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Analysis of Debt Market Innovation, Capital Formation, and Real Economic Growth in Nigeria

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A B S T R A C T

This study tests the market innovation theory, and the finance-leading and growth-following hypotheses. It examined the impact of matrix of debt market, that is, private domestic debt (PDBT), private external debt (PXDBT), and sovereign debt (SBND) on gross-fixed capital formation (GFCF) and real-gross domestic growth rate (RGDPGR) in Nigeria. Institutional quality (IQT) and interest rate (INRT) are control variables. Two-stage least square (TSLS) and Granger-causality techniques were utilized. Data were obtained from Central Bank of Nigeria (CBN) statistical bulletin and the World Bank (WB) database from 1980 to 2023. The study found that PDBT, PXDBT, and SBND drives GFCF, while GFCF drives RGDPGR respectively. However, SBND's impact on GFCF is relatively very weak, while the impact of SBND on Rdgpgr is negative, as private issued debts outperformed sovereign debt. Both results suggest superiority of private debt yield over SBND yield, and hence, affirms Thomas Piketty's hypothesis of higher returns on private wealth (r) over return on output (g). Bi-directional causalities operate between IQT and GFCF, and IQT and PDBT respectively. The study thus upholds the market innovation theory, the finance-leading hypothesis, and the credit-quality-spread theory. The study suggests institutional and regulatory reforms, among others.

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1. Introduction

One of the limitations against the wheel of accelerated real growth-rate in African economies has been low quantum of gross fixed capital formation (GFCF), and hence relatively low-quality productive infrastructures, which, may have stalled efficient economic deliveries. Consequently, high inflationary impact has been re-occurring. Quality infrastructure has multidimensional impact on economic growth and development processes. Though, every developing country attempt to mobilize internal and external resources possible for physical and social infrastructures, and in particular with successive government interventions in Africa, the infrastructural gap in these economies seem onerous to meeting the World Bank's global poverty reduction and shared prosperity ambition.

In developing economies, the type and sources of financial resources remain critical to determine whether growth would be spurred and poverty reduced or otherwise. In contemporary era of sustainable development, the type of finance that could ensure sustainable real growth comes to fore; hence the suggested gap to test market innovation theory, and the finance leading-growth following hypothesis or otherwise, to advance real gross domestic product growth rate (RGDPGR), using a matrix of debt market financing strategies. Acemoglu and Linn (2004) justified Joseph Schumpeter's philosophy that innovations and creative disruptions are required to accelerate rapid economic growth and development in an economy. The authors used the pharmaceutical industry market to posit that by innovating the drug market for new drugs and the entire pharmaceutical industry, could significantly raise the health sector output, spurred by demographic changes, and thus, a victory to endogenous theory.

This study raises the knowledge of debt market relatively in financial market's funding capability. It tests debt finance metric-channels, and thereon real gross domestic product (RGDP) growth. The following hypotheses were tested are, there is no significant relationship between the debt instruments and capital formation (CF); secondly, there is no significant effect between the three channels of debt market on-towards capital formation development (CFD), and thirdly, there is no significant relationship between CF and RGDPGR.

1.0 Debt Market Innovation and Capital Formation

Debt innovation is the process of broadening and deepening strategies of intermediating latent long-term capital finance from the surplus unit of the financial system. Capital formation is a long-term economic sacrifice of current consumption, accumulated overtime, towards the development of the economy's man-made productive capital, given the avalanche of divine capitals. Anecdotally, physical and social infrastructures aid effective and efficient production of goods and services. CF enhances real-growth process, the means to providing physical productive infrastructure that could manage production cost downwards for inflation control. The world economic forum (WEF) has consistently re-emphasized lack of critical infrastructure as the second growth induced-gap, that frustrates African's high real growth rate and improved citizens' well-being, after quality institution (WEF, 2015). African debt capital market requires innovation, that is committed to growth and development of new markets and instruments, which would promote efficient and transparency, and deepen the financial system (FS). Such a FS could context global standards for fund mobilization, attract and retain both domestic and foreign investors.

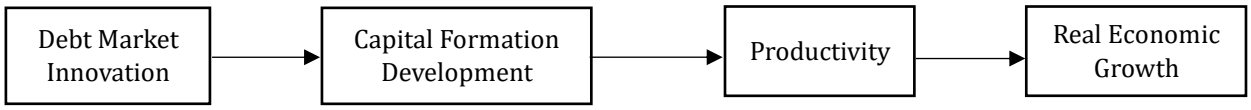
Evidences of Nigeria's infrastructure gap is well known in the literature, as the ratio of infrastructure to GDP as at 2022 is about 30% relative to international standard above 70%, while the African Development Bank (AfDB) estimates financing gap of US dollar 3 trillion (World Bank, 2022; Oshobi, 2020). Social overhead capital infrastructures such as, housing, pipe-borne water, electricity, motorable tarred roads, ports, public buildings, etc, are short of supply. For instance, it is a convention that, both the public and private physical infrastructures are often financed on installment basis, as hardly any public project budget meets set time. When in construction, projects are short of deadlines, which have increased number of abandoned projects; as at 2021 was 56,000 valued at 12 trillion Naira (4,800 quintrillion US dollar) (Businessday, 2021), and has been increasing annually. In rural Nigeria, the quality of supportive infrastructural capital required to inspire abundant labour is abysmal, such that, the very-lower average capital-output ratio has significantly contributed to rural poverty. These evidences may necessitate deepening the knowledge of capital formation (CF) for infrastructural development in developing economies such as Nigeria.

Debt financing for infrastructural development carries multi-dimensional benefits if judiciously applied (Cecchetti, Mohanty, and Zampolli, 2011). One advantage is that, due to institutionalization of different covenant clauses, it protects the investor, being contemporaneously senior to equity, as it is repayable. However, being the major inter-

generational financial resources and hence risk transfer instrument, the debt market may constitute a headache to the entire financial and economic system, when the required regulatory institutions are weak. Nevertheless, just like in the advanced economies, i.e. the United States and the United Kingdom, enthusiasm for debt market development may be enhanced in contemporary time given the adjoint role of technology and digital financial innovativeness for information flows in many developing economies (Dudley and Hubbard, 2004). As economies embrace financial liberalization, and free market culture being entrenched, debt capital market may dominate the FS.

On policy context, the growth of the domestic public debt market in Nigeria was catalyzed in 2003 following the then federal government's resolve to start issuing government bond to augment the finance of annual budget for infrastructural development. Since then, variants of bonds have been issued, including the recent preponderance sukuk bonds. The contribution of this paper is how to achieve high real-economic growth over the more studied nominal growth, by innovating the matrix of debt market instruments and CF. Real-growth process manages negative impact of general price level in the growth process. Debt capital is such a formidable form of financing, as it mainly requires the ability of the economic activity or business to be able to generate significant returns to service both the interest, in the case of loan and coupons, in the case of bonds and principal repayment. For an economy's debt market to be innovative for accelerated private capital formation development (CFD), it may require examining the country's legal system and quality of legal infrastructure, as the doctrine of efficient law-financial development has revealed. A country's legal system influences the size, efficiency, and productivity of the capital market (Eke & Busari, 2024; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, (LLSV), 1997). The authors found that economies with poor investors protection may have issues with liquidity, CF, and growth of their capital market. Presented in Figure 1 is the flow of debt-CF-real growth nexus. The private bond innovativeness links scarce CF, then links productivity on-towards real economic growth.

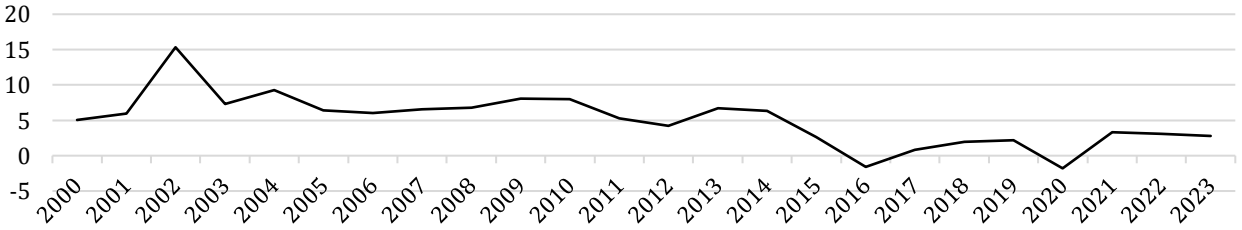
Figure 1: Debt Market Innovations, Capital Formation, and Real Economic Growth nexus



Source: Researchers (2025)

Shown in Figure 2 is the trend in RGDP in Nigeria from 2000 to 2023. The growth rate averaged between 2% to 3% in the last decade, more or less anchored on consumptive growth rather than productivity-output growth (NBS, 2022; Eke, 2017) perhaps due to low, and declining level of productivity-aided infrastructure such as energy supply, rural and urban road network, etc. Many factors account for hipper inflation rate in Nigeria, however huge gap in capital formation for infrastructure tops productivity-growth dilemma. Only productivity-led growth can raise an economy's competitiveness and real output growth. Nigeria Bureau of statistics (NBS) recalls that food inflation has consistently accounts for over 70% of inflation rate in Nigeria, having higher repercussion on the citizens' wellbeing from the very high unemployment rate (NBS, 2024).

Figure 2: Trend in Nigeria's real growth rate 2000 to 2023



Source: By the researchers, 2025. Data sourced from Central Bank of Nigeria Statistical Bulletin; International Monetary Fund-http://imf.org/en/publications/veo.

2. Literature Review

Theoretical review: Overtime, financial development thoughts often applied to growth of productive capital have been models suggested by the Keynesian school, the liberalized school, otherwise called the neoclassicals, and the structural school. Whichever school of thought, the role of capital in financial development is the employment of economic resources, via the mechanics of markets, institutions and instruments towards eased investments and productivity, that would raise economic growth, improve standard of living and reduce poverty. Should economic factors embrace organizational change, beyond just capital accumulation, it could accelerate economic development (Hoff and Stiglitz, 2000).

The Classical and the Keynesian theories' inputs in debt market development also suffices. To the Classist, governments usurp the free-market system for efficient and effective capital in production process. Therefore, real growth rate would be determined by the level of freedom for self-correction mechanism in the market system. However, Keynes stressed the unique role of government in promoting aggregate-demand in the event of inevitable unemployment inherent in the classical model. Therefore, government taxation and expenditure via the debt-market system are key tools common that government may employ to restore improve productivity, economic equilibrium, and rapid growth.

From the neoclassical perspective, real economic growth is a function of investment in production, and in particular the catalyst role of technology. Human and physical capital need to be enhanced significantly to increase productivity, hold-down inflation and achieve meaningful rise in real income. The neoclassical school's equilibrium thought of Pareto optimality in developing economies can be better achieved via increased allocation of capital for rural infrastructure, necessary to increase the rural industrialization and its economy's capital-output ratio and overall national competitiveness (Jhingan, 2016). The finance-growth theory, adapted from Patrick (1966) is the anchor theory of this paper, upon which the theoretical framework is established.

Empirical literature: Nguyen (2025) studied the interaction between public debt and income inequality in advanced and developing economies, with focus that tested whether the effect of public debt on income inequality differs in these two sets of economies. Income inequality measured with Gini was dependent variable, with main independent variable being public debt as proportion of GDP. Controls were also placed on economic growth (GDP per capita), schooling (gross enrollment in primary school), as well as unemployment rate. The research design placed the preferred estimator as two-step system GMM Arellano-Bond, in addition to PMG estimator as robustness test, in a panel data-set of 30 advanced countries, as well as 34 developing nations, spanning 2002 to 2020. Public debt decreased income inequality significantly in advanced countries, yet raised it in developing nations. In contrast, economic growth raised income inequality among advanced nations, yet decreased it among developing nations. Additionally, unemployment raised advanced nations' inequality, whereas schooling raised developing nations' inequality. It emerged, consequently, that contrary results are primarily due to variation in expenditure pattern on debt-based expenditure for government expenditure: advanced nations spent considerably on expenditure in category of social protection as well as transfers, in contrast with developing nations, where expenditure is focused towards expenditure in infrastructure, a commonality shared cumulatively for each member in society, with a clear likelihood towards fostering gaps in income.

Sarigul and Apak (2024) studied the nexus between economic growth, energy consumption, and trade openness among 29 net energy importing middle -income economies from 1990 to 2019. The paper uncovered that little had been known in the association between energy consumption, economic growth, and trade in net-energy importing and middle-income countries, that is, understudied, hence the need for research. The paper argued-out four hypotheses associated with the energy- growth nexus, namely, growth, conservation, neutrality, and the feedback loop. Employing the PMG-ARDL method, and Dumitrescu-Hurlin panel

Granger-causality test, it establishes that both energy consumption and trade openness have significant positive long-term effect on economic growth in net-energy middle income and net-energy importing upper middle-income economies. Moreover, bidirectional positive causal nexus suffices in the long-term between GDP-energy consumption, and between trade and energy consumption.

Sinoi (2025) accessed the effect of human capital, knowledge creation, and global governance quality on gross domestic product per capita among EU economies from 2000 to 2020. Three major features of growth network adopted were GDP per capita, governance quality, and human capital endowment. Secondly, applying the robust regression analysis generalized method of moment and structural equation modelling, the three variables were found to significantly drive GDP per capita with tertiary education immigrant having highest significance score, followed by knowledge, and governance quality.

Afonso, Alves, and Fortuna (2024), evaluated the effect of fiscal policies on expenditures, such as government, education, military, and tax revenue in OECD economies from 1985 to 2025. The study advanced the course of fiscal literature, given that no consistent conclusion had been achieved by past studies as per regression signs on the relationship between government expenditure and their impact on growth variables. Using key control variables such as capital formation, human capital development that could augment the effect of fiscal policies effect on economic growth, the study used panel data methodology with fixed effect technique to find that capital accumulation and gross-fixed capital (GFC) are essential to economic growth, as high capital stock, population, and higher investment in human capital boost economic growth (Ricardo, 1817). Furthermore, military spend was found to be of negative effect on growth, unlike investment in education and tax revenue which boosted economic growth. Finally, the paper advised on governance transparency and effective control of corruption to give meaningful effect of fiscal expenses on economic growth.

Konukcu (2024) examined the Buchanan-Wagner (B-W) theory in the light of the spendthrift democracy, typical in Turkey between 1924 and 2008. The study employed the ARDL Bound test to cointegration as novel gap in B-W hypothesis testing in the literature, and hence contribute to literature, as it reveals several other deficiencies that exist in the previous techniques adopted in the B-W literature. The result confirmed that budget deficit-finance through debt sourcing were the underlying issues that matters for Turkey's continued public spending within the period of study; which also provide evidence that the Tax price of public goods and services declines given increase in debt induced budget deficit through time.

Avci and Çalışkan (2024) employed the multivariate ARDL bound technique to test the effect of health expenditure on economic growth in Turkey, using the production approach from 1960 to 2004. The functional order includes health and education being component of human capital. Given the rise in growth theorising that employed non-economic variables to explain economic growth, the paper adapted Lucas (1988) concept of economic growth which revealed that economic growth is a summary measure of all economic and non-economic growth activities of the society. The study's outcome reveals that long-term cointegration exist between economic growth and human capital, via education and health expenditure in Turkey. A rise in life expectancy and student enrolment in tertiary education level were found to significantly improve economic growth.

Tan and Mohamad Shafi (2021) examined the effects of capital market on economic growth, with particular emphasis on the role of Sukuk bond in Malaysia between 1998 and 2018. The findings reveal that bond market (both the sukuk and conventional bond) have positive impact, albeit insignificant effect on economic growth in Malaysia. Sahay, Cihak, N'diaye, Barajas, Bi, Ayala, and Yousefi (2015) studied the access, depth, breath, and efficiency of the financial market, that is, the banking and stock market, on growth, to find that the financial market is neutral in economic growth process.

Echchabi and Idriss (2016) examined the impact of sukuk bond on gross capital formation among the Gulf Corporate Council (GCC) economies. The paper discovered that partial influence of sukuk bond can increasingly aid CF and growth when the entire council and other nations are simultaneously examined together, otherwise sukuk bond has no effect on countries like Saudi Arabia and the GCC separately. However, in 2017, Smaoui and Nechi (2017) discovered strong linkage of the effect of sukuk bond on long-run economic development in same jurisdiction of GCC and other nations.

In Indonesia, Mitsaliyandit and Arundina (2018) examined the simultaneous effect of sovereign bond and sukuk on economic growth between 2009 and 2016. Sukuk bond was found to be an outright friendly finance instrument other than the conventional bond. In a similar study, the demand following hypothesis was tested with sukuk finance, it was discovered that economic output has no effect on sukuk in Malysia (Muharam, Anwar, and Robiyanto, 2019).

3. Research Method

3.1. Theoretical framework

The study adapts Thomas Piketty's capital and inequality framework on the dynamics of managing society's income and wealth, as the bases of long-run inequality (Stephen, 2015). In conventional growth literature, an economy's real output (y) per year is a function of its capital (k), that is, national wealth, which underlie the economy's capacity and capability (Sen, 1999). The ratio of the economy's total capital stock to its income β ,is defined as:

$$\beta = \frac{k}{y} \tag{1}$$

β measures overall society's capital for productivity and thus regarded as the basis of society's progress. *k* is rationally expected to grow via debt financing and CFD. Hence, Piketty concludes that unless the society's beta (β) continue to grow substantially, resulting in higher growth rate (g), otherwise, return on private wealth (r) will continue to dominate economic growth rate (g), and thus society's inequality and poverty will persist, and the gap in equation (2) accentuates in the long-run, as follows:

$$r > g \tag{2}$$

Equation (1) indicates that the marginal growth rate, g, is a rising function of *k*, as more CF input is deployed, and vice versal. This framework produced the models specified in equations (11) and (12).

3.2. Methodology

This study adapted the two-stage least square (TSLS) specification, a variant of simultaneous equation system, where each equation is solved at a time for the estimation of the structural parameters. TSLS is a mechanics to eliminate simultaneous-equations bias (Koutsoyiannis, 2001; Kmenta, 1988). The two equations employed were the gross-fixed capital formation (GFCF) and the real gross domestic product (Rgdp) models implicitly presented in equations (11) and (12) respectively.

3.3. TSLS Framework

In a structural relationship that employs two-process, TSLS estimator require the condition that the equations are exactly identified or over-identified (Kmenta, 1988; Verbeek, 2004). The structural parameters would be obtained, through the reduced form equation. The study adapts Verbeek's specification; the reduced form of *k-th* explanatory variables is presented in vector notation:

$$x_k = Z\pi_k + \nu_k \tag{3}$$

Using OLS, the predictable values $\hat{x}_k = Z(Z'Z)^{-1}Z'x_k$. Where x_k is a column in Z, then:

$$\hat{x} = x \tag{4}$$

In the second step, the matrix form of the explanatory variables *X,* would have columns $\hat{xk}$, *k*=1, 2,…,*K*, where:

$$\hat{X} = Z(Z'Z)^{-1}Z'X \tag{5}$$

The second step estimator is produced as: $\hat{\beta}_{IV} = (\hat{X}'\hat{X})^{-1}\hat{X}'y$ (6)

Equation 6 is otherwise referred as generalized instrumental variable estimator (GIVE) with asymptotic distribution of $\hat{\beta}_{IV}$ given as: $\sqrt{N}(\hat{\beta}_{IV} - \beta) \rightarrow N(0, \sigma^2(\sum_{xz}\sum_{zz}^{-1}\sum_{zx})^{-1})$

The covariance matrix estimator is obtained via the small sample counterpart (Verbeek, 2004):

$$\hat{V}\left\{\hat{\beta}_{IV}\right\} = \hat{\sigma}^2(X'Z(Z'Z)^{-1}Z'X)^{-1} \tag{7}$$

The IV-residuals is $\hat{\varepsilon}_i = y_i - x_i'\hat{\beta}_{IV}$ (8)

The estimator σ^2 becomes: $\hat{\sigma}^2 = \frac{1}{N}\sum_{i=1}^{N}\hat{\varepsilon}_i^2$. (9)

The test of identification of equations (11) and (12) reveals that they were over-identified, hence qualified for TSLS method. The equations are unique in statistical form, and hence would produce unique estimates of structural parameters. In TSLS, the rule for identification is that the necessary (order) condition requires the number of missing exogenous variables in the system be greater than or equal to the number of endogenous variables (G) less one (1), which indicates over-identification or exactly identified, otherwise it is under-identified, as presented in model/equation (10). Under-identified equations can at best be estimated by the use of indirect least square technique. Algebraically, it is specified as follows:

$$M \geq G\text{-}1 \tag{10}$$

M stands for the missing exogenous variables in the particular equation while G is the endogenous variables in the entire system of equations. The sufficient or rank condition was also achieved, that is, the largest non-zero determinants established from the sub-matrices is at least equal to G-1 (Asteriou & Hall, 2011).

3.4. Data

The data types, sources, and justification are summarized in Table **1**, obtained from period 1980 to 2023.

Table 1: Data description, types and sources

Variable description	Type and Source	Justification
RGDPGR= real-gross domestic product growth rate	Endogenous/ CBN, IMF	Tan & Shafi (2021)
PDBT= private domestic debt	Exogenous/World Bank	Eke & Ashamu (2009)
PXDBT= private external debt	Exogenous/World Bank	Eke & Ashamu (2009)
SBND= sovereign debt	Exogenous/World Bank	Mitsaliyandito & Arundina (2018)
GFCF= grossed fixed capital formation	Endogenous/ CBN	Afonso et al. (2024); Dudley & Hubbard (2004)
INRT = interest rate	Control variable/ CBN	Eke (2017)
IQT= institutional quality	Control variable/ World Bank	Eke & Busari (2024)

Source: authors' compilation (2025)

The variables are natural log values, except IQT. IQT index comprises the average of governance, legal and judiciary quality, regulatory quality, and extent of control of corruption, annually published by the World Bank (WGI, 2022).

Given the theoretical credit spread advantage inherent in private issued debt relative to public debt for similar investment course (Eke and Ashamu, 2009), a matrix of three (3) debt financing strategies is tested.

3.5. Model specification

Given the order condition stated in model/equation (10), equation (11) is fully identified, that is 3 > 1 = over-identified; and equation (12) is also over-identified, that is 2 > 1, which enables the full adoption of the TSLS to obtain the value of the structured parameters (Pindyck and Rubinfeld, 1998). Equations (13) is the system's model.

$$Gfcf = f(Pdbt, Pxdbt, Sbnd) \quad (11)$$

$$Rgdpgr = f(Gfcf, Iqt, Inrt) \quad (12)$$

$$Rgdpgr = f(Gfcf, Pdbt, Pxdbt, Sbnd, Iqt, Inrt) \quad (13)$$

Due to possibility of heteroscedasticity and nature of some variable data, the equations were explicitly modeled in semi-log specification form, along with *a-priori* expectation signs as follows:

$$\lg fcf_t = lpdbt_t + lpxdbt_t + lsbnd_t + u_t \quad (14)$$

$$\quad\quad + \quad + \quad +$$

$$r\,g\,dpgr_t = \lg fcf_t + iqt_t + linrt_t + u_t \quad (15)$$

$$\quad\quad + \quad + \quad -$$

$$r\,g\,dpgr_t = \lg fcf_t + lpdbt_t + lpxdbt_t + lsdbt_t + iqt_t + linrt_t + u_t \quad (16)$$

$$\quad\quad + \quad + \quad + \quad + \quad + \quad -$$

4. Results and Discussion

4.1. Descriptive statistics

The descriptive statistics on Table 2 has GFCF with highest value of ₦65,227.1mil. ($153.12 mil.US dollars) in 2022, and lowest value of ₦87.2 mil. ($98.98 mil.) in 1985; PDBT has its highest value of ₦189.4 mil. ($0.98 mil.) in 2015, while the lowest amount of ₦0.12 mil. ($0.0013 mil) was incurred in 1999. PXDBT has highest expenditure of ₦38,631.5 mil. ($245.38 mil.) incurred in 2012, while the lowest amount of ₦644.4 mil. ($1,074.0 mil.) was incurred in 1980. The highest SBND of ₦22,210.4 mil. ($52.14 mil.) occurred in 2022, while the lowest amount of ₦11.2 mil. ($18.36 mil.) was incurred in 1981. The economy's highest INRT in the study period of 36.1% occurred in 1993, while the lowest of 9% occurred in 1980. The IQT has best index of -0.92 in 2008, and the worst of -1.38 in 1992. Finally, RGDPGR has highest value of 550.5% in 1981, while the lowest value of -7.05% occurred in 1983. On the variables' volatility, SBND is highest with 2.36, then PDBT debt 2.14, and GFCF 2.0. Overall, given the outcome of diagnostics test of the data, the variables may be fit for the expected regression outcome.

Table 2. Descriptive statistics

	GFCF	PDBT	PXDBT	SBND	INRT	IQT	RGDPGR
Max.	65,227.1	189.4	38,631.5	22,110.4	36.09	-0.92	550.5
Min.	87.15	0.12	644.41	11.19	9.00	-1.38	-7.05
Std. dev.	2.07	2.14	1.22	2.36	0.33	0.12	1.20
J.B. stat.	3.11*	3.13*	4.22*	3.14*	7.14	4.04*	64.64
Prob.	0.211	0.21	0.12	0.207	0.028	0.133	0.000
Obser.	44	44	44	44	44	44	37
Normality	yes	yes	yes	Yes	No	yes	no

Source: computed by the authors. J.B. is Jarque-Berra statistics; * denote significance, which indicates failing to reject the hypothesis of normality of residuals

4.2. Pre-estimation diagnostics

4.2.1. Lag length order

Five lag-order statistics were employed. One maximum lag-order was suggested by the majority, that is, four criteria, while Akaike information criterion (AIC) suggested lag-order three. The study employed lag-order one

4.2.2. Model Stability (MS) test

The result of the MS test suggests long-run stability, as the variables situate on the horizontal axis of the inverse root (the unit circle) of the AR characteristics polynomial

4.2.3. Unit root test

Three (3) stationarity test methods were employed, that is, the Augmented Dickey Fuller (ADF), the Dickey Fuller (DF), and Philip-Perron (PP). Mixed stationarity resulted in the process, that is, on level (stationery) and first difference (integration). Based on the structure, two-stage least square (TSLS) was employed.

4.2.4. Johansen system cointegration test

The Trace and Max-Eigen value statistics established four (4) and two (2) cointegration equations respectively at 0.05 level. The output implied that the variables have long-run relationship, and the explanatory variables may be impactful on the dependent variable.

4.3. Granger-causality results and implications

Presented in Table 3 are the outputs of the granger-causality test, whose results could be in four (4) modes, that is, the pairwise bi-directional, uni-directional, and no-causal relationship (Asteriou and Hall, 2011). The results reveal that two bi-directional causalities, that is, IQT drives lGFCF vice-versa, and IQT drives lPDBT (see row v & viii) respectively. It may imply that an up-scaled and well-organized institutions could raise the level of capital formation formidably and hence revolutionize the quality of infrastructure in Nigeria. Other significant results are that lPXDBT, IQT, and lNRT have unidirectional causal drive on RGDPGR (see row x, xi & xiii) respectively, which supports the demand-following growth hypothesis. It implies that given quality institutions, increased amount of private-external debt in form of FDI inflow could drive real growth significantly.

Interestingly, lINRT, the cost of capital, drives lGFCF significantly (row iii), while, however, against *a-priori* lINRT does not drive the three debt variables, of which lGFCF drives the three debt variables in rows i, ii, & iv. That is, very fundamental result suffices in demand leading-finance following context, as lGFCF significantly drives lSBND, lPDBT and lPXDBT (rows i, ii & iv) respectively. The implication suggests the potency of debt instruments to develop the Nigeria's infrastructural base if the market is appropriately structured and organized, given right institutions, legal and judicial support for the growth of the debt markets.

Table 3: Pairwise Granger-causality test of lag one (1)

S/n	Null Hypothesis	Obser.	F. Stat.	Prob.
i.	lGFCF ⟶ lPDBT	43	4.421**	0.041
ii.	lGFCF ⟶ lPXDBT	43	3.76*	0.059
iii.	lINRT ⟶ lGFCF	43	9.556***	0.003
iv.	lGFCF ⟶ lSBND	43	2.84*	0.099
v.	IQT ⟷ lGFCF	43	9.841***	0.003
	lGFCF IQT	43	7.104**	0.011
vi.	lPDBT ⟶ lPXDBT	43	9.719***	0.003
vii.	lPDBT ⟶ lSBND	43	3.634*	0.063
viii.	IQT ⟷ lPDBT	43	2.86*	0.098
	lPDBT IQT	43	3.51*	0.068
ix.	lSBND ⟶ lPXDBT	43	5.983**	0.018
x.	lPXDBT ⟶ RGDPGR	43	4.255**	0.045
xi.	IQT ⟶ RGDPGR	43	14.22***	0.003
xii.	lSBND ⟶ IQT	43	3.303*	0.076
xiii.	lINRT ⟶ RGDPGR	43	9.409***	0.003

Source: computed by the authors. *; **; and *** indicate 0.1; 0.05; and 0.01 level of significance respectively.
⟶ denotes one-way causality; ⟷ denotes two-way causalities.

4.4. TSLS analysis and implications

The outputs of the two equations significantly agree with the *a-priori* expectations pre-specified in equations (14) & (15), but for the negative impact of IQT on RGDPGR. In specific, in equation (14) (Table 4) a one-percent increase in PDBT issued could proportionately raise the GFCF, and by implication the level of infrastructure by 25 percent at 5 percent significance level. Similarly, a one percent increase in lpxbdt and lsbdt could increase lGFCF by 68.3 percent and 0.3 percent respectively, both at one (1) percent level of significance.

The regression diagnostic tests are reliable as the coefficient of determination and its adjustment rate are 82 percent and 81 percent respectively, which implies that 82 percent of the variation in the grow domestic product is determined by the three explanatory variables in the model. The instrumental rank is 5, as the instruments applied are the lagged values of the equation's explanatory variable. The short-coming of the J. statistics of the instrument rank test is however reviewed and may be revised in the Cragg-Donald weak-instrument test at post-estimation diagnostic presented, in Table 4. The the F-stat. of the weak instrument test score is 14.70 at 9.53 percent. The result suggests that the instruments applied were reliable. Other post-estimation diagnostic tests that may suggest fair regression outputs include the residual normality test, the Ramsey Reset test; and Breusch-Pagan- Godfrey Heteroscedasticity test. The results reveal that the study fails to reject the null hypotheses of normality, functional from relations and homoscedasticity of the outputs.

In equation 15, GFCF, IQT, and Intr had mixed impact on RGDPGR. In line with *a priori*, a one percent increase in GFCF increases RGDPGR by 75.2 percent, at 10 percent significant level. Also, a one-percent rise in INRT and IQT could reduce RGDPGR by 497 and 946 percents respectively. In line with Keynesian doctrine, while the relationship between interest rate and investment is negative (Keynes, 1936) the negative output for institutional quality negates institution theories and doctrines of Douglas North, Acemoglu and others. The negative output of IQT to RGDPGR may have much to desire. Indeed, the quality of institutions in Nigeria have not been encouraging, given the poor index records since the global index was introduced in 1996, as the country currently operate sub-optimally due to weak economic, legal and judicial systems' governance, and hence low-quality economic outputs (Agbakoba, 2023).

The regression's diagnostics produced mixed outputs. The coefficient of determination (R^2) is rather low at 1.4 percent, while the adjusted counterpart is of negative value. It suggests that the next additional explanatory variable could produce inverse impact on the dependent variable, that is, RGDPGR. The instruments applied significantly justifies the null hypothesis. The post-estimation diagnostics test of serial correlation and endogeneity test results suggest that we fail to reject the null-hypotheses that there is no serial correlation among the variables in equation 2 and that the dependent variables are strictly endogenous.

In the system's results (equation 16) lGFCF and two debt variables, the private domestic debt (lPDBT) and private external debt (lPXDBT) ally with *a-priori* expectations in driving real growth rate (RGDPGR). Of the three debt financing variables tested using the system's model, only sovereign bond (lSBND) failed to satisfy *a-priori* expectation, as a one percent rise in lSBND generates 259 percent decline in RGDPGR. The result may suggest the truism of the quality yield spread advantage of corporate bond over government bonds, given the additional yield an investor receives for taking up higher risk in corporate bonds (Eke and Ashamu, 2009).
Institutional quality (IQT) satisfies *a-priori* expectation of positive impact; and the interest rate, in line with the Mckinnon & Shaw's (1973) interest rate repression theory satisfied the *a-priori* expectations. Mckinnon & Shaw (1973) conclude that in developing countries' economic activities are often repressed by their capital control policies, given the restrictions and repressions of interest rate.

The equation's diagnostics are in order of required standard. The R^2 of 46% and the adjusted R^2 of 35 % explain variations in RGDPGR as function of the seven (7) explanatory variables. The instrumental rank test satisfies the null-hypothesis that the number of

instruments (8) is satisfactory, given the J. statistics of 0.015, with probability statistics of 0.992. Furthermore, on the post-regression diagnostics, the residual normality test, Ramsey reset test, serial correlation, heteroscedastic test, weak instrument, and endogeneity test, all satisfied the conditions of the null hypotheses at above 5 percent level of significance.

Table 4: Two- stage least square (TSLS) and system's results

	Equation 14: Dv is lGFCF			Equat. 15: Dv is RGDPGR			Equation 16 (system): Dv is RGDPGR					
	lPDBT	LSBDT	LSBDT	lGFCF	IQT	lINRT	lGFCF	lPDBT	lPXDBT	LSBDT	IQT	lINRT
Coeff.	0.25*	0.68**	0.0003**	0.75*	−9.46**	−4.8*	1.68**	0.58*	0.66	−2.59*	9.07	2.91
S.E	(0.12)	(0.12)	(0.003)	(0.41)	(4.41)	(2.56)	(0.73)	(0.30)	(0.49)	(0.70)	(10.63)	(4.61)
Prob.	0.036	0.000	0.000	0.073	0.04	0.06	0.03	0.067	0.192	0.001	0.402	0.53
R^2			0.82			0.014						0.459
Adj.R^2			0.81			-0.045						0.352
In. rank			5			5						8
J. statis.			28.11			0.438						0.015
P. (J.sta.)			0.000			0.832						0.992

Source**:** computed by the authors. The instruments employed, equation (14) & (15): lPDBT(-1), lPXDBT(-1), IQT(-1), lGFCF(-1), lSBND(-1), and for system's equation (16): lPDBT(-1), lPXDBT(-1), IQT(-1), lGFCF(-1), lSBND1(-1), lRGDPGR(-1), lINRT(-1); Dv is dependent variable. * and ** indicate 0.05 and 0.01 levels of significance respectively. In. rank is Instrumental rank; P. (J.stat.) is probability value of the J-statistics.

Table 5: Post-estimation diagnostics

		Equa. 14		Equa. 15		Equa. (system) 16	
S/n	Tests	Stat.	Pv	Stat.	Pv	Stat.	Pv
1.	Residual normality- J.B. Statistics	2.593*	0.273	–	–	0.15*	0.93
2.	Ramsey Reset:						
	T-stat. (38)	0.746*	0.460	–	–	0.050*	0.960
	F-stat. (1,38)	0.557*	0.460	–	–	0.003	0.960
3.	Breusch-Godfrey serial correla. LM	28.70	0.000	0.9*	0.32	2.463*	0.116
4.	Breusch-Pagan- Godfrey						
5.	Heteroscedasticity: F-stat.	1.508*	0.227	–	–	0.612*	0.718
	Obt. R*-Sqd.	4.469*	0.215	–	–	4.115*	0.661
	Scaled explained SS	2.253*	0.522	–	–	2.636*	0.853
6.	Weak Instrument:						
	Cragg- Donald: F. stat. (@5%)	14.70*	9.53	–	–	0.161*	9.53
7.	Endogeneity(eq.5 &6:df3);(eq.7:df 6)	8.26*	0.04	3.5*	0.32	6.662*	0.353

Source**:** by the authors. J. B. stand for Jaque-Berra; Stat. indicates regression statistics; Pv is probability value. *indicates significance at 0.05 level

4.5. Discussion of findings

This study reveals the potency and relative strength of debt markets towards raising the real-output growth rate in a typical developing economy, Nigeria through results presented in in model 1 (equation 14). The three metrics of debt market tested- private domestic, private external debt, and sovereign debt show positive impact on CF and RGDPGR. In model 2 (equation 15) and the granger-causality result, INRT negatively impacts RGDPGR, as INRT granger-causes GFCF. The results suggest high cost of capital to finance infrastructure, with adverse consequence on real growth rate. The role of INRT in economic management needs to be deeply examined while fixing the monetary policy rate. In capital scarce economy like Nigeria, INRT should be regulated downwards to invite investments in infrastructural development. The policy implications of the two conflicting theories of interest rate model, that is, the Keynesian, and the Mckinnon and Shaw, in developing economies would need to be examined often while taking policy rate decision, as INRT forms the cost of capital for investments, with varied multiplying effects on the macroeconomy.

Moreover, in model 2 (equation 15) IQT provides adverse relationship against RGDPGR. It suffices to stress the leading role quality institutions provide in the working of economics and fast-tracking the provision of economic goods. The negative regression coefficient of 946% suggests the low quality of Nigeria's economic activities and outputs, resulting in higher inflation, unemployment rates, and poor living-standard is attributed to quality of her

institutions, which this study draws from the average of governance index, legal and judicial quality, regulatory quality, and extent of control of corruption. The abundance of resources available in Nigeria may not produce quality life for the citizens if such resources are managed via low quality institutions. In an environment of weak institutions, rent-seeking and inefficiency in resource usage strives. When optimal productivity of scarce resource is absent, investments may not birth. The outcome may result in low real-growth rate at very high inflation rate, which has become the norm in many developing economies.

The system's model (equation 16) result is also revealing. In support of credit quality-spread theory, both the PDBT and PXDBT instruments show relative superiority impact in the finance of CF and impacts RGDPGR over the SBND, as the SBND was not *a-priori* compliant. Given the capital resource usage efficiency of private sector, that is, private yield on debt instruments relative to sovereign debt, it may call for policy rethink. The mechanics of capital asset pricing model (CAPM) provides formidable thought on the efficiency and hence the relative pricing and compensation for capital risks, which this study reveals is in favour of private debt capital. Given abundance of infrastructural decay whose financing could transform the lives of the people, encouragement should be given to developing the private capital debt market in this regard. The neo-classist school claim that organizational change can complement required institutions to make a difference in economic advancement, efforts at convergence, and delivery of public goods (Hoff and Stiglitz, 2000). Given the avalanche of global capital with appetite, hunting where to birth for high returns, developing economies like Nigeria may have to liberalize more, to open their economics to private sector dominance in the provision of infrastructure, and raise the quality of real growth rate.

Though, the study achieved many granger-causality outputs, however, two bi-directional causalities, that is, IQT drives GFCF vice-versa, and also, IQT drives PDBT vice-versa stand out. The literature has well recognized that quality institution is key to multiple paths to growth; and it matter more in achieving any growth, development, and poverty reduction goals. In particular, it determines a country's global respect. IQT is the main channel through which public policies may be impactful (Eke, 2017; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, (LLSV), 1997). The Work Bank reports that the secret of the East-Asian economic miracle was superior accumulation of physical and human capital, engineered by quality institutions (World Bank, 1993).

Given, that the channels through which institutions may improve economic performance are many and broad, that of GFCF is highly substantial, as GFCF generate greater economic outcomes on all economic activities, that eventually affects the citizen potentials, wellbeing and standard of living. On the other hand, quality infrastructure equates institution's productivity and low-service cost of operations. On IQT and PDBT bi-directional nexus, IQT can accelerate the debt issuance process, assist operational performance for higher yields through encouragements from regulatory and reporting institutions, such as the Debt Management office (DMO), SEC, CBN, etc (Eke and Busari, 2024). On the other-hand, PDBT market may, in revert, impact institutions through establishing antidote for financial stability, hence less shocks in the financial and economic system. Nigeria's financial development may have been stalled due to financial mix-match or maladaptation, that is, adopting the short-end financial resources to finance long-term real sector catalysis, hence the necessity to innovate varieties of private debt capital sourcing.

The PDBT is being preferred to drive developing economies' capital formation and infrastructure development faster on the heels of feature of debt or loan covenants, whose contractual clause places specific discipline, operating, financing constraints, and obligations on the borrower (Megginson, Smart, Gitman, 2007). The many control features of PDBT covenants over public debt market are additional reasons why the PDBT may be the better antidote against the agency problem of the relationship between the borrower and the lender.

5. Conclusion

The study affirmed market innovation theory in Nigeria's debt market development. Secondly, the study affirmed the finance-leading or growth-following finance lead theory, as the three debt instruments tested were found to drive CF, and CFD drives RGDP. Further, it affirmed the credit quality spread theory, as both PDBT and PXDBT were observed to drive RGDPGR relative to domestic SBND. The result supports the finance-lead-growth following hypothesis (Patrick, 1966). Following the conclusion, the study recommends as follows:

First, SEC should initiate required legislative bills to further institutionalized public-private infrastructure development for critical public infrastructures, particularly rural infrastructure. Secondly, as private debt instrument outperformed sovereign debt, SEC should raise its policy support for private debt market towards innovations for capital formation development (CFD) and infrastructures. Varieties of debt instruments would provide long-term finance, as the private sector could introduce purple bond, the blue bond for women and men necessaries; bonds for health, education, and other human development funding needs respectively; varieties of environmental bonds, such as green(farmer), blue, and climate bonds, etc, should be encouraged from supra-national institutions. Thirdly, Government should encourage debt market development by fiscal incentives to private debt issuers for infrastructure development. Fourthly, the study's outcome that private debts impact RGDPGR, requires that the CBN should manage its policy rate downwards. It would encourage capital flow and investments to the debt capital market, as the capital market is often in dare-relative competition with the money market. Finally, IQT holds bi-directional causality with GFCF and PDBT, which implies that IQT establishes dual role on infrastructure development and long-tenured debt market development. Towards putting Nigeria's institutions in competitive stead with advanced economies, governments at national and sub-national levels should reform institutions in all processes of infrastructural projects, from conception, through execution to delivery, such as on policy formulation, and review of existing policies; debt market liberalizations, compassionate market regulation by both the main and self -regulatory organizations; corruption control; legal and judiciary reforms; etc.

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