THE CAUSAL RELATIONSHIP BETWEEN PUBLIC DEBT AND ECONOMIC GROWTH IN NIGERIA

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Abstract

The role of institutions as a precursor to the success or otherwise in public debt management in Nigeria has received less attention. Considering regulations can help to ensure that public debt is managed in a way that does not lead to unsustainable levels of borrowing, it is essential to examine the growth-inducing capacities of public debt when institutional quality interacts with public debt. Therefore, this study examined The Causal Relationship between Public Debt and Economic Growth in Nigeria from 1996 to 2021. This study employed an ex-post-facto research design. Secondary annual time series data were used for this study and sourced from various publications of the World Bank (World Development Indicators) (WDI), Central Bank of Nigeria (CBN) Statistical Bulletin, Debt Management Office (DMO) statistical reports and the World Governance Indicator (WGI) database. The data collected were analysed using the Non-Linear Autoregressive Distributed Lag (NARDL) procedure and the Granger causality test using the frequency domain approach to explain the model's structural dynamics and reach

meaningful conclusions on the subject. The inferences were drawn at a 1% and 5% significant level. The causality analysis, this study found that the debt to GDP ratio returns short-run uni-directional causality to economic growth in Nigeria. External debt has both short-run and long-run uni-directional causality to economic growth in Nigeria. Domestic debt has only short-run unidirectional causality to economic growth. Debt servicing return only long-run uni-directional causality to economic growth. Real GDP has both short-run and long-run unidirectional causality to debt servicing. Tax revenue has both short-run and long-run uni-directional causality to GDP. The study concluded public debt has a positive relationship with economic growth in Nigeria both in the short run and the long run. Therefore, the study recommended that the Nigerian government should use expansionary fiscal policies to stimulate economic growth in the short run and long run. This can involve increasing government spending on infrastructure, education, and health, which can create jobs and boost economic activity while prioritising debt-financed investments in critical sectors to improve productivity and competitiveness.
Keywords: Public Debt, Debt Servicing, ARDL, Institutions, Real GDP, Causality.

Introduction

African debt crises have been mounting since the early 1980s and it became sickening when most African nation was unable to fulfil their debt obligations despite ostensible growth in the export of primary commodity and associated trade. The non-creditworthiness of many African nations led to more significant concerns for the financial stability of the international financial system, the questionable commitment of African nations to the international financial system and most overarchingly the ability of statutory financial institutions to withstand non-compliance in debt-serving agreements with African nations. The problems were many, and the consequences are immense. Economic growth outlook began to wane in the face of capital inadequacy, export deteriorated, unemployment rose astronomically, and hardship was apparent until the International Monetary Fund (IMF) together with the World Bank in 1996 introduced the Heavily Indebted Poor Countries (HIPC) initiative. The HIPC was set up to reduce the debt profile of developing countries to a sustainable level such that growth trajectory can once again become attractive.

Despite apparent reasons for the Nigerian government to embark on external borrowing to meet its ever-increasing financial obligations, the magnitude of the debt and the manner by which public debt was rising coupled with the unsustainability nature made it risky. If not properly managed, it could lead to worsening terms of trade when the exchange rate fluctuates (Acosta Ormaechea, 2020), and capital flight precipitates financial crises (Ndikumana & Boyce, 2003). Consequent to the above, donors, financial institutions, investment partners, policymakers and society at large are increasingly worried about the dynamic consequences of contemporaneous rising public debt with a particular focus on Africa's largest economy, Nigeria. Is public debt a source or a reflection of ill growth and underdevelopment in Nigeria? What are the intricacies of this relationship? What precise negative consequences and sub-optimal growth features put Nigeria at risk when public debts are inefficient? By what magnitude and dimensions does public debt induce variations in economic growth in Nigeria? These are indispensable research questions that remain dimly discerned in the large body of literature on debt management and sustainability.

There is an urgent need to use accurate data and appropriate methodology to answer such questions statistically and reliably if we are conscious about developing the much-proclaimed potentials of the country and the continent of Africa, particularly the realisation of the Africa 2063 Development Agenda (the Africa we want).

Over an extended period, research on public debt-growth nexus in Nigeria revealed the inverse relationship (See Anderu et al., 2019; Egbetunde, 2012; Eke & Akujuobi, 2021; Innocent Chile, Nzeh, 2020; Mba et al., 2015; Nwannebuike et al., 2016; Ochuko & Eferakeya Idowu, 2019; Yusuf & Mohd, 2023 for some examples). The inverse relationship could be due to the pervasive role of weak institutions in the debt-growth relationship that is yet unexplored. The intricacies of these unobserved factors (unobserved heterogeneity) in the debt-growth relationship in Nigeria underpin this study. There is no gainsaying that Nigeria has limited institutional and technical capacities to tackle debt management and ethical issues owing to the long history of mismanagement of external borrowings (Kemoe & Lartey, 2022b). How institutional capacity has mediated the established relationship between public debt and growth remains *a prior* unclear in Nigeria's debt sustainability literature. Knowing how capital outsourcing and insourcing predict variations in growth outcomes in Nigeria is an essential question for policy and research.

Another important issue in the literature on public debt and economic growth in Nigeria is premised on causality. Little or no empirical credence has been leaned to illuminate the obscure relations in the public debt-economic growth causal relationship. On one hand, Broner et al. (2014); Traum and Yang (2015) argue that high levels of public debt can hinder economic growth by crowding out private investment and increasing the cost of borrowing. This, in turn, can lead to higher interest rates and lower levels of investment, which can have a negative impact on economic growth.

On the other hand, Owusu-Nantwi and Erickson (2016); Panizza and Presbitero (2013) argue that public debt can be a necessary tool for promoting economic growth, particularly during times of recession or when private investment is low. In these cases, government spending can stimulate economic activity and create jobs, which can lead to higher levels of economic growth. While the concept of causality has been studied across borders (see Ferreira, 2016) in the public debt economic growth relations, it remains grossly understudied in the local context. Considering the relationship between public debt and economic growth is complex and context-specific which necessitates the need for empirical credence on the direction of causality if any exists on the subject matter. While high levels of public debt may be a concern for economic growth in some circumstances, it may be required to stimulate aggregate demands in other situations. Thus, establishing causal relations in the public debt-economic growth relationship in Nigeria will permit the development of policy actions that are most inclined toward the development objectives of Nigeria.

Literature Review
Economic Growth

Economic growth has been argued by Wardley-Kershaw and Schenk-Hoppé (2022) to have brought about eradicating the problem of abject poverty, improved diet and nutrition, improved living condition and improved health condition of human by preventing wide spread of diseases. The first rapid sustained economic growth that gave rise to increase in income occurred in Britain in the year 1760 (Wardley-Kershaw & Schenk-Hoppé, 2022). In the case of the USA, Akalpler and Shamadeen (2017) enthused that the economy had recovered from the negative economic growth of -0.92% witnessed in the global

financial crisis in December 2008 to 3.88% in December 2014 and by 2.93% in December, 2015. Among the factors the authors reported to have accounted for the recorded growth is increased state and local government expenditure. This, therefore, implies that increased public sector expenditure enhances economic growth and enhances the expectations of the citizens. Racy, Vartanian and Vendruscolo (2019) reported an average growth rate of 0.90% between 2007 and 2017 in Germany. The authors also stated further that the country accounted for more than one-quarter of the Eurozone's economic growth. In contrast, in the case of Nigeria, the economy has witnessed an unstable performance. Going by the statistics of the Central Bank of Nigeria (2020), the growth rate in real GDP, which stood at 11.8% between the years 1991 to 2000, 9.7% between 2001 to 2010, and -1.7% between 2011 and 2020, is an attestation to the unstable performance of the economy.

Economic growth is related to the quantitative and sustained increase in the countries per capita output or income accompanied by expansion in its labour force, consumption level, capital and volume of trade (Ijirshar, Joseph & Godoo, 2016). Timothy and Maria (2021) further opines that economic growth emerges because of sustained increase in per capita output or net national product over a long period. Hence, another qualification of economic growth requires that the national output be composed of goods and services, which satisfy maximum wants of the maximum number of people. Alternatively, Ömer (2022) states that economic growth is a steady process of increasing the productive capacity of the economy and hence, of increasing national income characterized by high rates of increasing per capita output and total factor (most especially labour) productivity. From these diverse definitions, we deduce that economic growth is simply an increase in the capacity of an economy to produce goods and services, compared from one period of time to another.

Public Debt

Government debt is very popular in developing countries such as Nigeria. According to Owusu-Nantwi and Erickson (2016), the prominence of government debt as a fiscal tool in developing countries is occasioned by the weak tax regimes and low incomes. In Nigeria, the growing trend in government debt has continued to be a matter of significant concern to government, policy makers, monetary authority and citizens, to mention a few.

Public debt is one of the means to finance government revenue. When government expenditure exceeds its receipts, it borrows from the public. Thus, borrowing or taking loans from the public is called public debt. Public debt as a source of government revenue is different from other sources of public revenue such as taxes, fees etc. in the case of public debt, the government has to pay interest and repay the principal to the public. But nothing is required to be paid by the government in the case of other sources of revenue (Chukwuemeka & Samuel, 2021). Sajuyigbe, Odetayo and Adeyemi (2018) opined that the government debt (sometimes called the public debt consists of the total or accumulated borrowings by the government. Hicham (2018) argued that public debt is a debt which a country owes its citizens or to other countries, or external organizations. George-Anokwuru and Inimino, (2020) defined public debt as the debt owned by the nations to the rest of the world. According to Dewett and Navalur (2012) public debt refers to borrowing by a government from within the country or from abroad, from private individuals or association of individuals or from banking and non-banking financial institutions.

Theoretical framework

The theory guiding the study is the Crowding out Effect Hypothesis. The crowding-

out effect hypothesis suggests that increased government spending, financed by borrowing, can lead to a reduction in private investment and economic growth. The mechanism behind this hypothesis is that increased government borrowing tends to push up interest rates, which in turn reduces private investment because borrowing costs become more expensive. This hypothesis has important implications for the relationship between public debt and economic growth.

Empirical studies have provided mixed evidence on the existence and magnitude of the crowding-out effect. For instance, a study by Barro (1984) found that high levels of public debt can lead to lower economic growth rates, as higher interest rates resulting from increased borrowing by the government can reduce private investment. However, other studies, such as those by Alesina and Perotti (1995) and DeLong and Summers (1991), have argued that the crowding-out effect is weak or non-existent.

One possible explanation for these mixed findings is that the crowding-out effect is likely to depend on the specific characteristics of the country's economy and the timing and purpose of government spending. For example, in economies with well-developed financial markets, higher government borrowing may not lead to a significant increase in interest rates because investors have access to a wide range of financial instruments that provide alternatives to government bonds. Additionally, if government spending is targeted towards productive investments, such as infrastructure, it may increase private investment and boost economic growth.

Furthermore, the magnitude of the crowding-out effect may also depend on the level of public debt. As the level of public debt increases, the government may need to pay higher interest rates to attract investors, leading to a stronger crowding-out effect.

Empirical Review

Forbe, Roland and Laisin (2022) investigated the extent to which external debt and public investment contribute to economic growth in Cameroon-emphasizing how public investment modulates the effect of external debt on economic growth. The Dynamic Ordinary Least Squares (OLS) approach was used to ascertain the nature of the long-run relationship between external debt, public investment, and economic growth in Cameroon. Consistent with the debt-overhang and crowding out literature, the study revealed a negative significant influence of external debt on economic growth in Cameroon. Results also revealed that there is a positive and significant direct effect of public investment on economic growth in the long run. Further results indicated that public investment and external debt positively and significantly affect engender economic growth in Cameroon.

Upadhyaya and Pun (2022) investigated the effect of public debt on the economic growth of Nepal using annual time-series data from the period 1978 to 2020. The study was based on an unrestricted Vector Auto regression model, which captures Multivariate Granger Causality between the variables. The result from the analysis revealed that there is no significant causal relationship between public debts and to the economic growth of Nepal.

Manasseh, Abada, Okiche, Okanya, Nwakoby and Offu (2022) examined the impact of external debt on economic growth. The study utilized annual time series data, focusing on thirty selected Sub-Saharan African (SSA) countries for the period 1997 to 2020. The Dynamic System Generalised Method of Moments estimation technique was adopted while controlling for conventional sources of economic growth. Empirical findings from the study reveal that external debt and external debt volatility have a negative and significant impact

on economic growth in SSA. Furthermore, the interaction of governance indicators, external debt and its volatility, had a positive impact on economic growth in SSA.

Akanbi, Uwaleke and Ibrahim (2022) investigated the relationship between external debt service and economic growth in Nigeria from 1981 to 2020. A quantitative research approach was adopted for this study. The method for estimation was the Auto-Regressive Distributed Lags (ARDL) model. The ARDL bound test results showed there was co-integration. The speed of change between the short-run and long-run of the co-integrating equations was 88.86%. The study used debt overhang theory, the neo-classical theory and endogenous theory as the theoretical framework. The study provided evidence of a negative relationship between external debt service and economic growth although this is not statistically significant. The result showed resource depletion effect of external debt services on growth. External debt stock has a positive but not significant relationship with growth. There was a positive but not significant relationship between external reserves to external debt ratio with growth. Debt service to export ratio has a positive relationship with growth.

Matthew and Adetayo (2022) examined the effect of debt sustainability on Nigeria's economic growth; the non-linear autoregressive distributed lag (NARDL) econometric technique was used. The study established that Nigeria's total debt stock and debt service payments had a considerable short-run effect on the economic growth of the country, but that only a reduction in total debt stock is important for long-run economic growth in the country. It was discovered that an increase in total debt stock initially has a terrible impact on economic growth, but that it has a positive impact after one year. On the other hand, the short-run effect of a total debt stock decrease is found to be consistently positive for all lags. Concerning debt service payment, the short-run effect showed that economic growth decreases when debt service payment increases and economic growth increases when debt service payment decreases. In the long-run, only a decrease in the total debt stock decreases economic growth significantly.

Mounir Belloumi1 and Atef (2021) investigated the impact of corruption on economic growth and investments in the Gulf Cooperation Council countries over the period 2003 to 2016 using the panel vector error correction model and the panel fully modified ordinary least squares method developed by Pedroni. The results of Granger causality tests indicate that corruption does not cause economic growth, foreign and domestic investments in the short run. Moreover, they find that there is strong long run unidirectional causality running from corruption to economic growth, foreign direct investment, domestic investment, and domestic credit. Estimation of the panel fully modified ordinary least squares model indicates that corruption has a negative impact on economic growth whereas a positive influence on domestic investment.

Teboho and Joel (2021) investigated the asymmetric relationship between government debt and GDP growth in Namibia. The study applied the non-linear autoregressive distributed lag (NARDL) methods to determine the asymmetrical effect of government debt on GDP growth. The estimated results suggest that a 1% increase in debt will be followed by a 0.104 decrease in GDP growth and that a 1% decrease in debt will produce a 0.738 increase in economic growth. This showed that the responsiveness of GDP growth to positive values of debt is different to that of negative values of debt. The responsiveness of GDP growth to negative values of debt was greater than to positive value of debt. This implied that it is important for Namibia to have manageable debt and fiscal sustainability in order to increase its GDP growth.

Hassan and Daniel (2021) determined the channels through which external debt transmits its impact on economic growth in sub-Saharan African (SSA) countries. Using the system generalized method of moments (GMM) estimation technique. The study identified public investment, private investment and total factor productivity as channels transmitting the non-linear effect from external debt to economic growth. Furthermore, the interest rate was also confirmed as a channel but with a direct effect. Contrariwise, the estimates indicated that savings are not a channel of transmission from external debt to economic growth in SSA. These findings call for urgent action from SSA countries to reduce their external debt stocks and implement alternative macroeconomic non-debt strategies to improve the identified channels to counteract the negative effect of high external debt on them.

Chigbo (2021) paper focused on fiscal deficit and Nigeria's economic growth. Johansen co-integration analysis and Error Correction Model (ECM) were employed to test for a relationship between or among variables. The paper concluded that the driving variables of economic growth in Nigeria were Public external debt-PEXD, total federal collection revenue-TFCR, and interest rate-INTR. The public deficit financing was determined based on the study by the variables of Government expenditure (GOVE), real GDP, exchange rate-EXCR. The best model of ECM to determine the impact of fiscal deficit in Nigeria is the interaction with economic growth performance measures in Nigeria. The findings confirm that one standard deviation of shocks of fiscal deficit has a significant influence on economic growth, hence confirming the long-run relationship.

Jalal and Ebrahim (2021) investigated the effects of external debt on economic growth in Iran and Malaysia. Findings of a Smooth Transition Regression (STR) model support a nonlinear relationship between the external debt size (the ratio of external debt stocks to GDP) and economic growth in Iran and Malaysia over the period 1973–2017. Moreover, results of the STR models estimation showed that external debt affects Iranian economic growth in a two-regime structure with a threshold of 2.96%, so that, the effect is negative in both regimes, but in the second regime as debt increases, the negative effect becomes larger. Also, findings indicate that external debt size harms Malaysian economic growth in a three-regime structure with two thresholds of 24.41% and 55.76%. Finally, the mentioned negative effect is considerably less severe in Malaysia than in Iran.

Ajuh, and Edith (2021) investigated the impact of external debt on economic growth in Nigeria from 1985 to 2018 using vector autoregressive (VAR) approach. The empirical results revealed that both external debt stock and external debt service exerted a negative and significant impact on economic growth. These outcomes entailed that when external debt stock changed by one-unit, economic growth declined by 0.495 unit. On the other hand, when external debt services changed by one-unit, economic growth declined by 0.017 unit. They concluded that external debt stock had been an impediment to economic growth in Nigeria over the period under study.

António (2021) used dynamic models and the Generalized Method of Moments (GMM) approach for a panel of 48 countries, from 2012 to 2019. They found an adverse effect of corruption on the level and growth of GDP per capita, but that large governments benefit less from reducing corruption. Furthermore, developing economies, regardless of government size, benefit less from reducing corruption, while government size is not sufficient to explain the influence of corruption on economic activity, although the level of effectiveness of public services was crucial. Finally, the findings suggested that private investment is a potential transmission channel for corruption

Utilizing GMM panel data analysis, Ring, Abdullah, Osman, Hamdan, Hwang, Mohamad, Hassan, and Khalid (2021) examined the nexus between external debt and economic growth where institutional quality acts as a moderator. Findings reported that the importance of institutional quality as a moderator in the relationship between external debt and economic growth for both samples of study. The results confirm that, despite the importance of good governance practices, as indicated by the significant effect of high scores in governance indicators such as voice and accountability (samples from low governance countries) and regulatory quality (samples from high governance countries), prescribing the right policy is crucial to avoid the negative impact of the wrong policy prescription on economic growth. The results are dissected into two groups, for low governance and high governance countries respectively. Overall, the study suggests good debt management and feasible policy prescriptions are the keys to controlling external debt.

Jacobs, Ogawa, Sterken, and Tokutsu (2020) investigated the causal relationship between public debt ratios and economic growth rates for 31 EU and OECD countries. They estimated a panel VAR model that incorporates the long-term real interest rate on government bonds as a vehicle to transmit shocks in both the public debt to GDP ratio and the economic growth rate. They found nocausal link from public debt to growth, irrespective of the levels of the public debt ratio. Rather, we find a causal relationship from growth to public debt. In high-debt countries, the direct negative impact of growth on public debt is enhanced by an increase in the long-term real interest rate, which in its turn decreases interest-sensitive demand and leads to a further increase in the public debt ratio.

Research Methodology

The research design adopted for this study is the *ex-post facto* research design. The data used in the study are secondary data spanning from 1996 through 2021, which are derived from statistical databases of World Bank, World Development Indicators (WDI), World Governance Indicators (WGI), the Central Bank of Nigeria (CBN) and the Debt Management Office (DMO) of various issues up to 2021. In accounting for the dynamic impact of institution in the public debt public – economic growth relationship in Nigeria, this study made use of a four (4)-prong econometric procedure. First, is the pre-estimation assessment using the descriptive statistics. Secondly, the unit root test was employed to ensure the variables under investigation are covariance-stationary. The tools used here for detecting non-stationarity of the data are the Augmented Dickey-Fuller (ADF), Philip Perron Test and the KPSS Test confirmatory test. Third, we proceed to estimate the the non-linear ARDL (NARDL) to account for asymmetric relationship.

Model Specification

To examine the direction of causality between public debt and economic growth in Nigeria, this study favours the Breitung and Candelon (2006) (BC) Granger causality test within the frequency domain context. Breitung and Candelon's (2006) Granger causality test permit the determination of the causality dynamics at varying periods in a bivariate Vector Autoregressive (VAR) model framework. Estimating Granger causality in its frequency domain may produce new and complementary insights into the causal relationships compared to the traditional Granger causality tests (Lemmens et al., 2008). An important consideration for the Breitung and Candelon's (2006) approach is premised on the fact that the frequency domain Granger causality test permits the observation of nonlinearities and

causality cycle, that is, high and low-frequency causality (Gokmenoglu, Kirikkaleli, and Eren 2019).

The causality dynamics between public debt and economic growth in Nigeria may vary over time, public expenditure cycles, structural breaks, and policy and structural changes. Thus, it is important to account for the possible variations in the causality dynamics between public debt and economic growth over time with the aid of a frequency domain approach to Granger causality testing which shows the causality pattern between two variables at different frequency domains by imposing linear restrictions on the autoregressive parameters in the bivariate VAR model. The BC Granger causality test in the frequency domain permits the decomposition of the information content of the time domain Granger causality.

We let $Y_t = (RGDP_t, PUB_{Debt_t})$ be a two-dimensional vector of time series observed at $t = 1, \ldots.T$, in line with BC. In this study, $RGDP_t$, and PUB_{Debt_t} are denotations for economic growth and public debt, respectively. It is assumed that Y_t follows a finite-order VAR representation of the form:

$$* (L)Y_t = \varepsilon_t \qquad\qquad (3.2)$$

Where

$* (L) = 1 - * (L) - \cdots - *_\rho (L^\rho)$ is a 2×2 lag polynomial with $L^k Y_t = Y_{t-k}$ and ε_t denotes the error, vector assumed to be white noise with $E(\varepsilon_t) = 0$. We let G be the lower triangular matrix of the Cholesky decomposition $G^/ G = \sum -1$ such that $E(\mu_t \mu_t^/) = 1$ and $\mu_t = G\varepsilon_t$.

Therefore, we test for the null hypothesis of no causality at frequency γ by using a standard F test. The F statistic follows a $F(2, T - 2p)$ distribution for $\gamma \in (0, \pi)$, with 2 being the number of restrictions; and T and p indicating the number of observations of a series and optimal lag order of the VAR model, respectively.

We select the optimal lag length of the VAR model employed for the BC Granger causality test in the frequency domain with the Bayesian information criterion, as suggested by Lemmens et al. (2008). Following Ciner (2011), we calculate the causality test statistic at high ($\gamma = 2.5$) and low ($\gamma = 0.01$) frequency. The causality test at high and a low-frequency level is equivalent to temporary (short-run) and permanent (long-run) causality tests, respectively.

Data analysis and discussion of findings
Descriptive Statistics

The result of the descriptive statistics can be seen in Table 4.1. The results indicate that the mean and median values of all the variables fall within their minimum and maximum values. This implies that all the variables, i.e. real GDP, debt to GDP ratio, external debt, domestic debt, debt servicing, tax revenue and institutions; indicate a high tendency of the normal distribution. All the variables are positively skewed, which implies that the distribution has a long right tail. The kurtosis statistics showed that all the variables were platykurtic, suggesting that their distributions were flat relative to a normal distribution as the values are less than three (3). The Jarque-Bera statistics show that the series is normally distributed since the p-values of all the series are not statistically significant at the 5% level.

Thus, informing the acceptance of the alternate hypothesis that says each variable is normally distributed.

Table 4.1: Descriptive Statistics

	RGDP	$\dfrac{DEBT}{GDP}$	$EXTER_{DEBT}$	DOM_{DEB}	$DEBT_S$	TAX_R	Ins_{Qua}
Mean	2.45	2.91	2.57	1.54	2.11	3.62	1.91
Median	3.34	2.95	3.67	2.21	2.29	3.74	2.23
Maximum	4.15	3.51	4.14	3.45	4.44	5.56	3.24
Minimum	1.57	1.34	1.93	1.11	1.28	2.11	-0.34
Skewness	1.59	0.11	0.58	0.61	0.95	0.37	0.22
Kurtosis	1.65	2.17	2.69	1.36	1.44	2.51	1.48
Jarque-Bera	4.44	3.12	1.34	4.21	3.44	1.38	2.54
Probability	0.15	0.22	0.23	0.11	0.30	0.11	0.30

Source: Author Computations

Note: Descriptive Statistics were taken before the variables were transformed into logarithm forms. The Jarque-Bera test is used to determine whether a given series follow a normal distribution or not. It tests the null hypothesis that a given series is normally distributed.

Test of Multicollinearity

In order to test for multicollinearity among the independent variables as well as the response term (debt to GDP ratio, external debt, domestic debt, debt servicing, tax revenue and regulatory quality), the correlation matrix was calculated.

Correlation Matrix

Table 4 shows the correlation analysis between the variables used in the study. It is evidenced from this analysis that no correlation exists between the variables making results emanating from the study largely reliable.

Table 4.2: Correlation Matrix

	RGDP	$\dfrac{DEBT}{GDP}$	$EXTER_{DEBT}$	DOM_{DEBT}	$DEBT_{SERV}$	TAX_{REV}	Ins_{Qua}
RGDP	1						
$\dfrac{DEBT}{GDP}$	-0.0027	1					
$EXTER_{DEBT}$	0.0345	0.0562	1				
DOM_{DEBT}	0.0023	0.0258	-0.3271	1			
$DEBT_{SERV}$	-0.0067	0.4214	-0.7231	-0.3443	1		
TAX_{REV}	0.4572	-0.034	-0.3224	-0.4211	0.5821	1	
Ins_{Qua}	0.1123	0.2322	0.4173	0.0389	0.0589	0.6674	1

Source: Author Computations

The result of the correlation matrix in Table 4.2 shows that the correlation coefficients among the variables are not perfectly correlated. Since the correlation between the variables is less than 0.75, hence, there is no tendency for multicollinearity among such variables (Baltagi, 2005; Wooldridge, 2002). Explicitly, the debt to GDP ratio is negatively correlated with real GDP (-0.027). External debt is positively correlated with real GDP (0.0345), and debt to GDP (0.0562). Domestic debt is positively correlated with real GDP (0.0023), positively with debt to GDP (0.0258) and negatively with external debt (-0.3443). Debt servicing is negatively correlated with real GDP (-0.0067), positively correlated with

debt to GDP (0.4214), negatively correlated with external debt (-0.7231) and negatively correlated with domestic debt (-0.3443). Tax revenue is positively correlated with real GDP (0.4572), negatively correlated with debt to GDP (-0.034), negatively correlated with external debt (-0.3224), negatively correlated with domestic debt (-0.4211) and positively correlated with debt servicing (0.5821). Institutional quality index is positively correlated with real GDP (0.1123), positively correlated with debt to GDP (0.2322), positively correlated with external debt (0.4173), positively correlated with domestic debt (0.0389), positively correlated with debt servicing (0.0589) and positively correlated with tax revenue (0.6674).

Unit Root Test

The outcomes of the ADF, PP, and the KPSS confirmatory test are shown in Table 4.

Table 4.3: Unit Root Test

Variables	@LEVEL			@FIRST DIFFERENCE			ORDER OF INTEGRATION
	ADF	PP	KPSS	ADF	PP	KPSS	
	Intercept {Trend & Intercept}	Intercept {Trend & Intercept}	Intercept {Trend & Intercept}	Intercept {Trend & Intercept}	Intercept {Trend & Intercept}	Intercept {Trend & Intercept}	
$RGDP$	0.5222 {0.2777}	0.4663 {0.11883}	0.4423 {0.4532}	0.6631* {0.6377}**	0.7737* {0.5636}*	0.2864* {0.2966}*	I(1)
$\dfrac{DEBT}{GDP}$	-1.4627 {0.4539}	-1.3374 {0.5399}	-1.3384 {0.4942}	-1.3889* {0.3478}*	-1.8234* {0.5525}*	-1.6788* {0.5432}*	I(0)
$EXTER_{DE}$	-1.8934 {0.6751}	-1.4782 {0.7922}	-1.6832 {0.6934}	-1.7523* {0.7892}*	-1.7641* {0.6974}*	-1.6821* {0.7721}*	I(1)
DOM_{DEBT}	0.7836 {0.5632}	0.5782 {0.6893}	0.5322 {1.6525}	0.5342* {0.8721}*	0.3482* {0.6447}*	0.4267* {0.2518}*	I(1)
$DEBT_{SERV}$	-1.5288 {0.4523}	-1.8211 {0.0051}	-1.9246 {0.1117}	-1.5834* {0.6782}*	-1.3255* {0.4327}*	-1.3784* {0.5711}*	I(1)
TAX_{REV}	0.6721 {0.4321}	0.6488 {0.5711}	0.4352 {1.2799}	0.8221* {0.0433}*	0.5432* {0.6732}*	0.5564* {0.8512}*	I(1)
Ins_{Qua}	-1.7899 {0.6732}	-1.0532 {0.0034}	-1.6032 {0.0487}	-1.0482* {0.0932}*	-1.0343* {0.7822}*	-1.2883* {0.0543}*	I(1)

Source: Author Computation

T-Stat values of intercept estimates are reported in the text box while T-Stat values of trend & intercept estimates are in the parentheses; $* P < 0.01$, $** P < 0.05$ respectively.

All tests in Table 4.3 confirmed that variables are non-stationary at levels but are stationary at first difference. It is as a result of this inferred that variables are first differenced stationary. These empirical outcomes did uncover not only the non-stationary properties of all the variables but also established the covariance nature of the data set under investigation. This study proceeds to estimate the non-linear ARDL to establish the asymmetric relationship between the variables of interest. This is indispensable in this research because the choice of the estimation strategy is consistent with the data behaviour and in consonance with contemporary NARDL-centric literature

Testing for Causality Using Frequency Domain between Public Debt and Economic Growth in Nigeria

Table 4.2 presents the result of the causality test between public debt and economic growth in Nigeria in the time and frequency domain. Granger (1988) emphasized the

relevance of the frequency-domain causation decomposition especially in the case of cointegrated systems with causality at the zero frequency.

In this study, a bivariate vector autoregressive (VAR) model was used to test simple procedures that are based on a set of linear hypotheses on the autoregressive parameters. This test procedure can easily be generalised to allow for cointegration relationships and higher-dimensional systems.

To test the hypothesis that y does not cause x at frequency w, this study considers the null hypothesis

$$M_{y \to x}(w) = 0$$

To test the causality at the frequency domain, this study tests the nullity of all coefficients.

Table 4.4: Test of Causality Using the Time an Frequency Domain

	Time Domain Causality Test	Frequency Domain Causality Test	
		Temporary ($y = 2.5$)	Permanent ($y = 0.01$)
$\frac{DEBT}{GDP} \to RGDP$	1.793 [0.001]*	41.738 [0.0041]*	11.433 [0.5422]
$RGDP \to \frac{DEBT}{GDP}$	0.5782 [0.1634]	7.662 [0.3224]	5.433 [0.1423]
$EXTER_{DEBT} \to RGDP$	7.8321 [0.0432]**	13.436 [0.0512]**	14.899 [0.0052]*
$RGDP \to EXTER_{DEBT}$	13.246 [0.2313]	15.332 [0.0782]	12.233 [0.0923]
$DOM_{DEBT} \to RGDP$	6.782 [0.0317]**	41.545 [0.05113]**	35.225 [0.5041]
$RGDP \to DOM_{DEBT}$	14.532 [0.1422]	20.871 [0.4401]	16.322 [0.7089]
$DEBT_{SERV} \to RGDP$	8.111 [0.0003]**	67.439 [0.8047]	34.553 [0.0041]*
$RGDP \to DEBT_{SERV}$	21.432 [0.0231]**	52.892 [0.0001]*	53.322 [0.0000]*
$TAX_{REV} \to RGDP$	11.433 [0.0317]**	33.221 [0.0141]**	55.289 [0.0002]*
$RGDP \to TAX_{REV}$	28.322 [0.3047]	54.5434 [0.0589]	49.628 [0.5504]

Source: Author Computations

Note: $* \ P < 0.01$, $** \ P < 0.05$ respectively; P values are in Parentheses.

The result in Table 4.4 is two-fold; the time domain causality and the frequency domain causality. The time domain causality shows that there is a uni-directional debt-to-GDP ratio to real GDP. This implies that the debt threshold causes economic growth in Nigeria. The result also shows uni-directional from external debt to Real GDP. This implies that external debt causes economic growth in Nigeria. Furthermore, there is uni-directional causality from domestic debt to real GDP. This implies that domestic debt causes economic growth in Nigeria. Nonetheless, the result also shows bi-directional causality from debt servicing to real GDP. This implies that debt servicing and economic growth in Nigeria Granger cause each other. Finally, there is uni-directional causality from tax revenue to real GDP. This implies that tax revenue causes economic growth in Nigeria.

In the frequency domain dimension, the temporal and permanent causality cycle denotes short-run and long-run causality dimensions which summarised the tendencies for the non-linearities in the causality in public debt and economic growth data in Nigeria. The result shows that there exists uni-directional temporary quality from debt to GDP ratio to real GDP but statistics were insignificant for permanent frequency domain causality. This implies that the debt-to-GDP ratio causes economic growth in Nigeria in the short run. The result also shows that there exists uni-directional temporary and permanent causality from external debt to real GDP. This implies that the external debt causes economic growth in Nigeria in the short run and long run. The result shows that there exists uni-directional temporary quality from domestic debt to real GDP but statistics were insignificant for permanent frequency domain causality. This implies that the domestic debt causes economic growth in Nigeria in the short run. The result shows that there exists bi-directional permanent causality from debt servicing to real GDP but statistics were only significant for temporal frequency domain uni-directional causality from real GDP to debt servicing. This implies that while debt servicing causes economic growth in Nigeria in the long run, real GDP causes debt servicing both in the short and long run.

Conclusion

This study set out to generate discussion on public debt and economic growth in Nigeria and conclude based on the findings emanating. While a growing number of studies have been done on public debt and economic growth in Nigeria, very few studies have explained why the size and magnitude of Nigeria's fiscal obligation remain underscored. The role of institutions as a precursor to the success or otherwise in public debt management in Nigeria has received less attention. Considering regulations can help to ensure that public debt is managed in a way that does not lead to unsustainable levels of borrowing, it is essential to examine the growth-inducing capacities of public debt under regulatory lenses. Fiscal rules, for example, can limit the amount of borrowing a government can undertake in order to prevent it from accumulating debt that it cannot afford to service. This can help to reduce the risk of default, maintain investor confidence, and promote long-term economic stability. Using disaggregated public debt variables which were interacted with the institutional quality index, this study reached some important conclusions given the results obtained

i.   When public debt was interacted with institutional quality, the impact on economic growth is positive.

ii.   There is unidirectional causality from public debt to economic growth in Nigeria.

Recommendations

i.   When the institutional quality index interacted with external debt, debt servicing and tax revenue, the interactive terms with institutions return a negative relationship with economic growth in Nigeria, an optimum policy recommendation would be for the Nigerian government to prioritise institutional reforms aimed at improving the quality of policies and governance. This may include measures to enhance transparency, accountability, and public participation in the decision-making process, as well as measures to strengthen the rule of law, reduce corruption, and promote political stability. Such reforms would help to enhance the effectiveness of policy implementation and reduce the risk of mismanagement and corruption associated with borrowing and debt servicing.

ii.   The causality test reveals that the debt to GDP ratio has short-run uni-directional causality to economic growth in Nigeria, the optimum policy recommendation would be for the government of Nigeria to prioritise debt management by monitoring the debt to GDP ratio closely and ensuring that it is within sustainable levels. They could also explore options to reduce the debt-to-GDP ratio, such as implementing fiscal policies that

promote economic growth and increase revenue generation, as well as optimizing debt servicing strategies to reduce the burden on the economy.

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