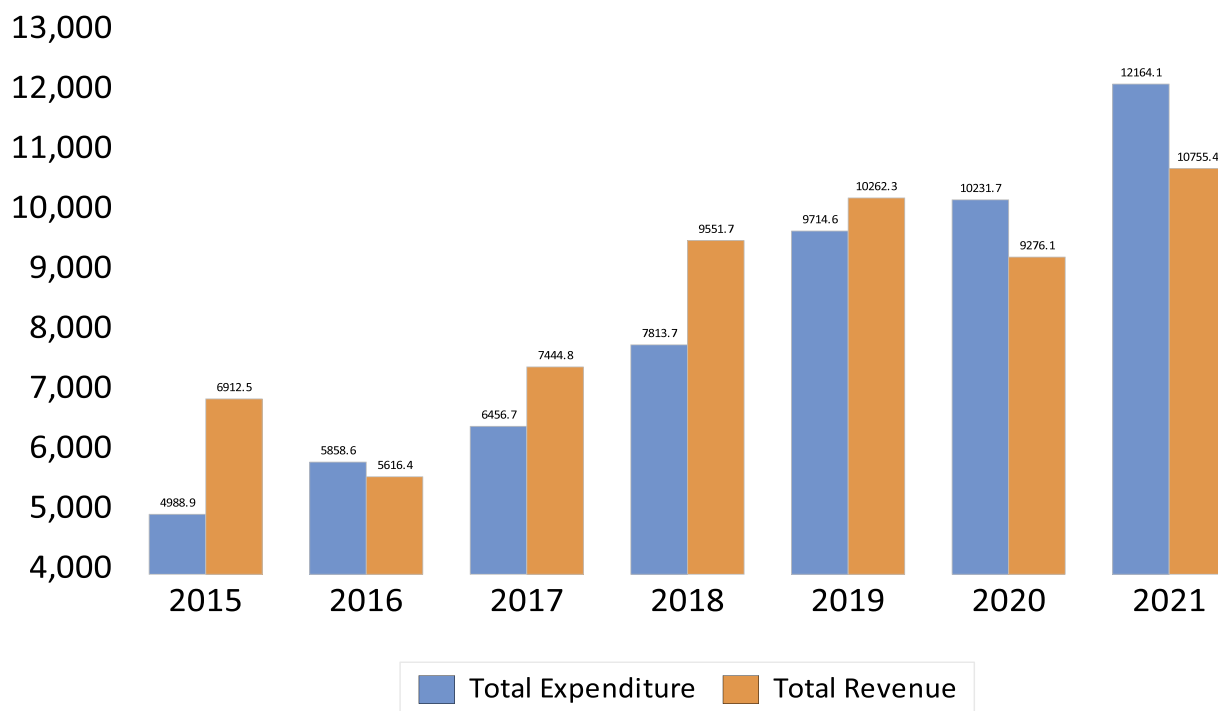


Fig. 1. Government Finances in Nigeria (2015–2021)

Note: The total expenditure and revenue are the sum of all public expenditures of the central government and all federally collected revenue and are expressed in billion Naira. The data are sourced from the database of the National Bureau of Statistics.

Brief literature review

A study of this nature is predicated on the need for macroeconomic stabilization tools such as fiscal stimulus, budget deficit, taxes, monetary policy rate, reserve requirements, and other fiscal and monetary policy instruments to correct the economy from short-term fluctuations and macroeconomic consequences of market failure. This has backing in Keynesian economics and later-day neo-Keynesians, which highlight the role of stabilization tools to correct the economy for business cycle fluctuations (see [11,18,19] for

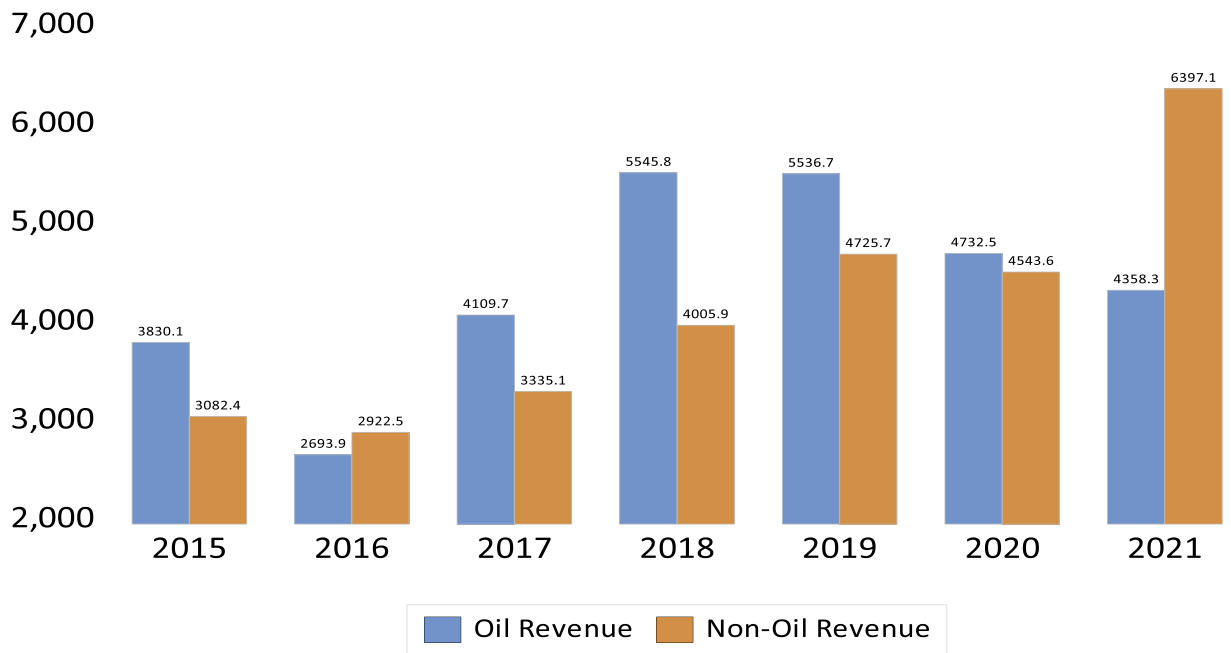


Fig. 2. Oil and Non-Oil Revenue in Nigeria (2015–2021)

Note: Oil and non-oil revenues are Nigeria’s two major classifications of government revenue. The variables are expressed in billions of Naira. The data are sourced from the National Bureau of Statistics database.

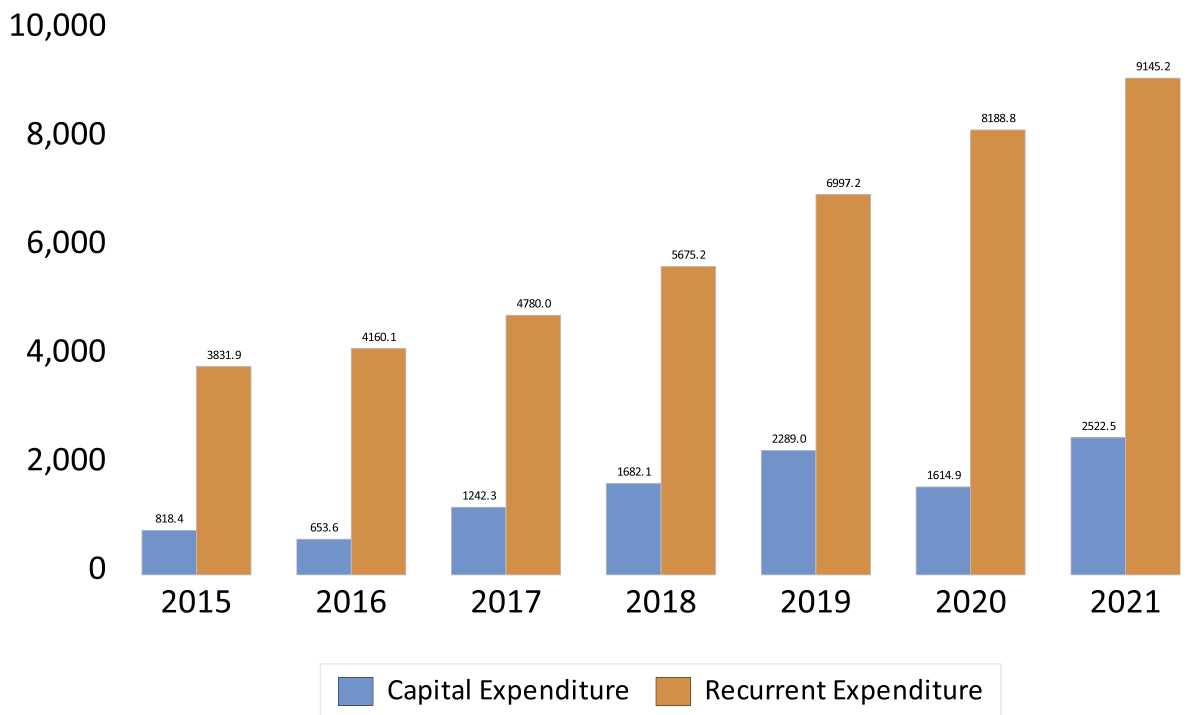


Fig. 3. Capital and Recurrent Expenditures in Nigeria (2015–2021)

Note: Capital and recurrent expenditures are Nigeria’s two major classifications of government expenditures. The variables are expressed in billions of Naira. The data are sourced from the National Bureau of Statistics database.

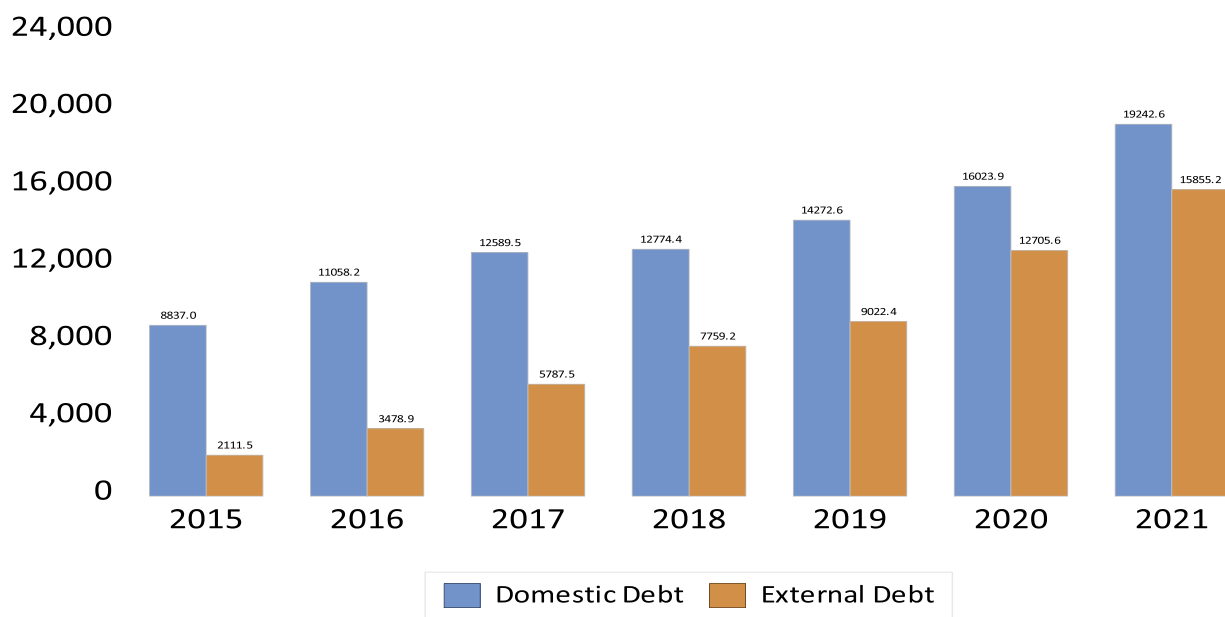


Fig. 4. Domestic and External Debts in Nigeria (2015–2021)

Note: Domestic debt and external (or foreign) debt are Nigeria’s two major classifications of public debt. The variables are expressed in billion Naira. The data are sourced from the database of the National Bureau of Statistics.

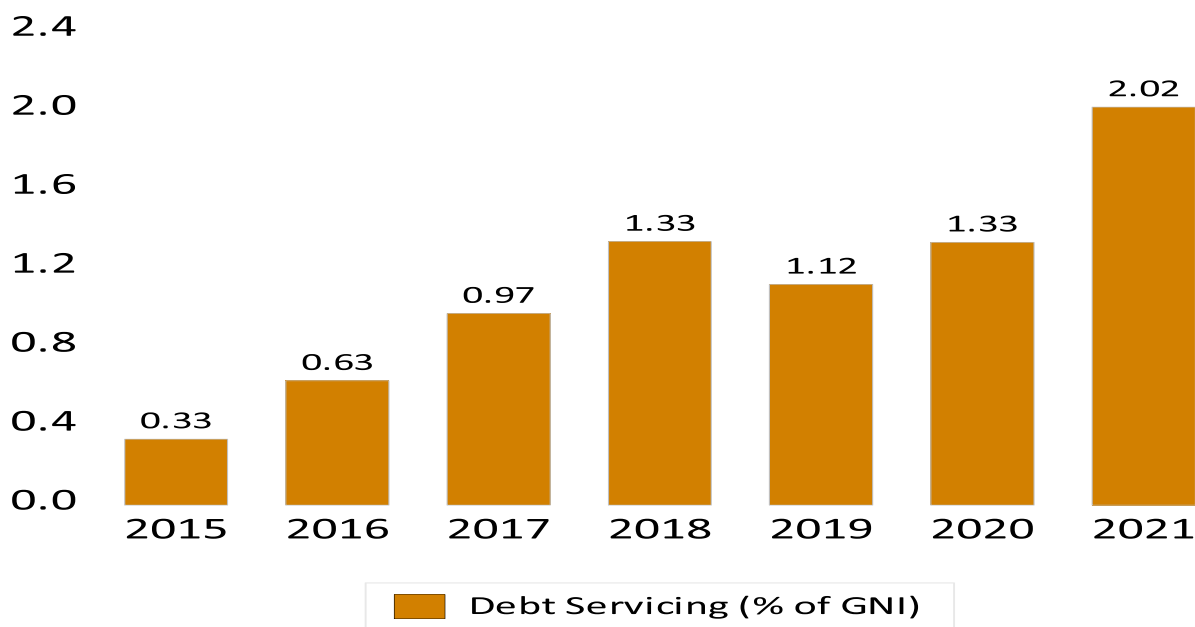


Fig. 5. Debt Servicing in Nigeria (2015–2021)

Note: Debt service captures the sum principal repaid and the interest paid on short-term and long-term debts. The variable is expressed as a proportion of gross national income. The data are sourced from the World Development Indicators of the World Bank.

some evidential supports). In modern economies and Nigeria, the role of government regulation continues to be emphasized, with fiscal and monetary policies being extensively explored over the years as activist macroeconomic policies for achieving macroeconomic objectives. Hence, the advocates of stabilization policies promote active macroeconomic policies, which could be demand management policies or those intended to manage the economy’s supply-side. In all, the overall goal of stabilization policies is to achieve macroeconomic objectives, which are, however, divergent depending on whether the policy-setting institution is fiscal or monetary, which are in Nigeria, the Federal Ministry of Finance and the Central Bank of Nigeria, respectively.

Table 2
Summary statistics of monetary & macro variables.

	2000–2005	2006–2010	2011–2015	2016–2021
Nominal GDP	13,460.93 [6053.86]	40,309.97 [9398.469]	79,595.09 [12,643.00]	135,500.0 [26,445.19]
Real GDP	31,669.11 [5182.028]	47,012.84 [5485.654]	63,367.27 [4807.831]	70,003.01 [1688.362]
Investment	3716.611 [1336.513]	7768.965 [1315.255]	11,872.64 [1908.282]	31,995.67 [16,496.44]
Consumption	8093.720 [3961.031]	23,616.36 [8537.732]	56,046.99 [14,212.12]	97,913.74 [9705.232]
Inflation	14.362 [4.224]	11.590 [4.322]	9.729 [1.762]	14.317 [2.378]
Real exchange rate	105.553 [33.477]	120.485 [30.506]	73.911 [7.563]	84.202 [9.242]
Prime lending rate	19.827 [2.6730]	17.184 [1.3847]	16.586 [0.3357]	15.527 [3.0484]
Maximum lending rate	22.712 [3.8247]	20.178 [2.1837]	24.670 [1.6691]	28.896 [1.3784]

Note: The mean values are presented with standard deviations in square brackets. The GDP figures (nominal and real GDP), investment (measured as gross fixed capital formation), and consumption (measured as household consumption expenditure) are all expressed in billion Naira. Inflation, prime, and maximum lending rates are in percentages, and the real exchange rate is the Real Effective Exchange Rate Indices for Nigeria. The data sources are the National Bureau of Statistics databases, the Central Bank of Nigeria, and the World Bank.

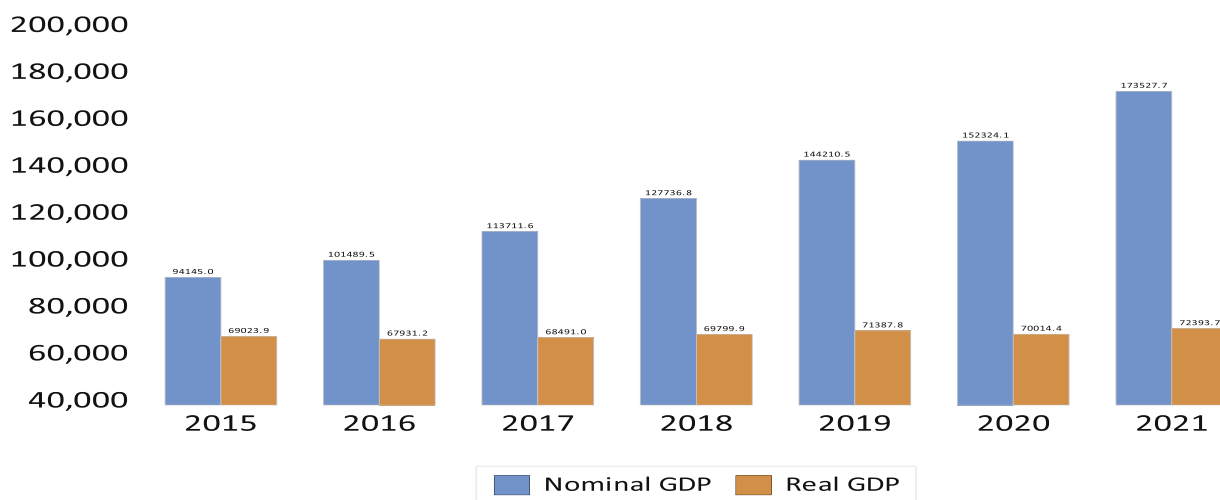


Fig. 6. Gross Domestic Products in Nigeria (2015–2021)

Note: Nominal GDP is gross domestic product at current market prices, and real GDP is gross domestic product at constant basic (2010) prices for Nigeria. The variables are expressed in billions of Naira. The data are sourced from the National Bureau of Statistics database.

The role played by fiscal and monetary policy mix and their impacts on macroeconomic variables have been the subject of extensive empirical literature with diverse findings (see, for example, [20–22]). On the former, Buyubasaran (2020) finds that monetary and fiscal policies perform complementary roles in Turkey in responding to shocks caused by each other. At the level of a union, Palek and Schwanebeck [23] show that a mix of monetary and fiscal policy decreases the efficiency of monetary policy and increases the need for fiscal stabilization. In Canada, Azad, Serletis and Xu [24] also investigate the fiscal-monetary policy interactions and find that fiscal policy has been more active than monetary policy (earlier results found in [25] suggest that fiscal policy is more effective in an economy with little or no supply constraints). A different result is obtained for Nigeria in Tule, Onipede and Ebuh [26], which assesses the interaction between monetary and fiscal policy, and the result indicates that monetary policy may have more immediate impacts on the economy than fiscal policy does (see also, [12]).

With regards to the connection between stabilization policies and macroeconomics variables, Mohanty and Rhanumurthy (2021) obtain results that connect fiscal policy with interest rates via a structural model that reveals that fiscal policy shock, through its inflation pass-through, has a negligible impact on interest rate in the short-term, but a sizeable positive impact on interest rate in the long-term in India. In China, Liu (2021) finds that shock due to fiscal policy considerably affects inflation and output growth, as Neaime and Gayset [27] find similar impacts on inflation, output, and interest rates for MENA countries. Using data for BRIC countries, Jawadi et al. [28] and Raza et al. [29] find that dear monetary policy is associated with a fall in the level of economic activities and a modest reduction in inflation. Combining evidence between Scotland and the United States, Holley et al. [30] and Ferrara et al. [31]

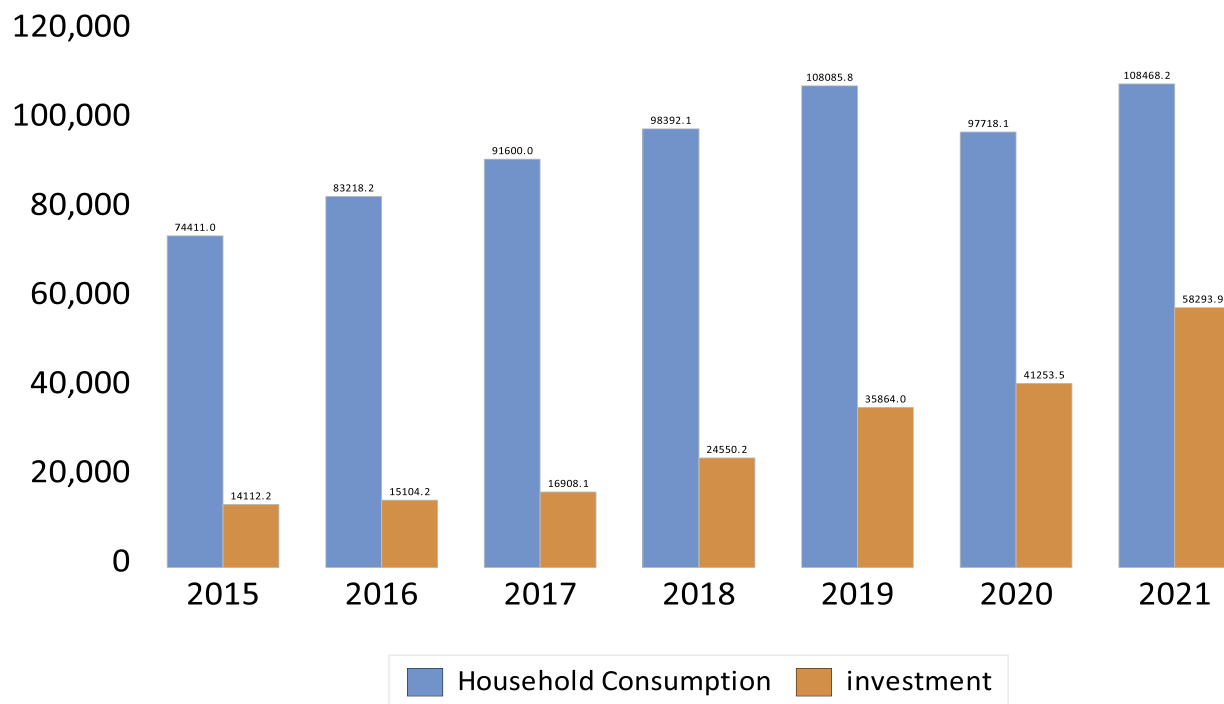


Fig. 7. Consumption & Investment in Nigeria (2015–2021)

Note: The final household consumption expenditure and gross fixed capital formation are used as proxies of consumption and investment, respectively, in Nigeria. The variables are expressed in billion Naira. The data are sourced from the database of the National Bureau of Statistics.

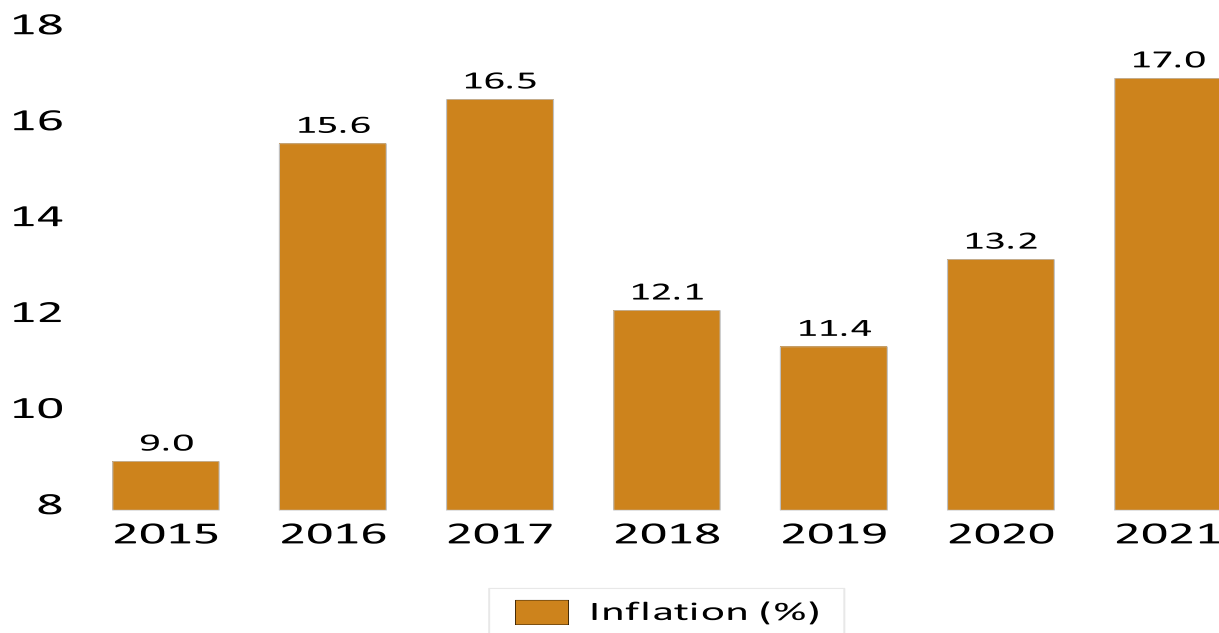


Fig. 8. Inflation Rates in Nigeria (2015–2021)

Note: The reported inflation figures are Nigeria’s annual inflation rates (expressed in percentages). The data are sourced from the database of the Central Bank of Nigeria.

relate increased public spending to higher inflationary pressures and real exchange rate appreciation. Similarly, Costa Junior, Gracia-Cintado, and Marques-Junior [32] affirm that fiscal policy impacts the price level and inflation in the short term, whereas the optimal monetary response holds the monetary policy rate constant.

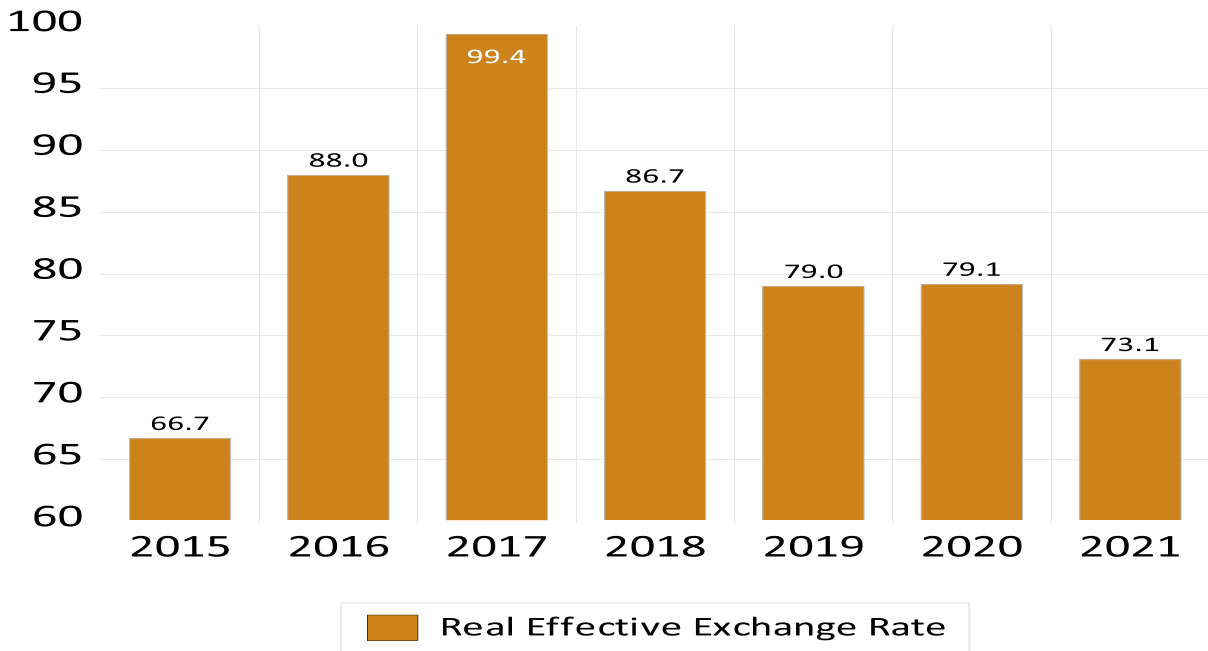


Fig. 9. Real Effective Exchange Rates in Nigeria (2015–2021)

Note: The variable captured here is the index of the real effective exchange rate for Nigeria. The data are downloaded from the Federal Reserve of St. Louis's database.

This concise literature review has been instructive in unravelling some connections among monetary policy shocks or tools, macroeconomic variables and fiscal policy shocks and instruments. It has also revealed that the stabilization tools are expected to affect prices/inflation, aggregate output/economic activities, market interest rate, employment, and possibly exchange rates. Our study employs this information to build the macro econometric model for Nigeria for pursuing the contribution of this study. Beyond what is readily obtainable in the literature, the present study considers various tax components in the fiscal rule for modelling fiscal policy instruments. Further, forecasting techniques adopted and scenario analyses allow us to complete the policy paper to guide policy-makers to available policy options with their attendant consequences.

Methodology and data

This study is intended as a simulation study; hence, we construct a system of macro-econometric models from theory, policy rules, and the institutional knowledge of the Nigerian economy. The ensuing structural models are thus useful for informing the actions of the fiscal and monetary policy authorities in Nigeria. Starting from the fiscal policy side, we specify the following equation for the fiscal rule (see [33]):

$$Debt_t - Debt_{t-1} = Exp_t - Rev_t + rDebt_{t-1} \quad (1)$$

Eq. (1) sets the rule for the government budget where the left-hand-side represents the change in outstanding public debt, and the right-hand-side is the fiscal deficit, which is divided into primary fiscal deficit ($Deficit_t$) measured as the excess of government expenditure over government revenue, and the cost incurred on debt servicing ($rDebt_{t-1}$). Exp_t is the expenditure of the central government of Nigeria on capital and recurrent projects, including expenditures on goods and services and transfer payments. Rev_t is the total government revenue, which, in the case of Nigeria, includes revenues from crude oil sales and non-oil sources such as proceeds from value-added taxes, company taxes, and personal income taxes, and r is the nominal interest rate, which is captured with the maximum lending rate in the case of Nigeria.

The strategy adopted by central banks for the conduct of monetary policy to achieve macroeconomic objectives has roots in the Taylor-rule-type specifications (see [34,35]):

$$polr_t = polr^* + \vartheta_1(inf_t - inf^*) + \vartheta_2(gdp_t - gdp^*) \quad (2)$$

Eq. (2) defines the rule for interest rate target as a function of the imparity between inflation and its target level and the divergence between output and its target level; $polr_t$ is the benchmark interest rate at instant t , i.e. the policy instrument set by the Central Bank of Nigeria; $polr^*$ is the equilibrium value of the benchmark rate, i.e. the desired rate when both inflation and output reach their target levels; inf_t is annual CPI inflation; inf^* measures the target for inflation; $(gdp_t - gdp^*)$ is the gap between actual output, gdp_t and its potential level, gdp^* ; the parameters ϑ_1 and ϑ_2 gauges the sizes of the response of the monetary policy instrument to inflationary pressure and the output gap;

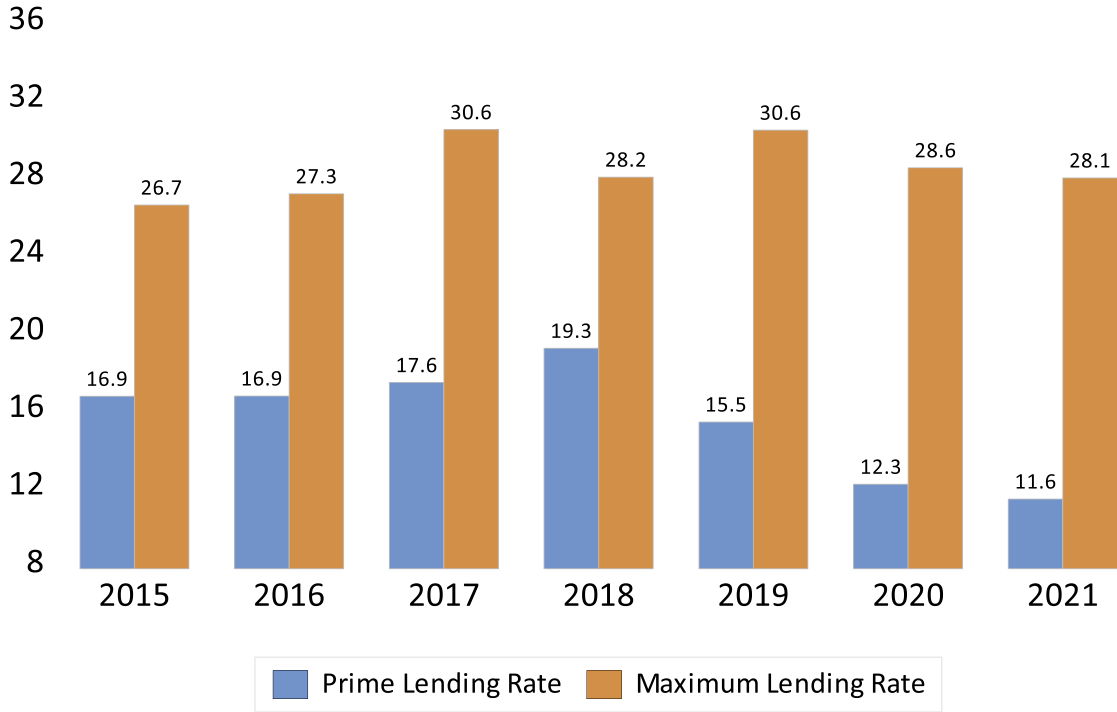


Fig. 10. Lending Rates in Nigeria (2015–2021)

Note: Prime and maximum rates are the major types of lending rates in Nigeria. The variables are expressed in percentages. The data are sourced from the database of the Central Bank of Nigeria.

$$inf_t = \beta_1(gdp_t - gdp^*) + \beta_2 exr_t \quad (3)$$

Eq. (3) is based on the Phillips curve, which defines the nexus between inflation and the output gap, where the short-term relationship is expected to be positive when actual output exceeds the potential output (as the economy attempts to produce above its capacity) (for example, [36–38]). The latter part denotes the positive relationship between inflation and factors that have proven to increase the cost of production, such as exchange rate (exr_t is the nominal exchange rate of the Naira to US dollar whose increase indicates depreciation) (see [39] for literature evidence for extending the Phillip's curve with exchange rate due to its impact on the cost of imported inputs which is typically valid for Nigeria).

The econometric forms of the foregoing specifications are rendered as follows for ease of estimation. Each model is estimated using the weighted least squares estimator to address serial correlation and heteroscedasticity concerns in the residuals.

$$\log(debt_t) = \alpha_{debt} + \delta_1 \log(debt_{t-1}) + \delta_2 \log(totexp_t) + \delta_3 \log(totrev_t) + \delta_4 \log(rdebt_{t-1}) + \varepsilon_t \quad (4a)$$

$$\log(polr_t) = \alpha_{polr} + \vartheta_1 (inf_t) + \vartheta_2 (\log gdp_t - \log gdp^*) + u_t \quad (4b)$$

$$inf_t = \alpha_{inf} + \beta_1 (\log gdp_t - \log gdp^*) + \beta_2 \log(exr_t) + v_t \quad (4c)$$

In terms of identification of the equations, Eq. (4a) is just identified since it excludes $\log(debt_{t-1})$ and $\log(rdebt_{t-1})$, i.e. three (3) endogenous variables specified less one (1). We introduce an identity function at the estimation stage (deficit = $totexp_t - totrev_t$) to guarantee this identification. The identity serves an additional purpose by allowing us to obtain forecasts for each of the fiscal variables and fiscal deficit. Eq. (4b) is identified since inflation (inf_t) is an endogenous variable in Eq. (4c) while Eq. (4c) is also just identified after excluding two exogenous variables; output gap and exchange rate.

Consequent to the statement of the macro-econometric models,⁶ the data requirements consist of the following: total debt (the sum of external and domestic debts), government expenditure (recurrent plus capital public expenditures), government revenue (sum of oil and non-oil revenues including revenues from tax sources), the monetary policy rate, annual CPI inflation, gross domestic product at

⁶ The models qualify as macro-econometric models since they are rooted in macroeconomic theories and postulates such as the Taylor rule, the Phillips curve, and the fiscal rule. Previous studies such as Olofin, Olubusoye, Mordi, Salisu, Adeleke, Orekoya and Adebisi [15], Olofin, Salisu and Tule [16], and Olofin, Adebisi, Salisu, Olubusoye, and Adenuga [17] have employed similar partial equilibrium macroeconomic modelling to determine the optimal monetary policy response in Nigeria. More closely related, Olofin et al. [17] adopt a partial equilibrium macro-econometric model based on structural VAR to simulate the monetary policy impacts of the COVID-19 pandemic in Nigeria.

Table 3
Model estimation.

Fiscal policy		Monetary policy		Phillips curve	
α_{debt}	-0.7080** (0.3537)	α_{poir}	2.4314*** (0.0656)	α_{inf}	0.5043*** (0.1211)
δ_1	0.0908 (0.1909)	ϑ_1	0.9117*** (0.3205)	β_1	-0.0644** (0.0256)
δ_2	0.3716*** (0.0799)	ϑ_2	-0.1663* (0.0914)	β_2	0.0632** (0.0319)
δ_3	-0.1971*** (0.0636)	($\vartheta_1 = 1$)	-0.0882 (0.3205)		
δ_4	0.6265*** (0.1495)				

Note: This table presents the estimation output of the three structural equations solved simultaneously for Nigeria. The equation for fiscal policy is offered in Eq. (4a) as follows: $\log(debt_t) = \alpha_{debt} + \delta_1 \log(debt_{t-1}) + \delta_2 \log(totexp_t) + \delta_3 \log(totrev_t) + \delta_4 \log(rdebt_{t-1}) + \varepsilon_t$; the monetary policy equation is $\log(polr_t) = \alpha_{poir} + \vartheta_1 (inf_t) + \vartheta_2 (\loggdpt - \loggdpt^*) + u_t$; and the Phillips curve equation is: $inf_t = \alpha_{inf} + \beta_1 (\loggdpt - \loggdpt^*) + \beta_2 \log(exr_t) + v_t$. The Wald restriction, $\vartheta_1 = 1$ is included to test the null that the inflation coefficient in the Taylor rule specification is not different from 1. Values in round brackets represent standard errors of the respective coefficients, whereas ***, **, and * are designated as representative of 1 per cent, 5 per cent, and 10 per cent levels of significance, respectively.

current market prices, and Naira/USD nominal exchange rate. Since t represents the fiscal year, the annual data frequency covers 1981 to 2022. The data are compiled from two major sources; statistical databases of the National Bureau of Statistics (see: <https://nigerianstat.gov.ng/>) and that of the Central Bank of Nigeria (see: <http://statistics.cbn.gov.ng/cbn-onlinestats/DataBrowser.aspx>).

Results and discussion

Main results

In this section, we estimate and discuss the results of the three structural equations constructed for the fiscal-monetary policy relations for Nigeria: the fiscal policy rule, the monetary policy rule, and the Phillips curve (see Table 3). The fiscal rule involves specifying the debt profile based on the lagged values of public debts and fiscal variables such as government expenditure, government revenue, and the amount spent on debt servicing. Theoretically, we would expect public debts to rise with higher fiscal deficits (excess of government expenditure over government revenue); hence, a positive relationship between public expenditure and debt ($\delta_2 > 0$) and a negative nexus between public revenue and public debt ($\delta_3 < 0$). The Taylor rule sets the rule for the Central Bank's behaviour in setting the policy instrument chiefly based on the inflationary pressure in the economy and the output gap (the difference between the actual and potential output). This estimation can reveal the indicator that drives the monetary policy decisions more between inflation and output. In addition, the estimation can guide the stability or otherwise of the monetary policy rule given these benchmarks ($\vartheta_1 = 1$ & $\vartheta_2 = 0$). The monetary policy rule will be accommodative of a shock to the economy if $\vartheta_1 > 1$ and or $\vartheta_2 > 0$ and fail to stabilize inflation and output if $\vartheta_1 \leq 1$ and or $\vartheta_2 \leq 0$ [35]. Lastly, the Phillips curve presents the determinants of inflation, such as output gap ($\beta_1 > 0$) and exchange rate ($\beta_2 > 0$).

The first two columns of Table 3 contain the estimation of the fiscal policy rule for Nigeria (informed by [33]). As highlighted in the theoretical discussion, the major coefficients of concern are δ_2 and δ_3 for the nexus between the two budget components and public debt. In line with apriori, a hundred per cent increase in national spending is associated with about a 37 per cent increase in the country's debt profile. The estimated coefficient δ_2 (0.3716) that informs this outcome is not only positively signed but also statistically significant at a 1 per cent level of significance. Similarly, the coefficient of government revenue is negatively signed as expected (-0.1971) and also statistically significant at a 1 per cent significance level, indicating that out of a hundred, debt declines by about 19 per cent in response to an increase in government revenue. In other words, government expenditure has almost twofold as much impact on public debt than government revenue. This suggests that the fiscal authorities will find it much easier to manage the debt problem in Nigeria with more prudent spending than by raising revenues. Although it is of lesser policy implication (but has empirical importance), the estimated δ_4 parameter demonstrates the positive connection between debt servicing and the accumulation of the debt stock in Nigeria.

We proceed to the results of the monetary policy rule estimation rendered in columns 3 & 4 of Table 3 (informed by [34,35]). Judging by the magnitudes of ϑ_1 and ϑ_2 in absolute values, we can infer that the orientation of the Central Bank of Nigeria is more swayed towards achieving price stability than influenced by the level of output. However, the strong statistical significance of the two parameters indicates that the Central Bank of Nigeria cannot be described as a conventional monetary policy authority dedicated to traditional functions of managing inflation alone. The state of the economy has also formed an integral part of the decision of the central bank in recent times as informed by its interventions such as the Nigeria Incentive-based Risk Sharing System for Agricultural Lending (NIRSAL) among them is the Anchor Borrowers Program in agriculture, several interventions in SMEs (e.g. SME Credit Guarantee Scheme and SME Re-structuring and Refinancing Fund, and power sector interventions (e.g. Power and Airline Intervention Fund, Nigeria Electricity Market Stabilization Fund), and a host of several others. Further, we evaluate the parameters based on the

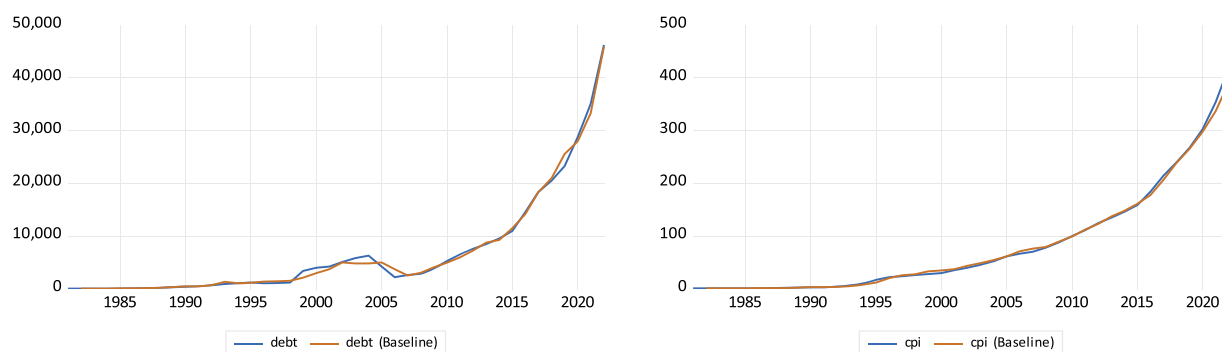


Fig. 11. Predictability graphs

Note: This figure shows the performance of the static model solution, which compares the actual values against the solution obtained from the structural model estimation (i.e. baseline). Debt here is measured as the level series, i.e. the sum of external and domestic debts. The consumer price index (CPI) is reported to be the basis for computing inflation after estimation.

benchmarks ($\vartheta_1 = 1$ & $\vartheta_2 = 0$). Since the results show that the coefficient of inflation is less than unitary ($\vartheta_1 < 1$) and that of the output gap is negative ($\vartheta_2 < 0$), these imply that the monetary policy in Nigeria cannot stabilize the economy (i.e. cannot manage inflation or stabilize output when it diverges from its potential).

The estimation of the Phillips curve relation, as documented in columns 5 & 6 of the result [Table 3](#) shows the relative impacts of output gap and exchange rate on inflation in Nigeria (informed by [[36–39](#)]). The broad evidence from the results indicates that inflation in Nigeria is a combination of cost-push and demand-pull as it comprises both demand-side and supply-side factors, given the statistical significance of the ϑ_1 and ϑ_2 parameters. The inverse relationship observed between inflation and the output variable is contrary to theoretical expectation, whereas inflation is expected to rise as the economy attempts to produce above its capacity. On the other hand, as expected, nominal exchange rate depreciation (increase in the bilateral exchange rate between the naira and the US dollar) is associated with higher inflation as it contributes to higher costs of imported and domestic inputs, respectively. In essence, the management of inflation in Nigeria cannot be exclusively limited to demand management-oriented policies alone based on the central bank's policy rate.

Having explored the structural equation models for parameter estimation and obtained theoretically justifiable and rational results for informing policy directions, we proceed to simulations to forecast future values of salient fiscal and monetary variables. Before this, we demonstrate in [Fig. 11](#) how the estimated model closely predicts the government debt variable and the consumer price index (which serves as the basis for the computation of inflation) in-sample predictability. This further reinforces using the model for out-of-sample forecasting analyses between 2023 and 2025. The forecasting analyses involve the assessment of three scenarios about the nature of government revenue as the policy variable, given the focus of the study on the new fiscal regime.

Based on current realities where the body language and actions of the sitting President favour measures geared at raising revenues, we explore scenarios where the government revenue rises by 25 per cent, 50 per cent and 75 per cent while government expenditure is allowed to follow its natural path given the argument that expenditure would likely be redirected rather than reduced. These scenarios are plausible given several ongoing efforts at raising revenues from various tax bases and rates and the recent removal of subsidy on PMS which has helped the government to retain revenue in billions of Naira. At the end of June 2023, a month after the new administration, the total distributable income of the three levels of government in Nigeria increased (by more than 100 per cent) to an all-time high of ₦1.9 trillion.⁷ Further, the federal government has projected a tax revenue to the tune of ₦19.44 trillion in 2024,⁸ hence, the 25 %, 50 % and 75 % scenarios explored in the study are plausible and realistic. The consequences of these actions are examined on the debt profile, fiscal deficit, inflation and the benchmark interest rate to better inform the monetary and fiscal policymakers in Nigeria (see [Table 4](#)).

In the first scenario, where the government raises income by 25 per cent, the fiscal deficit will be expected to decline by about ₦1.3 trillion between 2023 and 2024 and ₦1.5 trillion between 2024 and 2025. There may not be an immediate decline in debt stock, but it will eventually decline, perhaps due to already large expenditure outlays to be covered. Interestingly, these potential fiscal benefits will be greater if revenue can be raised by higher magnitudes, such as 50 per cent, 75 per cent or more, which will see fiscal deficit disappear immediately and an instantaneous drop in debt stock. These, however, come with some costs in terms of management of inflation as the fiscal actions are shown to be inflationary, raising inflation to about 14.80 per cent, 18.41 per cent, and 22.75 per cent by 2023, 2024 and 2025 on average, respectively. Interestingly, the model predicts a far lesser policy rate of around 13per cent for the economy, a far cry from the current 18.5 per cent. In essence, the current 18.5 per cent central bank policy rate may further stifle the economy as the fiscal side tightens (with more taxes and subsidy removals) and amid galloping inflation. Therefore, the monetary policy authority could consider lowering the benchmark interest rate to open up the economy owing to the outcome of the study

⁷ See: <https://www.premiumtimes.com/news/headlines/610954-subsidy-removal-nigerian-govts-revenue-doubles-as-fg-states-lgs-share-n907-billion.html?tztc=1>

⁸ See: <https://www.punchng.com/fg-projects-n19-4tn-revenue-in-2024/>

Table 4
Simulations & forecasting.

Forecasts	Total debt	Fiscal deficit	Inflation	Policy rate
Scenario 1: 25 per cent rise in total revenue				
2023	52,648.57	-6232.89	14.458	12.896
2024	55,595.86	-4984.74	18.058	13.309
2025	55,364.29	-3172.87	21.718	13.751
Scenario 2: 50 per cent rise in total revenue				
2023	50,789.49	-5050.33	14.631	12.916
2024	50,421.52	-1732.69	18.405	13.351
2025	46,339.74	3552.96	22.238	13.816
Scenario 3: 75 per cent rise in total revenue				
2023	49,268.97	-3867.77	14.800	12.936
2024	46,424.25	2110.64	18.742	13.392
2025	39,867.36	12,939.56	22.745	13.880

Note: This table presents the out-of-sample forecasts based on simulations. We simulate alternative scenarios for the fiscal authority, such as a rise in tax revenues and removal of subsidies that increase the total revenue by 25 per cent, 50 per cent, or 75 per cent, respectively. While most of the exogenous variables are allowed to follow their natural path using unequal weighted moving averages, the domestic oil price is specifically projected to reflect the price of the day for 2023.

showing that higher productivity will bring down inflation. In this vein, a synergy between fiscal and monetary policy authorities may also be to drive more supply-side solutions to controlling inflation in Nigeria.

Robustness

It is now customary to follow up empirical analyses with similar ones to evaluate the consistency of the estimates, especially in terms of direction of relationship (sign) or importance (statistical significance). Among several courses of action that can be explored for robustness, we opt for using an alternative proxy for the debt variable using the debt to GDP ratio in place of the level form to further aid the policy attraction of this study. Hence, all the variables in the fiscal rule equation are expressed as a proportion of GDP to be consistent with the left-hand-side variable, while the other equations are retained. The outcome of this experiment produced in Table 5 shows the similarity in the results, more so with the positive (negative) and significant impact of public expenditure (revenue) on public debt. The result still demonstrates the dominant effect of expenditure on debt rather than revenue. The in-sample predictability graphs in Fig. 12 also indicate that the model tracks the debt-to-GDP ratio as it did with the variable in its observed form. Working with the same scenarios, the forecasting analyses produce similar outcomes where the fiscal deficit and public debt begin to fall with higher income proportions. The rest of the empirical observations and policy implications still hold (see Table 6).

Concluding remarks

This study is informed by the emergence of a new fiscal regime in Nigeria, which has been demonstrated by the drive by the new political administration to raise revenue through new tax bases, increase in some tax rates, and removal of fuel subsidy, among others. This is predicated on the need to close the fiscal deficit gap, end the unsustainable debt accumulation, and retain resources to prosecute developmental projects. The study, informed by the theoretical indications that fiscal actions can have undesirable effects on

Table 5
Model estimation.

Fiscal policy		Monetary policy		Phillips curve	
α_{debt}	-0.1156*** (0.0405)	α_{polr}	2.4314*** (0.0656)	α_{mf}	0.5043*** (0.1211)
δ_1	0.8479*** (0.1342)	ϑ_1	0.9117*** (0.3205)	β_1	-0.0644** (0.0256)
δ_2	3.3192*** (0.5801)	ϑ_2	-0.1663* (0.0914)	β_2	0.0632** (0.0319)
δ_3	-0.6457*** (0.2025)	$(\vartheta_1 = 1)$	-0.0882 (0.3205)		
δ_4	-0.0035 (0.0049)				

Note: This table presents the estimation output of the three structural equations solved simultaneously for Nigeria. The equation for fiscal policy is offered in Eq. (4a) as follows: $debt_t / GDP_t = \alpha_{debt} + \delta_1 debt_{t-1} + \delta_2 (totexp_t / GDP_t) + \delta_3 (totrev_t / GDP_t) + \delta_4 \log(rdebt_{t-1}) + \varepsilon_t$; the monetary policy equation is $\log(polr_t) = \alpha_{polr} + \vartheta_1 (\inf_t) + \vartheta_2 (\loggdpt - \loggdpt^*) + u_t$; and the Phillips curve equation is: $\inf_t = \alpha_{mf} + \beta_1 (\loggdpt - \loggdpt^*) + \beta_2 \log(exr_t) + v_t$. The Wald restriction, $\vartheta_1 = 1$ is included to test the null that the inflation coefficient in the Taylor rule specification is not different from 1. Values in round brackets represent standard errors of the respective coefficients whereas ***, **, and * are designated as representative of 1 per cent, 5 per cent, and 10 per cent levels of significance respectively.

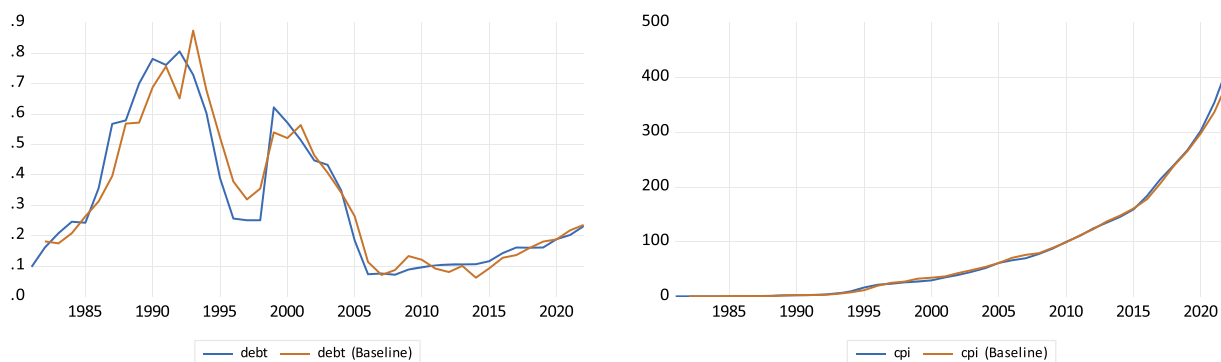


Fig. 12. Predictability graphs

Note: This figure shows the performance of the static model solution, which compares the actual values against the solution obtained from the structural model estimation (i.e., baseline). Here, debt is the ratio of total debt (the sum of external and domestic debts) to GDP. The consumer price index (CPI) is reported to be the basis for computing inflation after estimation.

Table 6

Simulations & forecasting.

Forecasts	Debt/GDP	Fiscal deficit	Inflation	Policy rate
Scenario 1: 25 per cent rise in total revenue				
2023	25.82	-6232.89	14.458	12.896
2024	27.32	-4984.74	18.058	13.309
2025	27.69	-3172.87	21.718	13.751
Scenario 2: 50 per cent rise in total revenue				
2023	25.40	-5050.33	14.631	12.916
2024	25.87	-1732.69	18.405	13.351
2025	24.29	3552.96	22.238	13.816
Scenario 3: 75 per cent rise in total revenue				
2023	24.98	-3867.77	14.800	12.936
2024	24.22	2110.64	18.742	13.392
2025	19.82	12,939.56	22.745	13.880

Note: This table presents the out-of-sample forecasts based on simulations. We simulate alternative scenarios for the fiscal authority, such as a rise in tax revenues and removal of subsidies that increase the total revenue by either 25 per cent, 50 per cent, or 75 per cent, respectively. While most of the exogenous variables are allowed to follow their natural path using unequal weighted moving averages, the domestic oil price is specifically projected to reflect the price of the day for 2023.

macroeconomic and monetary policy variables, attempts to conduct a simulation study to connect the choices of the fiscal and monetary policy instructions via a structural model of the Nigerian economy. The macro-econometric model comprises an equation for the policy rule of the fiscal authority, an equation for the monetary policy rule, and an equation for the determinants of inflation based on domestic variables. With these models, we estimate relevant parameters and highlight key empirical & policy implications therefrom. We use the structural models as the footing for the simulation exercise, examining the consequences of the contractionary fiscal regime on macroeconomic fundamentals and implications for monetary policy in Nigeria.

Some striking findings from the model estimation are as follows. One, public debt is an increasing function of government expenditure but a decreasing function of government revenue, although the former has a greater impact on debt than the latter. Hence, public debt can be reduced by cutting expenses by a certain magnitude than by raising revenue by the same magnitude. Two, the monetary policy rate does not appear to have stabilizing power in managing inflation or stabilization of output when it diverges from its potential, perhaps due to inconsistencies between fiscal and monetary policy directions over the years. Three, inflation in Nigeria is a function of both demand-side and supply-side factors; hence, it cannot be tamed with only demand management policies. Four, the out-of-sample forecasting clearly indicates that the fiscal actions increasing the nation's revenue by 50 per cent and above would clear up the fiscal deficit, reduce the debt profile and contribute to the inflationary pressure in the economy. Five, the optimal benchmark interest rate is obtained at around 13 per cent, far less than the actual rate of 18.5 per cent. In all, amid rising inflation and contractionary fiscal policy, this study suggests lowering the policy rate towards the value predicted by the model and other supply-side efforts, which should be coordinated by both policy authorities to boost the economy's productive capacity.

CRediT authorship contribution statement

Ezra Kure: Conceptualization, Methodology, Software, Writing – original draft, Writing – review & editing. **Afees Salisu:** Data curation, Software, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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