Crowding-out Effect of Public Debt on Private Sector Credit in Nigeria

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Abstract

This paper investigates the effect of public debt on private sector credit in Nigeria, aiming to determine if public-sector borrowings crowd out private sector credit through rising interest rates. Utilizing the quantile autoregressive distributed lag (QARDL) model, the study examines the long-term equilibrium effect of public debt on private sector credit across various quantiles. The Wald test was employed to assess the time-varying relationship and the constancy of integrating coefficients across quantiles. To address potential contemporaneous correlations between variables, a projection method is used to derive a QARDL-ECM model. Findings indicate a significant crowding-out effect, with a one-unit increase in public debt leading to a 1.49-unit decrease in private-sector credit. This negative impact is observed both in the short and long run, and the effect varies across quantiles, from positive at lower quantiles to negative at higher quantiles. Additionally, per capita GDP positively influences private sector credit, while interest rates and institutional quality index have negative effects of varying magnitudes. The study concludes that public-sector borrowings indeed crowd out private-sector credit in Nigeria. It is recommended among others that the Nigerian government should adopt strategies to manage and reduce public debt to mitigate its negative impact on private-sector credit and diversify its sources of funding to reduce reliance on borrowing.

Keywords: Crowding-out; domestic borrowing; government borrowing; quantile regression; private sector credit

JEL Classification Codes: C32, H32, H63, O16, P43

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1   Introduction

The link between private investment and state borrowing is a perpetual matter in economic development and growth based on the growing number of empirical and theoretical works that have given rise to the concepts of crowding-in and crowding-out Macfarlane *et al*., (2017). Crowding-out effect describes the cutback in investments in the private sector brought about by an increment in expenditure in the public sector. Whenever the state's expenditure goes above the usual amount, it can prompt a rise in state loans. This consequently raises the demand for credit reserves. Such an addition brings about an increase in lending rate and a reduction in the quantity of money at hand to meet the requirements for investment in the private sector. Consequently, such actions by the government crowd out private investment in the country; that is, individuals and businesses of all sizes are forced out, or "crowded-out" of the market.

Government intervention/participation in economic activities is still much in Nigeria. This is so for obvious reasons which include the inability of the weak and growing private sector to meet certain demands of the people. And attempts by the government to meet these needs of the citizenry put pressure on its meagre resources thereby frequently throwing it into a financial deficit. This compels the government to resort to fiscal actions that rely heavily on foreign aid and/or borrowing from the domestic and foreign markets to finance its deficit. This has seen the government, at times, borrowing from the domestic market at higher interest rates than the private sector would. To justify these borrowings, Okoro, (2013) asserts that countries borrow for two broad reasons: macroeconomic reasons, which include higher investment, higher consumption (education and health); or to finance transitory balance of payments deficits, which may be to lower nominal interest rates abroad, lack of domestic long-term credit, or to circumvent hard budget constraints. Public debts, according to Okoro (2013), therefore, are incurred to finance fiscal deficits created by expansive government expenditures if tax revenues and money creation cannot fill the fiscal gap. This falls under the expansionary monetary policy measure of an economy.

Nevertheless, the impact of such an expansionary measure depends on the elasticity of the money demand-supply curve and is said to be weak when investment is very insensitive to interest rate. That is, when investment is insensitive to interest rate an expansionary monetary policy will have a weak effect on output. Therefore, excessive deficits and public debts, according to Okoro (2013) and Al-Majali (2018), can create fiscal imbalances like exerting extra-budgetary burden for future generations; increase the cost of private sector financing (cost effect); decrease the availability of financing of private sector (crowding-out)in the economy; and unsustainable debts can trigger disruptive movements in interest rates and exchange rates as highly indebted countries become vulnerable to global market forces. These spill-over effects then make the implementation of expansionary monetary policies a cautious act.

In Nigeria, since independence, several economic development efforts have resulted in increasing public debt. A review of the debt profile of the country shows that, from Nigeria's first external loan of US$13.1 million (from the Paris Club) in 1964, Nigeria's total external debt stock stood at over US$35.9 billion as of end-December 2005, with US$30.8 billion owed to the Paris Club (Okoro, 2013). This was before the debt relief granted to the country in 2005 when Nigeria's public debt hovered about US$46.2 billion; with $35.9 billion being for external debt while domestic debt stock stood at $10.3 billion (Okoro, 2013; Debt Management Office – DMO, 2020). From a total public debt of about $58, 643.18 million in 2013, public debt currently stands at 25% of Gross Domestic Product (GDP) amounting to ₦26trillion as of December 2019 with an approval to acquire yet another $22.7 billion. The picture of the movement of Nigeria's debt profile is created by Figure 1, which has graphed a trend of the total outstanding debt (TOD) of

the country with its broad components – outstanding external (OED) and outstanding domestic debts (ODD) – from 1990 to 2019. These have grown with time, with ODD surpassing OED by 2006 and remaining the highest contributor to the country's TOD till the end of 2019.
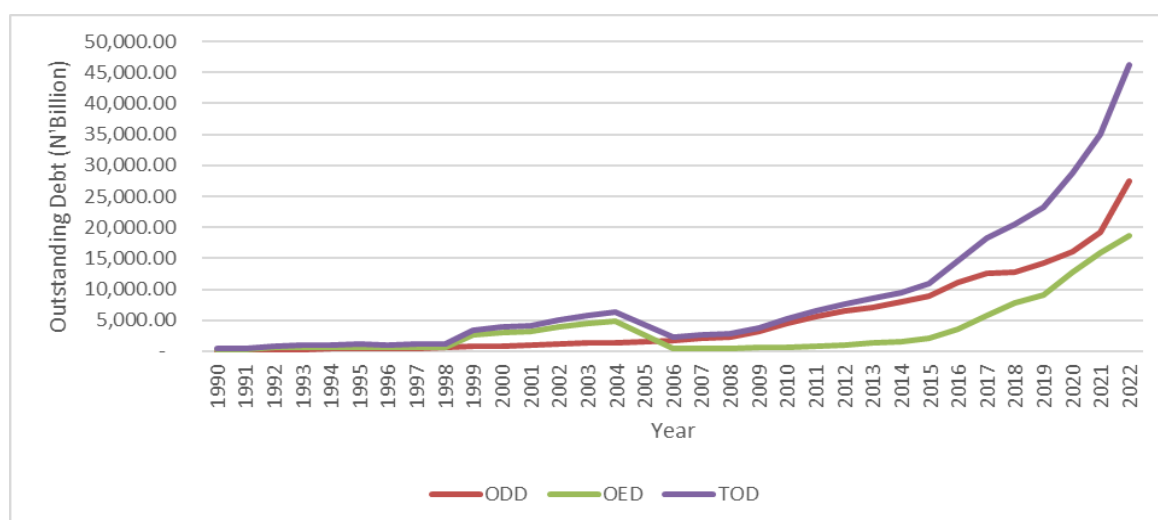
*Figure 1:* **Trend of public debt in Nigeria (1990-2022).**

This rise in debt profile is because, over 85% of the country's budget deficit was funded through borrowings sourced from different multilateral organizations as approved by the Federal Executive Council (DMO, 2020). The country has borrowed from various sources such as the multilateral, the World Bank, the Islamic Development Bank, the African Development Bank, the China-EXIM, and also issued products in the international market. Local, loans have been obtained through the issuance of treasury bills and Federal Government Treasury Bonds.

And as economists and other analysts believe, such expansionary (or loose) fiscal policy (or actions) may dilute the effects of tight monetary policy formulated for capping inflation and, furthermore, crowd-out private investment in the economy. Crowding-out is seen when the lending agents react to public borrowing by increasing its loan price – interest rate – or the monetary authorities hiking the price thereby making loans affordable only by the government but expensive for private investors to acquire credit for the growth of their businesses. This is likely the situation in Nigeria where the premium lending rate (PLR) and the monetary policy rate (MPR), which became operational in 2006, have remained above 10% (see Fig. 2). This is discouraging to private investment, capital accumulation and declining productivity.
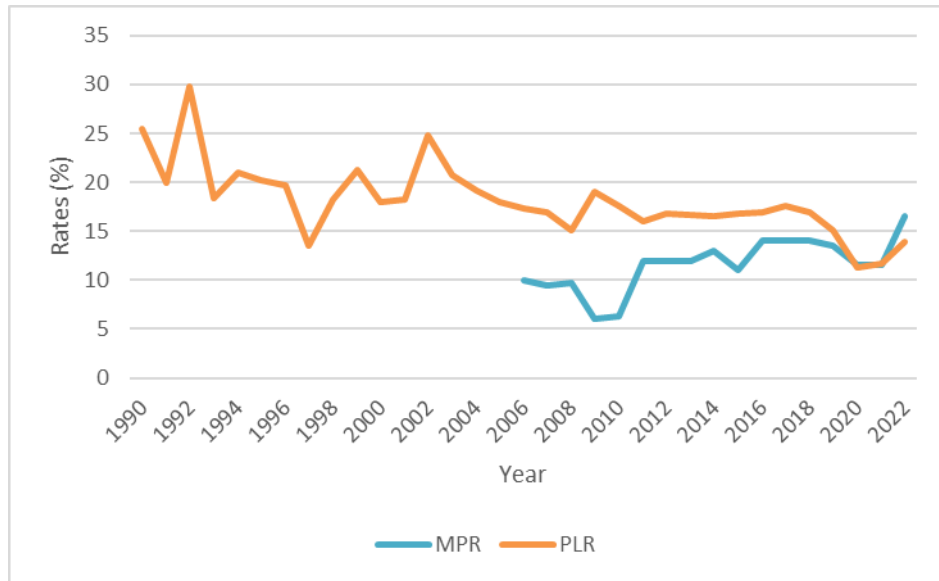
Figure 2: **Movement of the premium lending rate and monetary policy rate (1990-2022).**

In the recent past in Nigeria, the government's borrowing from domestic sources like the banks has increased tremendously. Such increasing reliance on the banking sector to finance budget deficits, according to Akpansung (2018), has made lending to the private sector relatively low as a percentage of total output. In general, therefore, this economic situation of ever-growing public debt can negatively impact private-sector credit acquisition which is necessary for investment and further lead to a drop in private-sector output and economic growth. Therefore, it can be seen that the interplay between fiscal and monetary policies is very relevant in determining the performance of the private sector of the Nigerian economy.
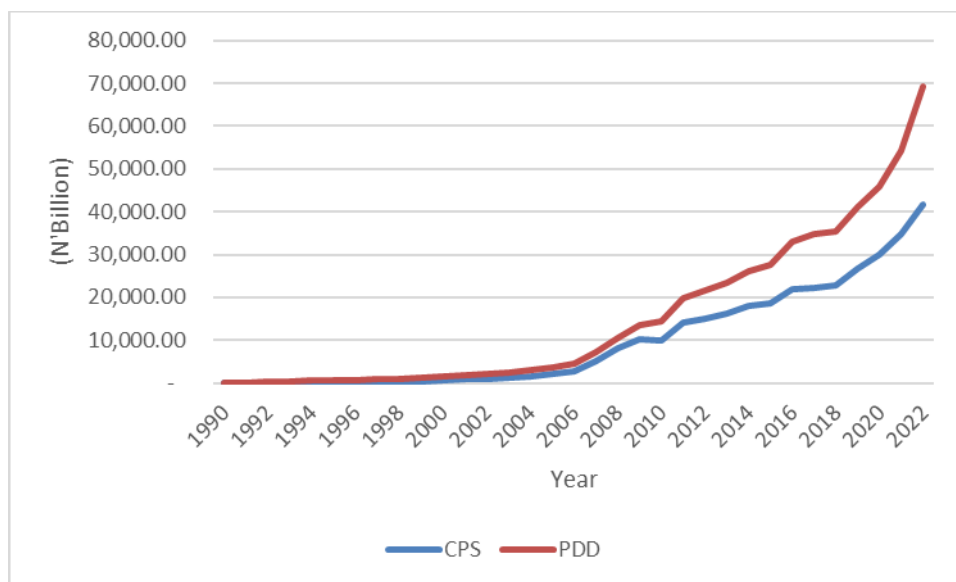
Figure 3: **Trend of public domestic debt (PDD) and credit to the private sector (CPS) (1990-2022).**

The overall objective of this study is to thus to investigate the effect of public debt on private-sector credit. That is to determine if public sector borrowings crowd-out the private sector in credit acquisition through a rise in interest rates. The study contributes to the existing literature by offering a nuanced understanding of how public borrowing impacts private-sector financing within an emerging economy context. Empirically, the study provides empirical evidence specific to

Nigeria, a major African economy with unique financial and economic structures. By focusing on Nigeria, the research fills a geographical gap in the literature, offering insights that may apply to similar economies in Sub-Saharan Africa and other developing regions. Methodologically, the study employs advanced econometric techniques, such as the quantile autoregressive distributed lag (QARDL) model, to rigorously analyze the relationship between public debt and private sector credit. This methodological approach ensures robust and reliable results, enhancing the credibility of the findings. Policy-wise, the findings of the study have significant policy implications. By demonstrating the crowding-out effect of public debt on private-sector credit, the research highlights the need for prudent fiscal management and the development of policies that balance public borrowing with the growth needs of the private sector. This can inform policymakers in Nigeria and other developing countries on how to structure debt strategies that minimize adverse effects on private sector growth. Also, by analyzing data over an extended period, the study captures long-term trends and shifts in the relationship between public debt and private-sector credit. This longitudinal perspective allows for a deeper understanding of how structural changes in the economy and financial system influence the crowding-out effect. Thus, this study significantly enriches the literature on the crowding-out effect of public debt by providing focused, methodologically sound, and contextually relevant insights from Nigeria. It bridges the gap between theoretical understanding and practical implications, offering valuable guidance for both academic researchers and policymakers in developing economies.

The study is not without challenges. A notable limitation of the study is its reliance on available historical data, which may not capture the full complexity of the economic environment or account for unrecorded transactions in the informal sector. Additionally, the study may not sufficiently consider the potential influence of external factors such as global economic conditions, international trade policies, and geopolitical events that can significantly impact both public debt levels and private sector credit availability. However, these limitations do not invalidate the results and relevance of the study and impact on policy. However, supplementing the study with further research that incorporates a broader range of variables and more comprehensive data will be fine.

The paper is structured into five parts. The first is the introduction which is followed by a literature review as the second section or part. Part three undertakes a discussion on the method of study, with empirical results and discussion contained in section four, while section five provides a conclusion and recommendation for the paper.

2.   Literature Review
Discourse on the effect of public borrowing (or debt) has interestingly been featured in many economic literature. And the arguments are as to whether public debt crowd-out or crowd-in private investment. Public debt is usually taken to be inversely related to private credit. However, at least on a theoretical level, the relationship has remained ambiguous with the debate ongoing. The Keynesian hypothesis in an attempt to relate government deficit to economic productivity (investment), advocated that government should raise aggregate demand by increasing deficit spending via some combination of more spending and lower taxes (Dantama, Gatawa & Galli, 2017). Keynes supported the deliberate creation of a budget deficit financed by public borrowing and believed that government expenditure does not crowd out private consumption expenditure (private investment). In this hypothesis, Keynes distinguished between two forms of government loan; net loan on capital budget (used to complement and support capital expenditure) and net loan on current budgetary deficit. He also foresaw the adverse effect of public borrowing on interest rate when he advocated for a long-run policy of systematic reduction of the riskless real interest rate towards zero.

The classical view, which still seems to hold sway, believes that public borrowing accumulates resources for government's use leaving the private sector with a lesser part and equally making that part expensive through rising interest rate (Fayed, 2012). Both the Classicists and Neoclassicals have argued that, when governments fund a deficit with public borrowing and even overseas borrowing, interest rates tend to increase across the market, since such government borrowings create higher demand for credit in the financial markets (Essien, Agboegbulem, Mba, & Onumonu, 2016; Robert & Bernanke, 2001). This then drastically reduced the amount of credit available to the private investors and they are said to be crowed out of the credit market by government whose high demand for credit causes a rise in interest rate that it is willing and able to pay.

Discussions about public debt and private sector investment (or generally about expansionary fiscal action) have tolled these lines of argument. According to Fielding (2007) and Khalid (1996), crowding out which is based on a bank's balance sheet happens when banks respond to a higher government borrowing by adjusting their loan portfolio optimally given the risk-return characteristics of different assets and liabilities. Akpansung (2018) posited that though government domestic borrowing is often thought of as a way of avoiding inflation and external crises, it oftentimes reduces the credit that would otherwise be available to the private sector, putting pressure on domestic interest rates. Stressing that, no matter how interest rates might be controlled, domestic borrowing can still lead to credit rationing and crowding-out of private sector investment. Others, like Kumhof and Tanner (2005), took the Keynes' way by arguing that a higher government borrowing from the banking sector may not have any significant effect on private credit or even crowd in private credit. They held that when the banks have excess liquidity, higher lending to the government may not result in any significant reduction of credit to the private sector. Adding that government borrowing might actually induce the banks to undertake relatively more risky private lending because the safe government assets in a bank's portfolio allow it to bear more risk.

Empirical evidences too have been torn along the theoretical arguments, however, with more tilting towards the crowing-out effect of public debt. Akpansung (2018); Al-Majali (2018); Asaleye *et al*. (2018); Chinanuife *et al*. (2018); Anyanwu, Ganii, and Hu (2017); Dantama *et al*. (2017); Lidiema (2017); Essien *et al*. (2016); Şen & Kaya (2014); Shetta & Kamaly (2014); and Khan and Gill (2009) had proven that public debt have negative effect on private credit or investment through interest rate and other means, thus concluded that public debt crowd-out private credit. Chinanuife *et al*. (2018), for instance, found that public debt has a negative impact on public investment in Nigeria when they used quarterly time series data ranging from 1981 to 2016 and the ARDL methodology in their analysis. Al-Majali (2018) used a vector error correction model to investigate the relationship between public borrowing and private credit in Jordan and came to the conclusion that government borrowing from the domestic banks leads to a more than one-to-one crowding out of private credit. Similar in conclusion is the work of Dantama *et al*. (2017) who examined the long-run impact of fiscal deficit on private investment employing annual time series data covering the period of 1980 to 2014 and arrived at the finding that an increase in government expenditure crowded out private investment in the long run. Essien et al. (2016) on the other hand found that shock to external debt stock increases prime lending rate, but with a lag; and that the level of external and domestic debt had no significant impact on the general price level and output.

Lidiema (2017) examined only the effect of domestic borrowing on gross fixed capital formation and found that domestic debt has a negative and significant relationship with gross fixed capital formation with a long-run diminishing relationship. Asaleye *et al*. (2018) also found that a gradual

increase in domestic debt in Nigeria has a crowding effect on private investment which resulted in negative implications on employment generation through the private sector. Differing in the mode of transmitting the effect, Anyanwu *et al.* (2017) revealed that though government domestic borrowing has resulted in the shrinking of private credit it works through the credit channel and not the interest rate channel. This means that while available domestic credit to the private sector dwindled in the face of increasing government borrowing, the price of such credits (i.e., interest rate) remained unchanged.

Other studies like those by Asogwa and Okeke (2013); Amiokor *et al.* (2014); Akomolafe *et al.* (2015); and Phillip *et al.* (2017) had their findings aligned with the Keynesian thesis. Amiokor *et al.* (2014), however, had their results showing a mixed effect. They discovered that government borrowing had a major impact in crowding out the private sector in Ghana and at some times it had crowded in private investments. Akomolafe et al. (2015) equally found such mixed effect where domestic debt was found to crowd out domestic investment in both the short run and long run, while external debt crowds in domestic investment in the long run.

On the other side of the argument, the works of Thilanka and Sri Ranjith (2018); Hatano (2010); Majumder (2007); and AbdullatifAlani (2006) are among others that have proven the classical proposition of no crowding out effect of public debt. Thilanka and Sri Ranjith (2018) found evidence of the presence of the crowding-in effect of public debt on private investment in the long run, in the same way Majumder (2007) findings did not corroborate the crowding-out hypothesis in Bangladesh, but rather, provide the evidence for crowding-in effect. Hatano (2010) addressed from the public investment angle and affirmed that there is crowding-in effect of public investment on private investment. AbdullatifAlani (2006), in his findings, established that deficit financing by bond issues does not crowd out private sector investment, but rather crowds in private credit for investment.

It is evident from the above review that crowding-out effect of public debt on private sector credit in Nigeria has been a topic of interest in economic literature, and several studies have contributed to understanding this phenomenon. Nevertheless, the current study stands out against previous studies like Anyanwu *et al.* (2017), Asaleye *et al.* (2018), Asogwa and Okeke (2013) in many regards. For instance, while previous studies have employed different methodologies such as econometric 63odelling or case studies to analyze the relationship between the variables, the current study utilized a novel approach of quantile autoregressive distributed lag (QARDL) model which are generally robust to outliers in the data. Outliers can significantly affect traditional regression models, leading to biased estimates. QARDL's focus on quantiles helps mitigate the impact of outliers, making it more reliable in datasets prone to extreme values thus providing a fresh perspective. The inclusion of institutional quality index (IQI) as variable is also deviation from previous studies. There are equally differences in the periods covered by the studies and the data sources used. The current study benefited from more recent data and alternative data sources that were not available to earlier researchers, potentially offering more accurate insights. Some of the previous studies like Asaleye *et al.* (2018) and Asogwa and Okeke (2013) have drawn conclusions about policy implications regarding fiscal management or monetary policy adjustments. The current study builds on these findings and proposes new policy recommendations based on updated empirical evidence. Based on these differences, the current study stands to contribute to the ongoing discourse on the crowding-out effect of public debt on private sector credit in Nigeria, potentially offering new insights or confirming existing findings in a different context or with updated data and methodologies.

3. Methods

Unlike previous studies, this study used the quantile autoregressive distributed lag (QARDL) model (Cho *et al.*, 2015) to study the crowding-out effect of public debt on private-sector credit in Nigeria. The QARDL approach tests the long-term equilibrium impact of public debt on private-sector credit across quantiles. By using the Wald test, the time-varying relationship of integration can also be tested which allows the checking of integrating coefficients' constancy through a range of quantiles. We can, therefore, write the ARDL model as:

$$PC_t = \beta_0 + \beta_1 PD_t + \beta_2 PCGDP_t + \beta_3 INR_t + \beta_4 IQI_t + \sum_{i=1}^{p} \alpha PC_{t-1} + \sum_{j=1}^{q^1} \delta_1 PD_{t-1}$$

$$+ \sum_{j=1}^{q^2} \delta_2 PCGDP_{t-1} + \sum_{j=1}^{q^3} \delta_3 INR_{t-1} + \sum_{j=1}^{q^4} \delta_4 IQI_{t-1} + \varepsilon_1 \qquad \text{Eqn. 1}$$

where error term is denoted by ε_t and is defined as $PC_{t-p}[PC_t/PC_{t-1}]$, with PC_{t-1} being the smallest σ-field made by $\{PD_t, PCGDP_t, INR_t, IQI_t, PC_{t-1}, PD_{t-1}, PCGDP_{t-1}, INR_{t-1}, IQI_{t-1},...\}$, and according to the Schwarz information criteria (SIC), the lag orders denoted by p, q^1, q^2, q^3, and q^4. In Eq. (1), $PD_t, PCGDP_t, INR_t$, and IQI_t, denotes the domestic debt, per capita GDP, interest rate, institutional quality index, respectively, while PC_t represents private sector credit.

Cho *et al.* (2015) presented the following basic QARDL (p, q) form by extending the model in Eq. (1) to a quantile context.

$$QPC_t = \beta_0 + \beta_1(\tau)PD_t + \beta_2(\tau)PCGDP_t + \beta_3(\tau)INR_t + \beta_4(\tau)IQI_t + \sum_{i=1}^{p} \phi_i(\tau)PC_{t-i}$$

$$+ \sum_{j=0}^{q^1} \lambda_1(\tau)PD_{t-i} + \sum_{j=0}^{q^2} \lambda_2(\tau)PCGD_{t-i} + \sum_{j=0}^{q^3} \lambda_3(\tau)INR_{t-i} + \sum_{j=0}^{q^4} \lambda_4(\tau)IQI_{t-i}$$
$$+ \varepsilon_1(\tau) \qquad \text{Eqn. 2}$$

Where $\varepsilon_1(\tau) = PC_t - PC_t(\tau/PC_{t-1})$ and $QPC_t(\tau/PC_{t-1})$ is the τth quantile of PC_t conditional on the information set PC_{t-1} (Kim & White 2003). We restructured Eq. (2) to analyze the QARDL as:

$$QPC_t = \beta_0 + \beta_{PD}(\tau)PD_t + \beta_{PCGDP}(\tau)PCGDP_t + \beta_{INR}(\tau)INR_t + \beta_{IQI}(\tau)IQI_t + \sum_{i=1}^{q^{1-1}} \delta PD_i$$

$$+ (\tau)\Delta PD_{t-i} + \gamma_{PD}(\tau)PD_t + \sum_{i=1}^{q^{2-1}} \delta PCGDP_i + (\tau)\Delta PCGDP_{t-i}$$

$$+ \gamma_{PCGDP}(\tau)PCGDP_t + \sum_{i=1}^{q^{3-1}} \delta INR_i + (\tau)\Delta INR_{t-i} + \gamma_{INR}(\tau)INR_t + \sum_{i=1}^{q^{4-1}} \delta IQI_i$$
$$+ (\tau)\Delta IQI_{t-i} + \gamma_{IQI}(\tau)IQI_t$$
$$+ \varepsilon_1(\tau) \qquad \text{Eqn. 3}$$

In Eq. (3), the parameters capture the previous and current dynamics, while the long-term association between public debt and private sector credit can be measured by restructuring Eq. (3) as formulated in Eq. (4):

$$QPC_t = \mu(\tau) + X_t^1\beta(\tau) + M_t(\tau) \qquad \text{Eqn. 4}$$

With QPC_t representing the dependent variable at time t in conditional quantile-specific form, $\mu(\tau)$ is the quantile-specific intercept term that estimates different intercepts for different quantiles allowing for a more detailed analysis of the distribution of the dependent variable, X_t^1 denotes the vector of independent variables at time t with the superscript (1) indicating that this is the set of variables in the model, $\beta(\tau)$ is the quantile-vector of coefficients associated with the independent variables representing how the quantile τ of the dependent variable changes with X_t^1, and the $M_t(\tau)$ term represents the error term or residual at time t for the quantile τ. In quantile regression, the residuals can vary across different quantiles, providing a more nuanced understanding of the error distribution.

In the following Eqn. 5, the QARDL model is further generalized to avoid the serial correlation of ε.

$$aQ\Delta PC_t = \alpha + \rho PC_{t-1} + \phi_{DD}PD_{t-1} + \phi_{PCGDP}PCGDP_{t-1} + \phi_{INR}INR_{t-1} + \phi_{IQI}IQI_{t-1}$$
$$+ \sum_{i=1}^{p} \phi_i\Delta PC_{t-1} + \sum_{i=0}^{q^{1-1}} w_i\Delta PD_{t-1} + \sum_{i=0}^{q^{2-1}} \delta_i\Delta PCGDP_{t-1} + \sum_{i=0}^{q^{3-1}} \psi_i\Delta INR_{t-1}$$
$$+ \sum_{i=0}^{q^{4-1}} \theta_i\Delta IQI_{t-1} \qquad \text{Eqn. 5}$$

By using the model formulated in Eqn. (5), it is likely that a contemporaneous correlation exists between v_t and ΔPD, $\Delta PCGDP_t$, ΔINR_t, and ΔIQI_t. By employing the projection of v_t on ΔPD, ΔPD^2, $\Delta PCGDP_t$, ΔINR_t, and ΔIQI_t with the form $v_t = \gamma_{PD}\Delta PD_t + \gamma_{PCGDP}\Delta PCGDP_t + \gamma_{INR}\Delta INR_t + \gamma_{IQI}\Delta IQI_t + \varepsilon_t$, the previous correlations can be evaded. Now, the subsequent outcome ε_t is not correlated with ΔPD_t, $\Delta PCGDP_t$, ΔINR_t, and ΔIQI_t. The following QARDL-ECM model is derived by integrating the earlier projection into Eq. (5) and generalized it to the framework of quantile regression:

$$private-sectorare Q_{\Delta PCt}$$
$$= \alpha(\tau) + \rho(\tau)\begin{pmatrix} PC_{t-1} - \beta_{DD}(\tau)PD_{t-1} - \beta_{PCGDP}(\tau)PCGDP_{t-1} \\ -\beta_{INR}(\tau)INR_{t-1} - \beta_{IQI}(\tau)INR_{t-1} - \beta_{IQI}IQI_{t-1} \end{pmatrix}$$
$$+ \sum_{i-1}^{p-1} \phi_i(\tau)\Delta PC_{t-1} + \sum_{i=0}^{q^{l-1}} w_i(\tau)\Delta PD_{t-1} + \sum_{i=0}^{q^{2-1}} \delta_i(\tau)\Delta PCGDP_{t-1}$$
$$+ \sum_{i=0}^{q^{3-1}} \psi_i(\tau)\Delta INR_{t-1} + \sum_{i=0}^{q^{4-1}} \theta_i(\tau)\Delta IQI_{t-1} + \varepsilon_t(\tau) \qquad \text{Eqn. 6}$$

The aggregate short-term dynamics is measured by $\sum_{j-1}^{p-1} \varphi_j$ Correspondingly, the aggregate short-term dynamics of public debt (PD) and private sector credit (PC) are measured by $w * \sum_{j-1}^{p^{1-1}} w_j, \delta * \sum_{j-1}^{p^{3-1}} \delta_j, \psi * \sum_{j-1}^{p^{4-1}} \psi_j \ \theta * \sum_{j-1}^{p^{2-1}} \theta_j = \sum_{j-1}^{p^{1-1}} \phi_j$. The long-term cointegrating parameters for public debt and private sector credit are calculated as $\beta PD *= -\frac{\phi PD}{p}, *= -\beta PCGDP *= -\frac{\phi PCGDP}{p}, \beta INR *= -\frac{\phi INR}{p}$ and $\beta_{IQI*} = -\frac{\phi IQI}{p}$, respectively. By using the delta method, the aggregate previous and current parameters and the long-term cointegrating parameters are measured. The PC parameter ρ should be significantly negative in the model is worth noting. We employed the Wald test to statistically explore the nonlinear and asymmetric short-term and long-term impacts of public debt, per capita GDP, interest rate, and institutional quality index on PC. A distribution of chi-square is asymptotically followed by the Wald test and uses the long-term, previous and current parameters φ∗, w∗, β∗, and

ρ∗ to test the main hypothesis that: public debt does not crowd-out private sector investment in Nigeria.

4   Results and Discussion
4.1   Unit root test

As conventional, we conducted the unit root test using the augmented Dickey-Fuller (ADF) and Phillips-Perron techniques to check for the stationarity of the series. The results, as presented in Table 1 show that for the ADF test, only INR and IQI were stationary in levels when tested without trend, thus leading to the rejection of the null hypotheses of no stationarity of the series at 1% and 10% levels of significance respectively. However, when performed with the trend, we were able to reject the null hypotheses for PD and PCGDP at a 10% level of significance, while that of INR and IQI were rejected at 1% and 5% levels of significance, respectively, with the other variables remaining non-stationary at level. Tested at first difference (with and without trend), all the variables attained stationary though at varying levels of significance. Equally, the Phillips-Perron test shows that all the variables are stationary at first difference (with and without trend) at varying levels of significance (see, Table 1).

Table 1: Results of Unit-root tests

	@ **Levels**		@ **First Difference**	
Augmented Dickey-Fuller (ADF) Test				
Variable	Without Trend	With Trend	Without Trend	With Trend
PD	-2.163819	-2.943816*	-3.891912**	-3.978224**
PC	-1.636679	-1.995722	-2.852740*	-3.995552**
PCGDP	-1.689874	-2.878574*	-3.251814**	-4.296729***
INR	-3.738281***	-5.704702***	-6.770070***	-6.621657***
IQI	-2.979977*	-3.859861**	-6.986344***	-3.904587**
Phillips-Perron Test				
Variable	Without Trend	With Trend	Without Trend	With Trend
PD	-2.266129	-2.963374*	-3.208816**	-4.201466***
PC	-1.025780	-2.338190	-2.945772*	-4.129646**
PCGDP	-2.125168	-2.329512	-3.404428**	-4.436395***
INR	-3.666941***	-5.704702***	-12.26309***	-12.02529***
IQI	-3.023498**	-3.882030**	-6.986344***	-6.800747***

Note: ***, ** and * indicate rejection of the null hypotheses at the 1%, 5%, and 10% significant levels respectively.

4.1   The quantile ADRL results

After ascertaining the stationarity of the data, the analysis was performed with the long- and short-run results presented in Tables 2 and 3 and that of the quantile estimates reflected in Table 4 and Panel 1. From the long-run result in Table 2, the estimated coefficients of PD and PCGDP are statistically significant with -1.490 and .040 respectively. This indicates that for a one-unit increase in public debt (PD), there's an associated decrease of approximately 1.49 units in private sector credit (PC); while for a one-unit increase in per capita GDP (PCGDP), there's an associated increase of approximately 0.040 units in PC. The estimated values of INR and IOI do not appear to be statistically significant, as their p-values are greater than 0.05. Their values suggest that a unit rise in INR and IQI will reduce PC by -152.966 and -113.180 units respectively. This result has aligned with those of past works like Akpansung (2018); Al-Majali (2018); Anyanwu *et al*. (2017); Dantama *et al*. (2017); Lidiema (2017); and Essien *et al*. (2016), who had earlier found that public debt negatively affect private investment.

The Pseudo Adjusted R-squared, which measures how well the independent variables explain the variability of the dependent variable, show that approximately 87% of the variations in private capital (investment) are accounted for by public debt and the other variables included in the model. The value of Quasi-LR statistic which measures how much the predictors contribute to explaining the variation in the response variable, indicates that all the predictors are significant and can be used to make inferences about their effects on private sector credit. As such, it is right to say that public debt crowds-out private-sector credit in the long run, at least in Nigeria, during the period of the study.

Table 2: Long-run parameter estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PD	-1.489998	0.166640	-8.941397	0.0000
PCGDP	0.039907	0.011070	3.604939	0.0019
INR	-152.9664	151.7321	-1.008135	0.3261
IQI	-113.1799	299.2176	-0.378253	0.7094
C	-4868.913	4961.560	-0.981327	0.3388
Pseudo R-squared	0.896279			
Adjusted R-squared	0.874443			
Restr. Objective	93941.09			
Quasi-LR statistic	182.3223			
Prob(Quasi-LR stat)	0.000000			

The given short-run Autoregressive Distributed Lag (ARDL) model estimates provide insights into the relationship between the dependent variable and the independent variables in the short run. The coefficient of -1.439360 indicates that a one-unit increase in PD leads to a decrease of approximately 1.44 units in the PC. The p-value of 0.0165 suggests that this result is statistically significant at the 5% level, indicating a strong relationship in the short run. In terms of PCGDP, the coefficient is 0.007608, which is very small and indicates that it has a significant effect on the PC in the short run. The high p-value (0.0506) confirms that this effect is statistically significant. Next is INR with a coefficient of -41.53653 suggesting its negative effect on PC, with a statistically significant p-value (0.0298). Equally, the coefficient of IQI (-32.68908) indicates that it has a negative effect on PC; however, not statistically significant due to the high p-value of 0.8710.

The error correction model (ECM) coefficient of -0.316921 suggests that there is an adjustment towards the long-run equilibrium, and the result is statistically significant (p-value of 0.0010). This means that the speed of adjustment to the long-run equilibrium is significant in the short run. The Pseudo R-squared of 0.825876 indicates that approximately 83% of the variance in the dependent variable is explained by the independent variables in the short run. The Adjusted R-squared of 0.807607, which accounts for the number of predictors, is lower and suggests that only about 81% of the variance is explained when adjusted for the number of predictors. This indicates the very strong explanatory power of the model.

Table 3: Short-run parameter estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PD)	-1.439360	0.544454	2.643675	0.0165
D(PCGDP)	0.007608	0.040932	3.185864	0.0506
D(INR)	-41.53653	0.003839	-3.350863	0.0298
D(IQI)	-32.68908	8.413852	-0.164693	0.8710
ECM (-1)	-0.316921	0.425505	-0.744811	0.0010

Pseudo R-squared	0.825876	Mean dependent var		1149.301
Adjusted R-squared	0.807607	S.D. dependent var		1382.059
S.E. of regression	1130.192	Objective		7664.518
Quantile dependent var	472.9100	Restr. objective		11369.60
Sparsity	3481.068			

The results of the quantile ADRL regression analysis in Table 4 lists the results of quantile regression for different quantiles (0.200, 0.400, 0.500, 0.600, 0.800) across the independent variables (PD, PCGDP, INR, & IQI), with each quantile regression's coefficient, standard error, t-statistic, and p-value (Prob). From the results, PD has positive and significant coefficient at the 0.200 quantile, but negative and significant coefficients at the 0.400, 0.500, 0.600, and 0.800 quantiles. With all p-values as 0.0000 indicate high statistical significance. This implies that PD has a significant impact on PC, with the direction of the impact changing from positive at the lower quantile (0.200) to negative at higher quantiles (0.400 and above).

The values for PCGDP reveal that it has positive and significant coefficients across all quantiles, with the significance being strongest at the 0.600 quantile (lowest p-value). Therefore, PCGDP is said to consistently show a positive and significant impact on the PC across all quantiles, indicating a robust positive relationship.

Considering INR and IQI, we noticed that both variables have negative coefficients across all quantiles. While INR was non-statistically significant only in the first and second quantiles; IQI was non-statistically significant in all the quantiles (all p-values > 0.05). This clearly shows that IQI does not have statistically significant effects on PC at any quantile, as indicated by its p-values. This analysis helps in understanding how the relationship between the dependent variable and the independent variables changes across different points in the distribution of the dependent variable.

Table 4. Results of quantile ADRL regression

Variables	Quantile	Coefficient	Std. Error	t-Statistic	Prob.
PD	0.200	1.520532	0.141015	10.78276	0.0000
	0.400	-1.586786	0.151914	-10.44528	0.0000
	0.500	-1.489998	0.166640	-8.941397	0.0000
	0.600	-1.406699	0.154968	-9.077330	0.0000
	0.800	-1.445644	0.153043	-9.445997	0.0000
PCGDP	0.200	0.036436	0.012643	2.881897	0.0096
	0.400	0.035384	0.011471	3.084617	0.0061
	0.500	0.039907	0.011070	3.604939	0.0019
	0.600	0.045975	0.010645	4.318887	0.0004
	0.800	0.038803	0.011024	3.519842	0.0023
INR	0.200	-413.2869	340.3832	-1.214181	0.2396
	0.400	-278.0303	205.2987	-1.354272	0.1915
	0.500	-152.9664	151.7321	-1.008135	0.0261
	0.600	-165.2932	142.4654	-1.160234	0.0103
	0.800	-253.3847	167.0610	-1.516720	0.0458
IQI	0.200	-329.1762	329.6414	-0.998589	0.3305
	0.400	-297.3648	288.3158	-1.031386	0.3153
	0.500	-113.1799	299.2176	-0.378253	0.7094
	0.600	-322.5600	305.1490	-1.057057	0.3037
	0.800	-169.7363	327.1334	-0.518860	0.6098
C	0.200	2684.945	8165.301	0.328824	0.7459
	0.400	548.0787	5755.283	0.095231	0.9251
	0.500	-4868.913	4961.560	-0.981327	0.3388
	0.600	-2690.817	5089.230	-0.528728	0.6031
	0.800	-1179.875	5466.875	-0.215823	0.8314

The graphs from the Quantile Process Estimates in panel 1 provides the graphical representations of quantile regression estimates for PD, PCGDP, INR, and IQI. For PD, the coefficient starts positive at lower quantiles and becomes negative at higher quantiles. With the blue line (coefficient estimates) – the second line – being within the red lines (confidence intervals), indicates statistical significance at different quantiles. There is a noticeable change in the sign of the coefficient from positive at the lower quantiles (0.2) to negative at the higher quantiles (0.4 & above). The coefficient for per capita GDP (PCGDP) remained positive across all quantiles, indicating a positive relationship with the dependent variable. This is shown by the blue line which remained within the red lines, suggesting statistical significance across quantiles. The magnitude of the coefficient increases with the quantile, indicating a stronger effect at higher quantiles. Interest rate (INR) is mostly negative across the quantiles, with the blue line sometimes crossing the red lines, indicating that the coefficient is not always statistically significant. This implies that there is some variability in the magnitude of the coefficient across quantiles. As for IQI, the coefficient is negative at most quantiles as the blue line stays within the red lines at some quantiles, but often gets close to the boundary, indicating marginal significance.

These graphs help visualize how the relationship between the dependent variable and the predictors changes across different points in the distribution of the dependent variable. This is particularly useful in understanding the heterogeneity in the effect of predictors at various levels of the dependent variable. The graphs support the earlier results which show that PD and PCGDP have significant and consistent effects across the quantiles, with PD showing a change in sign and

PCGDP maintaining a positive relationship. However, INR and IQI do not show consistent significant effects across the quantiles.

Quantile Process Estimates
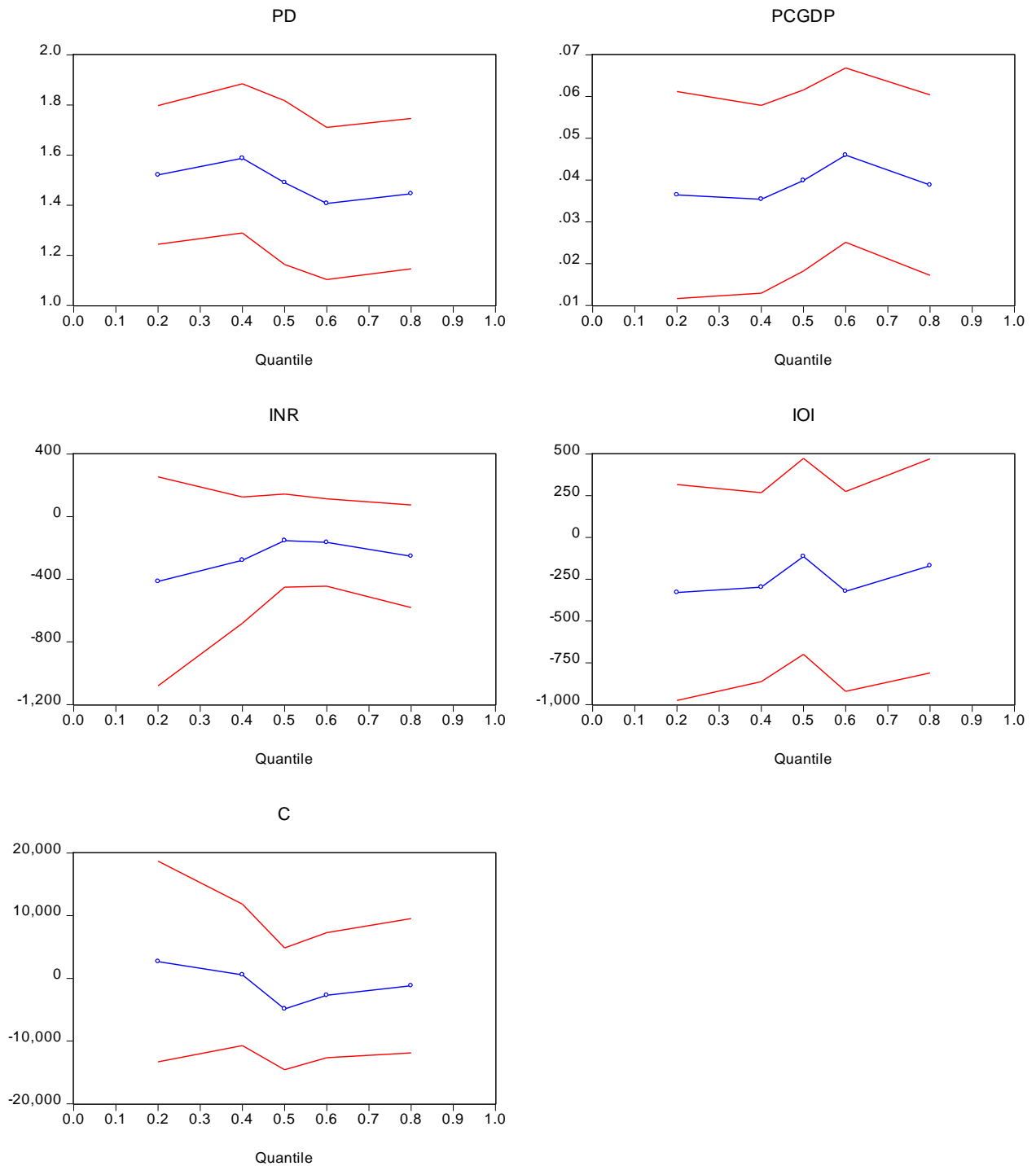
Panel 1: **Quantile Process Estimates**

5   Conclusion and Recommendations

The paper investigates the effect of public debt on private sector credit in Nigeria with the objective to determine if public-sector borrowings crowd-out the private sector in credit acquisition through a rise in interest rates. The study used the quantile autoregressive distributed lag (QARDL) model to analyze the crowding-out effect of public debt on private-sector credit in

Nigeria. The QARDL approach tested the long-term equilibrium effect of public debt on private-sector credit across different quantiles, and the study used the Wald test to check the time-varying relationship and the constancy of the integrating coefficients across the quantiles. The study also addressed the potential contemporaneous correlation between the variables by employing a projection method and deriving a QARDL-ECM model. The findings show that public debt has a crowding-out effect, with a one-unit increase in public debt associated with a 1.49-unit decrease in private-sector credit. Public debt has a significant negative effect on private sector credit in both the long run and short run in Nigeria. The effect of public debt on private sector credit is heterogeneous, changing from positive at lower quantiles to negative at higher quantiles. Per capita GDP was found to have significant positive effect on private-sector capital both the long run and short run. Interest rate and institutional quality index had negative on effect private-sector capital with mixed strength. Thus, it is concluded that public-sector borrowings crowds-out the private-sector credit in Nigeria.

Based on the findings of the study, the following recommendations are made to address the crowding-out effect of public debt on private sector credit in Nigeria. First, the Nigerian government should adopt strategies to manage and reduce public debt to mitigate its negative impact on private-sector credit. This could include prioritizing debt repayment and avoiding unnecessary borrowings.

The government should also diversify its sources of funding to reduce reliance on borrowing. Exploring alternative financing options such as public-private partnerships (PPPs) and attracting foreign direct investment (FDI) can help reduce the need for public debt. Improving the institutional framework and governance in Nigeria can enhance investor confidence and reduce the negative impact of interest rates on private-sector credit. Strengthening institutions can involve anti-corruption measures, legal reforms, and improving the overall business environment.

The Central Bank of Nigeria (CBN) should carefully consider the effects of interest rate policies on private-sector credit acquisition and come up with policies that will stabilize or reduce interest rates thus help to alleviate the crowding-out effect of public debt. Fostering economic growth through policies that enhance per capita GDP can help sustain its positive effect on private-sector credit. This includes investing in infrastructure, education, and healthcare to boost productivity and economic output.

Since the effect of public debt on private sector credit is heterogeneous across different quantiles, policymakers should tailor their strategies to address the specific needs of different segments of the economy. For instance, targeted support for small and medium-sized enterprises (SMEs) at lower quantiles can help mitigate the adverse effects of public debt. Policies that support the growth and development of the private sector should be prioritized. This includes providing incentives for private investment, reducing bureaucratic hurdles, and improving access to finance for businesses. It is believed that by implementing these recommendations, Nigeria can better manage its public debt and reduce its crowding-out effect on private-sector credit, fostering a more conducive environment for private sector growth and economic development.

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