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Fiscal dominance and exchange rate stability in Nigeria

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Abstract

This study investigates fiscal dominance and exchange rate stability in Nigeria. The period of investigation spanned 1981q1–2018q4, and the Structural Vector Autoregression (SVAR) technique was employed to test the fiscal dominance hypothesis and further examine the shock transmission effects of fiscal deficit components such as budget deficit and public debt on exchange rate movement in Nigeria. As a robustness, Autoregressive Distributed Lag (ARDL) technique was employed to analyse the shock transmission effects of these components on the movement of exchange rate in Nigeria. More so, granger causality test was conducted to trace the direction of causality among the fiscal deficit components and the exchange rates. The results show that budget deficit and changes in exchange rates in Nigeria have bi-causal relationship, while public debt could not granger cause exchange rate movement in the country. The SVAR estimates suggests that exchange rate movement in Nigeria reacted only to the shock effects of financial openness and the ARDL results indicate that both public debt and budget deficit have destabilizing effects on exchange rates in Nigeria.

Keywords: Budget deficit, Public debt, Exchange rate, Inflation, Financial openness

JEL Classification: E62, H68, E61, F31, F32

Introduction

Expectedly, fiscal and monetary policies are to be coordinated towards achieving the macroeconomic objectives in an economy. This coordination is understood to mean that these macroeconomic policies have their peculiar features and are aimed at achieving specific macroeconomic objectives. Conventionally, the monetary authorities are saddled with the single mandate of price stability, while the attainments of other objectives are achieved largely with the use of fiscal policies. In developing economies such as Nigeria, however, the monetary authorities have dual mandates and, consequently, the monetary and fiscal policies are always interacted towards achieving the set of macroeconomic objectives, including the stability of prices. This posed larger roles on fiscal policies towards the attainment of macroeconomic objectives. The implication is that the economy has to be stimulated with the use of fiscal stimuli from time to time. It is this need to continually rejig the economy and make it sustainably virile that have imposed telling consequences on the fiscal balances of the economy.

Primarily, high domestic savings and sound economic performance are considered too indispensable to measure economic stabilization. In Nigeria, however, savings is low and the economy is characterized with huge downswing and volatilities. Due to low saving habits, governments have continually accumulated debt: both domestic and foreign, as sources of financing government projects. More so, the slow economic performance and the non-competitiveness of most developing economies have made debt accumulation a cheap source of capital for financing these macroeconomic objectives. Most developing economies have become heavily indebted that the potency of monetary policies towards economic stabilization has become completely neutralized. A

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higher inflation rate, fuelled by increasing cost of debts, demands a reduction in the nominal rate of interest that the Fisher's effect can be obtained. A reduction in the interest rate suggests that there would be outflow of capital due to portfolio adjustment of investors. Consequently, the exchange rate would depreciate due to excessive capital outflow. All these indicate that the monetary policies would become dormant while fiscal policies become dominant.

The structure of public debt in Nigeria suggests that the debt profile in the country is dominated by the external debts up until 2005 and that domestic debt dominates the debt profile since 2006, but there has been a sustained increase in the amount of external debt afterwards. In 2005, the Paris Club forgave Nigeria a whopping US$18Billion value of external debt. This came with US$30Billion overall reduction in the country's debt stock [6]. As at 2018, the value of total external debt that stood at ₦7,759.20 Billion was more than the pre-debt-forgiveness amount of N2,695.07 in 2005. The implication is that the country has accumulated additional external debt again. Of the total domestic debt, the Federal Government of Nigeria (FGN) bonds and treasury bills have the largest amounts since 2006. However, the compositions of the total domestic debt profile in Nigeria suggests that the domestic debt profile for the country largely comprise financial instruments with low interest rate obligations [4]. More so, the holdings of federal government's domestic debt outstanding were mainly owned by the deposit money banks and the non-bank public. This was expected as treasury bills together with the treasury bonds and the FGN bonds constitute the total domestic debt profile in Nigeria. The amount of sinking fund in the domestic debt outstanding was grossly negligible throughout the period and the amount owned by the non-bank public becomes manifest since the year 2014. This further lent credence to the patronage enjoyed by the treasury bills and FGN bonds of all the financial instruments that comprise the domestic debt profile of the government.

During the decade that spanned the period 1992–2001, however, the Central Bank of Nigeria (CBN) has the highest holdings of the Federal Government domestic debt holdings. Although the total debt profile of Nigeria was characterized by debt from external sources during this decade, it still indicates that the dynamics of the debt profile will affect the price stability objective of the monetary authority. This trend has resurfaced again since the year 2014 as the holdings of the CBN in the domestic debt outstanding of the Federal Government has increased consistently to *N*2,005.44Billion in the year 2018 [4]. One major implication of these is that exchange rate movement in Nigeria has been characterized by over- and undervaluation of the domestic currency. The period 1981–1997 was a period of higher over-valuation of the domestic currency. This period conformed to the period of market-determined and liberal exchange rate arrangement. With the advent of the structural adjustment programme (SAP) in 1986, the fixed exchange market, like other segments of the financial markets, was liberalized. Prior to this time, the economy operated a fixed exchange rate regime; taken after one international reference currency and another; precisely against the United States Dollar and the United Kingdom Pound Sterling. Some other times, it was weighted against basket of currencies. There were three prominent episodes of exchange rate under-valuation in Nigeria. These were the July 1986, January, 1992 and December 1998. The exchange rate depicts the real purchasing power parity condition [4], which suggests that the real prices of goods and services in the domestic economy and that of the referenced country are similar. These are strong indications that the standard of living of people in both countries are not affected by the exchange rate of the foreign currencies.

The empirical literature on fiscal dominance and monetary leadership in various economies has been largely investigated. Empirical investigations carried out by Sabate, Fillat and Escario [24] and Sabate, Gadea and Escario [25] found evidence for fiscal dominance while the studies of Kimakova [15], Ifere and Okoi [13] that hinged on the political economy of fiscal deficits could not find role for the impact of budgetary spending on fiscal deficit. Also, Nachega [18] found evidence for long-run equilibrium relationship between budget deficits and seiniorage. This conformed to the findings that there is fiscal dominance in the study of Papadamou et al. [21] where public debts and economic growth where found to have impacted significantly on the independence of monetary authorities. In addition, Resende [23], Fan et al. [9]; Jalil, Tariq and Bibi [14] showed evidence for fiscal dominance when monetary and fiscal policies were integrated within the same analytical framework. The study of Kleim et al. [16] puts it in the right context when evidence for fiscal inflation was obtained. In terms of general equilibrium framework that captured the concerns for exchange rate pass-through and nominal prices, the study of Cebi [5] found evidence for the dominance of monetary policy in stabilizing prices. This was related to the studies of Sanusi and Akinlo [26], Afolabi and Atolagbe [1] that could not find evidence for the presence of fiscal dominance in Nigeria. Besides, Elbadawi et al. [8] found mix results, depending on the exchange rate regime adopted. The study, which investigated a collection of oil dependent Arab countries, harped on the fiscal theory of price. The study by Fragetta and Kirsanova

[11] also found similar mix results of fiscal and monetary dominances for the economies of UK, USA and Sweden. From the foregoing, it is evident that that the impact of fiscal dominance on the stability of exchange rate is still an open question owing to various reasons. A few study that attempted the same objective did that in retrospect to the historical periods of the gold era. However, the norms in financial integration are that monetary autonomy is usually traded off.

The theoretical line of thoughts for the dominance of fiscal or monetary policy in relation to the stability of the exchange rate was enshrined in the IS-LM-BP framework where both monetary and fiscal policies are expected to be interacted to achieve the macroeconomic objectives of an economy. This framework was enunciated by the duo of Mundell [17] and Fleming [10] as a static baseline model. The extended forms of this framework were the dynamic additions made by Dornbusch [7] and the stochastic versions postulated by Obsfeld [19]. Generally, the open-economy model has three equilibria of goods, money and capital markets. In its static form, prices of goods are assumed fixed and capital market is assumed perfectly mobile. Under a fixed exchange rate regime and in the presence of fiscal policy shock, domestic goods become competitive and export is increased. Fiscal policy is dominant in this scenario. Monetary policy is impotent under a fixed exchange rate regime as domestic credit expansion leaves money supply endogenous and interest rate and output remain unchanged. In contrast, there is monetary dominance under a flexible exchange rate regime as fiscal policy becomes an ineffective stabilization tool. The Dornbusch [7] model is an overshooting model where, due to monetary shocks, the instantaneous depreciation of the exchange rate overshoots its long-run value.

Basically, the stability of exchange rate has been the vocal policy objective of most developing economies, such as Nigeria, that could not afford to float their currencies and subject it to the dynamics of the market forces. Generally, too, exchange rate stability is central to researches in international finance. While many studies have considered the ex-post analyses of exchange rate stability, very few studies have investigated the ex-ante stability of the exchange rate. Prominent studies in this regard include Akinkumi [2], Hassan et al. [12], Oke and Adetan [20]. This study seeks to examine the role of fiscal dominance in the stability of exchange rate in Nigeria. First, it becomes imperative to ascertain whether fiscal policy has been dominant in determining the stability (or otherwise) of prices in Nigeria. Secondly, how the price-stability role of fiscal policy has engendered or endangered the stability of exchange rate is the second objective for this study. However, research efforts at investigating these objectives have been undertaken separately. This suggests that the empirical investigations on fiscal dominance and exchange rate stability are still open and remain an empirical question that this study seeks to answer. In addition to the introductory section, Sect. 2 deals with the methodology for the study. In Sect. 3, results were reported and discussion of findings were provided. Section 4 offers valuable policy suggestions.

Methods

The theoretical framework for this study is the conventional Mundell–Fleming model enunciated by Mundell [17] Fleming [10]. The underlying assumptions of this model and the resulting prediction will be captured in the following model derivation. Consider a static Mundell–Fleming model with three equilibria in the goods, money and capital markets. For the goods market, the IS equation is given as;

$$Y = A(\overset{-}{i}, \overset{+}{Y}) + T\left(Q = \frac{SP^*}{P}, \overset{-}{Y}\right) + \overset{+}{G} \tag{1}$$

where; $A(\overset{-}{i}, \overset{+}{Y})$ is the domestic absorption; T is trade balance as a function of income (Y) and competitiveness term, $Q = \frac{SP^*}{P}$; G is government expenditure.

Obtaining the logarithmic form of Eq. (1) gives

$$y = \gamma y - \sigma i + \delta(s + p^* - p) + g \tag{2}$$

Re-arranging Eq. (2) to obtain Eq. (3) as

$$y = \delta(s + p^* - p) + \gamma y - \sigma i + g \tag{3}$$

where g is an exogenous shifter, interpreted as changes in fiscal policy. The parameters δ, γ and σ have domain [0, 1].

For the money market equilibrium, the real money balance is a determinant of output and nominal interest rate. This is denoted as;

$$\frac{M}{P} = L(\overset{+}{Y}, \overset{-}{i}) \tag{4}$$

The logarithmic form of Eq. (4) gives;

$$m - p = \phi y - \lambda i \tag{5}$$

Rewritten as

$$m = \phi y - \lambda i + p \tag{6}$$

Capital market equilibrium is given as

$$i = i^* \tag{7}$$

i^* is the foreign interest rate.

Combining Eqs. (3), (6) and (7) and taking the small country assumption where $p^* = 0$ but with flexible prices in the domestic economy; $p \neq 0$; then,

$$y = \delta(s - p) + \gamma y - \sigma i + g \tag{8}$$

$$\begin{aligned} y &= \delta s - \delta p + \gamma y - \sigma i + g \\ y - \gamma y &= \delta s - \delta p - \sigma i + g \\ (1-\gamma)y &= \delta s - \delta p - \sigma i + g \end{aligned} \tag{9}$$

Substituting Eq. (7) into Xx Eq. (9), we have;

$$y = \frac{\delta s}{(1-\gamma)} - \frac{\delta p}{(1-\gamma)} - \frac{\sigma i^*}{(1-\gamma)} + \frac{g}{(1-\gamma)} \tag{10}$$

Differentiating Eq. (10) totally gives;

$$dy = \frac{\delta}{(1-\gamma)}ds - \frac{\delta}{(1-\gamma)}dp - \frac{\sigma}{(1-\gamma)}di^* + \frac{dg}{(1-\gamma)} \tag{11}$$

$$dy = \frac{\delta}{(1-\gamma)}ds - \left(\frac{\delta}{(1-\gamma)}dp + \frac{\sigma}{(1-\gamma)}di\right) + \frac{dg}{(1-\gamma)} \tag{11a}$$

$$dy = \frac{\delta}{(1-\gamma)}ds - \frac{\delta}{(1-\gamma)}dr + \frac{dg}{(1-\gamma)} \tag{11b}$$

Also, substitute Eqs. (7) and (10) into Eq. (6),

$$m = \phi\left(\frac{\delta s}{(1-\gamma)} - \frac{\delta p}{(1-\gamma)} - \frac{\sigma i^*}{(1-\gamma)} + \frac{g}{(1-\gamma)}\right) - \lambda i^* + p \tag{12}$$

Regrouping;

$$m = \phi\left[\frac{\delta s}{(1-\gamma)} - \left(\frac{\delta p}{(1-\gamma)} + \frac{\sigma i}{(1-\gamma)}\right) + \frac{g}{(1-\gamma)}\right] - \lambda i^* + p \tag{13}$$

Note that the logarithmic prices and nominal interest rate yield real interest rate. Therefore, Eq. (13) is rewritten as

$$m = \frac{\phi\delta s}{(1-\gamma)} - \frac{\phi\delta r}{(1-\gamma)} + \frac{\phi g}{(1-\gamma)} - \lambda i^* + p \tag{14}$$

Differentiating totally, we have;

$$dm = \frac{\phi\delta}{(1-\gamma)}ds - \frac{\phi\delta}{(1-\gamma)}dr + \frac{\phi}{(1-\gamma)}dg - \lambda di^* + dp \tag{15}$$

Equations (11") and Xx Eq. (15) are the simultaneous equations for obtaining a solution to the Mundell–Fleming model. Rewriting both equations for change in exchange rate and real interest rate, respectively, gives

$$dy + \frac{\delta}{(1-\gamma)}dr - \frac{dg}{(1-\gamma)} = \frac{\delta}{(1-\gamma)}ds \tag{16}$$

$$dm - \frac{\phi\delta}{(1-\gamma)}ds - \frac{\phi}{(1-\gamma)}dg + \lambda di^* - dp = \frac{\phi\delta}{(1-\gamma)}dr \tag{17}$$

Substituting Eq. (17) into (16) results in;

$$\frac{\delta}{(1-\gamma)}ds = dy + \left[dm - \frac{\phi\delta}{(1-\gamma)}ds - \frac{\phi}{(1-\gamma)}dg + \lambda di^* - dp\right] - \frac{dg}{(1-\gamma)} \tag{18}$$

$$\frac{\delta}{(1-\gamma)}ds + \frac{\phi\delta}{(1-\gamma)}ds = dy + dm - \left[\frac{\phi}{(1-\gamma)}dg - \frac{dg}{(1-\gamma)}\right] + \lambda di^* - dp \tag{19}$$

$$\frac{\delta(1+\phi)}{(1-\gamma)})ds = dy + dm - \left[\frac{\phi - 1}{(1-\gamma)}\right]dg + \lambda di^* - dp \tag{20}$$

Equation (20) is the structural model for this study where changes in the exchange rate are a function of growth rate of real gross domestic product, monetary growth, changes in government expenditure, foreign interest rate and domestic prices. In tandem with the fiscal dominance hypothesis, g is better captured as fiscal deficits, comprising both budget deficits and public debts. Introducing the respective parameters, the empirical model becomes

$$\begin{aligned} \Delta exchr = {} & \beta_0 + \beta_1 rgdpgr + \beta_2 \Delta m2 \\ & + \beta_3 \Delta dbudg\_def + \beta_4 \Delta public\_deb \\ & + \beta_5 forein\_\text{int} + \beta_6 \Delta cpi + \varepsilon \end{aligned} \tag{21}$$

As a control variable, the degree of financial openness (denoted as *finopen*) is also included in Eq. (21) as a major determinant that accommodates exchange rate transactions across borders. The study employs quarterly data that spanned 1981q1–2018q4. The data are sourced from the National Bureau of Statistics (NBS), Central Bank of Nigeria (CBN) Statistical Bulletin (2018) and the World Development Indicator [27]. Few of these data such as the index of financial openness were spliced into cubic-typed quarterly form. As a structural model, the Structural Vector Autoregression (SVAR) technique would be employed as the basic technique of estimation,

Table 1 Augmented Dickey–Fuller (ADF) and Phillip–Perron (PP) unit-root tests. Source: E-views output. Critical values at *I*(0): 1% = − 3.478; 5% = − 2.883; 10% = − 2.578

Variables	ADF statistics		*I*(*d*)	PP statistics		*I*(*d*)
	I(0)	*I*(1)		*I*(0)	*I*(1)	
Δexchr	− 3.101	–	*I*(0)	− 3.823*	–	*I*(0)
rgdpgr	− 1.728	− 3.740*	*I*(1)	− 2.879	− 3.065*	*I*(1)
Δ*m2*	− 2.411	− 3.761*	*I*(1)	− 2.779	− 2.866*	*I*(1)
Δ*budg_def*	− 1.850	− 4.761*	*I*(1)	− 2.731	− 2.637*	*I*(1)
Δ*public_deb*	− 1.497	− 4.396*	*I*(1)	− 3.196*	–	*I*(0)
*forein*_int	− 1.618	− 4.005*	*I*(1)	1.864	− 3.537*	*I*(1)
Δ*cpi*	− 0.796	− 4.634*	*I*(1)	− 2.845	− 3.860*	*I*(1)
finopen	− 0.363	− 2.116*	*I*(1)	− 1.744	− 2.796*	*I*(1)

Critical values at *I*(1): 1% = − 2.582; 5% = − 1.943; 10% = − 1.615

while the Autoregressive Distributed Lag (ARDL) model will be used for robustness. The use of the SVAR technique is considered appropriate as it help trace the shock transmission of exchange rate stability in Nigeria. Considering a non-recursive transformation,[1] the matrix representation of the SVAR mode for this study is specified below thus;

$$\begin{vmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1 \end{vmatrix} \begin{vmatrix} \Delta exchr \\ rgdpgr \\ \Delta m2 \\ \Delta budg\_def \\ \Delta public\_deb \\ forein\_\text{int} \\ \Delta cpi \end{vmatrix} = V(L) \begin{vmatrix} \Delta exchr \\ rgdpgr \\ \Delta m2 \\ \Delta budg\_def \\ \Delta public\_deb \\ forein\_\text{int} \\ \Delta cpi \end{vmatrix} + \begin{vmatrix} \varepsilon \Delta exchr \\ \varepsilon rgdpgr \\ \varepsilon \Delta m2 \\ \varepsilon \Delta budg\_def \\ \varepsilon \Delta public\_deb \\ \varepsilon forein\_\text{int} \\ \varepsilon \Delta cpi \end{vmatrix} \quad (22)$$

The variables are as earlier defined, while the error-term interacted variables, depicted in the last matrix, are meant to capture the shock effect of the variables within a structural transformation. The first matrix depicts the non-recursive nature of the SVAR model. For robustness, the ARDL technique is also employed. The economic intuition provided for the use of the ARDL model is to trace the dynamic paths of fiscal dominance and exchange rate stability in Nigeria. Both the short-run and long-run dynamics will be investigated. The long-run dynamics entail both the long-run equilibrium relationship and the long-run impact analyses. Statistically, the ARDL technique is found appropriate as it can be applied irrespective of the order of integration of the series included for empirical estimations. Both the *I*(0)—that is, level stationarity; and *I*(1)—that is stationary integrated series can accommodated within the same modelling framework.[2] The empirical specification of the ARDL model for this study is given thus;

$$\begin{aligned} \Delta exchr_t = \beta_0 + \chi \sum_{t=1}^{T} \Delta exchr_t + \beta_1 \sum_{t=0}^{T} rgdpgr_t \\ + \beta_2 \sum_{t=0}^{T} \Delta m2_t + \beta_3 \sum_{t=0}^{T} \Delta dbudg\_def_t \\ + \beta_4 \sum_{t=0}^{T} \Delta public\_deb_t + \beta_5 \sum_{t=0}^{T} forein\_\text{int}_t \\ + \beta_6 \sum_{t=0}^{T} \Delta cpi + \varepsilon_t(-1) \end{aligned} \quad (23)$$

Equation (23) is the ARDL model for empirical investigation. The optimal lag length will be selected automatically. Long-run equilibrium relationship is considered to have existed if the *F*-statistic is greater than the upper bound of the critical region. If the *F*-statistic falls below the lower bound, no long-run relationship exists and the results would be inconclusive should the *F*-statistic lies between the lower and upper bounds of the critical region.

Results and discussion

Pre-estimation tests

Unit-root tests

The variables included in the model are a mix of stationary (non-unit-root) and non-stationary (unit-root) series (see Table 1). Specifically, the ADF unit-root

[1] See Blanchard and Quah [3] for extensive formations of the SVAR model.

[2] See Pesaran, Shin and Smith [22] for the extensive formations of the ARDL modelling framework.

Table 2 Pairwise granger causality test

VAR	Causality *Ho : x → y	Lags	Test statistics		
			F-statistic	*p* values	Conclusion
$\Delta budg\_def, \Delta e, \Delta public\_debt, m2\_growth, \text{inf } r$	$\Delta budg\_def \rightarrow \Delta e$	4	7.009*	0.000	Reject
	$\Delta e \rightarrow \Delta budg\_def$	4	4.676*	0.002	Reject
	$\Delta e \rightarrow \Delta public\_debt$	4	1.832	0.126	Fail to reject
	$\Delta public\_debt \rightarrow \Delta e$	4	1.755	0.142	Fail to reject
	$\Delta budg\_def \rightarrow m2\_growth$	4	0.505	0.732	Fail to reject
	$m2\_growth \rightarrow \Delta budg\_def$	4	0.551	0.698	Fail to reject
	$\Delta public\_debt \rightarrow m2\_growth$	4	1.574	0.185	Fail to reject
	$m2\_growth \rightarrow \Delta public\_debt$	4	0.450	0.772	Fail to reject
	$\text{inf } r \rightarrow \Delta budg\_def$	4	1.743	0.144	Fail to reject
	$\Delta budg\_def \rightarrow \text{inf } r$	4	0.361	0.836	Fail to reject
	$\text{inf } r \rightarrow \Delta public\_debt$	4	0.907	0.463	Fail to reject
	$\Delta public\_debt \rightarrow \text{inf } r$	4	1.983	0.101	Fail to reject

*The null hypothesis is that *x* does not granger cause *y*, indicated as $x \rightarrow y$. If failed to reject, it means *x* does not granger cause *y* and if rejected, then it granger causes. *It shows significance at the 1% critical values.

tests indicate that only the change in the exchange rate ($\Delta exchr$) is non-unit-root at levels (i.e. $I(0)$). All other variables, such as the growth rate of the gross domestic product (*rgdpgr*), the monetary growth ($\Delta m2$), change in the budget deficit ($\Delta budg\_def$), public debt growth ($\Delta public\_deb$), foreign interest rate (*forein*_int), inflation rate (Δcpi) and financial openness (*finopen*), become stationary when integrated at order 1 (i.e. $I(1)$). For the Phillip–Perron (PP) unit-root tests, however, the growth of public debt ($\Delta public\_deb$) and the changes in the exchange rate also become stationary until integrated at order 1, while all other variables as similar to the results in the ADF unit-root test that were also stationary at levels.

Granger causality test

The granger causality test tabulated below shows that there is a bi-causal relationship between budget deficit and changes in the exchange rate in Nigeria. The null hypothesis that budget deficit does not granger cause changes in exchange rate is rejected at the 1 percent level with 7.009 *F*-statistic value. More so, the null hypothesis that exchange rate changes does not granger cause budget deficit is also rejected at the 1 percent level with 4.676 *F*-statistic value. However, evidence exists that public debt does not granger cause exchange rate changes in Nigeria with 1.755 *F*-statistic and 0.142 probability values (see Table 2). There is no evidence for the reverse causality too as exchange rate changes does not granger cause public debt in Nigeria. This suggests that budget imbalance is the major causal factor for exchange rate instability in Nigeria, while public debt dynamics is found to be negligible.

For the causality between all the other two variables, there is evidence that granger causality does not exists. The implication is that there is no evidence of fiscal dominance in Nigeria as budget deficits and public debt components of the fiscal deficit profile of Nigeria do not granger cause both monetary growth and inflation in the country. Specifically, the null hypothesis that budget deficit and public debt, respectively, does not granger cause monetary growth could not be rejected; even at the 10 percent level of significance, with 0.732 and 0.185 probability values, respectively. More so, null hypothesis that both budget deficit and public debt, respectively, do not granger cause inflation can also not be rejected with 0.836 and 0.101 probability values, respectively.

Model estimation

Estimations of autoregressive distributed lag (ARDL) bound test

Given that the unit-root tests show that there is a linear combination of $I(0)$ and $I(1)$ series included for the estimation of the empirical model captured in Eq. (21), it becomes imperative that ARDL is employed as the appropriate technique of analysis. Also, the dynamic interaction of fiscal deficit (a combined effect of budget deficit and public borrowing) on the stability of exchange rate can properly be analysed with the use of the ARDL technique. The decision rule is that a long-run equilibrium relationship exists only when the estimated *F*-statistic ratio is greater than the upper-bound critical value; at least, at the 5 percent level of significance. With a 4.45 *F*-statistic value greater than the 3.90 critical value at the 1 percent level, there exists a long-run equilibrium relationship among public debt, budget deficit, growth rate

Table 3 ARDL bound test. Source: E-Views Output

Test statistics		**Value**
F-statistic		4.45
Critical values		
	***I*(0)**	***I*(1)**
1%	2.73	3.90
5%	2.17	3.21
10%	1.92	2.89

of gross domestic product, monetary growth, inflation, foreign interest rate and the exchange rate movement in Nigeria (see Table 3).

The implication from this is that the level of public debt and budget deficits, along with other variables, are not destabilizing for exchange rate dynamics in Nigeria into the long-run situation. Therefore, fiscal dominance cannot affect the stability of exchange rate in Nigeria as the levels of public debt and budget deficits are still accommodating of the movement in exchange rate for a long-run period.

Short-run dynamics

For the short-run situation, the error correction term (ect) is properly signed with −0.035 coefficient and a highly significant *t*-statistic value of 4.314 with 0.000 probability value. This indicates that the rate of recovery by the economy when affected by exchange rate shock is very slow at the rate of 3.5 percent per quarter. This suggests that it will take 28.6 quarters (about 29 quarters); approximately 7.15 years, before the economy can return to equilibrium once affected by exchange rate shock. This corresponds to approximately 7 years 2 months period. This slow rate of recovery is justified as all the 3 periods lags effects of exchange rate changes on the current level of exchange rate are highly significant with 33.947, 16.594 and 10.264 probability values, respectively. The corresponding probability values are 0.000, 0.000 and 0.000.

The current level of growth of broad money supply, $D(m2\_growth)$, is positively related to the movement in the exchange with 0.997 coefficient and 5.524 t-statistic value and 0.000 corresponding probability value. The economic intuition here is that a unit increase in the growth of broad money supply leads to changes in the exchange rate to the tune of 1 percent depreciation. This shows that for a developing economy like Nigeria, the exchange rate value of the domestic currency to the international referenced currency increases proportionately on the attendant consequence of the amount of excess money in the circulation. When the monetary authority undertakes an expansionary monetary policy for an economy, domestic interest rate reduces and investors readjust their portfolios to enjoy increasing returns on their investment elsewhere. With this, capital outflows are evident and this further depreciates the value of the exchange rate, significantly. However, the lag periods of money supply growth negatively impacts on changes in the exchange rate. Specifically, one period lag of broad money supply growth, $D(m2\_growth(-1))$, has −2.654 coefficient and absolute 6.523 t-statistic value with corresponding 0.000 probability value. The two-period lag of broad money supply growth, $D(m2\_growth(-2))$, has −2.560 coefficient and 5.963 probability value with 0.000 probability value, while three-period lag, $D(m2\_growth(-3))$, has −0.917 coefficient with absolute 4.854 *t*-statistic value and corresponding 0.000 probability value.

The implication is that the initial depreciation of the domestic currency is reversed in three period lags and the net effects would mean an appreciation of the domestic currency given that the magnitude of reversal for the three periods would have more than counteracted the initial depreciation in the current period. More so, the growth of real gross domestic product in the current quarter, $D(rgdpgr)$, negatively impacts on exchange rate changes with −0.727 coefficient and 2.085 t-statistic value and corresponding 0.040 probability value, while its one-period lag, $D(rgdpgr(-1))$, has 0.670 coefficient and 2.144 t-statistic value with 0.034 probability value (see Table 4). This indicates that the current level of real growth rate of the Nigerian economy enhances exchange rate appreciation, while its one-period lag leads to the depreciation of the domestic currency. However, the net effect is a marginal appreciation of the domestic currency as the magnitude of currency depreciation in one-period lag is lesser than that of the current period.

The components of fiscal deficits, budget deficit and public debts, have alternating sign effects on exchange rate movement in Nigeria. The current level of budget deficit, $D(\Delta budg\_def)$, impacts positively with 0.010 coefficient and 3.910 *t*-statistic value, while the one-period lag, $D(\Delta budg\_def(-1))$, has −0.021 coefficient with 3.653 absolute *t*-statistic value. Two-period lag, $D(\Delta budg\_def(-2))$, and three-period lag, $D(\Delta budg\_def(-3))$, have corresponding 0.018 and −0.040 coefficients with 3.107 and 1.571 *t*-statistic value, respectively. On the other hand, the current level of public debt, $D(\Delta public\_debt)$, has 1.884 coefficient and 23.543 *t*-statistic, while the corresponding values for the one-period lag, $D(\Delta public\_debt(-1))$, are −4.270 and 18.365. The two-period lag, $D(\Delta public\_debt(-2))$, and three-period lag, $D(\Delta public\_debt(-3))$, have 3.778 and −1.287 coefficients and corresponding t-statistic values of 12.476 and 8.641. The implication of these alternating sign effects of budget deficits and public debts leave

Table 4 Conditional error correction regression. Source: E-views output

Variables	Coefficient	*T*-statistic	Probability values
C	−0.825	−1.615	0.109
D(*ect*(−1))	−0.035	−4.314	0.000
D(Δ*e*(−1))	2.241	33.947	0.000
D(Δ*e*(−2))	−1.971	−16.594	0.000
D(Δ*e*(−3))	0.677	10.264	0.000
D(*m2_growth*)	0.997	5.524	0.000
D(*m2_growth*(−1))	−2.654	−6.523	0.000
D(*m2_growth*(−2))	−2.560	5.963	0.000
D(*m2_growth*(−3))	−0.917	−4.854	0.000
D(*rgdpgr*)	−0.727	−2.085	0.040
D(*rgdpgr*(−1))	0.670	2.144	0.034
D(Δ*budg_def*)	0.010	3.910	0.000
D(Δ*budg_def*(−1))	−0.021	−3.653	0.000
D(Δ*budg_def*(−2))	0.018	3.107	0.002
D(Δ*budg_def*(−3))	−0.004	−1.571	0.119
D(Δ*public_debt*)	1.884	23.543	0.000
D(Δ*public_debt*(−1))	−4.270	−18.365	0.000
D(Δ*public_debt*(−2))	3.778	12.476	0.000
D(Δ*public_debt*(−3))	−1.287	−8.641	0.000
D(*forein*_int)	−3.460	−1.070	0.287
D(*forein*_int(−1))	10.516	1.401	0.164
D(*forein*_int(−2))	−10.891	−1.471	0.144
D(*forein*_int(−3))	5.546	1.807	0.074
D(inf *r*)	0.942	3.785	0.000
D(inf *r*(−1))	−2.175	−4.000	0.000
D(inf *r*(−2))	1.941	3.650	0.000
D(inf *r*(−3))	−0.629	−2.713	0.008
D(*finopen*)	−48.349	0.857	0.394
D(*finopen*(−1))	−7.017	−0.065	0.956
D(*finopen*(−2))	66.188	0.535	0.594
D(*finopen*(−3))	−69.357	−1.333	0.185
Adj. R^2		0.995	
F-stat		2759	
Prob. (*F*-stat)		0.000	
DW statistics		1.82	

the exchange rate in Nigeria to become highly unstable from one quarter to another. The price level in the economy also exhibits similar sign alternating effects on the exchange rate while the impacts of both the foreign interest rate and the degree of capital account openness were found to be negligible. Intuitively, the public expectation plays significant role in the effects that the price level would have on the exchange rate. Whenever the actual price level conforms to its expected value, the exchange rate appreciates. However, it depreciates to the level of the deviations between the actual and expected inflation rate. The adjusted squared coefficient of correlation indicates that the explanatory variables substantially explain for the movement in exchange rate movement to the tune of 99.5%. The Fisher's statistic of 2759 is highly significant at the 1 percent level, implying that there is no specification error in the model and that the Durbin–Watson statistic strongly shows that there is no autocorrelation problem in the estimation.

Long-run impact analyses

For the long-run impact of fiscal dominance on the stability of exchange rate in Nigeria, the optimal lag length chosen for estimations is four (4). This conforms to expectation, as the frequency of data employed for analysis is in quarterly form. The behaviour of the long-run dynamics aligns with the estimates for the short-run that were analysed in the preceding subsection. Both the foreign interest and financial openness do not have significant impact on exchange rate changes in Nigeria. As indicated by the estimates obtained, exchange rate behaviour in Nigeria is not affect by foreign factors but rather subjected to a host of monetary and fiscal factors in the long-run situation. These variables include the domestic interest rate, growth of broad money supply, budget deficit and public debt. Also, the growth of real gross domestic product impact significantly on the changes of the exchange rate (see Table 5). Similar to the findings in the short-run situation, both the budget deficit and public debt have alternating significant sign effects on the movement of the exchange rate. This further reinforces the fact that these alternating sign effects would translate to instability in the exchange rate in Nigeria over the long-run period as well.

Similarly, the growth of broad money supply, the domestic rate, the growth of gross domestic product also have destabilizing effects on the exchange rate as these variables also posed alternating significant sign effects on the behaviour of exchange in Nigeria over a long-run situation. Altogether, these alternating sign effects confirm the inconsistency in policy directions of the government in stabilizing the exchange rate in the country. This lends credence to the submission that there is lack of congruence in policy direction of successive government over the years in Nigeria, especially as it is related to macroeconomic policies and the policies directed towards the productive capacity of the Nigerian economy. The adjusted coefficient of determination indicates that the variables included for empirical investigation of the effect of fiscal dominance on the stability of exchange rate in Nigeria well accounted for a whopping 99 percent. This indicates that the model does not suffer from any specification error. In addition, the 1.82 DW statistics denotes that there is no presence of autocorrelation problem and

Table 5 Long-run dynamics. Source: E-views output

Variables	Coefficient	*T*-statistic	Probability values
C	−0.852	−1.615	0.109
Δ*e*(−1)	3.206	46.172	0.000
Δ*e*(−2)	−4.213	−22.966	0.000
Δ*e*(−3)	2.649	14.503	0.000
Δ*e*(−4)	−0.677	−10.264	0.000
m2_growth	0.997	5.524	0.000
m2_growth(−1)	−3.638	−6.348	0.000
m2_growth(−2)	5.214	6.309	0.000
m2_growth(−3)	−3.477	−5.688	0.000
m2_growth(−4)	0.917	4.854	0.000
rgdpgr	−0.727	−2.085	0.040
rgdpgr(−1)	1.364	2.180	0.032
rgdpgr(−2)	−0.670	−2.144	0.034
Δ*budg_def*	0.010	3.910	0.000
Δ*budg_def*(−1)	−0.031	−3.838	0.000
Δ*budg_def*(−2)	0.038	3.411	0.000
Δ*budg_def*(−3)	−0.022	−2.671	0.009
Δ*budg_def*(−4)	0.004	1.571	0.119
Δ*public_debt*	1.884	23.453	0.000
Δ*public_debt*(−1)	−6.095	−20.184	0.000
Δ*public_debt*(−2)	8.048	15.252	0.000
Δ*public_debt*(−3)	−5.064	−11.309	0.000
Δ*public_debt*(−4)	1.287	8.641	0.000
*forein*_int	−3.460	−1.070	0.287
*forein*_int(−1)	13.973	1.312	0.192
*forein*_int(−2)	−21.406	−1.444	0.152
*forein*_int(−3)	16.437	−1.582	0.117
*forein*_int(−4)	−5.546	−1.807	0.074
inf *r*	0.942	3.785	0.000
infr(−1)	−3.113	−3.985	0.000
inf *r*(−2)	4.116	3.867	0.000
inf *r*(−3)	16.437	1.582	0.117
inf *r*(−4)	−5.546	−1.807	0.074
finopen	−48.349	−0.857	0.393
finopen(−1)	43.032	0.231	0.818
finopen(−2)	73.205	0.293	0.770
finopen(−3)	−135.544	−0.778	0.439
finopen(−4)	69.357	1.333	0.185
Adj. R^2		0.99	
F-stat		16,457.04	
Prob. (*F*-stat)		0.000	
DW statistics		1.82	

the highly significant *F*-statistics strongly support the overall fitness of the model (see Table 5).

Structural vector autoregression (SVAR) estimates

In order to test for the presence of fiscal dominance and further examine the shock transmission of the fiscal dominance components on the stability of exchange rate in Nigeria, the variance decomposition of the Structural Vector Autoregression (SVAR) estimates were extracted for analyses. There is no evidence for fiscal dominance in Nigeria since neither the shock effects of budget deficit nor public debt substantially affects either monetary growth or price level in the country (see "Appendix 1"). The results shows that it is only the degree of financial openness that explains the substantial shock that affected both inflation and the growth of broad money supply in Nigeria. The implication is that inflationary pressures in Nigeria are due to dynamics of the global economy. This transmits through the exchange rate. In fact, the shock effects of both budget deficits and public debts in the Nigerian economy are largely explained by the degree of capital account transactions with other economies of the world. These results largely align with the findings obtained in the study of Afolabi and Atolagbe [1] where they could not find evidence for the presence of fiscal dominance in Nigeria. Also, the results conform to the study of Ifere and Okoi [13] that budget spending significantly accounts for fiscal deficits in the country. More so, there is no evidence for the dominance of monetary policy because monetary policy, being used as the instrument of exchange rate stabilization, has become endogenous in Nigeria. However, this study is a suspect of the results obtained from the study of Sabate, Gadea and Escario [25] where commitment to fixed exchange rate regime has to be abandoned in Spain due to the compelling financial needs of the Treasury to finance the budget.

Table 6 Residual diagnostic tests

Test statistic	Value	Prob. values
Ramsey-RESET		
t-stat	0.187	0.852
F-stat	0.035	0.852
Serial correlation		
F-stat	1.569	0.213
NR^2	4.248	0.120
Heteroscedasticity		
F-stat	1.368	0.111
NR^2	46.465	0.137
Scaled explained SS	40.889	0.304

Diagnostic tests

The diagnostic tests conducted on the estimated results include the residual diagnostic tests and the stability diagnostic tests. These tests are to lend credence to the validity of the results and the reliability of the estimates for conclusion, generalization and policy recommendation.

Residual diagnostic tests The diagnostic tests capture the residual, coefficient and stability tests. Evidently, the estimations obtained are reliable as there is no indication of serial correlation and heteroscedasticity in the residuals. The null hypotheses that these economic problems were not present in the estimated models cannot be rejected at the 5 percent level. The CUSUM test for stability depicted below also indicates that the model is stable and that the estimations obtained therefrom are not varying irrespective of the number of times the estimation is undertaken.

Stability diagnostic tests In order to further entrenched the reliability of the estimates as validated by the residual diagnostic tests tabulated in Table 6, the stability diagnostic tests were also analysed. These diagnostic tests are the CUSUM and CUSUM squared stability tests (see Figs. 1 and 2). As depicted in Figs. 1 and 2, the reliability of the estimates is not in doubt as the confidence values of the estimates cannot be rejected at the 5 percent level of significance.

Conclusions

It is evident from the foregoing analyses that exchange rate in Nigeria has long-run co-movement with fiscal dominance components of public debt and budget deficits. In the short-run, however, these components destabilize the exchange rate as they have highly significant alternating sign effects on it. Also, the price level in the economy exhibits the same highly significant sign alternating effects on the exchange rate movement. In fact,

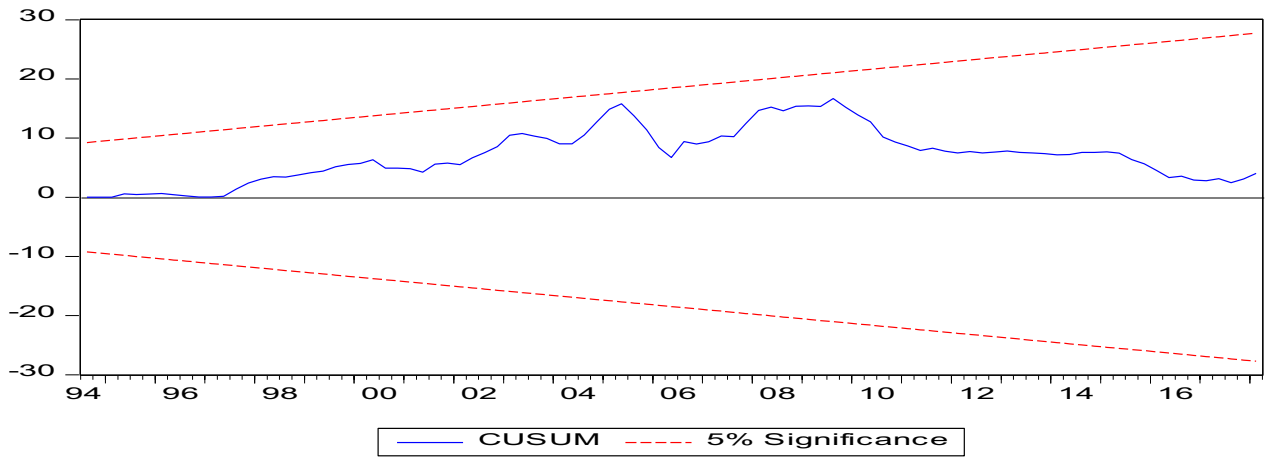

Fig. 1 CUSUM stability graph

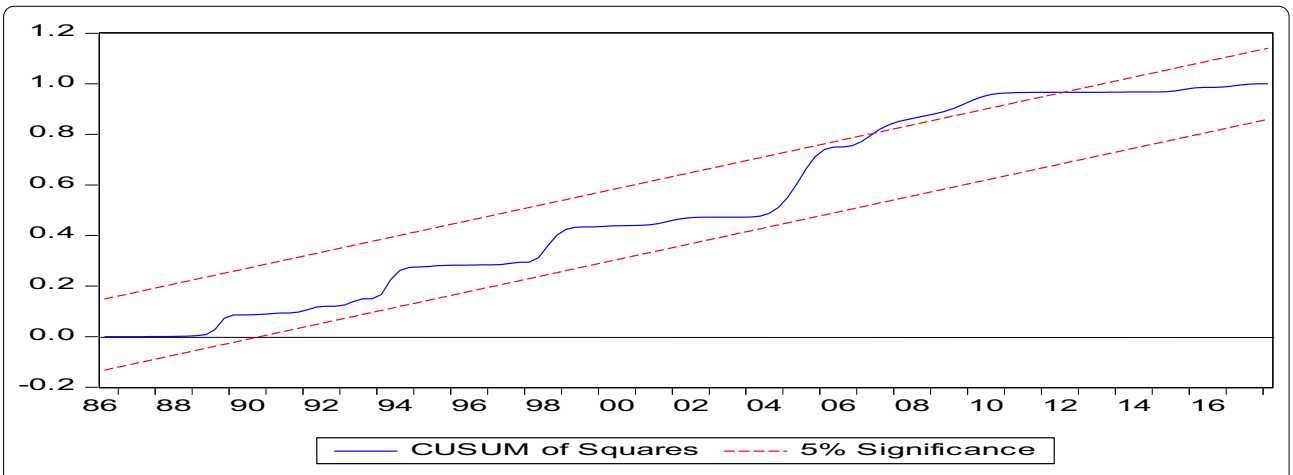

Fig. 2 CUSUM squared stability graph

the study found that budget imbalance is the major cause of exchange rate instability in Nigeria, while the degree of financial openness explains for the structural behaviour of exchange rate in the country. Similarly, the results show that the long-run dynamics of fiscal dominance and exchange rate nexus in Nigeria exhibit the same patterns and dynamics with that of the short-run dynamics. From these standpoints, the following policy suggestions are recommended;

- The monetary authority should ensure that monetary policy in Nigeria is made exogenous and not serve as adjustment instrument to manage exchange rate of the domestic currency in relation to the international referenced currency of the US dollar.
- As a corollary to the first policy suggestion stated above, the monetary authority should ensure it controls the indirect link that fiscal policy could disrupt the stability of the exchange rate. Since budget deficit and public debt affect exchange rate through the intervening variable of price level, the monetary authority should ensure it pursue its avowed mandate of price stability at all times.
- The budgetary process should be carefully scrutinized to meet global best practices and ensure its sustainability.
- That both the foreign interest rate and financial openness do not significantly impact on exchange rate stability in Nigeria lend credence to the small country assumption of the Nigerian economy. Hence, an integration of the economy is highly imperative, albeit in tandem with the developmental pace of the Nigerian economy.
- The degree of financial openness should be reconsidered and transactions on capital account items should be properly sequenced to conform to the stability of the domestic currency in Nigeria.
- In order to check the short-run and long-run impacts of budget deficit and public debts on exchange rate stability, expenditure votes in the budget should be inclusively allocated and the costs of public debts should be effective.
- Foreign exchange intervention should be reduced in order to make monetary policy assumed its exogenous status of ensuring the stability of prices in the economy.
- Both monetary and fiscal policies should be properly coordinated in achieving the macroeconomic objectives, including the stability of exchange rate.
- In order to reduce the destabilizing effects of alternating sign effects of macroeconomic variables on the stability of the exchange rate, policy statement of successive governments over the years have to be harmonized and properly knitted to avoid reversals of macroeconomic objectives.

Appendix 1: SVAR estimates

Structural VAR estimates

Date: 11/13/19 time: 03:42
Sample (adjusted): 1982Q3 2018Q1
Included observations: 143 after adjustments
Estimation method: method of scoring (analytic derivatives)
Failure to improve after 1 iterations
Structural VAR is over-identified (7 degrees of freedom)

Model: Ae = Bu where E[uu′] = I

Restriction type: long-run pattern matrix

Long-run response pattern:

1	**C(8)**	**0**	**0**	**0**	**0**	**0**	**0**
C(1)	1	0	0	0	0	0	0
C(2)	C(9)	1	0	0	0	0	0
C(3)	C(10)	C(15)	1	0	0	0	0
C(4)	C(11)	C(16)	C(20)	1	0	0	0
C(5)	C(12)	C(17)	C(21)	C(24)	1	0	0
C(6)	C(13)	C(18)	C(22)	C(25)	C(27)	1	0
C(7)	C(14)	C(19)	C(23)	C(26)	C(28)	C(29)	1

	Coefficient	**Std. error**	***z*-statistic**	**Prob**
C(1)	0.100000	0.415984	0.240394	0.8100
C(2)	0.100000	0.091778	1.089592	0.2759
C(3)	0.100000	0.092158	1.085097	0.2779
C(4)	0.100000	0.092536	1.080657	0.2798
C(5)	0.100000	0.092913	1.076271	0.2818
C(6)	0.100000	0.093289	1.071938	0.2837

	Coefficient	Std. error	*z*-statistic	Prob
C(7)	0.100000	0.093663	1.067657	0.2857
C(8)	0.100000	0.415984	0.240394	0.8100
C(9)	0.100000	0.091778	1.089592	0.2759
C(10)	0.100000	0.092158	1.085097	0.2779
C(11)	0.100000	0.092536	1.080657	0.2798
C(12)	0.100000	0.092913	1.076271	0.2818
C(13)	0.100000	0.093289	1.071938	0.2837
C(14)	0.100000	0.093663	1.067657	0.2857
C(15)	0.100000	0.083624	1.195826	0.2318
C(16)	0.100000	0.084041	1.189891	0.2341
C(17)	0.100000	0.084456	1.184044	0.2364
C(18)	0.100000	0.084869	1.178282	0.2387
C(19)	0.100000	0.085280	1.172604	0.2410
C(20)	0.100000	0.083624	1.195826	0.2318
C(21)	0.100000	0.084041	1.189891	0.2341
C(22)	0.100000	0.084456	1.184044	0.2364
C(23)	0.100000	0.084869	1.178282	0.2387
C(24)	0.100000	0.083624	1.195826	0.2318
C(25)	0.100000	0.084041	1.189891	0.2341
C(26)	0.100000	0.084456	1.184044	0.2364
C(27)	0.100000	0.083624	1.195826	0.2318
C(28)	0.100000	0.084041	1.189891	0.2341
C(29)	0.100000	0.083624	1.195826	0.2318

ARDL long-run form and bounds test

Dependent variable: D(_E)

Selected model: ARDL(4, 4, 2, 4, 4, 4, 4, 4)

Case 2: restricted constant and no trend

Date: 11/12/19 time: 15:06

Sample: 1981Q1 2018Q4

Included observations: 141

Conditional error correction regression

Variable	Coefficient	Std. error	*t*-statistic	Prob
C	−0.825208	0.511042	−1.614754	0.1094
_E(-1)*	−0.034906	0.008092	−4.313689	0.0000
M2_GROWTH(-1)	0.013192	0.013436	0.981837	0.3285
RGDPGR(-1)	−0.033798	0.036624	−0.922826	0.3583
_BUDG_DEF(-1)	3.35E−05	0.000399	0.083971	0.9332
_PUBLIC_DEBT(-1)	0.059063	0.011832	4.991599	0.0000
FOREIN_INT(-1)	−0.002645	0.105585	−0.025055	0.9801
INFR(-1)	0.003991	0.015033	0.265485	0.7912

Log likelihood **−2.31E+08**

LR test for over-identification:

Chi-square(7) 4.63E+08 Probability 0.0000

Estimated A matrix

1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000

Estimated B matrix

−0.776761	−1.333169	−0.755761	−0.909237	−0.916460	−2.123114	−0.799794	−7.669542
0.043415	0.129078	0.013521	0.034867	0.031776	0.080938	0.036572	0.293014
−0.046300	−0.201433	0.048159	−0.047569	−0.066329	−0.184822	−0.050468	−0.269499
−44.54409	−43.70878	−47.54076	−45.50583	−47.50212	−66.42419	−39.75509	−436.7339
0.036450	−0.089261	0.087398	0.023664	0.124448	−0.572971	0.048800	0.840386
0.006912	0.010641	0.009843	0.007961	0.009778	0.022439	0.004114	0.063925
−0.015417	−0.060182	0.011437	−0.007434	−0.009990	0.039545	0.019596	−0.154178
0.001013	0.000818	0.001057	0.001051	0.001107	0.000918	0.000994	0.010680

Appendix 2: ARDL long-run form and bound test

Conditional error correction regression

Variable	Coefficient	Std. error	*t*-statistic	Prob
FINOPEN(-1)	0.700925	1.119424	0.626148	0.5326
D(_E(-1))	2.241364	0.066025	33.94735	0.0000
D(_E(-2))	−1.971726	0.118820	−16.59425	0.0000
D(_E(-3))	0.677476	0.066004	10.26423	0.0000
D(M2_GROWTH)	0.996582	0.180407	5.524088	0.0000
D(M2_GROWTH(-1))	−2.654170	0.406892	−6.523028	0.0000
D(M2_GROWTH(-2))	2.559562	0.429251	5.962852	0.0000
D(M2_GROWTH(-3))	−0.917373	0.189012	−4.853524	0.0000
D(RGDPGR)	−0.727424	0.348960	−2.084552	0.0396
D(RGDPGR(-1))	0.669913	0.312412	2.144325	0.0344
D(_BUDG_DEF)	0.010062	0.002573	3.909938	0.0002
D(_BUDG_DEF(-1))	−0.020644	0.005651	−3.653219	0.0004
D(_BUDG_DEF(-2))	0.017556	0.005651	3.106637	0.0024
D(_BUDG_DEF(-3))	−0.004236	0.002697	−1.570738	0.1193
D(_PUBLIC_DEBT)	1.883567	0.080005	23.54316	0.0000
D(_PUBLIC_DEBT(-1))	−4.270462	0.232537	−18.36462	0.0000
D(_PUBLIC_DEBT(-2))	3.777224	0.302763	12.47584	0.0000
D(_PUBLIC_DEBT(-3))	−1.287153	0.148961	−8.640867	0.0000
D(FOREIN_INT)	−3.459631	3.232387	−1.070302	0.2870
D(FOREIN_INT(-1))	10.51571	7.506035	1.400967	0.1642
D(FOREIN_INT(-2))	−10.89053	7.405104	−1.470678	0.1444
D(FOREIN_INT(-3))	5.546345	3.069543	1.806896	0.0737
D(INFR)	0.941792	0.248792	3.785463	0.0003
D(INFR(-1))	−2.175117	0.543765	−4.000107	0.0001
D(INFR(-2))	1.940958	0.531748	3.650149	0.0004
D(INFR(-3))	−0.628903	0.231797	−2.713161	0.0078
D(FINOPEN)	−48.34874	56.40898	−0.857111	0.3934
D(FINOPEN(-1))	−7.017323	127.3248	−0.055114	0.9562
D(FINOPEN(-2))	66.18756	123.7075	0.535033	0.5938
D(FINOPEN(-3))	−69.35665	52.01694	−1.333347	0.1854

*p-value incompatible with t-bounds distribution

Levels equation

Case 2: restricted constant and no trend

Variable	Coefficient	Std. error	*t*-statistic	Prob
M2_GROWTH	0.377934	0.379495	0.995885	0.3216
RGDPGR	−0.968244	1.079666	−0.896800	0.3719
_BUDG_DEF	0.000961	0.011562	0.083113	0.9339
_PUBLIC_DEBT	1.692041	0.205582	8.230493	0.0000
FOREIN_INT	−0.075788	3.035870	−0.024964	0.9801
INFR	0.114334	0.446446	0.256098	0.7984
FINOPEN	20.08018	29.80851	0.673639	0.5020
C	−23.64064	11.76790	−2.008909	0.0472

EC = _E − (0.3779 * M2_ GROWTH − 0.9682 * RGDPGR + 0.0010 * _BUDG_ DEF + 1.6920 * _PUBLIC_DEBT − 0.0758 * FOREIN_ INT + 0.1143 * INFR + 20.0802 * FINOPEN − 23.6406).

F-bounds test		Null hypothesis: no levels relationship		
Test statistic	**Value**	**Signif**	***I*(0)**	***I*(1)**
			Asymptotic: $n = 1000$	
F-statistic	4.445515	10%	1.92	2.89
K	7	5%	2.17	3.21
		2.5%	2.43	3.51
		1%	2.73	3.9
Actual sample size	141		Finite sample: $n = 80$	
		10%	2.017	3.052
		5%	2.336	3.458
		1%	3.021	4.35

Appendix 3: Estimates for long-run impact analyses

ARDL tests.

Dependent variable: _E

Method: ARDL

Date: 11/12/19 time: 15:05
Sample (adjusted): 1983Q1 2018Q1
Included observations: 141 after adjustments
Maximum dependent lags: 4 (automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): M2_GROWTH RGDPGR _BUDG_DEF _PUBLIC_DEBT FOREIN_INT INFR FINOPEN
Fixed regressors: C
Number of models evaluated: 312,500
Selected model: ARDL(4, 4, 2, 4, 4, 4, 4, 4)

Variable	Coefficient	Std. error	*t*-statistic	Prob.*
_E(−1)	3.206458	0.069446	46.17227	0.0000
_E(−2)	−4.213090	0.183452	−22.96566	0.0000
_E(−3)	2.649202	0.182661	14.50334	0.0000
_E(−4)	−0.677476	0.066004	−10.26423	0.0000
M2_GROWTH	0.996582	0.180407	5.524088	0.0000
M2_ GROWTH(−1)	−3.637559	0.573054	−6.347675	0.0000
M2_ GROWTH(−2)	5.213732	0.826455	6.308548	0.0000
M2_ GROWTH(−3)	−3.476935	0.611252	−5.688219	0.0000
M2_ GROWTH(−4)	0.917373	0.189012	4.853524	0.0000
RGDPGR	−0.727424	0.348960	−2.084552	0.0396
RGDPGR(−1)	1.363539	0.625427	2.180172	0.0315
RGDPGR(−2)	−0.669913	0.312412	−2.144325	0.0344
_BUDG_DEF	0.010062	0.002573	3.909938	0.0002
_BUDG_DEF(− 1)	−0.030672	0.007992	−3.837892	0.0002

Variable	Coefficient	Std. error	*t*-statistic	Prob.*
_BUDG_DEF(−2)	0.038200	0.011198	3.411415	0.0009
_BUDG_DEF(−3)	−0.021793	0.008160	−2.670601	0.0088
_BUDG_DEF(−4)	0.004236	0.002697	1.570738	0.1193
_PUBLIC_DEBT	1.883567	0.080005	23.54316	0.0000
_PUBLIC_DEBT(−1)	−6.094966	0.301965	−20.18434	0.0000
_PUBLIC_DEBT(−2)	8.047687	0.527640	15.25222	0.0000
_PUBLIC_DEBT(−3)	−5.064377	0.447835	−11.30859	0.0000
_PUBLIC_DEBT(−4)	1.287153	0.148961	8.640867	0.0000
FOREIN_INT	−3.459631	3.232387	−1.070302	0.2870
FOREIN_INT(−1)	13.97269	10.64672	1.312394	0.1923
FOREIN_INT(−2)	−21.40624	14.82768	−1.443667	0.1519
FOREIN_INT(−3)	16.43687	10.38842	1.582229	0.1167
FOREIN_INT(−4)	−5.546345	3.069543	−1.806896	0.0737
INFR	0.941792	0.248792	3.785463	0.0003
INFR(−1)	−3.112918	0.781083	−3.985387	0.0001
INFR(−2)	4.116075	1.064426	3.866944	0.0002
INFR(−3)	−2.569861	0.753570	−3.410251	0.0009
INFR(−4)	0.628903	0.231797	2.713161	0.0078
FINOPEN	−48.34874	56.40898	−0.857111	0.3934
FINOPEN(−1)	42.03235	181.7287	0.231292	0.8175
FINOPEN(−2)	73.20488	249.4916	0.293416	0.7698
FINOPEN(−3)	−135.5442	174.3158	−0.777578	0.4386
FINOPEN(−4)	69.35665	52.01694	1.333347	0.1854
C	−0.825208	0.511042	−1.614754	0.1094
R-squared	0.999831	Mean dependent var		26.09480
Adjusted *R*-squared	0.999770	S.D. dependent var		55.51638
S.E. of regression	0.841728	Akaike info criterion		2.718256
Sum squared resid	72.97610	Schwarz criterion		3.512957
Log likelihood	−153.6371	Hannan−Quinn criter		3.041195
F-statistic	16,457.04	Durbin−Watson stat		1.819300
Prob(*F*-statistic)	0.000000			

*p values and any subsequent tests do not account for model selection

Abbreviations

ARDL: Auto-regressive distributed lag; CBN: Central Bank of Nigeria; CGD: Centre for global development; FGN: Federal Government of Nigeria; IS-LM-BP: Investment-savings, loanable fund-monetary, balance of payment; NBS: National Bureau of Statistics; SAP: Structural adjustment programme; SVAR: Structural vector auto-regression; WDI: World development indicator.

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Authors' contributions

Professor AS Bankole initiated the research work with the idea on fiscal dominance and contributed in the areas of conceptualization. Dr. TO Ayinde reviewed literature and provided the methodological framework. He also undertook the estimation of results and discussion of findings. All authors have read and approved the manuscript.

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Availability of data and materials

The datasets used for this study, as obtained from the 2018 Statistical Bulletin of the Central Bank of Nigeria (see www.cenbank.org), are available on request from the corresponding author.

Declarations

Competing interests

The authors declare that there is no competing interest for this study.

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