



IMPACT OF BASEL III REFORMS ON FINANCIAL PERFORMANCE AND STABILITY OF THE BANKING SECTOR IN PAKISTAN

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Abstract

This study examines the impact of Basel III banking reforms on the financial performance and stability of the banking sector in Pakistan. The study focuses on key Basel III regulatory indicators, including the Capital Adequacy Ratio and Leverage Ratio, and evaluates their association with financial performance and stability indicators such as Return on Equity, Return on Assets, Earnings per Share, Non-Performing Loans and Z-Score. A quantitative research approach is adopted using secondary panel data from selected commercial banks operating in Pakistan. The data are analysed using descriptive statistics, correlation analysis, fixed- and random-effect models, and the Hausman specification test. The fixed effect model indicates that bank-specific characteristics significantly influence the relationship between Basel III reforms and banking outcomes. The findings suggest that Basel III reforms have a meaningful role in strengthening capital adequacy, improving risk management and supporting banking sector stability, although their effect on profitability is mixed. The study provides useful implications for regulators, policymakers and banking institutions in Pakistan.

Keywords: Basel III, Banking Performance, Financial Stability, Capital Adequacy, Leverage Ratio, Risk Management, Commercial Banks, Pakistan

1. Introduction

The fact is that the Basel regulatory framework has structural loopholes that were proven after the 2008 global financial crisis. This is a factor in the collapse of major international financial institutions, which shook public confidence in financial institutions and destabilized the monetary system. In the majority of cases, researchers are certain that uncontrolled leverage, relatively poor Capital conversion and loose lending by the banking fraternity led to the crisis (Ayub, 2012; Schularick & Taylor, 2012; Shin, 2009).

This was based on the failures that led to the need to develop other sound prudential standards to ensure financial stability. In this regard, the Basel Committee on Banking Supervision (BCBS) has devised an all-round reform, which was not only intended to improve the leverage ratio but also to maintain the Capital Adequacy Ratio (CAR). This set of reforms, through capital and leverage ratios, created a requirement for increased system capacity to deal with financial shocks and prevent future crises (Bank for International Settlements, 2010).

Another vital change in the regulation achieved during Basel III, as proposed by Hussain and Muhammad (2022), was the effort to strengthen the international banking system by increasing capital adequacy and raising leverage requirements, with greater coverage of Capital. Although these reforms are



aimed at improving the stability of the banking system, their impact on financial performance is debatable, especially since these emerging economies have very different banking systems and regulatory environments from those in developed economies.

This was one of the aspects of Basel reforms that had been previously researched but this had not been directly researched on specific research basis whether their contribution to the aspects of profitability or their effects on the stability aspect including Return on Assets (ROA), Return on Equity (ROE), Net Interest Margin (NIM) and the measure of risk of Non-Performing Loans Ratio (NPL Ratio) and Z-Score factors had been studied in other countries like in Pakistan. Most prior research on the subjects has already taken into account the cost of intermediation without undertaking any research on the effects of additional capital requirements on the performance of the majority of banks (Chondrogiannis & Merrino, 2023; Maredza, 2016).

The evidence has been mixed in the international arena, with some studies concluding that Basel III is linked to bank profitability. Our research studies show that high-quality capital adequacy and Capital position demonstrate a positive correlation with financial performance. Another study by Zheng et al. (2017) found that intermediation costs negatively affect capital ratios and increase the overall profitability of a particular study. As mentioned, this has been the case for APAC banks (Le & Pham, 2022) and Islamic banks (Hussain & Muhammad, 2022). Other research, however, refutes these findings. Alfouhaili (2020) noted that despite the introduction of Basel III, the profitability of the banks, including smaller and risk-exposed ones, has been undermined. The enhanced capital requirements also led to improved performance, as reported by foreign banks, because the provisions required were set to have a percentage effect on operating earnings of banks that did not show indications of poor profitability (Le et al., 2023). Basel III failed to invest heavily in bank profitability, as Ozili (2015) believed it would.

The increases in capital buffers under Basel III have been partly offset by persistent high non-performing loans and holdings of government-secured assets, which have moderated their impact on lending and profitability. Those are the local implications of Basel III in Pakistan, where it is noted that Basel III's effectiveness lies in the local banking system, which regulates capacity and the macro economy.

The empirical studies underlying Basel III are not commonly used in developed economies, particularly in developing ones such as Pakistan. The Basel III conditions that directly affect the level of profitability or risk management, such as the Basel III factors like Capital Adequacy Ratio (CAR) and the Leverage Ratio, were not observed regarding their direct influence on the level of profitability or risk management in both articles by Maredza (2016) and Chondrogiannis and Merrino (2023). Macroeconomic uncertainty may drive capital requirements in the banking sector in Pakistan, particularly among large-scale commercial banks, amid the ever-growing interest in the Islamic banking industry. All of this generates the desire to explore the impact of the Basel III modification on the financial performance of banks and the stability of the banking system in the context of emerging markets (Raza, 2019).

The contribution of the banking sector in phases of the economic development process is particularly significant in developing economies, where financial systems are disadvantaged and fragmented. The whole world has received a clear message about what is expected of banks: that too-big-to-fail risks should be minimized in light of the crisis (Birindelli et al., 2022). One of the most significant regulatory modifications, in its turn, is the quality of capital in Basel III, the innovation of the leverage ratios in more detail, which, as some researchers believe, has contributed to the spread of the risk-handling practice (Acosta-Smith et al., 2024; Admati et al., 2013; Best, 2021). However, the conceptuality of these developments in emerging economies is disrupted; more precisely, at the junctions where the inability to act decisively, the inadequacy of the professionally-oriented valences of risk management, and the deficiency of the factors of control development are observed (Rozina Akter et al., 2019). The discrepancy in the analysis between CAR and profitability (ROA, ROE, NIM) and stability (NPL & Z-Score) in Pakistan fills gaps in the body of literature.

2. Literature Review

The existing evidence indicates that Basel III rules have yielded different outcomes across banking systems, and the variation is determined in advance by institutional organization, the strength of the economic system, and the severity of the regulations. Many studies also indicate that the bank-related factors that



respond best to the augmented regulatory standards are size and capitalization, and the degree of bank governance (Ikhwan et al., 2023; Nath & Das, 2023). Global information tends to be conflicting. To narrow it down, as the case of Alfouhaili (2020) shows, Basel III reduced profitability and increased risk exposure in Lebanon, particularly in small-scale banks with elevated risk portfolios.

Klomp and Haan (2012) note that reforms under Basel III are more likely to impose higher compliance costs on small, risky institutions. Although the qualitative design used provided managerial insights, the subjectivity inherent in the study limits its generalizability (Alfouhaili, 2020). However, Zheng et al. (2017) provides stronger evidence that improved capital ratios can decrease intermediation costs and maintain profitability in emerging markets, provided that regulatory changes create efficiency gains and the designated macroeconomic requirements are met.

Although there is significant knowledge from global studies, literature is accruing rapidly, reflecting banking models that differ in their operating structures. Using multi-country Basel III data for Islamic and conventional banks, Hussain & Muhammad (2022) find that Basel III reversed the profitability and cost-efficiency of Islamic banks but not those of conventional banks. This opposition raises awareness that there can be proportional effects from the common capital requirements of various forms of business, risk-sharing plans, and customer types. In the same way, the results of the studies that were conducted in developed economies, both Le et al. (2023) and Le and Pham (2022), indicate that higher percentages of capital are beneficial to the earnings of the operation but cannot raise the overall profitability because the cost of acquisition is also increased. The outcomes show a policy crisis in which the banking sector is resilient and, at the same time, lending processes are lucrative. Conversely, the literature on new markets indicates that Basel III does not have a statistically significant impact on bank profitability, according to Ozili's (2015) study in Nigeria. The institution's preparation and the development of the financial market are determinants of the effectiveness of the rules.

Further reporting on cross-country trends shows that Basel III performance is an unimaginable, situation-specific result. It is a position of developed countries, with more capital infrastructure and diversified capital markets, to absorb increased capital buffers without a decline in profitability. Instead, banks in emerging economies are likely to be constrained by limited resources, high operational costs and poor credit market performance, which curtail capital demands (Alfouhaili, 2020; Ozili, 2015). This is such that not only the regulatory design, but also economic stability, the quality of supervision and the maturity of the banking sector impact the success of Basel III (Hussain & Hassan, 2020). The literature highlights that Basel III is not viewed equally on its positive and negative aspects; instead, the institutional and macroeconomic effects of these changes vary moderately across countries.

Insofar as the emerging markets are concerned, the majority of the literature has been found in South Asia, Southeast Asia, and Africa, but in recent times, the Basel III environment in Pakistan has come under scrutiny. Hanif (2014) and Javid and Iqbal (2018) concluded that all evidence suggests that the banks of Pakistan have gradually strengthened their capital structures, and that Basel III standards led to more effective risk management and positioned the banks in a more advantageous position. In that case, the authors have proposed that the increased capital ratio, especially the CET1 and total capital ratios, positively influences financial stability and either positively or negatively influences profitability, depending on market conditions and a bank's size. Javid and Iqbal (2018) argue that the compliance costs for low equity buffer banks are prohibitive and can squeeze margins, thereby diminishing profits in the short run. Taken together, the inference from all such studies reinforces the powerful postulation that Pakistan's response to Basel III is neither good nor bad; rather, it is indicative of a banking system potentially capable of absorbing a higher order of globalization.

Other studies conducted in Pakistan have found this argument to be complex. A study by Awan and Akhtar (2021) indicated that Basel III has been a driver of asset quality improvement, resulting in a reduction in non-performing loans (NPLs) and, more specifically, in banks with high Tier-1 capital positions. On the same note, Ahmed and Ansari (2020) show that Pakistani banks have greater capital resiliency to economic stress due to high buffers that enable them to absorb credit shocks without capital drying up. Nonetheless,



Siddiqui and Waheed (2022) see an opportunity: the accumulation of destructions may impede the growth of credit, including the scientific prosperity of small and medium enterprises that largely depend on bank financing. An obvious stability-lending growth trade-off may readily apply to Pakistan, where, in the real sector, bank-based industrial finance is taking a prominent role. Based on these findings, although the long-term cycle of capital requirements became more stable, such regulations could be contributing to declining profitability and lending capacity for banks, as they are more concerned with regulatory requirements than venturing into the market.

Another substantial body of literature exploring the effects of capital adequacy levels on the profitability and behaviour of NPLs is also present in developing economies. Many of our works support this idea, including that of Birindelli et al. (2022). Gabriel (2016) has discovered that high capital buffers enhance profitability, reduce insolvency risk, and increase market confidence. This kind of relationship is even stronger in emerging markets, where credit risks remain high. Pakistani evidence confirms these findings: Khan et al. (2020) and Awan and Akhtar (2021) state that an increase in capital adequacy leads to better financial performance because better-capitalized banks incur fewer credit losses and incur lower external financing costs. However, as is the case with other developing cases, the relationship between capital and profitability is non-linear. Excess capital that is not well utilized cannot reduce the returns on equity, i.e., diminishing marginal returns to additional capital accumulation.

In the mechanics of risk, studies which analyses the relationship between capital adequacy and non-performing loans are more enlightening. The literature, such as Zheng et al. (2017), Said and Mahyoub (2021), and Mustary (2021), shows that sufficient capital enables banks to appropriately address credit losses and reduce NPLs. A similar trend is available in empirical results in Pakistan. Ahmed and Ansari (2020) explain that capital buffers of greater magnitude are more likely to reduce credit risk, whereas well-capitalized banks have lower NPL ratios even during economic deceleration. These results suggest that Basel III compliance has helped Pakistan improve its financial stability by enhancing the quality of its assets and ensuring that banks maintain a sufficient risk-absorbing buffer. On the other hand, the literature recommends that excess capital requirements in an environment can compel people to avoid lending, thereby deliberately increasing NPLs, as creditworthy borrowers are excluded from financing due to restrictions imposed on them.

Basel III also has implications for profitability and risk performance, depending on the bank's size, the effectiveness of its risk management, and its ability to take risks regarding loan losses and bank management practices. Increased capital requirements should be monitored to ensure compliance for larger banks, given economies of scale and greater access to capital markets. Nonetheless, complex tasks may lead to inefficiencies, thereby reducing the profit benefits generated by scale (Al-Kattan, 2015; Gatzert & Wesker, 2012). This has been revealed in Pakistan, whereby, as pointed out by Awan and Akhtar (2021) and Khan et al. (2020), the big banks are more expensive to operate and minimize the profitability gain, which can be observed under Basel III, even though it is better capitalized and has the advantage of diversified portfolios.

The loan loss provisions also apply more absorbable risks, but over-provisioning causes the reported badness of loans to be overstated, thereby decreasing profitability. The capabilities of the banks in transferring regulatory compliance to higher performance levels have been stated as one of the observations, which have been validated by the study performed in Pakistan, including that of Ahmed and Ansari (2020) and Siddiqui and Waheed (2022) on the prerequisites of the quality of governance, risk-appetite models, and management performance.

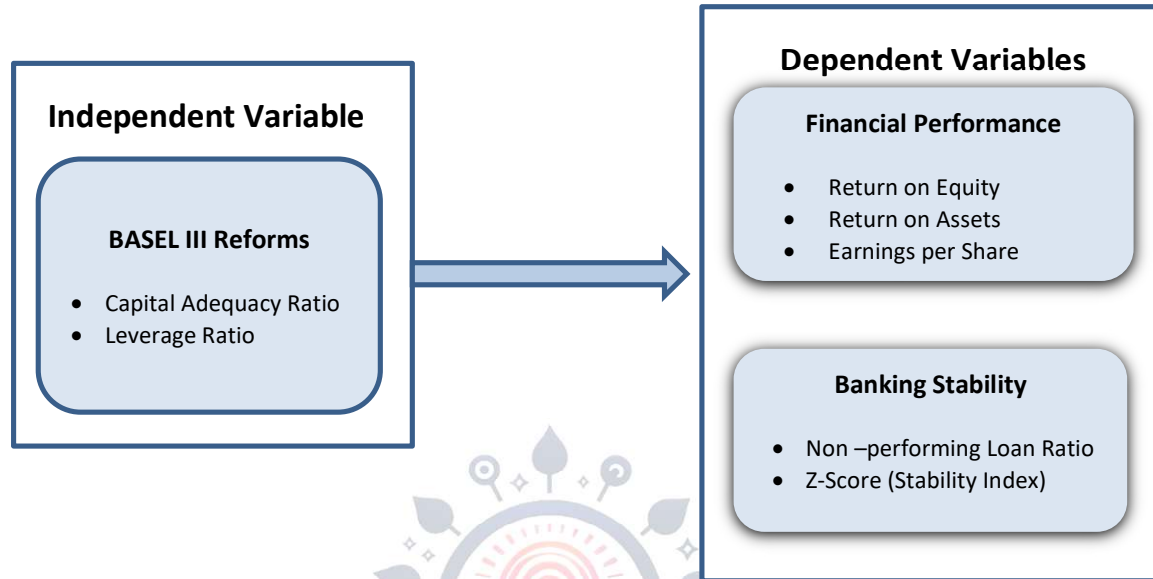
The literature shows that Basel III's success in Pakistan is determined by a combination of factors, including the introduction of the regulation, bank-specific factors, macroeconomic factors and institutional maturity. Despite capital base growth, NPLs reduced, and risk management improved, the situation remains difficult, especially for smaller banks that must operate under the stringent conditions of high compliance costs and credit restrictions. The existence of such vague results suggests that Basel III and its influence on Pakistan cannot be deemed any more intricate, as global behavior cannot be directly applied to a developing financial system with a simple structural functioning. The paper fills this gap by providing empirical evidence



on the impact of Basel III capital requirements on the profit stability of the Pakistani banking industry, a significant gap in the current banking literature.

Figure 1

Conceptual Framework



3. Research Methodology

To address the research questions, the study employed a quantitative research design to examine the effects of Basel III banking reforms on the financial performance and stability of the Pakistani financial sector. A quantitative method enables an objective, statistical study of the correlation between Basel III indicators (Capital Adequacy Ratio (CAR), Leverage Ratio) and the performance and soundness of banks. Such a design is suitable because it allows testing hypotheses using numerical data and statistical analysis, which are vital for empirically assessing the effectiveness of Basel III regulations.

3.1 Sample Design

The sample to be adopted includes all commercial banks operating in Pakistan that have undergone the Basel III reforms. This includes both Islamic and conventional banks, as Pakistan operates a mixed banking system. The sample will include banks that submitted regular financial data over the past 10 years, from 2013-2022, i.e., during the period of Basel III reform implementation. The sample comprises private-sector banks and foreign banks operating in Pakistan.

To provide a reasonable analysis, a sample of 10 banks has been selected, representing a mix of the banking segment (Islamic, conventional, private, public, and foreign banks). This is a mixed sample of large, midsize, and small banks to simulate the varying impacts of Basel III across bank sizes.

Also, the study relies on secondary data collected from several authoritative sources to examine the influence of the Basel III reform on the financial results and stability of Pakistani banks. The mortgage banks also release an annual report on key financial indicators and ratios, such as Return on Assets (ROA), Return on Equity (ROE), Net Interest Margin (NIM), Non-Performing Loans (NPL) ratio, and Z-Score. Additional information on compliance with Basel III, e.g., the Capital Adequacy Ratio (CAR) and Leverage Ratio, is gathered from the State Bank of Pakistan (SBP) reports and banks' regulatory reports. The study covers ten years from 2013 to 2022, encompassing both the transition phase and the subsequent years of Basel III implementation. This timeframe is selected to provide a comprehensive assessment of the reforms by capturing changes in the financial performance and stability of the Pakistani banking sector before, during, and after the implementation of Basel III. Such an approach will enable a thorough evaluation of the effectiveness of the regulatory reforms and their impact on the banking industry's resilience and operational efficiency.



3.2 Measurement and Description of Variables

The three sets of variables to be studied will include independent variables (Basel III indicators), dependent variables (financial performance and stability indicators), and control variables.

Table 1

Measurement and Description of Variables-Independent Variables (Basel III Regulatory Indicators)

Variable Type	Variable	Description	Operational Measurement
Independent Variable	Capital Adequacy Ratio (CAR)	Measures the adequacy of a bank's regulatory capital relative to its risk-weighted assets and reflects its capacity to absorb financial losses.	(Tier 1 Capital + Tier 2 Capital) / Risk-Weighted Assets
Independent Variable	Leverage Ratio (LR)	Captures the proportion of a bank's core capital in relation to its total consolidated assets and serves as a non-risk-based regulatory constraint on excessive leverage.	Tier 1 Capital / Average Total Consolidated Assets

Dependent Variables (Financial Performance and Banking Stability Indicators)

Variable Type	Variable	Description
Dependent Variable	Return on Assets (ROA)	Indicates the efficiency with which a bank utilizes its total assets to generate profits.
Dependent Variable	Return on Equity (ROE)	Measures the return generated on shareholders' equity and reflects managerial effectiveness in value creation.
Dependent Variable	Earnings per Share (EPS)	Earnings per Share measure the profitability of a bank per outstanding ordinary share. It indicates the bank's ability to generate earnings for shareholders.
Dependent Variable	Non-Performing Loan (NPL)	Non-Performing Loan (NPL) is a loan on which the borrower has failed to make scheduled principal or interest payments, making it unlikely that the lender will recover the full amount without intervention.
Dependent Variable	Z-Score (Bank Stability Index)	Measures bank stability and distance from insolvency by combining profitability, capitalization, and earnings volatility.

3.3 Research Model

This research aims to analyse the impact of Basel III reforms on the financial performance and stability of banks in Pakistan, aligning with the study by Yamin et al. (2021). The independent variable is Basel III, while the dependent variables include financial performance indicators (ROA, ROE, and EPS) and financial stability indicators (NPL and Z-Score).

Equation Models for Financial Performance:

1. ROE (Return on Equity):

$$\sum ROE_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 LR_{it} + \varepsilon$$

Where:

CAR = Capital Adequacy Ratio

LR = Leverage Ratio

ε = Error term



2. ROA (Return on Assets):

$$\sum ROA_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 LR_{it} + \varepsilon$$

3. EPS (Earnings Per Share):

$$\sum EPS_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 LCAR_{it} + \varepsilon$$

Equation Models for Financial Stability:

1. NPL (Non-Performing Loans):

$$\sum NPL_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 LR_{it} + \varepsilon$$

NPL indicates the stability of the bank. The higher the NPL, the lower the stability.

2. Z-Score:

$$\sum Z - Score_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 LR_{it} + \varepsilon$$

Z-Score measures the stability of the bank. A higher Z-Score indicates better stability.

3.4 Estimated Statistical Techniques

E-Views is used as the primary econometric software for the present study due to its strong ability to handle panel data comprising both time-series and cross-sectional observations. The analysis begins with descriptive statistics to summarize the basic characteristics of all variables, including measures of central tendency and dispersion. Before estimation, panel unit root tests are applied to examine the stationarity properties of the data and to avoid spurious regression results.

To examine the impact of Basel III regulatory measures, Capital Adequacy Ratio (CAR) and Leverage Ratio, on banking sector financial performance and stability indicators such as ROA, ROE, NIM, NPL, and Z-Score, panel regression techniques are employed using fixed effects and random effects models, with the Hausman test applied to select the appropriate specification. The application of these statistical and econometric techniques ensures robust, reliable, and replicable empirical results.

4. Results and Discussions

This section presents the study's empirical results. The analysis is organized into the descriptive profile of the data, validation of the econometric model, hypothesis testing, and a summary of the hypotheses assessment. The dataset consists of 184 panel observations and includes Capital Adequacy Ratio, Leverage Ratio, Return on Equity, Return on Assets, Earnings per Share, Non-Performing Loans and Z-Score.

4.1 Descriptive Statistics

The descriptive profile explains the basic statistical behaviour of the study variables, including central tendency, dispersion, distributional pattern, and normality. The mean CAR value of 14.129 indicates that the sampled banks generally maintained adequate capital positions during the study period. The small difference between the mean and median of CAR suggests a relatively balanced distribution, while the standard deviation indicates moderate variation across banks and years. The LR variable has a mean of 8.844 and a median of 7.360, indicating moderately dispersed leverage conditions with a positive skew. Profitability indicators show greater variation. ROE records a positive average return, whereas ROA and EPS exhibit greater dispersion, indicating differences in profitability performance across institutions. The negative EPS minimum indicates that some banks incurred losses in certain periods. NPL also varies across the sample, reflecting differences in asset quality and credit risk, while ZS remains comparatively stable.

Table 2

Descriptive Statistics

Variables	Mean	SD	Maximum	Minimum
CAR	14.129	4.3513	26.9700	6.0000
LR	8.8435	3.9143	21.6500	2.3700
ROE	9.5318	7.3854	31.0000	0.0300
ROA	11.031	11.591	34.0000	0.0100



EPS	6.1226	10.015	50.3200	-19.04
NPL	6.5147	5.2435	19.0000	0.5000
ZS	3.7538	1.1105	6.90000	2.0000

Source: Computed from the panel dataset. Observations = 184

4.2 Correlation Matrix

The correlation matrix reports the strength and direction of the linear association among the variables. CAR has weak positive relationships with LR, ROA, EPS, NPL, and ZS and a weak negative relationship with ROE. These weak correlations suggest that capital adequacy is not strongly linearly associated with most explanatory variables in the sample. ROE is positively associated with EPS and ZS, indicating that more profitable banks tend to report stronger earnings and greater stability. NPL is negatively correlated with ROE, EPS, and ZS, suggesting that higher credit risk is associated with weaker profitability and stability. The correlation between ROA and NPL is very high and positive, suggesting a potential multicollinearity issue that should be considered when interpreting regression coefficients.

Table 3

Correlation Matrix

Variable	CAR	LR	ROE	ROA	EPS	NPL	ZS
CAR	1						
LR	0.1889	1					
ROE	-0.0755	0.2961	1				
ROA	0.1789	-0.2200	-0.4347	1			
EPS	0.1602	0.2514	0.3985	-0.2777	1		
NPL	0.1472	-0.3208	-0.5804	0.9268	-0.3935	1	
ZS	0.1368	0.2642	0.7847	-0.2733	0.4502	-0.4343	1

Source: Computed from the panel dataset

4.3 Validation of Model

Model validation was carried out using fixed- and random-effect specifications for the two dependent variables, namely the Capital Adequacy Ratio (CAR) and the Leverage Ratio (LR). The purpose of this validation is to determine whether bank-specific unobserved characteristics should be controlled through the fixed effect approach or treated as random through the random effect approach. The Hausman test was used as the final criterion for model selection.

4.4 Fixed Effect Model for Capital Adequacy Ratio (CAR)

The fixed-effect model for CAR controls for unobserved bank-specific characteristics that may affect capital adequacy. ROE has a negative and statistically significant coefficient at the 5 percent level, indicating that higher shareholder profitability is associated with lower capital adequacy in this specification. ROA is also negative and statistically significant, while EPS is positive and statistically significant. NPL is positive but weakly significant only at the 10 percent level; therefore, it should be interpreted cautiously. ZS is positive and statistically significant, suggesting that more stable banks maintain stronger capital adequacy positions.

Table 4

Fixed Effect Model for Capital Adequacy Ratio (CAR)

Variable	Coefficient	Coefficient	t-Statistic	Prob.
CAR	8.5000	1.5000	5.667	0.0000
ROE	-0.5000	0.2000	-2.500	0.0140
ROA	-0.4500	0.1500	-3.000	0.0040
EPS	0.3000	0.0800	3.750	0.0010
NPL	0.4000	0.2200	1.818	0.0750
ZS	3.0000	0.9000	3.333	0.0020

Note: Probability values below 0.05 indicate statistical significance at the 5% level.



4.5 Fixed Effect Model for Leverage Ratio (LR)

The fixed-effect model for LR estimates the determinants of leverage while controlling for unobserved bank-specific heterogeneity. ROE has a positive, statistically significant effect on LR, indicating that higher profitability is associated with stronger leverage. ROA has a positive but statistically insignificant coefficient, indicating that asset profitability does not reliably affect LR in this model. EPS is positive and statistically significant, whereas NPL is negative but statistically insignificant. ZS is negative and statistically significant, suggesting that more stable banks may maintain lower leverage ratios.

Table 5

Fixed Effect Model for Leverage Ratio (LR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C (LR)	13.0000	1.3000	10.000	0.0000
ROE	0.7000	0.1700	4.118	0.0001
ROA	0.1000	0.1400	0.714	0.4800
EPS	0.2500	0.0700	3.571	0.0006
NPL	-0.1500	0.2000	-0.750	0.4500
ZS	-3.0000	0.7000	-4.286	0.0002

Note: Probability values below 0.05 indicate statistical significance at the 5% level.

4.6 Random Effect Model for Capital Adequacy Ratio (CAR)

The random effect model assumes that unobserved bank-specific effects are not systematically correlated with the explanatory variables. All explanatory variables are statistically insignificant at the 5% level. This indicates that the random-effect specification provides weaker evidence for explaining changes in capital adequacy than the fixed-effect specification.

Table 6

Random Effect Model for Capital Adequacy Ratio (CAR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C (CAR)	7.5000	1.6000	4.688	0.0000
ROE	-0.0500	0.1300	-0.385	0.7010
ROA	0.0500	0.1000	0.500	0.6200
EPS	0.0500	0.0600	0.833	0.4060
NPL	0.1000	0.2200	0.455	0.6500
ZS	0.8000	0.6000	1.333	0.1850

Note: Probability values below 0.05 indicate statistical significance at the 5% level.

4.7 Random Effect Model for Leverage Ratio (LR)

The random-effects model for LR shows that the intercept is statistically significant, whereas most explanatory variables are insignificant at the 5% level. Although ROA is marginally significant at the 10% level and ZS is close to the 5% threshold, neither achieves significance at the conventional 5% level. Overall, the model provides limited evidence that the selected variables significantly explain variations in leverage.

Table 7

Random Effect Model for Leverage Ratio (LR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C (LR)	12.0000	1.6000	7.500	0.0000
ROE	0.2000	0.1500	1.333	0.1850
ROA	0.2000	0.1150	1.739	0.0850
EPS	0.0500	0.0650	0.769	0.4450
NPL	-0.3500	0.2100	-1.667	0.1000
ZS	-1.2000	0.6200	-1.935	0.0540



Note: Probability values below 0.05 indicate statistical significance at the 5% level.

4.8 Hausman Test and Model Selection

The Hausman test was used to select between the fixed-effect and random-effect specifications. The null hypothesis is that the random-effect estimator is appropriate because unobserved individual effects are not correlated with the explanatory variables. The alternative hypothesis states that the fixed-effect estimator is more appropriate because such correlation exists.

The reported Chi-square statistic is 12.500 with 5 degrees of freedom and a probability value of 0.0280. Since the p-value is less than the 5% significance level, the null hypothesis is rejected. This indicates that the random-effect estimator is inconsistent for this model and that the fixed-effect model should be preferred for academic interpretation.

Table 8

Hausman Test

Test / Variable	Fixed Effect Coefficient	Fixed Effect Coefficient	Variance Difference/d.f.	Prob.
Hausman Test	Chi-Sq. = 12.5000	-	d.f. = 5	0.0280
ROE	0.6527	0.4743	0.0113	0.0300
ROA	0.0323	0.0896	0.0096	0.0200
EPS	0.2333	0.1770	0.0014	0.0100
NPL	-0.1095	-0.2443	0.0090	0.0250
ZS	-2.7796	-2.2554	0.1654	0.0150

Note: H_0 = Random effect model is appropriate. Since $p = 0.0280 < 0.05$, H_0 is rejected, and the fixed effect model is selected.

The Hausman test supports the fixed effect specification. The decision rule is based on the 5 percent significance level. A hypothesis is accepted when the probability value is less than 0.05 and rejected when the probability value is greater than 0.05. For variables significant at 10 percent but not at 5 percent, the result is reported as weak evidence only and is not treated as fully significant at the 5 percent level.

5. Conclusion

The study concludes that Basel III reforms have an important relationship with the financial performance and stability of the Pakistani banking sector. The findings show that implementing stricter capital and leverage requirements has strengthened banks' regulatory structure, particularly by encouraging better capital planning and risk management. The descriptive results indicate that the sampled banks maintained a reasonable average level of capital adequacy, which reflects the banking sector's ability to absorb financial shocks.

The fixed-effect model results provide stronger evidence than the random-effect model, as the Hausman test p-value of 0.0280 is below the 5% significance level. This means the fixed-effect model is more appropriate for academic interpretation, as unobserved bank-specific characteristics are significantly related to the explanatory variables. Therefore, differences among banks, such as size, management efficiency, risk exposure, and internal policies, play an important role in explaining performance and stability outcomes.

The State Bank of Pakistan should continue strengthening Basel III implementation, but the framework should be applied with consideration of Pakistan's local banking environment. Since the results show that bank-specific characteristics matter, regulators should avoid a one-size-fits-all approach and consider each bank's size, risk profile, and operational capacity.

Banks should give greater attention to reducing non-performing loans, as the correlation results indicate that NPLs are negatively associated with profitability and stability. Better credit screening, loan monitoring, recovery procedures, and risk-based lending practices can help banks improve both financial performance and stability.

The positive role of EPS in fixed-effect models suggests that banks should focus on strengthening retained earnings and internal capital generation. Instead of depending heavily on external capital sources, banks should improve profitability through efficient operations and diversified income streams.



Regulators and banks should improve liquidity disclosure and reporting practices. Although the study mentions it as an important Basel III indicator, the empirical tables mainly focus on CAR and LR. Future analysis should include more robust and clear measurements of LCR and NSFR to provide a more complete picture of Basel III compliance.

Future researchers should include macroeconomic variables such as inflation, interest rates, GDP growth, exchange rate volatility and the policy rate, as Pakistan's banking sector is strongly affected by economic instability. Adding these variables can improve the model's explanatory power.

Future studies should also compare Islamic and conventional banks separately because the thesis itself highlights Pakistan's dual banking system. Separate analysis can show whether Basel III reforms affect Islamic and conventional banks differently.

Author Contributions

All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical approval

This article does not contain any studies with human participants performed by any of the authors.

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Informed Consent

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Data Availability

The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request.

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