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**Evaluating the Effectiveness of Basel III Implementation on Bank Default Risk: Empirical Evidence from Pakistan**

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**Abstract**

This study assesses the retrospective impact of Basel III regulatory standards on the financial stability and default probability of Pakistani banks. Specifically, the analysis focuses on three major indicators introduced by Basel III: the Capital-to-Asset Ratio (CAR), Liquidity Coverage Ratio (LCR), and Net Stable Funding Ratio (NSFR). Using annual data from a panel of Pakistani banks spanning 2005 to 2018, the study applies both Ordinary Least Squares (OLS) and Generalized Method of Moments (GMM) estimations to analyze the relationship between these indicators and bank performance proxies, including Return on Assets (ROA) and Z-score. The results from OLS models suggest that Basel III reforms, especially improvements in CAR and LCR, are associated with enhanced financial resilience and lower probability of default. However, GMM estimations do not yield statistically significant results, likely due to the small sample size and annual nature of the data. This research contributes to the broader discourse on banking regulation in emerging economies, offering policy implications for regulators and banking institutions in Pakistan and similar contexts.

**Keywords:** Basel III, Probability of Default, Capital-to-Asset Ratio, Liquidity Coverage Ratio, Financial Stability, Pakistan

**Introduction**

The global financial crisis of 2007–2009 exposed significant weaknesses in the regulatory and risk management frameworks of financial institutions worldwide. These deficiencies necessitated the development of a more robust set of banking regulations aimed at improving the resilience of financial systems. In response, the Basel Committee on Banking Supervision introduced Basel III in 2010, a comprehensive set of reform measures designed to strengthen bank capital adequacy, introduce more stringent liquidity requirements, and reduce systemic risk (**Yamna***etal* 2024, BCBS, 2011). The Basel III framework was designed with the dual objective of enhancing microprudential supervision at the institutional level and macroprudential oversight to prevent the buildup of systemic risk. Central to the framework are capital buffers such as the Capital Conservation Buffer and the Countercyclical Capital Buffer, alongside revised standards like the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). These measures aimed to ensure that banks hold sufficient high-quality liquid assets and maintain stable funding profiles, particularly during periods of financial stress (**Zaira***etal* 2023, Cecchetti, 2014). In Pakistan, the significance of a resilient banking system cannot be overstated. As a bank-based economy, Pakistan relies heavily on financial intermediation to support economic activity, manage liquidity, and drive investment. Given this context, the implementation of Basel III regulations by the State Bank of Pakistan (SBP) beginning in 2013 marked a major shift in the regulatory landscape. The full phase-in of these standards was completed by 2019, aiming to bring Pakistani banks in line with international best practices (Noreen etal 2016, SBP, 2019). The question of whether Basel III has succeeded in enhancing the financial stability of Pakistani banks is of both academic and policy interest. Empirical research on Basel III’s impact in emerging markets remains limited, and the evidence from Pakistan is particularly sparse. While several studies have examined capital adequacy and liquidity management in the pre-Basel III context (e.g., Arif & Anees, 2012; Ahmed et al., 2016; Yamna etal 2024), few have systematically assessed the post-implementation effectiveness of these reforms on actual risk indicators such as probability of default. This study seeks to fill this gap by empirically evaluating the relationship between Basel III indicators—Capital-to-Asset Ratio (CAR), Liquidity Coverage Ratio (LCR), and Net Stable Funding Ratio (NSFR)—and financial resilience among Pakistani banks. The analysis uses two key proxies for resilience: Return on Assets (ROA) and the Z-score, a widely accepted indicator of default probability (Laeven & Levine, 2009). The study further strengthens its empirical rigor by employing both Ordinary Least Squares (OLS) and Generalized Method of Moments (GMM) estimation techniques to account for dynamic relationships and potential endogeneity (Giordana *etal*, 2011).

The main research questions guiding this study are:

1. Has the implementation of Basel III contributed to a reduction in the probability of default among Pakistani banks?
2. Do improvements in CAR, LCR, and NSFR translate into measurable gains in financial performance and stability?

By addressing these questions, this study aims to offer practical insights for policymakers, regulators, and financial institutions. It contributes to the growing literature on the effectiveness of post-crisis regulatory reforms and provides context-specific evidence relevant to other emerging economies implementing Basel III.

**Methodology**

This study uses a quantitative panel data approach to analyze the relationship between Basel III regulatory indicators and bank-level financial resilience in Pakistan. The methodology incorporates both cross-sectional and time-series components across a range of domestic commercial banks over a 14-year period from 2005 to 2018. This duration includes pre- and post-Basel III implementation phases, thereby offering comparative insights.

**Research Design**

The study employs both Ordinary Least Squares (OLS) regression and the System Generalized Method of Moments (GMM) to estimate the relationships between independent Basel III variables—Capital-to-Asset Ratio (CAR), Liquidity Coverage Ratio (LCR), and Net Stable Funding Ratio (NSFR)—and dependent financial stability proxies: Return on Assets (ROA) and the Z-score. OLS is used to provide baseline associations between the explanatory and outcome variables. However, because financial performance variables are inherently dynamic and may exhibit endogeneity (e.g., a well-performing bank may be more likely to comply with Basel III requirements), the GMM technique is employed. This estimator, as developed by Arellano and Bond (1991) and later extended by Blundell and Bond (1998), is appropriate for small time-series data with a relatively larger cross-section, making it ideal for this study.

**Data Collection and Sample**

The study utilizes secondary data gathered from the annual financial statements of Pakistani commercial banks, regulatory reports published by the State Bank of Pakistan (SBP), and verified banking databases such as Bankscope and the World Bank’s Financial Development database. Banks with incomplete data were excluded to maintain consistency and reliability of results. The final balanced panel consists of annual data from 19 commercial banks, encompassing both conventional and Islamic banks. To enhance robustness, macroeconomic variables like inflation rate, GDP growth, and interest rate are included as control variables in extended models.

**Variable Definitions and Measurement**

* **Capital-to-Asset Ratio (CAR):** Measures a bank’s core equity capital to total assets. It indicates capital adequacy, which is essential under Basel III.
* **Liquidity Coverage Ratio (LCR):** Ensures that a bank maintains an adequate level of unencumbered high-quality liquid assets to meet short-term obligations.
* **Net Stable Funding Ratio (NSFR):** Aims to limit over-reliance on short-term wholesale funding and promote stable funding over a one-year horizon.
* **Z-score:** A measure of a bank's insolvency risk, calculated as: Z = (ROA + (Equity/Assets)) / SD(ROA).
* **Return on Assets (ROA):** Indicates how profitable a bank is relative to its total assets.

**Model Specification**

Two regression models are employed:

Model 1 (OLS):

Z-score\_it = β0 + β1CAR\_it + β2LCR\_it + β3NSFR\_it + β4ROA\_it + ε\_it

Model 2 (GMM):

Z-score\_it = αZ-score\_it-1 + β1CAR\_it + β2LCR\_it + β3NSFR\_it + β4ROA\_it + η\_it

In the GMM model, the lagged dependent variable serves as an instrument to address potential autocorrelation and endogeneity.

**Results and Discussion**

**Descriptive Statistics**

Table 1 presents descriptive statistics for the study variables.

**Table 1: Descriptive Statistics**

| **Variable** | **Mean** | **Std. Dev.** | **Min** | **Max** |
| --- | --- | --- | --- | --- |
| ROA | 0.0124 | 0.0076 | -0.012 | 0.028 |
| CAR | 0.096 | 0.021 | 0.063 | 0.128 |
| LCR | 1.03 | 0.16 | 0.68 | 1.32 |
| NSFR | 1.08 | 0.13 | 0.72 | 1.41 |
| Z-score | 18.23 | 4.56 | 8.40 | 29.10 |

The descriptive statistics reveal that most Pakistani banks during the sample period met the minimum Basel III thresholds. The mean CAR (9.6%) suggests a healthy capital buffer above international minimums. Similarly, both LCR and NSFR are above 1, reflecting compliance with liquidity and stable funding requirements. The average Z-score of 18.23 suggests a relatively low probability of default.

**Correlation Matrix**

To explore multicollinearity risks and preliminary relationships, a correlation matrix was computed. The results showed moderate positive correlations between CAR, LCR, and Z-score, indicating potential associations between higher capital/liquidity and greater stability.

**OLS Regression Results**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **p-value** |
| --- | --- | --- | --- | --- |
| CAR | 1.25 | 0.45 | 2.78 | 0.006\*\* |
| LCR | 0.87 | 0.39 | 2.23 | 0.028\* |
| NSFR | 0.39 | 0.31 | 1.26 | 0.209 |
| ROA | 2.11 | 0.95 | 2.22 | 0.029\* |
| Constant | 9.15 | 2.14 | 4.28 | 0.000\*\* |

The OLS model reveals that both CAR and LCR have statistically significant positive effects on the Z-score, implying a reduction in default probability as capital and liquidity strengthen. The coefficient for NSFR is positive but not significant, possibly due to overlapping effects with LCR. ROA’s significance indicates that profitability is a strong contributor to financial stability.

**System GMM Results**

| **Variable** | **Coefficient** | **Std. Error** | **z-Statistic** | **p-value** |
| --- | --- | --- | --- | --- |
| Z-score (t-1) | 0.37 | 0.28 | 1.32 | 0.186 |
| CAR | 0.92 | 0.63 | 1.46 | 0.145 |
| LCR | 0.55 | 0.49 | 1.12 | 0.261 |
| NSFR | 0.24 | 0.35 | 0.69 | 0.491 |
| ROA | 1.08 | 1.06 | 1.02 | 0.311 |

In the GMM model, none of the explanatory variables achieved statistical significance. This result may be due to the limited number of observations and the annual frequency of the data, which reduces model efficiency. Nonetheless, the signs of the coefficients remain consistent with theoretical expectations.

**Discussion**

The positive impact of CAR and LCR on Z-score supports the hypothesis that Basel III indicators contribute to financial resilience in the Pakistani banking sector. These results align with previous findings (e.g., Giordana & Schumacher, 2011; Arif & Anees, 2012), suggesting that sufficient capital and liquidity buffers are essential to mitigate risk during financial stress. The insignificant GMM results caution against overinterpreting dynamic effects in small samples. Nevertheless, they underscore the importance of further longitudinal data and more granular (e.g., quarterly) information. These findings align with global studies showing that capital and liquidity buffers improve bank resilience (Giordana & Schumacher, 2011; ElBannan, 2017). The significant role of CAR and LCR in the OLS model affirms their effectiveness in mitigating risk. The non-significance of NSFR may be explained by its longer-term horizon, which may not reflect in annual solvency metrics. The divergence between OLS and GMM results also reflects common empirical challenges in small-sample dynamic modeling (Roodman, 2009). It highlights the importance of data granularity and suggests that quarterly reporting could improve the reliability of GMM estimates.

**Conclusion and Policy Implications**

This study aimed to evaluate the impact of Basel III regulations on the financial stability and probability of default among Pakistani banks, using a panel dataset from 2005 to 2018. The analysis focused on three core Basel III indicators—Capital-to-Asset Ratio (CAR), Liquidity Coverage Ratio (LCR), and Net Stable Funding Ratio (NSFR)—and assessed their relationship with financial resilience proxies, namely Return on Assets (ROA) and the Z-score. The results from the Ordinary Least Squares (OLS) regression suggest that both CAR and LCR have statistically significant and positive associations with Z-score, indicating a lower probability of default. ROA, a measure of profitability, was also found to significantly enhance financial stability. However, the Net Stable Funding Ratio (NSFR), while positively related, did not show statistical significance, implying that its effects might be more nuanced or observable over a longer horizon. The Generalized Method of Moments (GMM) estimation, used to account for endogeneity and dynamic relationships, did not yield statistically significant results. This may be attributed to the small sample size, annual data frequency, and limited time-series variability within the dataset. Despite this, the direction of the coefficients was consistent with economic theory and findings from other empirical studies. From a policy perspective, the findings reinforce the importance of capital adequacy and short-term liquidity as pillars of financial resilience. Regulators such as the State Bank of Pakistan (SBP) should prioritize consistent enforcement of CAR and LCR standards and monitor their integration into risk management frameworks. Moreover, while NSFR may not yield immediate results, it remains vital for long-term solvency and should continue to be enforced and monitored. The study also points to several areas for future research. First, expanding the dataset to include post-2018 observations would capture more of the post-Basel III implementation period and potentially the impact of the COVID-19 pandemic. Second, a deeper examination of sector-specific risk exposures, including Islamic versus conventional banks, could yield more tailored insights. Finally, incorporating macroeconomic shocks and global contagion effects would help contextualize bank-level responses in a broader economic framework.

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