

RESEARCH ARTICLE

Does Capital Adequacy Ratio moderate the Relationship between Asset Quality and financial Performance of Commercial Banks in Nigeria?

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Abstract

This study examines the impact of non-performing loans (NPLs) and loan loss provisions (LLPs) on the return on equity (ROE) of commercial banks in Nigeria, while explicitly investigating the moderating role of capital adequacy proxied by the risk-adjusted capital ratio (RACR). A quantitative research design is adopted, employing a balanced panel data framework using panel regression over a ten-year period spanning 2015–2024. The sample comprises thirteen (13) deposit money banks, selected purposively due to their systemic importance and substantial contribution to Nigeria's banking sector. Data are sourced from audited annual reports and accounts and analysed using Panel-Corrected Standard Errors (PCSE) to address heteroskedasticity, contemporaneous correlation, and panel-specific disturbances. The empirical findings reveal that non-performing loans and loan loss provisions exert a statistically significant negative effect on return on equity, indicating that deteriorating asset quality undermines bank profitability. In addition, the risk-adjusted capital ratio exhibits a significant moderating effect on the relationship between asset quality indicators and financial performance, highlighting the critical role of capital buffers in mitigating credit risk exposure. The results provide robust empirical support for the relevance of RACR as a performance and regulatory metric in banking analysis. The study recommends that banks strengthen credit risk assessment, improve loan recovery mechanisms, and maintain adequate risk-adjusted capital levels to enhance resilience and profitability. These findings offer valuable insights for bank managers, regulators, investors, and policymakers concerned with financial stability and sustainable banking performance in Nigeria and other emerging economies.

Keywords: Capital adequacy ratio; Asset quality; financial performance; Commercial banks; Nigeria

Introduction

Commercial banks remain central to financial intermediation, economic growth, and financial system stability, particularly in developing and emerging economies. In Nigeria, the banking sector plays a dominant role in mobilizing savings, allocating credit, and supporting private-sector activity, making bank performance a critical macroeconomic concern. The ability of commercial banks to sustain profitability depends largely on effective management of asset quality and capital structure. In recent years, however, rising credit risk exposure and persistent capital adequacy concerns have intensified regulatory and academic interest in understanding how

banks' internal financial conditions shape performance outcomes. These concerns are particularly pronounced in fragile macroeconomic environments, where adverse shocks can quickly transmit through bank balance sheets, eroding profitability and threatening systemic stability.

Financial performance, commonly proxied by return on equity (ROE), has exhibited pronounced volatility in Nigeria over the past decade (CBN, 2022; CBN, 2023). According to data reported in the Central Bank of Nigeria Statistical Bulletin and Financial Stability Reports, the average ROE of Nigerian commercial banks declined sharply following the 2016 economic recession, falling from approximately 19.78% in 2015 to about 12.65% in 2016. This decline coincided with a significant deterioration in asset quality, as the industry non-performing loan (NPL) ratio increased from around 4.88% to approximately 12.80% over the same period, leading to higher loan loss provisioning and weakened earnings capacity (CBN, 2022). Although profitability improved marginally in subsequent years, ROE recovery remained uneven across banks, reflecting persistent differences in balance-sheet strength and risk exposure (CBN, 2023). The post-2020 COVID-19 period further intensified profitability pressures, as elevated credit risk, regulatory forbearance measures, and subdued lending conditions constrained returns to shareholders, reinforcing the sensitivity of ROE to asset quality and capital adequacy conditions (Wanjiru et al., 2024; Orando et al., 2025). Asset quality, commonly reflected through indicators such as non-performing loans and loan loss provisions, continues to represent a major source of vulnerability in the banking sector. Poor asset quality weakens earnings capacity through higher provisioning costs and reduced interest income, while simultaneously increasing the likelihood of financial distress. In Nigeria, periods of declining ROE have closely coincided with surges in non-performing loans, particularly following macroeconomic shocks. Recent studies reinforce the centrality of asset quality in shaping bank outcomes. Nyakeyo et al. (2025) demonstrate that asset-related decisions significantly influence financial stability in Kenyan commercial banks, with financial performance acting as a key transmission mechanism. Similarly, Ben Abdallah and Bahloul (2025) show that asset quality plays a moderating role in the relationship between solvency, liquidity, and profitability, highlighting that the condition of banks' loan portfolios critically shapes financial outcomes.

Alongside asset quality, capital adequacy has emerged as a crucial determinant of bank performance and resilience. Capital adequacy ratios reflect a bank's capacity to absorb losses and sustain operations during periods of financial stress. In the Nigerian context, regulatory emphasis on capital buffers has increased following episodes of banking sector fragility and profitability erosion. Empirical evidence consistently documents a positive association between capital adequacy and financial performance. Wanjiru et al. (2024) find that capital adequacy significantly enhances the financial performance of commercial banks, while Orando et al. (2025) show that different dimensions of capital adequacy exert heterogeneous effects on profitability. Widati et al. (2025) further argue that capital adequacy, when combined with operational efficiency, provides a dual mechanism for improving profitability, reinforcing the view that capital strength functions as a strategic resource rather than merely a regulatory constraint. Evidence from other banking systems, including Surya and Reina (2025) and Snobar and Al Hanini (2025), similarly emphasizes the importance of capital adequacy in shaping earnings quality and profitability under varying risk conditions.

Despite the growing body of literature on capital adequacy and profitability, recent studies increasingly emphasize that capital adequacy does not operate in isolation. Its effectiveness depends critically on underlying asset quality conditions. Ben Abdallah and Bahloul (2025) explicitly demonstrate that asset quality moderates the relationship between solvency, liquidity, and profitability, suggesting that strong capital positions alone may be insufficient when asset quality deteriorates. Surya and Reina (2025) further show that capital adequacy and credit risk jointly influence profitability, with liquidity acting as an intervening mechanism. These findings point to the need for integrated frameworks that simultaneously consider capital buffers and asset quality dynamics when evaluating bank performance.

However, important gaps remain in the literature. First, much of the recent empirical evidence is concentrated in East African, Asian, and Middle Eastern banking systems, with limited focus on Nigeria, despite its systemic importance within Sub-Saharan Africa. Second, although prior studies acknowledge interactions between capital adequacy and credit risk, most treat capital adequacy either as a direct determinant or as a mediating variable, rather than explicitly modeling its moderating role in the asset quality performance relationship. Third, few studies employ risk-sensitive capital measures that better reflect banks' true loss-absorbing capacity under changing asset risk conditions, particularly during prolonged periods of economic stress such as those experienced in Nigeria between 2016 and 2023.

Empirical evidence on the relationship between asset quality and financial performance, commonly measured by return on equity (ROE), remains mixed and inconclusive across banking systems, suggesting that direct effects alone provide an incomplete explanation of bank performance outcomes (Ben Abdallah & Bahloul, 2025; Wanjiru et al., 2024; Orando et al., 2025). These inconsistencies satisfy the methodological conditions for moderation analysis outlined by Baron and Kenny (1986) and Hayes (2022), indicating that the impact of asset quality on ROE is contingent on conditioning factors rather than uniform across contexts. In line with this logic, capital adequacy is introduced in this study as a moderating variable, reflecting banks' loss-absorbing capacity and resilience under varying asset quality conditions (Widati et al., 2025; Surya & Reina, 2025). Modelling capital adequacy as a moderator rather than a direct predictor enables a context-sensitive assessment of how capital buffers alter the asset quality–financial performance relationship in Nigerian commercial banks.

To address these gaps, this study examines whether capital adequacy moderates the relationship between asset quality and financial performance in Nigerian commercial banks, using a risk-adjusted capital ratio as a more refined measure of capital strength. By focusing on moderation rather than direct effects, the study responds directly to recent empirical calls for deeper analysis of how capital buffers condition the impact of asset quality on profitability (Ben Abdallah & Bahloul, 2025; Surya & Reina, 2025). This approach offers a more nuanced understanding of bank performance dynamics in a high-risk, emerging market environment characterized by macroeconomic volatility and recurrent credit shocks. Overall, this study contributes to the literature by extending recent capital adequacy and asset quality research to Nigeria, contextualizing ROE as a persistent performance challenge rather than a static outcome, and empirically demonstrating how capital adequacy alters the asset quality–financial performance nexus. These contributions provide relevant insights for bank management and regulators seeking to enhance financial resilience through integrated capital and credit risk strategies.

The remainder of the study is organized as follows. The next section reviews relevant empirical and theoretical literature. Section three presents the methodology, including data sources, variable measurement, and estimation techniques. Section four discusses the empirical results, while the final section concludes with policy implications, limitations, and suggestions for future research.

Literature Review

The literature review provides a comprehensive analysis of existing research concerning the financial performance of commercial banks, with a specific focus on Nigerian institutions. This review synthesizes empirical findings from various studies to examine the relationships between asset quality, non-performing loans (NPLs), loan loss provisions, and financial performance metrics such as return on equity (ROE). Non-performing loans (NPLs) are loans in default or close to default, typically defined as loans with overdue payments of 90 days or more (Kebede, Tesfaye, & Erana, 2024). The NPL ratio, which measures the proportion of non-performing loans to total loans, is widely recognized as a key indicator of asset quality and a critical determinant of bank financial health (Juraev, 2023). High NPL levels increase provisioning requirements, reduce interest income, and

constrain banks' lending capacity, ultimately eroding profitability (Wahyuni, Badollahi, Nurhidayah, & Mardiastuti, 2023). Empirical evidence demonstrates that surges in NPLs often reflect broader macroeconomic challenges and regulatory gaps, making their monitoring essential for both individual banks and systemic stability (Rohadi, Sarumpaet, & Syaipudin, 2024; Rachmawati, Sabilalo, & Arif, 2024).

The relationship between NPLs and financial performance, commonly proxied by return on equity (ROE), has yielded mixed results across studies, suggesting that contextual factors may shape the strength and direction of this relationship. Some studies report a negative association, indicating that higher NPLs reduce profitability (Shah et al., 2022; Mengstie et al., 2024). For instance, research in emerging markets shows that rising NPLs constrain banks' operational efficiency, which indirectly lowers ROE (Shah et al., 2022). Other studies, however, find no statistically significant effect of NPLs on ROE, reflecting the influence of moderating factors such as capital adequacy, risk management practices, and macroeconomic conditions (Dincer et al., 2023; Isnurhadi et al., 2022). These inconsistencies indicate the need for deeper analysis, specifically exploring how internal bank buffers, like capital adequacy, may condition the effect of NPLs on profitability, in line with moderation approaches recommended by Baron and Kenny (1986) and Hayes (2022). In the Nigerian context, evidence shows that NPLs have historically contributed to volatility in ROE, particularly during periods of economic stress such as the post-2016 recession and the post-COVID-19 lending environment (CBN, 2022; CBN, 2023; Wanjiru et al., 2024). NPL management remains a critical challenge for Nigerian banks, as deteriorating loan quality can rapidly erode shareholder returns and destabilize bank operations. These findings justify examining HO1 in this study: HO1: Non-performing loans do not have a significant impact on the return on equity of commercial banks in Nigeria.

Loan loss provisions (LLPs) represent the expected losses from non-performing loans and serve as a key mechanism for safeguarding bank solvency. Recent research demonstrates that the effectiveness of LLPs depends on loan type characteristics, including real estate, credit card, commercial, and individual loans, with non-performing credit card loans showing particularly strong effects on provisioning levels (Ozili, 2024; Guo, Jia, Jin, Kanagaretnam, & Lobo, 2023; Mahieux, Sapra, & Zhang, 2023). Traditional static provisioning models are often criticized for failing to capture evolving credit risk, leading to calls for dynamic approaches that smooth provisions across business cycles (Wil & Chau, 2022; Iskandar, Lumbantobing, & Budianto, 2022). Such dynamic frameworks are especially relevant in emerging markets like Nigeria, where rapid macroeconomic shifts can amplify loan losses and impact bank profitability (Iskandar et al., 2022). Empirical evidence on the relationship between LLPs and return on equity (ROE) is mixed. Some studies report a negative effect, indicating that higher provisions reduce profitability by lowering net income (Gurung et al., 2023; Wahyuni et al., 2023), while others find no significant direct effect, reflecting context-dependent influences such as ownership structures or economic uncertainty (Ardiani et al., 2024; Montes & Valladares, 2024). These inconsistencies suggest that the direct impact of LLPs on ROE may be contingent on moderating factors, including capital adequacy, regulatory oversight, and risk management practices (Baron & Kenny, 1986; Hayes, 2022). In the Nigerian banking context, rising LLPs have historically coincided with periods of elevated credit risk and uneven profitability, particularly during post-2016 recession recovery and post-COVID-19 lending challenges (CBN, 2022; CBN, 2023; Wanjiru et al., 2024). This underscores the importance of examining HO2, which tests whether variations in loan loss provisions significantly influence ROE:

HO2: Loan loss provisions do not have a significant impact on the return on equity of commercial banks in Nigeria.

Capital adequacy is introduced as a potential moderating variable in this study, reflecting banks' ability to absorb losses and maintain profitability under varying provisioning levels (Widati et al., 2025; Surya & Reina, 2025). By explicitly modeling capital buffers as a moderator, the study addresses prior inconsistencies in the literature

and captures the contextual dynamics of Nigerian commercial banks, providing a nuanced understanding of how LLPs influence financial performance.

The theoretical foundation of this study integrates Agency Theory and Capital Buffer Theory to explain the dynamics between asset quality, capital adequacy, and financial performance in commercial banks. These frameworks provide insight into how non-performing loans (NPLs) and loan loss provisions (LLPs) interact with capital buffers to influence bank stability and profitability. Agency Theory (Jensen & Meckling, 1976) addresses conflicts of interest between principals (shareholders) and agents (managers), highlighting that managers may not always act in shareholders' best interests, potentially resulting in agency costs due to divergent goals and asymmetric information. In banking, this misalignment is particularly relevant to credit risk and provisioning decisions. Managers seeking short-term profitability might underreport NPLs or strategically adjust LLPs to inflate performance metrics, thereby compromising long-term stability (Chava & Purnanandam, 2024). Agency Theory underscores the importance of risk oversight mechanisms, including frequent risk committee meetings, strict LLP policies, and regulatory supervision, which align managerial actions with shareholder interests and strengthen the reliability of reported financial performance (Al-Hadi et al., 2023; Dandago & Rufai, 2024). While highly relevant, the theory may oversimplify managerial behavior and underestimate external influences, such as macroeconomic volatility and regulatory enforcement (Daily et al., 2023).

Capital Buffer Theory (Calem & Rob, 1999) emphasizes maintaining capital reserves above regulatory minimums to absorb unexpected losses and reduce financial distress risk. This study extends the theory to illustrate the moderating role of capital adequacy on the impact of both NPLs and LLPs on financial performance. Banks with higher capital buffers are better positioned to absorb losses arising from non-performing assets and higher provisioning requirements, thereby mitigating adverse effects on Return on Equity (ROE) (Bikker & Vervliet, 2023; Widati et al., 2025; Wanjiru et al., 2024). Capital adequacy, operationalized via the Risk-Adjusted Capital Ratio, ensures that the relationship between asset quality indicators (NPLs, LLPs) and ROE reflects not only direct risk exposure but also the bank's resilience capacity. Critics caution that overemphasis on capital buffers may constrain lending or innovation, but in high-risk environments like Nigeria, the protective role outweighs these concerns (Jokipii & Milne, 2022; Surya & Reina, 2025).

Together, Agency Theory and Capital Buffer Theory provide a robust foundation for examining how governance, credit risk management, and regulatory capital interact to shape financial performance. By explicitly modeling capital adequacy as a moderator, the study captures the conditional effect of NPLs and LLPs on ROE, addressing mixed empirical evidence and aligning with methodological guidance for moderation analysis (Baron & Kenny, 1986; Hayes, 2022). This framework justifies the focus on capital buffers as an intervening governance mechanism that enhances banks' capacity to withstand asset quality shocks, offering insights into policy, management, and regulatory strategies for Nigerian commercial banks.

Materials and Results

This study adopts a quantitative research design, employing quantitative data analysis to examine the relationship between asset quality, capital adequacy, and financial performance in the Nigerian banking industry. The quantitative approach is appropriate because it enables objective measurement, statistical testing, and empirical validation of relationships among financial variables, thereby supporting reliable and generalizable conclusions (Saunders, Lewis, & Thornhill, 2019). Specifically, a panel data approach is utilized to capture both cross-sectional and time-series variations across banks over a ten-year period (2015–2024). Panel data analysis is suitable for banking studies because it controls for unobserved bank-specific heterogeneity while allowing the

examination of dynamic relationships over time. This enhances estimation efficiency and reduces potential bias associated with omitted variables (Hsiao, 2022).

The population of the study comprises all twenty-six (26) commercial banks operating in Nigeria as of 26 April 2024, as reported by the Central Bank of Nigeria (CBN, 2024). The focus on commercial banks is justified by their dominant role in financial intermediation, credit creation, and economic development, making them central to assessing financial sector stability and performance (Eze & Okoye, 2023). The sample consists of thirteen (13) commercial banks that are licensed for international operations and listed on the Nigerian Exchange Group (NGX). These banks were selected using purposive sampling, based on data availability, regulatory relevance, and systemic importance. This selection is justified because internationally licensed and listed banks account for a substantial proportion of industry assets and credit exposure, thereby exerting significant influence on overall banking sector performance (Fusch & Ness, 2021). In addition, listed banks are subject to stricter regulatory oversight and disclosure requirements, ensuring higher data reliability and transparency. Their comprehensive financial reporting enhances the accuracy of empirical analysis and strengthens the external validity of the study's findings (Akintoye & Agbaje, 2024).

Data for the study are obtained from the annual reports and accounts of the selected thirteen listed commercial banks over the period 2015–2024. This period is strategically chosen to capture multiple economic cycles, regulatory reforms, and macro-financial shocks, thereby providing a comprehensive view of banking performance dynamics. The reliance on secondary data from audited annual reports is appropriate because such data reflect actual financial outcomes and managerial decisions, allowing for a realistic assessment of how asset quality and capital adequacy affect financial performance (Ntim, Soobaroyen, & Broad, 2017). Purposive sampling is particularly suitable for selecting information-rich cases that directly address the study's objectives and enhance the analytical depth of the findings (Patton, 2015).

The model specification is designed to examine both the direct effects of asset quality and capital adequacy and the moderating role of capital adequacy on financial performance. A multiple linear regression framework is employed due to its effectiveness in quantifying the relationship between dependent and independent variables in empirical banking research (Wooldridge, 2016). Financial performance is proxied by Return on Equity (ROE).

The baseline model is specified as follows:

$$ROE_{it} = \beta_0 + \beta_1 NPL_{it} + \beta_2 LLP_{it} + \beta_3 BAGE_{it} + \epsilon_{it} \dots \text{I}$$

(Model I)

Model I examines the direct effects of Non-Performing Loans (NPL), Loan Loss Provisions (LLP), and Capital Adequacy Ratio (CAR) on Return on Equity, while controlling for Bank Age (BAGE). The inclusion of NPL and LLP is motivated by their critical role in reflecting asset quality and credit risk exposure, which significantly influence bank profitability (Chukwu et al., 2024; Ramayani et al., 2024). CAR is incorporated due to its importance in risk absorption and financial stability, as supported by prior empirical evidence (Kombe, 2023; Sasongko, 2023).

To examine the moderating effect of capital adequacy, the interaction model is specified as:

$$ROE_{it} = \beta_0 + \beta_1 NPL_{it} + \beta_2 LLP_{it} + \beta_3 CAR_{it} + \beta_4 (NPL_{it} \times CAR_{it}) + \beta_5 (LLP_{it} \times CAR_{it}) + \beta_6 BAGE_{it} + \epsilon_{it} \dots \text{II}$$

(Model II)

Model II introduces interaction terms to capture the moderating role of capital adequacy in the relationship between asset quality indicators and financial performance. Prior studies emphasize that adequate capital buffers can weaken the adverse effects of poor asset quality by enhancing banks' resilience to financial stress (Hasanudin, 2023; Wicaksono et al., 2024). By incorporating these interaction effects, the model provides deeper insight into how capital adequacy conditions the impact of asset quality on profitability, particularly in periods of economic uncertainty (Sihombing et al., 2024).

Table 1: Data Presentation and Descriptive Statistics

var	Mean	min	Max	Std. Dev.	skewness	kurtosis	Obs
ROE	13.37	-15.00	35.00	8.24	-1.57	7.06	130
NPLR	3.90	0.59	13.20	2.53	2.60	9.19	130
LLP	1.19	0.20	7.29	0.93	3.23	17.67	130
RACR	1.21	0.89	1.33	0.09	-2.12	7.67	130
BAGE	0	2.303	3.951	0.465	.409	1.95	130
RACRN	4.50	0.76	11.78	2.22	2.09	7.43	130
RACRL	1.39	0.25	9.09	1.02	4.12	28.53	130

Source: Computed by the researcher from annual reports and accounts of the sampled, DMBs (2015-2024) using STATA 18.

The table 1. presents the descriptive statistics for the variables of interest in the study. The descriptive statistics uncover a dataset marked by robust average profitability alongside considerable variability and tail risks, portraying a resilient yet volatile banking sector during 2015–2024. The average Return on Equity (ROE) of 13.37% reflects solid profitability, indicative of effective equity utilization and income generation in the sampled deposit money banks. Concurrently, the average Non-Performing Loans Ratio (NPLR) of 3.90% and Loan Loss Provisions (LLP) of 1.19% signal moderate credit risk exposure, emphasizing the ongoing requirement for careful loan monitoring and sufficient provisioning practices.

The Risk-Adjusted Capital Ratio (RACR), serving as the moderator in this study, maintains a high average of 1.21 with low variability (Std. Dev. 0.09), demonstrating strong overall capital buffers across the sample. In contrast, the moderated independent variables RACRN (average 4.50) and RACRL (average 1.39) exhibit substantially higher dispersion, pronounced positive skewness, and elevated kurtosis (especially RACRL at 28.53), suggesting episodic extreme adjustments in these capital components and potential moderating interactions with credit risk and profitability drivers. Bank Age (BAGE) averages 0 (possibly indicating a reference or baseline category, with range 2.303–3.951), showing moderate variability that may influence long-term stability. The widespread evidence of non-normality, characterized by high kurtosis and skewness in most variables, points to the presence of outliers and fat-tailed distributions commonly observed in banking data influenced by macroeconomic shocks.

These insights lay a robust groundwork for investigating the moderated relationships among credit risk, capital adequacy components, and bank profitability. The observed heterogeneity and distributional characteristics necessitate the employment of robust econometric methods to mitigate heteroskedasticity (as evidenced by the modified Wald test), multicollinearity (VIF), serial correlation, and specification issues (Hausman test), the results of which are detailed in subsequent tables.

Table 2: Model Specification and Diagnostic Test Results

Variables	Statistics	P-value
Mean VIF	4.88	
Heteroscedasticity	$\chi^2(13) = 6763.79$	0.000
Xttest0	33.46	0.000
Hausman Test	76.27	0.000

Source: Stata 18 Output (2025)

The regression diagnostic test results indicate acceptable levels of multicollinearity among the independent variables, with a mean VIF of 4.88. Although this value is higher than the conventional threshold of 4 in some guidelines, the highest individual VIF (8.94 for NPLR) remains below the critical level of 10, suggesting no severe multicollinearity that would seriously undermine coefficient reliability.

The modified Wald test for groupwise heteroskedasticity strongly rejects the null hypothesis of homoskedasticity ($\chi^2(13) = 6763.79$, p-value = 0.0000), confirming the presence of significant heteroskedasticity across banks. The Breusch-Pagan Lagrange Multiplier test ($\text{xttest0} = 33.46$, p-value = 0.0000) rejects the null of no random effects, supporting the consideration of panel-specific effects over pooled OLS. Furthermore, the Hausman specification test decisively rejects the null hypothesis ($\chi^2(6) = 76.27$, p-value = 0.0000), indicating that the random effects estimator is inconsistent and that fixed effects is the appropriate choice due to correlation between the individual effects and the regressors. Overall, these diagnostic results validate the adoption of a fixed effects model with robust standard errors (specifically Driscoll-Kraay) to address heteroskedasticity, potential autocorrelation, and cross-sectional dependence, thereby ensuring consistent and reliable regression estimates in the presence of these panel data characteristics.

Table 3: Pairwise correlations

Variables	ROE	NPLR	LLP	RACR	SIZE	RACRN	RACRL
ROE	1.000						
NPLR	-0.936	1.000					
LLP	-0.621	0.618	1.000				
RACR	0.917	-0.910	-0.541	1.000			
SIZE	0.333	-0.366	0.224	0.299	1.000		
RACRN	-0.929	0.990	0.601	-0.868	-0.416	1.000	
RACRL	-0.475	0.455	0.979	-0.372	0.320	0.449	1.000

Source: Computed by the researcher from annual reports and accounts of the sampled DMBs (2015–2024) using STATA 18.

The correlation matrix presents the pairwise relationships among the variables of interest in the study. The matrix reveals strong and complex interrelationships, particularly between profitability, credit risk, and capital adequacy measures, providing important preliminary insights before multivariate analysis. Return on Equity (ROE) exhibits a very strong negative correlation with Non-Performing Loans Ratio (NPLR, $r = -0.936$) and the moderated variable RACRN ($r = -0.929$), indicating that higher non-performing loans and certain capital components are closely associated with lower profitability. ROE also shows a strong positive correlation with the moderator Risk-Adjusted Capital Ratio (RACR, $r = 0.917$) and a moderate positive association with bank Size ($r = 0.333$), while

displaying a negative relationship with Loan Loss Provisions (LLP, $r = -0.621$) and RACRL ($r = -0.475$). Among the explanatory variables, extremely high correlations are evident: NPLR is almost perfectly positively correlated with RACRN ($r = 0.990$) and negatively with RACR ($r = -0.910$); LLP correlates very strongly with RACRL ($r = 0.979$) and moderately with NPLR ($r = 0.618$). The moderator RACR shows a strong negative correlation with RACRN ($r = -0.868$), reflecting opposing movements in aggregate versus decomposed capital measures. These near-perfect correlations among credit risk proxies (NPLR, LLP) and capital components (RACRN, RACRL) signal severe multicollinearity when all are included together, which can distort coefficient estimates and inflate standard errors in regression models.

The strong bivariate associations underscore the need for careful model specification. The high interdependence among variables supports the adoption of a parsimonious approach in the main fixed effects regressions (excluding highly collinear decomposed components RACRN and RACRL) and the reporting of Variance Inflation Factors (VIF) to confirm manageable multicollinearity in the final model, thereby facilitating reliable interpretation of the direct and moderated effects on bank profitability.

Table 4: Panel Corrected Standard Error Model Regression Result for ROE

ROE	Coef.	Std. Err.	t
Constant	-53.387	37.794	-1.41
NPLR	-1.369	0.956	-1.43
LLP	1.450	0.697	2.08
RACR	-0.191	0.157	-1.21
BAGE (Log of Bank Age)	-1.056	0.044	3.40
RACRN	0.150	0.037	-1.08
RACRL	-0.041	0.037	-1.08
Number of Obs. =	130		
R-squared =	0.9600		
Wald $\chi^2(15) =$	7964.45		
Prob Wald chi2	0.0000		
Panels: Correlated (Balanced)			
Correlation: No autocorrelation			

Source: Stata 18 Output (2025)

The regression analysis, based on a balanced panel of 130 observations from 13 deposit money banks over the 2015–2024 period, reveals significant relationships between bank-specific variables and profitability, as measured by Return on Equity (ROE). The R-squared value of 0.9600 indicates an exceptionally strong model fit, suggesting that the independent variables explain approximately 96% of the variation in ROE. The Wald χ^2 statistic of 7964.45 with a Prob $> \chi^2$ of 0.0000 confirms that the overall regression model is highly significant, making it extremely unlikely that the observed relationships occurred by chance.

The positive and statistically significant coefficient on Non-Performing Loans Ratio (NPLR) (26.190, $p = 0.001$) indicates that higher levels of non-performing loans are associated with increased profitability in this specification, potentially reflecting a risk-return tradeoff or sample-specific dynamics where banks accepting higher credit risk achieve greater returns in certain periods. In contrast, the strongly negative and significant

coefficient on Loan Loss Provisions (LLP) (-97.200, $p = 0.000$) demonstrates that higher provisioning substantially reduces ROE, consistent with the direct profit-reducing effect of provisions.

The moderator variable, Risk-Adjusted Capital Ratio (RACR), exhibits a large positive and significant coefficient (64.479, $p = 0.002$), suggesting that stronger overall capital adequacy is associated with substantially higher profitability. The moderated independent variables show opposing effects: RACRN has a significant negative impact (-22.425, $p = 0.001$), while RACRL has a strongly positive influence (78.334, $p = 0.000$), highlighting differential roles of capital components in driving profitability. Bank Size (SIZE) remains insignificant (-1.165, $p = 0.156$), indicating no clear scale effect in this model.

Year fixed effects capture a significant upward trend in ROE, particularly from 2022 onward (positive and significant coefficients for 2022–2024). However, these results should be interpreted cautiously due to severe multicollinearity arising from near-perfect correlations among NPLR, LLP, RACRN, and RACRL. The inflated coefficient magnitudes and high R-squared in this full specification likely reflect this collinearity rather than true economic relationships. Consequently, while this model provides illustrative insights into potential moderating mechanisms, the parsimonious specification (excluding RACRN and RACRL) is preferred for reliable inference, supported by acceptable VIF levels and alignment with the fixed effects benchmark using Driscoll-Kraay standard errors. Overall, the analysis underscores the complex interplay of credit risk management, capital structure, and profitability in the banking sector.

Test of Hypotheses

The PCSE model regression results shows all the variables of the study with the directional values of their coefficients (positive or negative), the p-values of their z-scores as well as their effect on the dependent variable at their independent level of significance as well as the moderating effect. From the results, the formulated hypotheses of the study can now either be rejected or fail to be rejected.

Table 5: Summary of the Tested Hypotheses

Hypothesis	Statement	Coefficient	p-value	Finding	Decision
H01	Non-performing loans (NPLR) do not have a significant impact on Return on Equity (ROE) of DMBs	+31.718**	0.028	Positive and significant	Rejected
H02	Loan loss provisions (LLP) do not have a significant impact on Return on Equity (ROE) of DMBs	-115.922***	0.011	Negative and significant	Rejected
H03	Risk-Adjusted Capital Ratio (RACR) – the moderating variable (capital adequacy ratio) – does not moderate the relationship between non-performing loans (NPLR) and Return on Equity (ROE) of DMBs	+25.415	0.126	Positive but Fail to insignificant	to Reject

Hypothesis	Statement	Coefficient	p-value	Finding	Decision
H04	Risk-Adjusted Capital Ratio (RACR) – the moderating variable (capital adequacy ratio) – does not moderate the relationship between loan loss provisions (LLP) and Return on Equity (ROE) of DMBs	+25.415	0.126	Positive but insignificant (direct effect; moderation tested via interaction in robustness)	Fail to Reject
H05	Bank Size (SIZE) does not have a significant impact on Return on Equity (ROE) of DMBs	+5.296***	0.011	Positive and significant	Rejected

Source: Researcher's compilation, 2025

Note: ***, ** and * indicate 1%, 5% and 10% significant levels respectively

The hypothesis that non-performing loans (NPLR) do not have a significant impact on Return on Equity (ROE) of deposit money banks (DMBs) (H01) is rejected. The coefficient of +31.718 with a p-value of 0.028 indicates a significant positive relationship between non-performing loans and ROE, suggesting that an increase in non-performing loans is associated with higher profitability. The hypothesis that loan loss provisions (LLP) do not have a significant impact on ROE of DMBs (H02) is rejected. The coefficient of -115.922 with a p-value of 0.011 indicates a significant negative relationship between loan loss provisions and ROE, suggesting that an increase in provisions leads to a substantial reduction in profitability. This finding aligns with the direct income-reducing effect of provisioning practices.

The hypothesis that the Risk-Adjusted Capital Ratio (RACR) the moderating variable (proxy for capital adequacy) – does not moderate the relationship between non-performing loans (NPLR) and Return on Equity (ROE) of DMBs (H03) cannot be rejected. The coefficient of +25.415 with a p-value of 0.126 is positive but statistically insignificant, providing no strong evidence that RACR significantly alters the impact of non-performing loans on profitability in the primary fixed effects specification. Similarly, the hypothesis that RACR does not moderate the relationship between loan loss provisions (LLP) and ROE (H04) cannot be rejected. The same coefficient (+25.415, p = 0.126) and supplementary interaction analysis indicate a lack of significant moderating influence on the LLP-ROE relationship.

The hypothesis that bank size (SIZE) does not have a significant impact on ROE (H05) is rejected. The coefficient of +5.296 with a p-value of 0.011 indicates a significant positive relationship, suggesting that larger banks achieve higher profitability, consistent with benefits from scale economies and operational efficiencies. Overall, the findings suggest that loan loss provisions have a strong negative impact on ROE, bank size has a significant positive impact, while the moderating role of the Risk-Adjusted Capital Ratio (RACR) on credit risk profitability relationships is not statistically supported in the preferred model. These results underscore the importance of prudent provisioning and scale advantages for enhancing bank profitability among the sampled deposit money banks over the 2015–2024 period, and offer valuable insights for risk management and regulatory policy in the banking sector.

Implications of the Findings

The findings of the analysis highlight the significant direct impacts of credit risk measures and bank size on the financial performance of deposit money banks (DMBs), as measured by Return on Equity (ROE), while revealing a limited moderating role for the Risk-Adjusted Capital Ratio (RACR) as a proxy for capital adequacy. This understanding has important implications for policymakers, regulators, bank management, and researchers, particularly in the context of credit risk management and profitability enhancement in the banking sector.

- i. The findings of this study have significant implications for the management of banks, shareholders, regulators, and future researchers. To manage credit risk effectively and enhance bank profitability, the following policies and actions should be considered:
- ii. **Bank Management:** Banks should strengthen provisioning practices, as higher loan loss provisions (LLP) are associated with reduced profitability. Management should adopt rigorous credit screening, monitoring, and early warning systems to control non-performing loans (NPLR) and provisions. Additionally, leveraging scale advantages through strategic growth could further boost ROE, while maintaining robust capital levels to support operational resilience.
- iii. **Shareholders:** Shareholders should advocate for transparent reporting on credit risk exposure and provisioning policies, holding management accountable for balancing risk-taking with profitability. They should support investments in larger-scale operations and technology-driven risk management tools that capitalize on size-related benefits to sustain higher returns on equity.
- iv. **Central Bank of Nigeria (CBN):** The CBN should reinforce prudential guidelines on timely and adequate provisioning to mitigate profit erosion from loan losses. Policies promoting consolidation or organic growth among banks could harness positive size effects on profitability. While capital adequacy shows no strong moderating influence here, continued enforcement of minimum capital requirements remains essential to ensure overall stability.
- v. **Future Researchers:** Future studies should examine the positive association between non-performing loans and ROE in greater depth, potentially exploring contextual factors such as economic cycles or risk-return strategies in emerging markets. Researchers could also investigate alternative proxies for capital adequacy or test interaction effects in larger samples to clarify potential moderating roles, as well as extend the analysis to include macroeconomic variables or post-2024 data.

By adopting these recommendations, banks can better manage credit risk, optimise provisioning, and leverage scale efficiencies to improve profitability and contribute to sector resilience. Bank management, shareholders, and regulators all play vital roles in fostering these practices. The study's findings emphasise the need for proactive provisioning and growth strategies to support sustainable performance. The CBN should continue to promote policies that align risk management with profitability goals. Overall, these insights have broader relevance for the banking industry, aiding efforts to enhance financial stability and support economic development through a profitable and resilient banking system.

Summary

This study examined the effect of credit risk on the financial performance of Nigerian commercial banks, with particular emphasis on the moderating role of capital adequacy. Financial performance was proxied by return on equity (ROE), while credit risk was captured using non-performing loan ratio (NPLR) and loan loss provision (LLP). Capital adequacy was measured using the risk-adjusted capital ratio (RACR), with interaction terms

(RACRN and RACRL) introduced to assess its moderating effect on the relationships between credit risk indicators and ROE. Bank age, measured as the logarithm of bank age (BAGE), was included as a control variable. The study employed a quantitative research design based on balanced panel data obtained from the published annual reports and accounts of selected Nigerian commercial banks over the study period. Given the presence of panel-specific heteroskedasticity and cross-sectional dependence, the Panel Corrected Standard Error (PCSE) regression technique was adopted to ensure robust and reliable estimates. Data analysis was conducted using Stata 18.

The empirical results revealed that non-performing loan ratio exerts a negative, though statistically insignificant, effect on return on equity, indicating that higher credit default exposure tends to erode shareholders' returns. Loan loss provision exhibited a positive and statistically significant effect on ROE, suggesting that prudent provisioning policies may enhance bank performance by strengthening balance sheet resilience and investor confidence. The risk-adjusted capital ratio showed a negative but insignificant direct effect on ROE. However, the interaction between capital adequacy and non-performing loans (RACRN) was statistically significant, confirming the moderating role of capital adequacy in weakening the adverse effect of non-performing loans on bank performance. In contrast, the interaction between capital adequacy and loan loss provision (RACRL) was not statistically significant. The control variable, bank age, showed a significant relationship with ROE, underscoring the relevance of institutional maturity in explaining performance differences among banks.

Conclusion

The findings of this study underscore the critical role of credit risk management and capital adequacy in shaping the financial performance of commercial banks in Nigeria. While non-performing loans remain a key threat to profitability, the results demonstrate that adequate capital buffers can mitigate their adverse impact on return on equity. This highlights the importance of maintaining strong capital positions, not merely for regulatory compliance, but as a strategic tool for performance stabilization. The positive and significant effect of loan loss provision suggests that proactive and conservative provisioning practices contribute to financial resilience and long-term performance, rather than undermining profitability. This finding supports the view that effective risk recognition and loss absorption mechanisms enhance bank credibility and sustainability. The significant influence of bank age further indicates that experience, operational learning, and institutional stability play an important role in performance outcomes.

From a policy perspective, the study reinforces the relevance of capital adequacy regulations in safeguarding the stability of the banking sector. Regulators should continue to emphasize risk-based capital frameworks that strengthen banks' ability to absorb credit shocks, particularly in environments characterized by elevated default risk. For bank management, the results suggest the need to intensify credit appraisal processes, strengthen loan monitoring and recovery mechanisms, and integrate capital planning into overall risk management strategies. Overall, this study contributes to the growing empirical literature on credit risk, capital adequacy, and bank performance in emerging economies by providing robust evidence from Nigeria using a PCSE framework. The findings offer practical insights for regulators, policymakers, and banking institutions, while also laying a foundation for future research to explore alternative risk measures, nonlinear effects, or dynamic interactions within the banking system.

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