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NON-PERFORMING LOANS AND PROFITABILITY OF THE CONVENTIONAL BANKING SECTOR IN PAKISTAN: THE MODERATING ROLE OF CAPITAL ADEQUACY

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ABSTRACT

Significance: Non-Performing Loans (NPLs) are an important concern for the stability of banking sectors in emerging markets such as Pakistan. However, weak credit risk management and inconsistent enforcement of recovery regulations can lead to rising NPLs that erode bank earnings and weaken confidence among depositors and investors. Existing studies give results about how NPLs influence bank profitability. Most studies look at NPLs or capital adequacy separately. They pay little attention to how capital adequacy might change this effect in the conventional banking sector. **Objective**: This study examines the effect of NPLs on the return on assets (ROA) of Pakistan's conventional banks and tests whether capital adequacy (CAR) moderates this relationship. **Methodology:** Using annual sector-level data for 1991-2025 from the State Bank of Pakistan and the World Bank, the study applies ARDL bounds testing to separate short-run and long-run effects of NPLs on ROA. Capital adequacy (CAR) enters through a mean-centered interaction term to test its moderating role, with bank size, cost-to-income ratio, and net interest margin as controls. **Findings**: The bounds test confirms a stable long-run relationship ($F = 15.68$), with significant adjustment toward equilibrium (ECT = -1.648, $p < 0.001$). Contrary to conventional expectations, NPLs have a positive and significant long-run effect on ROA ($\beta = 0.1145$, $p < 0.01$), consistent with a risk-return trade-off, while their short-run effect is negative ($\beta = -0.3688$, $p < 0.001$). Capital adequacy significantly moderates the relationship The negative interaction ($\beta = -0.0133$, $p = 0.015$) shows that stronger capital buffers weaken the NPL-ROA relationship, with the long-run NPL effect falling from 0.157 to 0.072 as CAR rises. **Implications**: Regulators and bank managers should assess NPLs together with provisioning quality and capital buffers. The State Bank of Pakistan should encourage timely provisioning and regular stress testing, while banks should also control operating costs.

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Introduction

The banking industry plays a fundamental role in economic development by mobilizing savings, allocating financial resources, and providing credit to households and businesses. However, lending activities expose banks to credit risk when borrowers fail to meet their repayment obligations. Non-performing loans (NPLs) are therefore an important indicator of credit risk, making effective credit-risk management essential for maintaining asset quality, financial stability, and profitability (Naili & Lahrichi, 2022).

The importance of NPLs became particularly evident during major financial crises, including the 2008 global financial crisis, and was further highlighted by the economic disruption caused by the COVID-19 pandemic. Economic slowdowns can weaken borrowers' repayment capacity and consequently increase credit risk. Research shows that NPLs are influenced by both macroeconomic and bank-specific factors, including economic growth, inflation, profitability, and credit conditions (Arnone et al., 2024). High NPLs can adversely affect banks by reducing interest income, increasing loan-loss provisions and recovery costs, weakening asset quality, and restricting new lending. Consequently, deteriorating loan quality can reduce bank profitability and increase financial vulnerability (Arhinful et al., 2025). Evidence from Pakistan also indicates that weaknesses in risk-management practices contribute to NPL accumulation and adversely affect banking-sector profitability (Haneef et al., 2012). Similarly, Isik and Bolat (2016) found that deteriorating asset quality, profitability, and economic conditions were important factors associated with NPLs among Turkish deposit banks. The accumulation of NPLs is also associated with weaknesses in credit-risk management, including inadequate borrower assessment, insufficient post-disbursement monitoring, and ineffective recovery mechanisms. Effective governance can therefore play an important role in controlling risk and improving bank performance. Governance characteristics such as board size, board independence, gender diversity, CEO duality, ownership structure, and audit-committee characteristics may influence managerial decision-making and risk-taking. Empirical evidence indicates that corporate governance is associated with bank performance, although the effects vary across governance mechanisms and institutional settings (Osei-Baidoo et al., 2023).

The banking sector is particularly important to Pakistan's economy because commercial banks provide financial services that support investment, trade, consumption, and business activity. At the same time, maintaining asset quality and controlling NPLs remain important challenges. Previous research in Pakistan has emphasized the relationship between risk management, NPLs, and bank profitability (Haneef et al., 2012), while international evidence highlights the importance of bank-specific characteristics and governance in determining financial performance (Nguyen, 2024; Osei-Baidoo et al., 2023). Although previous studies have examined the determinants of NPLs and the factors affecting bank profitability, relatively fewer studies have integrated these relationships into a single framework. Building on this literature, the present study examines the effects of bank size and capital adequacy on NPLs, and subsequently investigates the effects of NPLs and corporate governance on bank profitability. Accordingly, the study aims to examine the determinants of NPLs and their implications for bank profitability while considering the role of corporate governance.

Problem Statement

Commercial banks are vital to Pakistan's economy, but high NPLs weaken asset quality, increase provisioning costs, and reduce profitability (Afzal et al., 2018; Haroon et al., 2020; Khan et al., 2020). Although previous studies report mixed evidence on the NPL and financial stability relationship (Abid et al., 2024; Faisal & Yamin, 2025), capital adequacy may moderate this effect by enabling banks to absorb credit losses and maintain financial stability. Since much of the existing evidence uses data ending before recent SBP prudential and Basel III reforms, this study examines the impact of NPLs on Pakistani commercial banks' profitability, measured by ROA and ROE, while testing the moderating role of capital adequacy and controlling for bank-specific and macroeconomic factors.

Literature Review

NPLs are an important determinant of banking profitability because they reduce interest income, increase loan-loss provisions, and raise credit recovery costs. Begum and Atiq (2023) examined the relationship between NPLs and profitability across different categories of Pakistani banks using annual data for 2008–2019. Their findings indicated that provisions against NPLs were significantly associated with profitability, whereas the direct relationship between NPLs and profitability was statistically insignificant. These findings suggest that the financial consequences of NPLs may depend on provisioning practices and banks' credit-risk management rather than solely on the volume of NPLs. In contrast, Faisal and Yamin (2025) reported a positive relationship between NPLs and profitability in Pakistan's conventional banking sector. Similarly, Zaheer et al. (2023) investigated the effect of NPL recoveries on the profitability of Pakistani banks using data for 2016–2020. Their findings revealed a positive and statistically significant relationship between NPL recoveries and profitability. Furthermore, Khan et al. (2020) examined the determinants of NPLs in Pakistan's commercial banking sector and found that profitability and operating efficiency were negatively associated with NPLs, while capital adequacy had a negative but statistically insignificant association with NPLs. Their findings suggest a possible reverse relationship in which more profitable and efficient banks may be better positioned to manage credit risk. Recent research has also emphasized the importance of bank-specific characteristics in explaining differences in profitability. Kamal et al. (2025) investigated banking efficiency and profitability in Pakistani commercial banks using data for 2020–2024. Their findings indicated that the relationship between efficiency and profitability varied across banks with different profitability levels. The study considered capital adequacy, NPLs, bank size, and the loan-to-deposit ratio, demonstrating the importance of accounting for differences in bank characteristics when explaining financial performance. However, its primary focus was not the interaction between NPLs and capital adequacy. Jannat and Alam (2024) analyze ten Pakistani commercial banks over 2007–2023 and report a negative and significant relationship between NPLs and both ROE ($t = -4.179$) and ROA ($t = -3.132$). Faisal and Xie (2025) study conventional banks in Pakistan over 2015–2024 and examine NPLs, profitability, capital adequacy, bank size and governance together. Burki (2025) uses system GMM on an unbalanced panel of 53 banks over 2007–2023 and finds that NPL shocks significantly affect both ROA and ROE, with bank size and liquidity also shaping profitability. Ali

and Ahmed (2024), using panel VAR, find that rising credit risk lowers returns in Pakistani commercial banks.

Capital Adequacy as a Moderator

Meliza et al. (2024) show that CAR moderates the effect of liquidity risk on profitability in Indonesian banks (t = 2.59). More recently, Sahibzada et al. (2026) examined the relationship between non-performing assets (NPAs) and profitability in South Asian banks, with particular attention to the moderating role of capital adequacy. Using panel data for 10 banks across Pakistan, India, Bangladesh, Sri Lanka, and Nepal for 2013–2022, the study found a negative and statistically significant relationship between gross NPAs and return on assets. However, the interaction between gross NPAs and capital adequacy was negative but statistically insignificant at the conventional 5% level. Their country-specific analysis also reported an insignificant relationship for Pakistan. These findings support the argument that impaired assets may reduce bank profitability, but they do not provide strong evidence that capital adequacy systematically moderates this relationship.

Research Gap

Evidence on the NPL-profitability relationship in Pakistan is mixed, with negative, positive and statistically insignificant results documented. Begum and Atiq (2023) found no significant effect, Faisal and Yamin (2025) a positive one, and Jannat and Alam (2024), Burki (2025) and Ali and Ahmed (2024) a negative one. The positive result challenges the conventional expectation that higher NPLs necessarily reduce profitability. The moderating role of capital adequacy also remains inconclusive. Sahibzada et al. (2026) examined the NPA × capital adequacy interaction only in a small cross-country South Asian panel and found insignificant results, including for Pakistan, while Meliza et al. (2024) and Kamal et al. (2025) did not test this interaction for credit risk in Pakistan. Few studies address the reverse causality between profitability and NPLs noted by Khan et al. (2020), and most samples end before the recent period of high interest rates. Therefore, this study focuses specifically on Pakistan's conventional banks, using recent data, to examine whether capital adequacy changes the relationship between NPLs and profitability.

Hypotheses of the Study

H_1: NPLs have a negative effect on the profitability of conventional banks in Pakistan.

H_2: Capital adequacy moderates the relationship between NPLs and profitability of conventional banks in Pakistan.

Conceptual Framework

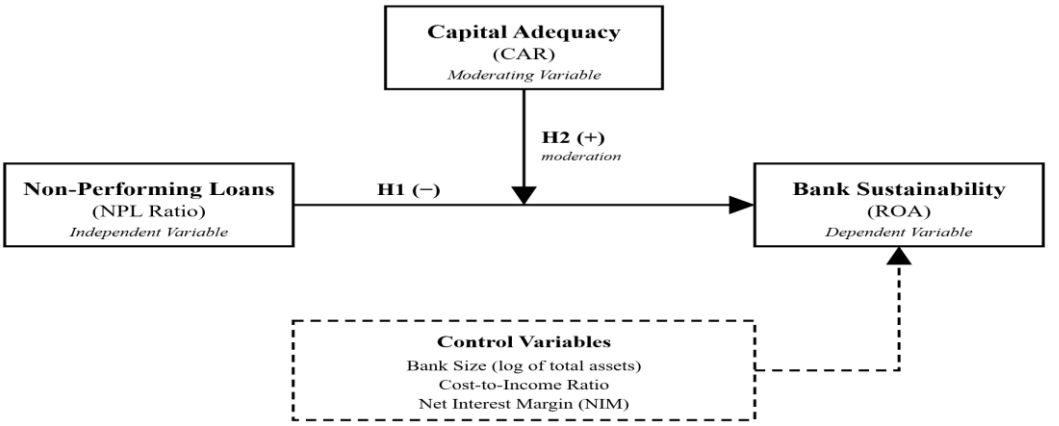


Figure 1: Conceptual Framework

Data And Methodology

Research Design

The study adopted a quantitative, explanatory time-series research design to examine the effect of NPLs on the profitability of Pakistan's conventional banking sector, with capital adequacy as a moderator. Annual sector-level data for (1991-2025) were collected from the State Bank of Pakistan and analyzed using the ARDL bounds testing approach. Time-series methods of this kind have been applied to annual macro-financial data for Pakistan in recent work (Zakria & Ali, 2026), which supports their use for a single-country sector study.

Sources of Data

The dataset for this study covers the period (1991-2025), capturing more than three decades of financial and regulatory developments in Pakistan's banking sector. This extended horizon reflects major changes in the sector, including financial liberalization, banking reforms, the global financial crisis, rising interest rates, and the COVID-19 shock. A longer sample also supports more reliable testing of the long-run and short-run relationships in the ARDL model. Annual sector-level data on return on assets, NPLs, capital adequacy, bank size, cost-to-income ratio and net interest margin were collected from the State Bank of Pakistan and the World Bank's Global Financial Development database.

Table 1: Measurement of Variables and Data Sources

Variable	Measurement	Reference	Data source
Bank profitability (ROA)	Net income/total assets	Sahibzada et al. (2026)	SBP, World Bank Global Financial Development database
Non-performing loans (NPL)	NPL / gross loans	Faisal & Xie (2025)	SBP, Financial Stability Review
Capital adequacy ratio (CAR)	Regulatory capital/risk-weighted assets	Meliza et al. (2024)	SBP, *Financial Stability Review*
Bank size (SIZE)	log of total assets	Kamal et al. (2025)	SBP, *Financial Stability Review*
Cost-to-income ratio (CTI)	Operating expenses/ operating income	Khan et al. (2020)	SBP, *Financial Stability Review*
Net interest margin (NIM)	Net interest income/ average earning assets	Faisal & Xie (2025)	SBP, *Financial Statements Analysis*

Model of the Study

$$ROA_t = \beta_0 + \beta_1 NPL_t + \beta_2 CAR_t + \beta_3 (NPL_t \times CAR_t) + \beta_4 SIZE + \beta_5 CTI_t + \varepsilon_t \text{----------1}$$

Estimation Technique

NPL and CAR are mean-centered before forming the interaction, which reduces non-essential multicollinearity and makes β_1 the effect of NPLs at the average level of CAR (Aiken & West, 1991). The marginal effect of NPLs on ROA is $\partial ROA/\partial NPL = \beta_1 + \beta_3 \cdot CAR$. Moderation is supported if β_3 is positive and statistically significant, indicating that higher capital adequacy buffers the adverse effect of NPLs. The ARDL error-correction (unrestricted ECM) form is:

$$\Delta ROA_t = \alpha_0 + \Sigma_{i=1}^{p} \varphi_i \Delta ROA_{t-i} + \Sigma_{j=0}^{q} \theta_j' \Delta X_{t-j} + \lambda_1 ROA_{t-1} + \lambda_2 NPL_{t-1} + \lambda_3 CAR_{t-1} + \lambda_4 (NPL \times CAR)_{t-1} + \lambda_5 GDPG_{t-1} + \lambda_6 INF_{t-1} + u_t \text{----------2}$$

where $X = (NPL, CAR, NPL \times CAR, SIZE, CTI)'$, and lag orders (maximum of two, given the sample size) are chosen by the Akaike or Schwarz information criterion. Cointegration is tested with the bounds F-test of $H_0: \lambda_1 = \ldots = \lambda_6 = 0$ (unrestricted intercept, no trend). Because the sample is small, critical values are taken from Narayan (2005) rather than the asymptotic values of Pesaran et al. (2001). If cointegration is found, the long-run coefficients are $\beta_k = -\lambda_k/\lambda_1$ (so the long-run

moderation effect is $\beta_3 = -\lambda_4/\lambda_1$), and the speed of adjustment, λ_1 (equivalently the ECT coefficient in the restricted ECM), must be negative, significant and between −1 and 0.

Findings And Discussion

Descriptive statistics

Mean ROA is 0.77% with a wide range (−1.45% in 2010 to 2.34% in 2012). ROA, CTI and NIM reject normality (Jarque–Bera $p \leq 0.001$); NIM is strongly right-skewed because of a single 2012 spike (8.13%). NPL, CAR and SIZE are close to normal. Cost-to-income is the dominant correlate of ROA ($r = -0.91$). NPL is negatively correlated with ROA ($r = -0.28$) and with CAR ($r = -0.48$). CAR and SIZE move together ($r = 0.81$), though VIFs in the full sample stay below 4. In the 2004–2021 window the CAR–SIZE correlation rises to 0.93 and their VIFs to about 11, which makes separating the two effects unreliable there.

Table-02: Descriptive Statistics

Variable	N	Mean	Median	SD	Min	Max	Skew	Kurt
ROA	35	0.774	0.872	0.732	-1.447	2.340	-1.16	5.35
NPL	35	10.477	11.600	2.581	5.360	16.200	-0.19	2.57
CAR	35	14.130	12.700	3.181	8.500	20.800	0.32	2.51
SIZE	35	15.342	15.428	1.456	12.759	17.759	-0.06	1.82
CTI	35	59.110	58.703	8.929	46.010	86.744	1.35	4.63
NIM	35	3.520	3.254	0.945	2.853	8.129	3.43	17.30

Source: SPSS results

4.2 Unit Root Test Results

Table 2 presents the ADF unit root test results for the study variables. ROA ($t = -3.976$, $p = 0.002$) and NIM ($t = -4.511$, $p = 0.000$) are stationary at level at the 1% significance level, and CTI ($t = -3.120$, $p = 0.025$) is stationary at level at the 5% level, so all three are integrated of order zero, I(0). This is consistent with the mean-reverting behavior of bank profitability under competitive pressure (Athanasoglou et al., 2008). In contrast, NPL ($p = 0.164$), CAR ($p = 0.967$) and SIZE ($p = 0.938$) are non-stationary at level but become stationary after first differencing ($p < 0.01$), indicating that they are integrated of order one, I (1). This agrees with the evidence that many economic and financial series are difference-stationary and that NPL ratios are persistent over the credit cycle (Ghosh, 2015). Since the variables are of mixed order, I(0) and I(1), and none is I(2), the ARDL bounds testing approach is appropriate (Narayan, 2005).

Table 2: ADF Unit Root Test Results

Variable	Level: t-stat	Level: p	1st diff.: t-stat	1st diff.: p	Order
ROA	-3.976	0.002	-3.775	0.003	I(0)

NPL	-2.326	0.164	-3.760	0.003	I(1)
CAR	0.119	0.967	-5.214	0.000	I(1)
SIZE	-0.204	0.938	-8.340	0.000	I(1)
CTI	-3.120	0.025	-4.060	0.001	I(0)
NIM	-4.511	0.000	-7.224	0.000	I(0)

Source: E-views results

Bounds Test for Cointegration

The ARDL bounds test examines whether ROA and its determinants (NPL, CAR, NPL×CAR, SIZE, CTI and NIM) share a long-run relationship, with the null hypothesis of no cointegration (Pesaran, Shin & Smith, 2001). The computed F-statistic of 15.68 exceeds the upper I(1) bound at every significance level, including 0.1% (5.21), so the null is rejected decisively and a stable long-run relationship is confirmed. This is consistent with the mixed I(0)/I(1) integration orders in Table 1, which make the bounds approach appropriate (Pesaran & Shin, 1999), and it justifies interpreting the long-run coefficients and the error-correction term.

Table 3: Bounds test for cointegration (unrestricted constant)

F-statistic	Significance	I(0) bound	I(1) bound	Decision
15.68	10%	2.03	3.14	Reject: cointegrated
	5%	2.33	3.50	Reject
	1%	2.96	4.25	Reject
	0.1%	3.78	5.21	Reject

Source: E-views results

Long-Run ARDL Estimates

The long-run estimates indicate that NPLs exerts a positive and statistically significant impact on ROA ($\beta = 0.1145$, $p < 0.01$), which contradicts the credit-risk channel reported by Al-Sharkas and Al-Sharkas (2022) and Bhowmik and Sarker (2024), but is compatible with evidence for Pakistani banks (Khan et al., 2025). This can be explained by a risk–return trade-off in which higher-yield lending raises measured returns, while the adverse NPL effect appears only in the short run. The CAR coefficient is negative and significant ($\beta = -0.0641$, $p < 0.01$), in line with Al-Sharkas and Al-Sharkas (2022), as higher capital lowers leverage. The negative NPL × CAR term ($\beta = -0.0133$, $p = 0.015$) shows that higher capital adequacy weakens, but does not reverse, the NPL–ROA relationship. Bank size is positive and significant ($\beta = 0.0964$, $p = 0.011$), consistent with Khan et al. (2025), and the cost-to-income ratio is negative and significant ($\beta = -0.0577$, $p < 0.01$), consistent with Berger and DeYoung (1997). NIM has the expected positive sign but is insignificant ($\beta = 0.0266$, $p = 0.622$).

Table 4: Long-run coefficients (delta-method standard errors)

Regressor	Coef.	Std. err.	t	p
NPL	0.1145	0.0193	5.94	0.000***
CAR	−0.0641	0.0119	−5.38	0.000***
NPL × CAR	−0.0133	0.0048	−2.76	0.015**
SIZE	0.0964	0.0333	2.89	0.011**
CTI	−0.0577	0.0047	−12.40	0.000***
NIM	0.0266	0.0528	0.50	0.622

*** $p < 0.01$, ** $p < 0.05$.

Moderating Role of Capital Adequacy

Table 5 shows that NPL positively and significantly affects ROA at all CAR levels, but its effect declines from 0.157 to 0.072 as CAR increases ($p \leq 0.006$). The negative interaction coefficient ($\beta = -0.0133$, $p = 0.015$) confirms that stronger capital adequacy weakens the NPL–ROA relationship. Although the positive effect contradicts conventional findings (Al-Sharkas & Al-Sharkas, 2022; Bhowmik & Sarker, 2024), it aligns with Khan et al. (2025) for Pakistani banks. The effect remains positive within the observed CAR range, reaching zero only at approximately 22.7%, above the sample maximum of 20.8%. However, this result warrants caution because, over the 2004–2021 estimation window, CAR and bank size are highly correlated ($r = 0.93$).

Table 5: Moderation by CAR (long-run effect of NPL on ROA)

CAR level	CAR (%)	Effect	Std. err.	p
Mean − 1 SD	10.95	0.157	0.027	0.000
Mean	14.13	0.115	0.019	0.000
Mean + 1 SD	17.31	0.072	0.022	0.006

Short-run (error-correction) estimates

The results of short-run dynamics indicate that the error-correction term is negative and statistically significant ($\beta = -1.6479$, $p < 0.001$), confirming adjustment toward long-run equilibrium with overshooting. The lagged change in NPL negatively affects ROA ($\beta = -0.3688$, $p < 0.001$), while the lagged change in CAR has a positive effect ($\beta = 0.1508$, $p = 0.002$). The lagged NPL × CAR interaction is negative and significant ($\beta = -0.0597$, $p = 0.003$), indicating moderation in the short run. CTI negatively affects ROA, whereas NIM and its lagged value have positive effects ($p < 0.01$). The remaining short-run coefficients are statistically insignificant.

Table 6: Short-run (error-correction) estimates

Term	Coef.	t-stat	p-value
ECT (lagged ROA)	−1.6479	−9.87	0.000*
ΔNPL	−0.0088	−0.17	0.865
ΔNPL (lag 1)	−0.3688	−5.66	0.000***
ΔCAR	0.0224	0.64	0.529
ΔCAR (lag 1)	0.1508	3.74	0.002***
Δ(NPL×CAR)	−0.0087	−0.70	0.492
Δ(NPL×CAR) (lag 1)	−0.0597	−3.52	0.003***
ΔSIZE	0.4340	0.95	0.355
ΔCTI	−0.0580	−5.99	0.000***
ΔNIM	0.2303	4.67	0.000***
ΔNIM (lag 1)	0.1428	2.99	0.009***

Source: E-views results

Diagnostic Tests and Model Stability

The results of diagnostic tests indicate normally distributed residuals ($p = 0.835$) and no evidence of serial correlation at lag one ($p = 0.730$), although the lag-two test identifies serial correlation ($p = 0.044$). The ARCH test indicates no ARCH effects ($p = 0.737$), whereas the Breusch–Pagan test reveals heteroskedasticity ($p = 0.001$). The Ramsey RESET test suggests possible model misspecification ($p = 0.016$), while the reported CUSUM result indicates parameter stability. Overall, the model satisfies some diagnostic assumptions, but serial correlation, heteroskedasticity, and potential misspecification require attention.

Table 7: Diagnostic tests

Test	Statistic	p	Result
Durbin-Watson	1.87	–	No autocorrelation
Jarque-Bera (normality)	0.36	0.835	Normal residuals
Breusch-Godfrey, 1 lag	0.12	0.730	No serial correlation
Breusch-Godfrey, 2 lags	4.02	0.044	Mild serial correlation
ARCH(1)	0.12	0.737	No ARCH effects
Breusch-Pagan	5.97	0.001	Heteroskedasticity
Ramsey RESET	7.48	0.016	Some misspecification
CUSUM	0.28	1.000	Parameters stable

Source: E-views results

Conclusion and Implication

Conclusion

This study examined how NPLs affect the profitability of Pakistan's conventional banks, and whether capital adequacy moderates that effect, using ARDL bounds testing on 1991–2025 sector-level data. A stable long-run relationship exists ($F = 15.68$). Contrary to the conventional credit-risk view, NPLs have a positive and significant long-run effect on ROA ($\beta = 0.1145$, $p < 0.01$), consistent with a risk–return trade-off in which higher-yield lending raises measured returns. The adverse effect of NPLs appears only in the short run ($\beta = -0.3688$, $p < 0.001$). Capital adequacy moderates the relationship. The negative interaction ($\beta = -0.0133$, $p = 0.015$) shows that stronger capital buffers weaken the NPL–ROA link, with the long-run effect falling from 0.157 to 0.072 as CAR rises, while bank size raises and the cost-to-income ratio lowers profitability. The study contributes one of the few Pakistan-specific tests of capital adequacy as a moderator, using a long and recent sample that separates short-run from long-run effects. For regulators and bank managers, the findings point to judging performance by provisioning quality and capital buffers, not by NPL ratios alone. Results should be read with caution given the small sample, the high CAR–SIZE correlation, and diagnostic concerns, and future research could use bank-level panel data and compare Islamic and conventional banks.

Implications

Practical implications

Bank managers should judge NPLs together with provisioning, pricing of risk, and capital buffers, and should plan liquidity for their short-run cost. Banks with strong capital gain less from carrying impaired loans, so they should focus on credit assessment, monitoring, and recovery. Scale and cost control are further routes to profitability, and analysts should read NPL ratios alongside capital adequacy and efficiency.

Policy implications

The State Bank of Pakistan should continue enforcing Basel III and prudential capital standards, since stronger buffers weaken the transmission of credit losses to profitability. The positive NPL effect should not be read as a reason to relax asset-quality rules, because the short-run costs and systemic risk remain. Regulators should monitor NPLs alongside provisioning and capital, use stress tests that capture both short-run and long-run effects, and consider higher capital buffers during periods of high interest rates, as the NPL effect reaches zero only at a CAR of about 22.7%.

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