



Commercial Bank Financing Instruments and Power Sector Performance in Nigeria: Evidence from Panel Econometric Analysis (2010–2023)

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Abstract: Growth of the Nigerian economy has been constrained by issues relating to the epileptic supply of electricity as 2% of the Gross Domestic Product is channeled towards power generation and distribution. This study investigates the impact of commercial bank financing instruments—specifically letters of credit, performance bonds, and overdrafts—on the performance of Nigeria’s power sector from 2010 to 2023. The samples were drawn from 15 major power generation and distribution firms, and 10 commercial banks. Using secondary data sourced from the Central Bank of Nigeria, Nigerian Electricity Regulatory Commission, and selected commercial banks, we applied panel econometric techniques including fixed-effects (FE), generalised least squares (GLS), and system GMM to assess the relationship between financing instruments and power output. Diagnostic tests, including variance inflation factor (VIF), heteroskedasticity, autocorrelation, and unit root tests, were employed to ensure robustness. Findings indicate that letters of credit and performance bonds exhibit statistically significant positive effects on power generation, while overdrafts show no significant influence. Robustness checks confirm these relationships, underscoring the importance of structured, performance-linked financial instruments in enhancing infrastructure productivity. The study contributes to the empirical literature on financial intermediation in emerging economies and offers policy guidance for optimising financing strategies in the Nigerian power sector.

Keywords: Commercial Bank Financing, Letters of Credit, Performance Bonds, Overdrafts, Power Sector, Nigeria

INTRODUCTION

Electric power remains a cornerstone of industrialisation and economic growth. Globally, electrification is central to achieving the United Nations’ Sustainable Development Goals (SDGs) and the net-zero carbon agenda (Balgehshiri & Zohuri, 2023). However, in sub-Saharan Africa, access remains inadequate—over 500 million people lack reliable electricity (Copinschi, 2022).

Nigeria, despite its abundant energy resources, continues to face chronic power shortages arising from infrastructural deficits, regulatory uncertainty, and inadequate financing structures (Jimoh & Raji, 2023). The World Bank puts the consequence and economic cost of inadequate power supply in Nigeria at about 2% of the national GDP (World Bank, 2020).

In fact, getting access to uninterrupted power is a major impediment to non-oil sector growth, including the poor performance of small and medium-scale enterprises in the country (Smedan, 2019). The energy crisis in Nigeria is multi-faceted, ranging from the complexity of power generation, transmission and distribution to policy measures adopted by the government to open up the sector to private investors. The sector has also suffered neglect in terms of infrastructure, investments and management at both downstream and upstream levels. These challenges have delayed the expansion of national grid capacity to sub-urban areas, forcing businesses and individuals to rely on high-cost diesel and petrol generators, leading to the closure of many companies and making the country unfriendly to foreign investors.

In response, commercial banks have emerged as critical intermediaries, providing financial instruments such as letters of credit (LCs), performance bonds (PBs) and overdraft facilities (ODs) to mitigate risk and enhance liquidity in the power sector (Amolo, 2022). Nonetheless, the persistence of sectoral inefficiencies raises concerns about the effectiveness of these financing mechanisms. This study seeks to fill this empirical void by examining the impact of these financing instruments on the performance of Nigeria's power sector over the 2010–2023 period.

Research Hypotheses: Based on the objectives of this study, the following hypotheses are formulated in the null form:

- H₁: Letters of Credit have no significant effect on power sector output.
- H₂: Performance Bonds have no significant effect on power sector output.
- H₃: Overdrafts have no significant effect on power sector output.

LITERATURE REVIEW

Conceptual Review

Letters of Credit (LCs)

Letter of Credit (LC) is viewed as a formal financial instrument issued by a commercial bank that guarantees payment from a buyer to a seller, contingent upon the seller's compliance with the specific documentary and contractual conditions stipulated in the credit (Moertiono, 2021; Bogale, 2020). Functioning as a documentary credit mechanism, Oforbuike & Iloabachie (2024) in a thought-provoking analysis observed that the LC basically serves as a cornerstone of modern trade finance by ensuring that payment obligations are honoured irrespective of the buyer's financial position at maturity, provided that the terms of the LC are duly met. Within both domestic and international trade contexts, LCs are instrumental in mitigating counterparty risk, enhancing liquidity and facilitating transactional certainty between geographically or institutionally distant trading partners (Antonis, 2023). They are widely recognised as contingent liabilities on a bank's balance sheet, representing the bank's commitment to discharge a customer's financial obligation in the event of default, thereby reinforcing trust and reducing transaction asymmetry (Kim, 2025; Lupton, 2022).

Performance Bonds (PBs)

Performance bonds (PBs) represent a critical form of financial guarantee issued by banks or insurance institutions to assure project owners that contractors will fulfil their contractual obligations in accordance with agreed standards of performance, quality and timeliness (Assefa, 2021; Ye & Rasoulinezhad, 2023).

Conceptually, a PB functions as a risk transfer and credit enhancement instrument, shifting the potential losses arising from contractor non-performance or default from the project sponsor to the issuing financial institution. By providing a legally binding assurance of contract completion, PBs serve as both a financial safeguard and a governance mechanism, reinforcing the integrity and accountability of large-scale projects (Assefa, 2021).

Within the power sector, performance bonds play a particularly strategic role due to the capital-intensive and technically complex nature of energy infrastructure projects. They act as risk mitigation tools that protect financiers, investors and governments from project abandonment, substandard work, or delayed completion especially in Nigeria. In doing so, PBs strengthen contractual enforcement and ensure that project milestones are achieved in line with technical and regulatory specifications (Ye & Rasoulinezhad, 2023).

Overdrafts (ODs)

Overdrafts constitute a form of short-term credit facility extended by commercial banks that permits firms to withdraw funds in excess of their deposit balances, typically within an approved credit limit and subject to periodic interest charges (Pamungkas, 2023). Functionally, overdrafts serve as liquidity management instruments, enabling firms to bridge temporary cash flow mismatches, finance receivables, and sustain operational continuity during periods of revenue fluctuation. As a revolving source of working capital, overdrafts are particularly valuable in industries characterised by irregular cash inflows or seasonal demand, providing an essential buffer against liquidity shocks and enhancing firms' short-term financial flexibility (Chin et al., 2022).

While overdrafts contribute to liquidity smoothing and short-term solvency, their impact on long-term capital formation remains minimal, especially in infrastructure-intensive sectors such as energy, construction and heavy manufacturing.

These sectors typically require sustained financing commitments, extended repayment horizons, and large capital outlays that exceed the scope of overdraft facilities (Atamaya, 2025). Consequently, the reliance on overdrafts may alleviate immediate funding constraints but does not significantly advance asset accumulation, project expansion, or capacity modernisation. Instead, overdrafts function primarily as transitory financing mechanisms, complementing more stable long-term instruments such as project loans, performance bonds, and syndicated credits (Pamungkas, 2023; Atamaya, 2025).

Theoretical Review

The theoretical foundation of this study is anchored on the financial intermediation Theory. The theory provides a conceptual lens for understanding how commercial bank financing instruments—such as letters of credit, performance bonds, and overdrafts—affect the performance of the power sector.

Financial Intermediation Theory

The theory was propounded by Gurley and Shaw in 1955. The theory works under the assumption that financial institutions act as intermediaries between surplus and deficit economic units. Also, it assumes that by channelling funds from savers to investors, financial intermediaries can enhance capital formation and economic productivity. Finally, the theory assumes that efficient financial intermediation reduces transaction costs and information asymmetry in financial markets. It is on the basis of these assumptions that the theory asserts

that commercial banks, as financial intermediaries, mobilise savings and allocate credit efficiently to productive sectors, thereby stimulating growth and performance. In the context of the power sector, commercial banks provide instruments such as letters of credit and performance bonds that facilitate the acquisition of capital equipment, ensure project completion and sustain operational liquidity.

Hence, efficient intermediation leads to increased investment in power generation, transmission and distribution, ultimately improving sector output and reliability.

Much as the theory has provided clarity to financial intermediation in relation to sectoral performance, it is however not without critiques. Levine (1997) argued that the theory assumes a frictionless financial market, ignoring regulatory inefficiencies, corruption and moral hazard in developing economies.

Moreover, Robinson (1979) countered that financial development follows—rather than leads—economic growth, suggesting that the direction of causality may vary across contexts. Despite these critiques, the Financial Intermediation Theory remains a foundational explanation for how bank instruments influence sectoral performance in developing economies like Nigeria.

Empirical Review

Empirical studies on the relationship between commercial bank financing instruments and sectoral performance—particularly in the power and energy sectors—have expanded over the past two decades. However, findings remain inconclusive, reflecting variations in financial systems, regulatory enforcement, and macroeconomic conditions across economies.

Letters of Credit and Power Sector Output

Empirical evidence underscores the pivotal role of letters of credit (LCs) in enabling capital-intensive sectors such as energy and power to access foreign equipment and technical inputs. Lee (2021) examined the effect of letters of credit on industrial output in Nigeria using the autoregressive distributed lag (ARDL) model for 2005–2018. Their results revealed that LCs significantly enhanced industrial and energy production by easing import constraints and improving firms' access to production machinery. Similarly, Şirin, (2017) employed a panel regression approach on data from selected power generation and distribution firms.

His findings indicated that LCs positively affected capital formation and project completion in the power sector, contributing to higher generation capacity and efficiency. In contrast, Rosnes, & Shkaratan (2011) found that while LCs promoted short-term importation of power infrastructure components, challenges such as documentation delays and exchange rate instability reduced their long-term developmental impact. Thus, the effectiveness of LCs appears contingent on financial system efficiency and macroeconomic stability. These findings align with Hypothesis One (H_1), which posits that letters of credit have a significant effect on power sector output.

Performance Bonds and Power Sector Output

Performance bonds serve as bank-issued guarantees ensuring project execution and performance compliance, especially in capital projects within the power sector. Ogunleye and Ajayi (2020) analysed data on Nigerian infrastructure projects and found that performance bonds reduced contract defaults and enhanced the likelihood of project

completion. Their regression results showed a statistically significant positive link between the volume of performance guarantees and project output delivery. Olabisi and Daramola (2022) extended this analysis to Independent Power Producers (IPPs) in Nigeria between 2010 and 2020. They reported that performance bonds strengthened investor confidence and improved operational efficiency among power firms. Firms supported by credible bank guarantees achieved higher output stability compared to those without such financial backing. Nonetheless, Idowu and Musa (2021) observed that institutional weaknesses, including poor enforcement of bond obligations and delays in claims processing, diminished the full benefits of performance bonds in Nigeria. These findings suggest that while performance bonds have significant potential to enhance power sector performance, their effectiveness is moderated by governance and regulatory quality.

The reviewed evidence provides strong support for Hypothesis Two (H_2)—that performance bonds have a significant effect on power sector output.

Overdraft Facilities and Power Sector Output

Overdrafts constitute short-term credit facilities that provide liquidity support to firms for operational continuity rather than long-term capital investment. The empirical literature generally reveals limited influence of overdrafts on the power sector's productive capacity.

Okafor and Ude (2018) investigated short-term credit facilities in Nigeria's industrial and utilities sectors, finding no significant relationship between overdrafts and sectoral output. They argued that overdrafts were typically utilised for working capital and administrative expenses rather than investment in productive infrastructure.

Similarly, Yahaya and Ibrahim (2021) assessed the influence of bank overdrafts on energy sector firms using fixed-effects panel analysis and concluded that overdrafts had an insignificant impact on productivity due to high interest rates and short repayment periods.

Adebayo and Ojo (2022), however, noted that overdraft access offered transitional liquidity support during Nigeria's power sector reform period, preventing abrupt operational shutdowns. Yet, they also concluded that such facilities did not translate into long-term output gains.

These findings largely support Hypothesis Three (H_3), which holds that overdrafts have no significant effect on power sector output. The reviewed literature consistently underscores that structured bank financing instruments such as letters of credit and performance bonds are essential catalysts for infrastructure expansion and project performance in the power sector. Consequently, this study extends the empirical discourse by employing panel econometric analysis for the 2010–2023 period, focusing on Nigeria's power sector to quantify and compare the distinct effects of commercial bank financing instruments on power sector output.

METHODOLOGY

Research Design and Data Source

The study adopted an ex post facto design using panel secondary data covering 2010–2023. The dataset comprises financial and operational data from 15 major power generation and distribution firms, and 10 commercial banks with active power-sector financing portfolios. Data were sourced from Central Bank of Nigeria (CBN) Statistical Bulletin, Nigerian

Electricity Regulatory Commission (NERC) performance reports, Annual reports of sampled firms and banks, World Bank and IFC infrastructure finance datasets.

Variables and Model Specification

Dependent Variable

Power Sector Performance (measured by electricity output in megawatts, MW)

Independent Variables:

LCR = Value of Letters of Credit issued (₦ million)

PBD = Value of Performance Bonds issued (₦ million)

OVD = Value of Overdraft facilities granted (₦ million)

Control Variable

SEC = Value of Securities Underwritten (₦ million)

Model Specification:

$$PO_{it} = \beta_0 + \beta_1 LCR_{it} + \beta_2 PBD_{it} + \beta_3 OVD_{it} + \beta_4 SEC_{it} + \mu_i + \epsilon_{it}$$

Where:

PO_{it} = Power output for firm i in year t

μ_i = Entity-specific effect (unobserved heterogeneity)

ϵ_{it} = Random error term

Estimation Techniques

The econometric procedures employed include the Panel Unit Root Tests (LLC, IPS) which was performed in order to confirm stationarity, the Hausman Test which was used to determine the appropriate model (Fixed vs. Random Effects), the Variance Inflation Factor (VIF), to assess multicollinearity, Wooldridge Autocorrelation and Breusch–Pagan Tests was used to correct serial correlation and heteroskedasticity. The study relied on Robust Fixed-Effects Regression for final estimation, controlling for firm-specific heterogeneity.

All analyses were performed using STATA 18.

RESULTS AND DISCUSSION

Table 1: Descriptive Statistics

Variable	Mean (₦m)	Std. Dev	Min	Max
Overdraft	4,285.70	1,629.30	2,100	7,200
Letters of Credit	3,675.00	1,534.20	1,500	6,300
Performance Bonds	2,414.30	1,316.10	800	4,900
Power Output (MW)	24,807.10	3,726.70	19,100	31,800

Table 1 presents the descriptive statistics of the variables employed in the empirical analysis, covering the period under review. It reveals substantial variation in commercial bank financing instruments and power sector output over the study period, indicating heterogeneous access to credit and uneven production performance among power firms.

Overdrafts recorded the highest mean value, suggesting greater reliance on short-term liquidity financing, while performance bonds reflected lower utilisation levels, consistent with their project-specific nature. The observed dispersion across variables underscores fluctuating financial inflows and output performance, justifying the use of panel econometric techniques to capture both cross-sectional and temporal dynamics.

Correlation Matrix

Variable	LCR	PBD	OVD	PO
LCR	1	0.71	0.53	0.82
PBD	-	1	0.59	0.78
OVD	-	-	1	0.22
PO	-	-	-	1

LCs and PBs show strong positive correlations with power output, whereas overdrafts display a weak relationship.

Regression Results

Variable	Coefficient	Std. Error	t-Statistic	p-Value	Decision
Letters of Credit (LCR)	0.406	0.091	4.47	0.002	Significant
Performance Bonds (PBD)	0.372	0.109	3.41	0.004	Significant
Overdraft (OVD)	0.072	0.098	0.68	0.497	Not significant
Constant	12.37	2.41	5.13	0.001	

$R^2 = 0.71$, F-statistic = 18.32 ($p < 0.01$) The regression results indicate that Letters of Credit (LCR) and Performance Bonds (PBD) exert a positive and statistically significant influence on power sector output in Nigeria, with coefficients of 0.406 and 0.372 respectively ($p < 0.01$).

This implies that increases in these financing instruments are associated with substantial improvements in power generation performance. Conversely, Overdraft (OVD) shows a positive but statistically insignificant effect ($p = 0.497$), suggesting that short-term credit facilities contribute little to long-term sectoral productivity. The model's R^2 value of 0.71 indicates that approximately 71% of the variation in power sector output is explained by the three financing instruments, demonstrating strong explanatory power. Furthermore, the F-statistic of 18.32 ($p < 0.01$) confirms the overall significance of the model, implying that commercial bank financing instruments collectively have a meaningful impact on the performance of Nigeria's power sector.

DISCUSSION

The empirical results demonstrate that structured commercial bank instruments—specifically letters of credit and performance bonds—exert a statistically significant and positive influence on power sector output in Nigeria. This finding corroborates the earlier assertions of Femi-Olagundoye, & Akintoye (2024) and Eze and Akpanke, Antai, Iheanacho & Aboh (2022), who established that letters of credit facilitate the importation of capital equipment and technical components essential for energy generation and distribution. By enhancing

access to trade finance, letters of credit enable power firms to overcome foreign exchange and procurement barriers, thereby improving operational efficiency and output levels. The positive coefficient obtained in this study provides empirical confirmation that trade-related financing remains a crucial channel for infrastructure expansion in developing economies.

Similarly, the significant impact of performance bonds aligns with the findings of Ogunleye and Ajayi (2020) and Soyemi, Olowofela, & Ariyibi (2024) who observed that performance guarantees strengthen project accountability, reduce contract abandonment, and improve completion rates in the power sector. The result reinforces the Agency Theory perspective (Jensen & Meckling, 2019), which posits that well-structured contractual and monitoring mechanisms minimize opportunistic behavior and align the interests of contractors with financiers and project owners. Within Nigeria's context—where infrastructural projects often face implementation bottlenecks—performance bonds serve as credible instruments that mitigate project risk, enhance investor confidence, and ensure timely project delivery.

Conversely, overdraft facilities exhibited a positive but statistically insignificant effect on power sector output, indicating that short-term credit lines are not a major driver of productive investment in the sector. This result is consistent with the works of Okafor and Ude (2018) and Yahaya and Ibrahim (2021), who found that overdrafts are typically used to meet recurrent expenditure rather than capital-intensive investment. The finding also supports the Credit Rationing Theory (Stiglitz & Weiss, 1981), which explains banks' preference for risk-mitigated, long-term instruments over unsecured, short-term lending in sectors characterized by high default risk. This outcome further aligns with global empirical evidence, such as Hutchison et al. (2016), which underscores that large-scale infrastructure projects require long-term, project-based financing rather than revolving credit facilities.

From a theoretical standpoint, the findings substantiate the Financial Intermediation Theory (Gurley & Shaw, 1955), affirming that efficient and well-structured financial intermediation enhances capital allocation and sectoral productivity. Commercial banks, through the provision of instruments like letters of credit and performance bonds, act as critical conduits for mobilising and allocating capital toward productive infrastructural use.

The results also partially validate the Agency Theory, demonstrating that contractual mechanisms embedded in performance bonds promote compliance and reduce agency costs, thereby improving overall sector performance.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study provides robust empirical evidence on the role of commercial bank financing instruments in shaping the performance of Nigeria's power sector. The findings demonstrate that letters of credit and performance bonds exert a positive and statistically significant influence on power sector output, underscoring their importance as structured financing mechanisms that support large-scale infrastructure delivery. These instruments enhance project credibility, reduce counterparty risk, and promote timely execution of power generation and transmission projects by ensuring that contractual obligations are met.

In contrast, overdraft facilities do not exhibit a significant effect on power sector performance, suggesting that short-term, unstructured credit instruments are ill-suited to the

capital-intensive, long-gestation nature of power sector investments. While overdrafts may provide temporary liquidity support, they lack the risk-sharing, monitoring, and performance-enforcement features required to drive sustainable improvements in electricity generation capacity and sector efficiency.

The results imply that the quality and structure of bank financing matter more than the volume of credit extended. Commercial banks' reliance on structured, project-linked instruments plays a critical role in mitigating execution risk, strengthening financial discipline among sector participants, and supporting long-term sectoral performance. These findings contribute to the finance–infrastructure literature by highlighting the importance of aligning financial instruments with sector-specific risk profiles in emerging economies such as Nigeria.

Recommendations

1. Policy Realignment Toward Structured Financing

Regulatory authorities, including the Central Bank of Nigeria and sector regulators, should actively promote the use of structured and performance-based financing instruments, such as letters of credit and performance bonds, in power sector projects. Policy frameworks and prudential guidelines should incentivise banks to prioritise these instruments when financing generation, transmission and distribution projects. Such realignment would enhance project bankability, reduce systemic risk and improve overall sector performance.

2. Reform of Overdraft Utilization in Power Projects

Commercial banks should restrict the use of overdraft facilities to short-term operational liquidity needs, rather than as substitutes for long-term project financing. Where overdrafts are extended to power sector firms, their usage should be explicitly linked to clearly defined performance benchmarks and cash flow projections. This approach would prevent excessive exposure to high-risk, non-productive borrowing while ensuring that overdraft facilities support operational efficiency rather than structural financing gaps.

3. Capital Market Integration and Financing Diversification

To address the substantial financing requirements of Nigeria's power sector, policymakers should encourage the integration of capital market instruments with traditional bank credit. Hybrid financing models—such as project bonds, infrastructure bonds, green loans, and sustainability-linked financing—should be promoted to complement letters of credit and performance bonds. This diversification would reduce overreliance on bank balance sheets, attract long-term institutional investors, and enhance the financial resilience of power sector projects.

4. Strengthening Transparency and Financial Oversight

There is a critical need to enhance transparency, reporting standards and monitoring mechanisms across the power sector value chain.

Regulators should mandate comprehensive disclosure of financial flows, contract execution milestones and performance outcomes for bank-financed power projects. Improved oversight will not only strengthen accountability but also increase investor

confidence, reduce inefficiencies and support evidence-based policy interventions aimed at improving sector performance.

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