



Public Debt and Exchange Rate Stability in Nigeria: An Empirical Analysis

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Abstract. This study examined public debt and its effect on exchange rate stability in Nigeria from 1980 to 2019. The data were subjected to statistical analysis using vector autoregression model. Using data on external and domestic debt servicing ratio to total debt stock, the findings showed no significant relationship between public debt and exchange rate stability in Nigeria within the period, likewise for ratio of external debt servicing to total external debt stock and exchange rate. Finally, domestic debt servicing had no significant relationship with exchange rate. The study concluded that as Nigeria increases external debt servicing, domestic prices increases and this also affects exchange negatively. It is recommended that concerted effort be intensified towards decreasing the level of external debt profile of Nigeria which will invariably decrease external debt servicing. Also, government should intensify revenue drive through exploring other viable sources that do not have repayment plan rather than relying on augmenting yearly budget through public debt accumulation.

Keywords: Public Debt, Exchange Rate, Economic Stability, External Debt Servicing Ratio, Nigeria Economy.

1. Introduction

Financial resources of a country are not usually sufficient to carry out its productive activities. The tendency is to borrow to meet shortfall in its finances. According to Igberi, Odo, Anoke, (2016) “the volatile nature of the Nigeria’s economy is due to its over-dependence on oil as the main source of income coupled with steady negative trade balance and reliance on importation”. Despite the enormous financial resources from the oil boom of the 1970s in terms of cash input to the economy, there appears to be little in the way of investment and infrastructural

development to support the productive sector of the economy. Therefore, the economy was forced to look for alternative ways to close the revenue gap due to its monocultural nature, which was defined by low per capita income, trade imbalances, ongoing fiscal deficits, poor productivity, unemployment, and the ensuing low savings level. As a result, public borrowing became an additional financial choice for all levels of government.

The money borrowed is meant to boost economic growth by improving the standard of living of the people (Nnamocha, 2012). Government can either borrow by issuing securities, government bonds, and bills. World Bank and international financial institutions are supranational organizations, countries could also borrow directly from.

In the early 70’s developing countries use borrowing as its main source of financing deficit. There has been understanding among scholars that huge external debt limit the value of its currency and if a country’s public debt is low, it will likely be favoured with an increase in currency value.

In order to ascertain if public debt is indeed required for the nation’s economic stability, as proposed by Keynes, or destructive to the economy, as suggested by the classical economists and their adherents, this article studies the impact of public debt on the exchange rate in Nigeria.

1.1 Research Hypothesis

H_{01} There is no significant relationship between Public debt and exchange rate stability in Nigeria;

2. Literature Review

Public debt is the total amount that the government has borrowed from domestic or foreign sources (Mayo, 2016). It is the sum of the government or public authority's borrowing both domestically and internationally (Nnamocha, 2018). Through changes in the amount, composition, and interest rates of this debt, public debt is a tool used to control the economy (Bhatia, 2017).

Hycenth (2017) also agreed with Nnamocha (2018) that public debt is the total borrowing by the government or public authority at home and overseas. That is, public debt is the amount of the country's contractual obligations and liabilities to individuals, institutions and other creditors. It is the aggregation of past deficits less past surplus. Since it accounts for a sizable portion of the economy's overall credit supply, public debt is an essential weapon employed by the government to regulate the currency exchange rate, inflation, and other factors. The use of the fund and the conditions to which it is subject determine whether public borrowing is suitable.

According to Anyanwu (2015) "public debt is claim against government by foreigners, and the private sector of the economy whether interest bearing or not (and including bank held debt and government currency if any)-less claims held by government against the private sector and foreigners". Public debt may be classified according to their sources: internal or domestic public debt and external public debt.

According to Omoruji (2017), the following factors are the main contributors to Nigeria's public debt: ineffective financial resource mobilization, sources of borrowing, currency composition of external borrowings, bunching of maturities, inadequate debt monitoring system, and ineffective fund management.

Public debt often has a negative impact on economic growth, savings, investments, income distribution, and price level. The Central Bank is tasked with managing the government's debt, which includes giving advice on when to issue debt instruments and the terms of the issue, soliciting public subscriptions for the issue, collecting the proceeds for the government, overseeing the issuance of certificates and warrants, keeping accurate books of accounts for receipts and disbursements, and paying interest and principal on time.

3. Public Debt and Exchange Rate

Scholars have disagreed throughout the years over the connection between exchange rates and various macroeconomic problems. It is impossible to overstate the significance of the exchange rate as a macroeconomic variable in developing and transitional nations. Imports, price range, exports, and other economic activity are affected. Over the years, the exchange rate has had an impact on the export and import of products and services, which has an impact on the level of prices in the economy. "The objective here is to identify the existence of a determination relationship between a component of external debt and exchange rate variation, to determine the intensity of this correction, is to select variables showing the most intense connection and to parameterize a linear regression model suitable for exchange rate forecasting," according to Bratu (2019). In order to choose a model, create linear regression estimators, and assess the model's reliability, research technique relies on the correlation between variables.

4. Theories of Public Debt

4.1 Classical Theory of Public Debt

The national debt was not favored by the classical economists. "Laissez Faire" policy was a cornerstone of classical economics. The classical school of thought upholds the notion that the government should only maintain internal law and order, provide protection against foreign attack, and concentrate on doing its constitutionally mandated duties. They think the economy can reach full employment, there is ideal competition, and the migration of production elements from one location to another. They embrace individualism and came to the conclusion that the engine driving national interest is self-interest.

Smith (1776), confirms the above theory by saying that "the problems of public debts are as a result of a rise in the government expenditures. So, he opined that it is because of the understanding that there will be loans available in times when the state needed it that motivate the state not to have budgetary savings during peace time".

Say (1929) states that "supply creates its own demand, and that the entire economy was self-regulating. Thus, lowest amount of state action and government interference was recommended". He criticized public debt. According to him, "There is a remarkable distinction between an individual borrower and a borrowing government, the former

borrowed capital for the purpose of the barren consumption and expenditure". He added that, "public borrowing is not only unproductive because the capital is consumed and lost, but in addition, the nation is burdened by the annual interest payment. It cannot be argued that the annual circulation of interest payment is a net addition to capital".

4.2 Neo-Classical Theory of Public Debt

The neo-classical economists uphold the view of the classical economists on the issue of public debt.

Pigou (1920) believes in human welfare, which is known in welfare theory. In his book titled "Economics of welfare" he submitted that the main reason of economic study is to help in social improvement. Pigou sees ideal output as "composition of production such that no alternative output which could be obtained by means of re-allocation among the various industries in the economy's resource would by itself achieve ideal output. If and only when a private market relationship departs from ideal output; then state intervention was justified".

4.3 Modern Theory of Public Debt

The economic philosophers' idea of "Laissez faire" about public debt in contemporary finance was drastically altered. After the Great Depression of the 1930s, the situation shifted significantly. The shift caused the traditional theory of public debt, which presupposed full employment and wasteful public spending, to disintegrate. On the basis of these presumptions, the traditional argument against governmental borrowing was based. Keynes and his supporters considered the public debt's ability to generate income and opposed to the idea that future generations may be burdened by internal debt.

4.4 Keynesian Theory of Public Debt

The economic crisis brought on by the Great Depression of the 1930s led to the development of the contemporary idea of public debt. The long-held belief that a perpetually unbalanced budget and a steadily rising public debt were what kept countries' finances stable gave way to a new theory that contends that a large national debt is an economic asset rather than a liability and that persistent deficit spending is essential to the country's ability to maintain full employment.

4.5 Post-Keynesian Theories of Public Debt

Even if the non-developmental component of the public debt was large and government spending was increasing quickly, the two factors that further sparked interest were the enormously expanding public debt and the developed nation going through a phase of inflation in the Post-Keynesian era. The debate over whether and how to evaluate the cost of the recent increase in public debt was revived. In his principles of public debt book from 1958, James M. Buchanan contested the notion that public debt has no negative economic effects and cannot be passed on to future generations, regardless of how it is financed. Later, Buchanan's proposal was approved by J. E. Meade and R. A. Musgrave.

4.6 Theories of Exchange Rate Determination

In general changes in money supply has implications for exchange rate in an economy. Changes in the demand for and supply of money between two countries affect the exchange rate (Olisadebe, 1991).

The Balance of Payments Theory: This theory states that the balance of payments affect and determine the exchange rate of currency in a freely floating exchange rate regime. The assumption is that, if the balance of payments has a favourable balance, the exchange rates tend to rise. On the other hand, when the balance of payments has an unfavourable balance, the exchange rate tends to depreciate.

Purchasing power parity theory: This theory advocates that there must be equilibrium between exchange rate and inconvertible paper currencies which is predicted by the quality of their purchasing powers. That is, the rate of exchange is predicted by their relative price levels. The implication is that when there is change in the price level, the exchange rate equally changes.

Market Expectation: This is very important in determining exchange rates. The important components consist of the forward rate, the technical and psychological factors, market participants, most times want to cover themselves from the exchange risks that result from exchange transactions.

5. Empirical Review

Amaefule (2018) examined "the effect of public debt on the performance of Nigeria's economy. Economic performance was measured with the nation's Gross Domestic Product (GDP), Public Capital Investment (PCI) and the Human Development Index (HDI)

while public debt was measured with external debt, domestic debt and total debt servicing. Data on the variables were sourced from the Central Bank of Nigeria Statistical bulletin, Debt Management Office reports and World Bank publications for the period of 1991 to 2016. Stationarity test using Augmented Dickey-Fuller Unit Root Test was used to confirm the stationarity of the data used. Ordinary Least Square Regression Model was adopted in analyzing the data. Findings indicate that external debt exerted significant negative effect on GDP and PCI without any evidence of significant effect on HDI. Result also indicated that domestic debt warranted significant positive effect on all the economic development indices while total debt servicing showed no statistical evidence of significance on any of the economic development proxies. The implication of the finding is that the huge external debt records together with the associated debt servicing cost are not justified; the government has not judiciously utilized the proceeds from such loans.”

Mupunga (2015) analyzed “the impact of macroeconomic shocks on public debt in Zimbabwe. The study applied the Bayesian Vector Regression (BVAR) Model to simulate the impact of macroeconomic shocks on public debt. The results showed that Zimbabwe’s public debt is more vulnerable to interest rate, exchange rate, economic growth and primary balance shocks. Together these shocks account for about 61 %of forecast error variation in the debt to GDP ratio. From this analysis, the major policy implication is the need for government to pay particular attention to automatic debt dynamics. It also indicated need to maintain the primary balance at manageable levels as well as instituting growth enhancing policies to ensure long-term sustainability of public debt. The need for appropriate selection of the currency composition of public debt is also necessary to mitigate the risk of unexpected increase in public debt from adverse external sector developments.”

Keigo, K & Masao, N (2018) analyzed “the influence of public debt on Japan’s macroeconomic stability. The study constructed three IS-LM type dynamic models estimate the Eigen-values of their differential systems. Then confirm whether or not the huge amount of public debt violates the stability conditions for the Japanese economy. The researcher estimation concludes the Japanese economy to be unstable with the existence of saddle point equilibrium. Their simulation also shows that severe tax reform would be required to restore the economic stability concretely the government has to raise the consumption tax rate to 15% from 5% and in addition, allowing the income elasticity’s of income taxes and inhabitant taxes to increase by 0.033% each

which is equivalent to tax hikes of about 8.3 trillion yen. They therefore, assert that structural reform for the government budget including a tax system is essential and emergent.”

Ajayi, (2019) examined “the effect of public debt on exchange rate in Nigeria. The researcher used ordinary least square, on the secondary data sourced from the CBN and DMO among other sources. Findings reveals that, all the dependent variables, that is, external debt, debt service payment and foreign reserve proved to be statistically significant in explaining exchange rate fluctuation in Nigeria within the period of observation, with debt service payment having the strongest effect. Based on the findings, the study recommends that government should ensure that all public borrowing, where and when necessary, be directed towards productive economic activities which can generate returns to service and pay up the debt at maturity.”

Israel, Richard, Meluin, and Blessing, (2018) examined “the external debt, foreign exchange and sustainable debt management: the Nigeria experience (1980-2017). The work which selected Nigeria as its sample covered a period of 37 years. The model developed for the research has sustainable debt management (SDM) as dependent variable and independent variable were; External Debt (ED) and foreign exchange (EXCHR). Secondary data were collected from the Central Bank of Nigeria and National Bureau of Statistics. The techniques used for analysis are the ordinary least square techniques, the augmented dickey fuller unit root test techniques and the cointegration test. The econometric techniques of ordinary least square (OLS) results show that exchange rate had significant relationship with SDM in both short and long periods while external debt showed positive but insignificant relationship with SDM in both periods. The study concludes that while there is a significant relationship between EXCHR and SDM in both short-run and long-run periods, there is however, an insignificant relationship between ED and SDM in both periods. The study also recommend amongst others appropriate pricing of external debt by the government and the engagement of such debt only for reproductive assets while diversifying the export base to earn sustainable foreign exchange, as these will assist in ensuring the attainment of sustainable debt management.”

Nnamocha and Akamike (2019) investigated “the Public Debt, External Reserve and Sustainable Economic Growth in Nigeria from 1988-2017. The model was estimated using annual time series data on real gross domestic product as the dependent variable

while Real Debt Stock, Real Debt servicing, Real External reserve and Real Exchange rate were the independent variables. Annual data for the study were sourced from the Central Bank of Nigeria Statistical Bulletin (2018 edition). A pre-test was carried out to check for the stationarity of the data and it revealed that Real Debt Servicing and Real External Reserve are stationary at level while Real Debt Stock, Real Exchange rate and Real Gross Domestic Product are stationary at first difference. The study used the ARDL Bounds test approach to estimate the long run relationship between Public Debt, External Reserve and Economic Growth in Nigeria. The result showed that there exists a long run relationship among the variables in the model. Also using the P-value at 5% critical value, it was revealed that there exist uni-directional causality relationship between Real Debt Stock and Real Debt servicing, that is Real debt stock granger causes Real Debt Servicing while Real Debt Servicing does not granger causes Real Debt Stock. In addition, the above result also revealed that there exist a uni-directional causality between Real Exchange rate and Real Debt Servicing, that is, real exchange rate granger causes real debt servicing while real debt servicing does not granger causes real exchange rate. It is recommended that Government should ensure that debt stocks are judiciously spent and solely for the purpose for which the borrowing is made.”

6. Literature Gap

Several studies dealt with public debt and exchange rate (Amaefule 2018; Mupunga 2015; Keigo, & Masao, 2018; Ajayi, 2019; Israel, Richard, Meluin, and Blessing, 2018; Nnamocha and Akamike 2019; etc.). These studies used either of external debt, exchange rate, and interest rate as the main variables. However, none of these previous variables considered ratio analysis of the country’s public debt servicing. For instance, the amount of the country’s external debt that is being serviced annually is still unused in economic literature likewise the ratio of Nigeria’s domestic debt servicing. This is seen as gap in the literature and as such, this study introduced the two variables as corollaries to public debt (aggregated).

Again, previous models adopted the Error Correction Model (short run analysis) and the RDL model framework in their discussion of the relationship between public debt and macroeconomic performance. The use of advanced econometric technique such as the Vector Auto regression (VAR) is still very scanty in this area of study.

The time scopes of previous studies were limited to 2016 and 2017 as evident in the works reviewed. The current study is updated to 2019. This fills time gap.

Model Specification

The specification of a model involves establishing a relationship between a dependent variable and a set of independent variables within a statistical framework

Our model modified the model of Ohwofasa, *et al* (2012) by aggregating external debt and domestic debt as one variable to obtain total public debt and also introducing ratio of external debt servicing to total external debt and the ratio of domestic debt servicing to total domestic debt in addition to the primary variable – public debt and exchange rate. The model is formulated thus:

$$EXR = f(Public\ Debt) \dots 1.1$$

Where: EXR is exchange rate of Naira to the US Dollar.

The public debt variables as identified from empirical and conceptual review include total public debt stock, ratio of domestic debt service to total domestic debt, ratio of external debt service to total external debt. These will now replace the public debt variables as explanatory variables and we re-specify as follows:

$$EXR = f(PDBT, REXTD, RDDT) \dots 1.2$$

Where;

EXR = Exchange rate of Naira to the US Dollar

PDBT= Public debt (external plus domestic debt stock)

REXTD = Ratio of external debt servicing to total external debt

RDDT = Ratio of domestic debt servicing to total domestic debt

In order to appropriately model the equations (1.2), we model an inter-relationship between the variables by adopting the Vector Autoregression (VAR) model. Thus, we model a VAR equation from each of the pivotal equations as shown below:

Where, EXR, PDBT, REXTD and RDDT are as

$EXR = f(PDBT, REXTD, RDDT)$

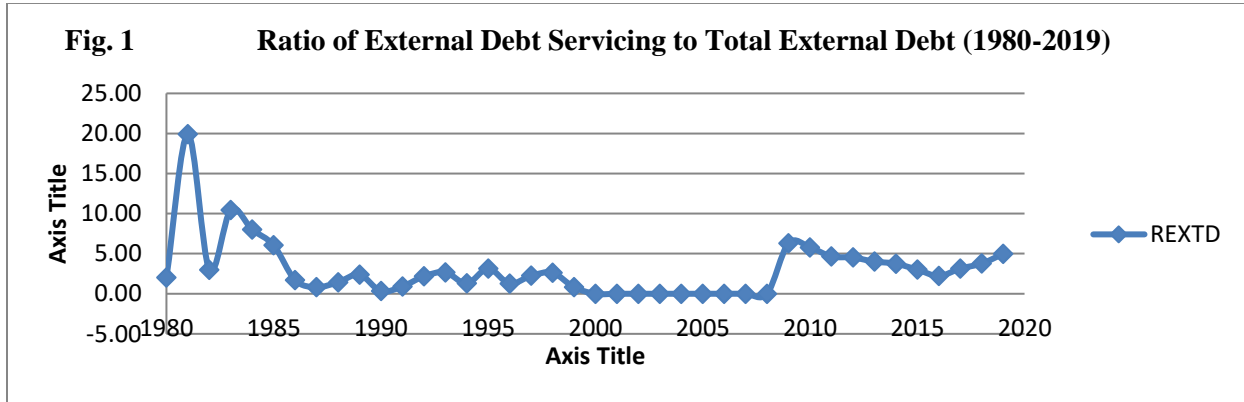
previously defined and “f” is the functional notation. In order to standardize the variables, we take the log-linear forms of the equations by taking the natural logarithm (Ln) of the variables in the RHS and LHS. The inter-relatedness of the public debt variables as a modification of the model of Ohwofasa, *et al* (2012) is a Vector Autoregressive model represented as follows:

$$EXR_t = \beta_0 + \beta_1 \sum_{j=1}^k PDBT_{t-1} + \varepsilon_{1t}$$

..... 1.3

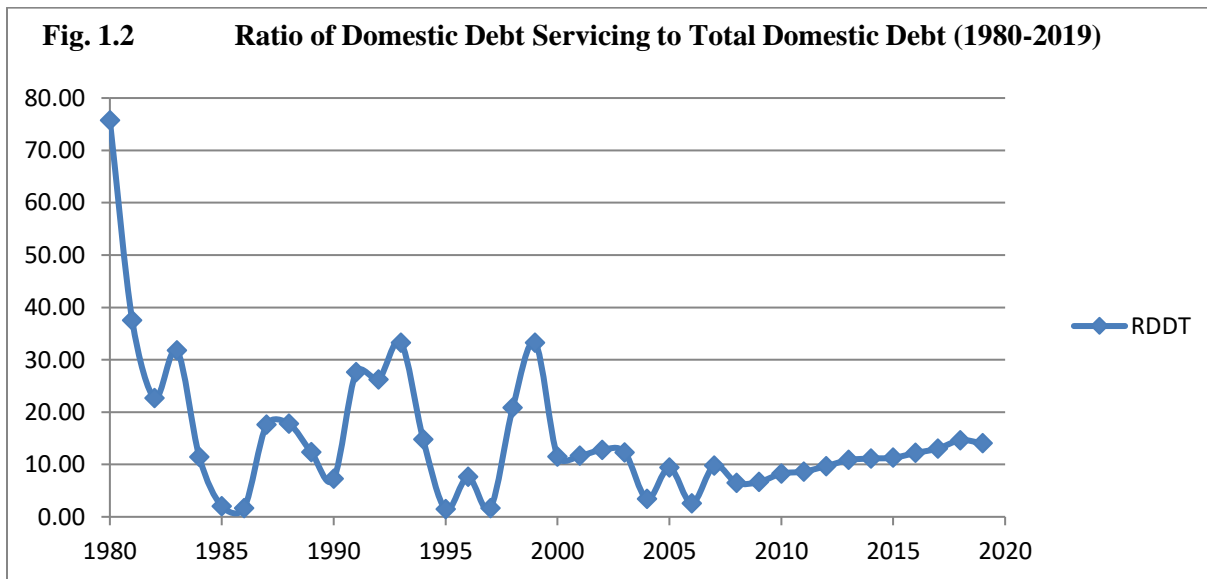
Where, “EXR” represents the matrice of the exchange rate variables, while “PDBT” is the matrice of the public debt variables.

Data Presentation



Source: Central Bank of Nigeria (CBN) Statistical bulleting 2019.

The figure indicates a fluctuating trend in external debt servicing to total debt and a continuity rising profile in the 1920s.



Source: Central Bank of Nigeria (CBN) Statistical Bulletin 2019.

The figure shows a fluctuating trend in the 1980s and 1990s and slowly but continual increase in the 2000s

7. Data Analyses and Interpretation

Unit Root Test

Table 1 below shows the stationarity test which was carried out using the Augmented Dickey Fuller (ADF) unit root test.

Table 1.1: Summary of Unit Root Test Result

Variable	ADF Test statistics		Decision Rule	Order of Integration
	At Level	1 st Difference		
LnEXR	-1.023492	-5.403759	Stationary at 1 st difference	I(1)
LnPDBT	-2.225234	-4.547946	Stationary at 1 st difference	I(1)
REXTD	-0.596884	-19.59585	Stationary at 1 st difference	I(1)
RDDT	-1.588242	-7.152568	Stationary at 1 st difference	I(1)

Critical value at 5% level = -2.941145

Source: Computed from E-Views 9.0

The unit root test above indicates that the variables EXR, REXTD and RDDT are stationary at first difference, which implies that variables are integrated of order one, I(1). While PDBT is initially stationary at level but the inclusion of trend and intercept made them to be stationary at first difference i.e. I(1). Thus, we have an I(1) stationary series which is very ideal for the fitting of a VAR or VEC model upon confirmation of the long run relationship amongst the variables, i.e. cointegration.

Johansen Cointegration Test

Table 2: Johansen Cointegration Test Results

Hypothesized No of CE (S)	Trace Statistic				Max-Eigen Statistic			
	Eigen-Value	Trace statistic	5% Critical Value	Prob**	Max-Eigen statistics	5% value	Critical	Prob**
None	0.8020	133.85	195.154	0.5682	61.5473	65.0776		0.4001
At most 1	0.5591	72.307	169.819	0.3312	31.1199	33.8769		0.1030
At most 2	0.4469	41.188	47.8561	0.1828	22.5085	27.5843		0.1955
At most 3	0.2562	18.679	29.7971	0.5162	11.2492	21.1316		0.6225
At most 4	0.1499	7.4299	15.4947	0.5282	6.17214	14.2646		0.5912
At most 5	0.0326	1.2577	3.84147	0.2621	1.25774	3.84147		0.2621

**Trace test indicates no cointegration at the 0.05 level

**Max-eigen value test indicates no cointegration at the 0.05 level

The Johansen cointegration tests summarized in table 2 above reveals that the Trace and Max-eigen statistics indicated no Cointegration at the 5% level. This means that there is no long-run relationship between public debt variables and exchange rate indicators in our model. Thus, the relationship between public debt and exchange rate is only in the short run and as such we estimate the short run VAR model.

The short run VAR model is also better known as the unrestricted VAR model as it does not include the error coefficient. In line with the VAR estimation, we shall carry out the important tests in a VAR model which includes the Granger Causality test, Impulse Response Function and the Variance Decomposition of the public debt variables.

Lag Selection Criteria

The optimal lag for the VAR model is selected using the Akaike information criteria (AIC). The criteria Table is shown below:

Table 3: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-333.1811	NA	2.280622	17.85164	18.11020	17.94363
1	-116.8912	352.8940	0.000177	8.362697	10.17266*	9.006668
2	-60.12005	74.69894*	6.87e-05*	7.269476*	10.63084	8.465423*

* indicates lag order selected by the criterion

The asterisk sign (*) at Lag 2 under the AIC criterion column means that the system automatically selected only 2 lag periods for the VAR model having automatically computed the values at various lag periods. Thus, we adopt 2 lags for our VAR model.

Granger Causality Test

The causal relationship between the variables is determined using the Granger causality test. This test is carried out at 2 lag periods in line with the lag selection criteria which is necessary to in VAR model estimation.

Table 4: Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
PDBT does not Granger Cause EXR	38	3.14980	0.0560
EXR does not Granger Cause PDBT		0.11295	0.8935
REXTD does not Granger Cause EXR	38	1.35687	0.2715
EXR does not Granger Cause REXTD		1.50767	0.2363
RDDT does not Granger Cause EXR	38	4.83955	0.0144
EXR does not Granger Cause RDDT		0.62278	0.5426

Source: Eviews 9 Output

The granger causality test summarized above shows that there is a bidirectional relationship between public debt (PDBT), ratio of external debt servicing (REXTD) and EXR. This means that current trends in Nigeria’s public debt and external debt servicing can be used to predict the exchange rate of the country and vice versa.

Result of variance decomposition of exchange rate

The Table 4 above shows that the amount of information exchange rates contributes to the public debt variables in the Autoregression in the 10th period was 3.67%, 5.20% and 28.16% for public debt (PDBT), ratio of external debt servicing (REXTD) and ratio of domestic debt servicing (RDDT) respectively.

The analysis shows that ratio of domestic debt (RDDT) contributes more to exchange rate in the VAR model with the highest percentage of 28.16% in the 10th period.

PDBT, REXTD and RDDT variables ranged from 1% to 17%. This means that between 1% - 17% of the forecast error variance of EXR is being explained by exogenous shocks to the public debt variables.

Estimation of the VAR Model

The Vector Autoregressive model (VAR) model estimates the interrelationship amongst variables. It shows the variables as both endogenous and exogenous and is deemed to be most appropriate in this study of the interaction between public debt and exchange rate indicators. The estimates are summarized below:

Table 5: Summary of the VAR Model Estimates for Exchange Rate Equation

	LNEXR	LNPDBT	REXTD	RDDT
aaaaaLNEXR(-1)	0.698679 (0.29531) [2.36590]	-0.126058 (0.27466) [-0.45896]	-3.043045 (1.91533) [-1.58879]	-7.713206 (8.95133) [-0.86168]
LNEXR(-2)	-0.049290 (0.27238) [-0.18096]	0.101695 (0.25333) [0.40143]	3.988459 (1.76661) [2.25769]	6.466290 (8.25630) [0.78319]

LNPDBT(-1)	0.159931 (0.31568) [0.50662]	1.243434 (0.29360) [4.23510]	2.364141 (2.04743) [1.15469]	8.873699 (9.56871) [0.92737]
LNPDBT(-2)	0.016349 (0.30806) [0.05307]	-0.266208 (0.28652) [-0.92912]	-3.016914 (1.99802) [-1.50995]	-8.341095 (9.33781) [-0.89326]
REXTD(-1)	0.000702 (0.01753) [0.04004]	0.015090 (0.01630) [0.92558]	0.154976 (0.11369) [1.36309]	-0.542015 (0.53135) [-1.02007]
REXTD(-2)	-0.007897 (0.01461) [-0.54057]	-0.000573 (0.01359) [-0.04218]	0.357422 (0.09475) [3.77218]	0.144868 (0.44283) [0.32714]
RDDT(-1)	0.008560 (0.00671) [1.27474]	0.007226 (0.00625) [1.15712]	0.060949 (0.04355) [1.39952]	0.443783 (0.20353) [2.18041]
RDDT(-2)	-0.010317 (0.00512) [-2.01512]	-0.008278 (0.00476) [-1.73850]	-0.052674 (0.03320) [-1.58632]	-0.074663 (0.15518) [-0.48113]
C	-0.161615 (0.50633) [-0.31919]	0.387017 (0.47092) [0.82183]	2.296295 (3.28397) [0.69924]	8.943958 (15.3477) [0.58276]
R-squared	0.981786	0.986577	0.605188	0.279314
Adj. R-squared	0.976762	0.982874	0.496275	0.080505
Sum sq. resids	2.131354	1.843656	89.65616	1958.256
F-statistic	195.4029	266.4293	5.556589	1.404933

The coefficient of exchange rate on its own first and second period lag is positive and significant in the first period lag but insignificantly negative on the second period lag. Interestingly, in the first period lag, all the public debt variables have positive effects on exchange rate.

Furthermore, increase in exchange rate decreased public debt stock by 0.1261 units in the first period lag. Also in the same first lag, a unit change in exchange rate decreased both ratio of external debt servicing and domestic debt servicing by 3.043 and 7.713 units respectively. In the second period lag, this changed to positive effect as exchange rate increased the three public debt variables.

The R-squared showed high fitness for public debt (PDBT) and ratio of external debt servicing (REXTD) with explanatory powers of 98.65% and 60.52%. Ratio of domestic debt servicing has a low explanatory power of 27.93%.

Test of Research Hypotheses

The hypothesis formulated for this study is tested here using the F-statistic. The joint F-test validates the joint significance of the variables in the VAR system of equations and the hypothesis are restated below:

H_{01} : There is no significant relationship between public debt and exchange rate in Nigeria.

Table 6: Summary of Joint Hypotheses Test

Hypotheses	t-statistic	t-table ($F_{0.05,6,40}$)	Decision
Hypothesis 1	-0.6113	1.960	Accept null hypothesis (H_{01}) since $t-cal < t-tab$

** the t-cal values at lag 1

We accepted the null hypotheses one (H_{01}). This is an indication that no significant relationship exist between public debt and exchange rate.

Autocorrelation Test

The serial correlation LM test is summarized in the Table 7 below:

Table 7: Serial Correlation LM Test Result

Null Hypothesis: no serial correlation at lag order h

Lags	LM-Stat	Prob
1	34.83938	0.2230
2	31.92638	0.6628

Source: Eviews 9 output

The VAR residual serial correlation LM test revealed that there was no autocorrelation in the model. This was evident in the insignificant p-value of the LM-stat at lag 2 (0.6628) which led to the acceptance of the null hypothesis of no serial correlation at both lags one and two.

8. Discussion of Findings

The findings from the unit root and conintegration tests showed that the variables were all stationary after first difference and are not cointegrated. The absence of cointegration in the model showed that there is no long run relationship and this confirmed the fitting of a VAR model as specified by Sims (2001).

There s no significant relationship between public debt and exchange rate in Nigeria. Also ratio of external debt servicing to total external debt stock was insignificant. This result agrees with Amaefule (2018) that public debt do not have significant relationship with exchange rate.

The analysis shows that ratio of domestic debt contribute more to exchange rate with 28.16% in the 10th period in the Autoregression test. This result relates to Mupunga (2015) that Zimbabwe public debt is vulnerable to exchange rate. It is however contrary to Ajayi (2019) that external debt, debt service pay and foreign reserve prove to be statistically significant in explain exchange rate fluctuation in Nigeria within the author’s study period.

Conclusion: Conclusively, it is found that public debt have negative effect on exchange rate within the period in question.

9. Recommendations

- There should be a concerted effort to reduce the level of external debt procurement which will invariably decrease external debt servicing.
- Since public debt had significant relationship exchange rate, government should intensify revenue drive through exploring other viable sources like bond, stock market, etc. instead of relying on budget augmentation through public debt accumulation.
- The increasing effect of external debt servicing on exchange rate means that even if the Nigerian government is going to borrow externally, the money should be used for productive purposes that will grow the economy and generate more returns that will be used to service the debts in the near future.
- Nigeria’s exchange rate is being heavily affected by public debt and its associated variables. There should be long term plan to diversify the economy and the revenue base of the economy through the exploration of the huge potentials presented by the non-oil sector of the Nigerian economy.

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Appendices

Table 4.1: Exchange Rate, Public Debt Stock, Ratio of External Debt Servicing to Total External Debt Stock and Ratio of Domestic Debt Servicing to Total Domestic Debt Stock (1980-2019)

Year	Exchange Rate	Public Debt Stock N' billion	Ratio of External Debt Service to External Debt	Ratio of Domestic Debt Service to Domestic Debt
1980	0.5640	7.52	2.04	75.72
1981	0.6100	13.52	19.92	37.53
1982	0.6729	23.83	2.99	22.67
1983	0.7241	32.80	10.46	31.76
1984	0.7649	40.48	8.00	11.41
1985	0.8938	45.25	6.05	2.04
1986	2.0206	69.89	1.71	1.67
1987	4.0179	137.58	0.83	17.57
1988	4.5367	180.99	1.43	17.78
1989	7.3916	287.44	2.38	12.32
1990	8.0378	382.71	0.33	7.25
1991	9.9095	444.65	0.91	27.64
1992	17.2984	722.23	2.18	26.25
1993	22.0511	906.98	2.68	33.28
1994	21.8861	1,056.40	1.29	14.78
1995	21.8861	1,194.60	3.13	1.49
1996	21.8861	1,037.30	1.27	7.63
1997	21.8861	1,097.68	2.25	1.67
1998	21.8861	1,193.85	2.62	20.82
1999	92.6934	3,372.18	0.82	33.22
2000	102.1052	3,995.63	0.0003	11.52
2001	111.9433	4,193.27	0.0003	11.67
2002	120.9702	5,098.89	0.0003	12.78
2003	129.3565	5,808.01	0.0002	12.31
2004	133.5004	6,260.59	0.0002	3.39
2005	132.1470	4,220.98	0.0004	9.40
2006	128.6516	2,204.72	0.0022	2.57
2007	125.8331	2,608.52	0.0023	9.79
2008	118.5669	2,843.56	0.0019	6.49
2009	148.8802	3,818.47	6.31	6.65
2010	150.2980	5,241.66	5.78	8.26
2011	153.8616	6,519.69	4.66	8.63
2012	157.4994	7,564.43	4.52	9.68
2013	157.3112	8,506.30	4.02	10.85
2014	158.5526	9,535.52	3.76	11.14
2015	193.2792	10,948.51	3.01	11.28
2016	253.4923	14,537.11	2.22	12.20
2017	305.7901	18,377.01	3.13	13.05
2018	306.0802	20,533.60	3.77	14.63
2019	306.9206	23,295.05	4.97	14.05

Sources: (1) Central Bank of Nigeria (CBN) Statistical Bulletin 2019 Edition
 (2) Debt Management Office (DMO), publications for various issues, Abuja, Nigeria.