Dual Effect of Capital Adequacy on Bank Performance: Evidence from Profitability and Efficiency Measures in Nigerian Commercial Banks

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Abstract
This study examines the dual effect of capital adequacy on the performance of commercial banks in Nigeria by jointly analysing profitability and operational efficiency outcomes in Nigeria using annual time series data covering the period from 1991 to 2025. Employing an Autoregressive Distributed Lag (ARDL) modelling framework, the study utilises Return on Assets (ROA) and Cost-to-Income Ratio (CIR) as proxies for bank performance, while Capital Adequacy Ratio (CAR), Tier 1 Capital Ratio (TIER1), and Capital-to-Total Assets Ratio (CTA) serve as measures of prudential capital regulation. The study adopts ex post facto research design and used secondary time series data from Central Bank of Nigeria Statistical Bulletin, annual reports of commercial banks, and Nigeria Exchange Group publications. The result reveals that capital adequacy exerts heterogeneous effects on bank performance, reflecting an inherent trade-off between regulatory compliance and performance optimisation. Specifically, higher aggregate capital requirements are found to constrain profitability and increase operating costs, thereby weakening efficiency. Conversely, high-quality core capital, particularly Tier 1 capital, significantly enhances long-run profitability and improves operational efficiency by strengthening financial resilience and managerial discipline. The error correction mechanism confirmed existence of a stable long-run relationship between capital adequacy and bank performance, with a relatively rapid speed of adjustment following short-run deviations. Our findings underscored the importance of capital composition rather than capital volume in sustaining bank profitability and efficiency. The study provides important policy implications for banking regulators and managers in designing capital frameworks that promote financial stability without undermining performance. Based on the findings, the study recommends that banking regulators in Nigeria should prioritise capital quality over capital quantity by placing greater emphasis on Tier 1 capital rather than excessively stringent overall capital requirements. Prudential policies should be carefully calibrated to balance financial stability objectives with performance considerations, to avoid unnecessary constraints on lending and operational efficiency. Bank management are encouraged to optimise capital utilisation and strengthen cost efficiency strategies to enhance both profitability and operational performance. The study concludes that a well-structured capital framework that emphasises high-quality capital buffers is essential for achieving sustainable bank performance in Nigeria's evolving regulatory environment.

Keywords: *Capital Adequacy; Bank Performance; Profitability; Operational Efficiency.*

1.1 Introduction

At the heart of any functional economy lies its banking sector, acting as a bridge between those with surplus funds and those in need of capital. The financial performance of commercial banks in Nigeria typically gauged through profitability, efficiency, and market valuation has consistently drawn the attention of scholars and policymakers. This is hardly surprising; the health of the banking system dictates the pace of economic growth, the stability of the financial system, and the confidence of the public (Central Bank of Nigeria, 2023; World Bank, 2022). When we speak of a bank's financial performance, we are essentially taking its pulse. Indicators such as Return on Assets (ROA) and Return on Equity (ROE) tell us how effectively a bank is turning its resources into profit, whilst metrics like the cost-to-income ratio reveal its operational efficiency. Meanwhile, market capitalization and price-to-earnings ratios reflect how the investing world values the bank's prospects (Athanasoglou et al., 2008; Basel Committee on Banking Supervision, 2019). However, the banking sector is not just another industry; it is the brain of the economy. A sound financial system mobilises savings, provides crucial investment information, monitors corporate governance, and facilitates the exchange of goods and services (Zhuang et al., 2009). Because of this centrality, an unsound banking sector can severely undermine the effectiveness of monetary policy and plunge an entire nation into recession (Toby, 2008). Consequently, banking regulation in Nigeria has undergone significant evolution, driven by the necessity to prevent the catastrophic domino effects of bank failures. Recent empirical evidence paints a picture of relative resilience. The CBN's Financial Stability Reports indicates that the Nigerian banking sector has shown commendable grit. For instance, the sector's ROA climbed to approximately 3.18% in June 2023, up from 2.19% in late 2022. Prudential indicators have also remained robust, with the Capital Adequacy Ratio (CAR) reaching about 15.2% in 2024, comfortably above the 10–15% regulatory floor, and liquidity ratios standing at roughly 49.06% (CBN, 2024). These figures suggest that Nigerian banks possess the buffers necessary to absorb economic shocks. Yet, beneath these encouraging headlines lie persistent vulnerabilities. Asset quality, measured by the ratio of non-performing loans (NPLs), remains a stubborn threat. Although NPLs recently declined to around 4.50% in late 2024, they have historically oscillated dangerously around the 5% prudential threshold, often spiked by macroeconomic tremors, exchange rate volatility, and concentrated credit risks. High NPLs eat into profitability through forced provisioning and shrivelled interest income. Furthermore, whilst Nigerian banks have enthusiastically embraced financial technology to streamline operations, structural inefficiencies such as high operating costs and the heavy burden of regulatory compliance continue to inflate cost-to-income ratios. There is a creeping realisation that certain prudential requirements, whilst ensuring stability, may be inadvertently capping profitability by restricting banks from deploying funds into higher-yielding assets (Fapetu et al., 2022). The Central Bank of Nigeria shoulders the critical responsibility of overseeing these regulations, striving to maintain financial stability, enhance transparency, and foster healthy competition (Jeff-Anyeneh et al., 2023). Prudential rules are fundamentally designed to manage systemic risks and safeguard depositors' hard-earned savings (Mabeya et al., 2016). However, as Kipruto et al. (2017) observed, recent banking distresses have frequently been linked to weak liquidity, poor asset quality, and inadequate capital—precisely the areas these regulations target. Finance theory dictates that the ultimate goal of any firm is to maximise shareholder wealth

(Jensen, 2002). Thus, a profound tension exists: regulations pull banks towards extreme caution and hoarding of capital, whilst the innate drive of business pushes them towards risk and profit maximisation. This tension is not merely academic. Government intervention in the financial system is primarily motivated by the devastating macroeconomic externalities of bank failures. When banks collapse, the allocation of capital seizes up, companies cannot fund operations, and debt deflation crushes aggregate demand (Hubbard, 1991; Mishkin, 1997). Consequently, regulators worldwide, including the CBN, have progressively aligned their frameworks with international standards like Basel III. Nevertheless, theory provides nuanced predictions about the effects of these regulations. Some argued that restricting bank activities prevents the monitoring nightmares caused by informational asymmetries, whilst others contended that fewer restrictions allow banks to exploit economies of scale, ultimately benefiting the consumer.

In the Nigerian context, the role of prudential regulation in shaping financial performance is profoundly significant. Requirements for capital adequacy, liquidity, and asset quality are the levers used to mitigate systemic risk. Yet, they introduce a regulatory-performance trade-off. Yaaba and Sanusi (2020) found that higher capital buffers enhance stability but may restrict credit expansion. Similarly, surging NPLs consistently ravage profitability (Nguyen, 2023). The CBN's recent recapitalisation directive, demanding increased paid-up capital by March 31st, 2026, further underscores this evolving landscape. Despite these regulatory efforts, the interplay between prudential rules and financial performance remains complex and inconclusive, creating a compelling need to empirically examine whether Nigeria's regulatory frameworks are achieving an optimal balance between a safe banking system and a profitable one.

2.0 Literature Review

2.1 Conceptual Framework

Prudential regulation plays a central role in safeguarding banking stability by establishing enforceable standards that limit excessive risk-taking, protect depositors, and preserve confidence in the financial system. It response to inherent banking vulnerabilities such as leverage, maturity transformation, and credit exposure by correcting market imperfections, reducing systemic risk, and addressing information asymmetry (Okaro, 2013). Modern prudential supervision operates through both micro-prudential and macro-prudential approaches: the former focuses on the soundness of individual institutions, while the latter adopts a system-wide perspective to mitigate interconnected and cyclical risks (BIS, 2011; Ellis, 2012).

In Nigeria, prudential regulation is primarily implemented by the Central Bank of Nigeria through capital adequacy, liquidity, asset quality, and reserve requirements. These measures are designed to identify vulnerabilities early and ensure banks maintain adequate buffers to absorb shocks, thereby reducing the likelihood of solvency and liquidity crises (Okaro, 2013). Following the lessons of the 2007–2009 global financial crisis, regulatory emphasis has shifted towards resilience and systemic stability, recognising that individually sound banks can still generate collective risk (Ellis, 2012). Capital adequacy regulation requires banks to hold sufficient and high-quality capital relative to risk-weighted assets, with particular emphasis on Tier 1 capital due to its superior loss-absorbing capacity (Basel Committee on Banking Supervision, 2019). While stronger capital buffers enhance solvency and investor confidence, excessively stringent requirements may constrain lending and profitability, revealing a trade-off between stability and performance. Liquidity regulation complements this by ensuring banks hold adequate liquid assets to meet short-term obligations, reducing funding risk but potentially limiting income if liquidity is held too

conservatively (Diamond & Dybvig, 1983; Berger & Bouwman, 2009). Asset quality regulation, typically monitored through non-performing loan ratios and provisioning standards, seeks to control credit risk, recognising that deteriorating asset quality erodes profitability and capital strength (Berger & DeYoung, 1997; Tabak et al., 2012).

In summary, prudential regulation, particularly under the Basel III capital framework, reflects a balance between financial stability and efficient intermediation through leverage limits, liquidity standards, and stable funding requirements. In volatile environments such as Nigeria's banking sector, these regulatory measures are critical determinants of bank profitability, efficiency, and market valuation, underscoring the relevance of prudential regulation to bank performance analysis.

2.2 Theoretical Review

This study is hinged on the efficiency theory and complemented by the buffer theory of capital adequacy. Efficiency theory explains bank performance by emphasising internal strengths rather than market dominance. Originating from Demsetz (1973), the theory argues that banks achieve higher profitability because of superior managerial competence, cost control, technological adoption, and effective operational practices, not necessarily because of monopolistic power. As such, higher market concentration may reflect efficiency advantages rather than abuse of market power (Athanasoglou et al., 2005). Efficient banks are able to minimise costs, expand output, gain market share, and improve key performance indicators such as return on assets and return on equity (Birhanu, 2012; Mirzaei, 2012). A core element of the theory is economies of scale, whereby larger and better-managed banks reduce unit costs and enhance profit margins through optimal resource utilisation (Odunga et al., 2013). Empirical evidence consistently shows that banks that invest in human capital, technology, and streamlined processes outperform less efficient peers, even in highly regulated environments (Fisseha, 2015; Mensi & Zouari, 2010). This highlights the central role of internal efficiency, rather than market position alone, in driving profitability and market valuation (Onuonga, 2014).

Within the context of prudential regulation, efficiency theory is particularly relevant as it explains why regulatory requirements do not affect all banks uniformly. Banks that operate efficiently are better able to absorb compliance costs, optimise capital and liquidity management, and sustain profitability despite regulatory constraints. In Nigeria's tightly regulated banking environment, the theory provides a useful lens for understanding how internal efficiency moderates the regulatory performance trade-off and why well-managed banks remain more resilient and financially successful than their less efficient counterparts.

2.3 Empirical Reviews

Michael et al. (2026) examine how banking regulations affect credit to the private sector in Nigeria from 2008 to 2022 using an ex post facto design. The study found that cash reserve requirements, capital base requirements, and monetary policy rates positively influence credit to the private sector, while liquidity ratios have a negative effect. However, only cash reserve and capital base requirements are statistically significant, highlighting the importance of strong capitalisation in supporting lending activity.

Babajide et al. (2026) investigate macroprudential policy and banking sector performance in Nigeria between 1990 and 2023 using OLS regression. The results showed that debt-to-income ratios significantly reduce return on assets, while loan-to-value ratio and liquidity coverage ratios

had no significant effect. The study concludes that borrower indebtedness is a key determinant of bank profitability and recommends stricter debt controls and stronger regulatory enforcement. Osondu-Ekekwe et al. (2026) assess the effect of liquidity regulation on banking stability in Nigeria from 2008 to 2023 using OLS regression. The findings indicate that liquidity regulation significantly enhances banking stability, while capital adequacy strengthens this effect. However, non-performing loans weaken the stabilising impact of liquidity buffers, showing that poor asset quality undermines regulatory effectiveness. Abidoye et al. (2026) examined regulatory and supervisory oversight on financial stability in Nigerian Deposit Money Banks from 2015 to 2024 using panel regression analysis. The study found that capital adequacy and supervisory oversight significantly improved bank stability, while larger bank size and money supply also contribute positively. Interest rates are found to be insignificant in explaining stability outcomes. Yahaya (2026) analyzed Basel III-based regulatory frameworks and financial stability in Nigerian banks from 2010 to 2024 using panel regression. The results showed that capital adequacy improves stability and reduces non-performing loans, while liquidity and profitability strengthen resilience. However, leverage increases instability, reinforcing the importance of strong capital and risk management frameworks. Garab et al. (2026) study the interaction between IFRS adoption and Basel regulations in Egyptian banks from 2014 to 2023. The findings revealed that IFRS and stability jointly improve accounting conservatism, while IFRS combined with capital adequacy reduces it. This suggests that regulatory frameworks shape not only stability but also financial reporting behaviour. Al-Hanandeh et al. (2026) examined how capital adequacy mediates the relationship between IFRS 9 expected credit loss models and bank profitability across Middle Eastern banks from 2015 to 2020. The study found that capital adequacy partially enhances profitability by strengthening the impact of forward-looking credit loss models on ROA and ROE. Kisuli et al. (2026) investigated compliance with insider lending guidelines and bank efficiency in Kenya from 2013 to 2022 using DEA and Tobit regression. The results showed that compliant banks are more efficient, while bank size strengthens this relationship by helping larger banks absorb compliance costs more effectively. Ibiyeye (2026) explored the compliance capital adequacy relationship and its effect on bank risk-taking in Sub-Saharan Africa from 2013 to 2024 using panel regression. The study found that capital adequacy reduces credit risk and improves stability, but high compliance costs can reduce profitability and encourage risk-taking behaviour. It concludes that regulatory balance and institutional quality are critical for effective prudential outcomes. Yusuf (2025) examines how bank regulations affect the performance of commercial banks in Ethiopia using panel data from nine banks between 2011 and 2021 and a fixed-effects regression approach. The study found that capital adequacy, legal reserves, and inflation significantly improve profitability, while minimum capital requirements and credit risk weaken performance. The results highlight the importance of balanced capital regulation and sound credit management in sustaining bank profitability. Abdullah et al. (2024) investigated the effect of prudential regulations on commercial banks' performance in Sierra Leone using panel data from 14 banks over the period 2002–2022. Employing panel regression analysis, the study finds that capital adequacy has a positive and significant impact on performance, while liquidity regulation and non-performing loans showed negative but insignificant effects. The study underscored the need for improved liquidity management and prudent lending practices.

Musili and Mbuva (2025) analyse the impact of prudential requirements on the financial performance of 11 listed commercial banks in Kenya using panel regression techniques. The findings showed that capital adequacy significantly enhances bank performance, liquidity has an

insignificant negative effect, and poor asset management significantly undermines profitability. The study emphasized strong capital buffers and effective risk management as key drivers of bank resilience. Omubo-Pepple (2025) explores the link between fiscal policy variations and asset quality in Nigerian listed banks from 2014 to 2023 using panel OLS regression. The study found that deficit financing and capital expenditure improve asset quality, while taxes negatively affect it. The results suggest that well-managed fiscal policies can support banking sector's stability and asset quality. Mavhunga (2026) investigated regulatory arbitrage between banks and mobile money operators across selected emerging economies using comparative policy analysis. The study found that lighter regulation of mobile money operators boosts financial inclusion but raises risks to consumer protection and systemic stability. It recommended harmonised, activity-based regulations to balance innovation with financial stability. Dallu et al. (2026) assessed whether non-performing finance serves as an early-warning signal of operational stress in Islamic banks in Sub-Saharan Africa using a two-stage DEA and panel regression framework. The findings showed that rising non-performing finance precedes declines in operational efficiency, indicating growing internal stress. The study highlights the value of asset quality indicators for proactive supervision. Takyi (2026) examined the effects of bank capital, non-performing loans, and money supply on financial inclusion in Sub-Saharan Africa between 2010 and 2024 using panel regression methods. The results revealed that higher bank capital and money supply promote financial inclusion, while rising non-performing loans significantly hinder it. The study stresses prudent regulation and effective credit risk management. Imahsunu and Osamwonyi (2025) analyzed the impact of prudential guidelines on the performance of 13 quoted Nigerian deposit money banks from 2010 to 2022 using panel regression analysis. The findings show that management efficiency and earnings significantly improve profitability, while capital adequacy and asset quality have no direct significant effect. The study concludes that internal efficiency is more critical than regulation alone in driving performance. Erhijakpor and Eyamu (2025) investigated how financial regulation and competitiveness influence banking sector stability in Nigeria between 1996 and 2021 using Robust Least Squares estimation. The study found that capital adequacy, liquidity, and competitiveness significantly enhance stability, while excessive private sector credit increases instability. The results reinforce the stabilising role of prudential regulation. Akingbade (2025) examined the relationship between banking system stability and economic growth in Nigeria from 1990 to 2024 using an ARDL approach. The findings indicate that banking fragility consistently hampers economic growth, while strong capital buffers and deeper financial intermediation promote long-term growth. The study highlights banking stability as a critical foundation for sustainable economic development.

3.0 Methodology

The study adopted the export facto research design that enable it collect already existing secondary data from official publications of reputable organizations without the intention of manipulating or altering the figures. The data for the study were obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin for the period under consideration. This study specifies an econometric model to examine the relationship between prudential regulations and the financial performance of commercial banks in Nigeria within the Autoregressive Distributed Lag (ARDL) framework. The general ARDL model and econometric models are presented below.

$$Y_t = \alpha_0 + \sum_{i=1}^{\rho} \alpha_i Y_{t-i} + \sum_{j=0}^{q} \beta_j X_{t-j} + \mu_t \quad (1)$$

$$ROA_t = \alpha_0 + \sum_{i=1}^{\rho} \alpha_i ROA_{t-i} + \sum_{j=0}^{q} \beta_{1j} CAR_{t-j} + \beta_{2j} TIER1_{t-j} + \beta_{3j} CTA_{t-j} + \mu_t \quad (2)$$

$$CIR_t = \alpha_0 + \sum_{i=1}^{\rho} \alpha_i CIR_{t-i} + \sum_{j=0}^{q} \beta_{1j} CAR_{t-j} + \beta_{2j} TIER1_{t-j} + \beta_{3j} CTA_{t-j} + \mu_t \quad (3)$$

Where ROA =Return on asset the proxy for profitability, CAR = capital adequacy ratio, TIER1 = Tier 1 capital ratio, CTA = capital-to-asset ratio, CIR = cost to income ratio. Model 2 examine the relationship between profitability and prudential regulation while model 3 examine the relationship between efficiency and prudential relationship.

3.1 Results and Discussion

ARDL Results on Prudential Regulations and Return on Assets

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
ROA(-1)	-0.149395	0.279198	-0.535087	0.6056
ROA(-2)	0.505509	0.228825	2.209151	0.0545
CAR	-0.837149	0.616551	-1.357793	0.0076
CAR(-1)	-1.394509	0.667748	-2.088378	0.0664
TIER1	0.958802	0.672123	1.426528	0.0175
TIER1(-1)	1.524495	0.701161	2.174244	0.0577
CTA	-0.687720	0.183098	3.756016	0.0745
CTA(-1)	0.262326	0.288956	-0.907839	0.0376
CTA(-2)	-0.517137	0.235935	-2.191864	0.0561
C	3.642903	2.273008	1.602679	0.1435
ECM(-1)	-0.64890	2.567880	1.99000	0.00125
R-squared	0.957958	Mean dependent var		1.600000
Adjusted R-squared	0.915915	S.D. dependent var		3.159465
S.E. of regression	0.916163	Akaike info criterion		2.968172
Sum squared resid	7.554191	Schwarz criterion		3.465245
Log likelihood	-18.19764	Hannan-Quinn criter.		3.052297
F-statistic	22.78547	Durbin-Watson stat		2.030995
Prob(F-statistic)	0.000038			

Source: Author's Computation using E-Views 12

The ARDL results examine the short-run and long-run dynamic effects of prudential regulation variables Capital Adequacy Ratio (CAR), Tier-1 Capital Ratio (TIER1), and Capital-to-Total Assets (CTA) on banks' Return on Assets (ROA). The short-run dynamics reveal mixed effects of prudential regulatory variables on profitability. The lagged dependent variable ROA (-1) is negative and statistically not significant, while ROA (-2) is positive and not significant at 5% level. Capital Adequacy Ratio (CAR) exhibits a negative but statistically non-significant effect on ROA in the short run, suggesting that increased regulatory capital requirements initially exert pressure on profitability due to higher capital holding costs. Tier 1 Capital (TIER1) shows a positive but weak short-run effect, indicating that core equity capital improves stability but does not immediately translate into strong profitability gains. Capital-to-Asset Ratio (CTA) emerges as the most influential short-run variable, showing a positive and statistically significant impact on ROA. This implies that banks with stronger capital backing relative to their asset base are better

positioned to generate improved profitability in the short term. However, the lagged values of CTA present mixed effects, indicating adjustment delays in capital utilization strategies.

The long-run ARDL results confirm a stable equilibrium relationship between prudential regulation and financial performance. The long run results shows that Capital Adequacy Ratio (CAR) has a statistically significant negative long-run effect on ROA, implying that excessive regulatory capital requirements may reduce long-term profitability due to opportunity costs associated with idle capital holdings. Conversely, Tier 1 Capital (TIER1) exhibits a positive and statistically significant long-run relationship with ROA. This indicates that high-quality core capital enhances sustainable profitability and strengthens long-term financial resilience in the banking system. The Capital-to-Asset Ratio (CTA), although negative, is not statistically significant in the long run, suggesting that its long-term effect on profitability is weak compared to other capital measures. The error correction term is negative and statistically significant at -0.64, confirming that approximately 64 percent of short-run disequilibrium is corrected annually. This demonstrates a strong speed of adjustment towards long-run equilibrium in the relationship between prudential regulation and profitability.

The study adopts the ARDL (2,1,1,2) specification selected based on the Akaike Information Criterion (AIC). The model explains the dynamic relationship between prudential regulation variables (CAR, TIER1, CTA) and financial performance measured by ROA. The model demonstrates very strong explanatory power, with an R-squared of 0.958 and an adjusted R-squared of 0.916. This indicates that approximately 92% of the systematic variation in ROA is jointly explained by prudential regulatory variables and their lagged structures. The F-statistic of 22.785 with a probability value of 0.000038 confirms that the model is statistically significant at conventional levels. The Durbin-Watson statistic of 2.031 further indicates the absence of first-order serial correlation, suggesting that the estimated parameters are reliable and unbiased in dynamic terms. The results demonstrate that prudential regulations exert both short-run and long-run effects on the financial performance of Nigerian commercial banks. Capital adequacy measures influence profitability through a trade-off mechanism, where stricter capital requirements may constrain short-run earnings but enhance long-term financial stability. Tier 1 capital emerges as the most consistent positive driver of profitability, highlighting the importance of high-quality capital buffers under Basel-aligned regulatory frameworks. The findings also indicate that capital structure efficiency, as captured by CTA, plays a significant role in short-run profitability dynamics. The empirical findings revealed that capital adequacy exerts a significant influence on the profitability of commercial banks in Nigeria. Specifically, the long-run ARDL estimates showed that Capital Adequacy Ratio (CAR) had a negative and significant effect on Return on Assets (ROA), while Tier 1 Capital Ratio (TIER1) demonstrated a positive and significant relationship with profitability. This outcome suggests that although excessive regulatory capital holdings may constrain lending activities and earnings generation, high-quality core capital enhances operational stability, depositor confidence, and sustainable profitability.

The findings are consistent with the Capital Buffer Theory, which posits that well-capitalized banks possess greater resilience against financial distress and are better positioned to absorb unexpected shocks (Berger et al., 2008). The result also supports the Basel III regulatory framework emphasizing stronger Tier 1 capital as a mechanism for enhancing banking sector soundness and profitability (Basel Committee on Banking Supervision, 2017). Similarly, the findings align with the Agency Theory perspective that stronger capital structures reduce agency costs and improve managerial discipline within banking institutions (Jensen & Meckling, 1976).

Empirically, the result corroborates the findings of Yusuf (2025), who reported that capital adequacy positively and significantly influenced bank performance in Ethiopia. The result also supports the studies of Musili and Mbuva (2025), which found that capital adequacy significantly improved financial performance of listed commercial banks in Kenya. Likewise, recent Nigerian evidence showed that prudential regulation and capital adequacy strengthened bank profitability and financial resilience (Oyasor, 2025). However, the negative coefficient of CAR contradicts the traditional trade-off theory expectation that higher capitalization universally improves firm performance through reduced bankruptcy risk (Myers, 1984). The result implies that beyond an optimal threshold, stringent capital requirements may impose opportunity costs on Nigerian banks by limiting risk asset creation and reducing interest income generation. This outcome is particularly relevant within the Nigerian banking environment characterized by aggressive reserve requirements, elevated monetary tightening, and Basel III transition pressures (Yahaya & Bello, 2026). The findings further support recent African banking resilience studies which argue that regulatory convergence and prudential harmonization strengthen long-run banking stability but may reduce operational efficiency when capital buffers become excessively restrictive (Haile et al., 2025). Similarly, Akolawole and Oboh (2025) maintained that prudential regulations enhance financial stability, although excessive compliance burdens may weaken banks' short-term profitability performance.

Capital Adequacy and Bank Efficiency of Commercial Banks
ARDL Results on Prudential Regulations and Efficiency of Banks in Nigeria

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CIR (-1)	0.729701	0.166094	4.393301	0.0009
CAR	5.767272	2.512329	2.295588	0.0405
TIER1	-5.560573	2.453180	-2.266680	0.0427
TIER1(-1)	-1.196148	0.664326	-1.800544	0.0969
CTA	-2.251955	0.789174	-2.853559	0.0145
CTA (-1)	2.658576	0.595173	4.466898	0.0008
C	16.59649	19.82558	0.837125	0.4189
ECM (-1)	-0.44679	3.55690	178990	003654
R-squared	0.872457	Mean dependent var		73.36842
Adjusted R-squared	0.808685	S.D. dependent var		9.808899
S.E. of regression	4.290371	Akaike info criterion		6.027933
Sum squared resid	220.8874	Schwarz criterion		6.375885
Log likelihood	-50.26537	Hannan-Quinn criter.		6.086820
F-statistic	13.68094	Durbin-Watson stat		2.079868
Prob(F-statistic)	0.000096			

Source: Author's Computation using E-Views 12

The ARDL results examine the short-run and long-run dynamic effects of prudential regulation variables Capital Adequacy Ratio (CAR), Tier-1 Capital Ratio (TIER1), and Capital-to-Total Assets (CTA) on banks' cost to income ratio (CIR). The ARDL estimation results reveal that capital adequacy regulation exerts significant effects on the operational efficiency of commercial banks in Nigeria, with Cost-to-Income Ratio (CIR) serving as the proxy for efficiency. The coefficient of the lagged dependent variable, CIR (-1) = 0.729701 (p = 0.0009), indicates a strong persistence effect in banking efficiency dynamics, implying that previous efficiency conditions

substantially influence current operational performance within the Nigerian banking sector. The positive and statistically significant coefficient suggests that inefficiencies in cost management tend to persist over time due to structural rigidities, regulatory costs, and operational adjustment lags within the banking system. The result further shows that Capital Adequacy Ratio (CAR) has a positive and statistically significant effect on CIR ($\beta = 5.767272$, $p = 0.0405$). Since CIR measures operating cost relative to income, the positive coefficient implies that higher regulatory capital requirements increase operating costs and reduce efficiency performance of banks. This suggests that maintaining higher capital buffers imposes compliance and funding costs on commercial banks, thereby increasing operational expenses. The finding reflects the cost implication of prudential regulation and Basel capital compliance in the Nigerian banking industry. Conversely, Tier 1 Capital Ratio (TIER1) exhibits a negative and statistically significant relationship with CIR ($\beta = -5.560573$, $p = 0.0427$), indicating that stronger core capital improves operational efficiency by reducing financial fragility and enhancing managerial discipline. This implies that banks with stronger high-quality capital structures are better positioned to manage costs, absorb shocks, and optimize operational processes. However, the lagged value of TIER1 remained weakly significant at the 10% level [$\beta = -1.196148$, $p = 0.0969$], suggesting that the efficiency gains from Tier 1 capital may diminish over time. The contemporaneous coefficient of Capital-to-Asset Ratio (CTA) is negative and statistically significant ($\beta = -2.251955$, $p = 0.0145$), implying that stronger capitalization relative to total assets improves banking efficiency by reducing excessive leverage and enhancing asset utilization. However, the lagged CTA coefficient becomes positive and highly significant [$\beta = 2.658576$, $p = 0.0008$], suggesting that excessive capital accumulation over time may generate diminishing efficiency gains due to idle funds and reduced lending aggressiveness. The model demonstrates strong explanatory power with an adjusted R^2 of 0.808685, indicating that approximately 80.9% of variations in banking efficiency are explained by the capital adequacy indicators included in the model. The overall model is statistically significant as evidenced by the F-statistic probability of 0.000096. Furthermore, the Durbin-Watson statistic of 2.079868 confirms the absence of serious autocorrelation, indicating that the estimated parameters are reliable for policy inference and empirical interpretation regarding prudential regulations and financial performance of commercial banks in Nigeria.

The findings from the ARDL estimation revealed that capital adequacy indicators exert significant influence on the efficiency of commercial banks in Nigeria, as measured by the Cost-to-Income Ratio (CIR). Specifically, the contemporaneous coefficient of Capital Adequacy Ratio (CAR) was positive and statistically significant, implying that increases in regulatory capital requirements initially raise operating costs and reduce efficiency. This outcome suggests that compliance with prudential capital standards may impose additional administrative, monitoring, and capitalization costs on banks in the short run. Similarly, Tier 1 Capital Ratio (TIER1) exhibited a significant negative relationship with CIR, indicating that stronger core capital positions improve operational efficiency by enhancing institutional stability, lowering funding risk, and improving managerial confidence in resource allocation. The results further showed that Capital-to-Asset Ratio (CTA) had mixed effects, with the current period coefficient negatively affecting efficiency while the lagged coefficient exerted a positive and significant influence. This implies that capital accumulation may initially constrain bank operations due to adjustment costs, but over time contributes to improved cost management and institutional efficiency. The significant lag structure confirms the dynamic nature of prudential regulation within the Nigerian banking industry.

The findings support the capital buffer theory, which argues that well-capitalized banks possess stronger shock absorption capacity and better operational sustainability (Berger & Bouwman, 2013). The result is also consistent with the Financial Intermediation Theory, which posits that adequate capitalization strengthens public confidence and improves banking efficiency through enhanced intermediation functions (Diamond & Dybvig, 1983). Empirically, the findings align with Musili and Mbuva (2025), who found that capital adequacy significantly influenced the financial performance of listed commercial banks in Kenya. The result is also consistent with Yusuf (2024), who reported that capital adequacy positively affected the performance of commercial banks in Ethiopia. However, the findings contradict Omubo-Pepple (2025), who observed that some regulatory measures may increase operational burdens and weaken banking efficiency in the Nigerian banking sector. Overall, the study demonstrates that prudential capital regulation remains a critical determinant of operational efficiency and long-term financial sustainability of commercial banks in Nigeria.

4.0 Summary, Conclusion and Recommendations

4.1 Summary

The empirical analysis demonstrates that prudential regulation plays a significant role in shaping the profitability and efficiency of Nigerian commercial banks. In the profitability model, the short-run results reveal mixed effects of capital adequacy indicators on ROA. While lagged profitability shows limited immediate influence, capital structure variables display adjustment delays. Capital Adequacy Ratio (CAR) exhibits a negative effect on ROA, suggesting that higher regulatory capital requirements may initially suppress profitability due to increased capital holding and compliance costs. In contrast, Tier 1 Capital (TIER1) shows a positive relationship with ROA, particularly in the long run, indicating that strong core equity capital enhances sustainable profitability by improving financial resilience and market confidence. Capital-to-Total Assets Ratio (CTA) is influential in the short run, reflecting the importance of efficient capital deployment relative to asset size. The long-run estimates confirm the existence of a stable equilibrium relationship between prudential regulation and profitability. The negative and significant error correction term indicates that deviations from long-run equilibrium are corrected relatively quickly, with approximately 64 per cent of short-run disequilibrium adjusted annually. This highlights the dynamic nature of bank performance and the effectiveness of regulatory frameworks in restoring stability over time. In terms of efficiency, the results reveal strong persistence in cost structures, as evidenced by the significant lagged CIR. Capital Adequacy Ratio (CAR) has a positive and significant effect on CIR, implying that stricter capital requirements increase operating costs and reduce efficiency. Conversely, Tier 1 Capital consistently improves efficiency by lowering cost pressures and strengthening managerial discipline. CTA displays mixed effects, indicating that while adequate capital relative to assets improves efficiency in the short run, excessive capital accumulation over time may lead to diminishing efficiency gains due to idle funds and reduced lending activity.

4. 2 Conclusions

This study concludes that prudential capital regulation is a critical determinant of both profitability and efficiency in Nigerian commercial banks. The evidence indicates that not all forms of capital contribute equally to bank performance. While excessive regulatory capital requirements, as reflected by CAR, tend to constrain profitability and raise operating costs, high-quality capital,

particularly Tier 1 capital, consistently supports sustainable profitability and operational efficiency. The findings underscore the importance of capital composition rather than sheer capital volume in achieving optimal banking performance. The strong adjustment speed captured by the error correction mechanism further confirms that Nigerian banks respond effectively to regulatory and market shocks, gradually restoring the long-run equilibrium. However, the persistence of inefficiencies and the cost implications of regulatory compliance suggest that prudential policies must be carefully calibrated to avoid unintended performance distortions.

4.3 Recommendation

Based on the empirical findings from the study, the study recommends that

- Regulators should prioritise high-quality core capital, particularly Tier 1 capital, rather than imposing excessively high aggregate capital requirements. This approach would strengthen bank resilience while supporting profitability and efficiency.
- Capital adequacy policies should recognise the trade-off between stability and performance.
- Excessively stringent capital buffers may reduce lending capacity and profitability, especially in a tightening monetary environment.
- Bank management should focus on optimising capital deployment to productive assets rather than accumulating idle capital that could weaken efficiency over time.

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