



Managerial Ownership and Bank Risk Taking: The Moderating Role of Capital Adequacy in Nigeria

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Abstract: Managerial ownership is widely regarded as a mechanism for aligning incentives and reducing bank risk-taking; however, its effectiveness remains uncertain within Nigeria's evolving regulatory environment. Existing empirical evidence provides mixed findings on whether managerial ownership mitigates or exacerbates risk, while limited attention has been given to the role of regulatory capital in shaping this relationship, particularly in emerging banking systems such as Nigeria. This study therefore examines the relationship between managerial ownership and bank risk-taking, with a specific focus on the moderating role of capital adequacy. The study adopts an ex post facto research design using panel data from fourteen Nigerian deposit money banks over the period 2009 - 2023. Data are obtained from audited annual reports and the World Development Indicators. A two way fixed effects model was employed as the preferred estimation technique. The findings revealed that Managerial ownership has a positive and statistically significant effect on bank stability leading to reduced taking and supporting the alignment hypothesis, although this effect becomes statistically insignificant in the lagged specification. There is no statistically significant evidence of a nonlinear relationship, while capital adequacy exerts a positive and statistically significant moderating effect on risk taking, highlighting the dominant role of regulatory capital in shaping bank risk-taking behaviour. The study concludes that managerial ownership has a significant stabilizing effect on bank risk-taking in the short term, while its effectiveness is strengthened under higher levels of capital adequacy. It is therefore recommended that regulators reinforce capital adequacy requirements alongside governance reforms to enhance the effectiveness of managerial ownership in promoting sustained bank stability.

Keywords: Managerial ownership, Bank risk taking, Capital adequacy, Z-score, Nigeria

INTRODUCTION

Banks play a central role in economic development by mobilizing savings, allocating credit, and facilitating financial intermediation, yet this function inherently exposes them to significant risk taking pressures. Nguyen (2022) argues that the intermediation role of banks makes risk taking unavoidable, as profitability depends on transforming short term liabilities into longer term, risk bearing assets. However, Degryse et al. (2025) [2] contend that excessive risk taking, particularly under weak oversight, can destabilize financial systems, as evidenced by repeated banking crises.

The implications of poorly managed bank risk taking extend beyond individual institutions to the broader economy Del Angel et al. (2024) show that bank failures constrain credit availability and weaken investment, thereby slowing economic growth. In contrast, Wu (2024) emphasizes that banking instability can trigger contagion through depositor

withdrawals and loss of confidence, even among otherwise solvent institutions. Siva (2025) further argues that such crises often necessitate costly government interventions, including bailouts and deposit insurance payouts, imposing significant fiscal burdens. Taken together, these arguments highlight that bank risk taking is not merely an internal managerial issue but a systemic concern that requires effective governance and regulatory oversight.

The governance of bank risk taking is closely linked to ownership structure, particularly the allocation of control rights between managers and shareholders. Jensen and Meckling (1976) argue that the separation of ownership and control creates incentives for managers to pursue private benefits, thereby increasing agency costs and potentially encouraging excessive risk taking. In contrast, Fama and Jensen (1983) suggest that governance mechanisms such as managerial equity participation can mitigate these conflicts by aligning incentives. However, Shleifer and Vishny (1997) caution that ownership concentration may introduce new agency problems, as controlling insiders may prioritize private benefits over firm value. These competing perspectives suggest that ownership structures can both mitigate and exacerbate agency conflicts, making their effect on bank risk taking inherently ambiguous.

Managerial ownership represents a key internal governance mechanism through which these dynamics operate. Jensen and Meckling (1976) argue that managerial equity participation aligns incentives and reduces opportunistic behavior by linking managerial wealth to firm performance. Consistent with this view, Furlong and Keeley (1989) show that higher managerial ownership increases managers' exposure to downside risk, thereby discouraging excessive risk taking. However, Morck et al. (1988) argue that beyond certain thresholds, increased managerial ownership may lead to entrenchment, weakening external monitoring and enabling riskier strategic choices. These opposing arguments suggest that managerial ownership may simultaneously act as both a disciplining and an entrenchment mechanism.

Empirical evidence reflects this theoretical thinking. Saunders et al. (1990) find that managerial ownership is associated with higher bank risk taking, suggesting that entrenched managers may exploit their control to increase risk exposure. In contrast, Anderson et al. (2024) show that when managerial wealth is closely tied to firm performance, managers tend to prioritize stability over risk. However, Bellardini (2024) demonstrates that managerial ownership can encourage risk taking in competitive banking environments where maximizing shareholder value dominates. These conflicting findings indicate that the effect of managerial ownership on bank risk taking is context dependent rather than uniform.

This ambiguity is particularly pronounced in emerging banking systems like Nigeria. Ozili and Uadiale (2017) show that ownership structures significantly influence bank risk taking in Nigeria, although the direction and magnitude of the effect vary across ownership types. In contrast, Musa et al. (2023) argue that managerial ownership improves governance outcomes by reducing opportunistic behavior such as earnings manipulation, suggesting an alignment effect. However, Obialor et al. (2024) report that managerial ownership may have weak or negative implications for firm performance, indicating potential inefficiencies associated with insider control. These mixed findings reinforce the argument that managerial ownership does not have a universally predictable effect on bank behavior, particularly in developing financial systems.

While prior studies focus on the direct relationship between managerial ownership and bank risk taking, less attention has been given to the regulatory conditions under which these governance mechanisms operate. Merton (1977) argues that capital structure shapes risk incentives, as higher leverage increases the benefits of risk shifting. In contrast, Keeley (1990) shows that stronger capital positions reduce risk taking by increasing the cost of financial distress and limiting moral hazard behavior. John et al. (2008) further argue that governance mechanisms and regulation are interdependent, implying that ownership effects cannot be fully understood without considering the regulatory environment. These perspectives suggest that capital adequacy may not only influence risk directly but also condition how managerial incentives translate into risk taking behavior.

Degryse et al. (2025) argue that governance mechanisms remain influential even within regulated environments, as managers adjust behavior within regulatory limits while Bavoso (2024) further suggests that weaknesses in capital regulation can amplify governance failures, allowing risk taking incentives to persist. These differing views indicate that capital adequacy interacts with internal governance mechanisms rather than acting as a standalone safeguard.

Despite these insights, existing studies largely examine managerial ownership and capital adequacy in isolation, leaving a critical gap in understanding the moderating effect of capital adequacy on managerial ownership on bank risk taking. Ozili and Uadiale (2017) do not consider how regulatory capital shapes ownership effects. Musa et al. (2023) focus on governance outcomes without linking them to risk taking or regulatory constraints. Obialor et al. (2024) examine ownership effects on performance but do not evaluate how capital adequacy conditions managerial incentives. This fragmented evidence suggests that the interaction between managerial ownership and capital adequacy remains underexplored.

This gap is particularly important in the Nigerian banking sector, where regulatory reforms and evolving governance structures create a relevant context for examining the interaction between ownership and risk. While existing studies provide evidence on ownership and governance outcomes, they do not explain how these effects are shaped by capital regulation or how they translate into risk taking behavior. Accordingly, the objective of this study is to examine the effect of managerial ownership on bank risk-taking in Nigeria, assess whether this relationship is nonlinear, and evaluate the moderating role of capital adequacy in the relationship between managerial ownership and bank risk-taking. The remainder of the study is structured as follows. Section 2 reviews the relevant literature. Section 3 outlines the data and methodology. Section 4 presents and discusses the empirical results. Section 5 concludes with policy implications.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Conceptual Review

Bank Risk-taking

Bank risk-taking is a core construct in banking theory because it links banks' incentives, capital structures, and governance mechanisms to financial stability and the wider economy. Acharya et al. (2021) argues that bank risk-taking determines the extent to which shocks are amplified into systemic crises, making it a central regulatory concern.

Conceptually, risk-taking encompasses the set of strategic decisions through which banks choose their portfolio mix, leverage, and exposure to credit, market, and operational risks. Importantly, risk-taking is not inherently negative. Prudently managed risk underpins intermediation and profit generation but excessive or mispriced risk can threaten solvency, undermine depositor confidence, and propagate crises (Adrian & Brunnermeier, 2016). In addition, empirical measurement of risk-taking relies on several proxies. Laeven and Levine (2009) advocate the Z-score, which combines profitability and capitalization relative to earnings volatility as a measure of distance to default.

Capital Adequacy

Capitalization remains one of the most critical prudential mechanisms linking bank solvency to systemic stability. Conceptually, capitalization is measured as the ratio of regulatory capital comprising Common Equity Tier 1 (CET1), Additional Tier 1, and Tier 2 instruments to risk-weighted assets (Basel Committee on Banking Supervision (BCBS), 2017). This ratio functions as the first line of defense against unexpected losses, ensuring that shareholders absorb distress rather than depositors or taxpayers. Modern empirical work confirms a predominantly negative relationship between CAR and risk-taking but highlights important nonlinearities. Risk generally falls with rising capital but flattens or reverses beyond a threshold, as overcapitalized banks “reach for yield” to preserve margins (Dias, 2021). Studies by Jiang et al. (2020) showed that the marginal effect of capital on Z-scores is strongest for riskier banks, indicating that capitalization has heterogeneous impacts across the risk distribution.

Managerial Ownership

Managerial ownership is conceptually defined as the proportion of a bank’s equity held directly or indirectly by directors, executives, and senior managers, encompassing ordinary shares, stock options, and other equity-linked compensation instruments that align managerial wealth with firm outcomes. Recent literature stresses that managerial ownership is not limited to shareholding figures as it also reflects incentive structures such as mandatory shareholding requirements, performance-based equity grants, and the convexity of chief executive officer (CEO) pay, all of which affect managerial risk appetite. Da et al. (2024) demonstrate that reducing the convexity of executive pay following the Dodd-Frank Act significantly lowered tail risk in U.S. banks, indicating that incentive design is central to risk-taking behavior. Theoretically, agency theory underpins this construct, predicting that equity participation aligns managers’ interests with shareholders, reduces agency costs, and encourages prudent risk-taking (Jensen & Meckling, 1976; Fama & Jensen, 1983). Nonetheless, this alignment is conditional; when insider control rises beyond certain thresholds, it can weaken external discipline and facilitate private benefit extraction, as observed in entrenchment theory (Shleifer & Vishny, 1997).

Theoretical Review

Agency theory conceptualizes banks as contractual systems in which shareholders, the principals, delegate decision-making authority to managers, the agents, and must design

incentives and monitoring mechanisms to ensure that managers act in the bank's best interest rather than pursuing private objectives (Jensen & Meckling, 1976). This agency problem is particularly acute in banking because banks operate with high leverage, opaque asset structures, and public safety nets such as deposit insurance, which shield insiders from full downside losses (Fama & Jensen, 1983). These features intensify agency frictions by creating an asymmetric payoff structure in which managers and shareholders benefit disproportionately from upside gains but can transfer part of the losses to creditors or the public, thereby increasing incentives for risk shifting (Merton, 1977). Unless constrained by strong capital requirements, credible contracts, or active monitoring, these incentives can encourage excessive risk-taking. This reasoning underpins much of the empirical literature linking capitalization, ownership, and bank risk-taking in modern banking research (Laeven & Levine, 2009).

From a theoretical perspective, capitalization is closely tied to agency theory and risk-shifting models. Thin equity increases shareholders' incentive to take excessive risks because their downside is limited by limited liability and safety nets (Jensen & Meckling, 1976; Merton, 1977). Furlong and Keeley (1989) show that higher equity reduces the private option value of risk shifting, thereby discouraging excessive risk-taking. Koehn and Santomero (1980) and Kim and Santomero (1988) introduce the insight that binding capital requirements may induce banks to increase portfolio risk to restore target return on equity (ROE), a prediction further formalized by Blum (1999).

Empirical Review

Managerial Ownership and Bank Risk-Taking

Empirical evidence across several countries indicates that when managers face greater downside risk, they tend to take fewer risks. Anderson et al. (2024) show that unlimited-liability bank presidents in U.S. history maintained higher equity ratios and experienced fewer runs, while Da et al. (2024) find that after the Dodd-Frank Act, reductions in CEO pay convexity weakened incentives for excessive risk-taking, leading to lower equity volatility and reduced tail risk. Complementary evidence shows that the structure of executive compensation significantly influences managerial risk-taking, with convex pay structures such as stock options encouraging greater risk-taking incentives (Kreilkamp et al., 2023). However, Nel et al. (2024), using panel linear regression and Johnson Neyman moderation analysis and data from Johannesburg stock exchange (JSE) listed firms in South Africa found that Managerial ownership improves alignment with short-term performance but may also encourage managerial entrenchment, while Chernobai et al. (2024) show that insider selling before operational loss announcements raises tail risk and delays market discipline. These findings underscore that managerial ownership is a double-edged instrument whose effect depends on governance and institutional context (Hirtle et al, 2020).

Lepetit et al. (2023), using a large European panel with System-GMM, show that both executive and non-executive ownership are associated with lower bank risk, depending on employee ability and incentives to take risks. Their results highlight that different types of insiders have different incentives. In related European evidence, Diez-Esteban et al. (2022) deploy a two-step System GMM and uncover a non-linear (U-shaped) effect as managerial ownership reduces systemic risk up to an optimal threshold, beyond which entrenchment raises risk for U.S. banks.

Bouwens and Verriest (2014) analyzed a large international sample of banks and documented that higher managerial equity ownership is associated with lower levels of risk-taking. The authors argue that managers holding equity stakes face limited opportunities to diversify their personal wealth compared to outside shareholders, thereby encouraging them to adopt more conservative risk management strategies. Their findings indicate that managerial ownership can serve as an effective risk reduction mechanism within financial institutions. Evidence from Dong et al. (2017) using panel regressions with bank fixed effects indicates that state and managerial ownership dampen risk-taking, conditional on governance and efficiency controls.

To separate ownership from managerial discretion, Fernandes et al. (2021) apply two-stage least squares (instrumentation) regressions for Eurozone banks and show that CEO power and insider ownership increase risk, with stronger effects in crisis periods, a design that mitigates simultaneity by instrumenting CEO influence. Altunbaş et al. (2020) use panel general least squares on a broad international sample and find that CEO power and high insider ownership raise risk unless offset by institutional investor oversight, highlighting governance as a moderating channel.

On incentive alignment, Armstrong et al. (2022) show using a sample of U.S. banks that equity-linked compensation and options elevate systemic risk, clarifying that “ownership-like” pay can push risk upward even when equity stakes are intended to align interests. Several studies move beyond idiosyncratic risk to systemic risk. Saghi et al. (2023) estimate panel fixed-effects models and show that concentrated insider/managerial ownership increases systemic risk among European banks. Bellavite Pellegrini et al. (2023), using panel regressions on EU financial institutions, reach similar conclusions.

Nwude et al. (2023) showed that CEO and board ownership significantly enhanced bank performance, with CEO equity stakes improving return on asset and equity, lending support to the alignment hypothesis that managerial shareholding aligns managers’ interests with those of shareholders. Similarly, Adeyeni (2018) found that managerial ownership, when combined with robust board processes, reduced risk, suggesting that its effectiveness depends on governance quality. Musa et al. (2023) further demonstrated that managerial ownership significantly curtailed earnings management, indicating a disciplining effect on opportunistic behaviour under certain conditions.

Capital Adequacy and Risk Taking

Empirical research on capitalization and bank risk-taking has produced consistent yet context-dependent evidence across both developed and emerging financial systems. Using a global panel sample of over 1,800 banks in 135 countries, Organisation for Economic Co-operation and Development (OECD) and emerging market banks, Dias (2021) finds that the relationship between capital ratios and bank risk-taking follows an inverse U shape. Increasing capital initially reduces risk-taking, but at higher capital levels, banks begin to increase risk-taking. Stronger regulatory requirements help reduce this effect.

Focusing on European markets, Anguren et al. (2024) used credit register data matched with firm and bank data to examine the impact of Basel III capital requirement changes and found that tighter capital requirements reduce credit supply, while looser requirements mitigate this effect. Banks affected by stricter capital rules reduce lending

but still maintain credit to riskier firms to prevent firm failure . Similarly, Cappelletti et al. (2024) using a regression discontinuity design using confidential supervisory data for euro area banks 2014-2017 show that higher capital buffers lead to a short term reduction in credit supply, followed by a medium term shift toward safer borrowers and lower risk-taking.

Similarly, Jiang et al. (2020) investigated 135 Chinese banks using quantile regression and found that the capital buffer showed a U-shaped relationship with bank risk-taking. Increasing capital buffers initially reduces risk-taking, but excessive buffers increase risk-taking, especially among high-risk banks. In OECD economies, Bitar et al. (2018) demonstrated that higher capital ratios improve bank efficiency and profitability, but risk-based capital ratios do not significantly reduce bank risk. Results raise concerns about the effectiveness of risk weighting frameworks used in regulatory capital requirements.

In Europe, Soederhuizen et al. (2023) estimated optimal capital ratios using system Generalized Method of Moments (GMM) across Eurozone banks, establishing that higher bank capital reduces the probability and economic cost of banking crises with an optimal capital average of 22-23%, higher than the Basel III requirement. This finding was complemented by Miao et al. (2025) using Panel analysis comprising data from 330 Chinese commercial banks (2009-2023), who found that the Capital adequacy ratio has a diminishing marginal effect on bank risk-taking. Increasing CAR reduces risk-taking when capital levels are low, but the risk-reducing effect weakens as CAR becomes higher. Both studies, while advancing the frontier of capital optimization, did not incorporate ownership typologies that could shift the optimal threshold between shareholder-controlled and manager-controlled banks.

Managerial Ownership, Capital adequacy and Risk Taking

From a global perspective, Siddika and Haron (2019) analysed 565 commercial banks across 52 countries (2011-2015) and confirmed a significant interactive effect between capital regulation and ownership concentration. Their dynamic GMM estimates revealed that stricter capital requirements moderate ownership-driven risk-taking, consistent with the view that well-capitalized banks engage in less aggressive portfolio strategies.

In MENA banks, Mateev et al. (2023) use System-GMM and document that managerial ownership reduces risk when capital buffers are strong an explicit ownership and capitalization interaction consistent with regulatory discipline. GCC evidence by Abidi et al. (2022) via panel fixed-effects shows managerial ownership moderates the governance risk link, while Boulanouar et al. (2021), using panel GLS, connect ownership structures to financial stability through institutional quality, suggesting country-level governance conditions shape the transmission from ownership to risk.

Similarly, Nwude et al. (2023) examined listed deposit money banks between 2010 and 2022 and observed that higher capital adequacy ratios were associated with reduced risk-taking, consistent with Basel regulatory expectations. However, the authors noted that the ownership concentration of Nigerian banks could either amplify or dampen this stabilizing effect depending on whether control was exercised by managers or by institutional investors. He emphasized that managerial ownership may lead to risk-shifting when insider incentives are misaligned with prudential objectives.

Aroghene and Ikeora (2022), who analyzed the relationship among non-performing loans, capital adequacy, and corporate governance in Nigerian banks. They found that banks with stronger capital positions and effective governance mechanisms exhibited lower credit risk and greater stability, suggesting that governance quality mediates how capitalization influences risk-taking.

One of the few studies to combine the three constructs is Yaaba and Sanusi (2020), who examined 15 Nigerian deposit money banks between 2010 and 2018 using a system-GMM estimator. They modelled capital buffers, ownership types (managerial, institutional, foreign), and risk-taking proxied by the Z-score. Their findings show that well-capitalized banks take significantly less risk and that ownership structure moderates this relationship. Specifically, foreign and institutional ownership were associated with lower risk, while managerial ownership displayed a non-linear effect; moderate insider stakes improved stability, but excessive control increased risk appetite.

Overall, empirical evidence across advanced, emerging, and African banking systems suggests that managerial ownership plays a significant but complex role in shaping bank risk-taking behaviour. Three key insights emerge. First, managerial ownership can reduce risk through incentive alignment, particularly at moderate levels. Second, excessive ownership may lead to entrenchment and increased risk, indicating nonlinear effects. Third, the effectiveness of managerial ownership depends on governance quality, institutional conditions, and regulatory oversight. Despite these advances, an important gap remains, as existing studies largely examine managerial ownership and capitalization as separate determinants of bank behaviour, with limited attention to how they jointly influence risk taking. This omission is both conceptually and empirically significant because managerial ownership shapes risk incentives while capitalization constrains risk capacity. This gap is particularly relevant in Nigeria, where diverse ownership structures coexist with recurring recapitalization reforms and varying governance quality. The present study therefore examines how managerial ownership interacts with capitalization to influence bank risk taking.

METHODOLOGY

This chapter presents the methodological framework adopted to examine the relationship between capitalization, ownership structure, and bank risk taking among Nigerian commercial banks over the period 2009 to 2023. It outlines the research design, sources and types of data, methods of data analysis, model specification, description and measurement of variables, a priori expectations, and the estimation techniques employed in the study.

Research Design

This study adopts an ex post facto research design to examine the relationship between managerial ownership and bank risk taking, as well as the moderating role of capital adequacy in Nigerian deposit money banks. The ex post facto approach is appropriate because the study relies on historical financial and governance data without manipulation of variables.

A panel data framework is employed as it allows for the simultaneous analysis of cross sectional and time series variation while controlling for unobserved heterogeneity across banks (Baltagi, 2005). This is particularly important in the banking context, where unobservable characteristics such as risk culture, managerial ability, and institutional differences may influence risk taking behaviour.

Population and Sample

The population of the study comprises all licensed commercial banks operating in Nigeria. A purposive sampling technique is employed due to the relatively small and heterogeneous nature of the population. The sample consists of fourteen deposit money banks with consistent financial and governance data over the period 2009 to 2023. Banks with incomplete data, recent establishment, or major structural changes such as mergers and acquisitions are excluded to ensure data consistency. The final dataset consists of a balanced panel of fourteen banks over fifteen years. Data were collected from annual reports and financial statements of the sampled banks from the Nigeria stock exchange and websites such as Africanfinancials.com. Macroeconomic data, including GDP growth, were sourced from worldwide indicators database

Variable Definition and Measurement

Bank risk-taking, which serves as the dependent variable of this study, was proxied by the Z-score, a widely used measure of a bank's distance to insolvency and overall financial stability. The Z-score is defined as:

$$Z\text{-score}_{it} = (ROA_{it} + CAR_{it}) / \sigma(ROA_i)$$

where return on assets (ROA) is a financial ratio that indicates how profitable a company is relative to its total assets, the capital adequacy ratio (CAR) reflects the bank's capital strength, and the standard deviation of ROA captures earnings volatility over the sample period. Higher values of the Z-score indicate greater financial stability and lower risk exposure (Boyd et al., 2006). The key independent variable in this study is managerial ownership, measured as the proportion of shares held by executive directors and senior management relative to total outstanding shares. This measure reflects the extent to which managers have a direct financial stake in the bank and is consistent with prior studies on ownership structure and risk-taking behavior (Morck et al., 1988; Saunders et al., 1990). To account for potential nonlinear effects, a squared term of managerial ownership is incorporated into the model.

Capital adequacy is included as a moderating variable and is measured as the ratio of regulatory capital to risk-weighted assets. It represents an important regulatory mechanism that influences bank risk-taking behavior by increasing the cost of financial distress and constraining excessive risk exposure (Merton, 1977). To examine this moderating effect, an interaction term between managerial ownership and capital adequacy is included in the model.

In addition, the model incorporates several control variables to isolate the effect of managerial ownership on bank risk-taking. Bank size is measured as the natural logarithm of total assets and captures scale and diversification effects. Profitability is proxied by

return on assets, reflecting internal performance and earnings capacity. Macroeconomic conditions are captured using GDP growth, which reflects the broader economic environment in which banks operate. These control variables are included to reduce omitted variable bias and ensure robustness of the estimated relationships (Laeven & Levine, 2009);).

Model Specification

$$Zscore_{it} = \theta_0 + \theta_1 MAOWN_{it} + \theta_2 BSIZE_{it} + \theta_3 ROA_{it} + \theta_4 GDP_t + \lambda_i + u_t + e_{it}$$

$$Zscore_{it} = \theta_0 + \theta_1 MAOWN_{it} + \theta_2 MAOWN_{it}^2 + \theta_3 BSIZE_{it} + \theta_4 ROA_{it} + \theta_5 GDP_t + \lambda_i + u_t + e_{it}$$

$$Zscore_{it} = \theta_0 + \theta_1 MAOWN_{it} + \theta_2 CAR_{it} + \theta_3 (MAOWN * CAR)_{it} + \theta_4 BSIZE_{it} + \theta_5 ROA_{it} + \theta_6 GDP_t + \lambda_i + u_t + e_{it}$$

Where:

Zscore is Bank Risk taking

CAR is the capital adequacy ratio

MAOWN is Managerial Ownership (MAOWN)

BSIZE is each bank total asset size

ROA is return on asset

GDP is the gross domestic product

θ_0 = Intercept, the mean value of the response variable when all independent variables are equal to zero

$\theta_{1,2,3,4,5}$ = Parameters to be estimated.

λ_i is Bank fixed effect

μ_t is year fixed effect

e_{it} = Stochastic or error term which reflects the unaccounted variables not included in the model

Estimation Technique and Econometric Considerations

The empirical analysis is conducted using panel data estimation techniques to account for both cross-sectional and time series variation in the data. Specifically, the study employs pooled ordinary least squares, fixed effects, and random effects estimators. However, the primary specification is based on the fixed effects model, as it controls for unobserved, time-invariant bank-specific heterogeneity that may be correlated with the explanatory variables. To further account for macroeconomic shocks and common time trends, year fixed effects are included in the preferred specification. The choice of the fixed effects estimator is supported by the Hausman test, which indicates that the fixed effects model is more appropriate than the random effects alternative.

Robust standard errors clustered at the bank level are employed to correct for heteroskedasticity and serial correlation within banks over time. This ensures consistent inference in the presence of within-panel dependence.

A key econometric concern in this study is potential endogeneity arising from reverse causality and omitted variable bias. For instance, while managerial ownership may influence bank risk taking, it is also possible that risk profiles affect ownership structures. To mitigate this concern, the study incorporates lagged managerial ownership as an alternative specification, thereby reducing simultaneity bias and allowing for a more credible interpretation of the direction of influence. The comparison between current and lagged models provides insight into the persistence and timing of ownership effects.

Multicollinearity is assessed using correlation analysis and variance inflation factors, with no evidence of severe collinearity among the explanatory variables.

A Priori Expectations

The a priori expectations of this study are grounded in agency theory and banking regulation frameworks. Managerial ownership is expected to have a positive effect on bank stability, as higher ownership aligns managers' incentives with those of shareholders and reduces excessive risk taking. However, this relationship may not be strictly linear, as increasing ownership beyond a certain threshold may lead to managerial entrenchment and weakened monitoring, implying a potential nonlinear effect. Capital adequacy is expected to enhance bank stability directly and, more importantly, to moderate the relationship between managerial ownership and risk taking, such that higher capital levels constrain the extent to which ownership driven incentives translate into risk. Accordingly, the interaction between managerial ownership and capital adequacy is expected to be positively associated with bank stability. With respect to control variables, profitability is expected to improve stability, economic growth is anticipated to reduce risk through better macroeconomic conditions, while bank size is expected to have an ambiguous effect reflecting the tradeoff between diversification benefits and moral hazard incentives.

RESULTS AND DISCUSSION OF RESULTS

Descriptive Analysis

The descriptive statistics of the variables used in the study are presented in Table 1. The results show that managerial ownership is relatively low, with a mean value of 0.0076, indicating that bank managers hold only a small proportion of equity in Nigerian banks. This reflects the ownership structure of the banking sector, where ownership is largely concentrated among institutional and external investors. Bank size exhibits substantial variation, as indicated by the large standard deviation, suggesting significant heterogeneity across banks. Profitability, measured by return on assets, shows moderate dispersion, reflecting differences in operational efficiency across banks. Capital adequacy also varies considerably, indicating differences in capitalization levels and regulatory compliance across institutions. Overall, the descriptive statistics suggest that the sample captures a diverse set of banks with varying characteristics, which is appropriate for examining the relationship between managerial ownership and bank risk taking.

Table 1: Result of Descriptive Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
MAOWN	206	0.0076	0.0151	0.0000	0.0782	3.323	10.864
BSIZE	206	2,484,357	3,217,200	142,786	26,688,830	3.671	19.112
ROA	206	0.0200	0.0236	-0.1275	0.1308	-0.811	10.342
GDP Growth	206	0.0341	0.0293	-0.0170	0.0804	-0.097	-0.735
CAR	206	0.1419	0.3145	-2.0159	0.4383	-5.343	31.516
NPL	206	0.1172	0.4358	0.0000	4.9800	9.277	93.618

Multicollinearity Test

To assess the presence of multicollinearity among the explanatory variables, both correlation analysis and variance inflation factors are examined. The correlation matrix indicates that the pairwise correlations among the independent variables are generally low, with no coefficient exceeding conventional thresholds that would suggest multicollinearity concerns. In particular, managerial ownership is only weakly correlated with other variables, suggesting that it captures a distinct governance dimension. The variance inflation factor results further confirm this finding, as all VIF values are well below the critical threshold of 5, with a mean VIF of approximately 1.15. This indicates that multicollinearity is not a significant concern in the estimated models and that the coefficients can be interpreted with confidence.

Table 2: Results of Multicollinearity test

	MAOWN	BSIZE	ROA	GDP	CAR	NPL
MAOWN	1.000	0.273	-0.039	-0.021	0.098	-0.076
BSIZE	0.273	1.000	0.124	-0.206	0.113	-0.083
ROA	-0.039	0.124	1.000	0.030	0.367	-0.090
GDP	-0.021	-0.206	0.030	1.000	0.165	-0.041
CAR	0.098	0.113	0.367	0.165	1.000	0.025
NPL	-0.076	-0.083	-0.090	-0.041	0.025	1.000

Variance Inflation Factor (VIF)

Variable	VIF
MAOWN	1.10
BSIZE	1.16
ROA	1.18
GDP	1.09
CAR	1.22
Mean VIF	1.15

Notes: Correlation coefficients are pairwise correlations. VIF values test for multicollinearity.

Heteroscedasticity and Model Diagnostics

Given the panel structure of the data, the study accounts for potential heteroscedasticity and serial correlation by employing robust standard errors clustered at the bank level. This approach ensures consistent and reliable inference even in the presence of non-constant error variance and within-panel dependence. The use of fixed effects further controls for unobserved bank-specific heterogeneity, while the inclusion of year effects captures

common macroeconomic shocks. These estimation choices mitigate key econometric concerns associated with panel data and enhance the robustness of the results. Consequently, the reported standard errors and statistical significance levels are robust to heteroscedasticity and intra-group correlation.

Managerial Ownership and Bank Risk Taking (H1)

The baseline results provide strong evidence that managerial ownership is positively associated with bank stability. As shown in Table 3, the coefficient on managerial ownership is positive and statistically significant in the preferred bank and year fixed effects model ($\beta = 50.767$, $p < 0.01$), indicating that higher managerial ownership increases the Z-score and therefore reduces bank risk. This result is robust across several model specifications, particularly in the pooled OLS and bank fixed effects estimations, although it becomes insignificant under year fixed effects and random effects models. The consistency of the positive and significant coefficient in the preferred specification suggests that managerial ownership plays an important role in shaping risk behaviour when unobserved bank-specific and time effects are properly controlled for.

This finding supports the alignment hypothesis, which posits that managerial ownership aligns the interests of managers with those of shareholders and reduces opportunistic risk taking (Jensen & Meckling, 1976). It is also consistent with Furlong and Keeley (1989), who argue that managerial equity participation increases exposure to downside risk and discourages excessive risk taking in leveraged banking environments. However, the lagged results reported in Table 4 provide an important qualification. While contemporaneous managerial ownership remains positive and significant ($\beta = 50.767$, $p < 0.01$), the lagged ownership variable becomes statistically insignificant ($\beta = 39.182$, $p > 0.10$), indicating that the effect does not persist over time. This suggests that managerial ownership operates primarily through short term incentive alignment rather than long term structural governance mechanisms.

Table 3: Results of Managerial Ownership on Bank Risk Taking

Variables	(1) Pooled OLS	(2) Bank FE	(3) Year FE	(4) Bank + Year FE	(5) Random RE
MAOWN	100.414** (0.014)	69.100*** (0.000)	38.230 (0.355)	50.767*** (0.000)	82.664 (0.105)
Bank Size (ln assets)	3.788*** (0.000)	-2.643** (0.036)	7.143*** (0.000)	1.708 (0.747)	-2.352*** (0.000)
Return on Assets (ROA)	123.745*** (0.000)	63.887*** (0.000)	99.813*** (0.000)	56.044*** (0.000)	65.904*** (0.000)
GDP Growth	113.818*** (0.000)	25.898 (0.323)	5.447*** (0.005)	5.755*** (0.005)	30.055** (0.014)
Constant	-48.401*** (0.000)	51.841*** (0.008)	-77.058*** (0.000)	-4.082 (0.961)	42.668*** (0.000)
Observations	209	209	209	209	209

Notes: Dependent variable is Z-score. p -values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 4: Results of Lagged panel estimation of Managerial Ownership on Bank Risk Taking

Variables	(1) FE + Year	(2) Lagged FE + Year
MAOWN	50.767***	
	(0.000)	
MAOWN (t-1)		39.182
		(0.220)
Bank Size (ln assets)	1.708	2.124
	(0.747)	(0.719)
Return on Assets (ROA)	56.044***	56.765*
	(0.000)	(0.059)
GDP Growth	5.755***	5.073**
	(0.005)	(0.019)
Observations	209	209
Adj. R ²	0.81	0.83
Bank FE	Yes	Yes
Year FE	Yes	Yes

Notes: Dependent variable is Z-score. p -values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Evidence from Nigeria reflects similar ambiguity in the ownership-outcome relationship. Ozili and Uadiale (2017) show that ownership structure influences bank risk taking, although the effects vary across ownership types. Musa et al. (2023) find that managerial ownership improves governance outcomes through reduced earnings management, indicating an alignment effect. In contrast, Obialor et al. (2024) document evidence consistent with opportunistic behaviour and weak performance effects, suggesting that managerial ownership may also create scope for entrenchment. Taken together, the results of this study indicate that while managerial ownership enhances bank stability in the short term, its effects are not persistent, reinforcing the view that ownership alone is insufficient to ensure sustained financial stability and highlighting the importance of complementary mechanisms.

Nonlinear Relationship Between Managerial Ownership and Bank Risk Taking (H2)

The nonlinear specification examines whether managerial ownership exhibits threshold effects consistent with the joint predictions of the alignment and entrenchment hypotheses. While agency theory suggests that managerial ownership may initially reduce risk through incentive alignment but increase it at higher levels due to managerial entrenchment (Morck et al., 1988; Hermalin & Weisbach, 1991), the empirical results do not provide robust support for this prediction. As shown in Table 5, the pooled OLS model indicates a significant quadratic relationship ($\beta = -3993.196$, $p < 0.05$), suggesting potential nonlinearity. However, this effect disappears once unobserved heterogeneity is controlled for. In the preferred bank and year fixed effects model, both the linear ($\beta = -3.211$, $p > 0.10$) and squared ($\beta = 675.437$, $p > 0.10$) terms are statistically insignificant, indicating that the nonlinear relationship is not structurally robust.

Table 5: Results of Nonlinear Relationship Between Managerial Ownership and Bank Risk Taking

Variables	(1) Pooled OLS	(2) Bank FE	(3) Year FE	(4) Bank + Year FE	(5) Random RE
MAOWN	362.456*** (0.003)	1.915 (0.971)	314.317 (0.187)	-3.211 (0.964)	41.006 (0.744)
MAOWN ²	-3993.196** (0.025)	851.869 (0.159)	-4203.208 (0.211)	675.437 (0.375)	535.570 (0.716)
Bank Size (ln assets)	3.588*** (0.000)	-2.614** (0.040)	6.917*** (0.000)	1.734 (0.743)	-2.336*** (0.000)
Return on Assets (ROA)	126.672*** (0.000)	63.393*** (0.000)	103.283*** (0.000)	55.634*** (0.000)	65.562*** (0.000)
GDP Growth	110.364*** (0.000)	26.297 (0.318)	5.374*** (0.005)	5.808*** (0.005)	30.290** (0.014)
Constant	-46.369*** (0.000)	52.165*** (0.007)	-75.092*** (0.000)	-3.777 (0.959)	42.593*** (0.000)
Observations	209	209	209	209	209

Notes: Dependent variable is Z-score. *p*-values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 6: Lagged Results of Nonlinear Relationship Between Managerial Ownership and Bank Risk Taking

Variables	(1) FE + Year	(2) Lagged FE + Year
MAOWN	-3.211 (0.964)	
MAOWN ²	675.437 (0.375)	
MAOWN (t-1)		-114.208* (0.066)
MAOWN (t-1) ²		1939.284* (0.080)
Bank Size (ln assets)	1.734 (0.743)	2.396 (0.686)
Return on Assets (ROA)	55.634*** (0.000)	54.692* (0.067)
GDP Growth	5.808*** (0.005)	5.201** (0.015)
Observations	209	209
Adj. R ²	0.81	0.83
Bank FE	Yes	Yes
Year FE	Yes	Yes

Notes: Dependent variable is Z-score. *p*-values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The lagged results in Table 6 provide only weak and unstable evidence of threshold effects. Although the coefficients on lagged managerial ownership ($\beta = -114.208$, $p < 0.10$) and its squared term ($\beta = 1939.284$, $p < 0.10$) suggest a possible U shaped pattern, their marginal significance and lack of consistency across specifications indicate that such dynamics are not stable. This implies that managerial ownership does not exhibit a clear threshold beyond which its effect on risk changes direction. Evidence from Nigeria supports this interpretation. Musa et al. (2023) and Obaje and Omolehin (2023) document governance improvements associated with managerial ownership, Obialor et al. (2024) highlight

opportunistic behaviour and weak performance outcomes. The absence of explicit nonlinear testing in these studies suggests that alignment and entrenchment effects may coexist without generating a distinct threshold pattern. Overall, the findings indicate that the relationship between managerial ownership and bank risk taking is predominantly linear and context dependent rather than nonlinear and structurally determined.

Moderating Role of Capital Adequacy (H3)

The moderating results provide evidence that capital adequacy conditions the relationship between managerial ownership and bank risk taking. As shown in Table 7, the interaction term between managerial ownership and capital adequacy is positive and statistically significant in the preferred bank and year fixed effects model ($\beta = 1586.017$, $p < 0.10$), indicating that the effect of managerial ownership on bank stability depends on the level of capitalization. Given that the dependent variable is the Z-score, this positive interaction implies that higher capital adequacy enhances stability and constrains the risk implications of managerial ownership. This finding is reinforced by the positive and significant coefficient on capital adequacy itself ($\beta = 14.526$, $p < 0.01$), suggesting that well capitalized banks are inherently more stable.

Table 7: Results of Moderating Role of Capital Adequacy

Variables	(1) Pooled OLS	(2) Bank FE	(3) Year FE	(4) Bank + Year FE	(5) Random RE
MAOWN	-589.568*** (0.000)	-347.316** (0.034)	-502.478** (0.011)	-319.342* (0.076)	-342.850*** (0.000)
CAR	13.078*** (0.000)	13.479*** (0.000)	9.450*** (0.000)	14.526*** (0.000)	13.558*** (0.000)
MAOWN × CAR	3165.754*** (0.000)	1720.564** (0.019)	2548.679** (0.011)	1586.017* (0.052)	1741.229*** (0.000)
Bank Size (ln assets)	3.069*** (0.000)	-2.561*** (0.000)	5.931*** (0.000)	-3.919** (0.038)	-2.412*** (0.000)
ROA	69.772*** (0.000)	59.093*** (0.000)	58.126** (0.026)	60.548*** (0.000)	59.402*** (0.000)
GDP Growth	62.612*** (0.000)	-7.069 (0.357)	2.730* (0.091)	3.813** (0.028)	-5.091 (0.529)
Constant	-37.024*** (0.000)	52.300*** (0.000)	-64.845*** (0.000)	69.962*** (0.007)	43.405*** (0.000)
Observations	209	209	209	209	209

Notes: Dependent variable is Z-score. p-values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 7: Results of Lagged Moderating Role of Capital Adequacy

Variables	(1) FE + Year	(2) Lagged FE + Year
Managerial Ownership (MAOWN)	-319.342* (0.076)	-253.965* (0.054)
Capital Adequacy (CAR)	14.526*** (0.000)	14.824*** (0.000)
MAOWN × CAR	1586.017* (0.052)	1416.358** (0.045)
Bank Size (ln assets)	-3.919**	-4.211**

	(0.038)	(0.044)
ROA	60.548***	52.637*
	(0.000)	(0.073)
GDP Growth	3.813**	4.595***
	(0.028)	(0.000)
Observations	209	209

Notes: Dependent variable is Z-score. Column (2) uses lagged managerial ownership. p-values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Importantly, this moderating effect remains robust in the lagged specification, where the interaction term remains positive and statistically significant ($\beta = 1416.358$, $p < 0.05$), even though the direct effect of lagged managerial ownership is weak. This indicates that capital adequacy operates as a structural constraint on managerial incentives, exerting a more stable and persistent influence on bank risk behaviour than ownership alone. Evidence from Nigeria supports this interpretation. Ozili and Uadiale (2017) show that ownership influences bank risk taking without accounting for regulatory capital, while Emengini et al. (2024) demonstrate that ownership effects are sensitive to institutional conditions. Taken together, the findings indicate that managerial ownership and capital adequacy are complementary mechanisms, with capital adequacy playing a dominant role in constraining risk taking and enhancing financial stability

CONCLUSION AND RECOMMENDATIONS

This study examined the relationship between managerial ownership and bank risk taking in Nigeria, with particular emphasis on the moderating role of capital adequacy. The findings show that managerial ownership has a statistically significant stabilizing effect on bank risk-taking in the baseline models, supporting the alignment hypothesis. However, this effect is not persistent over time, as the lagged results indicate that ownership effects are largely contemporaneous. In addition, there is no statistically significant evidence of nonlinear effects, suggesting that the alignment and entrenchment mechanisms do not manifest as stable threshold dynamics. Overall, the results indicate that while managerial ownership contributes to bank stability, its influence is limited to the short term. In contrast, capital adequacy emerges as a dominant and persistent mechanism in shaping bank stability. The interaction between managerial ownership and capital adequacy is positive and statistically significant, indicating that the effectiveness of managerial ownership is strengthened under higher levels of capitalization. This effect remains robust across model specifications, highlighting the critical role of regulatory capital in constraining risk-taking behaviour. From a policy perspective, the findings suggest that managerial ownership alone is insufficient to ensure sustained financial stability. It is therefore recommended that regulators reinforce capital adequacy requirements alongside governance reforms to enhance the effectiveness of managerial ownership in promoting a more stable and resilient banking system.

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APPENDIX A: VARIABLE DEFINITIONS

Variable	Definition	Measurement	Source
Z-score	Bank stability (distance to insolvency)	$(ROA + CAR) / \sigma(ROA)$	Authors calculation from Annual reports
MAOWN	Managerial ownership	% shares held by management	Annual reports of banks
CAR	Capital adequacy	Capital / risk-weighted assets	Annual reports of banks
BSIZE	Bank size	Log of total assets	Annual reports of banks
ROA	Profitability	Net income / total assets	Annual reports of banks
GDP Growth	Macroeconomic control	Annual GDP growth rate	World Bank

APPENDIX B: DATA AND SAMPLE DESCRIPTION

The final sample consisted of fourteen deposit money banks for which reliable data were available from 2009 to 2023. These banks collectively account for a substantial share of the Nigerian banking sector in terms of total assets, deposits, and market coverage.

Banks were excluded if they had insufficient longitudinal data, experienced significant structural changes, or commenced operations recently within the study period. This selection process ensured that the sample provided a reliable and representative dataset for analysing the relationship between capitalization, ownership structure, and bank risk taking.

Banks included in the study: The study covers fourteen Nigerian deposit money banks, namely Access Bank Plc, Ecobank Nigeria Plc, Fidelity Bank Plc, First Bank of Nigeria Limited, First City Monument Bank Plc, Guaranty Trust Bank Plc, Stanbic IBTC Bank Plc, Sterling Bank Plc, United Bank for Africa Plc, Unity Bank Plc, Wema Bank Plc, Citibank Nigeria Limited, Standard Chartered Bank Nigeria Limited, and Zenith Bank Plc.

APPENDIX C: REGRESSION RESULTS

Table 1: Managerial Ownership and Bank Risk Taking - Base line model

Variables	(1) Pooled OLS	(2) Bank FE	(3) Year FE	(4) Bank + Year FE	(5) Random RE
MAOWN	100.414**	69.100***	38.230	50.767***	82.664
	(0.014)	(0.000)	(0.355)	(0.000)	(0.105)
Bank Size (ln assets)	3.788***	-2.643**	7.143***	1.708	-2.352***
	(0.000)	(0.036)	(0.000)	(0.747)	(0.000)
Return on Assets (ROA)	123.745***	63.887***	99.813***	56.044***	65.904***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP Growth	113.818***	25.898	5.447***	5.755***	30.055**
	(0.000)	(0.323)	(0.005)	(0.005)	(0.014)
Constant	-48.401***	51.841***	-77.058***	-4.082	42.668***
	(0.000)	(0.008)	(0.000)	(0.961)	(0.000)
Observations	209	209	209	209	209

Notes: Dependent variable is Z-score. *p*-values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Diagnostic - statistics

Model	Adj. R ²	F / Wald	Prob	Observations
Pooled OLS	0.380	32.822	0.000	209
Bank FE	0.799	42.171	0.000	209
Year FE	0.601	21.483	0.000	209
Bank + Year FE	0.810	66.064	0.000	209
Random RE	—	78.490	0.000	209

Diagnostic - statistics

Hausman chi2	df	p-value	Decision (5%)
0	8	1	RE acceptable (variance diff not PD)

Table 2: Lagged Baseline Model Results ;Managerial Ownership and Bank Risk Taking

Variables	(1) Pooled OLS	(2) Bank FE	(3) Year FE	(4) Bank + Year FE	(5) Random RE
MAOWN(t-1)	78.288**	8.858	24.624	39.182	24.853
	(0.028)	(0.509)	(0.530)	(0.220)	(0.605)
BSIZE (ln assets)	3.838***	-2.516**	7.129***	2.124	-2.236***
	(0.000)	(0.038)	(0.000)	(0.719)	(0.000)
ROA	153.011***	84.282***	104.610***	56.765*	86.798***
	(0.000)	(0.000)	(0.000)	(0.059)	(0.000)
GDP Growth	85.128***	17.975	3.529**	5.073**	20.869*
	(0.000)	(0.414)	(0.035)	(0.019)	(0.069)
C	-49.024***	52.577***	-79.290***	-10.510	41.194***
	(0.000)	(0.006)	(0.000)	(0.900)	(0.000)
Observations	209	209	209	209	209

Notes: Dependent variable is Z-score. Lagged managerial ownership is used. p-values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Diagnostic Statistics (Lagged Model Base line)

Model	Adj. R ²	F / Wald	Prob	Observations
Pooled	0.400	33.383	0.000	209
Bank FE	0.816	30.081	0.000	209
Year FE	0.624	77.054	0.000	209
Bank+Year FE	0.830	235.742	0.000	209
RE		67.628	0.000	209

Hausman Test (Lagged Model Base line)

Statistic	Chi-square	df	p-value	Decision
Value	0	8	1	RE acceptable

Table 3: Results of Nonlinear Relationship Between Managerial Ownership and Bank Risk Taking

Variables	(1) Pooled OLS	(2) Bank FE	(3) Year FE	(4) Bank + Year FE	(5) Random RE
MAOWN	362.456*** (0.003)	1.915 (0.971)	314.317 (0.187)	-3.211 (0.964)	41.006 (0.744)
MAOWN ²	-3993.196** (0.025)	851.869 (0.159)	-4203.208 (0.211)	675.437 (0.375)	535.570 (0.716)
BFSIZE (ln assets)	3.588*** (0.000)	-2.614** (0.040)	6.917*** (0.000)	1.734 (0.743)	-2.336*** (0.000)
ROA	126.672*** (0.000)	63.393*** (0.000)	103.283*** (0.000)	55.634*** (0.000)	65.562*** (0.000)
GDP Growth	110.364*** (0.000)	26.297 (0.318)	5.374*** (0.005)	5.808*** (0.005)	30.290** (0.014)
Constant	-46.369*** (0.000)	52.165*** (0.007)	-75.092*** (0.000)	-3.777 (0.959)	42.593*** (0.000)
Observations	209	209	209	209	209

Notes: Dependent variable is Z-score. p-values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Diagnostic Statistics (Nonlinear Model)

Model	Adj. R ²	F / Wald	Prob	Observations
Pooled OLS	0.392	27.801	0.000	209
Bank FE	0.798	4472.205	0.000	209
Year FE	0.616	141.478	0.000	209
Bank + Year FE	0.809	119.500	0.000	209
Random RE	—	78.741	0.000	209

Hausman Test (Nonlinear Model)

Statistic	Value
Chi-square	0
df	8
p-value	1.000
Decision	RE acceptable (variance diff not PD)

Table 4: Lagged Nonlinear Results of Nonlinear Relationship Between Managerial Ownership and Bank Risk Taking

Variables	(1) Pooled OLS	(2) Bank FE	(3) Year FE	(4) Bank + Year FE	(5) Random RE
MAOWN(t-1)	210.658*	-103.855	192.974	-114.208*	-69.969
	(0.081)	(0.193)	(0.398)	(0.066)	(0.559)
MAOWN(t-1)^2	-2034.507	1446.727	-2592.530	1939.284*	1230.336
	(0.251)	(0.171)	(0.423)	(0.080)	(0.387)
BSIZE (ln assets)	3.696***	-2.383*	6.967***	2.396	-2.128***
	(0.000)	(0.065)	(0.000)	(0.686)	(0.000)
ROA	154.592***	83.276***	106.350***	54.692*	85.883***
	(0.000)	(0.000)	(0.000)	(0.067)	(0.000)
GDP Growth	82.123***	20.591	3.471**	5.201**	23.040**
	(0.000)	(0.376)	(0.036)	(0.015)	(0.049)
C	-47.377***	51.795***	-77.780***	-12.396	39.972***
	(0.000)	(0.007)	(0.000)	(0.882)	(0.000)
Observations	209	209	209	209	209

Notes: Dependent variable is Z-score. Lagged nonlinear specification. *p*-values in parentheses. *** *p* < 0.01, ** *p* < 0.05, * *p* < 0.10.

Model	Adj. R ²	F / Wald	Prob	Observations
Pooled OLS	0.401	27.018	0.000	209
Bank FE	0.816	15,646.778	0.000	209
Year FE	0.629	252.362	0.000	209
Bank + Year FE	0.830	127.304	0.000	209
Random RE		68.756	0.000	209

Hausman chi2	df	p-value	Decision (5%)
0	8	1	RE acceptable (variance diff not PD)

Table 5: Result of Moderating Role of Capital Adequacy on Managerial ownership

Variables	(1) Pooled OLS	(2) Bank FE	(3) Year FE	(4) Bank + Year FE	(5) Random RE
MAOWN	-589.568***	-347.316**	-502.478**	-319.342*	-342.850***
	(0.000)	(0.034)	(0.011)	(0.076)	(0.000)
CAR	13.078***	13.479***	9.450***	14.526***	13.558***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MAOWN×CAR	3165.754***	1720.564**	2548.679**	1586.017*	1741.229***
	(0.000)	(0.019)	(0.011)	(0.052)	(0.000)
BSIZE (ln assets)	3.069***	-2.561***	5.931***	-3.919**	-2.412***
	(0.000)	(0.000)	(0.000)	(0.038)	(0.000)
ROA	69.772***	59.093***	58.126**	60.548***	59.402***
	(0.000)	(0.000)	(0.026)	(0.000)	(0.000)
GDP Growth	62.612***	-7.069	2.730*	3.813**	-5.091
	(0.000)	(0.357)	(0.091)	(0.028)	(0.529)
Constant	-37.024***	52.300***	-64.845***	69.962***	43.405***
	(0.000)	(0.000)	(0.000)	(0.007)	(0.000)
Observations	209	209	209	209	209

Notes: Dependent variable is Z-score. *p*-values in parentheses. *** *p* < 0.01, ** *p* < 0.05, * *p* < 0.10.

Diagnostic Statistics

Model	Adj. R ²	F / Wald	Prob	Observations
Pooled OLS	0.616	55.517	0.000	209
Bank FE	0.916	87.150	0.000	209
Year FE	0.739	241.911	0.000	209
Bank + Year FE	0.914	625.202	0.000	209
Random RE	—	439.997	0.000	209

Hausman Test

Statistic	Value
Chi-square	0
df	8
p-value	1.000
Decision	RE acceptable (variance diff not PD)

Table 6: Lagged Result of Moderating Role of Capital Adequacy on Managerial ownership

Variables	(1) Pooled OLS	(2) Bank FE	(3) Year FE	(4) Bank + Year FE	
MAOWN(t-1)	-576.100*** (0.000)	-283.702** (0.026)	-441.581* (0.068)	-253.965* (0.054)	-283.15*** 0.00
CAR	12.733*** (0.000)	13.596*** (0.000)	9.495*** (0.000)	14.824*** (0.000)	13.65*** (0.000)
MAOWN(t-1)×CAR	3317.514*** (0.000)	1546.068** (0.017)	2413.778* (0.060)	1416.358** (0.045)	1575.34*** 0.00
BFSIZE	2.920*** (0.000)	-2.579*** (0.000)	5.750*** (0.000)	-4.211** (0.044)	-2.47*** 0.00
ROA	75.905*** (0.000)	50.535** (0.019)	55.126 (0.103)	52.637* (0.073)	51.13*** (0.000)
GDP	51.156*** (0.001)	-5.693 (0.385)	2.532* (0.070)	4.595*** (0.000)	-4.63*** 0.483
C	-35.036*** (0.000)	51.914*** (0.000)	-62.892*** (0.000)	74.181** (0.013)	44.16*** (0.000)
Observations	209	209	209	209	209

Notes: Dependent variable is Z-score. Lagged moderation specification. *p*-values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.