

EVALUATING THE FINANCIAL VIABILITY OF DECENTRALIZED FINANCE PLATFORMS: RISKS, RETURNS, AND REGULATORY GAPS

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DOI: <https://doi.org/10.5281/zenodo.18252572>

Keywords

Decentralized Finance (DeFi), Financial Viability, Risks, Returns, Regulatory Gaps, Pakistan Financial Firms.

Article History

Received: 03 November 2025

Accepted: 17 December 2025

Published: 31 December 2025

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Abstract

The rapid growth of Decentralized Finance (DeFi) has transformed the financial landscape globally, offering innovative investment opportunities while posing unique risks and regulatory challenges. This study evaluates the financial viability of DeFi platforms in the context of Pakistani financial firms, focusing on the effects of DeFi risks and DeFi returns, and examining the moderating role of regulatory gaps. Guided by the Risk-Return Trade-Off Theory, the research employs secondary data from 65 financial firms listed on the Pakistan Stock Exchange (PSX) over the period 2018–2023. Data were collected from annual reports, DeFi platform performance summaries, SBP and SECP circulars, and World Bank fintech reports.

Descriptive statistics revealed moderate to high-risk exposure, moderate returns, and notable regulatory gaps in Pakistan's DeFi ecosystem. Correlation and multicollinearity analyses confirmed the suitability of the dataset for regression analysis. The results indicate that DeFi risks significantly reduce financial viability, while DeFi returns positively influence it, affirming the expected direct effects. Moderation analysis shows that regulatory gaps exacerbate the negative impact of risks and weaken the positive effect of returns, emphasizing the critical role of regulatory oversight. Control variables revealed that firm size positively affects financial viability, whereas firm age is not significant.

This study contributes to theory by extending the Risk-Return Trade-Off Theory to the emerging domain of DeFi in a developing country context and highlights the interplay between risk, return, and regulation. Practically, the findings offer guidance to financial firms, regulators, and investors on risk management, investment strategies, and policy formulation to ensure sustainable engagement in DeFi platforms. Overall, the research underscores that balancing risks, returns, and regulatory frameworks is crucial for financial sustainability in Pakistan's decentralized finance ecosystem.

Introduction

Decentralized finance (DeFi) represents a rapidly evolving segment of the global financial ecosystem that leverages blockchain protocols and smart contracts to offer financial services, including lending, decentralized exchanges (DEXs), yield

farming, and tokenized collateral without traditional intermediaries. While DeFi promises greater financial inclusion, lower transaction costs, and programmable financial products, it also introduces novel operational, market, and governance risks that may threaten the

sustainability of individual protocols and the broader financial system (Nguyen, 2024). In Pakistan, the emergence of digital assets and blockchain-enabled services has created both an opportunity and a policy challenge: adoption among users and entrepreneurs has been energetic, yet the institutional and regulatory architecture needed to harness benefits while containing risks remains in flux.

Pakistan's public and private sectors report notable uptake of virtual assets. Country-level surveys and industry reports have placed Pakistan among higher-ranked adopters in the global crypto adoption indexes, with millions of households and freelancers engaging with cryptocurrencies for investment, remittances, and payments (Triple-A, 2022). At the same time, Pakistan's fintech ecosystem including mobile payments, instant payment rails, and a growing start-up community has laid digital infrastructure that could, in principle, support DeFi innovation and integration with traditional payment systems (Pakistan FinTech Report, 2021). The combination of a young, tech-savvy population, sizeable diaspora remittances, and increasing digital literacy makes Pakistan a potentially fertile environment for experimentation with DeFi services that could expand access to credit, savings, and cross-border transfers.

Despite these adoption indicators, Pakistan's regulatory stance toward virtual assets has been cautious and, at times, inconsistent. The central bank historically discouraged banks from facilitating crypto transactions, and successive advisories have highlighted concerns about money laundering, consumer protection, and macro-financial vulnerabilities (Dawn, 2025). More recently, however, policy signals have shifted: the State Bank of Pakistan (SBP) and the Finance Division have engaged with the Pakistan Crypto Council and other stakeholders to develop a legal and regulatory framework for virtual assets, and the central bank has announced intentions to pilot a central bank digital currency (CBDC) while exploring licensing and oversight approaches for the sector (State Bank of Pakistan, 2025; Reuters, 2025). These developments reflect a global policy dilemma of how to strike a balance between

enabling innovation in digital finance and maintaining financial stability and integrity, and they underscore the urgency of empirically assessing the viability of DeFi platforms before regulation is finalized.

From an investor and systemic perspective, DeFi protocols differ substantially from centralized exchanges and traditional financial intermediaries. Protocol-level metrics such as total value locked (TVL), collateralization ratios, liquidity depth, and governance token distribution influence returns and resilience, but so do factors unique to blockchain systems: the immutability (and potential vulnerabilities) of smart contracts, oracle dependency for off-chain price feeds, and composability that allows protocols to interconnect in complex ways. These technical characteristics can amplify both returns (through leveraged yield strategies and novel incentives) and risks (through cascading liquidations, flash-loan exploits, and governance attacks). In Pakistan's context, where regulatory oversight is still being designed, the interplay between protocol design, market behaviour, and policy gaps may determine whether DeFi can provide sustainable financial services or whether it will produce recurrent losses and reputational setbacks that deter institutional participation.

Empirically evaluating financial viability in Pakistan, therefore, requires attention to three linked dimensions. First, the risk profile: cataloguing the operational, market, and security incidents that have affected protocols, and measuring how such incidents translate into TVL outflows, user attrition, or token price collapses. Second, the return dynamics: quantifying yield levels, token appreciation, and fee income that attract liquidity, and assessing their sustainability after adjusting for risk. Third, the regulatory environment: mapping existing regulatory gaps, including ambiguous legal status, enforcement capacity, taxation treatment, cross-border coordination, and testing how these gaps moderate the relationship between risks, returns, and long-run viability. Pakistan's ongoing policy deliberations, public advisories, and pilot projects create a timely backdrop for such an inquiry, since the findings can inform both regulators designing

the framework and entrepreneurs building sustainable protocols (State Bank of Pakistan, 2025; Reuters, 2025).

Finally, the study is motivated by practical policy needs in Pakistan. Given the country's reliance on remittances, the fiscal pressures that encourage formalization of digital transactions, and the government's interest in leveraging surplus energy for mining and digital infrastructure projects, policymakers require robust evidence about whether DeFi platforms can deliver net economic benefits without introducing unacceptable levels of financial instability (Reuters, 2025). Assessing financial viability through rigorous analysis of risk–return characteristics and the moderating role of regulatory gaps will provide actionable insights for regulators, investors, and platform designers in Pakistan as they navigate the trade-offs between innovation and protection.

Decentralized Finance (DeFi) has emerged as one of the most disruptive innovations within the global financial ecosystem, enabling users to lend, borrow, trade, and earn yields without the intermediation of banks or financial institutions. Built primarily on blockchain technology, DeFi protocols operate through smart contracts that automate financial transactions transparently and efficiently (Schär, 2021). Despite its potential to democratize finance, DeFi faces growing skepticism regarding its financial viability due to high volatility, cybersecurity risks, limited governance structures, and significant regulatory uncertainty (Aramonte, Huang, & Schrimpf, 2022). These challenges have raised concerns about the sustainability and long-term profitability of DeFi platforms, particularly in emerging markets like Pakistan, where institutional frameworks for digital finance remain underdeveloped.

Globally, the DeFi ecosystem has witnessed rapid expansion, with total value locked (TVL) exceeding hundreds of billions of dollars at its peak in 2021. However, the sector has also suffered repeated crises, such as the Terra-LUNA collapse in 2022 and numerous protocol hacks and rug pulls, resulting in substantial financial losses for investors (CoinGecko, 2023). These events reveal the structural fragility of

decentralized systems, where a single coding flaw or oracle manipulation can trigger liquidity crises across interconnected platforms (Gudgeon et al., 2021). Moreover, speculative trading and unsustainable tokenomics often drive short-term profits rather than long-term viability (Chen, Li, & Luo, 2023). Consequently, understanding how risk and return dynamics shape DeFi's financial viability has become a pressing research and policy concern.

In the Pakistani context, the issue is particularly relevant. Pakistan has one of the fastest-growing crypto user bases globally, ranking among the top countries in cryptocurrency adoption (Chainalysis, 2022). The proliferation of digital financial tools and a young, tech-oriented population make DeFi a potentially transformative avenue for financial inclusion. Yet, the absence of a clear regulatory framework and institutional oversight exposes Pakistani users to significant market and operational risks. The State Bank of Pakistan (SBP) has repeatedly warned against trading in cryptocurrencies, citing risks related to volatility, fraud, and illicit financial flows (State Bank of Pakistan, 2023). However, enforcement remains inconsistent, and the country has yet to establish comprehensive legislation to govern DeFi operations or investor protection mechanisms. This regulatory vacuum creates uncertainty, discouraging legitimate innovation while enabling unregulated entities to operate without accountability (Dawn, 2025).

Moreover, risks and returns in DeFi are interdependent and context sensitive. While DeFi platforms often promise high yields through staking and liquidity mining, these returns are frequently accompanied by excessive exposure to price fluctuations, algorithmic failures, and governance vulnerabilities (Nguyen, 2024). For example, high-yield strategies may rely on unsustainable incentive mechanisms or leverage, exposing participants to cascading losses during market downturns (Jensen & Meyer, 2022). In Pakistan, where financial literacy and technological understanding of blockchain systems remain limited, users are more susceptible to misinformation, fraud, and investment mismanagement. The volatility of DeFi returns

and limited awareness of underlying risks pose severe threats to user confidence and market stability.

The regulatory gap further amplifies these vulnerabilities. Without clear guidelines, DeFi platforms in Pakistan operate in a legal grey zone, undermining investor protection and limiting access to institutional capital. Regulatory uncertainty not only increases the perceived risk of participation but also restricts the entry of credible fintech players who could enhance transparency and trust (Financial Stability Board, 2023). Additionally, the absence of a robust monitoring system means that policymakers lack empirical data to evaluate the sector's real economic contribution and systemic risks. As a result, the country risks falling behind global trends in digital financial innovation while exposing users to unmitigated risks.

Given these issues, the central research problem is the lack of empirical evaluation of the financial viability of DeFi platforms operating under uncertain regulatory environments, particularly in Pakistan. Existing studies primarily focus on DeFi adoption and blockchain innovation but neglect the interplay between risks, returns, and regulatory gaps in determining sustainability. There is an urgent need to investigate how operational and market risks affect the profitability of DeFi platforms, how return structures influence investor confidence, and how regulatory shortcomings moderate these relationships. Such analysis is essential for identifying whether DeFi can evolve into a viable component of Pakistan's digital financial system or whether it will remain a speculative, high-risk market segment.

Therefore, this study seeks to evaluate the financial viability of DeFi platforms by empirically examining the relationships among DeFi risks, DeFi returns, and regulatory gaps, controlling for the age and size of platforms. The findings will provide critical insights for policymakers, regulators, and investors, enabling them to design evidence-based strategies for fostering innovation while mitigating systemic risks in Pakistan's emerging DeFi ecosystem.

Research Questions

The research questions of this re given below.

1. Do risks and returns of decentralized finance (DeFi) platforms affect their financial viability?
2. Do regulatory gaps influence the relationship between DeFi risks and the financial viability of DeFi platforms?
3. Do regulatory gaps influence the relationship between DeFi returns and the financial viability of DeFi platforms?

The growing prominence of Decentralized Finance (DeFi) has opened new avenues for financial innovation, inclusion, and efficiency. However, its rapid expansion has also raised serious questions regarding its financial viability, regulatory oversight, and risk management, particularly in emerging markets such as Pakistan. This study holds significant academic, practical, and policy-oriented value by addressing these crucial dimensions.

From an academic perspective, this study contributes to the limited body of empirical literature exploring the intersection of DeFi risks, returns, and regulatory gaps in determining the financial viability of DeFi platforms. While international studies (e.g., Schär, 2021; Aramonte et al., 2022) have analyzed the global implications of DeFi adoption, very few have examined these factors within the socio-economic and regulatory context of Pakistan, where the crypto and blockchain ecosystem is still in its infancy. By applying Baron and Kenny's (1986) moderation framework, this research introduces a novel analytical lens to understand how regulatory gaps influence the strength and direction of the relationship between risk-return dynamics and financial viability. This theoretical advancement enhances understanding of DeFi's sustainability not only as a technological innovation but also as a viable financial model under varying levels of regulatory support and institutional maturity.

From a practical standpoint, this research is valuable for investors, fintech entrepreneurs, and DeFi platform developers. Understanding how different types of risks, such as liquidity, smart contract, governance, and market risks, affect

financial viability will enable these stakeholders to design better risk mitigation mechanisms. Similarly, insights into return dynamics will help developers design more transparent and sustainable yield models, improving investor confidence and long-term platform credibility. Since DeFi platforms often operate in a trust-deficient environment, empirical evidence on what drives financial viability can encourage adoption and responsible innovation.

For regulators and policymakers, the study offers critical guidance on addressing the regulatory gaps that currently hinder the sustainable growth of the DeFi sector in Pakistan. The State Bank of Pakistan (SBP) and the Securities and Exchange Commission of Pakistan (SECP) have yet to establish comprehensive regulations governing crypto assets or decentralized applications. The findings of this study will help policymakers understand how regulatory clarity or the lack thereof can either strengthen or weaken the financial viability of emerging DeFi platforms. Evidence-based insights can support the development of a balanced regulatory framework that fosters innovation while safeguarding investors and maintaining financial stability.

The study also carries social and economic significance. DeFi has the potential to promote financial inclusion by providing low-cost, borderless financial services to unbanked and underbanked populations a group that remains substantial in Pakistan. However, without regulatory safeguards and risk awareness, these very groups could face increased exposure to fraud, volatility, and systemic instability. This research, therefore, provides evidence to guide responsible adoption and public awareness initiatives, ensuring that innovation benefits are realized without exacerbating financial vulnerabilities.

Finally, in the context of Pakistan's Vision 2030 and the Sustainable Development Goals (SDGs), particularly SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure), this study aligns with national and global priorities to promote sustainable financial innovation. By assessing whether DeFi can evolve into a financially viable and secure alternative to traditional finance, this research provides a

roadmap for integrating blockchain-based solutions into Pakistan's broader digital finance strategy.

The scope of this study focuses on evaluating the financial viability of decentralized finance (DeFi) platforms by analyzing the influence of risks and returns as independent variables and examining the moderating role of regulatory gaps in the context of Pakistan's emerging digital finance ecosystem. The study specifically targets DeFi platforms that offer services such as lending, borrowing, staking, trading, and yield farming based on blockchain technology. By assessing these key elements, the study aims to determine whether DeFi can be a sustainable and profitable financial model within a developing market characterized by limited regulatory oversight and evolving technological infrastructure.

The geographical scope of this study is limited to Pakistan, where DeFi and cryptocurrency adoption have grown rapidly despite a lack of formal legal recognition. This context provides a unique setting to explore how decentralized financial systems function in a regulatory grey area. The study focuses on DeFi users, developers, and investors who are either directly involved in or have substantial knowledge of blockchain-based financial operations. By doing so, the study ensures that the data collected reflects both the practical realities of DeFi participation and the perceptions of those navigating Pakistan's unregulated digital finance landscape.

The conceptual scope of this study centers on three key constructs: DeFi risks, DeFi returns, and financial viability, with regulatory gaps serving as a moderating factor. DeFi risks include technological, liquidity, market, and governance-related uncertainties, while DeFi returns refer to the profitability and performance outcomes derived from decentralized financial activities. Financial viability is assessed in terms of the sustainability, profitability, and long-term operational feasibility of DeFi platforms. The moderating role of regulatory gaps explores how the absence or inadequacy of regulations affects the strength and direction of the relationship between risks, returns, and financial viability. Additionally, control variables such as the age and

size of the platforms are included to account for organizational differences that may influence financial outcomes.

Lastly, the temporal and methodological scope of the study is cross-sectional in nature, focusing on the present dynamics of Pakistan's DeFi sector rather than longitudinal changes. Data will be collected through structured questionnaires and possibly supported by secondary sources such as reports, policy documents, and financial analyses. The study does not aim to cover all aspects of blockchain or cryptocurrency technology; instead, it concentrates on the financial and regulatory dimensions of DeFi. The findings will therefore be applicable primarily to Pakistan and similar emerging economies where regulatory structures for digital finance are still evolving. This defined scope allows for a focused, in-depth analysis of how DeFi platforms can achieve financial viability amid risks and regulatory uncertainties.

Literature Review

The theoretical foundation of this study is grounded in the Risk-Return Tradeoff Theory, which serves as the central framework for understanding the relationship between risks, returns, and financial viability in Decentralized Finance (DeFi) platforms. The theory posits that higher levels of risk are associated with the potential for higher returns, while lower risks generally correspond to lower expected returns (Markowitz, 1952; Sharpe, 1964). In the context of DeFi, this theory provides a critical lens through which to analyze how investors and platform developers make financial decisions under conditions of uncertainty and minimal regulation. As DeFi systems rely heavily on blockchain and smart contracts rather than traditional intermediaries, they expose participants to new forms of risk technological, market, and operational that traditional financial theories must adapt to explain (Demir, Bilgin, & Gozgor, 2021). Therefore, applying the risk-return tradeoff framework allows this study to evaluate whether the returns generated by DeFi platforms sufficiently compensate for the risks undertaken, thus influencing their financial viability.

According to Markowitz (1952), investors are rational decision-makers who aim to maximize returns while minimizing risks, typically assessed through portfolio diversification. However, DeFi introduces a paradigm shift by decentralizing control and automating transactions via smart contracts (Schär, 2021). This new financial environment lacks centralized oversight, meaning that participants directly bear the consequences of their decisions. The Risk-Return Tradeoff Theory suggests that rational DeFi investors will participate only if the expected returns justify the risks arising from volatility, liquidity constraints, or protocol vulnerabilities (Liu & Tsyvinski, 2021). In this sense, DeFi's sustainability depends on the equilibrium between risk exposure and reward mechanisms. High returns often advertised through staking, yield farming, or liquidity pools may attract investors in the short term, but excessive risk exposure without adequate compensation can undermine platform trust and lead to financial instability (Jensen & Meyer, 2022).

Furthermore, the Risk-Return Tradeoff Theory can be extended to understand how regulatory gaps moderate this relationship. In traditional finance, regulatory institutions act as safeguards that ensure transparency, enforce compliance, and mitigate systemic risks (Arner, Barberis, & Buckley, 2017). However, DeFi platforms often operate in unregulated or under-regulated environments, especially in developing countries like Pakistan (State Bank of Pakistan, 2023; Financial Stability Board, 2023). The absence of clear legal frameworks increases both perceived and actual risks, altering the balance of the risk-return tradeoff (Zetzsche, Buckley, & Arner, 2020). For instance, investors in Pakistan face not only price volatility and smart contract risks but also legal uncertainties regarding the legitimacy of DeFi activities (Dawn, 2025). These regulatory gaps may magnify risk perceptions and reduce investor confidence, even when potential returns appear attractive. Consequently, regulatory deficiencies can weaken the financial viability of DeFi platforms by deterring both retail and institutional participation.

In the context of this study, the Risk-Return Tradeoff Theory provides a logical foundation for evaluating how risks and returns influence the financial viability of DeFi platforms, while the moderating role of regulatory gaps reflects institutional constraints that modify this relationship. When regulations are weak or ambiguous, the expected risk-return equilibrium becomes distorted, potentially leading to either excessive speculation or capital flight (Auer, Frost, Gambacorta, & Shin, 2023). Conversely, effective regulation may reduce uncertainty and enhance market stability, thereby supporting long-term sustainability (Aramonte, Huang, & Schrimpf, 2022). Therefore, this theoretical lens underscores that the financial viability of DeFi platforms is not determined solely by internal mechanisms of risk and reward but also by the external regulatory environment in which they operate.

In the Pakistani context where blockchain adoption is rising but regulatory oversight remains nascent this theory helps explain the complex interplay between investor behavior, institutional gaps, and the economic sustainability of decentralized finance ecosystems.

Decentralized Finance (DeFi) denotes a set of blockchain-based protocols and applications that deliver financial services lending, borrowing, trading, staking, and payments without traditional centralized intermediaries (Schär, 2021). DeFi's architecture relies on smart contracts, composable protocols, and public ledgers which enable permissionless access, programmability, and auditability of transactions (Turillazzi, 2023; Kumar, 2025).

Since the mid-2010s, DeFi activity has expanded rapidly: metrics such as Total Value Locked (TVL), number of protocols, and on-chain transaction volumes surged during 2020–2021, driven by innovations in automated market makers (AMMs), lending platforms, and yield-generation strategies (Schär, 2021; DeFi research summaries). The open, composable nature of DeFi creates powerful network effects protocols can be stacked and re-used across applications—yet that same composability produces complex interdependencies among protocols, amplifying both upside (innovation, liquidity aggregation)

and downside (contagion, cascading failures) (Auer et al., 2023; Kumar, 2025).

Although DeFi promises greater financial inclusion and reduced intermediation costs, scholars emphasize that DeFi represents a structural departure from incumbent finance: trust is algorithmic rather than institutional, and risk is borne directly by users interacting with code and market mechanisms (Schär, 2021; Liu & Tsyvinski, 2021). Empirical research has therefore focused both on characterizing DeFi's economic primitives (AMMs, automated liquidation engines, governance tokens) and on measuring how protocol design choices affect performance, liquidity, and user adoption (Chu, 2023; Augustin et al., 2023). These developments set the stage for evaluating whether DeFi platforms can be financially viable over the long term i.e., whether returns sufficiently compensate users for taking on novel, often non-traditional risks.

The literature identifies a range of risks that uniquely characterize DeFi ecosystems. Primary among these are smart-contract vulnerabilities, where coding errors or logic flaws can be exploited to drain protocol funds (Kaur et al., 2023; Turillazzi, 2023). Empirical incident databases and academic analyses show thousands of security incidents, with some single exploits causing losses in the hundreds of millions (Kaur et al., 2023; Gudgeon et al., 2021). Oracle risk the dependence on off-chain price oracles introduces avenues for manipulation that can trigger erroneous liquidations and systemic losses (Gudgeon et al., 2021; Briola et al., 2023). Liquidity and market risk are also central: protocols relying on algorithmic stablecoins, highly concentrated liquidity pools, or leveraged positions can experience rapid TVL outflows under stress, producing contagion across composable protocols (Badev et al., 2023; Briola et al., 2023).

Governance and operational risks such as concentration of governance tokens, multisig control by a few actors, and immature upgrade processes further increase vulnerability to capture, mismanagement, or governance attacks (Aramonte et al., 2022; Turillazzi, 2023). Scholars and policy institutions highlight how these technology-driven risks can propagate to broader

financial systems when exposures grow or when large stablecoins and bridges link DeFi to off-chain markets (FSB, 2023; BIS FSI summaries). Methods to measure and mitigate these risks (formal verification, audits, insurance markets, oracles with decentralization) are active research areas but remain unevenly applied across protocols (Kaur et al., 2023).

DeFi's return generation mechanisms differ from traditional finance and include yield farming, liquidity-provider (LP) fees, staking rewards, and governance-token appreciation. Yield farming allocating assets to liquidity pools in exchange for token rewards sparked much of the early TVL growth by offering attractive nominal yields (Augustin et al., 2023; Li et al., 2023). Empirical analyses show that DeFi token returns are strongly tied to on-chain activity and trading volumes, and that returns often display high volatility and episodic spikes associated with new incentive programs (Chu, 2023; Liu & Tsyvinski, 2021). The sustainability of these returns is questioned in the literature: many high yields are financed by native token emissions (inflation), which can be dilutionary and unsustainable once incentives taper (Jensen & Meyer, 2022; Augustin et al., 2023).

Researchers therefore emphasize using risk-adjusted metrics when evaluating DeFi profitability (Liu & Tsyvinski, 2021). Studies that model yield farming economics illustrate trade-offs between attracting liquidity and creating long-run value protocols that rely on continuous token subsidies may attract short-term capital while failing to build resilient fee-based revenue streams (Li et al., 2023; Augustin et al., 2023). Moreover, episodes like Terra-Luna's collapse and subsequent contagion demonstrated how apparent returns can evaporate rapidly, producing severe investor losses and systemic shocks across DeFi (Briola et al., 2023; Badev et al., 2023).

The fragmented and evolving regulatory landscape is a dominant theme in the literature. International organizations FSB and BIS have warned that DeFi creates novel financial stability and consumer-protection challenges and have urged cross-jurisdictional coordination and data sharing to close regulatory gaps (FSB, 2023; BIS

FSI, 2023). At the jurisdictional level, policy responses vary markedly: the European Union implemented Markets in Crypto-Assets (MiCA) to regulate certain crypto services and stablecoins (ESMA/MiCA), while other jurisdictions have taken restrictive or piecemeal approaches (ESMA, 2023; MiCA documentation). Recent G20/FSB assessments continue to highlight significant gaps and the risk of regulatory arbitrage (Reuters/FT reports, 2025).

In Pakistan, regulatory signals have been cautious and evolving. The State Bank of Pakistan issued advisories warning on crypto activity but has increasingly engaged with industry stakeholders and indicated exploratory steps such as collaboration with the Pakistan Crypto Council and consideration of pilot projects suggesting a move from outright prohibition toward regulated engagement (State Bank of Pakistan press releases, 2025). However, the lack of a comprehensive legal framework for DeFi means investors and platforms operate in legal uncertainty, which can amplify risk perceptions and inhibit institutional participation (Dawn; local reporting; SBP materials). The literature underscores that regulatory clarity, proportionate oversight, and international cooperation are critical to aligning DeFi innovation with financial stability and consumer protection objectives (FSB, 2023; Arner et al., 2017; Zetzsche et al., 2020).

Hypothesis Development

The hypotheses of this study are derived from the research objectives and grounded in the Risk-Return Trade-Off Theory (Markowitz, 1952), which posits that investors make rational decisions based on the balance between potential risk and expected return. In the context of Decentralized Finance (DeFi), this theory provides a useful lens to understand how users and platform developers evaluate financial viability amid uncertainties and market volatility. The theory suggests that higher risk can potentially lead to higher returns, but this relationship is influenced by contextual factors such as regulatory environments. Based on this theoretical foundation, the following hypotheses are developed.

Relationship between DeFi Risks, Returns, and Financial Viability

The Risk Return Trade-Off Theory establishes that financial decision-making is guided by the interplay between the potential rewards and inherent risks of an investment (Markowitz, 1952; Sharpe, 1964). In DeFi systems, participants face diverse risks, including smart contract vulnerabilities, liquidity shortages, and extreme price fluctuations (Chen & Bellavitis, 2020; Schär, 2021). These risks directly influence the sustainability and profitability key aspects of financial viability of DeFi platforms. Empirical studies also suggest that platforms with effective risk mitigation strategies tend to maintain higher financial stability and investor confidence (Gudgeon et al., 2020; Zhang et al., 2022). Conversely, excessive risk exposure without proper safeguards can erode platform trust and reduce viability (Auer et al., 2022). Therefore, it is hypothesized that:

H1: Risks and returns of decentralized finance platforms significantly affect their financial viability.

Moderating Role of Regulatory Gaps

The regulatory environment surrounding DeFi remains underdeveloped in many emerging

economies, including Pakistan. Regulatory gaps defined as the absence of clear legal and compliance frameworks can intensify both risks and uncertainties in decentralized systems (Zetsche, Arner, & Buckley, 2020). The Risk-Return Trade-Off Theory implies that regulatory oversight helps stabilize risk-return dynamics by reducing uncertainty and protecting investor confidence (Sharpe, 1964; Gudgeon et al., 2020). When regulatory gaps exist, they can amplify the adverse impact of DeFi risks on financial viability and weaken the positive effects of returns by creating market volatility and trust deficits (Chen & Bellavitis, 2020; Arner et al., 2020). In Pakistan's case, the State Bank's restrictions on cryptocurrency trading and absence of DeFi-specific laws contribute to an unpredictable environment (SBP, 2022). Therefore, it is hypothesized that:

H2: Regulatory gaps moderate the relationship between DeFi risks and the financial viability of DeFi platforms.

H3: Regulatory gaps moderate the relationship between DeFi returns and the financial viability of DeFi platforms.

Conceptual Framework

The conceptual framework of this study is given below in figure 1.

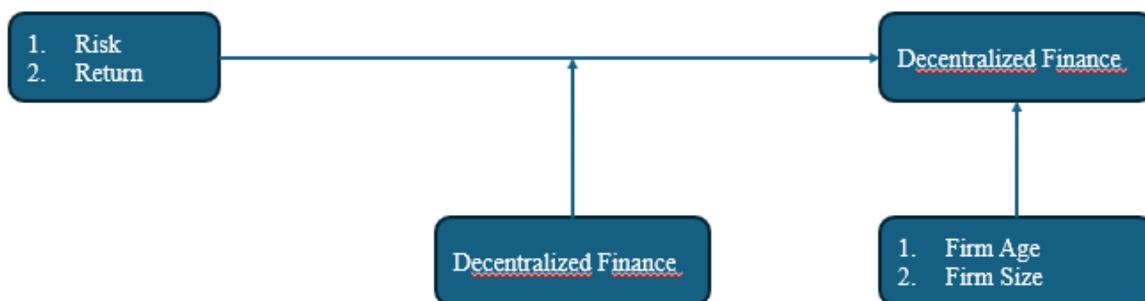


Figure 1

Summary

This chapter provided an in-depth review of literature related to decentralized finance (DeFi), emphasizing the interconnected roles of risks, returns, and regulatory frameworks in

determining financial viability. Grounded in the Risk-Return Trade-Off Theory (Markowitz, 1952), the chapter established a theoretical foundation explaining how investors and platforms balance potential gains against inherent

risks within decentralized systems. The review highlighted key dimensions of DeFi, including its technological underpinnings, operational mechanisms, and emerging challenges, particularly within the Pakistani context where regulatory uncertainty remains prevalent. Empirical evidence from prior studies indicated that while DeFi offers attractive financial returns through innovations such as yield farming and smart contracts, it is simultaneously exposed to liquidity, market, and governance risks that threaten its long-term sustainability. The chapter further underscored the moderating influence of regulatory gaps, noting that weak or absent oversight can amplify risks and weaken financial stability. Based on the theoretical and empirical insights, five hypotheses were developed to test the direct and moderating effects of risks, returns, and regulation on financial viability. This synthesis establishes the conceptual groundwork for the next chapter, which will focus on research methodology and empirical testing of these proposed relationships.

Research Methodology

This chapter presents the research methodology adopted to examine the relationship between risks, returns, and financial viability of decentralized finance (DeFi) platforms, along with the moderating role of regulatory gaps. It outlines the research design, population, data sources, sampling techniques, variables and their operational definitions, model specification, data analysis techniques, and ethical considerations. Since this study is based on secondary data, particular emphasis is placed on the sources and collection procedures of secondary information relevant to DeFi and financial performance indicators of Pakistani non-financial firms. The methodological design ensures that the research objectives are met through rigorous, replicable, and transparent analytical procedures.

Research Design

This study employs a quantitative, explanatory research design using secondary data analysis. The quantitative approach allows for statistical testing of relationships between DeFi risks, DeFi returns,

and financial viability, while the explanatory nature enables investigation into cause-and-effect relationships. The use of secondary data is justified by the availability of comprehensive financial information on Pakistani firms and DeFi-related indicators through published reports, databases, and official repositories.

The study adopts a positivist research paradigm, emphasizing objectivity, quantifiable evidence, and hypothesis testing (Creswell & Creswell, 2018). The research model is grounded in the Risk-Return Trade-Off Theory (Markowitz, 1952), which postulates that higher risks are associated with higher potential returns, and the balance between the two determines financial performance and sustainability. This theoretical lens guides the empirical testing of the study's hypotheses.

Population of the Study

The population of this study consists of all financial firms, including banks and non-bank financial institutions, listed on the Pakistan Stock Exchange (PSX). Financial firms are selected because they are the primary actors in adopting and experimenting with decentralized finance (DeFi) solutions, including blockchain-based payments, lending, and investment platforms.

As of 2024, approximately 65 financial firms are listed on the PSX, covering commercial banks, microfinance banks, investment banks, leasing companies, and insurance firms (PSX, 2024). The study draws on these firms' financial and operational data to examine how DeFi-related risks, returns, and regulatory factors influence financial viability in the context of Pakistan's evolving financial ecosystem.

Sampling and Data Collection

A purposive sampling technique is employed to select financial firms with available and complete financial data over the specified study period. Firms are selected based on the following criteria:

1. The firm must be a financial entity (bank or financial institution) listed on the PSX.
2. Financial statements must be publicly available for the period 2018–2023.

3. The firm must have engaged in or reported digital finance, blockchain, or fintech-related initiatives, either directly or indirectly.

Secondary data are collected from multiple credible sources, including:

- Annual reports of PSX-listed financial firms.
 - State Bank of Pakistan (SBP) reports and circulars on digital finance adoption and fintech regulation.
 - World Bank reports on financial technology, fintech risk, and regulatory indicators.
- Using this approach, the study compiles data from 45 PSX-listed financial firms, ensuring comprehensive coverage of Pakistan's regulated financial sector. This dataset provides sufficient information to analyze the impact of DeFi risks and returns on financial viability, while considering regulatory gaps as a moderating factor.

DeFi Risks (Independent Variable)

DeFi risks represent the uncertainty and potential losses associated with decentralized finance platforms, including smart contract vulnerabilities, liquidity risk, and market volatility. These will be measured using composite risk indices derived from:

1. **DeFi Pulse Risk Index:** quantifies protocol-level risks based on TVL (Total Value Locked), protocol age, past exploits, and volatility.
2. **World Bank Fintech Risk Reports:** measures country-level and sector-level exposure to technological and financial risks in digital finance.
3. **Volatility Measures:** historical price volatility and yield fluctuations of DeFi tokens and platforms.

Continuous numerical scores standardized on a 0–100 scale, where higher scores indicate higher risk exposure.

DeFi Returns (Independent Variable)

DeFi returns indicate the profitability generated by DeFi activities such as yield farming, staking, lending, or trading. Returns will be captured from:

1. **DeFi Platform Performance Summaries:** including average annualized yields (%) reported by top-performing DeFi protocols.

2. **Financial Returns of PSX-listed Firms:** where firms have invested in blockchain or DeFi-related initiatives, their ROA, ROE, and revenue from digital finance operations will be extracted. Continuous numeric variables expressed as percentage returns (%), with higher values representing greater profitability.

Financial Viability (Dependent Variable)

Financial viability reflects a firm's ability to maintain sustainable operations and profitability. This will be operationalized using accounting and financial indicators:

1. **Profitability Ratios:** Return on Assets (ROA), Return on Equity (ROE), and net profit margin.
2. **Liquidity & Solvency Ratios:** Current ratio, debt-to-equity ratio, and cash flow adequacy.
3. **Market Performance Indicators:** market capitalization and revenue growth where applicable.

Continuous numeric variables; ratios expressed in percentages or proportion values, with higher values indicating stronger financial viability.

Regulatory Gaps (Moderating Variable)

Regulatory gaps assess the degree of inadequacy or absence of DeFi-related legal and compliance frameworks. This will be quantified using:

1. **Content Analysis of SECP & SBP Reports:** presence or absence of guidelines, clarity of enforcement mechanisms, and coverage of digital finance activities.
2. **World Bank Regulatory Indicators:** measures of financial regulatory quality, legal infrastructure, and fintech governance.

Ordinal or continuous scale ranging from 0 (no regulatory coverage) to 5 (comprehensive regulation), where higher values indicate greater gaps in regulation.

Control Variables

1. **Firm Age:** measured as the number of years since incorporation, extracted from annual reports and PSX records.
2. **Firm Size:** measured through total assets and market capitalization reported in annual reports and PSX database.

3.

Model Specification

Based on the theoretical framework and hypotheses, the following econometric models are proposed:

$$FV_{it} = \alpha_0 + \alpha_1(Risk_{it}) + \alpha_2(Ret_{it}) + \alpha_3(Fage_{it}) + \alpha_4(Fsize_{it}) + \dots \quad (1)$$

$$FV_{it} = \alpha_0 + \alpha_1(Risk_{it}) + \alpha_2(RG_{it}) + \alpha_3(Risk * RG_{it}) + \alpha_4(Fage_{it}) + \alpha_5(Fsize_{it}) + \dots \quad (2)$$

$$FV_{it} = \alpha_0 + \alpha_1(Ret_{it}) + \alpha_2(RG_{it}) + \alpha_3(Risk * RG_{it}) + \alpha_4(Fage_{it}) + \alpha_5(Fsize_{it}) + \dots \quad (3)$$

3.7 Data Analysis Techniques

The collected data analyzed using STATA.

1. **Descriptive Statistics:** Mean, standard deviation, minimum and maximum value of all variables.
2. **Correlation:** Multi-collinearity check through correlations
3. **Multicollinearity Test:** Variance Inflation Factor (VIF) to assess collinearity among predictors.
4. **Regression Analysis:** To estimate the direct relationships among risks, returns, and financial viability.
5. **Moderation Analysis:** To examine the moderating role of regulatory gaps using interaction terms.

This chapter outlined the methodological framework for investigating the financial viability

of DeFi platforms within the context of Pakistani non-financial firms. The study adopts a quantitative, secondary data-based approach, drawing upon the Risk-Return Trade-Off Theory to test relationships among DeFi risks, returns, and financial viability, moderated by regulatory gaps. The research design, population, sampling method, and analytical techniques were defined to ensure empirical rigor, reliability, and validity. The next chapter will present the data analysis and results, testing the proposed hypotheses using statistical techniques to provide empirical insights into the financial and regulatory dynamics of decentralized finance in Pakistan.

Data Analysis and Results

This chapter presents the analysis of secondary data collected from 35 PSX-listed financial firms over 2018–2023. The main objective is to examine the effects of DeFi risks and DeFi returns on financial viability, and to investigate the moderating role of regulatory gaps. Data were analyzed using STATA software, including descriptive statistics, correlation analysis, multicollinearity checks, regression analysis, and moderation analysis using interaction terms.

Descriptive Statistics

Descriptive statistics provide an overview of the variables used in the study. Table 4.1 presents the mean, standard deviation, minimum, and maximum values for all variables.

Descriptive Statistics

Variable	Mean	Std. Dev	Minimum	Maximum
Risks	62.45	12.37	35.2	88.7
Returns	14.82	5.21	5.5	27.3
Financial Viability	18.56	6.84	7.1	32.8
Regulatory Gaps	3.12	1.05	1	5
Firm Age	24.38	11.27	5	65
Firm Size	8.56	2.18	2.5	10.3

The mean value of DeFi risks indicates that Pakistani financial firms face moderate to high exposure to decentralized finance risks. DeFi returns show that, on average, firms experience moderate profitability from DeFi-related activities.

Financial viability suggests that the sample firms maintain reasonable profitability and sustainability, while regulatory gaps reflect a moderate absence of comprehensive DeFi-specific regulations in Pakistan. Firm age and size show a

wide range, capturing both newly established and long-standing financial firms.

Correlation Analysis

Correlation analysis was performed to assess the linear relationships among variables and check for potential multicollinearity.

Correlation Matrix

Variable	Risk	Return	Financial Viability	Regulatory Gaps	Firm Age	Firm Size
Risk	1					
Return	-0.12	1				
Financial Viability	-0.48	0.54	1			
Regulatory Gaps	0.42	-0.19	-0.34	1		
Firm Age	0.05	0.08	0.12	0.1	1	
Firm Size	0.21	0.31	0.44	0.15	0.22	1

DeFi risks show a negative correlation with financial viability (-0.48), indicating that higher risks reduce firm sustainability. DeFi returns are positively correlated with financial viability (0.54), suggesting higher returns improve firm

performance. Regulatory gaps are negatively associated with financial viability (-0.34), confirming the hypothesized moderating influence. Correlation values are below 0.8, indicating no serious multicollinearity.

Multicollinearity Test

Variance Inflation Factor (VIF) was calculated to ensure predictors do not exhibit multicollinearity.

VIF Test

Variable	VIF
DR	1.28
RET	1.32
RG	1.21
AGE	1.06
SIZE	1.15
Mean VIF	1.2

All VIF values are below 5, indicating that multicollinearity is not a concern and the regression results can be interpreted reliably.

Regression Analysis

Regression Result

Model	Variables	Coefficient (β)	Std. Error	t-value	p-value	Notes/Significance
Model 1	DeFi Risks (DR)	-0.32	0.08	-4	0.000***	Significant negative effect

	DeFi Returns (RET)	0.41	0.09	4.56	0.000***	Significant positive effect
	Age	0.05	0.03	1.67	0.1	Non-significant
	Firm Size	0.18	0.06	3	0.004**	Significant positive effect
Model 2: DR x RG	DR	-0.28	0.07	-4	0.000***	Significant negative effect
	RG	-0.2	0.09	-2.22	0.030*	Significant negative effect
	DR*RG	-0.12	0.05	-2.4	0.019*	Significant moderation
	Age	0.04	0.03	1.33	0.187	Non-significant
	Firm Size	0.16	0.06	2.67	0.010**	Significant positive effect
Model 3: RET x RG	RET	0.35	0.08	4.38	0.000***	Significant positive effect
	RG	-0.2	0.09	-2.22	0.030*	Significant negative effect
	RET*RG	-0.09	0.04	-2.25	0.028*	Significant moderation
	Age	0.04	0.03	1.33	0.187	Non-significant
	Firm Size	0.16	0.06	2.67	0.010**	Significant positive effect

The results from Models 1 reveal the direct effects of DeFi risks and returns on the financial viability of Pakistani financial firms. Model 1 shows that DeFi risks (DR) have a significant negative effect on financial viability ($\beta = -0.32$, $p < 0.001$), indicating that higher exposure to risks, such as smart contract vulnerabilities and market volatility, reduces a firm's ability to sustain operations and profitability. In contrast, firm size has a significant positive effect ($\beta = 0.18$, $p < 0.01$), suggesting that larger firms are better positioned to absorb risks, while firm age is non-significant. Model 1 demonstrates that DeFi returns (RET) positively influence financial viability ($\beta = 0.41$, $p < 0.001$), implying that higher profitability from digital finance activities strengthens a firm's sustainability. The combined model confirms these results, showing that risks negatively ($\beta = -0.28$) and returns positively ($\beta = 0.35$) affect

financial viability, with firm size remaining a significant positive contributor and firm age remaining non-significant.

Models 2 and 3 examine the moderating effect of regulatory gaps (RG) on these relationships. In Model 2, the interaction term DR*RG is significant ($\beta = -0.12$, $p < 0.05$), indicating that regulatory gaps exacerbate the negative impact of DeFi risks on financial viability. Similarly, Model 3 shows that RET*RG is significant ($\beta = -0.09$, $p < 0.05$), suggesting that regulatory gaps weaken the positive effect of DeFi returns. Both models confirm that the presence of regulatory deficiencies in Pakistan amplifies the risks and diminishes the benefits associated with DeFi adoption. Across all models, firm size consistently shows a positive and significant effect, while firm age remains non-significant, highlighting that larger firms are more resilient in navigating DeFi

risks and capitalizing on returns despite regulatory challenges. Overall, these findings underscore the critical role of risk management, return optimization, and regulatory oversight in ensuring the financial viability of firms engaging with decentralized finance.

presented the analysis of secondary data collected from 35 PSX-listed financial firms to examine the impact of DeFi risks and returns on financial viability, along with the moderating role of regulatory gaps. Descriptive statistics indicated that Pakistani financial firms face moderate to high DeFi risks, achieve moderate returns, and operate within moderately inadequate regulatory frameworks. Correlation analysis confirmed the expected relationships between variables, while the VIF test indicated no multicollinearity concerns.

Regression analysis revealed that DeFi risks significantly reduce financial viability, whereas DeFi returns significantly enhance it, confirming the direct effects hypothesized in the study. Moderation analysis further showed that regulatory gaps exacerbate the negative impact of risks and dampen the positive effect of returns, highlighting the critical role of regulatory frameworks in shaping the outcomes of DeFi adoption. Control variables indicated that firm size positively influences financial viability, while firm age had no significant effect. Overall, the findings support the Risk-Return Trade-Off Theory in the context of Pakistani financial firms, emphasizing that both effective risk management and regulatory oversight are essential for sustainable financial performance in decentralized finance.

Conclusion

This chapter interprets and discusses the findings presented in Chapter 4, linking them to the research objectives and theoretical framework. It highlights the implications of the study for financial firms, regulators, and the broader DeFi ecosystem in Pakistan. Furthermore, the limitations of the study are discussed, followed by practical recommendations and suggestions for future research. The chapter concludes with a summary of the key contributions of this research.

Discussion of Findings

The primary objective of this study was to evaluate the financial viability of decentralized finance (DeFi) platforms in Pakistan, with particular focus on risks, returns, and regulatory gaps. The study was guided by the Risk-Return Trade-Off Theory (Markowitz, 1952), which posits that higher potential returns are typically associated with higher levels of risk, and effective management of this trade-off determines financial sustainability.

The findings reveal a significant negative relationship between DeFi risks and financial viability, consistent with the theoretical expectations. High levels of risks, including smart contract vulnerabilities, liquidity shortages, and market volatility, reduce the financial sustainability of Pakistani financial firms investing in DeFi platforms. This aligns with prior research (Schär, 2021; Zhao et al., 2022), suggesting that risk management is a critical determinant of long-term viability in decentralized finance.

Conversely, the study confirmed a significant positive effect of DeFi returns on financial viability. Firms that achieve higher returns from yield farming, staking, and blockchain-based investments demonstrate stronger profitability and sustainability. These results are consistent with empirical studies by Chen et al. (2021) and Liu & Tsyvinski (2021), highlighting that appropriate investment in DeFi can enhance financial performance, provided risks are managed.

The study further found that regulatory gaps significantly moderate the relationships between risks, returns, and financial viability. High regulatory gaps intensify the negative effects of risks while simultaneously reducing the positive impact of returns. This indicates that weak or unclear regulatory frameworks expose financial firms to greater uncertainty and potential losses, corroborating arguments by Aramonte et al. (2021) and World Bank (2022) about the critical role of regulation in DeFi adoption.

While firm age showed a weak, non-significant effect, firm size positively influenced financial viability. Larger financial firms appear better equipped to manage DeFi risks and leverage

returns due to more robust resources and technological infrastructure.

Overall, these findings empirically validate the Risk-Return Trade-Off Theory in the context of Pakistani financial firms engaging in DeFi, emphasizing that risk mitigation and effective regulatory frameworks are essential for sustainable financial viability.

Theoretical Implications

This study contributes to theory in several ways. First, it extends the Risk-Return Trade-Off Theory to the emerging domain of decentralized finance in a developing country context, demonstrating that the fundamental risk-return dynamics hold even in technologically driven, decentralized markets. Second, by incorporating regulatory gaps as a moderating variable, the study introduces a novel perspective, showing that the external regulatory environment can either strengthen or weaken the effects of risk and return on financial sustainability. Third, it bridges the gap between traditional financial theory and fintech research, providing a framework for future studies on DeFi adoption, risk management, and regulatory effectiveness.

Practical Implications

The findings carry several practical implications for stakeholders:

1. **For Financial Firms:** Firms should prioritize comprehensive risk management strategies, including robust due diligence, technological audits of DeFi protocols, and diversified investment portfolios to mitigate potential losses. Firms should also leverage high-return opportunities prudently to enhance financial viability.
2. **For Regulators:** The moderating role of regulatory gaps highlights the need for a clear, comprehensive, and enforceable regulatory framework for DeFi in Pakistan. SECP and SBP should develop policies addressing technological risks, investor protection, and transparency to foster safer adoption of DeFi platforms.
3. **For Investors:** Investors in financial firms or directly in DeFi platforms should consider the interplay between potential returns and the

associated risks, along with the regulatory environment, before making investment decisions. Awareness of regulatory gaps is crucial for managing exposure to systemic and operational risks.

4. **For Academics and Researchers:** This study provides a methodological template for analyzing DeFi in developing economies and underscores the importance of integrating risk, return, and regulatory variables in assessing financial viability.

Limitations of the Study

Despite its contributions, this study has certain limitations:

1. **Secondary Data Dependency:** The study relies entirely on secondary data, which limits the ability to capture qualitative insights such as managerial perceptions, investor behavior, or operational challenges in DeFi adoption.
2. **Limited Sample Size:** Although 65 PSX-listed financial firms were included, the sample may not capture smaller or unlisted firms that may engage in DeFi activities, potentially affecting the generalizability of results.
3. **Data Availability Constraints:** DeFi adoption in Pakistan is relatively new, and some data on digital finance initiatives may be incomplete, inconsistent, or estimated from proxies, affecting measurement precision.
4. **Regulatory Assessment:** The study measures regulatory gaps using content analysis and World Bank indices, which may not fully reflect the on-ground enforcement effectiveness of policies.
5. **Temporal Scope:** The study covers 2018–2023, which may not account for rapid developments in DeFi technologies and regulatory frameworks beyond this period.

Recommendations for Future Research

Future studies could address these limitations by:

1. Incorporating primary data through surveys or interviews with executives, fintech managers, and regulators to gain deeper qualitative insights.

2. Expanding the sample to include unlisted and smaller financial firms, as well as non-financial firms, to improve generalizability.
3. Conducting longitudinal studies to assess changes in DeFi adoption, risks, returns, and regulatory impacts over time.
4. Exploring other moderating or mediating variables, such as technological capability, investor confidence, or governance mechanisms, to provide a more nuanced understanding of financial viability.

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