

Credit Risk Management Effectiveness and Profitability of Deposit Money Banks in Nigeria

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ABSTRACT

This study examines the effect of credit risk management on the profitability of 25 deposit money banks (DMBs) in Nigeria over the period 2016–2025, a decade marked by macroeconomic turbulence, regulatory tightening, and the full implementation of IFRS 9. Using a balanced panel of 250 bank-year observations and the System Generalized Method of Moments (GMM) estimator, the study investigates the individual and joint effects of the non-performing loan ratio (NPLR), loan loss provision ratio (LLPR), and capital adequacy ratio (CAR) on bank profitability, measured by return on assets (ROA) and return on equity (ROE). The findings reveal that NPLR and LLPR exert significant negative effects on ROA, with coefficients of -0.188 and -0.225, respectively. CAR displays an inverted U-shaped relationship with ROE, with an optimal capital adequacy level of approximately 17.1%. The interaction between NPLR and CAR is positive and significant, indicating that a strong capital buffer mitigates the adverse effect of NPLs on profitability. Conversely, the interaction between NPLR and LLPR is negative and significant, revealing that simultaneous high NPLs and aggressive provisioning have a compounding negative impact on ROA. The study concludes that credit risk management is a critical and multifaceted driver of bank profitability in Nigeria, and that effective credit risk management requires a dynamic equilibrium among NPLs, provisions, and capital. Based on these findings, the study recommends that bank management strengthen credit underwriting and early-warning systems to keep NPL ratios well below the 5% regulatory threshold, maintain a forward-looking provisioning culture aligned with IFRS 9, and optimise capital structure around the 17% CAR sweet spot rather than hoarding sterile buffers. Regulators are advised to enforce the 5% NPL limit with greater granularity, review capital adequacy guidelines to discourage over-capitalisation, and continue promoting full and transparent IFRS 9 implementation. Investors and analysts should integrate NPLR and LLPR trends into equity valuation models and treat CAR as a value driver, targeting banks operating in the 15%–18% CAR range for optimal risk-adjusted returns.

Keywords: Credit Risk Management, Bank Profitability, Non-Performing Loans, Capital Adequacy Ratio, Loan Loss Provisions, IFRS 9, Nigerian Banking Sector

INTRODUCTION

The banking sector is universally acknowledged as the engine room of economic growth and development. Its primary function of financial intermediation—the channelling of funds from surplus economic units (savers) to deficit economic units (borrowers)—is a necessary, though not sufficient, condition for capital formation, entrepreneurship, and wealth creation. In an economy like Nigeria's, where capital markets remain relatively shallow and access to long-term finance is constrained, the credit channel provided by deposit money banks (DMBs) assumes an even more profound significance. Yet, this very act of lending inextricably binds the fate of banks to the risk that their borrowers might not fulfil their promises. This is credit risk, and its management is not a peripheral compliance activity but the central determinant of a bank's survival, profitability, and its ability to contribute to the broader economy.

The history of banking globally is, in many respects, a history of the failure to manage credit risk. From the bank runs of the Great Depression to the global financial crisis (GFC) of 2007–2009, the mispricing and mismanagement of credit consistently proved to be the proximate cause of institutional collapses and systemic contagion. The GFC, which originated in the subprime mortgage market of the United States, served as a brutal and costly reminder of the consequences when the twin disciplines of rigorous credit underwriting and effective portfolio monitoring break down. A wave of defaults on poorly underwritten mortgages, amplified by complex securitisation structures, froze global credit markets, triggered a deep recession, and resulted in the failure or bailout of some of the world's most venerable financial institutions. The global regulatory response was swift and comprehensive: the Basel III framework was designed to strengthen bank capital requirements, introduce a leverage ratio, and create a global liquidity standard. Crucially, the accounting standardsetters, led by the International Accounting Standards Board (IASB), undertook a fundamental review of how banks accounted for credit losses, eventually giving birth to the forward-looking International Financial Reporting Standard 9 (IFRS 9).

The Nigerian banking landscape has its own distinct and turbulent history, punctuated by cycles of boom, reckless lending, and painful regulatory intervention. The landmark banking consolidation exercise announced by the Central Bank of Nigeria (CBN) Governor, Professor Charles Soludo, in July 2004, and concluded by December 31, 2005, was a seismic shock therapy designed to address fundamental vulnerabilities. The policy mandated a minimum shareholders' fund of ₦25 billion, a quantum leap from the previous ₦2 billion requirement. The strategy forced a wave of mergers and acquisitions, and through the process, 89 banks were compressed into 25 larger, purportedly more resilient entities. However, what followed demonstrated that size and capital, without a corresponding transformation in risk culture and corporate governance, were an insufficient bulwark against credit risk. This lesson was learned at great cost during the 2008–2009 crisis in the Nigerian banking sector.

The global financial crisis of 2007–2009 transmitted to Nigeria through a dual channel: a sharp decline in oil prices and a catastrophic crash in the Nigerian Stock Exchange, where the market capitalisation lost over 60% of its value. This macroeconomic shock immediately exposed the reckless post-consolidation lending practices of several major banks. The subsequent CBN audit of the 24 banks operating in 2009 revealed that ten banks, accounting for a substantial share of the industry's assets, were in a grave condition, burdened by toxic assets and critically undercapitalised. The CBN's response—a ₦620 billion bailout, the sacking of eight bank CEOs, and the establishment of the Asset Management Corporation of Nigeria (AMCON) in 2010—was a dramatic and costly fiscal intervention that underscored the catastrophic consequences of a systemic failure in credit risk management.

The global reform culminated in IFRS 9, which the CBN mandated for Nigerian banks with effect from January 1, 2018. The adoption of IFRS 9 represented a paradigm shift of profound importance to this study. The standard fundamentally rewrote the philosophical basis of credit provisioning. Instead of waiting for a triggering event, banks now compute Expected Credit Losses (ECL) on a forward-looking basis. The IFRS 9 framework operates on a three-stage model. At the point of initial recognition of a financial asset (Stage 1), the bank calculates and holds a provision equal to the 12-month ECL. If the credit risk of the asset increases significantly since initial recognition (Stage 2), the bank immediately recognises lifetime ECL. Finally, if the financial asset becomes credit-impaired (Stage 3), the bank continues to recognise lifetime ECL, but interest revenue is now calculated on the net carrying amount. This was not merely a technical accounting adjustment. It forced banks to build extensive internal credit risk models that incorporated not just historical default data but current conditions and, critically, reasonable and supportable forecasts of future economic conditions.

It is within this complex, dynamic, and regulation-heavy environment that the core research issue of this study crystallises: the theoretical and empirical link between the effectiveness of credit risk management and bank profitability. Profitability, measured by indicators such as Return on Assets (ROA) and Return on Equity (ROE), is the ultimate measure of a bank's performance and its capacity to generate internal capital to support future growth. The causal chain connecting CRM to profitability is direct and multi-layered. First, effective credit risk management begins with robust underwriting standards and due diligence, which are the primary filters that determine the quality of loans entering the bank's portfolio. A high-quality portfolio, by definition, generates a

lower quantum of non-performing loans (NPLs). The NPL ratio is therefore not just a measure of the stock of toxic assets; it is a historical footprint of past credit decisions. Second, a lower level of NPLs directly translates into a lower charge for loan loss provisions (LLP) on the income statement. The LLP is an expense that directly reduces a bank's profit before tax. The relationship is almost mechanical: a spike in NPLs drives a spike in provisions, which decimates the bottom line.

However, the relationship is not without its paradoxes. A bank that is excessively conservative in its credit risk management might forgo profitable lending opportunities and lose market share to less risk-averse competitors, potentially leading to a lower ROA and ROE. Conversely, a bank with a high Capital Adequacy Ratio (CAR), a key CRM indicator, might have lower profitability in the short run because high capital buffers, while protective, could dilute returns to equity holders if the capital is not leveraged into profitable assets. This is the classic risk-return trade-off in banking. Therefore, the empirical question is not whether credit risk management matters, but to what extent, through which specific channels, and with what magnitude it drives profitability in the Nigerian context.

Despite a formidable regulatory edifice, a critical and persistent problem remains: the profitability of Nigerian DMBs continues to be severely and unpredictably buffeted by credit impairments, raising fundamental questions about the practical effectiveness of the credit risk management frameworks that these regulations were designed to enforce. The problem manifests in a series of interconnected and empirically observable anomalies. First, the aggregate NPL ratio of the Nigerian banking industry exhibited significant volatility in the post-IFRS 9 era, contrary to the expectation of stability. Following a period of relative improvement, the macroeconomic shock of the COVID-19 pandemic and the subsequent currency devaluations triggered a renewed surge in problem loans across key sectors such as oil and gas, general commerce, and manufacturing. Second, this asset quality deterioration translated directly into huge and often concentrated spikes in loan loss provisions (LLP). For several DMBs, quarterly and annual earnings releases revealed instances where a single obligor or a single sector's distress necessitated a massive credit impairment charge, singlehandedly wiping out a significant percentage of pre-provision profits and triggering a sharp contraction in Return on Assets (ROA) and Return on Equity (ROE). This pattern of earnings surprise suggests that internal credit risk identification and measurement systems are failing to provide adequate early warning signals, only reacting forcefully when default is imminent or had already occurred.

This situation exposes a troubling disconnect between the form and the substance of credit risk management. Nigerian DMBs invested heavily in the institutional trappings of IFRS 9 compliance: they established dedicated risk management departments, acquired credit scoring and portfolio modelling software, and engaged external consultants to build ECL models. Their annual reports contained extensive disclosures on risk governance, the three-stage impairment model, and sensitivity analyses. Yet, the empirical reality of recurrent and large provisioning shocks suggested that, in practice, these frameworks were often more cosmetic and compliance-oriented than genuinely embedded in the strategic and operational fabric of the institution. The problem was not the absence of a credit risk management policy statement. The problem was a failure in the effectiveness of that policy as a predictive, proactive, and profit-protecting instrument.

Furthermore, a critical dimension of the problem lies in the strategic tension between regulatory capital and profitability, embodied in the Capital Adequacy Ratio (CAR). The CBN maintained stringent minimum CAR requirements to ensure banks could absorb unexpected losses. Intuitively, a higher CAR should signal a stronger loss-absorbing buffer and promote confidence. However, from a bank management perspective, capital is a costly resource. Banks operating with a high CAR, while safer, faced pressure on their Return on Equity (ROE), as a larger equity base diluted returns to shareholders. This created a strategic dilemma: would the pursuit of safety through high capital adequacy inadvertently penalise profitability, and would this influence management's risk-taking behaviour in a way that undermined the risk framework? The empirical relationship between CAR (a key CRM indicator) and ROE was therefore ambiguous and had to be resolved within the Nigerian context.

The core research problem, therefore, is a critical empirical lacuna. Given the transformative shift in the accounting and regulatory framework for credit losses under IFRS 9, there is a lack of robust, methodologically rigorous, and current empirical evidence that quantifies the differential effect of the core instruments of credit

risk management—the Non-Performing Loan (NPL) ratio, the Capital Adequacy Ratio (CAR), and the Loan Loss Provision (LLP) ratio—on the twin pillars of bank profitability: Return on Assets (ROA) and Return on Equity (ROE). Without this evidence, bank management navigates the risk-return trade-off with an incomplete map, relying on intuition and regulatory pressure rather than data-driven strategy. The central question of this study is therefore clear and urgent: In the post-IFRS 9 Nigerian banking environment, what is the quantifiable and significant impact of credit risk management effectiveness on the profitability of deposit money banks?

The study is guided by the following research questions

- i. What is the effect of non-performing loan ratio on return on assets of deposit money banks in Nigeria?
- ii. What effect does loan loss provision ratio have on return on assets of deposit money banks in Nigeria?
- iii. How does capital adequacy ratio affect return on equity of deposit money banks in Nigeria?
- iv. What is the combined effect of non-performing loan ratio, loan loss provision ratio, and capital adequacy ratio on the profitability of deposit money banks in Nigeria?

In line with these research questions, the study tests the following null hypotheses:

The following hypotheses are stated in the null (H_0) form and are tested at the 0.05 significance level.

H_{01} : Non-performing loan ratio has no significant effect on the return on assets of deposit money banks in Nigeria.

H_{02} : Loan loss provision ratio has no significant effect on the return on assets of deposit money banks in Nigeria.

H_{03} : Capital adequacy ratio has no significant effect on the return on equity of deposit money banks in Nigeria.

H_{04} : Non-performing loan ratio, capital adequacy ratio, and loan loss provision ratio jointly have no significant combined effect on the profitability of deposit money banks in Nigeria.

LITERATURE REVIEW

Conceptual Review

Credit Risk Management

Credit risk management is a structured process of identifying, measuring, monitoring, and controlling credit exposures to ensure that the risk of default is maintained within acceptable parameters. In the Nigerian banking system, this process is governed by the Central Bank of Nigeria (CBN) Prudential Guidelines, the Basel II/III capital accords as domesticated by the CBN, and individual bank policies. The ultimate goal is not the elimination of credit risk—for that would imply zero lending—but the optimisation of the risk-return trade-off. Conceptually, the effectiveness of credit risk management can be decomposed into three observable pillars: ex-ante screening and monitoring, which determines the quality of the loan portfolio; ex-post recognition and provisioning, which captures the timeliness and adequacy of loss absorption; and structural resilience, which reflects the capital base available to withstand unexpected losses. These three pillars correspond directly to the proxy variables used in this study: the non-performing loan ratio, the loan loss provision ratio, and the capital adequacy ratio.

Non-Performing Loan (NPL) Ratio

The non-performing loan ratio is the most widely used indicator of asset quality and, by extension, the outcome of a bank's credit risk management framework. A loan is classified as non-performing in Nigeria when principal or interest is due and unpaid for 90 days or more, in line with the CBN's prudential guidelines. The NPL ratio is calculated as Gross Non-Performing Loans divided by Total Gross Loans, expressed as a percentage. Conceptually, the NPL ratio is an ex-post measure of credit risk crystallisation. It reflects the accumulated

failures in the credit process: weak borrower appraisal, inadequate collateral coverage, lax monitoring, insider abuse, or macroeconomic shocks that undermine repayment capacity. A rising NPL ratio is a symptom of ineffective credit risk management. It signals that the bank's filters for separating good borrowers from bad ones have failed, that its monitoring systems have not triggered timely intervention, or that its recovery mechanisms are weak.

Loan Loss Provision (LLP) Ratio

While NPL ratio measures the stock of problem assets, loan loss provision ratio reflects the accounting and prudential recognition of expected and incurred losses. Provisions are charges against current earnings set aside to cover potential future losses on the loan portfolio. In Nigeria, the CBN mandates specific provisioning rates based on loan classification: 1% for performing loans (general provision), and graduated rates (10%, 50%, and 100%) for substandard, doubtful, and lost facilities respectively. Beyond these regulatory minima, banks can exercise managerial discretion to book additional provisions if they anticipate further deterioration. The LLP ratio captures two distinct but interlinked aspects of credit risk management effectiveness. First, a higher LLP ratio in the face of rising NPLs is a sign of prudent and timely loss recognition. It indicates that management is not delaying the inevitable write-down of asset values but is proactively absorbing losses through the income statement. Second, the LLP ratio is also a measure of earnings quality and conservatism. Excessive provisioning, however, could be a tool for earnings management—'big bath' accounting where provisions are inflated in bad years to smooth income in good years.

Capital Adequacy Ratio (CAR)

Capital adequacy is the third pillar of credit risk management effectiveness, representing the structural resilience of the bank. The CAR measures a bank's regulatory capital (Tier 1 plus Tier 2 capital) as a percentage of its risk-weighted assets (RWAs). In Nigeria, the CBN has progressively increased the minimum CAR requirement, currently set at 10% for national banks and 15% for banks with international authorisation, with an additional countercyclical buffer and a capital conservation buffer under Basel III domestication. Capital serves multiple functions. It absorbs unexpected losses that exceed the levels anticipated by loan loss provisions, thereby protecting depositors and maintaining systemic confidence. It constrains excessive risk-taking by ensuring that shareholders have 'skin in the game'. And it provides a foundation for sustainable growth, as capital availability determines the quantum of risk assets a bank can create.

THEORETICAL REVIEW

Adverse Selection and Moral Hazard Theories (Akerlof, 1970; Stiglitz & Weiss, 1981)

The foundational explanation for the existence of non-performing loans lies in the unequal distribution of information between borrowers and lenders, as articulated by Stiglitz and Weiss (1981). In credit markets, borrowers possess superior knowledge about their own repayment capacity, project risk, and behavioural intentions. This asymmetry creates two distinct problems: adverse selection and moral hazard. Adverse selection occurs ex-ante, before the loan is originated. Lenders, unable to perfectly distinguish high-quality from low-quality borrowers, offer contract terms based on the average risk of the applicant pool. Stiglitz and Weiss (1981) demonstrated that as lenders raise interest rates to compensate for perceived risk, the safest borrowers—those with low-risk projects yielding modest returns—withdraw from the market. The remaining pool is disproportionately composed of high-risk borrowers, leading to a higher probability of default. Moral hazard arises ex-post, after loan disbursement. The borrower, no longer bearing the full consequences of failure, might alter their behaviour in ways that increase default risk, such as switching to riskier projects or diverting funds. In the Nigerian context, the limited historical coverage of credit bureaus and weak judicial enforcement exacerbated both problems.

Financial Intermediation and Delegated Monitoring Theory (Diamond, 1984)

Diamond's (1984) model of delegated monitoring provides a second critical theoretical foundation, explaining why banks exist and why loan losses diminish their profitability. In the absence of banks, multiple lenders to a single borrower would each need to incur monitoring costs, leading to duplication and, due to free-riding, under-monitoring. The bank solves this problem by acting as a single, delegated monitor on behalf of numerous depositors. The bank's profit—the net interest margin—compensates it for this monitoring function and the credit risk it absorbs. Within this framework, a non-performing loan represents a failure of the delegated monitoring function. The bank has incurred the monitoring cost but has not received the expected return.

Buffer Theory of Capital and Risk-Taking (Basel Committee on Banking Supervision, 2004, 2010)

The Buffer Theory of Capital, central to the Basel framework, offers a powerful theoretical lens for understanding the relationship between capital adequacy and bank profitability (BCBS, 2004, 2010). This theory views capital not as a costly constraint but as an enabler of franchise value and a buffer against financial distress. A bank with a strong capital buffer can withstand credit shocks without breaching its minimum regulatory requirements. Therefore, it does not need to engage in defensive actions such as cutting lending, selling assets at distressed prices, or shrinking its balance sheet—actions that would permanently impair its earnings capacity. A well-capitalised bank can also take measured, profitable risks that a less-capitalised competitor must forgo due to concentration limits or risk appetite constraints. This "risk-taking channel" suggests that a higher CAR could support a higher, more sustainable ROA.

Signalling Theory and Market Discipline (Spence, 1973; Flannery, 2001)

Signalling Theory, originally developed by Spence (1973) in the context of labour markets, provides a crucial framework for understanding how a bank's financial metrics can convey information to the market. In the context of banking, a bank's capital ratio and its provisioning policies can serve as powerful signals of its financial health and management quality to external stakeholders. A voluntarily high CAR (exceeding regulatory requirements) can signal to depositors, creditors, and investors that the bank is conservatively managed, has strong internal capital generation capacity, and is a safe counterparty (Flannery, 2001). Similarly, a bank that proactively increases its LLP ratio in the face of rising NPLs is signalling prudence and forward-looking risk management. This credible signal can reduce the bank's cost of funds as depositors and wholesale lenders perceive it as less risky and improve its market valuation.

Empirical Review

A dominant stream of empirical literature examines the link between asset quality, proxied by the NPL ratio, and bank profitability measured by ROA. The overwhelming majority of studies report a significant negative relationship. Berger and DeYoung (1997) conducted a seminal study on the intertemporal relationship between loan quality, cost efficiency, and bank capital in the United States commercial banking sector over the period 1985–1994. Using Granger-causality techniques and a panel of bank-level data, they found that increases in NPLs significantly reduced measured cost efficiency and profitability. The study identified a causal chain where poor management (measured by cost inefficiency) preceded higher NPLs, which subsequently eroded profits through higher provisioning and reduced interest income. This "bad management" hypothesis remains a key theoretical underpinning for the NPL-ROA nexus.

Louzis, Vouldis, and Metaxas (2012) explored the determinants of NPLs in the Greek banking system using dynamic panel data methods for the period 2003–2009. Their results confirmed that NPLs had a strong negative contemporaneous effect on bank profitability. In Nigeria, Kargi (2011) specifically evaluated the impact of credit risk on the performance of Nigerian banks covering the period 2004–2008, a period that preceded the 2009 banking crisis. Using regression analysis on secondary data from annual reports, the study reported that NPLs had a significant negative effect on ROA. Adebayo and Akinsola (2021) conducted a more recent study on Nigerian deposit money banks from 2010 to 2020 using a panel fixed-effects regression approach. Their findings

revealed that a 1% increase in the NPL ratio was associated with a 0.18 percentage point decline in ROA, significant at the 1% level.

The effect of loan loss provisions on profitability is more nuanced because LLP is both a reflection of credit risk and a management decision variable. Empirical evidence distinguishes between the immediate earnings-reducing effect and potential future stabilisation effects. Ahmed, Takeda, and Thomas (1999) examined the determinants and consequences of loan loss provisions for a large sample of US bank holding companies. Using time-series cross-sectional data, they found that loan loss provisions had a negative contemporaneous relationship with ROA, consistent with the direct expense effect. However, they also documented that higher provisions were followed by lower future NPLs and improved future earnings for well-capitalised banks. This suggested that while provisions compressed current profitability, they might signal proactive risk management that enhanced future asset quality. Afolabi and Adeyemi (2019) focused specifically on Nigerian deposit money banks from 2008 to 2017 and found that the LLP ratio had a negative and significant contemporaneous effect on ROA, with a coefficient of -0.24.

The relationship between CAR and ROE is theoretically ambiguous because of the leverage trade-off: higher equity reduces the equity multiplier (a negative effect on ROE) but can also lower funding costs and enable riskier, higher-yielding assets (a positive indirect effect). Empirical findings reflect this ambiguity. Bourke (1989) in a pioneering cross-country study of bank profitability in 12 countries found a positive and statistically significant relationship between capital ratios and profitability, including ROE. He argued that well-capitalised banks enjoyed lower funding costs due to depositor confidence and higher credit ratings, which boosted net income sufficiently to offset the dilution effect of more equity. Goddard, Molyneux, and Wilson (2004) investigated profitability determinants in six European countries using dynamic panel models. Contrary to Bourke, they found a negative relationship between capital-to-asset ratios and ROE. They explained this using the standard DuPont decomposition: holding ROA constant, a higher equity-to-asset ratio reduced the equity multiplier and thus lowered ROE. Lee and Hsieh (2013) addressed this ambiguity by testing for non-linearity in a sample of Asian banks. They found an inverted U-shaped relationship between CAR and profitability, with an optimal capital ratio around 14–16%.

Studies that simultaneously incorporate all three credit risk management indicators—NPL ratio, LLP ratio, and CAR—and examine their joint and interactive effect on bank profitability are relatively rare. Kithinji (2010) assessed the impact of credit risk management on the profitability of commercial banks in Kenya using data from 2004 to 2008. The model regressed ROA on NPL ratio, loan loss provisions, and capital adequacy, among other variables. In the joint estimation, NPL ratio was the dominant negative predictor of ROA, while LLP and CAR showed weaker and sometimes insignificant individual effects. The author attributed this to multicollinearity, as high NPLs generally drove high provisions and could erode capital, making it difficult to disentangle their separate impacts. A notable gap in the literature is the absence of formal moderation analysis. No reviewed study introduced an interaction term (e.g., NPL ratio $\times$ CAR, or NPL ratio $\times$ LLP ratio) into the profitability regression. Theoretically, a strong capital base should cushion the profitability impact of rising NPLs, because well-capitalised banks can absorb loan losses without fire sales or severe contraction of lending, thereby stabilising ROA.

CONCEPTUAL FRAMEWORK

The conceptual framework posits that the NPL ratio, LLP ratio, and CAR are not merely independent variables but form an interdependent system that jointly determines profitability. The framework depicts three credit risk management indicators on the left: NPL Ratio, LLP Ratio, and CAR. These are linked via directional arrows to two profitability metrics on the right: ROA and ROE. The NPL Ratio has a direct, negative arrow to ROA, representing the erosion of interest income and asset impairment. The LLP Ratio also has a direct, negative arrow to ROA, representing the accounting charge against earnings. The CAR has a direct, negative arrow to ROE via the mechanical leverage channel (equity multiplier), but also a direct, positive arrow to ROA via the 'safety premium' channel (lower funding costs, higher investor confidence), which then feeds through to a positive indirect effect on ROE. Critically, the framework includes interaction arrows: NPL Ratio is linked to LLP Ratio

(as NPLs rise, provisions are expected to increase), and CAR moderates the NPL-ROA relationship, indicating that a strong capital buffer can dampen the negative impact of NPLs on profitability.

METHODOLOGY

This research focuses on the Nigerian deposit money bank (DMB) sector. Nigeria, Africa's largest economy by GDP and most populous nation, operates a financial system dominated by commercial banks. As of December 2023, the Central Bank of Nigeria (CBN) licensed 25 deposit money banks, which together held over 90% of total financial system assets. This sector is the primary channel for financial intermediation, credit allocation, and monetary policy transmission. The choice of Nigeria's DMB sector as the study area is motivated by the critical interplay between credit risk management and bank profitability in an environment characterised by macroeconomic volatility, regulatory transitions, and unique structural features.

The study adopts a quantitative ex-post facto research design within a longitudinal panel data framework. This design is appropriate because the research relies entirely on existing secondary data to examine the cause-and-effect relationships between credit risk management proxies and bank profitability without any manipulation of the variables. The ex-post facto design permits the investigation of naturally occurring variations in non-performing loan (NPL) ratio, loan loss provision (LLP) ratio, and capital adequacy ratio (CAR) and their subsequent influence on return on assets (ROA) and return on equity (ROE), as recorded in historical financial reports.

The population comprises all 25 licensed deposit money banks in Nigeria as of December 2023. Since the study is based solely on secondary data, the sampling strategy is a census, driven by the need for comprehensive coverage and data availability. All banks are included in the panel if they have complete, audited annual financial statements for the selected study period (2016–2025) and are consistently listed in the Central Bank of Nigeria (CBN) statistical bulletin and Nigeria Deposit Insurance Corporation (NDIC) annual reports. This criterion ensures a balanced panel of 25 banks that represents the entire core of the sector, including all systemically important institutions.

Descriptive Statistics: Mean, median, standard deviation, minimum, and maximum are computed for each variable across the full panel and by bank tier.

Correlation Analysis: A Pearson correlation matrix is generated to examine the pairwise relationships among the dependent variables (ROA, ROE), the key explanatory variables (NPL ratio, LLP ratio, CAR), and the control variables.

Panel Unit Root Tests: To avoid spurious regression, panel unit root tests (Levin-Lin-Chu and Im-Pesaran-Shin) are conducted on all variables.

Panel Regression Estimation: The core analytical method is panel regression. The study specifies multiple models corresponding to the research questions:

Model 1 (RQ1): $ROA = f(\text{NPL ratio, control variables})$

Model 2 (RQ2): $ROA = f(\text{LLP ratio, control variables})$

Model 3 (RQ3): $ROE = f(\text{CAR, CAR}^2, \text{control variables})$

Model 4 (RQ4): $ROA/ROE = f(\text{NPL ratio, LLP ratio, CAR, NPL} \times \text{CAR, NPL} \times \text{LLP, controls})$

Model Selection and Endogeneity Treatment: First, the Hausman test is applied to decide between the Fixed Effects (FE) and Random Effects (RE) estimators. However, given potential endogeneity, the primary estimation technique is the System Generalized Method of Moments (GMM), developed by Arellano and Bover (1995) and Blundell and Bond (1998). System GMM uses internal instruments (lagged levels and differences of the

explanatory variables) to address endogeneity. The validity of the instruments is assessed using the Hansen test of over-identifying restrictions and the Arellano-Bond test for serial correlation (AR(2)).

Variables Identification and Measurement

Variable	Type	Code	Measurement	Source
Return on Assets	Dependent	ROA	Profit After Tax / Average Total Assets	Bank financials, CBN, NDIC
Return on Equity	Dependent	ROE	Profit After Tax / Average Shareholders' Equity	Bank financials, CBN, NDIC
Non-Performing Loan Ratio	Independent	NPLR	(Substandard + Doubtful + Lost Loans) / Total Gross Loans	CBN Prudential Guidelines, Bank financials
Loan Loss Provision Ratio	Independent	LLPR	Loan Loss Provisions (charge for the year) / Total Gross Loans	Bank income statements, CBN
Capital Adequacy Ratio	Independent	CAR	(Tier 1 + Tier 2 Capital) / Risk-Weighted Assets	CBN/Basel II/III, Bank Pillar 3 reports
Bank Size	Control	SIZE	Natural logarithm of Total Assets	Bank balance sheets
Loan Growth	Control	LGRW	Annual percentage change in gross loans	Bank financials
Cost-to-Income Ratio	Control	CIR	Operating Expenses / Operating Income	Bank financials
GDP Growth	Control	GDPGR	Annual GDP growth rate	World Bank, IMF
Inflation	Control	INFL	Annual inflation rate	World Bank, IMF
Exchange Rate	Control	EXCH	Naira/USD exchange rate	World Bank, IMF

Model Specification

Based on the research questions and the theoretical framework, the study specifies a series of panel regression models. The general form of the models is:

Model 1 (RQ1): Effect of NPL Ratio on ROA

$$ROA_{it} = \beta_0 + \beta_1 NPLR_{it} + \beta_2 SIZE_{it} + \beta_3 LGRW_{it} + \beta_4 CIR_{it} + \beta_5 GDPGR_{it} + \beta_6 INFL_{it} + \beta_7 EXCH_{it} + \mu_i + \varepsilon_{it}$$

Model 2 (RQ2): Effect of LLP Ratio on ROA

$$ROA_{it} = \beta_0 + \beta_1 LLPR_{it} + \beta_2 SIZE_{it} + \beta_3 LGRW_{it} + \beta_4 CIR_{it} + \beta_5 GDPGR_{it} + \beta_6 INFL_{it} + \beta_7 EXCH_{it} + \mu_i + \varepsilon_{it}$$

Model 3 (RQ3): Effect of CAR on ROE (including quadratic term)

$$ROE_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 CAR^2_{it} + \beta_3 SIZE_{it} + \beta_4 LGRW_{it} + \beta_5 CIR_{it} + \beta_6 GDPGR_{it} + \beta_7 INFL_{it} + \beta_8 EXCH_{it} + \mu_i + \varepsilon_{it}$$

Model 4 (RQ4): Combined and Interaction Effects on ROA

$$ROA_{it} = \beta_0 + \beta_1 NPLR_{it} + \beta_2 LLPR_{it} + \beta_3 CAR_{it} + \beta_4 (NPLR \times CAR)_{it} + \beta_5 (NPLR \times LLPR)_{it} + \beta_6 SIZE_{it} + \beta_7 LGRW_{it} + \beta_8 CIR_{it} + \beta_9 GDPGR_{it} + \beta_{10} INFL_{it} + \beta_{11} EXCH_{it} + \mu_i + \varepsilon_{it}$$

A Priori Expectations

- β_1 (NPLR): Negative. Higher NPL ratios indicate deteriorating asset quality, which leads to increased provisioning, lost interest income, and higher monitoring costs.

- β_1 (LLPR): Negative (contemporaneous). An increase in the loan loss provision charge directly reduces net operating income.
- β_1 (CAR) in the linear model: Ambiguous. The leverage trade-off suggests a negative sign, while the signalling and risk absorption channels suggest a positive sign.
- β_2 (CAR²): Negative. This would confirm an inverted U-shaped relationship.
- β_4 (NPLR $\times$ CAR): Positive. A high capital buffer is expected to moderate the negative effect of NPL on profitability.
- β_5 (NPLR $\times$ LLPR): Negative. This interaction tests whether provisioning deepens the profitability shock when NPLs are already high.

Results and Discussion

Descriptive Statistics

The descriptive statistics for the core variables are presented in Table 4.1.1, providing insights into the central tendency, dispersion, and range of the data across the sample period.

Table 4.1.1 Descriptive Statistics for Study Variables (N = 250 Bank-Year Observations)

Variable	Mean	Median	Std. Dev.	Minimum	Maximum
ROA (%)	1.95	1.9	0.92	-0.98	5.52
ROE (%)	13.8	13.1	5.85	-7.8	31.5
NPLR (%)	5.05	4.7	3.28	1.1	19.2
LLPR (%)	2.1	1.85	1.72	0.2	11.8
CAR (%)	17.5	17.1	4.02	10.5	30.8
SIZE (Ln Assets)	18.5	18.4	1.48	14.32	21.75
LGRW (%)	10.2	8.5	12.1	-17.8	44.5
CIR (%)	67.8	67.2	9.54	45.5	91.8
GDPGR (%)	2.05	2.4	1.78	-1.7	4.1
INFL (%)	14.5	13.2	6.15	8.5	28.5
EXCH (N/USD)	460.13	395	205.2	205	840

Source: Researcher's computation from secondary data, 2026.

The average return on assets (ROA) is 1.95%, with a standard deviation of 0.92%, suggesting moderate profitability but substantial variability. Some banks recorded losses (minimum -0.98%), while the most profitable achieved 5.52%. Return on equity (ROE) averaged 13.80%, with a wide dispersion, as evidenced by the standard deviation of 5.85% and a negative minimum of -7.80%, indicating that certain banks destroyed shareholder value in some years. Asset quality, proxied by the non-performing loan ratio (NPLR), averaged 5.05%, barely above the Central Bank of Nigeria's 5% prudential threshold. The maximum NPLR of 19.20% points to acute asset quality deterioration in specific institutions, likely driven by sectoral lending concentration and macroeconomic shocks. The loan loss provision ratio (LLPR) averaged 2.10% but peaked at 11.80%, reflecting aggressive provisioning during periods of heightened credit risk. The capital adequacy ratio (CAR) averaged 17.50%, comfortably above the regulatory minimum of 15% for international banks, though a minimum of 10.50% signals that some banks operated dangerously close to the floor.

Pearson Correlation Analysis

Table 4.1.2 displays the Pearson correlation coefficients among the main variables.

Table 4.1.2 Pearson Correlation Matrix

	ROA	ROE	NPLR	LLPR	CAR
ROA	1				
ROE	0.76***	1			
NPLR	-0.49***	-0.38***	1		
LLPR	-0.52***	-0.42***	0.54***	1	
CAR	0.14**	0.11*	-0.23***	-0.18***	1
SIZE	0.22***	0.25***	-0.15**	-0.12*	0.08
LGRW	0.1	0.08	-0.05	-0.02	0.04
CIR	-0.45***	-0.40***	0.20***	0.25***	-0.1
GDPGR	0.25***	0.18***	-0.22***	-0.15**	0.06
INFL	-0.28***	-0.22***	0.30***	0.28***	-0.05
EXCH	-0.19***	-0.15**	0.26***	0.21***	-0.07

indicate significance at the 1%, 5%, and 10% levels, respectively. Source: Researcher's computation, 2026.

Both NPLR and LLPR exhibit strong negative correlations with ROA (-0.49 and -0.52) and ROE (-0.38 and -0.42), consistent with the expectation that credit risk erodes profitability. CAR displays weak but positive correlations with profitability measures, suggesting a possible non-linear relationship. The moderate correlation between NPLR and LLPR (0.54) is expected, as higher NPLs typically necessitate larger provisions. All correlation coefficients among the independent variables are well below 0.80, indicating that multicollinearity is unlikely to distort regression estimates.

Panel Unit Root Test

To avoid spurious regression, panel unit root tests were conducted using the Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS) approaches. The results are summarised in Table 4.3.

Table 4.3: Panel Unit Root Test Results

Variable	LLC Statistic (p-value)	IPS Statistic (p-value)	Conclusion
ROA	-6.85 (0.000)	-4.20 (0.000)	Stationary
ROE	-6.10 (0.000)	-3.95 (0.000)	Stationary
NPLR	-4.45 (0.000)	-3.50 (0.000)	Stationary
LLPR	-7.35 (0.000)	-5.10 (0.000)	Stationary
CAR	-4.20 (0.000)	-3.10 (0.001)	Stationary
SIZE	-5.80 (0.000)	-3.80 (0.000)	Stationary
LGRW	-8.10 (0.000)	-6.25 (0.000)	Stationary
CIR	-4.90 (0.000)	-3.35 (0.000)	Stationary

Source: Researcher's computation, 2026.

Both tests reject the null hypothesis of a unit root for all variables at the 1% significance level. Thus, the series are integrated of order zero, $I(0)$, making them suitable for panel regression in their level form without the need for first-differencing, which preserves the economic interpretation of coefficients.

Preliminary Panel Regression Estimates

Before the main System GMM analysis, a baseline fixed-effects (FE) regression was estimated to assess the sign and significance of the relationships, and the Hausman test was performed to guide model selection. The FE estimates confirm the negative and significant effects of NPLR and LLPR on ROA, while CAR is positive but insignificant, hinting at a non-linear relationship. The Hausman test rejects the random-effects model, supporting the use of fixed-effects for consistent estimation. However, given the potential endogeneity of credit risk variables and the dynamic nature of profitability, the System GMM estimator was adopted for hypothesis testing.

Test of Hypotheses

Hypothesis One: Effect of NPLR on ROA

H_{01} : NPLR has no significant effect on ROA.

Table 4.2.1 System GMM Estimates for the Effect of NPLR on ROA

Variable	Coefficient	Robust Std. Error	z-statistic	p-value
Lagged ROA (-1)	0.34	0.052	6.54	0.000***
NPLR	-0.188	0.03	-6.27	0.000***
SIZE	0.205	0.092	2.23	0.026**
LGRW	0.014	0.008	1.75	0.080*
CIR	-0.038	0.009	-4.22	0.000***
GDPGR	0.105	0.042	2.5	0.013**
INFL	-0.022	0.011	-2	0.046**
EXCH	-0.002	0.001	-2	0.046**
Constant	-2.8	1.25	-2.24	0.025**

Diagnostics: Wald $\chi^2 = 258.40$ (0.000); Hansen J $p = 0.262$; AR(1) $p = 0.012$; AR(2) $p = 0.328$.

significant at 1%, 5%, 10%. Source: Researcher's computation, 2026.

The NPLR coefficient is -0.188 ($p=0.000$), indicating that a one percentage point increase in the non-performing loan ratio reduces ROA by 0.188 percentage points. Decision: The null hypothesis is rejected. NPLR has a significant negative effect on ROA.

Hypothesis Two: Effect of LLPR on ROA

H_{02} : LLPR has no significant effect on ROA.

Table 4.2.2 System GMM Estimates for the Effect of LLPR on ROA

Variable	Coefficient	Robust Std. Error	z-statistic	p-value
Lagged ROA (-1)	0.312	0.057	5.47	0.000***

LLPR	-0.225	0.039	-5.77	0.000***
SIZE	0.18	0.095	1.89	0.058*
LGRW	0.011	0.009	1.22	0.222
CIR	-0.034	0.011	-3.09	0.002***
GDPGR	0.108	0.047	2.3	0.022**
INFL	-0.021	0.013	-1.62	0.105
EXCH	-0.002	0.001	-2	0.046**
Constant	-2.2	1.32	-1.67	0.095*

Diagnostics: Wald $\chi^2 = 248.15$ (0.000); Hansen J $p = 0.298$; AR(1) $p = 0.015$; AR(2) $p = 0.285$.

significant at 1%, 5%, 10%. Source: Researcher's computation, 2026.

The LLPR coefficient is -0.225 ($p=0.000$), indicating that a one percentage point increase in the loan loss provision ratio reduces ROA by 0.225 percentage points. This effect is even larger in magnitude than that of NPLR, underscoring the immediate income-statement impact of provisioning. Decision: The null hypothesis is rejected. LLPR has a significant negative effect on ROA.

Hypothesis Three: Effect of CAR on ROE

Ho3: CAR has no significant effect on ROE.

To capture the theorised non-linear relationship, both CAR and its squared term (CAR^2) are included.

Variable	Coefficient	Robust Std. Error	z-statistic	p-value
Lagged ROE (-1)	0.465	0.048	9.69	0.000***
CAR (Linear)	0.82	0.34	2.41	0.016**
CAR^2 (Quadratic)	-0.024	0.01	-2.4	0.016**
SIZE	1.42	0.51	2.78	0.005***
LGRW	0.052	0.034	1.53	0.126
CIR	-0.145	0.044	-3.3	0.001***
GDPGR	0.83	0.315	2.63	0.008***
INFL	-0.078	0.044	-1.77	0.076*

Diagnostics: Wald $\chi^2 = 312.50$ (0.000); Hansen J $p = 0.310$; AR(1) $p = 0.010$; AR(2) $p = 0.295$.

significant at 1%, 5%, 10%. Source: Researcher's computation, 2026.

The positive linear coefficient (0.820) and negative quadratic coefficient (-0.024) confirm an inverted U-shaped relationship. The optimal CAR is calculated at approximately 17.1%. Decision: The null hypothesis is rejected. CAR has a significant non-linear effect on ROE.

Hypothesis Four: Joint and Interactive Effects

Ho4: NPLR, LLPR, and CAR jointly have no significant combined effect on profitability.

Interaction terms $NPLR \times CAR$ and $NPLR \times LLPR$ are introduced to test for moderation.

Table 4.2.4 System GMM Estimates for Joint and Interactive Effects on ROA

Variable	Coefficient	Robust Std. Error	z-statistic	p-value
Lagged ROA (-1)	0.295	0.053	5.57	0.000***
NPLR	-0.305	0.048	-6.35	0.000***
LLPR	-0.175	0.038	-4.61	0.000***
CAR	0.014	0.01	1.4	0.161
NPLR × CAR	0.011	0.004	2.75	0.006***
NPLR × LLPR	-0.017	0.006	-2.83	0.005***
SIZE	0.19	0.083	2.29	0.022**
LGRW	0.009	0.007	1.29	0.197
CIR	-0.037	0.009	-4.11	0.000***
GDPGR	0.088	0.039	2.26	0.024**
INFL	-0.019	0.011	-1.73	0.084*
EXCH	-0.002	0.001	-2	0.046**
Constant	-3	1.28	-2.34	0.019**

Diagnostics: Wald $\chi^2 = 348.20$ (0.000); Hansen J $p = 0.275$; AR(1) $p = 0.018$; AR(2) $p = 0.335$.

significant at 1%, 5%, 10%. Source: Researcher's computation, 2026.

The direct effects of NPLR and LLPR remain significantly negative. The interaction term NPLR×CAR is positive and significant (+0.011, $p=0.006$), indicating that a higher capital ratio mitigates the adverse effect of NPLs on ROA. In contrast, the NPLR×LLPR interaction is negative and significant (-0.017, $p=0.005$), revealing that when NPLs are already elevated, increased provisioning compounds the profitability decline. Decision: The null hypothesis is rejected. The three variables jointly exert a significant combined effect on profitability through both direct and moderating channels.

DISCUSSION OF FINDINGS

NPLR and Profitability

The significant negative relationship between NPLR and ROA aligns with the Financial Intermediation Theory (Diamond, 1984) and the Bad Management Hypothesis (Berger & DeYoung, 1997). A 0.188 percentage point reduction in ROA for each 1% rise in NPLs reflects the dual income-disruption and provisioning-pressure channels. Under IFRS 9, expected credit loss provisioning makes this relationship more contemporaneous, as banks recognise impairment earlier. This finding corroborates Adebayo and Akinsola (2021) and reinforces the CBN's 5% prudential threshold: exceeding it carries a direct and measurable cost to earnings.

LLPR and Profitability

The negative effect of LLPR on ROA (-0.225) confirms that loan loss provisions act as an immediate charge against profits. While this depresses short-term profitability, it is a necessary prudential action that strengthens the balance sheet. The slightly larger coefficient relative to NPLR indicates that the flow of provisions is the proximate driver of earnings erosion, particularly when banks are forced to provision aggressively for a deteriorating portfolio. This supports the findings of Afolabi and Adeyemi (2019) and is consistent with the forward-looking philosophy of IFRS 9.

CAR and Shareholder Returns

The inverted U-shaped relationship between CAR and ROE, with an optimal threshold of approximately 17.1%, provides empirical evidence for the Trade-Off Theory of capital structure. Below this level, higher capital reduces funding costs and enhances confidence, boosting ROE; above it, the equity multiplier dilution

dominates. This reconciles the contradictory linear findings in the literature (e.g., Uchendu & Onyema, 2020 vs. Akinwunmi & Essien, 2017) and confirms that the CBN's 15% minimum is prudently set slightly below the profit-maximising capital ratio, encouraging efficient capital usage.

Joint and Interactive Effects

The positive $NPLR \times CAR$ interaction supports the Buffer Theory of Capital, demonstrating that well-capitalised banks can absorb credit shocks without drastic earnings contraction. Conversely, the negative $NPLR \times LLPR$ interaction highlights the danger of delayed provisioning: when NPLs are high, the same provision charge inflicts disproportionately greater damage. This systemic view underscores that effective credit risk management cannot focus on a single indicator; it requires simultaneous optimisation of asset quality, provision coverage, and capital buffers.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study examined the effect of credit risk management on the profitability of 25 deposit money banks in Nigeria over the period 2016–2025, a decade marked by macroeconomic turbulence, regulatory tightening, and the full implementation of IFRS 9. The specific objectives were to determine the individual and joint effects of the non-performing loan ratio (NPLR), loan loss provision ratio (LLPR), and capital adequacy ratio (CAR) on bank profitability, measured by ROA and ROE. Using a balanced panel of 250 bank-year observations and the System GMM estimator, the study tested four hypotheses at the 5% significance level.

The key findings are:

1. NPLR has a statistically significant negative effect on ROA, with a coefficient of -0.188, indicating that a 1% rise in NPLs reduces return on assets by 0.188 percentage points.
2. LLPR exerts a significant negative effect on ROA, with a coefficient of -0.225, demonstrating that loan loss provisions directly charge against earnings and diminish profitability.
3. CAR displays an inverted U-shaped relationship with ROE, with an optimal capital adequacy level of approximately 17.1%, beyond which shareholder returns decline due to leverage dilution.
4. The combined and interactive effects reveal that a strong capital buffer positively moderates the NPL-profitability link, while simultaneous high NPLs and aggressive provisioning have a compounding negative impact on ROA.

Conclusions

Based on the empirical evidence, the study concludes that credit risk management is a critical and multifaceted driver of bank profitability in Nigeria. Asset quality, as captured by the NPL ratio, remains the most fundamental determinant; any deterioration directly erodes returns. The cost of prudent provisioning, although a drag on current profits, is an indispensable element of financial stability in the IFRS 9 era. Capital adequacy, when optimally calibrated, enhances shareholder value, but excessive capital accumulation destroys it. Most importantly, these three pillars of credit risk management are not independent; their interaction defines the resilience and profitability of a bank. Effective credit risk management, therefore, is not about maximising any single ratio but about achieving a dynamic equilibrium among NPLs, provisions, and capital.

Recommendations

To Bank Management:

1. Strengthen credit underwriting and early-warning systems to keep NPL ratios well below the 5% threshold. The financial penalty for lax credit standards is immediate and quantifiable.
2. Maintain a forward-looking provisioning culture that aligns with IFRS 9, accepting short-term earnings volatility for long-term balance sheet integrity.

3. Optimise the capital structure around the 17% CAR sweet spot, deploying excess capital into profitable lending or returning it to shareholders, rather than hoarding sterile buffers.

To Regulators:

- a. Enforce the 5% NPL limit with greater granularity, imposing stricter supervisory measures on banks that persistently exceed 7%, including limitations on dividend payments.
- b. Review capital adequacy guidelines to discourage over-capitalisation; consider linking the systemic risk buffer to the efficiency of capital usage.
- c. Continue to promote full and transparent IFRS 9 implementation, as it enhances the timeliness of loss recognition and strengthens market discipline.

Investors and Analysts:

- a. Integrate NPLR and LLPR trends into equity valuation models; a bank with rising NPLs and low provision coverage is a value trap.
- b. Treat CAR not as a simple safety indicator but as a value driver: target banks operating in the 15%–18% CAR range for optimal risk-adjusted returns.

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