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Domestic Debt Holding and Public Infrastructure in Nigeria: An ARDL Approach

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Abstract

This study investigates the effect of total domestic debt and domestic debt holdings on public infrastructure expenditure in Nigeria using the ARDL model. The dimensions of domestic debt holdings are CBN, commercial banks, merchant banks, total banking sector and non-banking public, while total capital expenditure is used to proxy public infrastructure. The empirical analysis based on quarterly data covering from 1981Q1 to 2016Q4. There is evidence that holding of domestic debt by the total banking sector has a positive effect on capital expenditure while holding of debt by both commercial banks and CBN have negative effects. Further, our results suggest that the effect of total public debt is statistically insignificant. Therefore, our evidence largely supports the crowding out effect theory of public debt which states that government's fiscal actions crowd out private investments when increased government expenditure, financed by either increase in taxes or issuance of more debt instruments, has no overall economic benefit. It is therefore, our view that the on-ongoing debt restructuring by the Federal government towards external long term debt is a welcome development.

Keywords:
Domestic debt holding, Public infrastructure, Capital expenditure

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Background to the Study

All over the world, infrastructure financing is a major issue of concern for sovereign governments, investors, public policy analysts etc. and has received considerable scholarly attention, especially in the context of poor and developing countries. This is because, infrastructure provisions such as roads, rails, education, hospitals etc. play a significant role in economic development and growth. The global significance of public infrastructure has been highlighted in the literature. World Economic Forum (2013) identifies infrastructure deficit as among the major supply chain barriers to trade that hampers world GDP. It is estimated that if border administration and transport and communications infrastructure and related services can be improved by every country, even halfway to the world's best practices, global GDP and export could increase by 5% and 16% respectively. By comparison, if all forms of tariffs are eliminated, the global GDP and exports could increase by 0.7% and 10.1% respectively (WEF, 2013). The argument is that improving infrastructure and removing other forms of supply chain barriers would significantly reduce resource waste while removing tariffs is mere resource reallocation (WEF, 2013).

Generally, infrastructural developmental programmes can be financed either by either taxes or by borrowing. However, it has been argued that since taxes have distortionary effects and can cause intergenerational problems if used excessively, governmentsmust rely on public borrowing to finance their developmental programmes aimed at improving social welfare and living standards (Akram, 2011). According to Gill and Pinto (2005), governments leverageon public borrowing to accelerateeconomic growth by investing in key infrastructural projects, especially in developing countries where taxation has limited capacity and government cannot rely on printing money that would naturally cause high and volatile inflation.

Broadly, public debt has two dimensions; namely, domestic debts and external debts. Whereas domestic debts are government borrowing from the domestic debt market with instruments such as treasury bills, treasury certificates, development stocks etc., external debts are public debts are government borrowing from the international sources such as bilateral agreements, Paris club, London Club and Multilateral organizations. According to Panizza (2008), the difference between the two dimensions of public debt can be viewed in terms of place of issuance and the law that governs the debt contract. Domestic debts are issued in the domestic debt market that is governed by local laws, external debts are issued in international debt markets that are governed by international laws.

In Nigeria, as evident in Figure 1.1, the Federal government largely relies on the domestic debt to finance capital expenditure and budget deficit, although, since 2012, external debt stock has steadily increased. However, this increasing trend in public external debt is in line with the debt management strategy, which sets a target of 60:40 optimal debt composition for domestic and external debts respectively to be achieved by the end of 2019 fiscal year (DMO, 2016). Further, as evident in Figure 1.2, the Federal government bonds, which are the most liquid and capitalized bond in Nigeria (NSE, 2019), has

continued to be the main source of domestic debt, followed by treasury bills and then by treasury certificate. A closer look at Figure 1.2 also shows that since 2012, the proportion of FGN bonds has continued to show an upward trend while both treasury bills and treasury certificates has been showing a decreasing trend. This underscores the importance of long-term sources in financing public infrastructure.

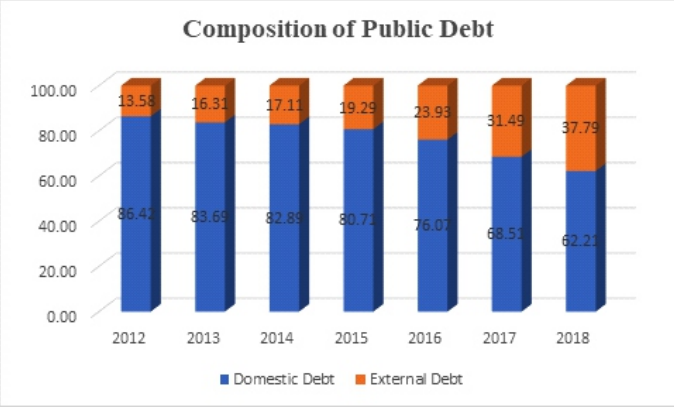

Figure 1: Composition of Public Debt
Source: Researcher using CBN data

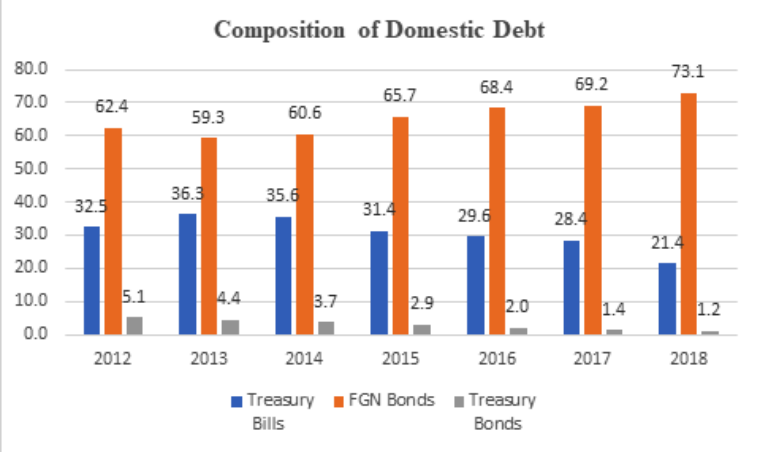

Figure 2: Composition of Domestic Debt
Source: Researcher using CBN data

In terms of domestic debt holdings, available statistics from CBN (see Figure 1.3) shows that between 2012 and 2017, the banking systems holds approximately 54.5% of the total domestic debt, while the remaining 45.5% are held by non-banking public. Also, the proportion of the banking system holding by commercial banks is quite substantial being 70.1%, compared to the proportion held by CBN, merchant banks and sinking funds which stood at 18.1%, 8.7% and 3.1% respectively.

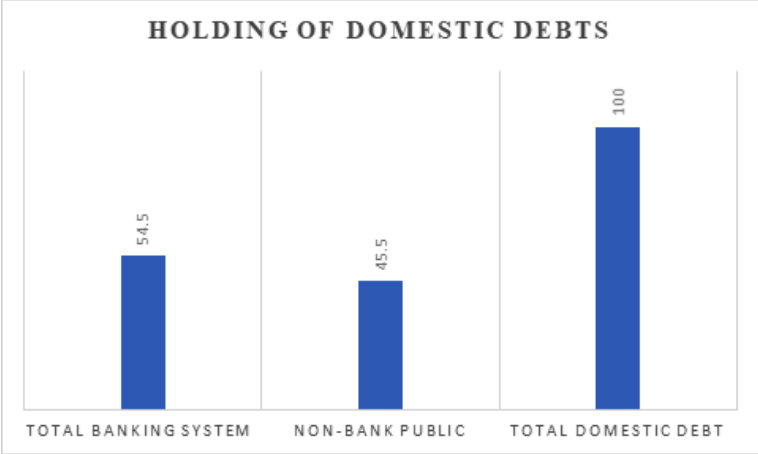

Figure 3: Holding of Domestic Debt
Source: Researcher using CBN data

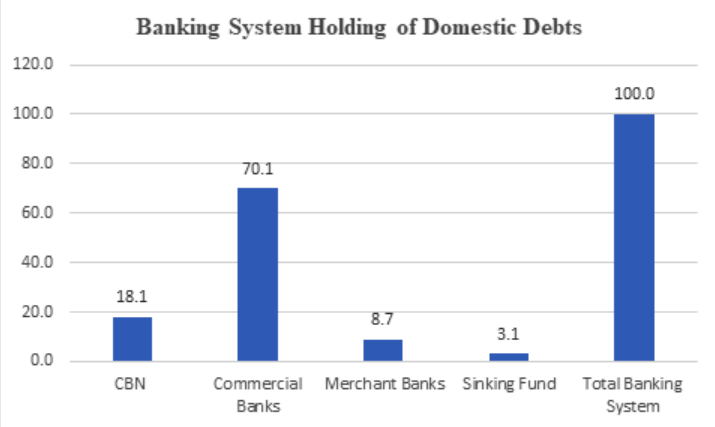

Figure 4: Banking System Holding of Domestic Debt
Source: Researcher using CBN data

Theoretically, using public debt to finance public expenditure can crowd out private sector investment and produce little or no overall economic benefit. According to Carlson and Spencer (1975), government's fiscal actions crowd out private investments when increased government expenditure, financed by either increase in taxes or issuance of more debt instruments, has no overall economic benefit. Higher government expenditure raises the demand for goods and services, which in turn raises interest rates. Higher interest rates lead to high cost of capital, thereby reducing private investment (Ahmed & Miller, 2000). Also, government's borrowing from the capital market causes interest rate to rise, thereby reducing both the amount of savings available for private investment and the expected rate of return on private capital (Carlson & Spencer, 1975).

Previous studies on the impact of domestic debts produce mixed results. While some studies (for example, Akram (2011), Al-Refai (2015), Christensen (2005)) find evidence supporting the view that domestic debt hurts the economy by crowding out private sector investment, others (for example, Khan and Gill (2009) and Mba, Yuni and Oburota (2013)), find that government borrowing from domestic sources has beneficial effects. Therefore, there is no consensus on the impact of domestic debt on the economy.

This study contributes to the on-going dialogue by considering effect of domestic debt holding on public infrastructure in Nigeria within the ARDL framework using quarterly data from 1981 to 2016. The current study is distinct in two important ways. First, it is the first to examineempirically the different holdings of public domestic; namely, CBN, commercial banks, merchant banks, total banking system and non-banking public, and how they affect public infrastructure in Nigeria. Most of the previous Nigerian studies in this line of research focused mainly on the effects of public debt stock and public debt servicing on economic growth. Second, compared with previous empirical studies in Nigeria which are mostly based on annual data, the empirical analysis in this study is based on quarterly data from 1981Q1 to 2016Q4, which gives a total of 144-time series observations. We argue that 144-time series observations are large enough to give more reliable evidence.

The rest of the study is structured as follows: The next section reviews the existing literature on the subject area. Section 3 describes the data and empirical strategy, Section 4 contains the empirical results and discussion of findings. Section 5 concludes the study.

Literature Review

Lora (2007) considers the impact of public debt on public infrastructure investment for seven Latin American countries; namely, Argentina, Brazil, Bolivia, Chile, Mexico, Colombia and Peru, for the period from 1987 to 2001 using the panel data framework. The study finds that public debt and public infrastructure investment are positively related. The study also finds that private investment and public investment are complements, a result that disagrees with the crowd out effects theory.

Lora and Olivera (2007) examine the effect of total public debt on social expenditure for 50 countries worldwide and Latin America from 1985 to 2003. Using the Arellano-Bond first difference GMM approach, they find that public debt has a harmful effect on the economy, with higher debt stocks reducing social infrastructure investment.

Khan and Gill (2009) examine whether government borrowing crowds out private investment in Pakistan for a period of 34 years from 1971- 72 to 2005-06 using the error correction model. In their empirical model, real private investment is the dependent variable while real public sector borrowing, real GDP and nominal interest rate are the independent variables. They find that rather than crowding out effects, public debts crowd in private investment through, contractors, politicians and bureaucrats.

Akram (2011) examines the effect of public debt on both investment and economic growth in Pakistan using the autoregressive distributive lag model. The study specifies two empirical models; one relates investment to public debt and the second one relates economic growth to public debt. For the two models, external debt, domestic debt, debt servicing are the explanatory variables while export, import, trade openness and inflation serve as control variables. The study covers the period from 1972 to 2009 and annual time series data is used. They find evidence of debt overhang effect and conclude that increasing both domestic debt and external debt levels would significantly reduce investment and economic growth both in short run and long run in Pakistan.

Mba, Yuni and Oburota (2013) examine the relationship between government domestic debt and economic growth using annual Nigerian data from 1980 to 2011. The results from multiple regression show that domestic debt has a positive and highly significant relationship with economic growth.

Al-Refai (2015) investigates the relationship between total public debt and economic growth in Jordan between 1990 and 2013 using the Cob-Douglas function. The study specifies two econometric equations; one linking GDP to external debt and the other linking GDP to domestic debt. For each equation, gross fixed capital formation and labour are control variables. The study finds amongst others that while domestic debt has a positive and significant relationship with economic growth, external debt has a negative but insignificant relationship with economic growth. Thus, the crowding out effect theory is supported in Jordan.

Anyanwu, Gan and Hu (2018) investigate the effect of domestic debt for 28 oil-producing countries in the contest of crowding out effect theory. The study focuses on the period from 1990 to 2012 and employs two panel data methods; namely, fixed effects and GMM methods. They find amongst others that domestic borrowing significantly crowds out private sector investment through private sector credit.

Methodology

Data and Sample

Our empirical data comprises 144 quarterly time series observations on total capital expenditure ((TCE) and five dimensions of domestic debt holding; namely, CBN, commercial Banks (CB), merchant banks (MB), total banking system (TBS) and non-banking public (NBP), spanning from 1981Q1 to 2016Q4. However, since most of the variables are officially reported at annual frequency, we converted them into quarterly frequency using the EViews frequency conversion window. All data were sourced from the CBN statistical bulletin and annual reports for different years.

Figure 5 shows the time series plot of the variables in logarithmic form. The Figure shows that all our study variables show an upward trend, except total capital expenditure over time, which shows a downward trend. This indicates that our empirical data may be nonstationary.

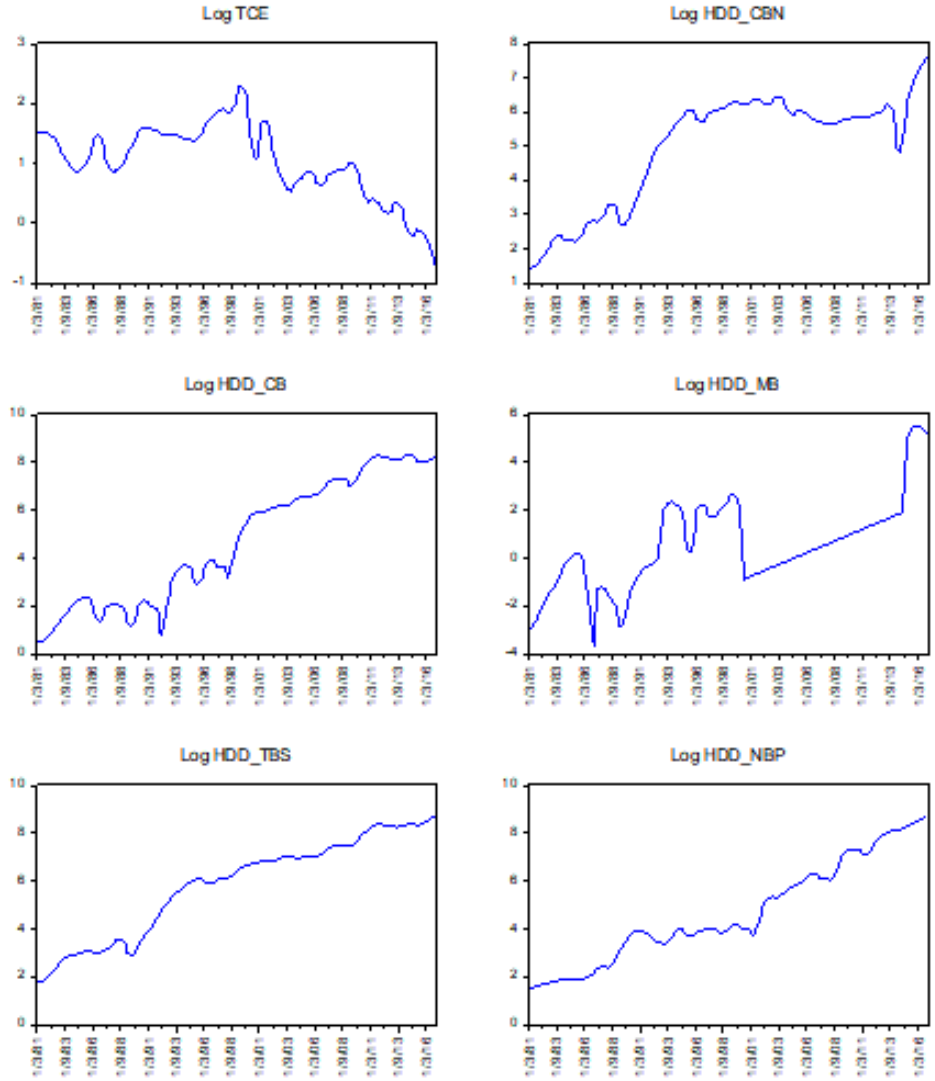

Figure 5: Time series plot of the study variables

Method of Data Analysis

This study employs the autoregressive distributive lag (ARDL) method. The ARDL method is employed because its implied model, which does not discriminate variables based on their levels of stationarity, has dynamic features which is consistent with the behaviour of most financial and macroeconomic time series data. In the context of time series data, a dynamic model is used when it is believed that lagged dependent variable is a significant right-hand side variable and when a causal or explanatory relationship is of interest (Brooks, 2008).

The simple ARDL specification for the relationship between domestic debt holding and public infrastructure are given as follows:

$$LTCE_t = \beta_0 + \beta_1 LTCE_{t-1} + \beta_2 LHDD\_CBN_t + \beta_3 LHDD\_CBN_{t-1} + \beta_4 LHDD\_CB_t + \beta_5 LHDD\_CB_{t-1} + \beta_6 LHDD\_MB_t + \beta_7 LHDD\_MB_{t-1} + \beta_8 LHDD\_TBS_t + \beta_9 LHDD\_TBS_{t-1} + \beta_{10} LHDD\_NBP_t + \beta_{11} LHDD\_NBP_{t-1} + e_t$$

Where;
LTCE = logarithm of total capital expenditure as a ratio of GDP which (proxy for public infrastructure), LHDD_CBN = logarithm of domestic debt holding by CBN, LHDD_CB = logarithm of domestic debt holding by commercial banks, LHDD_MB = logarithm of domestic debt holding by merchant banks, LHDD_TBS = logarithm of domestic debt holding by total banking system and LHDD_NBP = logarithm of domestic debt holding by non-banking public. Further, while β_0 = the model constant, β' are the slope coefficients, and e_t = error term. However, the autoregressive feature of the model is reflected in β_1, which also captures the effect of lagged total capital expenditure on current total capital expenditure. Similarly, while $\beta_2, \beta_4, \beta_6, \beta_8$ and β_{10} are the contemporaneous coefficients, β_3, β_5, β_7, β_9, and β_{11} are the distributive lag coefficients that capture the lagged effects of the main explanatory variables.

The subscript *t* represents the current time period while *t* – 1 represents the previous time period. However, the number of lags to be included in the ARDL model for optimum specification would be determined using the Schwartz information criterion.

Empirical Analysis
Stationarity Test
We start our empirical analysis by examining the stationarity of the variables using the unit root test suggested by Dickey and Fuller (1979). The test is conducted on both the level data and the first difference data, while the optimum lag selection is based on the Schwarz information criterion. The ADF test results are presented in Table 1.

Table 1: ADF tests

Variable	*tau-statistic*		Conclusion
	Level	**First difference**	
LTCE	-1.09615 (0.9250)	-3.6870 (0.0229)	I(1)
LHDD_CBN	-1.3629 (0.5987)	-4.4229 (0.0004)	I(1)
LHDD_CB	-0.2707 (0.9249)	-3.1732 (0.0239)	I(1)
LHDD_MB	-1.9002 (0.3307)	-5.5946 (0.0000)	I(1)
LHDD_TBS	-1.2471 (0.6527)	-3.7845 (0.0039)	I(1)
LHDD_NDP	-1.8604 (0.6694)	-3.9473 (0.0127)	I(1)

Source: EViews output based on research data; parenthesis contains p-values

From Table 1, the p-values of 0.9250, 0.5987, 0.9249, 0.3307, 0.6527 and 0.6694 all are far above the conventional significance levels, indicating that the level data test is insignificant for all variables. For the first difference test, the p-values of 0.0229, 0.0004, 0.0239, 0.0000, 0.0039 and 0.0127 indicate that the test on first difference data is significant. Thus, LHDD_CBN, LHDD_CB, LHDD_MB, LHDD_TBS and LHDD_NBP all are nonstationary at level series but are stationary at first difference series. In other words, the variables are integrated of the first order or I(1).

Empirical Analysis

Figure 6 shows the lag selection for the plausible ARDL specification based on Schwarz information criterion (SIC). The SIC criterion selects a model which minimizes its value. The ARDL estimation results are presented in Table 2 while the model fit statistics are shown in Table 3. The model estimation is based on Newey-West HAC standard errors and covariance which are robust to both autocorrelation and heteroskedasticity. The cointegrating form and the long run coefficients of the model are shown in Tables 4 and 5 respectively.

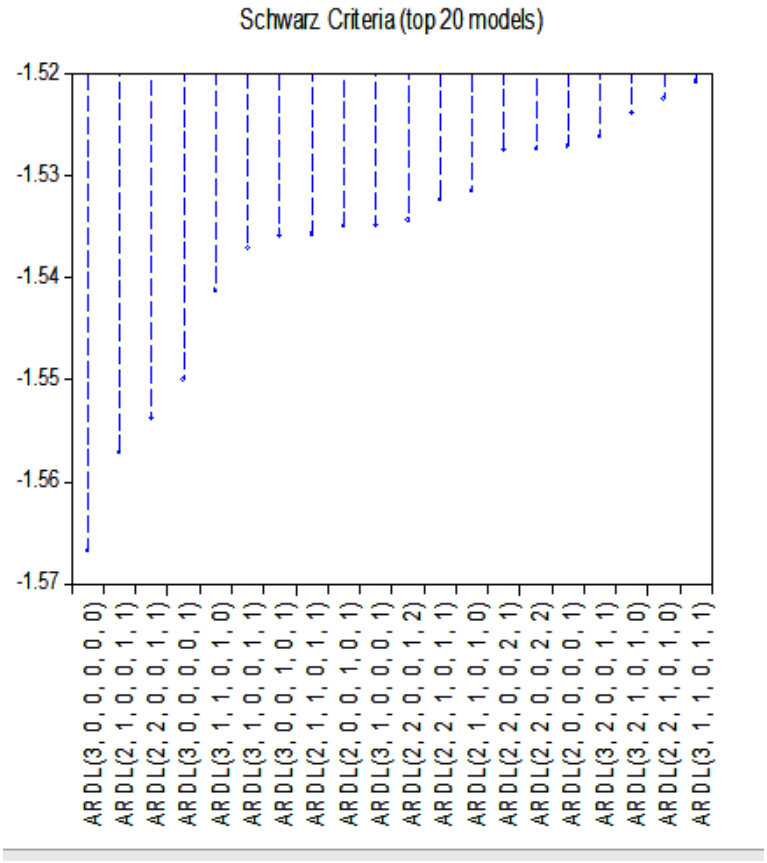

Figure 6: Model Selection for Model 5

Table 2: ARDL Results for Model 5

Variable	Coefficient	P-value
LTCE(-1) β_1	1.319126	0.0000
LTCE(-2) β_2	-0.044180	0.8982
LTCE(-3) β_3	-0.344075	0.0715
LHDD_CBN β_4	-0.066619	0.1027
LHDD_CB β_5	-0.081428	0.0672
LHDD_MB β_6	0.014556	0.2558
LHDD_TBS β_7	0.125863	0.0413
LHDD_NBP β_8	-0.014422	0.2657
Constant	0.072323	0.2445
Wald (F-statistic) ($\beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$	1.279984	0.2817

Source: E-Views output

Table 3: Model Fit Statistics

R-squared	0.982797
Adjusted R-squared	0.980937
F-statistic	528.437
Prob(F-statistic)	0.000000
Durbin-Watson stat	2.063301

Source: E-Views output

Table 4: Cointegrating Form

Variable	Coefficient	P-value
D(LTCE(-1))	0.388254	0.0281
D(LTCE(-2))	0.344075	0.0715
D(LHDD_CBN)	-0.066619	0.1027
D(LHDD_CB)	-0.081428	0.0672
D(LHDD_MB)	0.014556	0.2558
D(LHDD_TBS)	0.125863	0.0413
D(LHDD_NBP)	-0.014422	0.2657
CointEq(-1)	-0.069129	0.0944

Source: E-Views output

Table 5: Long-run coefficients

Variable	Coefficient	P-value
LHDD_CBN	-0.963699	0.1459
LHDD_CB	-1.177926	0.0187
LHDD_MB	0.210558	0.2315
LHDD_TBS	1.820703	0.0566
LHDD_NBP	-0.208621	0.3438
Constant	1.046205	0.0557

Source: E-Views output

From figure 6, the value of SIC is minimum at -1.567 and the model that gives this minimum value is ARDL (3,0,0,0,0,0), thus, a model with three lagged values of the dependent variable as additional explanatory variables was selected.

From Table 2 we can see that while LTCE (-1) (p-value = 0.0000) is highly significant, LTCE (-2) (p-value = 0.8982) and LTCE (-2) (p-value = 0.0715) both are insignificant at 5% level. However, LTCE (-3) is significant at 10% level. This implies that total capital expenditure relative to nominal GDP is autoregressive and can be predicted based on its own previous values.

Also from Table 2, the beta coefficients of -0.0666, -0.0814 and -0.0144 indicate that LHDD_CBN, LHDD_CB and LHDD_NBP each has a negative contemporaneous relationship with LTCE. In contrast, the beta coefficients of 0.0145 and 0.1258 indicate that both LHDD_MB and LHDD_TBS have a positive contemporaneous relationship with LTCE. However, the p-values of 0.0672 and 0.0413 indicate that the effects of LHDD_CB and LHDD_TBS are significant at 10% and 5% levels respectively, while the p-values of 0.1027, 0.2558 and 0.2657 indicate that the effects of LHDD_CBN, LHDD_MB and LHDD_NDP all are insignificant. The Wald (F-test), which tests the restriction that LHDD_CBN, LHDD_CB, LHDD_MB, LHDD_TBS and LHDD_NDP are jointly zero ($\beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$), is insignificant at all conventional levels (F-statistic = 1.2799, p-value = 0.2817), suggesting that the restriction is valid. Thus, in statistical sense, the independent variables jointly have no significant on LTCE. The constant term of 0.0723 with a p-value of 0.2445 indicates that LTCE would be positive but not significant when LHDD_CBN, LHDD_CB, LHDD_MB, LHDD_TBS and LHDD_NDP all are not incorporated in the model.

From Table 3, the Adjusted R-square of about 0.98 and the F-statistic (= 528.43) that is very high with zero probability indicate that the selected ARDL model has a very good fit and all the explanatory variables collectively have highly explanatory power for the changes in the dependent variable. The Durbin Watson statistic (= 2.06) is approximately 2, showing that estimated model is well-behaved.

From Table 4, the cointegrating term (CointEq(-1) = -0.0691, p-value = 0.0944) has the expected negative sign and is significant at 10% level, indicating that the short run deviations in the model can indeed be corrected towards the long run equilibrium. The coefficients of 0.3882 and 0.3440 with the p-values of 0.0281 and 0.0715 shows that a 1% increase in LTCE in the current period would significantly increase its own value one period after by approximately 0.39% and two periods after by approximately 0.34%.

From Table 5, while the long run effects of LHDD_CB (p-value = 0.0187), LHDD_TBS (p-value = 0.0566) both are statistically significant, the long run effects of LHDD_CBN (p-value = 0.1459), LHDD_MB (p-value = 0.2315) and LHDD_NDP (p-value = 0.3438) all are insignificant. The constant term of 1.0462 with a p-value of 0.0557 indicates that at 10% level of significance, the long run average of LTCE would be significantly different from zero when LHDD_CBN, LHDD_CB, LHDD_MB, LHDD_TBS and LHDD_NDP all are not included in the model.

Discussion of Findings

The main objective of this study is to examinethe effect of domestic debt holdings on public infrastructure in Nigeria. Here, the effects of domestic debts held by the CBN, commercial banks, merchant banks, total banking system and non-banking public are all examined. Thus, the effect of domestic debt holdings on public infrastructure is tested based on the joint significance of β_4, β_5, β_6, β_7 and β_8 in Table 2. *Apriori*, we expected that domestic debt holdings would exert significant effects on total capital expenditure, and that the proportion of domestic debts held by the banking sector would affect the real economy more significantly than the proportion held by the non-banking public, since the banking sector is the main channel through which government fiscal activities affect the real economy. According to Das, Papapioannou, Pedras, Ahmed and Surti (2010), the higher the public debt stock, the higher the probability of affecting financial assets prices, which in turn affects the soundness of the balance sheet of the financial sector.

Our results show that holding of domestic debt has no significant effect on total capital expenditure in Nigeria. The Wald test statistic in Table 2, which tests the joint significance *o*f β_4, β_5, β_6, β_7 and β_8, is associated with a probability of 0.2817, indicating that the joint effects of domestic debts held by CBN, commercial banks, merchant banks, total banking system and non-banking public is statistically insignificant. Thus, we could not reject the null hypothesis of no significant joint effects. This finding implies that Nigeria's domestic debt stock is not high enough to exert the expected significant influence on the real economic through total capital expenditure.

Further, as expected, our results show that domestic debt holding by total banking sector has a positive and statistically significant effect on total capital expenditure, while the effect of domestic debt holding by non-bank public is statistically insignificant. As shown in Table 2, the coefficient of 0.1258 with an associated p-value of 0.0413 indicates that a 1% increase in domestic debt held by total banking sector would lead to approximately 0.13% increase in total capital expenditure, while the coefficient of -0.0144 with a p-value of

0.2657 indicates that a 1% increase in domestic debt held by non-banking public would reduce total capital expenditure by only approximately 0.01%. Thus, the effect of domestic debt held by total banking sector is also economically significant.

For the banking sector, domestic debt holding by both CBN and commercial banks have negative coefficients while domestic debt holdings by merchant banks is associated with positive coefficient. However, only the beta on domestic debt holding by commercial banks (β_5 = –0.0814, p-value = 0.0672) is statistically significant but at 10% level. The beta on domestic debt holding by central bank (β_5 = –0.0666, p-value = 0.1027) is almost significant at 10% level while the beta on domestic holding on merchant banks (β_5 = –0.0145, p-value = 0.2558) is statistically insignificant. The size of these betas implies that total capital expenditure would reduce by approximately 0.08% and 0.07% following a 1% increase in domestic debt holding by commercial bank and domestic debt holding by central bank respectively, while it would increase by only approximately 0.01% following a 1% increase in domestic debt holding by merchant bank. Thus, the negative effects of domestic debt holdings by both commercial banks and central bank are consistent with the theoretical view that increase in public domestic debts hurts the economy by crowding out private sector investment.

Conclusion

This study investigates the effect of total domestic debt and domestic debt holdings on public infrastructure expenditure in Nigeria using the ARDL model. The dimensions of domestic debt holdings are CBN, commercial banks, merchant banks, total banking sector and non-banking public, while total capital expenditure is used to proxy public infrastructure. The empirical analysis based on quarterly data covering from 1981Q1 to 2016Q4. The optimum lag for determined using the Schwarz information criterion.

There is evidence that holding of domestic debt by the total banking sector has a positive effect on capital expenditure while holding of debt by both commercial banks and CBN have negative effects. Further, our results suggest that the effect of total public debt is statistically insignificant. Therefore, our evidence largely supports the crowding out effect theory of public debt which states that government's fiscal actions crowd out private investments when increased government expenditure, financed by either increase in taxes or issuance of more debt instruments, has no overall economic benefit. It is therefore, our view that the on-ongoing debt restructuring by the Federal government towards external long term debt is a welcome development.

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