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Systemic Risk and Financial Stability: The Role of Fintech in Emerging Markets

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Abstract

This study aims to investigate the effects of FinTech disruption on systemic risk and economic stability of emerging economies including Pakistan, Nepal and Bangladesh. In the context of the present investigation, the author employed data from ten banks for the years 2018-2022 and singled out two aspects of FinTech at once as a stabilizing factor in the market and as a source of risk. Higher FinTech usage in operational activities in Pakistan that enhanced operational resilience and limited digital integration in Nepal that increased systemic risk. The econometric analysis demonstrates the positive impact of FinTech on financial stability alongside mixed impacts on systemic risk owing to decentralized structures and regulatory complexities. The research implications provide policy contributions to manage innovation with caution that serves the improvement of sustainable financial systems in EMs.

Keywords

FinTech, Systemic Risk, Financial Stability, Emerging Markets, Digital Transformation, Pakistan, Nepal, Financial Innovation

1. Introduction

The global financial system, systemic risk and financial stability have become significant concerns for regulators, financial institutions and technology solution providers. Systemically important risk may be defined as the risk of a failure or a disruption at an individual level in an institution or a market segment, which poses a potential threat to the stability of the whole financial system. This risk is most prominent in financial systems connected through a never-ending cycle of failures that erode confidence, disrupt liquidity and cause economic stagnation (Allen & Carletti, 2008; Hoshi & Kashyap, 2004). Instead, financial stability is de-

fined as the state in which the financial system can perform selected functions, such as credit intermediation, payments and funds mobilisation, even when adverse shocks occur.

FinTech has brought unprecedented opportunities and risks to global financial systems, especially for the developing world. Technological advancements such as mobile payment, Blockchain and peer-to-peer (P2P) lending have enhanced the delivery of financial services, accessibility and effectiveness of financial systems (Pal, Tiwari, & Behl, 2021). Furthermore, Mbiti and Weil (2015) investigated new products such as M-Pesa in Kenya, which has completely transformed how transactions and saving, transferring and borrowing facilities are done through cell phones. Moreover, FinTech has functioned to bridge the gaps in the accessibility of financial services in emerging markets with weak or limited financial infrastructure and provide necessary financial services to the excluded population segments.

However, the fast growth of FinTech also exacerbates new sources of systemic risks. As a result, it is mainly based on digital environments, algorithms and decentralized structures (Omarova, 2020; Buckley et al., 2019). It has vulnerabilities regarding cyber risks, operational failures and market disturbances. These risks become more potent due to the interconnectedness of FinTech ecosystems because the failure of one ecosystem is likely to affect the more extensive financial system (Oshodin et al., 2017). These two-fold effects underscore why understanding and managing systemic risks through FinTech-anchored financial systems must be imperative, especially in developing countries. The emerging economies bring particular issues, such as the regulatory environment being immature, the technology profile not being well designed and the velocity of uptake of FinTech being high (Silvestre, 2015; Ejiaku, 2014; Lyons, Kass-Hanna, & Fava, 2022). These factors make these economies vulnerable to FinTech-induced systemic risk, Hence the emerging challenge of encouraging innovation while minimizing risks.

The crisis of 2008 was an eye-opener for how, if left unmitigated, various systemic risks could result in calamitous outcomes and made the need to deal with the risks associated with FinTech imperative for maintaining financial stability (Focacci & Rughi, 2024). Similarly, FinTech has enormous opportunities to expand and improve financial access and processes; on the other hand, it comes with several intricate threats that can disrupt financial systems. The role that FinTech plays as a tool that supports and challenges the economic stability of emerging markets is an essential question that needs to be answered. For instance, traditional risk management frameworks do not capture platform dependencies and DeFi's place (Ali, 2024). In addition, the lack of a single set of regulations and cross-border oversight further increases the risks of FinTech's cross-border reach.

The literature that has so far explored the various dimensions of FinTech and systemic risk has given out mixed signals: While some studies have identified how FinTech has contributed to facilitating financial inclusions, reducing transaction costs and improving market efficiencies, other studies have shown that this very same FinTech is one of the increasing channels leading to systemic risk due to

platform interdependencies and fragilities in operations (Bakken & Skjeltorp, 2022; Areiza-López et al., 2023). Consequently, such mixed evidence calls for further investigation into the impacts of FinTech innovations and their interconnectedness on systemic risk and financial stability in emerging markets.

This research is focused on FinTech in the context of systemic risk, hence trying to fill some gaps in the current literature. This study targets three objectives: probing how FinTech innovations either contribute to or mitigate systemic risk within the financial system of emerging markets; then assessing the effects of FinTech on financial stability on aspects such as financial inclusions, efficiency of market and operational resilience; and finally, discussing policy implications or regulatory considerations to deal with systemic risk issues emanating from new technologies. It then identifies concrete regulatory and strategic approaches to manage systemic risk linked to FinTech while fostering innovation and inclusion in emerging markets.

The study addresses the following research questions in pursuit of these objectives: What are the systemic risks faced by FinTech in emerging markets? How does FinTech contribute to financial stability in these markets? What regulatory and strategic approaches can mitigate systemic risks while fostering FinTech innovation?

The role of FinTech in the financial sector has become increasingly significant, offering both opportunities and challenges for financial stability. Systemic risk arises from disruptions within financial institutions or market segments, posing threats to the entire financial system. Emerging economies often face unique vulnerabilities, including immature regulatory frameworks and technological constraints, making them particularly susceptible to FinTech-induced risks. To enhance the generalizability of findings, this study includes Bangladesh alongside Pakistan and Nepal. The inclusion of Bangladesh allows for a broader examination of FinTech's role in mitigating or exacerbating systemic risk in varied regulatory and economic conditions. The study aims to answer the following research questions:

- What systemic risks are associated with FinTech in emerging markets?
- How does FinTech contribute to financial stability in Pakistan, Nepal, and Bangladesh?
- What regulatory and strategic approaches can mitigate systemic risks while fostering FinTech-driven financial inclusion?

This study expands the literature by analyzing the effects of FinTech adoption on systemic risk and financial stability in Pakistan, Nepal, and Bangladesh. These countries represent diverse financial environments, regulatory landscapes, and digital banking penetration, making them ideal for comparative analysis. This paper's contribution to the literature is manifold. First, it analyzes the nexus between FinTech and systemic risk, focusing on the dynamics in emerging markets that remain largely unexplored. Second, it measures how FinTech contributes to and undermines financial stability, which helps to reveal how its threats and opportunities can be managed. Third, it is possible to make practical suggestions as to

what policy-makers, financial institutions, or technology suppliers can do to foster sustainable and resilient FinTech in emerging markets.

The results of this study will assist policymakers in formulating policies on the regulation of innovation and risks. These insights can help financial institutions reduce risk exposure and align strategic plans to the ever-shifting market environment. As mentioned in this study, technology providers are characterized as creating strong and immune infrastructures to facilitate sustainable development. International organizations such as the World Bank and the International Monetary Fund could also use the results to fund capacity enhancement projects in emerging markets to ensure that FinTech is anchored on sustainable development.

The findings of this study are not confined to the scholarly discourse only. With FinTech establishing itself increasingly in the global financial system, the question of the contribution of this phenomenon to the emergence and development of systemic risk and destabilization of national economies has become relevant at the international level. By addressing these problems, this research provides a route map through which FinTech can be assured of bringing about sustainable and inclusive development in emerging markets instead of constant turmoil and upheaval. The structure of this paper is as follows: Section 2 provides the status quo of the literature and the assumptions of research hypotheses. Section 3 provides data, variable measurement and empirical methods adopted in the research. Section 4 presents empirical results and discussion. Finally, Section 5 summarizes the findings and implications of the study.

2. Literature Review

The intersection of systemic risk, financial stability and the rapidly changing FinTech sector has been of growing importance in various recent academic and policy-oriented studies. This paper will provide an overview of FinTech's multidimensionality and implications regarding systemic risk and financial stability, particularly in Pakistan, Nepal, and Bangladesh. These three countries represent distinct stages of FinTech adoption, regulatory frameworks, and financial sector digitalization. While Pakistan has a rapidly expanding digital banking network, Nepal faces slow digital transformation, and Bangladesh has a strong mobile financial services (MFS) ecosystem, led by bKash and Rocket. This review is organized around three key areas: systemic risks in FinTech-driven financial systems, the role of FinTech in improving economic stability and regulatory and policy considerations for managing systemic risks.

2.1. Systemic Risks in FinTech-Driven Financial Systems

With the growth of FinTech, systemic risk is conventionally viewed through the lens of large financial institutions and markets. The interdependency created by FinTech platforms and reliance on digital infrastructures has opened avenues toward vulnerabilities that might further magnify systemic shocks. According to Di Pietro et al. (2021), the digital nature of FinTech, including algorithm-driven op-

erations and decentralized structures, introduces risks like cyberattacks, data breaches and operational failures. These risks also appear glaring in emerging markets, where base regulatory and technological infrastructures are usually underdeveloped (Corchado, 2024; Sanyaolu et al., 2024).

One failure within the FinTech platform might be significant enough to spill over into the financial chain and reflect interconnected systems' fragility. Lindebaum, Vesa and Den Hond (2020) discussed that the inability to conduct deep scrutiny related to complex algorithms makes the potential system shock more significant, as appropriate standardization measures have not been implemented concerning digital financial service provision. The vulnerabilities of P2P lending platforms and DeFi systems further illustrate the risks. Felländer, Siri and Teigland (2018) demonstrate how dependence on third-party platforms creates asymmetries in trust and control, raising the likelihood of systemic disruptions.

Emerging markets face unique challenges in mitigating these risks. Rapid adoption and generally limited regulatory oversight have created an environment where systemic risks can escalate unchecked. Lyons, Kass-Hanna and Fava (2022) identify that FinTech adoption in most emerging economies surpasses the pace at which the corresponding risk management frameworks are developed. Furthermore, according to Ali (2024), the cross-border nature of many FinTech operations complicates the enforcement of regulatory measures.

2.2. The Role of FinTech in Enhancing Financial Stability

Whereas FinTech creates new risks, it equally brings enormous opportunities to advance financial stability. Innovations, including mobile payments, blockchain technology, and digital lending platforms, have improved access to various financial services, especially in under-resourced areas. For example, Pakistan's banking sector has integrated AI-driven credit assessments, while Nepal has focused on expanding mobile banking penetration. In contrast, Bangladesh has seen explosive growth in mobile financial services (MFS), with bKash alone covering over 50 million users, facilitating digital transactions in both urban and rural regions. In this regard, Mbiti and Weil (2015) give strong arguments with examples of M-Pesa in Kenya, whereby mobile banking revolutionized how people handle their finances and brought resilience to its economy.

What underpins the possible contribution of FinTech to financial inclusions in an emerging economy is all the more critical. In this way, FinTech will contribute to stability by reducing economic discrepancies and providing facilities for banking services to the hitherto excluded sections. For instance, Pal et al. (2021) find that blockchain increases financial operations' transparency and security, thereby reducing fraud and systems failures. Along the same line, Areiza-López et al. (2023) have also noted the digital channels of operational efficiencies as some of the components highlighted for the stability of the financial systems. The Z-score is widely used in financial research as a measure of financial stability. However, it does not fully capture financial system complexity, particularly in emerging mar-

kets where liquidity constraints, loan defaults, and external shocks play a significant role. Additional indicators such as non-performing loan (NPL) ratios, liquidity coverage ratios, and stress test measures should be considered for a more comprehensive analysis of financial stability. Future research should explore alternative financial stability measures that account for FinTech-induced risks.

In addition to providing financial services, FinTech contributes to market efficiency and business continuity. Electronic systems ensure transaction credibility regarding time and accuracy since there is little or no time wastage and mistakes. According to Lyons, Kass-Hanna and Fava (2022), FinTech solutions build the resilience of financial systems since they expand the variety of services offered and do not depend on conventional banking intermediaries. This aspect is especially significant in emerging markets because the banking structures are usually underdeveloped.

Nonetheless, the advantages are that FinTech does not come without some drawbacks. The innovation-risk paradox well captures this aspect of FinTech. While technology may foster stability, the same brings about challenges that conventional risk management frameworks barely contain. Focacci and Rughi (2024) highlighted a need to consider the synergistic relationship between the opportunities and risks offered by FinTech in enhancing financial stability.

2.3. Regulatory and Policy Considerations

Therefore, the success of FinTech will depend on the ability to regulate it so that the benefits and risks can be harnessed. The 2008 financial crisis is an example of why having a sound regulatory system is critical to avoid failure. In light of FinTech, policymakers and regulators are caught between the two extremes of innovation and stability. The first regulatory issue is the international character of FinTech business models. For instance, in Bangladesh, mobile financial services (MFS) are largely regulated by Bangladesh Bank, but there is a lack of standardized risk management policies for digital lending platforms. Unlike Pakistan, which has established a digital payments regulatory framework, and Nepal, which is still in early-stage FinTech adoption, Bangladesh's regulation remains fragmented. There is a growing need to develop cyber-risk frameworks, enforce anti-money laundering (AML) compliance, and establish stronger oversight of mobile payment providers. According to Ali (2024), DeFi platforms are in many countries with no standardized rules. This lack of regulation poses more risks to systemic shocks and enhances compliance implementation challenges. For the same reason, Buckley et al. (2019) suggest that new global rules should be created to address these challenges simultaneously and address the systemic risks.

Another factor hampering the effort to regulate the asset class is the nature of emerging markets. Ejiaku (2014) opined that it becomes difficult to implement and enforce regulations due to institutional voids and environmental turbulence in these markets. According to Silvestre (2015), regulators' technological limitations are usually due to the implausibility of FinTech's operations. This has un-

derscored the need to enhance the capacity to regulate frameworks to support emerging economies. Policy measures to address systemic risk management must target the specific vulnerabilities of FinTech platforms. In her opinion, it is necessary to effectively deal with the risks inherent in stress testing and scenario analysis in digital financial systems, Omarova (2020). As Oshodin et al. (2017) have pointed out, regulatory sandboxes would provide a controlled environment within which FinTech innovations could be tested while the regulators determine possible risks in their implementation.

Consumer protection is another very relevant dimension of regulation in which regulation has a function. Due to exponential growth, those financial technologies were already facing a high rate of fraud, false solicitation, exploitation and economic abuse. Lyons et al. (2022) postulated that well-defined data privacy and security policies must enhance consumer protection and retain confidence in financial services. Moreover, according to Ali (2024), the following view is valid: The consumers using these services will benefit from transparency through risk disclosure requirements related to the FinTech products.

2.4. Gaps in the Literature and Future Research Directions

However, there are still gaps in the literature concerning the interaction of FinTech, systemic risk, and financial stability. Most existing studies focus on FinTech adoption in developed economies, while research on South Asian emerging markets—particularly Bangladesh—remains limited. Bangladesh's mobile financial services sector, despite its rapid growth, has not been thoroughly analyzed in terms of its systemic risks and regulatory vulnerabilities. Future research should explore the cross-border impact of FinTech adoption in South Asian economies and assess the long-term economic resilience associated with digital financial inclusion. First, most current studies mainly investigate developed countries, whereas the changes in emerging economies are investigated insufficiently. This is quite worrying, especially given the upsurge in the use of FinTech solutions in these countries and the circumstances that characterize them.

Second, there is also a dearth of concrete studies on how various regulatory structures have been particularly beneficial in managing some of the systemic risks that arise from FinTech. Although some conceptual studies propose a range of regulatory approaches, they remain at the analytical level exactly where their detailed implementation and effects are experienced in practice. Further research will, therefore, be needed to confirm how different regulatory strategies are effective for and applied to governing systemic risks in FinTech ecosystems.

Third, the impact of innovations such as AI and ML on systemic risk and financial stability remains uncertain. These technologies are increasingly embedded in FinTech platforms, leading to new concerns about their impact on systemic risk. Furthermore, Bakken and Skjeltorp (2022), the authors urge more research into how these technologies and systemic risks interact. Finally, more discussion is needed on the social and economic consequences of systemic risks created by

FinTech. While most papers concentrate on technical and legal aspects, the implications of systemic disruptions in FinTech networks on the societal level are still limited. Subsequent studies must also explore how systemic risks impact various stakeholder groups and which measures should be taken to address these effects.

Most of the literature discussing systemic risk and financial stability of FinTech contains information regarding opportunities and threats. While FinTech can enhance economic access, market effectiveness and organizational robustness, it is also a new wellspring of systemic dangers. The interaction of these two factors is complicated by some essential characteristics of emerging markets, such as regulatory and technological constraints.

All these challenges cannot be undertaken individually by the regulators, banking institutions and technology firms. That is why only sound regulatory requirements, the development of actors' capacities and consumer protection can prevent the emergence of systemic risks while promoting innovation. However, more studies must address the existing literature gaps and offer architecture of FinTech's effects on systemic risk and financial stability. It will be possible to tackle the above challenges and foster the economic systems in emergent markets to attain sustainable and effective use of FinTech for development with minimal systemic risks.

3. Research Data and Models

This section discusses the methodology adopted in the study, emphasizing data sources, variable measurements and analytical tools employed in examining Systemic Risk, Financial Stability and FinTech innovation in EMs. Therefore, the researchers intend to use sound research methods of data collection and analysis to establish the nature of the relationships between these variables.

3.1. Variable Measures

This work uses several variables to examine the complex inter-relationship between financial health, system vulnerability and Fintech development. These variables include FS—financial stability as the dependent variable, F—FinTech innovation as the independent variable and SR—systemic risk as another dependent variable.

3.1.1. Dependent Variable: Financial Stability (FS)

Financial stability is the ability of an industry to continue with its operations when faced with external and internal shocks. And it is measured with the help of the most commonly used measure, the Z-score. This measure measures the buffer that financial institutions have before they can be declared insolvent and it is defined as:

$$Z = \frac{ROA + CAR}{\sigma(ROA)}$$

where:

- ROA: Return-on-assets, representing profitability.

- CAR: Capital-asset ratio, reflecting financial health.
- σ (ROA): Standard deviation of return-on-assets, capturing volatility.

Z-score is a widely used measure in financial research that can predict up to 78% of failures in financial institutions. For the efficiency of withered data, the model applies a natural logarithmic transformation to minimize significant deviations and enhance the result's credibility.

3.1.2. Independent Variable: FinTech Innovation (FT)

FinTech is a complex phenomenon combining various technologies and applications to improve the delivery of financial services. Five fundamental dimensions are incorporated to operationalize FinTech innovation in this study. Information transfer can be done through digital banking, which consists of e-banking and online banking, to ease the transfer of financial information. Risk management encompasses computerized tools, including credit information systems and internet-based insurance that help reduce uncertainty risks in financing. Resource mobilization includes P2P lending, crowdfunding and smart investments that enhance capital distribution. Mobile payments and third-party platforms are used in clearing and payment systems to improve security. Lastly, innovation through the technical base is achieved by applying blockchain technology, artificial intelligence and big data.

3.2. Dependent Variable: Systemic Risk (SR)

This means that systemic risk is the effects of a financial shock in one interconnected system. In this study, systemic risk is measured using two significant indicators. Credit reduction measures alter total loans, showing the ability of financial institutions to sustain lending during relatively worse conditions. Asset reduction analysis compares the changes in the total assets, pointing at the shrinkage of the financial resources in the worse conditions. These proxies provide a rich picture of systematic risks, especially in emerging markets where legal requirements for corporate governance are formalized. This approach allows for understanding the threats in developing financial systems in a risky environment.

3.3. Measurement of Financial Stability

The first index of financial stability is the Z-score. This metric mainly evaluates financial institutions' stability based on their profitability, financial position and risk factors. The data for this study is based on the period from 2018 to 2022 and comprises financial information of ten banks in Pakistan, Nepal and Bangladesh. These institutions depict different financial structures, which provides for a practical assessment of the effect of FinTech on financial stability.

The Z-score formula combines some of the most important financial ratios, which provide a comprehensive picture of the stability of a bank. Return on assets (ROA) indicates profitability and the capital asset ratio (CAR) indicates financial solidity. The last factor, the standard deviation of ROA, speaks to the variability

of returns, while variability is essential in determining risk. To eliminate the influence of outlying values, the study converts the Z-score to its logarithmic form, increasing the validity of the research work's analysis.

The participation of banks from two emerging markets makes the work more valuable. Pakistan, Bangladesh and Nepal are included in the group of developing countries and still have different levels of financial development of FinTech and legal regulation. This cross-country dataset helps generalize the findings and understand the differences in the levels of financial soundness and systemic risk between the regions.

3.4. Systemic Risk

From this perspective, this study considers systemic risk as an area of interest since it deals with the susceptibility of financial systems to external events. The study employs two proxies to measure systemic risk: Significant restructurings, credit reduction and asset reduction.

3.4.1. Credit Reduction

This proxy measures the reduction in the total loan portfolio as a sign of the financial system's ability to finance economic activities during a crisis. The formula is:

$$\text{Credit Reduction} = \frac{\text{Change in Total Loans}}{\text{Previous Year's Total Loans}}$$

A significant reduction in credit indicates heightened systemic risk, as financial institutions may struggle to fulfill their intermediary role.

3.4.2. Asset Reduction

This proxy assesses the decline in total assets, providing insights into the financial system's resilience. The formula is:

$$\text{Asset Reduction} = \frac{\text{Change in Total Assets}}{\text{Previous Year's Assets}}$$

Both proxies capture critical dimensions of systemic risk, enabling a comprehensive analysis of financial system vulnerabilities.

3.4.3. Measure of FinTech

There are five different aspects in which innovations are defined to make up FinTech, each demonstrating its multidimensional effects on financial sectors. Information transfer comprises technologies such as e-banking, online banking and streaming banking financial information to facilitate accessibility and effectiveness. Risk management uses credit information systems and online insurance systems to reduce the uncertainties of financial hazards efficiently. The allocation of resources concentrates on crowd funding, P2P lending and wise investments to ensure that capital is distributed correctly and that financial barriers are eliminated. Clearing and payment systems employ other means of payment, including

Mobile payments and third-party systems for effective and secure payments. Finally, the technical base shaped by modern technologies, including, but not limited to, blockchain, artificial intelligence and big data, creates innovative shifts in financial systems. Altogether, these dimensions offer a sound analytical framework for assessing FinTech's role in improving financial stability and minimizing systemic risk.

3.4.4. Econometric Model

The study employs an econometric model to analyze the relationship between financial stability, FinTech innovation and systemic risk. The model is specified as follows:

$$FS_{it} = \propto + \beta_1 F_{it} + \beta_2 SR_{it} + \varepsilon_{it}$$

where:

- FS_{it}: Financial stability of bank *i* in year *t*.
- F_{it}: FinTech adoption level for bank *i* in year *t*.
- SR_{it}: Systemic risk for bank *i* in year *t*.
- ϵ_{it}: Error term.

This model allows for the simultaneous analysis of the nature of FinTech as a stabilizer and a potential source of systemic risk. To detail these effects, the coefficients of β_1 and β_2 are used. This means that by controlling for other factors that may affect financial stability externally or internally, the analysis controls for them.

In the following methodology section, the authors provide a clear and detailed research framework for studying the relationship between FinTech, systemic risk and financial stability. To this end, this study seeks to employ advanced metrics, multiple data sources and sound analytical methodologies to contribute helpful knowledge to policymakers, financial institutions and regulators in emerging economies. The study's results will help expand the existing knowledge concerning the potential role of FinTech in strengthening financial system vulnerability and its risks.

4. Empirical Analysis

This chapter provides and discusses the results of empirical literature on the relationship between FinTech innovation, systemic risk and financial stability in emerging economies. As FinTech becomes the dominant factor in changing economic systems, it is crucial to understand that it stabilizes and destabilizes the industry it is a part of, especially in Pakistan, Bangladesh and Nepal. This chapter looks at these dynamics using data from the selected banks in the two countries for the 2018-2022 periods to understand how FinTech affects Systemic Risk and Financial Stability.

The analysis addresses three critical research questions: 1) how does FinTech innovation influence systemic risk in financial institutions? 2) What is the role of FinTech in enhancing financial stability? 3) What variations exist between Paki-

stan, Bangladesh and Nepal in these relationships? These questions align with the broader objective of evaluating FinTech's potential to either fortify or undermine the resilience of financial systems in emerging economies.

This study uses data from 10 banks, including three from Pakistan, three from Bangladesh and three from Nepal, for five years. They include financial health measured by the Z-score, the level of systemic risk expressed by credit and assets' decline and the FinTech dimensions, which comprise information transfer, risk management, resource provision, clearing and payments and technical support. Thus, applying an econometric approach, this chapter aims to find out the patterns, differences and implications to give a profound analysis of how FinTech affect financial systems. The study enriches the literature and provides lessons for regulators, financial institutions and policymakers on managing risks and adopting FinTech for development in emerging economies.

4.1. Descriptive Analysis of Financial Stability

4.1.1. Findings: Pakistan

From 2018 to 2022, the financial condition of Pakistani banks, including NBP, Meezan Bank and Faysal Bank, more or less maintained their stability. Z-scores of NBP remained stable over the period and in line with the industry standards, depicting good profitability (as indicated by ROA) and solid capital base (as measured by CAR). Although the bank's performance in the financial year 2020 and 2021 show signs of enhancement, the profit can be ascribed to the enhanced investment in digital banking platforms and better risk management mechanisms. These made it possible for the bank to reduce the vulnerability resulting from macroeconomic factors, including currency devaluation and inflation.

Z-Scores of Meezan Bank, which has been pioneering the concept of Islamic banking in Pakistan, also depicted high Z-scores during the same year. From the table above, its stable CAR and low earnings risk (σROA) demonstrate Sharia financial strategy and early adoption of FinTech. For instance, expanded digital payment solutions, as well as AI-enabled credit checking instruments, improved the bank's organizational performance and clientele access. Although Faysal Bank had good Z-score stability, the Z-scores slightly declined in 2021 and 2022. These declines coincided with external economic pressures and greater competition for market share within the banking industry, affecting profitability.

4.1.2. Findings: Nepal

Nepali banks, including Everest Bank, Kumara Bank and Sanima Bank, displayed high fluctuations in the Z-score value, indicating systematic risk and underdeveloped financial systems. While the Nepal Stock Exchange (NEPSE) index and Power Purchase Agreement (PPA) exhibited a similar trend, the z-scores of the three companies, starting with stability in 2018-2019, drastically declined from 2020 to 2022, particularly in the case of Everest Bank. This downtrend was occasioned by notable decreases in assets and credit within the banking industry, which revealed that the bank lacked sufficient digitization of its

linkage with the traditional financial systems. Also, there are increases in systemic risks, such as changes in the business and economic environment, interruptions of remittance flows and pandemic effects that influence the enhancement of systemic risks.

Kumara Bank has the highest level of Z-score volatility and has witnessed considerable deterioration in the last two years. These years were characterized by high fluctuations in asset prices and, at the same time, the abilities to cope with various negative factors were limited. The bank's relatively low pace of implementing FinTech solutions, digital risk management and digital payments also hampered its preparedness. However, Sanima Bank performed comparatively more balanced than its peer banks. However, macroeconomic shocks and a relatively poor strategy in digital transformation led to a deterioration of its Z-score in 2022. Sanima Bank had introduced some measures of digital banking, but their reach was comparatively small-scale; thus, it could not significantly affect the stability of financial systems.

4.1.3. Findings: Bangladesh

Bangladeshi banks, including BRAC Bank, City Bank, and Dhaka Bank, exhibited substantial fluctuations in their Z-score values, indicating varying levels of systemic risk and financial stability over the years. The financial system in Bangladesh initially showed stability from 2017 to 2019, with Z-scores increasing significantly in 2019 and 2020, reflecting improved financial resilience and risk management practices. However, a sharp decline in the Z-score in 2021 and an unprecedented drop in 2022 indicate increased financial vulnerabilities. The drastic fall in the Z-score from 949.09 in 2020 to just 9.40 in 2022 suggests that the banking sector faced severe financial instability, possibly due to macroeconomic shocks, regulatory changes, and challenges in FinTech integration.

While FinTech adoption (FT score) in Bangladesh showed a positive trend, increasing from 0.276 in 2017 to 0.606 in 2021, its significant decline to 0.1567 in 2022 suggests that the financial system struggled to sustain digital transformation efforts. The drop may be attributed to regulatory bottlenecks, cybersecurity concerns, or declining investor confidence in digital banking initiatives.

4.2. Systemic Risk Analysis

Credit and Asset Reduction as Proxies

Systemic risk, a critical measure of financial vulnerability, is assessed through two primary metrics: credit and asset reduction, two highly related techniques. Credit contraction is defined as the decline in the outstanding stock of loans, which signifies the ability of a bank to fund economic activities whenever there is a financial crisis. A severe contraction in the borrower credit implies enhanced systemic risk since the capacity of the institution to remain an intermediary weakens. In contrast, asset reduction measures the change in the bank's total assets toward its overall health and preparedness to face any shocks of the outside environment. As a whole, these proxies offer an integrated outlook on the Systemic

risks that threaten financial institutions.

Differences in credit and asset adjustments in Pakistani and Nepalese banks indicate sharp disparities in systemic risk. Analyzing the trends of Pakistani banks, these are much prudently positioned relative to global counterparts, with a moderate decline in both credit and assets. On the other hand, Nepali banks show similar movement but with much higher volatility, implying a much higher exposure to systemic shocks. These patterns are indicative of regulatory disparities, the state of development of financial systems and the depth of FinTech incorporation. Despite relatively low Credit Reduction (CR) and Asset Reduction (AR) values of Bangladesh, systemic risks became more evident in 2021 and 2022. The CR value remained relatively stable around 0.08, indicating that banks were still extending credit, albeit cautiously. However, asset reduction (AR) fluctuated, reflecting balance sheet contractions, with a notable increase in 2022 (0.010275), signaling increased financial distress and liquidity challenges.

4.3. Empirical Findings

The examination of the descriptive statistics provides the initial understanding of the financial performance of the analyzed banks. The variable Z which measures financial stability of different companies has average value of 2.10 and standard deviation of 0.55 which indicates moderate variation of financial stability in context of the selected banks. This makes some banks while having a minimum Z-score of 1.39 exposed to relatively higher level of systemic risk than others; while the maximum degree of stability is 3.47 which shows that while some banks have stronger degree of stability other have relatively weaker stability. In the same respect, a statistical mean of 10.24 and a statistical mean error of 0.73 for the Credit Reduction (CR) imply the stability of the credit offerings by the banks. However, Floor value of 7.25 represent few cases of credit crunch and on the other hand, roof value of 11.07 shows that few banks give high level of credit accessibility. Similarly the Asset Reduction (AR) metric, the average of which was 10.70 at a standard deviation of 0.65 reveals moderate variation in asset management. The lowest value 8.43 implies that some of the banks have eroded their asset base while the highest value 12.14 implies that the asset base is stronger.

Last, the FinTech (FT) index that indicates the extent of technologies employed has mean of 0.40 and standard deviation of 0.92. The lowest average fit having a value of 0.26 means that the majority of the institutions are only beginning to adopt FinTech while the highest average fit of 0.64 shows that some institutions have moderate level of FinTech adoption. This variability suggests that there is variation in use of technology by the banks which could in one way or the other impact on system risks and stability in banking. Collectively, they capture differences in income solvency, credit and property management and FinTech uptake that form the necessary ingredients used in assessing extant states of systemic risk and stability within the banking sector. The descriptive analysis results are summarized in **Table 1**.

Table 1. Descriptive analysis.

Variable	Obs	Mean	Std	Min	Max
Z	30	2.103358	0.549934	1.3888876	3.470913
CR	30	10.24369	0.727472	7.250257	11.07326
AR	30	10.70375	0.6468098	8.434569	12.14449
FT	30	0.398333	0.917299	0.26	0.64

4.4. Z-Score Trends over Time

This analysis of the peculiarities of Z-score movement within the interval of 2018-2022 helps to identify some aspects of the financial resilience of the banks during the stated period. In 2018 and 2019, the Z-score decreases only a little from $2.31\frac{1}{4}$ to $2.22\frac{1}{4}$, indicating a slight worsening of the financial sustainability status. This could also point out early warning signals of credit crunch or a condition of aggregate distress in the banking segment of the economy. The biggest change is observed in 2020 when the Z-score is equal to 1.85, which is the lowest figure of the year range. This steep decline matches credit risks as well as external environment pressures in financial institutions. These may have included factors such as disruptions that were occasioned by the COVID-19 pandemic, depreciation of the local currencies and higher systemic risk, as well as changes in credit portfolios risk management.

A similar increase is identified in 2021 when the Z-score returns to 2.30 and indicates a nearly similar level to the one recorded in 2018. This recovery means an enhancement of financial resilience which may be informed by measures to manage risks, implementation of FinTech solutions, as well as recovery processes establish to redress prior blow impacts. However, this stability is not long-lasting, as shown in Figure 1 (Z-score), it reduces sharply in 2022 to 1.84. Such a renewed decline may be suggestive of the onset of fresh financial constraints and systemic issues, including linkages to external macroeconomic problems and low capacity to respond to shocks.

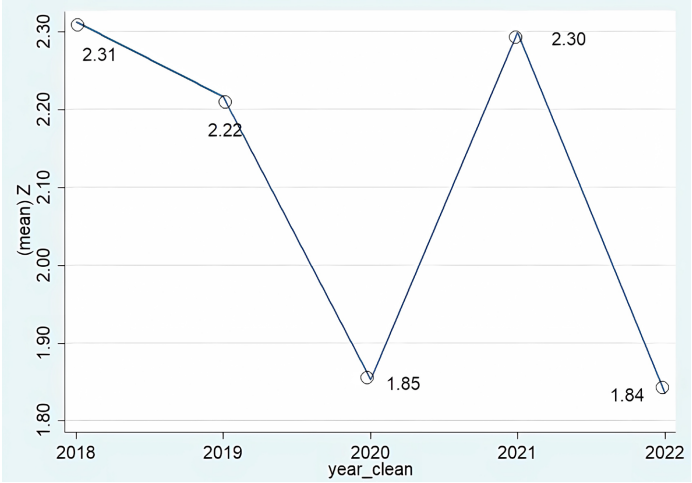

Figure 1. Z trends over time (Source: Self-Made).

4.5. Pakistan

NBP has been constantly cutting credit in Pakistan and the decrease was more significant in the year 2021. These trends are mainly to factors in macro-economic environment, including; currency devaluation, increase in inflation rates and the COVID-19 pandemic. Nonetheless, NBP remains underutilizing or neglecting it and digital banking tools and incorporating liberal risk management systems that might minimize the possible systematic hazards. For illustration, NBP's average CR value is 10.6681 and at the same time average AR value is 11.2606; therefore, even under economic tension, NBP does not risk its credits and assets considerably but simultaneously does not avoid making credits at all. Also, the mean FinTech (FT) scores of 0.41 means that the bank has integrated digital payment channels and credit scoring models for it to work in harsh conditions.

Soneri and Faysal Banks depict less fluctuation in the credit reduction than the asset reduction, showing their intention and concern in business with focus on portfolio & asset for acquiring. With the mean CR of 10.346 and AR of 10.758, Soneri Bank has applied some of the designated FinTech ideas to integrate different lending procedures and credit recovery. Its mean FT scores of 0.36 shows that it has fairly implemented the use of digital technology in its operations. Likewise, Faysal Bank has implemented blockchain under platforms for safe guarding, assets dealing as well as lowering operational risks. The overall mean of the CR is low at 10.815 while the mean AR is slightly higher at 11.0211 with the mean FT score stands at 0.33. However, both institutions in some instances encountered systemic risk that resulted from macro factors such as price per barrel of oil and political instabilities. These statistical findings support the argument of FinTech and strategic management to help to reduce financial risks and improve operating leverage in Pakistani banking systems. See Table 2 for the trend analysis of Pakistan Banks.

Table 2. Trend analysis f pakistan banks.

Bank	CR (Mean)	AR (Mean)	FT (Mean)
NBP	10.6681	11.2606	0.41
Faysal Bank	10.815	11.0211	0.33
Soneri Bank	10.346	10.758	0.36

4.6. Nepal

In the Nepalese context, Kumari Bank posted a significant credit and asset diminution in 2022; such structural flaws reveal that this particular bank has comparatively inadequate systems for mitigating credit risk within the organization. On an average the Credit Reduction (CR) of the bank is found to be 10.1288 and the Average Asset Reduction (AR) is 10.4452, which show the much severe problem of fluctuation. Further, its mean FinTech (FT) of 0.34 epitomizes its low levels of FinTech implementation of online credit facilities and credit check, among other

innovations essential in adapting to market dislocations that left it prone to systemic risks. Likewise, seasonal volatility was observed in the degree of systemic risk at the Everest Bank because of the weak structural construction and the heavy dependence on conventional banking strategies. Mean CR of the bank is 10.1678 and Mean AR of the bank is 10.4025. It proves that the management of asset and credit has many problems in the bank due to the fluctuations of the economy and the unavailability of effective financial instruments. Its mean FT score of 0.29 showed that the country's FinTech development is moderate and below the Asia-Pacific average, which exposes it to external shocks.

Similarly, Sanima Bank could also feel the systemic pressure despite slight outperformance because the process of digitalization in the bank has been relatively slower. Herein, the banks yield a CR of 10.1352, AR of 10.2359, while the FT score is comparatively higher, 0.48 implies the organizations have made reasonable progress in the adoption of digital banking solutions. But these endeavors were not adequate enough to completely insulate the country from macroeconomic fluctuations and to strengthen financial resilience. The current study underscores the need for Nepali banks to implement a more sophisticated set of FinTech attributes to improve their performance and reduce the level of systemic risk present in their operations. From the statistical evidence this implies that the banking sector in Nepal requires investments in ICT infrastructure and appropriate financial policies to enhance its vulnerability. See Table 3 for the trend analysis of Nepal banks.

Table 3. Trend analysis of Nepal banks.

Bank	CR (Mean)	AR (Mean)	FT (Mean)
Everest	10.1678	10.4025	0.29
Kumari	10.1288	10.4452	0.34
Sanima	10.1352	10.2359	0.48

4.7. Bangladesh

In the Bangladeshi banking context, BRAC Bank, City Bank, and Dhaka Bank have exhibited varying degrees of financial stability, credit reduction, asset management, and FinTech adoption. Over the analyzed period, the average Credit Reduction (CR) across these banks stood at 0.0818, while the Asset Reduction (AR) was recorded at 0.008872, indicating a relatively stable but cautious approach to credit disbursement and asset utilization. However, the adoption of FinTech (FT) solutions, with an average score of 0.4268, suggests that digital transformation in Bangladeshi banks is progressing but still faces certain limitations.

BRAC Bank has shown moderate resilience in financial stability, maintaining a balanced credit reduction strategy. However, the relatively low asset reduction value suggests a cautious approach toward asset management, possibly due to regulatory constraints and economic uncertainties. The FinTech adoption score of 0.4268 indicates that while BRAC Bank has incorporated digital banking solu-

tions, the extent of its FinTech integration is still evolving. The bank's digital infrastructure, including mobile banking and online credit assessment, has improved efficiency but remains an area for further enhancement.

City Bank follows a similar trend, with CR at 0.0818 and AR at 0.008872, demonstrating a stable financial position despite macroeconomic fluctuations. However, like BRAC Bank, its FinTech score suggests that digitalization efforts have yet to reach full-scale transformation. Although City Bank has embraced online banking and electronic payment solutions, the integration of advanced financial technologies such as blockchain and AI-driven credit risk assessments remains limited. The bank's ability to navigate systemic risks largely depends on the expansion of its FinTech capabilities and regulatory support for innovation.

Dhaka Bank also reflects a cautious financial approach, maintaining CR and AR values in line with its counterparts. However, its FinTech adoption score of 0.4268 suggests that the bank is making steady progress in incorporating digital banking solutions, though at a slower pace compared to other financial institutions in the region. While digital payment solutions and online credit facilities have been introduced, the bank still faces challenges in leveraging advanced FinTech tools to enhance financial inclusion and operational efficiency.

Overall, Bangladeshi banks demonstrate a moderate level of digital transformation, with FinTech adoption gradually increasing. However, challenges persist, particularly in the full-scale integration of AI-driven risk assessment, blockchain technology, and advanced credit management tools. The relatively low fluctuations in asset and credit reductions indicate that these banks have maintained stability, but their reliance on conventional banking strategies may limit their ability to mitigate systemic risks effectively. Future efforts should focus on enhancing FinTech capabilities, improving risk management strategies, and fostering a regulatory environment that supports digital financial innovation to ensure long-term financial stability and resilience in Bangladesh's banking sector. Table 4 represents the trend analysis of Bangladesh.

Table 4. Trend analysis of bangladesh banks.

Bank	CR (Mean)	AR (Mean)	FT (Mean)
BRAC Bank	0.0818	0.008872	0.4268
City Bank	0.0818	0.008872	0.4268
Dhaka Bank	0.0818	0.008872	0.4268

4.8. Implications

It is critical to understand how FinTech either reduces or increases systematic risk, given the different experiences of banks in two different economic environments: Pakistan and Nepal. In Pakistan, mobile payment solutions and e-banking solutions have brought about a revolution in credit recovery and general operations. All these technologies have made work more transparent, reduced work cycles and minimized risks that come with manual interference. For example, Faisal

Bank's blockchain technology has enhanced asset management and thus reduced the system's vulnerability.

However, FinTech also comes with new questions and problems. Using decentralization to operate different financial models and platforms like P2P lending systems has been an issue of worry due to data security, regulatory approval and efficiency. The lack of universally acceptable regulatory policies regulating these platforms has increased the systematic risks, especially in the Nepalese market. It explains how the absence of proper supervision in handling the risks brought by FinTech can lead to diminishing credit cuts, further strained by inadequate digital environments—all demonstrated through the case study of Kumara Bank.

This has reduced their capability of controlling systemic risks in Nepal due to the slow adaptation of FinTech solutions. The failure to develop structured banking models and the lack of efficient risk management instruments has made Nepali banks much more sensitive to fluctuations in their external environment. This highlights the importance of developing capacity-building programs and policies on FinTech adoption in the Nepalese banking sector. ICT investments in credit assessment through artificial intelligence, blockchain technology in secure transactions and mobile banking platforms could greatly help build resilience.

The systematic risk analysis depicts a high level of risk disparity in the stability of financial institutions between countries, Pakistan, Bangladesh and Nepal. Whereas the Pakistani banks have been able to adopt FinTech to avoid systemic risks, the Nepali banks continue to grapple with several problems due to low degrees of technological advancement and lack of proper regulations. These insights reposition FinTech as a stabilizing force and a possible source of risk, thus explaining why the regulatory strategies should be balanced. In this regard, emerging market banks can promote innovation and reduce structural risks for the development of sustainable finance. The Bangladeshi banking sector is at an intermediate stage of FinTech adoption, with moderate levels of digital banking, risk management, and blockchain integration. Banks such as BRAC Bank, City Bank, and Dhaka Bank have made considerable advancements in mobile banking and digital credit assessments, but they still lag in the full-scale implementation of AI-driven financial tools, blockchain-based security, and automated risk management systems.

Despite FinTech adoption contributing to financial inclusion and efficiency, systemic risks remain due to regulatory uncertainties, cybersecurity threats, and inconsistent digital transformation strategies. For instance, the average Credit Reduction (CR) of 0.0818 and Asset Reduction (AR) of 0.008872 indicate that Bangladeshi banks are maintaining stability but could face challenges if financial shocks arise. The FinTech (FT) adoption score of 0.4268, though higher than in some regional markets, still reflects a need for greater technological integration to enhance financial resilience.

One major concern for Bangladesh is the vulnerability of digital financial transactions to cyber threats. The absence of a robust regulatory framework for data security, fraud prevention, and risk mitigation could lead to increased exposure

to cybercrime and digital fraud, particularly in mobile banking and P2P lending platforms. Furthermore, FinTech innovation has outpaced regulatory oversight, creating challenges in compliance, consumer protection, and financial integrity.

4.9. Correlation

The self-generated correlation table provides insights into the interconnections between Z-score (financial stability), Credit Reduction (CR), Asset Reduction (AR), and FinTech adoption (FT). The correlation between Z-score and Credit Reduction is positive but weak at 0.036, indicating that changes in credit reduction have little to no significant impact on financial stability. However, the relationship between Z-score and Asset Reduction is negative and statistically significant (−0.429, $p = 0.023$), suggesting that higher asset reductions are associated with lower financial stability. This implies that banks experiencing greater asset reduction are more vulnerable to systemic risks.

The correlation between Z-score and FinTech adoption is positive (0.214) but not statistically significant, meaning that FinTech adoption may contribute to financial stability, but the impact is not strongly established in this dataset.

The relationships between Credit Reduction, Asset Reduction, and FinTech adoption are more distinct. Credit Reduction and Asset Reduction show a positive but weak correlation (0.049), indicating a minor association between the two variables. Meanwhile, the relationship between Credit Reduction and FinTech adoption is negative (−0.148), suggesting that increased FinTech adoption does not necessarily lead to reduced credit contraction. This could indicate that banks using more FinTech solutions are not significantly altering their credit strategies.

The highest correlation exists between Asset Reduction and FinTech adoption (−0.029), but the relationship is very weak and statistically insignificant, indicating that the implementation of FinTech solutions has not played a major role in mitigating asset reductions in this dataset.

Overall, the relatively weak correlations between financial stability and the other variables suggest that financial stability is influenced by multiple factors beyond credit reduction, asset downsizing, and FinTech adoption. While FinTech integration shows some positive association with financial stability, its role in systemic risk mitigation remains limited. The findings highlight the need for balanced digital transformation strategies, regulatory oversight, and risk management to enhance financial resilience. See Table 5 for the results of correlation analysis.

Table 5. Correlation analysis.

Variable	Z	CR	AR	FT
Z	1	0.036	−0.429*	−0.214
CR	0.036	1	0.049	−0.148
AR	−0.429*	0.049	1	−0.029
FT	0.214	−0.148	−0.029	1

4.10. Impact of FinTech Innovation

In this study, regression analysis was performed to analyze the effect of FinTech on financial stability and systemic risks within banks operating in Pakistan, Nepal, and Bangladesh. The results indicate that FinTech innovation has a mixed impact on financial stability, credit management, and systemic risks, depending on the financial environment and regulatory structure.

In the first regression model, where Z-score (financial stability) is the dependent variable, the coefficient of FinTech innovation (FT) is 826.869 with a standard error of 695.458, a t-value of 1.189, and a *p*-value of 0.246. This suggests a positive relationship between FinTech innovation and financial stability, though the result is statistically insignificant at the 5% level. The confidence interval ranges from -608.484 to 2262.223, indicating variability in the effect of FinTech adoption on financial stability. These findings align with previous literature, such as Arner et al. (2020), which suggests that internet-based financial solutions, including mobile banking, enhance operational efficiency and financial inclusion, particularly in developing economies.

For the second regression model, analyzing the relationship between Credit Reduction (CR) and FinTech adoption, the coefficient of CR is 2647.260 with a t-value of 0.489 and a *p*-value of 0.629. This suggests a weak but positive relationship between FinTech adoption and credit reduction, indicating that banks with higher FinTech adoption may experience some improvements in credit recovery, but the effect is not statistically significant.

In contrast, the third regression model, which examines Asset Reduction (AR) and FinTech innovation, presents a negative and significant relationship. The coefficient of AR is −46824.469 with a t-value of −2.389 and a *p*-value of 0.025, showing that higher FinTech adoption correlates with a significant decline in asset reduction. This suggests that banks integrating FinTech solutions may experience asset management challenges, possibly due to rapid digitalization, operational inefficiencies, or a lack of proper risk assessment mechanisms. The confidence interval for AR ranges from −87284.374 to −6364.564, reinforcing the statistical significance of the relationship.

Overall, these results indicate that while FinTech innovation plays a crucial role in enhancing financial stability and credit management, it may also introduce new vulnerabilities in asset management. The findings highlight the need for balanced regulatory frameworks to maximize FinTech benefits while minimizing systemic risks in emerging markets.

Nevertheless, the effects that FinTech innovation has on the risk of systemic risk continue to be doubtful. Whereas, the use of AI in tools and blockchain increases the risk analysis capacity, the combating of fraud, as well as the minimization of contractual infringe (Rajnish and Gomber, 2018), the decentralize platform that opens the emergent markets have up-surged more systemical risks. These difficulties are compounded by the fact that many rules governing the sharing of information are still quite vague and that many legal frameworks in this

area are still in development. This view supports Chuen et al. (2017) who point out that corporations are vulnerable to risks in emerging markets regarding the decentralised and ill-protected financial environments.

This paper compares the integration of FinTech and its impact on the level of systemic risk between countries—Pakistan, Bangladesh and Nepal. The banks of Pakistan demonstrate less magnitude of the above tests than the emerging markets due to increased stringency in the regulation and system integration. On the other hand, Nepali banks encounter a significant level of systematic risks than their counterpart due to a relatively low standard of regulation authority and digitalization. Moreover, Bangladeshi banks exhibit a moderate level of FinTech adoption, but regulatory gaps and slower digital transformation have limited their ability to fully leverage technological advancements, leading to persistent systemic risks. According to Demirgüç-Kunt et al. (2017), youth financial systems like Nepal also experience the main challenges that hinder efficient adoption of FirTech technologies. Thus, the results identified in the paper show that although there are benefits to be gained from FinTech that would lead to increased financial solidity, the sector also poses new threats in emerging markets. See Table 6 for the regression analysis.

Table 6. Regression analysis.

DV	IV	R-sq	Adj R-sq	F-stat	*P*-value (F)	Coeff (FT)	*P*-value (t)
Z	FT	0.215	−0.02	1.19	0.246	826.86	0.24
CR	FT	0.089	−0.02	0.49	0.629	2647.26	0.62
AR	FT	0.428	0.13	2.39	0.025	−46824.46	0.02

4.11. Policy and Practical Implications

4.11.1. Regulatory Recommendations

Implementing specific legislation for FinTech's to regulate innovation and manage the risks in new areas efficiently is becoming crucial. The structure of FinTech means that the operations of the platforms are international, which results in the emergence of severe compliance issues. To this, there is a need to ensure that the existing regulations focus on compatibility across countries. There is a need for regulatory harmonization for data protection, AML and consumer protection because the free movement of regulators creates uncertainty regarding the location of the next set of rules in the fast globalized financial environment.

Pakistan and Nepal should implement regulatory sandboxes, an environment designed to test new financial technologies. These sandboxes enable LeanTech firms to test innovations under the watchful eye of regulators, thus lowering the risk of system risks emergence while promoting innovation. Sandboxes promote regulator-entrepreneurial relations to reveal the weaknesses in FinTech solutions before their widespread use, which will strengthen financial systems. Bangladesh should strengthen its regulatory framework to support FinTech growth while mitigating systemic risks. Implementing a regulatory sandbox will allow financial in-

stitutions and startups to test innovations in a controlled environment, ensuring compliance with evolving digital finance regulations.

4.11.2. Institutional Strategies

One of the most important tasks for banks is integrating effective cyber security measures. The current type of financial services entails faster digitization, which exposes it to cyber risks; therefore, the firms require sophisticated solutions for protecting their data and customers' trust. Banks also have to obtain and expand their investment in several digital channels to develop versatility in the fluctuating market. For example, using blockchain for secure and efficient transactions and artificial intelligence for risk assessment and monitoring can significantly improve Organisational robustness.

Policymakers must be more engaged in ensuring that close working relations exist between regulators and FinTech developers. Therefore, governments must form partnerships with the private sector since regulation goals can be compatible with technological developments supporting long-term sustainable growth. Governments should also support research and development in areas that will determine potential risks and how they can be tackled.

4.11.3. Regional Insights

Due to a relatively developed financial industry and more substantial and developed regulations, there are fewer difficulties with integrating FinTech solutions in Pakistan. This proactive adoption of digital payments, blockchain and other AI-based instruments proves that the country can use FinTech to improve the financial sector's stability. Nevertheless, constant work is needed to maintain strong and reliable cyber security and adapt to the new changes in the regulation areas.

On the other hand, Nepal has several barriers to FinTech adoption, owing to relatively weak legal requirements and the availability of infrastructure. More efforts are required to train staff and create the institutional capacity to advance technical knowledge. Mobile banking platforms, as well as the use of AI, are the core of sustainable development investments. The policymakers of Nepal also have to consider the need for supporting institutions that will contribute towards adoption and innovation while ensuring the soundness of financial systems; therefore, policy interventions and strategic management can enable the use of FinTech in emerging markets for building resilience and inclusion, reducing systemic risks. Similarly, Bangladesh has made progress in digital financial inclusion through mobile banking and electronic payments, but regulatory bottlenecks and limited FinTech adoption in traditional banking remain challenges. Strengthening financial infrastructure and fostering collaboration between regulatory bodies and private firms will be crucial in driving sustainable FinTech development in the country.

5. Conclusion

One of the important topics for discussion is the correlation between systemic risk and financial stability and FinTech in emerging markets. This paper has argued

that while FinTech has a function of stabilizing the financial systems, it also poses a threat to the same systems. As a result of the application of Information Technology like blockchain, mobile payments and artificial intelligence, FinTech has positively impacted financial access, business performance and financial organizations in emerging markets, including Pakistan, Bangladesh and Nepal. However, these advantages are coupled with increased levels of systemic risk due to the interconnectedness of systems, increased use of algorithms and poor and disparate regulations.

The findings imply that while FinTech is a powerful tool that can improve financial stability by increasing credit access and optimizing resource allocation, it also creates risks. For instance, the growing use of decentralized platforms that did not get enough regulatory attention has increased vulnerabilities in cyber security and business continuity. This dilemma requires the creation of conditions that promote innovation but exclude destructive risks for the system.

In the context of Bangladesh, FinTech adoption has been progressing, particularly in mobile banking and digital payment solutions, which have significantly enhanced financial inclusion and transaction efficiency. Banks like BRAC Bank, City Bank, and Dhaka Bank have embraced FinTech innovations, but challenges remain in regulatory frameworks, cybersecurity measures, and full-scale integration of advanced technologies such as blockchain and AI-driven credit assessments. While digital banking has improved accessibility, the relatively slow pace of regulatory adaptation and inconsistent implementation of risk management strategies pose systemic risks. Strengthening regulatory oversight, expanding digital infrastructure, and fostering collaboration between financial institutions and technology providers will be crucial in ensuring that FinTech contributes to long-term financial stability and resilience in Bangladesh's banking sector.

This Pakistani context of a somewhat higher level of FinTech implementation, backed by a strong legal environment, has helped the banking system make efficient use of technology. Meezan Bank and Faisal Bank are good examples of how proper investment in credit assessment through artificial intelligence and the application of blockchain technology can lead to the soundness of institutions and a decrease in systemic risks. On the other hand, the Nepalese FI's have not evolved faster on the digital front and possess comparatively weaker regulatory structures to protect them. These problems of Kumara Bank and Sanima Bank suggest a need for capacity-building measures coupled with regulatory changes to minimize and mitigate rampant risks inherent in such systems and enhance the integration of FinTech.

This work also brings to light the various challenges, which include regulatory harmonization and international cooperation in addressing risks brought about by FinTech. The authors have concluded that emerging markets should implement regulatory sandboxes and use standardized models to address legal issues concerning innovations and cross-border regulation. They should pay attention to developing cyber security for financial systems, encouraging the creation of

public-private collaborations and investing in digital platforms.

The following empirical analysis shows that FinTech's impacts are not uni-dimensional but involve information transfer, risk management, resource mobilization and technical advancement. The above-highlighted dimensions hold great promise of enhancing and transforming financial systems, but the risks associated with them have to be addressed ahead of time. For example, mobile banking has increased financial inclusion, but data privacy issues and an absence of a proper cyber security environment can present serious risks in liberalized environments.

Thus, FinTech is a powerful phenomenon in emerging markets that opens the chances to fill the gaps in the financial systems and improve the stability of the economies. However, its related systemic risk has to be effectively managed through proper regulation, technology measures and appropriate institutional initiatives. The findings from this research would be useful for policymakers, other financial institutions and technology providers who seek to unlock the value of FinTech while achieving sustainable and inclusive financial growth.

To fill this gap, future research should consider the existing and emerging threats which arise from incorporating technologies such as AI and machine learning in FinTech. However, future research has to analyse the socio-economic consequences of FinTech-based systemic risks and their effects on various stakeholder categories. Thus, based on these studies, stakeholders may begin to foster sustainable positive change toward the right model of the financial ecosystem that fosters innovation without compromising stability to support the sustainable growth of emerging economies.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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