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THE EFFECT OF CAPITAL ADEQUACY ON SUSTAINABLE PERFORMANCE OF MICROFINANCE BANKS IN NIGERIA

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Abstract

This study investigates the impact of capital adequacy on the sustainable performance of Nigerian microfinance banks (MFBs), employing return on assets (ROA) as the primary profitability indicator. The analysis utilises a quantitative ex post facto design with panel data from 41 microfinance banks across a decade, and employing the system Generalised Method of Moments (GMM) to mitigate endogeneity issues. Findings indicate that total loans and advances (TLA) positively and considerably influence profitability, whereas capital adequacy ratio (CAR) and liquidity ratio (LR) have negative, occasionally considerable, impacts. The findings emphasise the credit-driven characteristics of MFB success and advocate for cautious loan growth accompanied by appropriate regulatory supervision.

Keywords: Microfinance Bank, Capital Adequacy, Sustainability, Financial Performance

INTRODUCTION

Background to the Study

The Nigerian financial sector has undergone considerable transformation, with microfinance banks (MFBs) becoming essential tools for addressing poverty, promoting financial inclusion, and fostering grassroots development. Established in accordance with the Central Bank of Nigeria's (CBN) 2005 policy framework, MFBs offer credit, savings, and financial services to low-income households and microenterprises that are typically excluded from traditional banking (CBN, 2011; CBN, 2012; Onoyere, 2014). Capital adequacy serves as a crucial factor in determining their viability, characterised by the ratio of capital that can absorb potential losses, safeguard depositors, and support growth (Abubakar et al., 2020; Oke & Ikpesu, 2022). Across the globe, sufficient capital is associated with the performance of banks and their long-term profitability, while also acting as a regulatory standard in accordance with Basel II/III to ensure financial stability (Le and Ngo, 2020; Ozili, 2025; Adesina & Mwamba, 2016). In Nigeria, capital adequacy plays a crucial role in shaping performance indicators like return on assets (David & Afolabi, 2023), where enhanced buffers contribute to improved sustainability (Wanjala, 2020). However, ongoing issues such as persistent undercapitalisation, poor governance, and high portfolio-at-risk ratios continue to hinder the sustainable performance of MFBs (Ahamad et al., 2024).

Statement of Problem

Research on the performance of microfinance banks (MFBs) has explored corporate governance, macroeconomic challenges, credit risk, capital adequacy and regulatory frameworks (Ahlin, Lin & Maio, 2011; Kiplagat & Kalui, 2020; Aliyu et al., 2023). However, capital adequacy remains a central factor due to its role in ensuring solvency and providing a buffer against financial shocks (Onaolapo & Adebayo, 2012). It acts as a safeguard for depositors' funds and is influenced by liquidity ratios, capital adequacy ratio, and total loans and advances (Onoh & Eze, 2019; Duho, 2023).

Despite significant attention, the link between regulatory capital and financial performance remains inconclusive. While some studies (Kivuvo & Olweny, 2014; Kimando, 2016; Wanjiru, 2016) suggest a negative relationship, consensus is still lacking. This study addresses this gap by examining capital adequacy and financial performance among deposit-taking MFBs in Nigeria, an issue that continues to generate scholarly debate.

Operational performance is essential to the economic sustainability of MFBs (Muriu, 2011), particularly given their role in offering microloans to underserved communities. Success is tied to strong loan portfolios, as seen in low default rates (Barus et al., 2017). However,

recent Central Bank of Nigeria (CBN) reports show persistent losses among several MFBs. This raises concerns about their financial health, capitalisation, and long-term viability (Afolabi, 2021).

This research primarily aimed to explore the influence capital adequacy on the sustainable performance of microfinance banks in Nigeria. The specific objectives are to assess the impact of capital adequacy indicators such as total loans and advances, liquidity ratio, and capital adequacy ratio on the profitability of microfinance banks in Nigeria.

Research Questions

This study will attempt to answer the following research question in light of the literature gaps identified:

What is the effect of total loans and advances, liquidity ratio and capital adequacy ratio on the profitability of MFBs in Nigeria?

1.4 Research Hypotheses

Based on the stated research question, the following hypotheses are posited in their null form for this study.

H_{01}: Total loans & advances have no significant effect on the profitability of MFBs in Nigeria.

H_{02}: Liquidity ratio have no significant effect on the profitability of MFBs in Nigeria.

H_{03}: Capital adequacy ratio have no significant effect on the profitability of MFBs in Nigeria.

LITERATURE REVIEW AND IMPLICATIONS FOR RESEARCH

Concept of microfinance

Microfinance is acknowledged as an effective mechanism for empowering impoverished populations and alleviating global poverty (Ahlin, Lin & Maio, 2011; Yunus, 2007). MFB's provides financial services to self-employed individuals, micro-businesses, and informal groups that are excluded from traditional finance due to low income (Armendáriz & Morduch, 2010; Cull et al., 2011).

Microfinance was introduced to promote inclusive access to affordable credit (Labie et al., 2013) and specifically targets low-income earners (Ndanitsa, et al., 2011) with the objective of enhancing their socioeconomic status (Nwigwe et al., 2012). It offers capital to economically active individuals in deprivation through low-interest, collateral-free loans (Taha, 2010; Ahmed & Saif, 2013; Akram & Routray, 2013). It serves as a developmental tool by providing savings, credit, payments (Ayertey, 2008), micro-insurance, and money transfers (Khandker et al., 2016) to low-income households and micro-businesses (Appah et al., 2012; Ashamu, 2014). This is

essential in developing nations where the impoverished lack collateral for formal credit (Roberts, 2013; Mujahid et al., 2015; Hadi & Kamaluddin, 2015).

Overview of Microfinance and its Institution in Nigeria

Microfinance in Nigeria has emerged as a pivotal instrument for enhancing the economic circumstances of marginalised groups, particularly those who are overlooked by conventional banking systems. The Central Bank of Nigeria's 2005 Microfinance Policy played a pivotal role in institutionalising its growth, aiming to enhance financial inclusion and empower those who are economically active yet poor (Alaro & Alalubosa, 2019). Nonetheless, outreach continues to be restricted, with merely a small portion of the estimated 60 million Nigerians in need of microfinance services actually receiving them (Godfrey, 2022).

Microfinance banks (MFBs) are essential in gathering savings and providing financing for SMEs, particularly important considering that approximately 70% of Nigeria's workforce is engaged in the informal sector (Ayodeji & Ogundipe, 2021). The significance of these factors has increased in the aftermath of the COVID-19 recovery period, as microcredit aids small producers in re-establishing their roles within the economy (Ozoji & Beatrice, 2024; Roseline, 2022).

Capital adequacy is essential for the sustainability of MFBs, providing resilience against shocks and facilitating efficient operations (David & Afolabi, 2023; Aliyu et al., 2024). Research indicates that capital adequacy, operational efficiency, and credit risk play a crucial role in performance (David & Afolabi, 2023). Nonetheless, obstacles like elevated interest rates, insufficient regulation, and governance shortcomings impede effectiveness (Bello, 2019; Enyia & Inyang, 2018; Ibrahim & Muhammad, 2023). While, MFBs play a crucial role in promoting financial inclusion and development, it is vital to enhance their capitalisation, governance, and regulatory oversight to ensure their sustainability in the long run.

The Concept of Capital Adequacy

Bank capital, comprising paid-up share capital and reserves, underpins the stability, solvency, and public trust in banking operations. Although higher capital levels may reduce equity returns, regulators consider it a safeguard to absorb potential losses before depositors are affected. Capital is broadly categorised into regulatory capital—mandated by authorities to ensure systemic stability—and economic capital, determined internally by banks to mitigate risk exposures (Molyneux, Casu & Girardone, 2006).

The Basel Accords advocate maintaining adequate capital aligned with risk exposure. In Nigeria, the Central Bank (CBN) mandates that bank boards and management oversee capital adequacy frameworks and operational risk (CBN, 2004). This includes planning for loss events, evaluating risks from new activities, and maintaining regulatory compliance (Molyneux et al., 2014).

Due to systemic weaknesses and macroeconomic instability, the Nigerian banking sector has undergone significant reforms (Kama, 2006). The 2005 recapitalisation initiative required banks to raise ₦25 billion to enhance financial strength and operational efficiency (Essien, 2012). Despite these efforts, undercapitalisation, governance failures, and weak risk management persist (Oladejo & Oladipupo, 2011). Adequate capital acts as a financial shield against losses and supports continued operation (Raghavan, 2004).

Capital adequacy is crucial for measuring financial soundness, maintaining depositor confidence, and sustaining liquidity (Torbira & Zaagha, 2016). It influences lending capacity, profitability, and institutional resilience. Regulatory frameworks in Nigeria aim to foster stability and prevent failure, although reforms have yielded mixed outcomes (Ikpefan, 2013; Abdul, 2017).

Ultimately, capital adequacy refers to a bank's ability to cover risks, support growth, and withstand financial shocks (Wondifraw, 2015). It serves as a strategic tool for regulators and institutions to enhance transparency, financial intermediation, and long-term profitability (Marcussen, 2007).

Determinants of Capital Adequacy

Despite its relevance, the literature on capital adequacy in microfinance remains limited, with key studies by Tchuigoua (2016) and Soumaré et al. (2023). Determinants such as market power, institutional size, and operational self-sufficiency are identified as crucial (Tchuigoua, 2016). Soumaré et al., (2023) observed a negative relationship between business cycles and capital-to-asset ratios, indicating that capital adequacy varies across economic phases. This research aims to extend the discourse by investigating capital adequacy in Nigerian microfinance institutions (MFIs).

Loans and advances significantly influence capital adequacy through their impact on credit risk and financial stability (Armendariz & Morduch, 2010). A well-managed loan portfolio strengthens capital buffers, whereas poor credit quality threatens solvency (Bokhari et al., 2019; Afolabi, et al., 2023). Liquidity ratio and CAR (Capital Adequacy Ratio) are crucial in determining an MFI's financial strength. High liquidity improves compliance and operational stability (Christen et al., 2019), while CAR reflects a bank's ability to absorb losses (Amahalu et al.,

2017). Regulatory standards like Basel and CBN require robust capital to mitigate systemic risks (CBN, 2006; Armendariz & Morduch, 2010). Profitability, measured by ROA, is also a key determinant of capital adequacy, reflecting how efficiently assets are managed (Dissanayake, 2012; Muriu, 2011).

Sustainable performance of microfinance banks

The concepts of "sustainable performance" and "financial performance" are not clearly defined and are generally categorised within the broader context of corporate performance (Saliha & Abdessatar, 2011). Business performance indicates the results of strategic planning and implementation. The sustainable performance of Microfinance Banks (MFBs) denotes their ability to function independently of external funding, while consistently providing financial services and economic advantages (Duguma & Han, 2018). Their objective is to enhance client welfare while internally managing operational costs. Microfinance banks facilitate regional development and economic stability by transforming local savings into loans (Birchall & Simmons, 2013; Tuyishime et al., 2015). This study utilises loan performance as a critical indicator of microfinance bank sustainability.

Microfinance banks in developing countries frequently experience inadequate loan portfolios. Collateral is essential (Klomp, 2018; Ssekiziyivu et al., 2017; Samba, 2017), and the quality of loans indicates institutional risk (Addai & Pu, 2015). A robust loan portfolio indicates low default rates and a limited number of non-performing assets (Michael et al., 2015). Subpar loan quality diminishes efficiency and income as a result of increasing losses (Peek & Rosengren, 1995; Mehran & Thakor, 2011; Floro, 2010), thereby rendering loan performance essential for evaluating the sustainability of microfinance.

Hypotheses Development

Capital Adequacy ratio as a measure of profitability

Capital adequacy ratio (CAR) has been widely examined as a determinant of profitability in microfinance institutions. Tosin and Otonne (2019) assert that improved CAR enhances profit levels in both commercial and microfinance banks, suggesting that strengthened capital positions benefit microfinance institutions' profitability. Supporting this, Teshome et al. (2018) found a statistically significant positive relationship between CAR and bank performance, while Amene and Alemu (2019) confirmed that higher CAR contributes to increased profitability. Collectively, these studies reinforce the proposition that a strong capital base positively influences profitability in microfinance banks. Therefore, this study will assess CAR as a key

indicator of profitability in Nigeria microfinance banks and propose the hypothesis that higher CAR leads to improved financial performance.

H_{01}: Capital adequacy ratio have no effect on microfinance Banks' profitability.

Liquidity ratio as a measure of profitability

Research shows that liquidity ratios positively influence the profitability of banks. Alali (2019) found that sufficient liquidity enhances profitability through credit provision, while Pokharel (2019) highlighted the role of effective liquidity management. This study evaluates liquidity ratio as a measure of profitability in Nigeria microfinance banks and proposes a hypothesis linking higher liquidity to improved performance.

H_{02}: Liquidity ratio have no effect on microfinance Banks profitability.

Total loans & advances as a measure of profitability

The profitability of microfinance institutions is closely linked to loans and advances, which serve as major investment channels. Nawai and Shariff (2010) identified strong returns on capital from such investments, while Babarinde (2022) confirmed their significant economic impact. Similarly, Nemati et al. (2021) and Kofarmata and Danlami (2020) found that increased credit supply enhances profitability. However, Ghalib (2017) cautioned that greater lending raises risk exposure, highlighting the need for prudent loan management. Therefore, this study examines total loans and advances as a key measure of profitability in Nigerian microfinance banks and proposes a hypothesis based on this relationship.

H_{03}: Total loans and advances have no effect on microfinance Banks' profitability.

Empirical Review

Empirical studies have explored the link between capital adequacy and microfinance bank profitability. Tosin and Otonne (2019) found that capital adequacy significantly influences profit levels in both commercial and microfinance banks in Nigeria, suggesting improved capital adequacy enhances profitability.

Dembel (2020) also confirmed a positive relationship between capital adequacy and financial performance in Ethiopian commercial banks. Similar findings in India suggest that higher capital adequacy can improve profitability. Collectively, these studies provide strong empirical support that increased capital adequacy ratios positively impact the profitability of microfinance institutions.

Theoretical Framework and capital adequacy model on the profitability of MFBs

Capital Buffer Theory

This study adopts the capital buffer theory to understand the profitability of microfinance banks (MFBs) in Nigeria. Capital adequacy is essential for MFBs' sustainable performance, influencing profitability, credit risk management, and operational efficiency (Okoye & Siwale, 2017). The capital buffer theory posits that banks should maintain capital above regulatory minimums to absorb financial shocks (Jokipii & Milne, 2011; Hessou & Lai, 2021).

Dewatripont and Tirole (1994) assert that capital buffers mitigate risks, especially during financial crises. Higher buffers enhance stakeholder confidence and address agency problems (Demirguc-Kunt et al., 2013). Empirical studies (Berger & Bouwman, 2009; Anisa & Sutrisno, 2020) show that improved buffers can increase profitability, though some findings (Jokipii & Milne, 2008) suggest counter-cyclicality. The theoretical model is expressed as:

$$\textit{Profitability} = \alpha + \beta_1(TLA) + \beta_2(LR) + \beta_3(CAR) + \varepsilon$$

This model links profitability (ROA) to Total Loans & Advances, Liquidity Ratio, and Capital Adequacy Ratio. It serves as a framework to assess how capital buffers influence MFB performance and guide regulatory policy.

RESEARCH METHODOLOGY

Research Approach and Design

This study adopts a quantitative research approach, collecting numerical data to enhance generalisability and reliability in hypothesis testing (Henn et al., 2009). The quantitative design supports correlation analysis between variables to explain the broader population. A longitudinal design was employed, enabling the observation of trends and cause-effect relationships in the financial performance of microfinance banks (MFBs) over the period 2011–2021 (Patten, M.L., 2016).

The research population comprises licensed microfinance banks in Nigeria's North Central region, which includes states such as Benue, Kogi, Kwara, Nasarawa, Niger, Plateau, and the Federal Capital Territory (FCT), Abuja. Only MFBs with at least 10 years of operation as of December 2021 were considered to ensure data reliability and minimise distortions caused by global financial disruptions. According to the Central Bank of Nigeria (CBN, 2022), 155 of Nigeria's 866 licensed MFBs operated in this region, representing 18% of the national total, with Abuja alone accounting for 32% (51 MFBs).

Table 1. Nigeria Microfinance Market Share by Ownership Tier (2021)

Category	Nigeria: Total Assets (%)	NC + FCT: Total Assets (%)	Nigeria: Deposits (%)	NC + FCT: Deposits (%)
National MFBs	31.22	59.15	38.52	52.10
State MFBs	25.11	13.50	21.28	18.70
Units (Tier 1 & 2)	43.67	27.35	40.20	29.20

Source: CBN (2022)

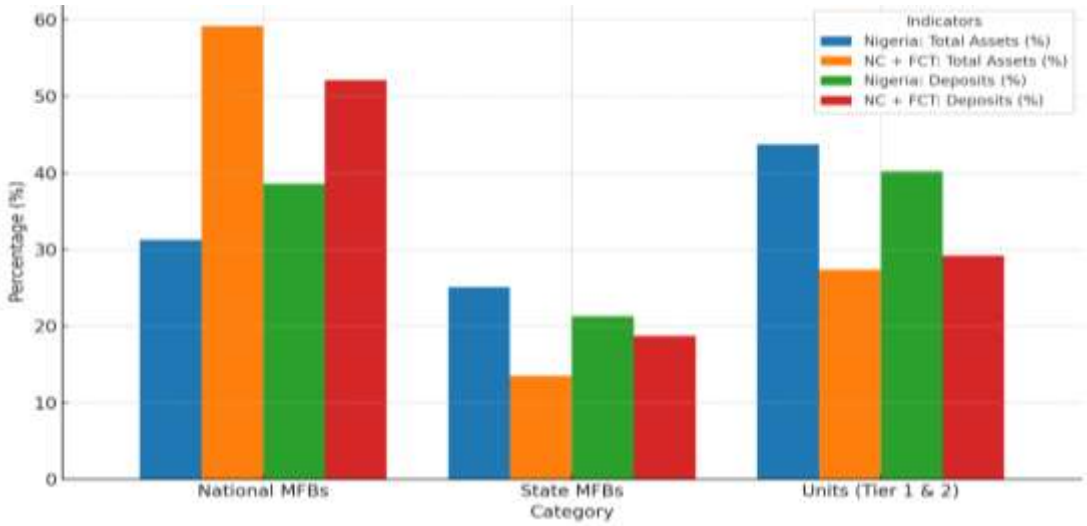

Figure 1. Nigeria Microfinance Banks: Distribution of Total Assets and Deposits (%)

Source: *CBN Financial Stability Report, 2022*

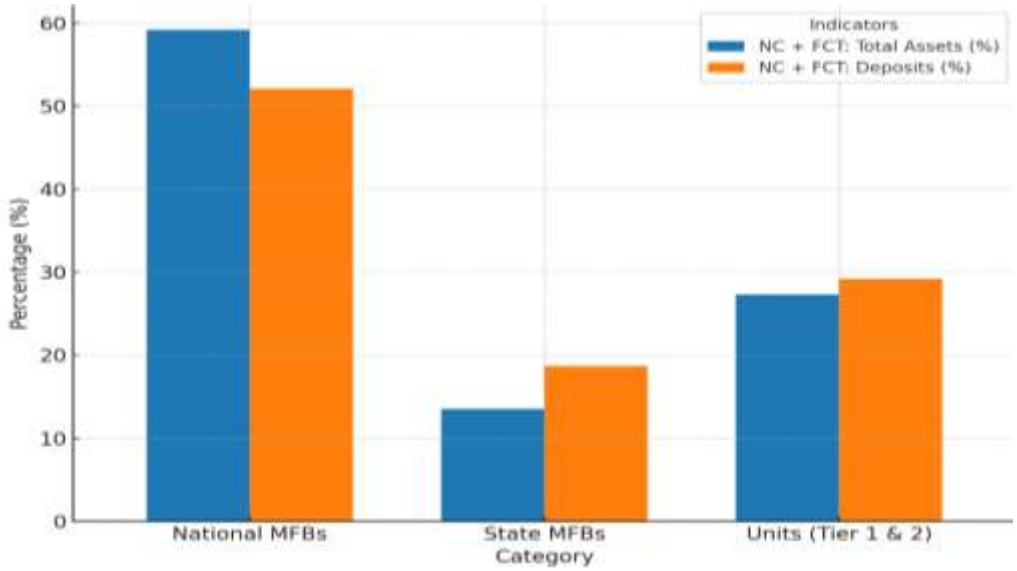

Figure 2. NC + FCT: Distribution of Total Assets and Deposits (%)

Source: *CBN Financial Stability Report, 2022*

The sample includes 451 panel observations from 41 microfinance banks, with data drawn from audited financial statements spanning 2011–2021. The research examines the period from 2011 to 2021 to maintain data integrity by excluding distortions caused by systemic shocks, including the 2007–2009 global financial crisis, the 2008–2009 UK credit crunch, and ensuing regulatory reforms (Laeven et al., 2010; Ashamu & Abiola, 2012; CBN, 2011). Data post-2021 were omitted to avoid contamination from the COVID-19 epidemic, the Russia–Ukraine conflict, and the worldwide inflation increase, which significantly transformed financial conditions (Inegbedion, 2021; World Bank, 2022; IMF, 2022). This period encapsulates relative regulatory and macroeconomic stability, enabling performance metrics to mirror structural determinants rather than exceptional disturbances (Baltagi, 2008).

Descriptive statistics and inferential econometric tests, including the Hausman test and stationarity tests, were conducted to assess model suitability and data properties. The estimation strategy involved panel regression techniques using Pooled OLS, Fixed Effects (FE), and Random Effects (RE) models.

Model Specification

To evaluate the impact of capital adequacy on sustainable performance, a dynamic panel data model was specified, incorporating lagged dependent variables to account for temporal dependencies. The baseline model is expressed as:

$$Y_{it} = \alpha + \sum_{k=1}^{j} j\beta_k X_{kit} + u_{it}; \quad k = 1,..., j.....(1)$$

Where:

Y_{it} : the dependent variable representing the sustainable performance of a microfinance bank.

X_{kit} : Explanatory variables (financial determinants) that potentially influence Y_{it}

α : Intercept term.

β_k : Coefficients representing the impact of each explanatory variable on the dependent variable.

u_{it} : Composite error term.

i: Cross-sectional dimension, representing individual observations such as different firms, countries, or groups.

t: Time dimension, capturing the temporal aspect of the data.

Components of the model

- The financial performance of a microfinance bank, denoted by Y_{it}, is considered the dependent variable that reflects the bank's sustainable performance over time.
- The determinants of this performance, represented by X_{it}, are a set of explanatory variables that include financial variables like return on assets, total loans and advances, liquidity ratio, and capital adequacy ratio.

Error Term Decomposition:

- The composite error term u_{it} captures all unobserved factors that affect the dependent variable, Y_{it}. This error term can be decomposed into specific components to account for unobserved effects that vary across different dimensions. The decomposition of u_{it} can be represented in two forms:

One-Way Error Component Model:

- When the model includes only one set of specific effects (either individual-specific or time-specific), it is referred to as a one-way error component model:
  - **Individual-Specific Effects:** $u_{it} = \theta_t + \varepsilon_{it}$
    - Here, θ_t represents the unobserved individual-specific effects (e.g., characteristics unique to each microfinance bank, such as management style or regional factors) that do not change over time.
    - ε_{it} is the remainder disturbance term that varies over both individuals and time, capturing random noise or unobserved influences that are not accounted for by the model.
  - **Time-Specific Effects:** $u_{it} = \theta_t + \varepsilon_{it}$
    - Here, θ_t represents the unobserved time-specific effects (e.g., macroeconomic shocks, regulatory changes, or market conditions affecting all banks at a specific time) that do not vary across individuals but change over time.

Two-Way Error Component Model:

- When both individual-specific and time-specific effects are included, the model is referred to as a two-way error component model:

$$u_{it} = \vartheta_i + \theta_t + \varepsilon_{it}$$

- This decomposition accounts for both dimensions:
    - **Individual-Specific Effects** (ϑ_i): Capturing factors that vary across entities (e.g., different banks) but remain constant over time.
    - **Time-Specific Effects** (θ_t): Capturing factors that are common to all entities at a given time but vary across time periods.
    - **Error Term** (ε_{it}): The remainder disturbance term that represents other random influences.

Equations (2) and (3) show decomposition of u_{it} into one way and two-way error components.

$$u_{it} = \vartheta_i + \varepsilon_{it} \text{.....(2)}$$

$$u_{it} = \theta_t + \varepsilon_{it}$$

$$u_{it} = \vartheta_i + \theta_t + \varepsilon_{it} \text{.....(3)}$$

Where, φ_i and $\emptyset_t$ denote the unobserved individual and time-specific effects respectively. The study will limit the empirical applications to a one-way error component. This means the analysis will focus on either the individual-specific effects (ϑ_i) or the time-specific effects (θ_t), but not both. By choosing a one-way error component model, the study simplifies the analysis by considering either the unique characteristics of each microfinance bank or the common factors affecting all banks over time, depending on the research objective. The focus on a one-way error component model offers flexibility in empirical applications, thereby allowing the author to tailor the analysis to the specific characteristics or temporal dynamics relevant to their study.

Estimation Techniques and Diagnostics

Both Fixed Effect (FE) and Random Effect (RE) models were estimated. The FE model addresses unobserved heterogeneity by allowing intercepts to vary across MFBs. Estimation techniques include Within Transformation (De-meaning), First Difference (FD) Estimation, and Least Squares Dummy Variable (LSDV).

Variable Description and Measurement

All variables were derived from secondary data in MFBs' financial statements (Bateni, et al., 2014; Kayode et al., 2015; Otieno et al., 2016; Afolabi et al., 2020). Key variables included:

• Dependent Variable:
  - Return on Assets (ROA) – a measure of MFB sustainability

• Independent Variables:
  - Total Loan Advances (TLA)
  - Liquidity Ratio (LR)
  - Capital Adequacy Ratio (CAR).

Descriptive statistics (mean, standard deviation) and correlation matrices supported the pre-estimation diagnostics. Unit root tests (e.g., Levin-Lin-Chu) ensured stationarity of the data series. The combination of these techniques ensured the robustness of the findings and the reliability of inferences drawn from the econometric model.

Control Variables

In addition to capital adequacy, various institutional characteristics can substantially affect the performance of microfinance banks (MFBs). This study introduces three control variables: average loan size, firm size, and firm age, to address potential heterogeneity among banks. The econometric model is expressed as;

$$ROA_{it} = \beta_0 + \beta_1 TLA_{it} + \beta_2 LR_{it} + \beta_3 CAR_{it} + \beta_4 ALS_{it} + \beta_5 FSZ_{it} + \beta_6 FAG_{it} + \mu_{it} + \lambda_{it} + \varepsilon_{it} \text{.....(4)}$$

Where:

ROA_{it} = Return on assets of bank *i* at time *t*

TLA_{it} = Total loan and advances of bank *i* at time *t*

LR_{it} = Liquidity ratio of bank *i* at time *t*

CAR_{it} = Capital adequacy ratio of bank *i* at time *t*

ALS_{it} = Average lone size

FSZ_{it} = Firm size

FAG_{it} = Firm Age

μ_{it} = Unobserved bank specific effect

λ_{it} = Time specific effect to capture the macroeconomic shock

ε_{it} = Error term

Average Loan Size

The average loan size serves as an indicator of outreach and lending strategy. Increased average loans may indicate a shift towards affluent consumers (mission drift), perhaps boosting short-term profitability while jeopardising social viability. In contrast, smaller loans generally indicate a greater dedication to assisting the impoverished, however they may elevate administrative expenses and default dangers (Cull, Demirgüç-Kunt & Morduch, 2018; Cull, Demirgüç-Kunt, & Morduch, 2009; Sangwan, & Nayak, 2021). In Nigeria, where microfinance aims to reduce poverty and boost MSMEs, the average loan size elucidates the equilibrium between financial sustainability and developmental objectives.

Firm Size

Firm size, represented by the natural logarithm of total assets, reflects economies of scale and diversification effects. Larger MFBs demonstrate greater resilience, enhanced access to capital markets, and the ability to distribute operational risks across a wider client base (Olowa et al., 2021; Wijesiri, et al., 2017; Kivaya, et al., 2020). Regulatory forbearance and reputational advantages may facilitate sustained performance during periods of macroeconomic stress. In contrast, smaller MFBs generally depend on short-term and frequently costlier funding, which may limit their sustainable performance over time.

Firm Age

The age of a firm signifies its expertise, institutional knowledge, and market reputation. Established MFBs frequently cultivate enhanced social capital and client loyalty, hence augmenting loan recovery and operational effectiveness. They are also more inclined to possess sophisticated internal control systems and risk management frameworks, hence improving sustainability (Adusei, 2022; Wijesiri, et al., 2017). Nevertheless, certain studies indicate that established companies may have bureaucratic lethargy or diminishing creativity, potentially hindering performance if not adeptly handled. In Nigeria, where regulatory enforcement has risen in recent years, the durability of a microfinance bank (MFB) may reflect its capacity to adjust to evolving capital adequacy standards and competitive challenges.

By incorporating these control variables, the study offers a more refined comprehension of the factors influencing sustainable performance in Nigerian MFBs. Although capital sufficiency is the primary variable, incorporating average loan size, firm size, and firm age guarantees that the model encompasses both structural and institutional processes influencing bank sustainability.

RESULTS

Descriptive Statistics

Table 2. Descriptive Summary

Variable	Obs	Mean	Std.Dev	Min	Max
Return on Assets	451	.4395001	.3206867	-.0709	.92039
Total Loan Advances	451	.0484627	.0693753	-.2595	.1838
Capital Adequacy Ratio	451	.3753224	.2185813	.00075	.7734905
Liquidity Ratio	451	.0761072	.0456783	.00069	.1569952
Average Laon	451	273737	133393.6	50504.05	499873
Firm Size	451	55.17521	26.1332	5.540265	99.77157
Firm Age	451	17.61197	7.083172	10	44

Table 2 presents the descriptive statistics of the study variables for 451 bank–year observations of Nigerian microfinance banks. The average ROA of 43.95% reflects a robust performance, whereas the negative minimum of -0.0709 indicates a degree of volatility among the banks. The CAR stands at 37.53%, indicating robust capitalisation accompanied by significant variability. TLA stands at a modest 4.85%, indicative of a careful approach to lending practices. LR has an average of 7.61%, while AL stands at ₦273,737, exhibiting significant variability. FS averages 55.18, and FA has an average of 17.61 years, indicating a diverse sample.

Correlation Analysis

Table 3. Correlation

	TLA	ROA	CAR	LR	AL	FS	FA
TLA	1						
ROA	0.1848	1					
CAR	-0.0134	-0.0994	1				
LR	0.0141	-0.0991	0.0363	1			
AL	-0.0321	0.0753	0.0869	-0.0587	1		
FS	0.0522	-0.0048	-0.0274	0.0459	0.0472	1	
FA	-0.0445	-0.0303	0.0678	0.0132	0.0682	0.0892	1

ROA = Return on assets, TLA = Total loan advances, CAR = Capital adequacy ratio, LR = Liquidity ratio, AL = Average loan, FS = Firm size and FA = Firm age.

The correlation analysis reveals a positive relationship between TLA and ROA (r = 0.1848), whereas CAR and LR exhibit weak negative correlations with ROA. FS and FA exhibit

minimal correlations with performance and other variables, indicating low multicollinearity concerns.

Stationarity Test

Table 4. Stationarity Test

	Level Stage (0)	Comment
TLA	-6.6027 (0.000)	Stationary at the level stage
ROA	-10.3141 (0.000)	Stationary at the level stage
CAR	-12.6883 (0.000)	Stationary at the level stage
LR	-14.0852 (0.000)	Stationary at the level stage
AL	-10.9449 (0.000)	Stationary at the level stage
FS	-9.1079 (0.000)	Stationary at the level stage
FA	-7.0932 (0.000)	Stationary at the level stage

ROA = Return on assets, TLA = Total loan advances, CAR = Capital adequacy ratio, LR = Liquidity ratio, AL = Average loan, FS = Firm size and FA = Firm age.

Before estimating the regression model, a unit root test was conducted to evaluate the stationarity of the study variables. The results of the Augmented Dickey–Fuller (ADF) test at level show that Total Loan Advances (TLA), Return on Assets (ROA), Capital Adequacy Ratio (CAR), Liquidity Ratio (LR), Average Loan Size (AL), Firm Size (FS), and Firm Age (FA) are all significant at the 1% level ($p = 0.000$).

The substantial negative test statistics, with values of –6.6027 for TLA, –10.3141 for ROA, and –12.6883 for CAR, surpass critical thresholds, leading to the rejection of the null hypothesis of a unit root for all variables. This indicates that the series exhibit stationarity at the level, characterised by a constant mean and variance.

The results suggest that differencing is not required, allowing for the retention of long-term information within the data and guaranteeing that regression estimates remain valid.

This study emphasises the importance of stationarity in CAR and ROA, affirming that their relationship accurately represents genuine economic connections within Nigerian microfinance banks.

Endogeneity Test (Theoretical Assumptions)

Endogeneity in econometric models, especially concerning Return on Assets (ROA) and variables like Total Loans and Advances (TLA), Liquidity Ratio (LR), and Capital Adequacy

Ratio (CAR), presents significant challenges in financial econometrics. This occurs when explanatory variables are correlated with error terms, resulting in biassed and inconsistent estimates, particularly due to the reciprocal nature of financial interactions.

A crucial factor is simultaneity: ROA may be influenced by TLA, LR, and CAR, although these indicators can also be affected by ROA. Yao et al. (2018) identify these problems and advocate for the use of lagged factors to reduce bias. Quayes and Hasan (2014) employed three-stage least squares to examine this issue in microfinance, whereas Setiawan and Muchtar (2021) shown that elevated loan ratios may diminish CAR due to credit risk. GMM methodologies are extensively advocated for such difficulties (Rahim et al., 2015; Karmakar & Mok, 2015). Liquidity affects lending capacity and Capital Adequacy Ratio (CAR) (Dao & Nguyen, 2024), while ownership arrangements (Watkins-Fassler, 2018) and financial literacy cycles (Lusardi & Mitchell, 2014) add complexity to these interactions.

Consequently, neglecting endogeneity may lead to erroneous findings. The utilisation of lagged or instrumental variables using GMM yields dependable estimations, rendering this methodology essential for Nigerian microfinance banks (Ozili & Arun, 2023).

Panel Regression Results

Table 5. Panel Regression (Without Control Variable)

	Fixed Effect Model				**Random Effect Model**			
Variables	Coefficient (β)	St. Error	t-Statistic	P-value	Coefficient (β)	St. Error	t-Statistic	P-value
TLA	.048635	.0125377	3.88	0.000 *	.040016	.0099583	4.02	0.000 *
CAR	-.0319381	.0157862	-2.02	0.044 *	-0.0296172	.0146183	-2.03	0.043 *
LR	-.1662335	.0766486	-2.17	0.031 *	-.1492824	.00699525	-2.13	0.033 *
Constant β_0	.0517263	.0106246	4.87	0.000 *	.0533532	.0092536	5.77	0.000 *
F (3, 407)		8.63				25.11		
Prob >F		.0000				.0000		

Hausman Test

Test Summary	Chi-Square	Prob
Cross Section	2.42	0.4898

ROA = Return on assets, TLA = Total loan advances, CAR = Capital adequacy ratio, LR = Liquidity ratio, AL = Average loan, FS = Firm size and FA = Firm age.

Table 5 displays the panel regression outcomes (without control variables) regarding the relationship between capital adequacy and the sustainable performance of Nigerian

microfinance banks, assessed through Fixed Effect (FEM) and Random Effect Models (REM) without any controls.

In the FEM, Total Loan Advances (TLA) exhibit a positive and statistically significant relationship (β = 0.0486, p < 0.01), indicating that an increase of one unit in lending correlates with an approximate 4.86% rise in ROA. The REM validates this outcome (β = 0.0400, p < 0.01), highlighting the significance of lending as a primary factor influencing profitability, contingent upon effective management of credit risk.

The Capital Adequacy Ratio (CAR) exhibits a negative and significant impact in both models (FEM: β = –0.0319; REM: β = –0.0296), indicating that an excess of capital constrains returns by restricting income-generating opportunities. In a similar vein, the Liquidity Ratio (LR) has a negative impact on ROA (FEM: β = –0.1662; REM: β = –0.1493), suggesting that elevated liquidity limits lending capacity.

Both models demonstrate statistical significance, and the results of the Hausman test (χ^2 = 2.42, p = 0.4898) indicate a preference for the Random Effects Model. Lending contributes positively to performance, whereas increased capital and liquidity requirements limit returns, indicating a balance between stability and profitability.

Table 6. Panel Regression (With Control Variable)

	Fixed Effect Model				**Random Effect Model**			
Variables	Coefficient (β)	St. Error	t-Statistic	P-value	Coefficient (β)	St. Error	t-Statistic	P-value
TLA	.0491011	.0125779	3.90	0.000 *	.0405765	.0099807	4.07	0.000 *
CAR	-.0355618	.0158247	-2.25	0.025 *	-0.0318041	.0147045	-2.16	0.031 *
LR	-.1580349	.0766669	-2.06	0.040 *	-.13978	.0701269	-1.99	0.046 *
AL	5.99E-08	2.60e-08	2.30	0.022 *	4.50e-08	2.41e-08	1.87	0.062
FS	-.000563	.0001335	-0.42	0.673	-.0000412	.0001231	-0.33	0.738
FA	-.000894	.0025485	-0.35	0.726	-.0001807	.0004547	-0.40	0.691
Constant β_0	.0547066	.0452395	1.21	0.227	.0463324	.01456	3.18	0.001 *
F (6, 404)		5.25				28.79		
Prob >F		.0000				.0001		

Hausman Test

Test Summary	Chi-Square	Prob
Cross Section	3.08	0.6874

ROA = Return on assets, TLA = Total loan advances, CAR = Capital adequacy ratio, LR = Liquidity ratio, AL = Average loan, FS = Firm size and FA = Firm age.

Table 6 displays the dynamic panel data outcomes (with control variables) utilising two-step system GMM, incorporating control variables—Average Loan Size, Firm Size, and Firm Age—to mitigate endogeneity and reflect the dynamic characteristics of bank performance via the lagged dependent variable (ROA.L1).

ROA.L1 is both positive and significant ($\beta = 0.1675$, $p < 0.01$), indicating performance persistence; prior profitability significantly affects current results, highlighting the importance of institutional reputation and operational stability.

Total Loan Advances (TLA) are positive and statistically significant ($\beta = 0.0509$, $p < 0.01$), underscoring lending intensity as the primary determinant of profitability. The Liquidity Ratio (LR) and Capital Adequacy Ratio (CAR) exhibit negative yet insignificant impacts, indicating that their restrictive influence diminishes upon the inclusion of controls.

The Average Loan Size, Firm Size, and Firm Age are inconsequential; however, their incorporation mitigates omitted variable bias. The model demonstrates general robustness ($F = 93.35$, $p < 0.01$), with diagnostic assessments validating its efficacy.

The data confirm that lending is the most reliable factor influencing sustainable success, but capital and liquidity buffers diminish in value, underscoring the necessity of long-term strategic management.

Table 7. Diagnostic Test

Breusch–Pagan/Cook–Weisberg test for heteroskedasticity		
Chi (1)	0.06	
Prob >chi2	0.8017	
Variance Inflation Factor (VIF)		1/VIF
FA	1.02	0.981458
AL	1.02	0.981523
FS	1.02	0.983399
CAR	1.01	0.985408
LR	1.01	0.992097
TLA	1.01	0.993710

ROA = Return on assets, TLA = Total loan advances, CAR = Capital adequacy ratio, LR = Liquidity ratio, AL = Average loan, FS = Firm size and FA = Firm age

To confirm the integrity of the regression results, post-estimation diagnostics were performed. The Breusch–Pagan/Cook–Weisberg test ($\chi^2 = 0.06$, $p = 0.8017$) demonstrated the

absence of heteroskedasticity, affirming continuous error variance and dependable standard errors.

Multicollinearity was evaluated by the Variance Inflation Factor (VIF), yielding values between 1.01 and 1.02 and tolerances ranging from 0.981 to 0.994, much below critical thresholds. This indicates the absence of troublesome intercorrelations among the explanatory variables.

The diagnostic tests verify that the panel regression models are devoid of heteroskedasticity and multicollinearity, hence enhancing the stability and interpretability of the computed coefficients.

Table 8. Dynamic Panel Data Estimation, two step system GMM (Without control variable)

Roa	Coefficient	t-stat	P>|t|	AR (1)	AR (2)	Sargan Test	Hansen Test
Roa.L1	.1681718	13.92	0.000 *	-3.89 [0.000]	0.97 [0.330]	1.55 [213] *	4.60 [0.204]
TLA	.0517759	10.36	0.000 *				
LR	-.184853	-3.02	0.003 *				
CAR	-.0277701	-2.22	0.027 *				
Constant	.0397654	-5.52	0.000 *				
F (6,40)	3510.17						
Prob > F	0.000						

Table 8 presents the findings from the dynamic panel estimation (without control variable) conducted with the two-step system GMM, excluding control variables. This method tackles endogeneity, unobserved heterogeneity, and dynamic effects by incorporating the lagged dependent variable (ROA.L1).

ROA.L1 is positive and highly significant ($\beta = 0.1682$, $p < 0.01$), indicating a strong persistence in performance—previous profitability has a substantial impact on current results, highlighting the necessity to maintain operational momentum in Nigerian microfinance banks.

Total Loan Advances (TLA) continue to show a positive and statistically significant relationship ($\beta = 0.0518$, $p < 0.01$), underscoring the importance of lending as a crucial factor influencing returns. In contrast, the Liquidity Ratio (LR: $\beta = –0.1849$, $p < 0.01$) and the Capital Adequacy Ratio (CAR: $\beta = –0.0278$, $p < 0.05$) demonstrate significant negative impacts, indicating that surplus liquidity and capital reserves limit profitability by diminishing income-generating activities.

The model demonstrates a robust fit (F = 3510.17, p < 0.01), with diagnostics affirming its validity: AR(1) is significant, AR(2) is not significant, and both Sargan and Hansen tests indicate instrument reliability.

Overall, the findings emphasise that the expansion of loans promotes sustainability, whereas prudential cushions tend to suppress returns, with profitability exhibiting a significant path dependency.

Diagnostics: AR(1) –3.89 [0.000], AR(2) 0.97 [0.330], Sargan χ^2 = 1.55 [0.213], Hansen χ^2 = 4.60 [0.204]. Results indicate performance persistence (ROA.L1) and positive TLA impact; CAR and LR negatively affect ROA.

Table 9. Dynamic Panel Data Estimation, two step system GMM (With control variable)

Roa	Coefficient	t-stat	P>|t|	AR (1)	AR (2)	Sargan Test	Hansen Test
Roa.L1	.1674665	3.00	0.005	-3.67 [0.000]	0.95 [0.341]	2.21 [0.137] *	11.99 [0.062]
TLA	.050891	4.59	0.000				
LR	-.1856809	-1.52	0.136				
CAR	-.0306915	-1.28	0.208				
Average loan size	5.24e-08	1.26	0.216				
Firm size	-.0000549	-0.28	0.782				
Firm age	-.0002057	-0.52	0.603				
Constant	.0336163	1.72	0.093				
F (6,40)	93.35						
Prob > F	0.000						

Table 9 displays the dynamic panel estimation utilising two-step system GMM (with control variable), incorporating control variables such as Average Loan Size, Firm Size, and Firm Age. This approach addresses endogeneity while effectively capturing the dynamic characteristics of microfinance bank performance through the inclusion of the lagged dependent variable (ROA.L1).

ROA.L1 demonstrates a positive and significant relationship (β = 0.1675, p < 0.01), affirming the concept of performance persistence while underscoring the importance of institutional reputation and operational stability in maintaining profitability.

Total Loan Advances (TLA) continue to show a positive and highly significant correlation (β = 0.0509, p < 0.01), underscoring the role of lending as the primary factor influencing returns.

Conversely, the Liquidity Ratio (LR) and Capital Adequacy Ratio (CAR) exhibit negative yet insignificant effects, indicating that their limiting impact lessens when controls are accounted for.

The average loan size, firm size, and firm age are also not statistically significant, yet they play a valuable role in mitigating omitted variable bias. The model demonstrates strong robustness overall ($F = 93.35$, $p < 0.01$), and diagnostic tests validate the instrument's effectiveness.

The findings clearly indicate that lending serves as the primary catalyst for sustainable performance, while the consistency of profitability highlights the importance of adopting long-term strategies.

Diagnostics: AR(1) –3.67 [0.000], AR(2) 0.95 [0.341], Sargan $\chi^2 = 2.21$ [0.137], Hansen $\chi^2 = 11.99$ [0.062]. Findings reaffirm TLA as a robust driver of ROA; CAR and LR effects become insignificant when controls are included.

DISCUSSION

Capital adequacy is essential for banks to function effectively, offering a safeguard against financial disruptions and liquidity strains. The findings from descriptive, static, and dynamic models underscore critical factors influencing sustainable performance in Nigerian microfinance banks (MFBs). Total Loan Advances (TLA) continuously exhibit a positive and significant correlation with Return on Assets (ROA), highlighting lending as the primary catalyst for profitability and sustainability. This corresponds with studies indicating that effectively administered lending to low-income households and microenterprises enhances returns while broadening outreach (Quayes, 2015; Olaiya et al., 2025). In Nigeria, where access to credit facilitates poverty alleviation and business expansion, the function of TLA exemplifies the equilibrium between financial and developmental goals. Conversely, the Capital Adequacy Ratio (CAR) adversely impacts ROA, although its significance diminishes upon the introduction of controls. Stronger capitalisation improves resilience but diminishes resources for income-generating activities, corroborating results that surplus capital protects institutions during crises while decreasing profitability in calm periods (Berger & Bouwman, 2013; Adusei, 2022; Ozili & Arun, 2023). The Liquidity Ratio (LR) is inversely related to ROA, aligning with Nguyen and Dao, (2022), who observe that substantial buffers enhance stability but limit lending capacity. Control factors provide supplementary insights. The Average Loan Size (AL) is pertinent in static models but not in dynamic contexts, indicating context-dependent effects: higher loans may enhance efficiency while risking mission drift (Cull et al., 2018; Hermes & Hudon, 2018). Firm

Size (FS) and Firm Age (FA) are continuously inconsequential, reinforcing the notion that efficiency and governance are more critical than scale or longevity (Adeniyi et al., 2025).

The continuity of ROA in GMM models underscores route dependency, wherein historical profitability influences present results via institutional trust and customer loyalty (Yao et al., 2018; Setiawan & Muchtar, 2021). Nigerian MFB success is mostly driven by credit, although prudential constraints constrain returns. Evidence advocates for appropriate, context-sensitive regulation—capital and liquidity buffers must safeguard stability without impeding lending—enabling MFBs to reconcile financial inclusion with sustainable profitability.

CONCLUSION

This study analysed the influence of total loans and advances (TLA), liquidity ratio (LR), and capital adequacy ratio (CAR) on the profitability of Nigerian microfinance banks (MFBs) with a two-step system GMM methodology. The findings indicate that TLA exerts a substantial beneficial influence on profitability, affirming that lending is the primary catalyst of MFB earnings. Conversely, LR and CAR are statistically negligible, indicating that excessive liquidity and conservative capital buffers do not directly improve performance.

These findings underscore that optimising loan portfolios is the most efficacious route to sustainable profitability. Diagnostic tests confirm the reliability of the estimates, showing no signs of serial correlation and utilising valid instruments.

This paper provides empirical evidence from Nigeria, contributing to microfinance literature and supporting the assertion that loan portfolio management is the principal determinant of profitability, whereas liquidity and capital adequacy have less influence. Policymakers should consequently advocate for judicious loan growth in conjunction with balanced liquidity and capital plans (Ozili & Arun, 2023).

RECOMMENDATIONS

1. **Enhance loan portfolio management** – Since total loans and advances have a significant positive effect on profitability, MFBs should focus on expanding well-managed lending activities, supported by rigorous credit appraisal and monitoring systems to minimise default risk.
2. **Avoid excessive liquidity holdings** – Although maintaining liquidity is necessary for operational stability, the results suggest that surplus liquid assets may dilute profitability. MFBs should aim to maintain an optimal liquidity ratio that meets regulatory and operational needs while maximising income generation.
3. **Optimise capital adequacy without over-capitalisation** – While capital adequacy is important for risk resilience, excessively high capital levels may limit funds available for lending.

Regulators and MFB management should strike a balance between maintaining sufficient capital buffers and using available resources for profitable investments.

4. **Regulatory guidance on efficiency thresholds** – The Central Bank of Nigeria and other regulatory agencies should provide clear industry benchmarks for optimal liquidity and capital adequacy levels that encourage profitability without compromising stability.

5. **Capacity building and financial innovation** – MFBs should invest in training for staff in risk-based lending and adopt digital financial services to reach more clients and improve operational efficiency.

CONTRIBUTION TO KNOWLEDGE

This study presents the first empirical data regarding the impact of capital adequacy on the performance of microfinance banks (MFBs) in Nigeria's North Central region from 2011 to 2021, a subject that has received limited scholarly attention. It demonstrates that capital adequacy metrics—specifically the capital adequacy ratio, liquidity ratio, and total loans and advances—are critical determinants of profitability and long-term sustainability. This study enriches the microfinance literature by linking regulatory capital standards to institutional resilience, providing actionable insights for policymakers and practitioners seeking to strengthen sector stability and foster broader economic development.

LIMITATIONS AND FUTURE RESEARCH

This study enhances understanding of capital sufficiency and sustainable performance in Nigerian microfinance banks (MFBs); however, certain limitations are evident. The analysis of 41 MFBs in the North Central region from 2011 to 2021 provides significant insights, yet limits the generalisability to the wider sector. Conducting extensive research across various geopolitical regions characterised by diverse socio-economic and regulatory environments would improve external validity.

The timeline excludes significant global disruptions, specifically the 2008–2009 financial crisis and the post-2021 COVID-19 era, which had a profound impact on the resilience and sustainability of financial institutions. Integrating these experiences into future studies would provide a more comprehensive perspective.

The study utilised solely quantitative analysis, overlooking qualitative factors such as governance and institutional culture; incorporating mixed-methods approaches could improve the findings. The absence of cross-country comparisons restricts contextual scope. Comparative analyses among Global South nations may reveal effective practices and inform Nigerian policy and implementation.

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