

Analyzing Dual Impact of Macroeconomic Factors & Climate Related Variables on Financial Performance of Banking Sector of Pakistan

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Abstract

This study examines the joint impact of macroeconomic factors and climate related risks on the financial performance of Pakistan's banking sector. Quarterly unbalanced panel data for 32 banks covering 2015–2024 are used, with Return on Assets (ROA) serving as the profitability measure. Consumer Price Index, real interest rate, Gross Domestic Product, temperature change, and flood occurrences are included as explanatory variables. While, bank size is incorporated as a control. Fully Modified Ordinary Least Squares and Dynamic Ordinary Least Squares estimators are applied to capture long run relationships. The results indicate that temperature change has a negative and statistically significant effect on bank profitability. GDP shows a positive and significant impact. Furthermore, flood occurrences also exhibit a positive and significant association with ROA. CPI demonstrates a mildly negative effect and the real interest rate remains insignificant. In brief, the findings emphasize the importance of integrating climate risk into financial regulation and indicate that larger banks are more resilient to macroeconomic and environmental shocks.

Keywords: *Banking Sector Profitability, Macroeconomic Indicators, Climate Related Risks, ROA, Pakistan, FMOLS and DOLS.*

Chapter 01

Introduction

1.1. Background

The banking sector plays a central role in Pakistan's economic growth, financial inclusion, and stability by supporting investment, industrial activity, employment, and government financing (Rashid & Jabeen, 2016). Through expanded access to credit, banks enhance monetary policy transmission and contribute to inclusive growth, including increased financial participation of women (Demirgüç-Kunt et al., 2018; Ahmad & Malik, 2015).

The banking sector is central to Pakistan's economy. However, it is highly vulnerable to macroeconomic conditions and climate-related risks. Together, these factors affect the profitability of the banking sector. Economic growth influences credit demand and asset quality (Nguyen, 2024). According to (Kanwal & Nadeem, 2013), interest rates affect earnings through net interest margins. Inflation, measured by CPI, affects operating costs and purchasing power (Converse & Jain, 2024; Athanasoglou et al., 2008; Rachdi, 2013).

Most studies on bank profitability in Pakistan focus on macroeconomic determinants. But, these largely ignore climate change. According to (Lin & Raza, 2019), Pakistan is exposed to climate change, despite contributing only about 1 percent to global CO₂ emissions. Extreme heat waves and major floods in 2010 and 2022 resulted in economic losses of approximately US\$ 14.9 billion (4.8 percent of GDP) and displaced millions of people (World Bank, 2022; Dajana & Shujat, 2024). (Ahmed & Sehgal, 2018 & Cevik & Jalles, 2020) added that climate shocks reduce borrower income, shocks also affect collateral values, and add to non-performing loans. As a

result, it increases credit risk for banks. Environmental and transition risks have emerged as key concerns for financial policy.

The State Bank of Pakistan (SBP) has introduced regulatory measures to enhance climate resilience within the banking sector. Under the Green Banking Guidelines and the Environmental and Social Risk Management Framework (2021), banks and Digital Financial Institutions are required to incorporate environmental and social risk assessments into governance structures, credit appraisal, and project screening.

Therefore, it is important to study the combined effects of macroeconomic and climate-related factors on bank profitability. Macroeconomic variables affect earnings through traditional channels. Climate events create new systemic risks that influence lending, asset quality, and bank operations. Understanding these links can help banks become more resilient. It can also support profitability and promote sustainable finance.

1.2. Problem Statement

Climate-related risks are increasing in both frequency and severity. They pose serious threats to traditional models of bank profitability. Macroeconomic factors are already well studied. However, there is a clear research gap in understanding how climate risks, along with macroeconomic indicators, affect the financial performance of banks in Pakistan.

1.3. Research Hypotheses

This study proposes three hypotheses:

H1: Macroeconomic factors have a significant positive impact on the financial performance of the banking sector in Pakistan.

H2: Climate related factors cause negative impact on the profitability of the banking sector in Pakistan.

H3: Bank size significantly influences the profitability of the banking sector in Pakistan.

1.4. Research Objectives

This study has three main objectives. First, it analyzes how macroeconomic indicators affect the profitability of Pakistan's banking sector. Second, it examines the impact of climate-related variables on banking performance. Third, it assesses how bank size moderates the effects of macroeconomic and climate related factors.

1.5. Research Questions

In line with these objectives, the study addresses the following questions:

1. How do macroeconomic factors affect the profitability (ROA) of Pakistan's banking sector?
2. How do climate-related factors influence the profitability (ROA) of Pakistan's banking sector?

1.6. Significance of the Study

This study contributes to understanding how macroeconomic and climate related factors jointly influence the profitability of Pakistan's banking sector. The findings offer practical insights for banks and policymakers to incorporate both economic and environmental risks into sustainable banking strategies. The study supports the formulation of climate resilient policies that enhance financial stability and adds to the literature on resilient financial systems in climate vulnerable economies.

Chapter 2

Literature Review

This chapter reviews the theoretical and empirical literature on how macroeconomic conditions and climate related risks affect bank profitability in Pakistan. It discusses Keynesian Liquidity Preference Theory and Climate Financial Risk Theory. It develops a framework linking ROA with economic and environmental variables. Furthermore, the chapter reviews global and local evidence to identify research gaps addressed by this study.

2.1. Theoretical Framework

2.1.1. Keynesian Liquidity Preference Theory

This study uses the Keynesian Liquidity Preference Theory as its theoretical framework. Research on Pakistan and other developing countries shows that bank profits are affected by interest rates, inflation, and economic growth (Kanwal & Nadeem, 2013; Rahman, Yousaf, & Tabassum, 2020).

2.1.2. Climate–Financial Risk Theory

Studies show that climate change adds nontraditional risks to banks' balance sheets. Climate Financial Risk Theory explains that physical risks such as temperature changes and floods, and transition risks like climate policies and regulations, increase credit risk, damage collateral, disrupt operations, and weaken borrowers' repayment ability (Battiston et al., 2017; Campiglio et al., 2018).

2.1.3. Rationale for a Dual-Theory Approach

The Keynesian view explains bank profitability using economic factors.

The climate financial view explains bank profitability using environmental factors. Pakistani banks now operate under both macroeconomic volatility and recurrent climate shocks. Therefore, using both frameworks together is better for explaining bank profitability in this situation.

2.2 Conceptual Framework

Based on these theories, the study examines bank profitability, measured by Return on Assets (ROA), using macroeconomic and climate related factors.

Macroeconomic conditions affect bank profitability by influencing credit demand, funding costs, and real returns. Inflation can lower real income and increase costs if interest rates do not change, but moderate inflation can help increase profit margins (Converse & Jain, 2024; Athanasoglou et al., 2008; Rachdi, 2013). GDP growth can bring higher lending, lower non performing loans, and stronger earning. Furthermore, real interest rates reflect monetary policy and can reduce loan demand but may improve profit margins.

Climate change variables give hint on how temperature and floods affect profitability of banks in Pakistan. Rising temperatures affect sectors financed by banks, which results in reduction of borrowers' capacity to repay (Zhang et al., 2022; Yaseen et al., 2024). Similarly, floods damage collateral, disrupt business activity and increase nonperforming loans (Cevik & Jalles, 2020; Ahmed & Sehgal, 2018). Bank size is expected to positively affect ROA. It is due to scale, diversification, and stronger risk management. But, empirical evidence remains mixed.

2.3. Review of Empirical Literature

2.3.1. Macroeconomic Factors and Bank Profitability

Empirical evidence confirms that macroeconomic conditions influence bank performance. In Pakistan, findings on inflation (CPI) are mixed. Some studies report that inflation and interest rate pressure reduce profitability (Rahman et al., 2020; Muzammil, 2020), Others find positive or insignificant effects, indicating that banks may widen spreads in certain settings (Lutf & Omarkhil, 2018; Sarkar & Rakshit, 2023; Alsharif, 2023). Studies from other countries show that inflation often increases costs and erodes real margins (Ashraf et al., 2017; Jureviciene & Dofartaite, 2013). Recent research further links inflation volatility to climate shocks. According to (Azhar et al., 2025), floods and heat waves can destabilize prices and affect banking performance.

Results for interest rates similarly vary. Pakistani and African studies which include (Rahman et al., 2020; Simiyu & Ngile, 2015) found a negative relationship between high rates and ROA. It reflects weaker credit demand and higher funding costs. Other studies like (Khan et al., 2015; Ul Mustafa, Ansari, & Younis, 2012; Lyimo & Hussein, 2022) find no significant effect. Some Islamic banking evidences show that wider interest measures can increase profitability when banks can price loans effectively (Gazi et al., 2024; Babarinde et al., 2023).

GDP is a consistently positive determinant of bank profitability in many studies, because stronger economic activity raises credit demand and lowers credit risk (Aspal et al., 2019; Alsharif, 2023; Jadah et al., 2020; Lyimo & Hussein, 2022; Babarinde et al., 2023). However, climate related shocks can reduce output and weaken this relationship (World Bank, 2022; Azhar et al., 2025).

2.3.2 Climate-Related Risks and Bank Performance

Climate related risks are now seen as important factors affecting bank stability. Rising temperatures negatively affect ROA by damaging infrastructure, raising operating costs, and lowering asset quality (Yaseen et al., 2024; Wu et al., 2023; Lee & Alam, 2024). Studies also show that temperature, especially in countries with weaker financial systems, stress increases non performing loans and raises systemic risk (Zhang et al., 2022; Peters, 2025). Floods consistently reduce bank profitability and lending by causing sudden losses, disrupting economic activity, and damaging collateral (Yaseen et al., 2024; Zhang et al., 2022; Qadir, Iftikhar, & ul Mustafa, 2025). In Pakistan, where floods have caused losses of up to 4.8% of GDP, ignoring these risks would underestimate banks' true exposure.

2.3.3 Bank Size

Bank size is often used as control variable, but its effect on profitability is unclear. Some studies find a positive effect due to economies of scale, diversification, and reputational benefits (Jadah et al., 2020; Hasanov et al., 2018; Muzammil, 2020). Other research reports insignificant or negative effects suggesting that larger size may increase complexity and risk rather than stability (Jawarneh, 2022; Hasanov et al., 2018).

2.4 Research Gap

Although many studies examine the effects of GDP, inflation, and interest rates on bank profitability. Macroeconomic or climate risks have been studied separately. Few adopt an integrated approach suitable for climate vulnerable economies like Pakistan. In Pakistan economic and environmental shocks occur together. Furthermore, existing research also relies heavily on static panel models. Such models do not address endogeneity, long run relationships, or

unbalanced panels. Climate shocks such as floods are rarely modeled explicitly. Limited use of high frequency data restricts analysis of short term dynamics.

To address these gaps, this study jointly examines macroeconomic factors (CPI, interest rate, GDP growth) and climate related variables (temperature change, flood occurrence) for Pakistani banks using a panel data framework. This study applies advanced estimators such as FMOLS and DOLS. It provides robust long run evidence on how combined economic and environmental shocks affect bank profitability. It also offers policy relevant insights for regulators and practitioners.

Chapter 3

Research Methodology

This chapter explains the methods used to study effects of macroeconomic and climate related factors on the financial performance of Pakistan's banking sector. It explains the research design, data sources, and definition of variables. It also describes the models, estimation methods, and tests used to ensure reliable and valid results. The main goal is to use a clear and rigorous approach. This approach aims to produce strong evidence using panel data from multiple banks over different time periods.

3.1 Research Design

The study employs a quantitative, deductive research design. It has taken quarterly panel data from 32 commercial banks in Pakistan. The study covers the period 2015–2024. It aims to measure the dual impact of macroeconomic and climate related variables on bank profitability which is

measured by Return on Assets (ROA). The analysis follows a sequential empirical process provided below:

1. Diagnostic procedures, which include panel unit root and Pedroni cointegration, tests were undertaken. This confirmed mixed integration orders $[I(0)/I(1)]$ and the existence of long run relationships.
2. Dynamic Ordinary Least Squares (DOLS) was employed as the main estimator based on these results. While, Fully Modified Ordinary Least Squares (FMOLS) was used for robustness verification.

This progression helps to address issues such as unobserved heterogeneity, endogeneity, and serial correlation. As a result, it allows accurate assessment of both short run and long run effects. The Generalized Method of Moments (GMM) is common in banking studies. It was deemed unsuitable here because the data structure ($T > N$) violates GMM's small time dimension assumption.

3.2 Data Sources and Sample Selection

Bank level financial data, including Return on Assets (ROA) and bank size, were extracted from the State Bank of Pakistan (SBP). Consistent with previous empirical studies, ROA was chosen as the key profitability indicator (Khan et al., 2015; Horobet et al., 2021; Mabkhot & Al-Wesabi, 2022).

Macroeconomic indicators were obtained from international and national sources. Consumer Price Index (CPI) and interest rate data was taken from the International Monetary Fund (IMF) portal. GDP growth related data was taken from the Economic Survey of Pakistan and

National Accounts Committee (NAC). Furthermore, temperature change and flood events related data was from IMF climate datasets and national meteorological records.

The dataset is unbalanced. It comprise of 40 quarterly observations (2015–2024) for most variables. Limited data is missing for real interest rates and temperature. The sample includes public sector, local private, foreign, and specialized banks, ensuring sectoral diversity representative of Pakistan’s financial system.

3.3 Definition and Measurement of Variables

The study incorporates macroeconomic, environmental, and institutional variables which are summarized below.

Variable	Type	Proxy / Measurement
ROA	Dependent	Return on Assets (%)
CPI	Independent	Consumer Price Index (Inflation %)
IR	Independent	Real Interest Rate (%)
GDP	Independent	GDP Growth Rate (%)
TEMP	Independent	Annual Average Temperature Change (°C)
FLOOD	Independent	Dummy Variable (1 = Flood, 0 = Otherwise)
SIZE	Control	Log of Total Assets

3.4 Hypothesis Development

The study proposes the following hypotheses:

Macroeconomic Variables

- H1: CPI has a negative effect on banks' financial performance (ROA).
- H2: Real interest rate has a negative effect on banks' financial performance (ROA).
- H3: GDP growth has a positive effect on (ROA).

Climate-Related Variables

- H4: Temperature change has a negative effect on banks' financial performance (ROA).
- H5: Flood occurrence has a negative effect on banks' financial performance (ROA).

Bank-Specific Variable

- H6: Bank size positively influences banks' financial performance (ROA).

3.5 Model Specification and Estimation Technique

The empirical model assesses how macroeconomic and climate-related factors affect profitability, formulated as:

$$ROA_t = \alpha_t + \beta_1 CPI_{it} + \beta_2 RIR_{it} + \beta_3 GDP_{it} + \beta_4 TEMP_{it} + \beta_5 FLOOD_{it} + \beta_6 BSize_{it} + \varepsilon_{it}$$

Where:

ROA_{it} ROA_{it} denotes the profitability of bank i at time t . α_i captures unobserved bank-specific effects. ε_{it} is the random error term.

Study applies FMOLS and DOLS estimators due to the long time dimension ($T > N$) and potential cointegration among variables. FMOLS corrects for serial correlation and endogeneity in cointegrated panels. DOLS introduces lags and leads of first differenced regressors to mitigate simultaneity bias. Both are widely used in similar contexts (Mark & Sul, 2003; Chudik & Pesaran, 2015; Srinivasan & Mitra, 2024; Farhat, 2023).

DOLS has been selected as the main estimation method. It is due to its superior statistical efficiency and clearer interpretation of long term elasticities, especially for GDP growth, temperature, and flood impacts. FMOLS served as a robustness check to validate long run relationships and ensure result consistency.

3.6 Diagnostic Tests and Pre-Estimation Checks

Several diagnostic and pre-estimation procedures were conducted prior to estimation. The same are provided below:

- Descriptive statistics and correlation matrix were used to evaluate data distribution and preliminary associations.
- Panel unit root tests, including Levin-Lin-Chu (LLC), Im-Pesaran-Shin (IPS), and Fisher-type ADF and PP tests were used to verify stationarity.
- Pedroni and Kao cointegration tests were used to confirm long-run relationships among variables.
- Multicollinearity assessment was undertaken using Variance Inflation Factor (VIF).
- Tests for heteroskedasticity and serial correlation was also conducted to validate model robustness.

These diagnostics confirmed that FMOLS and DOLS estimators were appropriate and yielded stable results under the chosen model specification.

3.7 Ethical Considerations

All data used are secondary and publicly available. The study maintains data integrity through transparency and proper citation of sources. It also follows ethical research standards for accuracy, confidentiality, and academic honesty.

3.8 Methodological Limitations

Despite employing robust techniques, the study acknowledges following limitations:

1. Limited quarterly data is covered for certain macroeconomic and climate indicators.
2. Use of proxies, which include temperature and flood dummy, may not fully capture multidimensional climate risk.
3. Potential omissions of unobservable institutional or behavioral factors influence profitability.

However, these limitations do not undermine the validity of findings. Use of FMOLS and DOLS estimators minimizes estimation bias and enhances reliability.

Conclusion

This chapter described the methodological foundation of the study. Details of research design, data collection, variable definitions, model specification, and estimation procedures are provided. DOLS is the main estimator and FMOLS is for robustness. The study ensures a

evaluation of how macroeconomic and climate related factors jointly influence the profitability of Pakistan's banking sector. The next chapter presents the empirical analysis and results derived from these methods.

Chapter 4

Results and Discussion

This chapter presents the empirical findings on how macroeconomic indicators and climate related risks influence the financial performance of Pakistan's banking sector. The financial performance of Pakistan's banking sector is measured by Return on Assets (ROA). Quarterly panel data from 32 banks (2015–2024) were analyzed using FMOLS and DOLS. The estimators were used after verifying stationarity and long run cointegration. The discussion focuses on the direction, strength, and policy implications of these relationships.

4.1 Diagnostic and Cointegration Results

Pre estimation diagnostics confirmed that the dataset comprised a mix of stationary and first difference variables ($I(0)/I(1)$), with none integrated of order two. Panel unit root tests (LLC, IPS, ADF-Fisher) indicated that ROA, temperature change, GDP growth, and real interest rate were largely stationary. However, CPI and bank size showed mixed integration, and the flood dummy was $I(1)$. These results justified the use of co integration techniques capable of handling mixed integration orders.

The Pedroni cointegration test established a strong long run equilibrium relationship between ROA and macroeconomic and climate factors. Four of the seven test statistics, notably the PP and ADF forms, rejected the null hypothesis of no co integration. The null hypothesis rejected at 1–5% significance levels. The model explained around 52% of long run variation in

ROA ($R^2 = 0.519$). It indicates moderate but reliable explanatory power. The findings confirmed the suitability of FMOLS and DOLS for long run estimation.

4.2 Long-Run Estimates: FMOLS Model

FMOLS results revealed significant long run effects from temperature change, inflation, and bank size. These are discussed below:

Temperature change had a negative and statistically significant effect ($\beta = -5.91$, $p \approx 0.05$). It implies that even modest climatic variations reduce profitability. This highlights Pakistan's vulnerability to environmental stress. The result supports previous evidence that climate shocks undermine credit quality and operational stability (Yaseen et al., 2024).

Inflation (CPI) was marginally negative ($\beta = -1.47$, $p \approx 0.08$), consistent with Horobet et al. (2021). The result suggests erosion of real interest margins and cost pressures.

Bank size showed a strong positive relationship ($\beta = 2.81$, $p < 0.01$). It confirms economies of scale, risk diversification, and better resource management among larger banks (Jadah et al., 2020).

GDP growth, real interest rate, and flood occurrence had statistically insignificant coefficients. This indicates limited direct long run influence within this specification.

In short, FMOLS results emphasize that climate variability and inflationary trends are key long term threats to banking profitability. Whereas, institutional strength, captured by size, enhances resilience.

4.3 Long-Run Estimates: DOLS Model

The DOLS model was chosen as the main estimator because it is more efficient. It confirmed most FMOLS results and showed stronger and more significant effects.

Temperature change exhibited a highly significant and large negative impact ($\beta = -31.84$, $p < 0.01$). The result underscores that rising temperatures and climate volatility critically impair profitability through higher credit risk and asset devaluation.

GDP growth became strongly positive and significant ($\beta = 14.94$, $p < 0.01$). The finding confirms that economic expansion drives long run banking profitability by boosting loan demand and reducing default risk.

Flood occurrence surprisingly showed a positive and significant coefficient ($\beta = 81.70$, $p < 0.05$). This may reflect post disaster recovery lending, liquidity injections, or insurance and relief inflows. Injections temporarily enhance profitability. This is a finding consistent with short term post crisis rebounds observed in other developing economies.

Inflation (CPI) remained weakly negative ($\beta = -4.56$, $p \approx 0.10$). It suggests persistent erosion of real margins.

Bank size again exerted a highly significant positive effect ($\beta = 8.68$, $p < 0.01$). This confirms that larger institutions are more profitable, efficient, and adaptive.

Real interest rate continued to show no meaningful impact. It implies that structural or policy factors may offset interest rate transmission to profits.

Together, the DOLS estimates reinforce the robustness of the cointegration results and validate the dual risk framework combining macroeconomic and environmental determinants.

4.4 Discussion and Implications

The empirical evidence confirms a long run relationship between banking profitability and both economic and climatic dynamics.

Key insights include:

Climate risk matters. Rising temperatures exert a persistent and economically large drag on profitability. This underscores the need for banks to integrate climate stress testing and green risk management into their governance frameworks.

Macroeconomic stability remains central. Inflation reduces profit margins, while steady GDP growth improves profitability. This shows that stable fiscal and monetary policies are important for the banking sector's health.

Strong institutions reduce risk. Larger banks earn higher profits because they are better capitalized and can absorb shocks more easily.

Unexpected positive post-flood effects may reflect short-term recovery lending and liquidity support. However, they also highlight the need for stronger long-term resilience planning in disaster-prone areas.

Conclusion

In conclusion, both FMOLS and DOLS analyses confirm the dual impact of macroeconomic and climate related factors on the financial performance of Pakistan's banking sector. Temperature rise and inflation emerge as long term constraints. However, economic growth and bank size serve as profitability drivers. The findings emphasize that sustainable banking

strategies must jointly address economic cycles and environmental risks to ensure long term stability. The next chapter provides the conclusions and policy recommendations derived from these results.

Chapter 5

Conclusion & Policy Recommendation

This study investigated the dual impact of macroeconomic indicators and climate-related risks on the profitability of Pakistan's banking sector. The study measures the profitability of Pakistan's banking sector through Return on Assets (ROA). The research is guided by three objectives assessing macroeconomic effects, evaluating climate related influences, and examining the moderating role of bank size. The research employed quarterly panel data from 32 banks between 2015 and 2024, which included public, private, foreign, and specialized institutions.

Following the approach of Chudik & Pesaran (2015), Mark & Sul (2003), and Srinivasan & Mitra (2024) a quantitative, cointegration based design was adopted using Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) estimators. Diagnostic tests confirmed mixed $I(0)/I(1)$ integration and long run cointegration among variables. This validates the use of these estimators.

5.1 Summary of Key Findings

The FMOLS results show that temperature change has a significant negative effect on bank profitability (Yaseen et al., 2024). Inflation (CPI) also has a marginally negative impact. This indicates that persistent price increases reduce real margins (Horobet et al., 2021). Bank size positively and strongly affects ROA, highlighting the advantages of larger banks (Jadah et al.,

2020). However, GDP growth, interest rates, and flood occurrence are not significant in the long run.

The DOLS model, the primary estimator, largely confirmed these patterns but revealed sharper magnitudes. Temperature changes had a strong and significant negative effect. This confirms that climate volatility reduces profitability. GDP growth became strongly positive; validating that economic expansion supports banking performance (Alsharif, 2023). Interestingly, the flood, dummy variable, turned positive and significant. It implies that post disaster credit expansion or insurance inflows may temporarily boost profitability. The result is contrary to Zhang et al. (2022). The real interest rate remained insignificant (Sarkar & Rakshit, 2023). CPI continued to exert a marginally negative influence (Jureviciene & Doftartaite, 2013). Bank size again displayed a robust positive effect (Muzammil, 2020). It confirms the persistent role of institutional scale in profitability and risk absorption.

5.2 Theoretical Implications

The findings extend the Climate-Financial Risk Theory. Findings empirically validate that environmental stressors, particularly rising temperatures, materially influence bank profitability in a developing country context. The results also refine the Keynesian Liquidity Preference Theory. It determines that traditional macroeconomic levers, interest rates and inflation, are insufficient to explain modern banking dynamics without accounting for environmental factors. The evidence supports integrating Environmental, Social, and Governance (ESG) dimensions into mainstream banking theory and practice.

5.3 Policy Recommendations

Integrate Climate Risk in Regulation.

The State Bank of Pakistan (SBP) should include climate risk metrics into supervisory frameworks. Climate adjusted profitability indicators can enhance transparency. One of the examples of it includes Green ROA, in which income from sustainable assets is distinguished conventional assets.

Develop Climate-Adjusted Capital Buffers.

SBP can introduce differentiated capital adequacy requirements for banks exposed to climate sensitive sectors. This way it can be aligned with Basel style environmental stress testing.

Upgrade Collateral and Valuation Standards.

Banks should incorporate climate depreciation factors into property and asset valuation.

Create a National Climate-Risk Data Platform.

In collaboration with NDMA and PDMAs, SBP should establish a geospatial risk portal. The portal should map temperature rise, flood exposure, and regional vulnerabilities to support climate informed lending.

Enhance Resilience of Smaller Banks.

Smaller banks should be encouraged to develop green financial products, diversify income sources, and participate in sustainable finance initiatives to mitigate climate shocks.

5.4 Limitations and Future Research

Some limitations remain despite the rigorous econometric design. The flood dummy variable does not fully capture the intensity or duration of disasters. The unbalanced panel creates small data gaps in later years. In addition, qualitative factors such as governance and policy adoption were not included.

Future research should incorporate:

Short run analyses can be undertaken using GMM or ARDL models to examine immediate responses to shocks.

5.5 Concluding Remarks

This study adds to existing research on how economic and environmental factors affect bank performance. It shows that temperature change and inflation reduce profitability. In contrast, economic growth and larger bank size increase profitability. The findings suggest that sustainable financial stability in Pakistan needs a dual approach. This approach should combine economic fundamentals with climate related risks.

This research confirms the link between climate risks and finance in an emerging market. It provides practical insights for policymakers and regulators. It also helps financial institutions build a banking system that is resilient, climate aware, and inclusive. These insights are especially important in a time of growing environmental uncertainty.

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