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Does debt servicing matter for capital formation in Nigeria?

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Abstract

Public borrowing is recognized as an important source of capital financing especially in developing countries where revenue gaps constrain investment. This paper examines the nexus between debt servicing and capital formation in Nigeria using an asymmetric time series model to analyse data for the period 1980-2021. The results show that there is a long-run asymmetric link between debt servicing and capital formation. Debt service was found to exert a negative and significant impact on capital formation in the short- and long-run. Findings also indicate that while there is a considerable difference between the cumulative sum of negative and positive changes in debt servicing strategy in the long-run with the magnitude of the former being relatively more pronounced, the contemporaneous model reveals there is no significant divergence. This suggests that debt servicing potentially crowds out investment in capital formation and therefore, alternative financing strategies are required to sustainably build up capital in Nigeria.

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1. Introduction

The low growth rate owing to low savings that generally characterized most developing countries has prevented them from providing financial support for investment in both private and public sectors. Thus, saving and investment are two main macroeconomic variables that support and sustain the economic growth of any nation. The sustainability of economic growth is tied to the threshold of the level and structure of capital formation. Capital formation is critical for economic growth and development since it expands the capacity of the country to produce more goods and services, creates more job opportunities, and enlarges the export capacity. Savings facilitates capital formation by making available resources for the needed investment but developing economies are often confronted with inadequate capital formation arising from the vicious cycle of low productivity, low income, and low savings (Adepoju, Salau, & Obayelu, 2007). In most developing countries, the level of domestic saving is very low to spur capital formation, hence they resort to foreign borrowing to fill this gap. Foreign borrowing promotes economic growth if the borrowed funds are used to promote and sustain projects with a higher marginal return than the cost of the funds. Conversely, a lack of information about the size, structure, and nature of the debt coupled with the inability to meet debt servicing requirements has been harmful to the economic growth of most developing countries.

Although the increase in gross external borrowing fills the savings gap, however, the implication of a continued increase in debt servicing at non-concessional interest rates could diminish the influx of foreign investors and also reduce the present and future savings to pay off the debt (Aliyu & Usman, 2013). Higher debt servicing also has a significant effect on public spending composition by reallocating available resources away from human capital development and infrastructures that can promote the growth process. It is therefore justified that the growth and development of the Nigerian economy cannot be fully understood without analysing the contribution of external debt servicing on capital formation.

More recently in Nigeria, there has been concern about the rising debt and the implications for future development. The total external debt outstanding rose from $6.53bn in 2012 to $38.4bn in 2021 while the percentage of debt service/GDP in the same period increased geometrically from 5.96% to 22.47%. In 2021, the Nigerian government incurred a sum of ₦4.22 trillion on debt servicing which is a 29.3% increase compared to ₦3.27 trillion spent in 2020. Also, Nigeria's debt service-to-revenue ratio increased from 81.1% in 2020 to 96% in 2021. Thus, the danger of accumulating foreign debt has also been linked to financial difficulties currently being experienced by countries such as Sudan, Greece, Eritrea, and Cape Verde with a warning that Nigeria might go down the same path if the current policy of accumulating debts through borrowing is not reversed. Based on the aforementioned issues, this study examines the link between external debt servicing and capital formation in Nigeria for the period 1980-2021 using the Non-linear Autoregressive Distributed Lag Approach (NARDL) proposed by Shin et al. (2014). This approach permits the incorporation of asymmetric effects of positive and negative changes in explanatory variables on the dependent variable, unlike the ARDL, wherein the possible impact of explanatory variables remains the same.

The rest of the paper is organized as follows: the trend and pattern of external debt servicing in Nigeria during the period under review are presented in section two followed by the reviews of empirical literature in section 3. The discussion of the theoretical framework and methodology is in section four while the empirical results and major findings are presented in the fifth section. The last section presents the concluding remarks and policy recommendations.

2. Facts about Debt Servicing in Nigeria and Capital Formation (1981-2021)

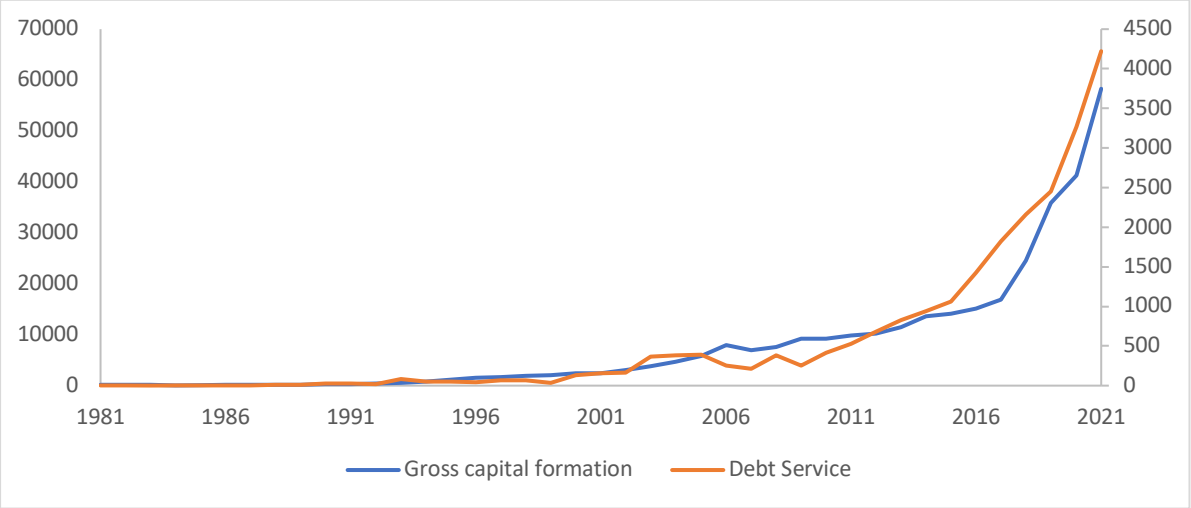
The trend and pattern of debt service payments (₦' Billion) and debt service sustainability indicators (measured by total debt service/revenue (%), debt service/export (%), and debt service/recurrent expenditure (%)) are presented in Table 1. Over the years, the value of total debt service payments fluctuated considerably but surged in recent years. For instance, debt service payments stood at ₦415.7 billion in 2010 and increased by about five-fold in 2018 (₦2,161.4). The figure increased further to ₦2,454.1 billion in 2019, ₦3,264.0 billion in 2020, and ₦4,221.7 billion in 2021. This jump reflects the substantial increase in both nominal domestic and external debts. For example, domestic debt value increased from just ₦4,551.8 billion in 2010 to ₦12,774.4 billion, ₦14,272.6 billion, ₦16,023.9 billion, and ₦19,242.6 billion in 2018, 2019, 2020, and 2021 respectively. The same rapid increase occurred for external debt within the same period. External debt outstanding increased from a mere ₦689.9 billion in 2010 to ₦7,759.2 billion in 2018 and ₦9,022.4 billion in 2019. The amount increased further to ₦12,705.6 billion in 2020 and stood at ₦15,855.2 billion in 2021.

Capital formation, which depicts the ability of the country to minimize or stay off debt, has increased minimally since 2010 compared to the fluctuation noticed in the 80s and 90s. For example, capital formation stood at ₦124.52 billion in 1981 and fell drastically to 87.14 billion in 1985. The figure rose sharply to ₦1153.47 billion in 1995 and continued to rise marginally to ₦2098.54 billion in 1999. Since the advent of democracy in 1999, capital formation has been increasing marginally, except for 2007, when a sharp fall was recorded. As of 2021, capital formation stood at ₦58293.95 billion. Figure 1 compares capital formation and debt service for the sampled period.

Meanwhile, total debt service/revenue (%) as an indicator of debt service sustainability reveals that in 2005, it was 24.1% and fell precipitously to 5.7% in 2010. This indicator increased sharply to 27.9% in 2015 and 33.6% in 2017. The values were 30.7%, 54.7%, 81.1%, and 96% in 2018, 2019, 2020, and 2021, respectively. These figures are above the international threshold of 20-25%, suggesting the inability of Nigeria to service its debt due to a dwindling revenue base. The recent rise in this figure portends danger for the country if it does not nip it in the bud.

The debt/export ratio as a measure of debt service sustainability has fluctuated over the years. For instance, it reduced to 1.5% in 2010 from 15.4% in 2005. It increased to 3.2% in 2015, 6.8% in 2017 and 7.9% in 2018. There was a sharp increase in 2020 (13.4%) and 2021 (21.9%). On average, export has not increased compared to the huge increase in debt service occasioned by the sharp increase in domestic and external debt. The ratio of debt service to overall recurrent expenditure revealed that debt servicing accounted for more than 38.2% of total recurrent expenditure in 2017. It increased to 39.9% in 2020 and 46.2% in 2021 (See Table 1). With the rate at which the government is borrowing, debt servicing might account for more than 60% of total recurrent expenditure. The implication of this is that the country would not be able to effectively pay salaries which might lead to the downsizing of workers, which would create more pressure on the economy which is already witnessing a high level of unemployment.

Figure 1: Trend of capital formation and Debt service in Nigeria (1981-2021)



Source: Central Bank of Nigeria
Note: Values are in billion naira (domestic currency)

Table 1: Debt Service Payment and Debt Service Sustainability Indicators

Indicators	International Threshold	2005	2010	2015	2017	2018	2019	2020	2021
Total Debt Servicing (₦' Billion)	-	1,334.2	415.7	1,060.4	1,823.9	2,161.4	2,454.1	3,264.0	4,221.7
Total Debt Service/ Revenue (%)	20-25 (max=25)	24.1	5.7	27.9	33.6	30.7	54.7	81.1	96
Debt service/export (%)	-	15.4	1.5	3.2	6.8	7.9	7.1	13.4	21.9
Debt service/recurrent expenditure (%)	-	10.1	13.4	27.7	38.2	38.1	35.1	39.9	46.2

Source: Central Bank Annual Report, various Issues

3. Review of Existing Literature

Theoretically, three theories show the possible link between debt servicing and capital formation. These are the dual gap, crowding-out effect, and debt overhang hypothesis. The Dual gap theory emphasizes the capital investment-saving nexus in the developmental process of a nation. The proponent of this view opined that the needed savings to promote development in most developing countries is insufficient; thus, these countries seek to acquire loans to bridge the gap between domestic savings and needed capital investment for growth and development.

In order words, the saving-investment gap exists when a nation's domestic saving is less than what is required to spur growth. The crowding-out effect theory, on the other hand, dwells on the effect of debt servicing on government spending patterns towards growth-induced infrastructures. The reduction of government public investment (infrastructures) harms private investment due to the complementarity between public and private investment. Therefore, the expansion of public debt to improve public investment crowds out the limited funds available for effective private-sector capital formation geared towards investment and growth. The debt overhang hypothesis posits that highly indebted countries benefit very little from the return of an additional investment made because of their huge debt service obligations. Thus, if the country's level of debt exceeds its capacity to refund, the expected debt is projected to be an increasing function of the economic growth level/capacity (Krugman, 1988).

Empirical studies on the link between debt servicing and capital formation are scanty, evolving, and mixed findings. These mixed findings are country-specific and methodologically driven. Besides, cross-country studies have shown a sharp divide emphasizing the development level of the countries involved in the study. For cross-country studies on developed countries, debt servicing does not impact capital formulation and accumulation. Studies on developing

countries indicate the crowding-out effect of debt servicing. The study by Kocha, Iwedi, and Sarakiri (2021) examined the dynamic impact of public external debt on capital formation in Sub-Saharan Africa using the Pooled Mean Group Approach for the period 2000 to 2008. The variables of interest adopted for the study are external debt stock, debt service on external debt, and interest payment on external debt. The findings reveal that increasing external debt stock and interest payment on external debts impacted marginally on capital formation in the short run while a negative effect was evident in the long run.

Serven and Solimano (1993) estimated an investment equation for 15 developing countries to ascertain the impact of macroeconomic uncertainty (measured by the exchange rate and inflation rate) and debt sustainability on capital formation for the period 1976 to 1988. The findings of the study indicate that macroeconomic uncertainty and debt fluctuation impacted the capital formation of these countries. The study concludes that debt overhangs certainly exist in these countries. In the same vein, to validate the argument of Krugman (1983) on debt overhang, Hennessy (2004) estimated the investment equation for 3,869 sampled manufacturing firms for the period 2000–3999 using the measurement error-consistent generalized method of moment estimator. The findings suggest that the debt overhang correction term was statistically significant, corroborating the findings of Serven and Solimano (1993). Likewise, Joy and Panda (2020) analysed the pattern and link between public debt and debt overhang in BRICS countries. Using panel data spanning the period 1980 to 2016, the authors affirm the debt overhang effect in BRIC nations.

Analysing the impact of external debt on capital formation in Nigeria, Abdullahi, Hassan, and Abu-Bakar (2016) used the autoregressive distributed lag approach covering the period 1980 to 2013 and found a negative and statistically significant relationship between the two variables. The results also show the positive impact of saving on capital formation in Nigeria. In the same vein, Adegboyega (2021) examines the relationship between debt service payment and economic growth in Nigeria from 1981 to 2019 and shows a negative link between the two variables. Similarly, Omodero (2019) considers the consequences of external loans on capital investment in Nigeria from 1996 to 2018 using the ordinary least squares multiple regression method. The results show that external debt impacted negatively on capital investment while debt service payment has a positive effect on capital investment in Nigeria.

In another dimension, studies have also been conducted in Nigeria linking debt stock, debt servicing, and human capital development. For instance, Atueyi (2019) investigated the impact of the external debt stock and debt servicing on human capital development (HCD) in Nigeria between 1960 and 2019 using the Ordinary Least Squares (OLS) estimation technique. The findings indicate that external debt servicing has an inverse relationship with HCD while external debt stock impacted positively on HCD. Moreover, Igudia (2021) examined the impact of external debt servicing on HCD in Nigeria between 1970 and 2019 using Ordinary Least Squares (OLS) and found that external debt servicing impacted HCD negatively.

Elsewhere in Africa, Ndemange (2018) investigated the impact of external debt servicing on capital formation and GDP in Kenya from 1980 to 2010. The results of the ARDL model revealed a negative relationship between capital formation and debt servicing whereas debt service affects GDP negatively via its effect on capital formation. Likewise, Fumeyi, Bekoe, and Imoru (2022) empirically examined the effects of external debt servicing on capital formation in Ghana from 1980 to 2019 using the Autoregressive Distributed Lag (ARDL) model. Their findings show that external debt servicing negatively affects capital formation in the short and long runs owing to the disincentive effect of tax. This invariably implies that there is a likelihood for the economy to experience a reduction in investment due to high debt servicing caused by high debt stock which may attract a high marginal tax rate. The results also show that debt servicing affects private capital formation more than public capital formation

whereas there exists complementarity between public and private investments suggesting that public investments have the potential of attracting private investment to Ghana.

Summarily, the link between capital formation and debt service has no distinct pattern across countries. Thus, country-specific studies tend to reveal the actual pattern that exists and the findings are sensitive to the method of analysis adopted. Furthermore, none of the papers on the Nigerian economy reviewed utilized the NARDL techniques. Unlike the ARDL, the NARDL approach includes the asymmetric effects of positive and negative changes in explanatory variables on the dependent variable.

4. Theoretical Framework and Methodology

4.1 Theoretical Framework

This study adopts the Keynesian alternative equilibrium analysis in the market as the starting point. We know that at equilibrium, investment is assumed to be equal to saving:

$$I_t = S_t = sY_t \quad (1)$$

Where I_t is Investment in period t, S_t is savings in period t and ${}_sY_t$ is savings rate in period t. Also, we know that capital formation which is key for investment is expressed as:

$$K_t = (1-\alpha)K_{t-1} + I_t \quad (2)$$

Where K_t is capital in period t, $(1-\alpha)K_{t-1}$ is capital depreciation in period t.

Substituting equation 1 into 2 gives:

$$K_t = (1-\alpha)K_{t-1} + sY_t \quad (3)$$

By definition, total savings is the sum of private and public savings:

$$S_t \equiv S_t^{pr} + S_t^{pu} \quad (4)$$

Where S_t^{pr} is private saving and S_t^{pu} is public saving

Further, the size of the total savings of the economy is reduced by the debt repayment schedule of the government and this can negatively affect investment opportunities in the economy. The total savings can be expressed as:

$$S_t = Gfs_t - Ds_t \quad (5)$$

Where Gfs_t is government fiscal spending and Ds_t is the debt servicing obligation of the government in period t.

Therefore, total savings at time t can be expressed as a function of government debt service.

$$S_t = f(Ds_t) \quad (6)$$

Combine equation(s) 1 and 6 gives:

$$S_t = sY_t = f(Ds_t) \quad (7)$$

Substituting equation 7 into the capital equation (3) gives:

$$K_t = (1-\alpha)K_{t-1} + f(Ds_{t-1}) \quad (8)$$

Equation (4.8) implies that capital information has an inverse relationship with debt service. This is because capital formation at time t is expressed as a function of debt service at time t-1. These are expressed below:

$$K_t = f(Ds_{t-1}) \quad (9)$$

Note: $f' < 0$

Equation (4.9) can be augmented to include other control variables that have a direct effect on capital formation. These variables are total debt stock, total national savings, and the real interest rate. Thus equation 9 can be written as:

$$K_t = f(Ds_{t-1}, \theta) \quad (10)$$

Where θ represents the control variables stated above. Thus, the gross capital formation can be expressed as the function of:

$$K_t = f(Ds_t, TDS_t, S_t, RIR_t) \tag{11}$$

Where K_t is the gross capital formation at time t, Ds_t is debt service at time t, TDS_t is total debt stock at time t, S_t is total national savings at the time, and RIR_t is the real interest rate at time t.

4.2 Estimation Technique

To evaluate the asymmetric impacts of independent variables (like debt service, total debt stock, total national savings, and the real interest rate), this study adopts the Non-linear Autoregressive Distributed Lag Approach (NARDL) proposed by Shin et al. (2014). This is expressed with the conditional error correction as:

$$\begin{aligned}
\Delta \ln K_t = {} & \alpha + \sum_{j=1}^{p_0} (\beta_{0,i} . \Delta \ln K_{t-1}) + \sum_{j=0}^{p_1^+} (\beta_{1^+,j} . \Delta \ln Ds_{t-j}^+) + \sum_{j=0}^{p_1^-} (\beta_{1^-,j} . \Delta \ln Ds_{t-j}^-) \\
& + \sum_{k=0}^{p_2^+} (\beta_{2^+,k} . \Delta \ln TDS_{t-k}^+) + \sum_{k=0}^{p_2^-} (\beta_{2^-,k} . \Delta \ln TDS_{t-k}^-) \\
& + \sum_{m=0}^{p_3^+} (\beta_{3^+,m} . \Delta \ln S_{t-m}^+) + \sum_{m=0}^{p_3^-} (\beta_{3^-,m} . \Delta \ln S_{t-m}^-) + \sum_{q=0}^{p_4^+} (\beta_{4^+,q} . \Delta \ln RIR_{t-q}^+) \\
& + \sum_{q=0}^{p_4^-} (\beta_{4^-,q} . \Delta \ln RIR_{t-q}^-) + \phi_0 . \Delta \ln K_{t-1} + \phi_1^+ . \Delta \ln Ds_{t-1}^+ + \phi_1^- . \Delta \ln Ds_{t-1}^- \\
& + \phi_2^+ . \Delta \ln TDS_{t-1}^+ + \phi_2^- . \Delta \ln TDS_{t-1}^- + \phi_3^+ . \Delta \ln S_{t-1}^+ + \phi_3^- . \Delta \ln S_{t-1}^- + \phi_4^+ . \Delta \ln RIR_{t-1}^+ \\
& + \phi_4^- . \Delta \ln RIR_{t-1}^- + \varepsilon_t
\end{aligned} \tag{12}$$

From equation (12), the "+" and "–" notations of the independent variables respectively denote the partial sum of positive and negative changes specifically from the minimum to the maximum values. Similar to the linear ARDL approach, Shin et al. (2014) created a bound test for identifying asymmetrical cointegration in the long run. Therefore, the null hypothesis is stated as:

$(HO: \phi_0 = \phi_1^+ = \phi_1^- = \phi_2^+ = \phi_2^- = \phi_3^+ = \phi_3^- = \phi_4^+ = \phi_4^- = 0)$ indicating a symmetrical effect in the long run while the alternative hypothesis states as:

$(H1: \phi_0 \neq \phi_1^+ \neq \phi_1^- \neq \phi_2^+ \neq \phi_2^- \neq \phi_3^+ \neq \phi_3^- \neq \phi_4^+ \neq \phi_4^- \neq 0)$ also indicating an asymmetrical effect in the long run.

The F-statistic and critical values are also used to accept or reject the H_0. The rejection of H_0 implies the presence of an asymmetrical effect. To ascertain cointegration, the computed F-statistic is compared to the critical lower and upper bounds values. If the computed F-statistic exceeds the upper critical bounds value, H_0 is rejected. If the F-statistic is below the lower critical bounds value, no cointegration. Finally, if the F-statistic falls in between the bounds, the test is inconclusive. The CUSUM (Cumulative Sum of Recursive Residuals) and CUSUMSQ (Cumulative Sum of Square of Recursive Residuals) are used to determine the stability of the NARDL model.

4.3 Sources of Data

Annual time series data from 1981 to 2021 were collected from the Central Bank of Nigeria Statistical Bulletin (2021) and CBN Annual Statement of Account for various years. See Table 2 for the variable name, abbreviation used, source of the data and variable description.

Table 2: Data Description

S/N	Variable	Abbreviation	Source	Variable description
1	Gross capital formation (N'M)	K	CBN Statistical Bulletin (various issues)	Absolute value was logged to compress the data
2	Debt service (N'M)	DS	CBN Statistical Bulletin (various issues)	Absolute value was logged to compress the data
3	Total debt stock (N'M)	TDS	CBN Statistical Bulletin (various issues)	Absolute value was logged to compress the data
4	National saving (N'M)	S	CBN Statistical Bulletin (various issues)	Absolute value was logged to compress the data
5	Real interest rate	RIR	CBN Statistical Bulletin (various issues)	The actual value was used.

Source: Author's Compilation

5. Empirical Analysis and Discussion

Descriptive statistics for the series are presented in Table 3. The maximum value of capital formation is 10.973 and the minimum value is 4.468. It also revealed that national saving has the maximum value of 31.139 followed by a real interest rate (18.180). Debt service has the lowest minimum value (0.008). The skewness values for all the variables in the model are less than -1.0 indicating that all the variables are left skewed. Moreover, the kurtosis values for all the variables are greater than +1.0 implying that the distributions are leptokurtic.

Table 3: Summary of Statistics

Statistics	LOGK	LOGS	LOGDS	LOGTDS	RIR
Mean	7.632	28.509	4.537	7.367	0.454
Median	7.813	28.996	5.046	7.953	4.310
Maximum	10.973	31.139	8.348	10.466	18.180
Minimum	4.468	25.269	0.008	2.605	-65.857
Std. Dev.	1.974	1.979	2.449	2.109	14.259
Skewness	-0.226	-0.373	-0.457	-0.667	-2.718
Kurtosis	1.768	1.671	2.208	2.501	12.911
Jarque-Bera	2.941	3.965	2.501	3.468	218.269
Probability	0.229	0.138	0.287	0.177	0.000
Sum	312.927	1168.856	186.001	302.052	18.596
Sum Sq. Dev.	155.941	156.763	239.992	178.077	8132.960
Observations	**41**	**41**	**41**	**41**	**41**

Source: Author's computation

The correlation coefficients between the variables in the model are presented in Table 4. It can be seen that all the independent variables except real interest rates strongly correlate with the dependent variable (capital formation). Besides, none of the independent variables correlate with each other, indicating that there is no multicollinearity in the model.

Table 4: Correlation Matrix

Variables	LOGK	LOGS	LOGDS	LOGTDS	RIR
LOGK	1				
LOGS	0.791	1			
LOGDS	0.768	0.464	1		
LOGTDS	0.752	0.349	0.480	1	
RIR	0.408	0.414	0.433	0.469	1

Source: Author's computation

The results of the ADF and KPSS unit root tests presented in Table 5 revealed that the dependent variable capital formation (K) and one of the independent variables, real interest rate (RIR), are stationary at levels, while debt service (DS), total debt stock (TDS), and national saving (S) are stationary at first difference. The mixture of the order of integration of the variables permits the bound testing approach to ascertain the long-run relationship of the variables in the model.

Table 5: Unit Root Tests

	Levels		First difference	
Variables	ADF	KPSS	ADF	KPSS
K	-3.929*	0.111*	-	-
DS	-2.583	1.155	-4.212*	0.059*
TDS	-2.162	1.167	-4.651*	0.213*
S	-1.291	1.264	-7.032*	0.306*
RIR	-7.478*	0.214*	-	-

Note: * indicates significance at the 5% significance level. For the ADF Test, the critical value at 5% was -3.196 while the KPSS critical value was 0.463 at the 5% significance level.

The bound test result for equation (12) is presented in Table 6. From the table, the computed F-Statistic is 4.694. This value exceeds the upper bounds critical value of 4.10 at the 1% significance level. This implies that Gross capital formation (K_t), debt service (DS_t), total debt stock (TDS_t), total national savings (S_t), and the real interest rate (RIR_t) are co-integrated. Thus, long-run relationships exist among the variables mentioned above.

Table 6: Bound Tests for cointegration

F-Statistics	**10%**		**5%**		**2.5%**		**1%**	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
4.694***	1.95	3.06	2.22	3.39	2.48	3.7	2.79	4.10

Source: Authors' computation.
Note: The asterisks ***, ** and * are respectively the 1%, 5% and 10% significance levels.

Ascertaining the long-run relationship among the variables in equation (12) implies that we can present the NARDL results to examine the link between external debt servicing and capital formation in Nigeria. NARDL results presented in Table 7 revealed that the Akaike info criterion (AIC) was used to select a maximum lag order of 2 to save the degree of freedom. Also, based on the AIC, NARDL (1, 0, 1, 0, 0, 0, 0, 0, 0) was applied. The results also reveal that negative and positive coefficients of debt service are significant and are the major determinant of capital formation in Nigeria. The positive debt service coefficient (LNDS_POS) exhibits a positive effect, while the negative debt service coefficient (LNDS_NEG) shows a negative effect on capital formation. Other variables are total debt stock and total national savings. The overall goodness of fit (91.8%) indicates that 91.8% variation in capital formation (LNK) can be explained by debt service (DS_t), total debt stock (TDS_t), total national savings (S_t), and the real interest rate (RIR_t). The diagnostic tests further show that there is no issue with the NARDL model estimated.

Figures 2 and 3 illustrate the CUSUM and CUSUMSQ tests. The cumulative sum of recursive residuals and cumulative sum of the square of recursive residuals are within the 5% significance level critical bounds while implying that parameters estimated and presented in Table 4.2 are stable and consistent for the period covered.

Table 7: Results of NARDL Model Estimation.

Dependent Variable: LNK		
Variable	**Coefficient**	**t-statistic**
Constant	1.042***	4.681
LNK(-1)	0.731***	7.891
LNDS_POS	0.144**	2.484
LNDS_NEG	-0.146**	-2.411
LNDS_NEG(-1)	0.319**	2.238
LNTDS_POS	-0.031	-0.306
LNTDS_NEG	0.234*	1.896
LNS_POS	0.445***	3.324
LNS_NEG	0.110	1.284
RIR_POS	-0.004	-1.666
RIR_NEG	-0.001	-0.267
$Adj - R^2 = 0.918$ $DW - statistics = 2.0332$ $SE\ of\ Regression = 0.0957$		
Diagnostic tests	A: Serial Correlation B: Functional Form C: Normality D: Heteroscedasticity	ChiSQ(2) = 2.0201 [0.364] F-statistic(1) = 0.1112 [0.7413] ChiSQ(2) = 0.299 [0.7435] F-statistic(10) = 0.6324[0.774]

Source: Authors' computation.

Note: ***, ** and * are respectively the 1%, 5% and 10% significance levels. A: Lagrange multiplier test of residual serial correlation; B: Ramsey's RESET test using the square of the fitted values; C: Based on a test of skewness and kurtosis of residuals; D: Based on the regression of squared residuals on squared fitted values.

Fig. 2 Plot of Cumulative Sum of Recursive Residuals (CUSUM)

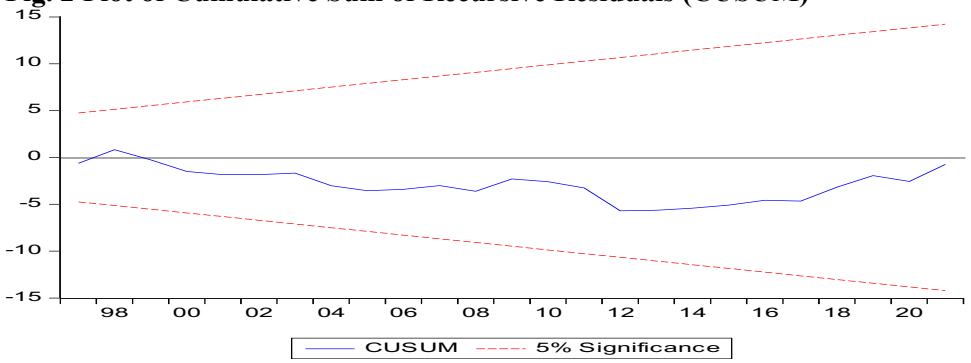
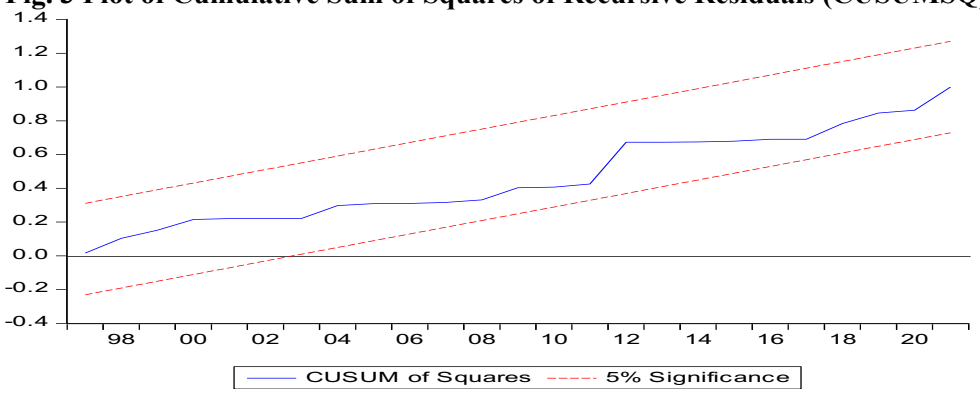


Fig. 3 Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ)



The results of the short-run and long-run asymmetric coefficients are presented in Table 8. The result reveals that the estimated coefficient of the lagged value of the residual (ECT_{t-1}) is negative (-0.269) and statistically significant (0.001) affirming the bound testing

cointegration results reported in Table 6. Thus, approximately 27% of the discrepancy from long-run equilibrium in the previous year is adjusted for by the current year. The result also implies that a change in the negative asymmetric of debt service affected capital formation in the short and long runs, and positive and negative asymmetries of total national saving affected capital formation in the short- and long-run.

Table 8: Result of Asymmetric short-run and long-run Coefficients

Asymmetric long-run coefficients (Dependent Variable: LNK)		
Variable	**Coefficient**	**t-statistic**
Constant	5.733***	6.684
LNDS_POS	0.155	0.588
LNDS_NEG	-0.016**	-2.204
LNTDS_POS	-0.116	-0.317
LNTDS_NEG	0.869**	2.088
LNS_POS	0.654***	3.636
LNS_NEG	0.409*	1.814
RIR_POS	-0.015	-1.241
RIR_NEG	-0.003	-0.269
Asymmetric short-run coefficients (Dependent Variable: ΔLNK)		
Constant	1.023***	4.333
ΔLNDS_POS	0.042	0.590
ΔLNDS_NEG	-0.046**	-2.390
ΔLNTDS_POS	-0.031	-0.306
ΔLNTDS_NEG	0.234*	1.896
ΔLNS_POS	0.445***	3.323
ΔLNS_NEG	0.110*	1.843
ΔRIR_POS	-0.004	-1.666
ΔRIR_NEG	-0.001	-0.267
ECT_{t-1}	-0.269***	-2.908

Source: Authors' computation.
Note: ***, ** and * are respectively the 1%, 5% and 10% significance levels.

Furthermore, to test for the short- and long-run asymmetry, the Wald test is conducted and presented in Table 9. The long-run coefficients for the positive and negative asymmetric values of debt service are represented by C(3) and C(4); the short-run coefficients for the positive and negative asymmetric values of debt service are represented by C(10) and C(11). Based on the results in Table 9, there is an asymmetry in the long-run whereas no asymmetry in the short-run.

Table 4.4. Wald Test for Long- and Short-Run Asymmetry

Long-run Asymmetry				**Short-run Asymmetry**			
Test Statistic	**Value**	**df.**	**Prob.**	**Test Statistic**	**Value**	**df.**	**Prob.**
t-statistic	-1.811	28	0.081	t-statistic	-0.312	28	0.758
F-statistic	3.281	(1, 28)	0.081	F-statistic	0.097	(1, 28)	0.758
Chi-square	3.281	1	0.070	Chi-square	0.097	1	0.755
Note: C(3) = C(4)				Note: C(10) = C(11)			

Source: Authors' computation.

5. Conclusion

This study examines the impacts of debt service on Nigeria's capital formation between 1981 and 2021 using the NARDL estimation procedure. The Non-linear ARDL results indicate statistically significant asymmetric effects of debt service, total debt stock, total national savings, and the real interest rate on capital formation indicating a cointegrating long-run relationship among the variables. Specifically, debt service impacted negatively on capital formation in both the short-run and long-run, there is a considerable difference between the negative cumulative sum of changes and the positive one in the long run while the magnitude of the former is much more than that of the latter. However, in the short run, there is no considerable difference between the negative cumulative sum of changes and the positive values of debt service. Nevertheless, the asymmetry between the positive and negative values of debt service is relatively weak in the long run, thus similar to the negative linear connection between debt service and capital formation reported by empirical studies like Ndemange (2018) for the Kenyan economy, Fumeyi, Bekoe, and Imoru (2022) for Ghanaian economy, and Adegboyega (2021) for the Nigerian economy.

Consequently, debt service invariably affects capital formation and necessitates effective policies so that the macroeconomic environment can develop sustainably, which fosters a stable capital accumulation that attracts domestic and foreign investors and improves growth and development in Nigeria. Thus, this study recommends that the government should slow down in its quest to borrow and henceforth create an ideal threshold for borrowing to minimize the high debt servicing obligation which at the moment is over 100% of the total federated collected revenue of the country.

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