

DETERMINANTS OF COMMERCIAL BANK PERFORMANCE IN PAKISTAN: THE ROLE OF CREDIT RISK, LIQUIDITY, AND CAPITAL ADEQUACY

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Abstract

This study examines the determinants of commercial bank performance in Pakistan, with particular emphasis on credit risk, liquidity risk, and capital adequacy. The analysis considers bank performance from three complementary dimensions – return on assets, return on equity, and net interest margin – to capture differences in the profitability implications of bank-specific risks. Using panel data for fifteen Pakistan Stock Exchange-listed commercial banks covering 2014–2023, the study employs fixed-effects and random-effects panel regression models selected through the Hausman specification test. System Generalised Method of Moments is additionally employed as a robustness approach to account for dynamic relationships and potential endogeneity. The empirical findings demonstrate that credit risk is the most consistent determinant of bank performance. The non-performing loan ratio has a significant negative association with return on assets and net interest margin, indicating that deterioration in loan quality is associated with weaker asset-based profitability and interest-based earnings. In contrast, the loan-to-deposit ratio and cash-to-assets ratio do not exhibit statistically significant relationships with the principal performance measures in the preferred panel estimations, indicating that liquidity positions did not generate substantial differences in profitability across the sampled banks during the study period. Capital adequacy displays a differentiated relationship with performance, exhibiting a positive and significant association with net interest margin but no statistically significant relationship with return on assets, while its negative association with return on equity is not statistically significant. The System Generalised Method of Moments results provide additional evidence that the effects of credit risk and capital adequacy vary across alternative measures of bank performance. The findings highlight the importance of strengthening credit risk management, maintaining adequate regulatory capital, and aligning risk-management practices with profitability objectives. The study provides relevant implications for the State Bank of Pakistan, commercial bank management, auditors, and financial analysts concerning credit quality, capital planning, and sustainable banking performance.



Introduction

The banking sector constitutes a fundamental component of a modern financial system because it mobilizes savings, channels financial resources toward productive investment, facilitates domestic and international payments, and supports the transmission of monetary policy. Commercial banks occupy a particularly important position within this system because their decisions concerning lending, investment, liquidity management, and capital allocation influence the availability and cost of finance throughout the economy (Adeyanju, 2011; Audi & Yu, 2024; Khalid et al., 2025; Humayun et al., 2026). The performance of commercial banks is therefore not merely an institutional concern but an important determinant of financial stability, private-sector development, investment activity, and sustainable economic growth. Well-performing banks are better positioned to absorb financial shocks, maintain credit flows, meet their obligations, and support economic activity, whereas persistent deterioration in bank performance can weaken financial intermediation and amplify vulnerabilities across the wider economy (Adewunmi, 1981; Marc, 2016; Siddique et al., 2025; Shafqat & Audi, 2026).

The importance of commercial bank performance is particularly

pronounced in emerging economies, where banks often represent the principal source of external finance for firms and households. In such economies, capital markets may not provide sufficient depth or accessibility to meet the financing requirements of businesses, making bank-based financial intermediation essential for economic development. Bank profitability also provides an important indication of the efficiency with which financial institutions transform deposits and other funding sources into earning assets while managing the risks associated with their operations. Consequently, understanding the factors that determine bank performance is important for bank managers, regulators, investors, depositors, and policymakers (Aduda & Kalunda, 2012; Iqbal et al., 2025; Muzaffar et al., 2026). Among the various factors affecting banking outcomes, financial risk management and balance-sheet strength remain particularly important because banks operate through a business model that inherently exposes them to credit, liquidity, and solvency-related risks (Alam & Musukujjaman, 2011; Farras et al., 2025; Zamir et al., 2026; Ali et al., 2026; Farooq et al., 2026). Within this broader context, the banking sector in Pakistan plays a central role in supporting economic and financial activity. Commercial banks collectively hold assets



equivalent to approximately fifty percent of gross domestic product and remain the dominant source of credit for businesses, households, and the public sector. Their financial condition consequently has implications extending beyond individual institutions to the stability and functioning of the broader Pakistani economy (Bukhari et al., 2025; Batool et al., 2025; Naseer et al., 2026). The ability of commercial banks to maintain profitability while controlling financial risks is particularly important in an environment characterized by exchange-rate pressures, inflationary conditions, changing interest rates, fiscal constraints, and fluctuations in economic activity. Variations in the quality of bank assets, liquidity positions, and capital strength can directly affect the capacity of financial institutions to continue lending and withstand periods of economic and financial stress. Bank performance in Pakistan is therefore closely connected with both institutional risk management and the broader macroeconomic environment.

The period from 2014 to 2023 provides an especially relevant setting for examining these issues. During this period, the State Bank of Pakistan implemented the Basel III Accord in phases, requiring listed commercial banks to progressively strengthen capital adequacy, comply with liquidity

coverage requirements, and adopt the net stable funding ratio as a binding regulatory minimum. These regulatory developments substantially influenced the manner in which banks managed their balance sheets, capital resources, and liquidity positions. At the same time, Pakistani banks operated through a period of considerable macroeconomic and financial uncertainty. The balance-of-payments crisis during 2018 and 2019 resulted in an International Monetary Fund programme, substantial currency depreciation, and heightened financial pressures. The COVID-19 pandemic subsequently disrupted economic activity during 2020 and 2021, creating additional uncertainty for borrowers and financial institutions. These conditions were followed by persistent inflationary pressures and a substantial tightening of monetary policy, with the State Bank of Pakistan policy rate reaching twenty-two percent in 2023. The combination of regulatory transformation and macroeconomic disruption created substantial variation in the financial risk characteristics and balance-sheet positions of commercial banks during this period.

Three financial factors are particularly relevant to the performance of commercial banks: credit risk, liquidity risk, and capital adequacy. Credit risk represents the possibility that borrowers will fail



to meet their contractual obligations and is one of the most direct threats to bank profitability. Deterioration in credit quality can increase non-performing loans, raise provisioning requirements, reduce interest income, and ultimately weaken profitability. Liquidity risk, by contrast, concerns the ability of a bank to meet its short-term financial obligations without incurring excessive losses. Inadequate liquidity can increase funding costs, constrain lending activity, and expose banks to financial distress, particularly during periods of market uncertainty or deposit withdrawals. Capital adequacy reflects the extent to which a bank possesses sufficient equity relative to its risk-weighted assets to absorb unexpected losses and sustain its operations. Adequate capital can strengthen financial resilience, enhance market confidence, reduce vulnerability to shocks, and provide banks with greater capacity to expand their balance sheets. These three dimensions are interconnected because decisions concerning lending, liquidity, and capital allocation can simultaneously influence both the risk profile and profitability of a commercial bank. Several theoretical perspectives provide a foundation for examining these relationships. The CAMEL supervisory framework emphasizes the importance of capital adequacy, asset quality, management quality, earnings, and liquidity in

evaluating the financial condition of banks. From this perspective, credit quality, liquidity management, and capital strength represent important dimensions of institutional soundness and financial performance. Agency theory provides another relevant perspective by emphasizing potential conflicts between managers, shareholders, depositors, and other stakeholders and the resulting importance of monitoring, risk controls, and financial discipline. The risk-return trade-off further establishes that decisions involving greater exposure to financial risk may generate additional returns but can also increase the potential for financial losses. Together, these perspectives provide complementary explanations for why credit risk, liquidity risk, and capital adequacy may influence commercial bank performance. Against this background, this study examines the effects of credit risk, liquidity risk, and capital adequacy on the performance of fifteen commercial banks listed on the Pakistan Stock Exchange during 2014–2023, using return on assets, return on equity, and net interest margin as alternative measures of bank performance.

Literature Review

The determinants of commercial bank performance have received sustained attention because profitability reflects the capacity of



banks to transform financial resources into productive assets while maintaining financial stability and absorbing adverse shocks. The literature identifies several bank-specific and macroeconomic factors that influence performance, but credit risk, liquidity risk, and capital adequacy remain among the most important dimensions of bank financial management. These factors are closely connected because lending decisions influence asset quality, liquidity positions affect the capacity to meet short-term obligations, and capital provides a buffer against unexpected losses (Zahid et al., 2025; Rafique et al., 2025; Audi et al., 2026; Fatima et al., 2026). Their simultaneous consideration is therefore particularly relevant for understanding bank performance in emerging financial systems. The CAMEL framework provides an important theoretical foundation for assessing bank soundness. The framework, an acronym for Capital Adequacy, Asset Quality, Management, Earnings, and Liquidity, originated as a supervisory tool introduced by United States federal banking regulators and was formalised in subsequent decades (Barker & Holdsworth, 1993; Cole & Gunther, 1995). Three of its five dimensions correspond directly to the principal financial characteristics examined in this study: capital adequacy, asset quality, commonly represented

through non-performing loan ratios and provisions, and liquidity. The framework therefore provides a natural basis for connecting financial risk management with bank performance. Agency theory provides another important explanation. Jensen and Meckling (1976) established that conflicts between principals and agents can influence managerial decisions, while banking institutions involve several layers of potential conflict, including relationships between shareholders and managers, depositors and shareholders, and regulators and bank owners. Managers who are protected from the full consequences of excessive risk-taking through limited liability and deposit insurance may have incentives to accept greater levels of credit and liquidity risk, creating the moral hazard described by Merton (1977). Capital adequacy requirements under Basel III partly address this problem by requiring banks and their owners to maintain sufficient capital exposure and financial discipline (BCBS, 2010; Umair et al., 2025; Khan & Audi, 2026).

Classical portfolio theory also provides a useful explanation for the relationship between financial risk and bank returns. Markowitz (1952) established that portfolio decisions involve a fundamental trade-off between expected return and risk. Berger and DeYoung (1997) extended this reasoning to banking



through their “bad luck” and “bad management” hypotheses, linking deteriorating asset quality, managerial inefficiency, and bank performance. Similarly, Diamond and Dybvig (1983) emphasized the role of liquidity in banking and the potential costs associated with holding excessive liquid assets. These theoretical perspectives indicate that bank performance cannot be understood solely through profitability measures; it must also be examined in relation to the risks undertaken and the financial resources available to absorb those risks.

Credit Risk and Bank Performance

Credit risk, defined as the possibility that borrowers will fail to meet their contractual obligations, represents one of the most consequential risks faced by commercial banks. The non-performing loans ratio is widely used as an empirical proxy for credit risk because deterioration in loan quality directly affects interest income, provisioning expenses, asset values, and profitability (Ghosh, 2015; Shaukat et al., 2025; Naeem et al., 2025; Javed et al., 2026). Berger and DeYoung (1997) provided an early empirical examination of the relationship between credit risk and bank efficiency using United States banking data. Louzis et al. (2012) subsequently demonstrated that macroeconomic conditions and bank-specific characteristics were

important determinants of non-performing loans among Greek banking groups. Ghosh (2015) documented a robust negative association between non-performing loans and return on assets among United States commercial banks. Comparable evidence has been reported for Sub-Saharan Africa (Flamini et al., 2009; Ditta et al., 2025; Karim et al., 2026) and the Middle East (Hasan & Wall, 2004), reinforcing the argument that deterioration in credit quality can constrain banking profitability. Evidence from Pakistan has generally supported the adverse profitability consequences of credit deterioration. Ali and Dhiman (2019) identified a significant negative effect of the non-performing loans ratio on return on assets and return on equity using a fixed-effects panel covering 2006–2015. Mehmood et al. (2019) reported similar evidence using a broader sample of Pakistani banks, while Usman et al. (2021), using a system generalized method of moments approach, demonstrated that lagged profitability and current credit risk jointly influence current bank profitability. More recent Pakistani evidence reinforces the continuing relevance of credit quality. The study by Iftikhar and Azmat (2024) found that credit risk was negatively associated with profitability among twenty-two Pakistani commercial banks over 2006–2022, while Mahmood et al.



(2023) reported that credit risk management variables, including non-performing loans, were important determinants of the performance of commercial banks listed on the Pakistan Stock Exchange. Similarly, Hussain et al. (2024) examined Pakistani banks during and around the COVID-19 period and demonstrated that credit risk and liquidity risk remained important factors associated with profitability. These recent findings indicate that credit quality continues to be particularly important in an environment exposed to economic uncertainty, repayment difficulties, and changes in financing conditions.

Liquidity Risk and Bank Performance

Liquidity risk encompasses both funding liquidity risk and market liquidity risk and concerns the ability of a bank to meet its financial obligations when they become due (BCBS, 2010; Iqbal et al., 2025; Zafar et al., 2025; Rauf et al., 2026). The relationship between liquidity and profitability is theoretically ambiguous because liquid assets reduce the probability of financial distress but generally generate lower returns than riskier earning assets. Bourke (1989) was among the first to document a positive association between liquid asset holdings and profitability across twelve European and North American banking systems. Molyneux and Thornton (1992) reported comparable evidence for

European banks. Later studies, however, demonstrated that the relationship may depend on the level of liquidity maintained by banks. Dinger (2009) identified a non-linear liquidity-performance relationship, while Bonfim and Kim (2012) found that very high loan-to-deposit ratios were negatively associated with profitability among European banks.

Recent evidence further emphasizes the conditional nature of the liquidity-performance relationship. Haris et al. (2024), examining thirty-seven Pakistani banks before and during the COVID-19 period, found that liquidity and credit risks had different implications for profitability across crisis and non-crisis periods. The study demonstrates the importance of considering the institutional and macroeconomic context when evaluating liquidity effects. Iftikhar and Azmat (2024) also reported a significant inverse association between liquidity risk and profitability in Pakistani commercial banks while identifying a positive role for bank capital. Their findings reinforce the argument that maintaining liquidity involves a trade-off between financial resilience and the opportunity cost of holding or deploying assets.

Evidence from other emerging and developed banking systems also indicates that liquidity does not exert a uniform effect on bank



performance. Bilal et al. (2024), examining Gulf Cooperation Council banks, found that the relationship between liquidity risk and financial performance varies according to the structure of the financial system. More recent international evidence has strengthened the case for a non-linear interpretation. A 2025 cross-country study of banks in Group of Twenty economies identified different liquidity-performance regimes, indicating that liquidity can be associated with weaker performance at some levels and improved performance once banks reach more efficient liquidity positions. This evidence is particularly relevant for emerging markets because the optimal liquidity position may depend on funding conditions, regulatory requirements, and the ability of banks to convert liquid resources into earning assets.

Capital Adequacy and Bank Performance

Capital adequacy refers to the sufficiency of a bank's equity relative to the risks associated with its assets and operations. Adequate capital enables banks to absorb unexpected losses, maintain depositor confidence, reduce financial vulnerability, and continue lending during periods of stress (Ullah et al., 2025; Karim et al., 2025; Zahid et al., 2026; Choudhary et al., 2026). Berger (1995) provided seminal evidence that better-

capitalised United States banks can achieve higher returns, attributing this partly to lower deposit insurance premia and reduced costs of uninsured funding through the signalling hypothesis. Pasiouras and Kosmidou (2007) confirmed a positive relationship between equity-to-assets ratios and return on assets across 584 European Union commercial banks. Dietrich and Wanzenried (2011) further found that the positive capital effect became stronger during the 2007–2009 financial crisis.

Evidence from Pakistan has produced somewhat more heterogeneous findings. Ayub and Javeed (2016) reported a significant positive relationship between capital adequacy and return on assets, whereas Shair et al. (2019) identified positive effects of capital adequacy on return on assets but negative effects on return on equity. This divergence is important because higher capitalization can strengthen financial resilience while simultaneously affecting the return generated on shareholders' equity. Recent evidence continues to demonstrate the importance of capital in Pakistani banking. Iftikhar and Azmat (2024) found that bank capital was positively associated with profitability, while Boda et al. (2024), using a broader sample of forty-one Pakistani financial institutions and examining return on assets, return on equity, and net interest margin, identified capital



adequacy among the relevant bank-specific determinants of profitability. The broader use of multiple profitability measures is particularly important because the effect of capitalization may differ depending on whether performance is evaluated from an asset-based, equity-based, or interest-margin perspective.

Recent international research also indicates that capital and liquidity should not necessarily be treated as independent dimensions. Haq et al. (2025) demonstrate that changes in bank capital can influence liquidity risk through adjustments in cash holdings, funding structures, and balance-sheet composition. Similarly, recent evidence from frontier banking markets shows that bank capital can enhance return on assets while liquidity may have different effects depending on the profitability measure used. These findings reinforce the theoretical proposition that capital strength can improve resilience but that its relationship with profitability depends on the way banks allocate capital and manage liquidity and credit exposures.

Integrated Evidence and the Pakistani Banking Context

A subset of the literature examines credit risk, liquidity, and capital adequacy jointly rather than treating them as isolated determinants. Athanasoglou et al. (2008) incorporated credit risk, liquidity, and capital adequacy

within a generalized method of moments framework for Greek banks, while Alper and Anbar (2011) and Sufian and Habibullah (2010) reported broadly consistent evidence for Turkish and South-East Asian banking systems. This integrated perspective is important because bank-specific risks are interconnected. Weak credit quality can reduce earnings and capital, liquidity pressures can increase funding costs and restrict lending, and stronger capital can provide a buffer against both credit and liquidity shocks (Kanwal et al., 2025; Khalid et al., 2025; Saim et al., 2025; Gillani et al., 2026).

The Pakistani banking literature has expanded in recent years, but the findings remain heterogeneous across samples, periods, measures, and estimation techniques. Pakistan operates under a dual banking structure comprising conventional and Islamic institutions, with Islamic banking accounting for approximately one-fifth of total banking assets by 2023. Sufian (2009) established an important foundation for profitability-determinants research in developing-economy banking sectors, while Hassan and Bashir (2003) documented the positive relevance of capital adequacy for Islamic bank profitability across twenty-one countries, including Pakistan. More recent research has broadened the scope of bank-performance analysis in Pakistan.



Income diversification has been found to influence risk-adjusted bank performance, while credit risk remains an important constraint on profitability (2023). Boda et al. (2024) further incorporated multiple profitability measures and both bank-specific and macroeconomic determinants, thereby demonstrating the importance of examining performance through more than a single accounting indicator. Işık et al. (2025) also developed a multi-criteria framework for evaluating Pakistani commercial banks, reflecting the increasing recognition that bank performance is multidimensional rather than reducible to a single profitability measure.

The most recent literature continues to emphasize the interaction between financial risks and bank performance. Research published in 2025 examines liquidity, credit, and leverage risk jointly among Pakistani commercial banks, while emerging evidence from 2026 links credit-risk shocks to bank resilience and examines the interaction between credit and liquidity risks in emerging banking systems. International evidence likewise indicates that capital, liquidity, and credit risk can produce different effects depending on the performance measure, regulatory environment, and stage of financial development.

This literature establishes that credit risk, liquidity risk, and capital

adequacy are theoretically interconnected and empirically relevant determinants of commercial bank performance, but their effects are not uniform across banking systems, periods, or performance measures. Evidence from Pakistan particularly indicates that the direction and magnitude of these relationships can vary according to the selected profitability indicator and the institutional and macroeconomic environment. This provides a strong basis for examining the three determinants within a common empirical framework and across multiple measures of commercial bank performance.

Theoretical Framework, Model Specification, and Data Sources

Theoretical Framework

Commercial banks operate under a fundamental financial management problem: they must generate sufficient returns from their assets while controlling the risks associated with lending, liquidity management, and capital allocation. Excessive exposure to credit risk can deteriorate asset quality and increase provisioning costs, whereas insufficient liquidity can constrain the ability of banks to meet short-term obligations and maintain lending operations. At the same time, inadequate capitalization reduces the capacity of banks to absorb unexpected losses, while excessive capitalization may alter the return generated for



shareholders. Bank performance is therefore determined not only by the income generated from financial intermediation but also by the manner in which banks balance risk, liquidity, and capital (Saim et al., 2025; Longston et al., 2025).

The present study addresses this issue through three complementary theoretical perspectives: the CAMEL supervisory framework, agency theory, and the risk-return trade-off. The CAMEL framework provides the principal institutional foundation because it evaluates banking soundness through capital adequacy, asset quality, management quality, earnings, and liquidity. Three dimensions of this framework correspond directly to the principal financial factors examined in this study: capital adequacy, asset quality, and liquidity. Credit risk is represented through indicators of loan quality and provisioning, liquidity risk through indicators of loan and cash positions, and capital adequacy through the capital adequacy ratio. The framework therefore establishes a direct conceptual connection between the financial condition of a bank and its operating performance.

Agency theory provides a second theoretical explanation for the relationship between bank risk and performance. Jensen and Meckling (1976) argue that conflicts between principals and agents can influence managerial decisions when

managers' interests do not fully coincide with those of owners. In banking, such conflicts may arise among shareholders, managers, depositors, creditors, and regulators. Limited liability and deposit insurance can create incentives for managers or shareholders to undertake greater levels of risk because some consequences of unsuccessful risk-taking may be transferred to other stakeholders. Merton (1977) identifies this mechanism as moral hazard. From this perspective, effective credit risk management, adequate liquidity, and sufficient capitalization can serve as mechanisms for reducing excessive risk-taking and protecting the interests of depositors and other stakeholders (Rana et al., 2025; Hashmi et al., 2025).

The risk-return trade-off provides a third theoretical foundation. Banking institutions generate income partly by accepting financial risks, particularly through lending and investment activities. Higher exposure to risk may create opportunities for greater returns, but it also increases the potential magnitude of losses. Markowitz (1952) established the broader portfolio-theoretic basis for this relationship, while Berger and DeYoung (1997) applied related reasoning to banking through their discussion of the relationships between asset quality, managerial efficiency, and bank performance. Diamond and Dybvig (1983) further



emphasize the importance of liquidity because banks transform relatively liquid liabilities into comparatively illiquid assets. Maintaining liquidity provides protection against funding pressures but may also involve an opportunity cost because highly liquid assets generally generate lower returns than alternative earning assets (Kumar et al., 2025; Ashraf et al., 2025; Khan et al., 2025). The regulatory environment provides an additional institutional dimension to these relationships. The Basel III framework strengthened international banking regulation by introducing enhanced capital standards, leverage requirements, and liquidity standards. In Pakistan, the State Bank of Pakistan began implementing Basel III capital requirements from December 31, 2013, through a phased arrangement intended to reach full implementation by December 31, 2019. The regulatory framework subsequently strengthened capital-adequacy disclosure and reporting requirements for commercial banks. Liquidity requirements were also incorporated into the regulatory framework through the implementation of the Liquidity Coverage Ratio and Net Stable Funding Ratio. Consequently, the 2014–2023 observation period provides an appropriate institutional setting for examining bank performance after the

introduction of Basel III and through the subsequent period of regulatory consolidation.

Basel III is therefore treated in this study as the regulatory and institutional context within which the relationships among credit risk, liquidity, capital adequacy, and bank performance operate. It is not treated as a statistical moderator because no interaction term or separate regulatory-regime estimation is specified in the empirical models. This distinction is important because a regulatory framework can shape the operating environment without necessarily constituting a formally estimated moderating variable.

Based on these theoretical arguments, credit risk, liquidity risk, and capital adequacy are expected to influence commercial bank performance through different but interconnected mechanisms. Credit risk affects profitability through loan losses, provisioning, and impaired interest income. Liquidity risk affects performance through funding costs, lending capacity, and the opportunity cost associated with liquid assets. Capital adequacy affects performance through loss-absorption capacity, funding conditions, regulatory resilience, and the allocation of equity relative to risk-weighted assets. These theoretical relationships provide the basis for the empirical model developed below.

Research Design and Model Development

The study follows a positivist research philosophy and adopts a deductive quantitative research approach. Because the objective is to examine the empirical relationships between bank-specific financial risks and bank performance over time, a longitudinal explanatory research design is employed. Panel-data econometrics is particularly appropriate because it combines cross-sectional information across commercial banks with annual observations over time (Khan et al., 2025; Shahid et al., 2025). This structure permits the analysis to account for both variation between banks and changes within individual banks across the study period.

The empirical analysis covers ten financial years from 2014 to 2023. The period encompasses the post-introduction phase of Basel III implementation in Pakistan, the subsequent completion of the regulatory transition, major macroeconomic pressures, the COVID-19 period, and the subsequent recovery and monetary tightening period. The final panel comprises 150 bank-year observations based on fifteen commercial banks observed over ten years.

The theoretical framework implies that bank performance is a function of credit risk, liquidity risk, capital adequacy, and relevant bank-level

and macroeconomic control variables. The general functional relationship can therefore be expressed as:

Bank Performance_{it} = f(Credit Risk_{it}, Liquidity Risk_{it}, Capital Adequacy_{it}, Economic Growth_t, Inflation_t, Bank Size_{it})

For empirical estimation, three separate models are specified according to the three measures of commercial bank performance.

Model 1: Return on Assets

$$ROA_{it} = \beta_0 + \beta_1 NPLR_{it} + \beta_2 LLPR_{it} + \beta_3 LDR_{it} + \beta_4 CASHR_{it} + \beta_5 CAR_{it} + \beta_6 GDP_t + \beta_7 INF_t + \beta_8 SIZE_{it} + \mu_i + \varepsilon_{it}$$

Model 2: Return on Equity

$$ROE_{it} = \beta_0 + \beta_1 NPLR_{it} + \beta_2 LLPR_{it} + \beta_3 LDR_{it} + \beta_4 CASHR_{it} + \beta_5 CAR_{it} + \beta_6 GDP_t + \beta_7 INF_t + \beta_8 SIZE_{it} + \mu_i + \varepsilon_{it}$$

Model 3: Net Interest Margin

$$NIM_{it} = \beta_0 + \beta_1 NPLR_{it} + \beta_2 LLPR_{it} + \beta_3 LDR_{it} + \beta_4 CASHR_{it} + \beta_5 CAR_{it} + \beta_6 GDP_t + \beta_7 INF_t + \beta_8 SIZE_{it} + \mu_i + \varepsilon_{it}$$

In all three models, (i) identifies the individual commercial bank and (t) identifies the annual observation. The intercept is represented by (β_0), while (β_1) through (β_8) represent the estimated parameters of the explanatory and control variables. The term (μ_i) captures unobserved bank-specific effects that remain constant over time, whereas (ε_{it}) represents the idiosyncratic error term.



The expected relationships are derived directly from the theoretical framework. Higher non-performing loans are expected to reduce profitability because impaired loans generate provisioning costs and reduce effective interest income. The loan loss provision ratio is also expected to have an adverse relationship with performance because greater provisioning generally reflects deterioration in asset quality or a higher expected loss burden. The effect of the loan-to-deposit ratio is theoretically ambiguous because greater lending may increase interest income while excessive loan concentration may increase liquidity and funding pressure. Similarly, a higher cash-to-assets ratio may strengthen liquidity protection but can reduce profitability if excessive cash holdings replace higher-yielding earning assets. Capital adequacy is expected to strengthen financial resilience and may improve performance through lower funding risk and greater capacity to absorb losses, although a high equity base may also reduce the return generated for shareholders. Economic growth, inflation, and bank size are included as control variables to account for broader macroeconomic conditions and institutional differences that may independently influence bank performance.

Measurement of Variables Bank Performance

Bank performance is examined through three complementary profitability measures. Return on assets is calculated as net income divided by total assets and captures the efficiency with which a bank generates earnings from its asset base:

$$ROA_{it} = (\text{Net Income}_{it} / \text{Total Assets}_{it}) \times 100$$

Return on equity measures the return generated for shareholders relative to the equity employed by the bank:

$$ROE_{it} = (\text{Net Income}_{it} / \text{Total Equity}_{it}) \times 100$$

Net interest margin captures the spread generated from the bank's core financial intermediation activities and is measured as net interest income relative to earning assets:

$$NIM_{it} = (\text{Net Interest Income}_{it} / \text{Earning Assets}_{it}) \times 100$$

Using three performance measures permits the analysis to distinguish between profitability generated from the overall asset base, returns accruing to shareholders, and the effectiveness of the bank's core interest-generating intermediation activities.

Credit Risk

Credit risk is operationalized through two complementary indicators. The first is the non-performing loan ratio, calculated as non-performing loans relative to gross loans:

$$NPLR_{it} = (\text{Non-Performing Loans}_{it} / \text{Gross Loans}_{it}) \times 100$$



The second is the loan loss provision ratio, measured as loan loss provisions relative to total loans:

$$LLPR_{it} = (\text{Loan Loss Provisions}_{it} / \text{Total Loans}_{it}) \times 100$$

The use of both indicators allows credit risk to be captured from the perspectives of loan-quality deterioration and the provisioning response associated with expected or recognized credit losses.

Liquidity Risk

Liquidity risk is measured through the loan-to-deposit ratio and the cash-to-assets ratio. The loan-to-deposit ratio is defined as:

$$LDR_{it} = (\text{Total Loans}_{it} / \text{Total Deposits}_{it}) \times 100$$

A higher loan-to-deposit ratio indicates that a larger proportion of deposit funding has been deployed into loans, which may increase earning potential but can also reduce the liquidity buffer available to meet withdrawals and other short-term obligations.

The cash-to-assets ratio is calculated as:

$$CASHR_{it} = (\text{Cash and Cash Equivalents}_{it} / \text{Total Assets}_{it}) \times 100$$

This measure captures the proportion of the bank's asset base maintained in highly liquid resources. A higher cash-to-assets ratio can strengthen short-term liquidity capacity but may involve an opportunity cost when liquid assets generate lower returns than alternative earning assets.

Capital Adequacy

Capital adequacy is measured using the capital adequacy ratio:

$$CAR_{it} = (\text{Eligible Regulatory Capital}_{it} / \text{Risk-Weighted Assets}_{it}) \times 100$$

The measure is constructed in accordance with the applicable State Bank of Pakistan regulatory framework and Basel III capital requirements. The use of eligible regulatory capital is preferable to simply adding Tier 1 and Tier 2 capital because the regulatory definition incorporates applicable eligibility criteria and regulatory adjustments.

Control Variables

Economic growth is measured by the annual real gross domestic product growth rate, while inflation is measured by the annual percentage change in the Consumer Price Index. Both indicators are obtained from World Bank Open Data and cross-checked against publications of the State Bank of Pakistan.

Bank size is included as a bank-specific control variable and is measured as the natural logarithm of total assets:

$$SIZE_{it} = \ln(\text{Total Assets}_{it})$$

The logarithmic transformation reduces the influence of substantial differences in bank scale and allows the models to account for systematic differences between large and smaller institutions.

Data Sources and Sample Selection



The study relies exclusively on secondary data obtained from publicly available and authoritative sources. Bank-level financial information is collected primarily from audited annual financial statements published by the sampled commercial banks through their official investor-relations or corporate-reporting platforms. Regulatory information relating to capital adequacy and Basel III compliance is obtained from State Bank of Pakistan regulatory disclosures, including capital adequacy reporting and Pillar 3 disclosures where applicable. The State Bank of Pakistan introduced standardized Basel III capital-adequacy disclosure templates for banks from the accounting year ending December 31, 2014, improving the comparability of regulatory capital information across institutions. Macroeconomic indicators are obtained from World Bank Open Data and validated against State Bank of Pakistan economic publications.

The accessible population comprises commercial banks listed on the Pakistan Stock Exchange because listed institutions are subject to continuing disclosure and reporting requirements that facilitate consistent longitudinal data collection. Purposive sampling is used to identify institutions satisfying three inclusion criteria: continuous listing on the Pakistan Stock Exchange throughout 2014–

2023, classification as a scheduled commercial bank under the Banking Companies Ordinance 1962, and continuous availability of audited annual financial statements for the full study period.

The resulting sample consists of fifteen commercial banks: Habib Bank Limited, United Bank Limited, MCB Bank Limited, Allied Bank Limited, Bank Alfalah Limited, Meezan Bank Limited, National Bank of Pakistan, Faysal Bank Limited, Bank AL Habib Limited, Standard Chartered Pakistan, Askari Bank Limited, Habib Metropolitan Bank, Silk Bank Limited, Summit Bank Limited, and JS Bank Limited. The sample incorporates large, medium-sized, Islamic, and financially weaker institutions, thereby providing variation in institutional characteristics, risk exposure, and financial structure. The fifteen institutions generate 150 bank-year observations across the ten-year study period.

Missing observations represent less than one percent of the total dataset. Where a limited missing value occurs, the respective bank's multi-year mean is used for imputation. Because imputation can influence estimates, the procedure is applied only to the small proportion of missing observations and is documented explicitly to maintain transparency in the construction of the panel dataset.



Econometric Estimation and Diagnostic Procedures

The empirical strategy begins with specification testing to determine the appropriate panel-data estimator. The Breusch-Pagan Lagrange Multiplier test is used to assess whether panel-specific effects are statistically preferable to pooled ordinary least squares. The Hausman (1978) specification test is then employed to distinguish between fixed-effects and random-effects estimators. This procedure permits the estimator to be selected according to the statistical properties of the panel rather than being imposed a priori.

Multicollinearity is examined using the variance inflation factor, with values below ten treated as indicating that severe multicollinearity is unlikely to undermine coefficient estimation. The Modified Wald test is employed to examine group-wise heteroskedasticity, while the Wooldridge (2002) test is used to detect first-order serial correlation within the panel. These diagnostic procedures are important because violations of classical error assumptions can produce inefficient or misleading statistical inference.

Where diagnostic tests indicate heteroskedasticity or within-bank serial dependence, inference is based on standard errors clustered at the bank level. Clustered standard errors account for correlation of disturbances within

the same bank across the study period and provide more reliable inference for the longitudinal structure of the data.

Finally, a two-step system Generalised Method of Moments estimator is employed as a robustness procedure to address potential dynamic endogeneity and persistence in bank profitability. The system Generalised Method of Moments approach developed by Blundell and Bond (1998) is appropriate when the dependent variable may exhibit persistence and explanatory variables may be jointly determined with bank performance. The robustness analysis therefore provides an additional assessment of whether the principal relationships remain stable when potential dynamic endogeneity is taken into consideration.

Empirical Results and Discussion

Table 1 presents the descriptive statistics for the 150 bank-year observations. Return on assets has a relatively low mean, indicating modest asset-based profitability, while return on equity records a higher average but substantially greater dispersion, reflecting considerable variation in shareholder returns across banks and years. Net interest margin displays comparatively moderate variability, indicating greater stability in banks' core interest-generating activities. Credit risk measures exhibit substantial

dispersion, particularly the loan loss provision ratio, indicating marked differences in provisioning patterns across the sample. The loan-to-deposit ratio shows moderate variation, while the cash ratio remains comparatively stable, reflecting relatively consistent liquidity positions. Capital adequacy also demonstrates considerable variation, indicating differences in banks' capitalization

and financial resilience. The macroeconomic indicators show notable variation across the study period, with economic growth ranging from contraction to stronger expansion and inflation displaying substantial fluctuations. These descriptive patterns indicate meaningful cross-sectional and temporal heterogeneity, supporting the use of panel-data techniques.

Table 1: Descriptive Statistics

Variables	Mean	Std Dev	Min	Median	Max
Return on Assets (ROA %)	0.71	1.64	-8.97	0.95	4.6
Return on Equity (ROE %)	14.5	36.79	-323.02	15.56	171.51
Net Interest Margin (NIM %)	3.39	1.77	-4.45	3.43	11.45
NPL Ratio (NPLR %)	10.97	12.91	1.04	7.14	69.47
Loan Loss Provision Ratio (LLPR %)	8.46	24.62	-1.47	1.06	183.79
Loan-to-Deposit Ratio (LDR %)	48.88	12.0	12.49	46.93	85.74
Cash Ratio (CASHR %)	7.71	2.09	3.68	7.45	14.15
Capital Adequacy Ratio (CAR %)	11.93	18.24	-88.05	15.73	26.21
GDP Growth Rate (GDP %)	3.76	2.61	-1.27	4.33	6.57
Inflation Rate / CPI (INF %)	10.31	8.34	2.53	8.34	30.77

Table 2 reports the Hausman specification test used to determine the appropriate panel-data estimator for each model. The results indicate that the null hypothesis of no systematic difference between fixed-effects and random-effects estimates is rejected for Model 1 and Model 3 because their probability values are statistically significant. Accordingly, the fixed-effects estimator is

appropriate for the return on assets and net interest margin models. In contrast, the null hypothesis is not rejected for Model 2, indicating that the random-effects estimator is appropriate for the return on equity model. These findings demonstrate that estimator selection should be model-specific rather than applying a common specification across all measures of bank performance.

Table 2: Hausman Specification Test Results

Model (DV)	chi2 Statistic	df	p-value
Model 1 – ROA	54.11	8	< 0.001

Model 2 – ROE	1.75	8	0.988
Model 3 – NIM	24.52	8	0.002

Table 3 presents the fixed-effects panel regression results examining the determinants of return on assets among the sampled commercial banks. The findings demonstrate that credit risk, particularly the non-performing loan ratio, has a statistically significant negative relationship with return on assets. This indicates that deterioration in loan quality is associated with weaker asset-based profitability. Higher levels of non-performing loans can reduce interest income, increase provisioning requirements, and impose additional monitoring and recovery costs on banks. This finding is consistent with Berger and DeYoung (1997), who established a relationship between problem loans and bank efficiency, and with Ghosh (2015), who documented an adverse association between non-performing loans and bank profitability. Evidence from Pakistan also supports this finding, as Ali and Dhiman (2019) and Mehmood et al. (2019) reported negative effects of credit risk on bank profitability. The result is also consistent with the CAMEL framework, which identifies asset quality as a fundamental dimension of banking soundness. In contrast, the loan loss provision ratio exhibits a statistically significant positive relationship with return on assets. Although this direction differs from the conventional expectation that

higher provisioning reflects greater credit losses, the finding can be interpreted in the context of prudent risk management and provisioning practices. Higher provisioning may reflect stronger recognition and management of credit risk, enabling banks to absorb potential losses and maintain the quality of their loan portfolios. Hasan and Wall (2004) emphasize the importance of loan loss allowances in reflecting differences in credit-risk management across banking systems. The positive relationship may also indicate that banks with stronger profitability possess greater capacity to recognize and accommodate provisions without experiencing deterioration in their asset-based returns. Thus, provisioning may capture not only underlying credit deterioration but also differences in banks' risk-management practices and financial capacity.

The loan-to-deposit ratio has a weak negative relationship with return on assets and is statistically significant at the ten percent level. This result indicates that greater reliance on deposits to support lending activity does not necessarily translate into higher asset-based profitability. Although loan expansion can generate additional interest income, excessive deployment of deposits into loans may increase funding pressure and expose banks to



greater liquidity risk. The finding is consistent with the risk-return perspective, under which greater asset utilization can create additional earning opportunities while simultaneously increasing financial exposure. It also corresponds with the more cautious evidence reported by Bonfim and Kim (2012), who found that very high loan-to-deposit positions can adversely affect bank profitability. Evidence from Pakistan has also identified a relationship between liquidity management and profitability, although the direction can vary across banking institutions and operating conditions (Akhtar et al., 2011; Anam et al., 2012; Shahi et al., 2025; Hamza et al., 2025; Sattar et al., 2025; Kanwal et al., 2025). The cash-to-assets ratio has a negative but statistically insignificant relationship with return on assets. This finding indicates that variations in the proportion of assets held as cash do not provide sufficient evidence of a systematic effect on asset-based profitability within the sampled banks. The negative direction is economically plausible because highly liquid cash holdings generally generate lower returns than loans and other earning assets. Maintaining excessive liquidity can therefore involve an opportunity cost. Diamond and Dybvig (1983) emphasize the importance of liquidity in protecting banks against withdrawal and funding pressures,

while Bourke (1989) and Molyneux and Thornton (1992) demonstrate that the profitability implications of liquidity depend on the balance between safety and income generation. The insignificant result in the present model indicates that cash holdings alone may not be sufficiently influential to explain differences in return on assets after controlling for other bank-specific and macroeconomic factors. Capital adequacy also has a negative but statistically insignificant relationship with return on assets. Thus, differences in capital strength do not appear to produce a statistically identifiable effect on asset-based profitability in this specification. The negative direction may reflect the opportunity cost associated with maintaining a larger equity buffer, since additional capital can reduce reliance on relatively cheaper deposit-based funding and may lower financial leverage. This result differs from Berger (1995), Pasiouras and Kosmidou (2007), and Ayub and Javed (2016), who documented positive relationships between capitalization and bank profitability. The divergence may reflect differences in institutional environments, regulatory requirements, sample periods, and profitability measures. In Pakistan, Shair et al. (2019) also found that the profitability effect of capital adequacy can vary according to the performance indicator employed,

supporting the importance of examining capitalization in conjunction with alternative measures of bank performance. Among the macroeconomic variables, economic growth exhibits a weak negative relationship with return on assets and is statistically significant at the ten percent level. The negative direction indicates that stronger aggregate economic growth does not necessarily translate into greater asset-based profitability for the sampled banks during the study period. This may reflect the distinctive macroeconomic conditions experienced by Pakistan during 2014–2023, including periods of monetary tightening, inflationary pressure, exchange-rate depreciation, and financial instability. Athanasoglou et al. (2008) and Alper and Anbar (2011) demonstrate that macroeconomic conditions can influence bank profitability, although the direction of the relationship varies across countries and periods. The finding therefore indicates that bank profitability may depend not simply on the pace of economic activity but also on the quality and stability of the macroeconomic environment. Inflation has a positive but statistically insignificant relationship with return on assets. The positive direction may indicate

that banks can partially adjust lending rates and other income-generating activities in response to rising prices, thereby preserving nominal profitability. However, the lack of statistical significance indicates that inflation did not exert a sufficiently consistent influence on asset-based profitability after accounting for the other explanatory variables. The result is compatible with the broader literature showing that the profitability consequences of inflation depend on banks' ability to anticipate and adjust to changing price conditions (Athanasoglou et al., 2008; Alper & Anbar, 2011; Sabir et al., 2025; Niaz et al., 2025; Khan et al., 2025). Bank size has a negative but statistically insignificant relationship with return on assets. This indicates that larger asset holdings do not automatically generate higher asset-based profitability among the sampled institutions. The finding may reflect the possibility that larger banks experience greater organizational complexity, operating costs, or diminishing returns to scale. It also indicates that differences in bank size alone are insufficient to explain variations in return on assets once credit risk, liquidity, capital adequacy, and macroeconomic conditions are controlled for.

Table 3: Panel Regression Results – Model 1: Return on Assets (Fixed Effects)

Variables	Coefficient	Std. Error	p-value
Non-Performing Loan Ratio (NPLR)	-0.181	0.041	< 0.001 ***
Loan Loss Provision Ratio (LLPR)	+0.025	0.004	< 0.001 ***
Loan-to-Deposit Ratio (LDR)	-0.038	0.019	0.052 *
Cash-to-Assets Ratio (CASHR)	-0.041	0.029	0.160
Capital Adequacy Ratio (CAR)	-0.014	0.018	0.423
GDP Growth Rate (GDP)	-0.016	0.009	0.085 *
Inflation Rate (INF)	+0.011	0.018	0.545
Bank Size – ln(Assets) (SIZE)	-0.463	0.433	0.286
R ² (Within)	0.524		
F-Statistic	17.44		

Table 4 reports the random-effects estimates for return on equity. The results indicate that none of the principal risk variables has a statistically significant relationship with return on equity. The non-performing loan ratio and loan loss provision ratio both exhibit negative associations, indicating that weaker asset quality and greater provisioning may reduce shareholder returns, although the evidence is insufficient to establish these relationships statistically. The loan-to-deposit ratio, cash-to-assets ratio, and capital adequacy ratio also display negative but insignificant relationships with return on equity. These findings differ from Berger (1995), Pasiouras and Kosmidou (2007), and Ayub and Javeed (2016), who reported positive profitability effects of stronger capitalization, while the negative capital relationship is more consistent with Shair et al. (2019), who found that capital adequacy can affect return on assets and return on equity differently. The insignificant liquidity effects are consistent with the context-

dependent evidence of Akhtar et al. (2011) and Anam et al. (2012).

Among the macroeconomic variables, economic growth and inflation show positive but statistically insignificant relationships with return on equity. This indicates that aggregate economic conditions did not exert a sufficiently consistent influence on shareholder returns during the study period. Athanasoglou et al. (2008) and Alper and Anbar (2011) similarly demonstrate that macroeconomic influences on bank profitability can vary across institutional environments and periods. Bank size is the only variable showing a statistically meaningful relationship at the ten percent level, with larger banks associated with higher return on equity. This may reflect economies of scale, broader revenue-generating capacity, and greater access to financial resources. The result is consistent with the broader bank-profitability literature emphasizing bank-specific characteristics as important determinants of performance

(Sufian, 2009; Athanasoglou et al., 2008; Audi & Al Masri, 2024; Marc et al., 2021; Ghauri et al., 2025; Qaisrani et al., 2025; Khalil et al., 2025). Overall, the findings indicate

that shareholder-based profitability responds differently to financial risk factors than asset-based profitability, supporting the use of multiple performance measures.

Table 4: Panel Regression Results – Model 2: Return on Equity (Random Effects)

Variables	Coefficient	Std. Error	p-value
Non-Performing Loan Ratio (NPLR)	-1.323	1.568	0.400
Loan Loss Provision Ratio (LLPR)	-0.045	0.466	0.924
Loan-to-Deposit Ratio (LDR)	-0.620	0.387	0.112
Cash-to-Assets Ratio (CASHR)	-0.012	0.949	0.990
Capital Adequacy Ratio (CAR)	-1.114	0.758	0.144
GDP Growth Rate (GDP)	+0.117	1.356	0.931
Inflation Rate (INF)	+0.027	0.365	0.940
Bank Size – ln(Assets) (SIZE)	+5.262	3.172	0.099 *
R ² (Overall)	0.245		
F-Statistic	5.77		

Table 5 reports the fixed-effects estimates for net interest margin and indicates that credit risk, capital adequacy, inflation, and bank size are important determinants of banks' interest-based profitability. The non-performing loan ratio has a significant negative relationship with net interest margin, indicating that deterioration in loan quality can weaken the spread generated from lending activities. This finding is consistent with Berger and DeYoung (1997), Ghosh (2015), and Ali and Dhiman (2019), who associate poorer credit quality with weaker bank performance. In contrast, the loan loss provision ratio has a significant positive relationship with net interest margin. This result may indicate that banks with stronger provisioning practices also adopt pricing strategies that preserve

interest spreads, or that profitable banks possess greater capacity to absorb provisioning expenses. Hasan and Wall (2004) emphasize the importance of provisioning practices in banking risk management.

Capital adequacy has a significant positive relationship with net interest margin, indicating that better-capitalized banks achieve stronger interest-based profitability. This finding is consistent with Berger (1995), Pasiouras and Kosmidou (2007), and Ayub and Javeed (2016), who identify positive links between capitalization and banking profitability. The result also indicates that capital strength may support confidence, reduce financial vulnerability, and provide greater flexibility in lending decisions. The loan-to-deposit ratio and cash-to-assets ratio are

statistically insignificant, indicating that these liquidity measures do not systematically influence net interest margin after controlling for other factors. This is consistent with the context-dependent liquidity evidence reported by Akhtar et al. (2011) and Anam et al. (2012).

Among the macroeconomic variables, economic growth has a negative relationship with net interest margin and is weakly significant, whereas inflation has a positive and statistically significant relationship. The inflation result may reflect banks' ability to adjust lending rates and preserve interest spreads during periods of rising prices. The finding is broadly

consistent with the macroeconomic dimension of bank profitability emphasized by Athanasoglou et al. (2008) and Alper and Anbar (2011). Bank size has a significant negative relationship with net interest margin, indicating that larger institutions may operate with narrower interest spreads, potentially because of greater competition, diversified income sources, or scale-related pricing effects. The model explains a substantial proportion of within-bank variation in net interest margin, while the significant model statistic confirms the joint explanatory relevance of the included variables.

Table 5: Panel Regression Results – Model 3: Net Interest Margin (Fixed Effects)

Variables	Coefficient	Std. Error	p-value
Non-Performing Loan Ratio (NPLR)	-0.082	0.01	< 0.001 ***
Loan Loss Provision Ratio (LLPR)	+0.037	0.006	< 0.001 ***
Loan-to-Deposit Ratio (LDR)	-0.003	0.01	0.738
Cash-to-Assets Ratio (CASHR)	+0.020	0.061	0.748
Capital Adequacy Ratio (CAR)	+0.079	0.015	< 0.001 ***
GDP Growth Rate (GDP)	-0.042	0.022	0.063 *
Inflation Rate (INF)	+0.087	0.029	0.003 ***
Bank Size – ln(Assets) (SIZE)	-1.066	0.524	0.044 **
R ² (Within)	0.618		
F-Statistic	25.72		

Table 6 presents the two-step system generalized method of moments robustness results and provides additional evidence on the determinants of bank performance after accounting for dynamic persistence and potential endogeneity. The lagged dependent variables indicate that profitability exhibits persistence across the three

performance measures, although the strength and direction differ by indicator. For return on assets, the lagged effect is positive but insignificant, whereas return on equity displays a significant negative dynamic association. Net interest margin has a positive but statistically insignificant lagged relationship. Credit risk remains



particularly important for return on equity and net interest margin. The non-performing loan ratio has a significant negative relationship with both measures, confirming that deterioration in loan quality can weaken shareholder returns and interest-based profitability. This finding is consistent with Berger and DeYoung (1997), Ghosh (2015), and Ali and Dhiman (2019). The non-performing loan ratio is insignificant for return on assets, indicating that its influence may vary according to the performance measure. The loan loss provision ratio has a positive and significant relationship with net interest margin but is insignificant for return on assets and return on equity. This result is consistent with the view that provisioning practices may reflect banks' broader credit-risk management and pricing decisions rather than representing only a direct profitability burden (Hasan & Wall, 2004). The loan-to-deposit ratio is significantly negative for return on equity but insignificant for the other two measures, indicating that greater loan deployment relative to deposits may place pressure on shareholder-based profitability. This finding is compatible with the liquidity-risk literature emphasizing the trade-off between lending opportunities and liquidity exposure (Akhtar et al., 2011; Anam et al., 2012; Marc et al., 2022; Nasir et al., 2025; Anus et al., 2025).

Capital adequacy exhibits differentiated effects across performance measures. It is positively associated with return on assets and net interest margin, while its relationship with return on equity is significantly negative. The positive findings are consistent with Berger (1995), Pasiouras and Kosmidou (2007), and Ayub and Javeed (2016), whereas the negative relationship with return on equity is consistent with Shair et al. (2019), who identified differences in the profitability effects of capital adequacy across performance indicators.

Among the macroeconomic variables, economic growth has a positive and significant relationship with return on assets, while its effects on return on equity and net interest margin are insignificant. Inflation is insignificant for return on assets and return on equity but has a significant positive relationship with net interest margin, indicating that banks may adjust interest spreads during inflationary periods. This is consistent with the broader evidence that macroeconomic conditions influence bank profitability differently across performance measures (Athanasoglou et al., 2008; Alper & Anbar, 2011). Bank size remains statistically insignificant across all three models. Overall, the robustness results reinforce the importance of credit risk and capital

adequacy while demonstrating that their effects differ according to the specific dimension of bank performance being examined.

Table 6: System-GMM Robustness Results (Blundell-Bond Two-Step Estimator)

Variables	ROA	ROE	NIM
L1. Dependent Variable	+0.127	-0.347***	+0.322
NPL Ratio (NPLR)	-0.061	-1.548***	-0.042***
Loan Loss Provision Ratio (LLPR)	+0.020	+0.419	+0.034*
Loan-to-Deposit Ratio (LDR)	-0.023	-0.496**	-0.009
Cash Ratio (CASHR)	+0.066	+0.463	+0.160***
Capital Adequacy Ratio (CAR)	+0.042*	-1.169***	+0.077***
GDP Growth Rate (GDP)	+0.013	+0.943	-0.025
Inflation Rate (INF)	+0.019	+0.291	+0.068***
Bank Size (SIZE)	-0.187	+4.395	-0.349
Hansen test p-value	0.9995	0.9991	0.9993
AR(2) p-value	0.502	0.319	0.141

Conclusions and Policy Implications

This study examined the determinants of commercial bank performance in Pakistan by focusing on credit risk, liquidity risk, and capital adequacy while considering return on assets, return on equity, and net interest margin as alternative dimensions of bank performance. Using panel data for fifteen PSX-listed commercial banks over the period 2014–2023, the study provides evidence that the financial consequences of bank-specific risks vary across different measures of performance. The findings therefore reinforce the importance of evaluating bank performance through multiple dimensions rather than relying on a single profitability indicator. Among the examined determinants, credit risk emerges as the most consistent factor associated with bank performance. The non-performing loan ratio is negatively

associated with return on assets and net interest margin, indicating that deterioration in loan quality can weaken both asset-based profitability and interest-based earnings. This finding is consistent with the CAMEL framework, particularly its emphasis on asset quality, and with the agency-theoretic perspective concerning monitoring, managerial incentives, and risk-taking. The result highlights the importance of effective credit appraisal, continuous borrower monitoring, early-warning systems, and timely recovery of distressed loans. Liquidity risk, measured through the loan-to-deposit ratio and cash-to-assets ratio, does not demonstrate a statistically significant relationship with the principal performance measures in the baseline estimations. This does not diminish the importance of liquidity management for banking



stability. Instead, the finding indicates that differences in liquidity positions among the sampled banks did not translate into sufficiently distinct profitability outcomes during the study period. Banks therefore need to maintain adequate liquidity buffers while ensuring that excessive liquidity does not result in inefficient resource allocation. Capital adequacy presents a more differentiated relationship with performance. Its positive association with net interest margin indicates that stronger capital positions may support the interest-income channel, whereas its relationship with return on assets is statistically insignificant and its negative association with return on equity is also statistically insignificant. Thus, capitalisation should be considered simultaneously as a regulatory safeguard and a financial management decision, rather than assuming that higher capital automatically produces higher profitability. The policy implications are particularly relevant for the State Bank of Pakistan and bank management. Continued emphasis on risk-based supervision, accurate loan classification, timely provisioning, and effective resolution of non-performing loans is important for strengthening banking-sector performance. Bank management should invest in credit underwriting, monitoring systems, recovery

mechanisms, and internal risk controls. Capital planning should maintain regulatory resilience while considering its implications for profitability and shareholder returns. External auditors and financial analysts should also pay close attention to loan classification, impairment assessment, and provisioning practices.

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