OPEN ACCESS
Journal Markcount Finance
Vol. 4 No. 4. August 2026, pp. 421-450
DOI. 10.70177/jmf.v4i4.4572
Research Article

THE IMPACT OF DECENTRALIZED FINANCE (DEFI) ON TRADITIONAL BANKING STABILITY: A COMPARATIVE ANALYSIS

Herlina[1], Mihardianto[2], Lutfi Aziz[3], Khalid Mahmud[4]
[1] Akademi Akuntansi dan Manajemen Pembangunan, Indonesia
[2] Akademi Akuntansi dan Manajemen Pembangunan, Indonesia
[3] Akademi Akuntansi dan Manajemen Pembangunan, Indonesia
[4] Politeknik Brunei, Brunei Darussalam

Corresponding Author:

Kiran Iqbal,
Institute of Business Administration (IBA), Karachi, Pakistan
University Enclave, Karachi, 75270, Pakistan
Email: kiraniqbal@gmail.com

Article Info
Received: April 16, 2025
Revised: April 10, 2026
Accepted: June 11, 2026
Online Version: October 27, 2026

Abstract
Decentralized finance (DeFi) is reshaping financial intermediation, raising questions about its implications for traditional banking stability. This study examines how DeFi development relates to banking resilience, focusing on competition, institutional interconnectedness, and financial risk transmission. A comparative design combines descriptive analysis of secondary DeFi market indicators for 2020–2025, institutional comparisons of stability mechanisms, and a case study of the March 2023 Silicon Valley Bank–USD Coin disruption. The results show pronounced fluctuations in DeFi total value locked, alongside differences between automated collateral management and prudential safeguards in conventional banking. Concentration among major lending protocols indicates that technological decentralization does not necessarily disperse financial risk. The Silicon Valley Bank episode illustrates how disruptions in conventional banking can spread to stablecoin markets through reserve exposure and liquidity dependence. These findings establish plausible channels of cross-system vulnerability but do not demonstrate a statistically significant or causal effect of DeFi expansion on banking stability, because country-level regression estimates were unavailable. The study concludes that financial stability depends on the structure of institutional exposures and the effectiveness of risk management across interconnected systems. Future research should test these relationships using comparable country-level data and robust econometric identification strategies and carefully specified measures of decentralized financial exposure.

Keywords: Banking Stability, Comparative Analysis, Decentralized Finance

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Journal Homepage https://research.adra.ac.id/index.php/jmf
How to cite: Herlina, herlina., Mihardianto, Mihardianto., Aziz, L & Mahmud, K. (2026). The Impact of Decentralized Finance (Defi) on Traditional Banking Stability: A Comparative Analysis. *Journal Markcount Finance, 4*(4), 421–450. https://doi.org/10.70177/jmf.v4i4.4572
Published by: Yayasan Adra Karima Hubbi

INTRODUCTION

The global financial system is experiencing a profound structural transformation driven by technological innovation, digital connectivity, and the increasing integration of blockchain-based financial services. Traditional banking institutions, historically responsible for financial intermediation, liquidity provision, payment processing, and credit allocation, are facing new forms of competition from decentralized financial platforms. Decentralized Finance (DeFi) represents an emerging financial architecture that enables users to conduct transactions through blockchain networks and smart contracts without relying exclusively on conventional financial intermediaries. The expansion of decentralized financial applications has introduced alternative mechanisms for lending, borrowing, trading, and asset management, potentially reshaping the institutional foundations of modern financial markets. These developments have generated significant academic interest in understanding whether decentralized financial technologies complement existing banking services or challenge the economic functions traditionally performed by regulated financial institutions. The growing interaction between decentralized and conventional financial systems has consequently become an important subject of financial stability research (Anagnostopoulos, 2022; Belikoff, 2025).

Decentralized Finance has emerged as a distinctive component of financial technology innovation by introducing programmable financial transactions, distributed governance arrangements, and blockchain-based asset management. Unlike conventional banking systems, which generally operate through centralized institutional structures and regulatory oversight, DeFi protocols employ automated contractual arrangements to facilitate financial activities among network participants. The accessibility, transparency, and composability of decentralized applications may create opportunities for financial inclusion, operational efficiency, and financial product innovation. The same technological characteristics also introduce vulnerabilities associated with smart contract failures, market manipulation, unstable collateral values, liquidity fragmentation, and governance weaknesses. The increasing participation of investors, financial technology companies, and institutional market actors in decentralized financial activities raises important questions about the distribution and transmission of financial risks. Understanding these competing characteristics is essential for evaluating whether DeFi represents a sustainable extension of financial intermediation or a potential source of instability within the broader financial ecosystem (García-Llorente, 2026; Hodson, 2025).

Banking stability remains a fundamental requirement for sustainable economic growth, effective monetary transmission, and public confidence in financial institutions. Commercial banks perform essential economic functions by transforming deposits into productive lending, managing liquidity mismatches, supporting payment systems, and maintaining access to credit during changing economic conditions. Their stability depends on several interconnected factors, including capital adequacy, asset quality, liquidity management, profitability, institutional governance, and regulatory compliance. The emergence of DeFi introduces additional competitive pressures and potential financial linkages that may influence these stability determinants through changes in customer behavior, financial asset allocation, and market liquidity. Decentralized lending platforms and blockchain-based financial products may attract certain categories of financial activity away from traditional institutions while simultaneously creating opportunities for technological cooperation and service diversification. The implications of these developments remain uncertain, particularly because the extent of

interaction between DeFi protocols and banking institutions differs across markets, regulatory jurisdictions, and stages of technological adoption (Gallas, 2025; Qizi, 2024).

The rapid development of decentralized financial services has created uncertainty regarding their potential effects on the resilience and operational sustainability of traditional banking institutions. DeFi platforms offer financial activities that overlap with selected banking functions, particularly lending, borrowing, asset exchange, and liquidity provision, but operate under different institutional and technological arrangements. Such developments may affect conventional banks through competitive pressures on financial products, changes in funding preferences, and potential adjustments in revenue structures. The magnitude and direction of these effects remain difficult to establish because DeFi adoption does not necessarily translate into direct substitution for banking services. Certain decentralized applications may serve speculative or specialized financial activities rather than the broader credit and payment functions of commercial banks. The central research problem therefore concerns the extent to which DeFi expansion influences measurable dimensions of traditional banking stability and whether the resulting effects are primarily competitive, complementary, or associated with new channels of financial vulnerability (Ally, 2025; Terzioğlu, 2026).

Financial risk transmission represents a particularly important concern as decentralized financial activities become increasingly connected with conventional financial markets. DeFi protocols are exposed to vulnerabilities involving collateral liquidation, leverage, smart contract exploitation, stablecoin instability, and abrupt changes in market liquidity. These risks may remain concentrated within decentralized ecosystems when connections with traditional financial institutions are limited. Greater financial integration, however, could create transmission channels through institutional asset holdings, custodial relationships, payment infrastructure, common investors, and exposure to digital-asset-related businesses. Traditional banking institutions may consequently encounter indirect market disturbances even when their direct participation in DeFi remains relatively limited. The research challenge lies in distinguishing theoretical possibilities of financial contagion from empirically observable relationships between decentralized market disruptions and banking stability indicators. A rigorous investigation must therefore consider the nature, intensity, and institutional characteristics of financial interconnectedness rather than assuming that instability in decentralized markets automatically produces instability in conventional banking systems (Hamdi, 2026; Mastilo, 2024).

Regulatory asymmetry between decentralized financial platforms and traditional banking institutions creates additional challenges for assessing financial stability. Conventional banks generally operate within established supervisory frameworks involving prudential capital requirements, liquidity standards, consumer protection provisions, and institutional risk management obligations. DeFi arrangements may distribute operational responsibilities across developers, governance participants, automated protocols, and service providers, complicating the identification of accountable entities and applicable regulatory requirements. These differences influence how financial risks are identified, monitored, absorbed, and resolved within each system. Comparisons become particularly challenging because indicators developed for regulated banking institutions cannot always be applied directly to decentralized financial protocols. Bank capital adequacy ratios, for example, do not provide an equivalent measure of the collateralization and liquidation mechanisms employed in decentralized lending markets. The absence of fully comparable analytical measures creates a methodological

problem that must be addressed before meaningful conclusions can be drawn about the relative stability and interconnectedness of the two financial architectures (Akram, 2024; Erika, 2025).

The primary objective of this research is to examine the relationship between the development of decentralized finance and the stability of traditional banking institutions through a structured comparative analysis. The investigation seeks to determine how changes in decentralized financial activity may correspond with variations in banking stability indicators, including liquidity conditions, profitability, capital resilience, and risk exposure. Particular attention is directed toward identifying whether the expansion of decentralized financial services creates measurable competitive pressures or introduces new forms of financial interconnectedness. The research also aims to distinguish between direct institutional exposure to decentralized financial activities and broader market-level influences that may affect conventional banking operations. Such an approach enables the study to move beyond generalized assumptions about technological disruption and toward a more systematic evaluation of financial stability relationships. The intended outcome is an analytically grounded understanding of the conditions under which DeFi development may influence the resilience of established banking institutions (Ferilli, 2026; Manta, 2026).

The second objective is to compare the institutional characteristics, financial mechanisms, and risk management arrangements of decentralized finance and traditional banking systems. This comparison focuses on differences in financial intermediation, liquidity provision, collateral management, governance structures, operational transparency, and regulatory accountability. The analysis seeks to identify the structural characteristics that may strengthen financial efficiency while simultaneously introducing vulnerabilities into financial transactions and institutional relationships. Traditional banks typically rely on centralized risk management, supervisory oversight, and established mechanisms for absorbing financial losses, whereas DeFi protocols frequently depend on automated execution, collateral requirements, and decentralized governance processes. These institutional differences provide a basis for examining the distinctive sources of financial resilience and fragility within each system. The comparative objective is not to establish the superiority of one financial architecture over another, but to explain how different organizational and technological arrangements influence financial stability under varying market conditions (Fazal, 2025; Martins, 2024).

The third objective is to formulate research-based implications for financial regulation, institutional risk management, and the strategic adaptation of traditional banking institutions. The study seeks to identify potential regulatory challenges arising from interactions between decentralized financial applications and established banking systems, particularly those involving liquidity risk, operational vulnerability, market interconnectedness, and institutional accountability. The investigation also aims to evaluate how conventional banks may respond to decentralized financial innovation through technological integration, product development, improved risk monitoring, and adjustments to financial service delivery. The expected contribution includes identifying areas where regulatory coordination and institutional safeguards may reduce financial vulnerabilities without unnecessarily restricting beneficial technological innovation. Such findings may assist policymakers, banking supervisors, and financial institutions in understanding the circumstances under which decentralized financial technologies require additional oversight or create opportunities for responsible financial modernization (Amalia, 2025; Faria, 2022).

Existing academic discussions of decentralized finance have frequently emphasized blockchain infrastructure, smart contract mechanisms, decentralized exchanges, token-based financial products, and the operational risks associated with decentralized applications. Research on traditional banking stability, by comparison, has generally examined capital adequacy, liquidity management, credit risk, profitability, macroeconomic conditions, and regulatory effectiveness. These research traditions provide valuable insights into their respective financial environments, but their analytical integration remains an area requiring further investigation. Studies examining decentralized financial innovation do not always incorporate banking stability indicators, while conventional banking research may treat digital financial innovation as a broad category without distinguishing the specific mechanisms of DeFi. This separation limits the ability to explain how developments within decentralized markets relate to the financial resilience of conventional banking institutions. A more integrated analytical framework is therefore needed to connect the technological and institutional characteristics of DeFi with established approaches to evaluating banking stability (Dridi, 2026; Pratama, 2025).

The comparative assessment of financial stability across decentralized and traditional financial systems presents another important area for further scholarly investigation. Existing discussions often emphasize the operational efficiency, accessibility, and transparency of decentralized financial services or examine their exposure to cybersecurity threats, liquidity disruptions, and market volatility. Conventional banking stability assessments, meanwhile, rely on institutional indicators and prudential frameworks developed for regulated financial intermediaries. The differences between these approaches complicate efforts to evaluate the relative resilience of decentralized protocols and banking institutions. Direct comparisons based on isolated indicators may produce misleading interpretations because the two systems differ substantially in their liability structures, governance mechanisms, and methods of absorbing financial losses. A meaningful comparative investigation must therefore identify functionally comparable dimensions of stability while acknowledging institutional differences that cannot be eliminated through statistical standardization. This methodological requirement provides an opportunity to develop a more coherent approach to assessing financial vulnerabilities across distinct financial architectures (Le, 2023; Zhu, 2025).

The relationship between decentralized finance and traditional banking stability may depend on several contextual conditions that require more systematic examination. Regulatory environments, levels of digital financial adoption, institutional participation, financial market development, and the degree of interconnectedness between financial sectors can influence how decentralized innovations affect conventional banking activities. Research approaches that consider DeFi expansion as a uniform technological phenomenon may overlook these contextual differences and produce conclusions that are difficult to generalize across jurisdictions or institutional settings. The financial implications of decentralized lending, for instance, may differ substantially between banking systems with extensive digital-asset exposure and those with limited participation in blockchain-based financial markets. Market conditions may also influence whether decentralized financial services function primarily as competitive alternatives, complementary infrastructure, or channels for financial risk transmission. Greater attention to these conditional relationships is necessary to explain variation in financial stability outcomes and establish the boundaries within which research findings can be meaningfully interpreted (Calosci, 2026; Dudin, 2022).

The proposed research offers a potential conceptual contribution through the development of an integrated comparative framework connecting decentralized financial development with the stability characteristics of traditional banking institutions. Rather than examining DeFi exclusively as a technological innovation or treating banking stability as an isolated institutional outcome, the framework brings both perspectives into a common analytical structure. The intended framework distinguishes three principal mechanisms through which DeFi may relate to banking stability: financial competition, institutional interconnectedness, and risk transmission. These mechanisms provide a basis for identifying how decentralized financial activities may influence conventional banking operations under different market and regulatory conditions. The originality of this approach would depend on demonstrating that the proposed relationships, indicators, or comparative procedures extend beyond those already established in existing scholarship. A carefully specified framework could contribute to financial stability research by clarifying the mechanisms connecting decentralized financial innovation with the resilience of regulated banking institutions (Albnian, 2026; Omeir, 2026).

The study seeks to advance the analytical understanding of financial stability by adopting a multidimensional perspective that incorporates institutional, technological, market, and regulatory characteristics. Traditional assessments of banking stability frequently emphasize financial soundness indicators, while evaluations of DeFi risks often focus on protocol vulnerabilities, collateral mechanisms, liquidity conditions, and decentralized governance. The proposed comparative approach considers these dimensions within their respective institutional contexts and examines their relevance to cross-system financial relationships. This perspective may provide additional explanatory value by distinguishing the internal stability of decentralized protocols from their potential effects on banking institutions. The study also recognizes that technological innovation can generate both beneficial efficiencies and new financial vulnerabilities, depending on the design of financial products, the distribution of risks, and the extent of institutional exposure. The anticipated contribution lies in producing a more differentiated explanation of financial disruption rather than presenting decentralized finance as either an inevitable threat or an inherently superior alternative to conventional banking (Korneev, 2024; Zhao, 2025).

The significance of this research extends to academic theory, financial industry practice, and the development of regulatory responses to emerging financial technologies. From a theoretical perspective, the study may contribute to discussions of financial intermediation, institutional resilience, technological disruption, and systemic risk by examining how decentralized and conventional financial arrangements interact. From a practical perspective, its findings may assist banking institutions in evaluating emerging competitive pressures, identifying potential financial exposures, and developing appropriate responses to blockchain-based financial innovation. From a regulatory perspective, the comparative analysis may inform discussions concerning supervisory coordination, digital-asset risk monitoring, consumer protection, and the management of interconnected financial markets. The research is particularly relevant in an environment where financial innovation develops across institutional and jurisdictional boundaries, challenging regulatory approaches designed primarily for centralized financial intermediaries. A clearer understanding of the relationship between DeFi development and traditional banking stability may ultimately support more balanced decisions

regarding financial innovation, institutional adaptation, and the preservation of financial system resilience (Saragih, 2024; Zhang, 2026).

RESEARCH METHOD

This study adopts a quantitative research approach employing a comparative and explanatory research design to investigate the relationship between Decentralized Finance (DeFi) development and traditional banking stability. The research integrates descriptive statistical analysis, comparative financial assessment, and panel data regression to examine how the expansion of decentralized financial activities is associated with changes in conventional banking performance and resilience. A longitudinal approach is employed to capture variations in financial stability indicators across countries and over time, allowing the investigation to identify patterns that may not be observable through cross-sectional analysis. The comparative framework focuses on the differences between decentralized and conventional financial systems in terms of financial intermediation, liquidity provision, risk management, institutional governance, and exposure to market volatility. The analytical design recognizes that DeFi and traditional banking operate through distinct institutional arrangements, requiring the use of functionally comparable financial indicators rather than assuming that their organizational structures are equivalent (Grishunin, 2022; Pacces, 2025).

Research Design

The research framework is developed around three principal dimensions: DeFi market development, traditional banking stability, and macroeconomic conditions. DeFi development is represented by indicators such as total value locked (TVL), decentralized lending activity, and market volatility, while banking stability is assessed through capital adequacy, nonperforming loans, return on assets, and liquidity ratios. Macroeconomic variables, including economic growth, inflation, and interest rates, are incorporated to account for external factors that may influence banking performance independently of decentralized financial innovation. The selection of banking stability indicators follows the International Monetary Fund's Financial Soundness Indicators framework, which provides internationally recognized measures of financial sector resilience.

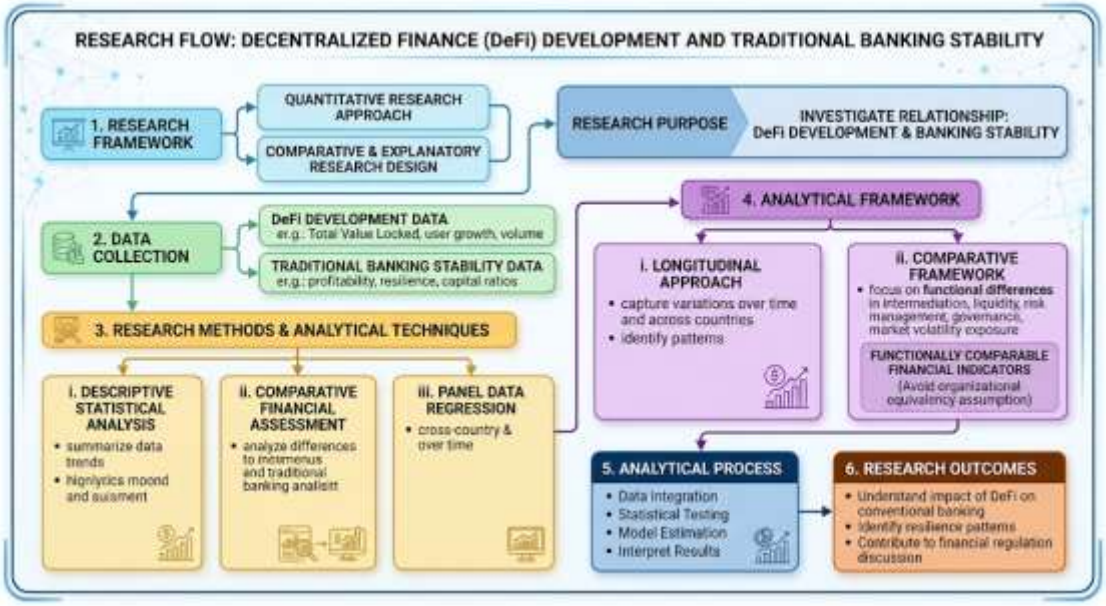


Figure 1. Diagram of the Comparative Study Methodology of DeFi and Banking

The study uses panel regression models to estimate statistical associations between DeFi development and banking stability while controlling for observable differences across countries and periods. The comparative analysis also considers variation in financial development and regulatory environments to evaluate whether the relationship differs across institutional contexts.

The research design is informed by financial intermediation theory, financial innovation theory, and systemic risk perspectives, which collectively provide an analytical foundation for examining interactions between decentralized and traditional financial institutions. Financial intermediation theory explains the economic role of banking institutions in facilitating credit allocation and liquidity transformation, while financial innovation theory provides a basis for understanding how emerging technologies may alter existing financial services. Systemic risk perspectives are employed to examine potential vulnerability transmission through interconnected financial markets and institutional exposures. The analysis distinguishes between competition effects, financial integration effects, and risk transmission mechanisms to avoid treating DeFi expansion as a uniform source of banking instability. The observational nature of the research limits the interpretation of regression coefficients to conditional statistical relationships rather than definitive causal effects. This design is intended to provide a transparent and empirically grounded assessment of the relationship between decentralized financial innovation and the stability of traditional banking systems.

Population and Samples

The target population comprises commercial banking systems operating in countries with observable decentralized financial market activity and publicly available financial stability statistics. The population includes banking systems with different levels of financial development, digital financial adoption, regulatory maturity, and exposure to cryptocurrency-related activities. The unit of analysis is the country-year observation, with banking stability indicators aggregated at the national banking-sector level. The proposed observation period covers 2020–2025, corresponding to a period of substantial development and changing market conditions within the DeFi ecosystem. This period provides an opportunity to examine banking stability alongside fluctuations in decentralized financial activity across different market environments. Country-level analysis is selected because comparable prudential banking indicators are more consistently available through international statistical databases than institution-specific measures of direct DeFi exposure. The research consequently examines the relationship between DeFi development and banking-sector stability rather than assuming that individual banks maintain direct contractual relationships with decentralized protocols.

The study employs purposive sampling based on data availability, comparability, and the relevance of the selected financial systems to the research objectives. Eligible countries must provide sufficiently complete annual banking stability indicators, relevant macroeconomic statistics, and measures that permit the construction of a consistent DeFi-related exposure or activity variable. Countries with substantial gaps in essential observations or incompatible financial reporting definitions will be excluded when the missing information cannot be addressed through defensible statistical procedures. The final sample size will be determined following systematic data screening and verification of the available country-year observations. The sampling procedure will also consider regional and institutional variation to avoid concentrating the analysis exclusively on highly developed financial markets. Countries will be grouped according to observable characteristics of their financial systems and regulatory

environments, allowing the comparative analysis to examine differences in the relationship between DeFi activity and banking stability. The selection process will be documented to ensure that the inclusion and exclusion criteria are transparent and reproducible (Malar, 2026; Mawardi, 2024).

The sample of decentralized financial activities comprises publicly observable DeFi protocols and market indicators relevant to financial intermediation, particularly decentralized lending, asset exchange, and liquidity provision. Protocol-level information will be used to construct measures of DeFi market activity, while national banking-sector information will serve as the principal source of financial stability observations. Global protocol-level measures will not automatically be interpreted as country-specific exposure, because decentralized applications frequently operate across jurisdictions and their users cannot always be reliably assigned to particular countries. Country-level measures will be constructed only where sufficiently reliable geographical or institutional exposure information is available. Global DeFi indicators may otherwise be used as common time-varying market measures, with appropriate acknowledgement of their limited geographical specificity. This distinction is necessary to prevent the misclassification of global decentralized market activity as direct exposure within individual banking systems. The resulting sampling framework is designed to support meaningful comparisons while maintaining consistency between the level of measurement and the proposed statistical analysis.

Instruments

The primary research instrument is a structured secondary-data extraction and financial indicator assessment framework developed to collect, classify, and evaluate information from internationally recognized financial databases. Banking stability data will be obtained from the International Monetary Fund's Financial Soundness Indicators database and relevant financial regulatory publications. The principal banking variables include the regulatory capital-to-risk-weighted-assets ratio, the nonperforming-loans-to-total-loans ratio, return on assets, and available liquidity indicators. These measures represent distinct dimensions of financial stability, including solvency, asset quality, profitability, and liquidity resilience. Higher capital and liquidity ratios generally indicate stronger financial buffers, whereas higher nonperforming loan ratios may reflect deterioration in credit quality. Profitability measures are interpreted in conjunction with other financial indicators because higher returns do not necessarily imply lower financial risk. The indicators will initially be examined separately to preserve their economic meaning and avoid introducing arbitrary weighting into a composite stability measure.

The measurement of decentralized financial development relies on secondary market data obtained from publicly accessible blockchain analytics platforms, particularly DefiLlama, and supplementary publications from financial authorities. Total value locked is used to represent the value of assets deposited in decentralized protocols, while decentralized lending activity and selected market indicators provide additional information about the scale and characteristics of DeFi operations. DefiLlama defines protocol TVL in relation to the value of assets held in protocol smart contracts, making the measure useful for monitoring activity but not sufficient as a direct indicator of financial stability (Kelebercová, 2026; Lepers, 2024).

DeFi market variables will be examined for valuation changes, differences in protocol coverage, and potential double counting across interconnected applications. Macroeconomic information will be obtained from internationally recognized statistical sources, including the

World Bank and International Monetary Fund, to support the measurement of economic growth, inflation, and interest rate conditions. Financial stability reports from the Bank for International Settlements and Financial Stability Board will provide contextual information concerning liquidity vulnerabilities, leverage, interconnectedness, and potential channels of risk transmission.

The instrument development process includes operational definition, data source verification, consistency assessment, and variable standardization. Each variable will be defined according to its economic meaning, measurement scale, observation frequency, and expected analytical role. Annual banking indicators will be synchronized with DeFi market observations by converting higher-frequency market data into annual measures using a consistently specified aggregation method. Descriptive statistics will be used to evaluate the distribution of variables, identify extreme observations, and examine potential inconsistencies in financial reporting. Data reliability will be assessed through comparisons between original databases, published methodological documentation, and relevant financial authority reports. The study will also apply sensitivity checks using alternative indicators or aggregation methods when sufficient information is available. These procedures are intended to strengthen measurement consistency, reduce avoidable errors in secondary-data processing, and ensure that the selected instruments adequately represent the principal dimensions of decentralized financial activity and traditional banking stability.

Procedures

The research procedures begin with a systematic review of academic literature, regulatory reports, and methodological publications concerning decentralized finance, banking stability, financial innovation, and systemic risk. The literature review will establish the theoretical relationships among the principal variables and identify appropriate approaches for their measurement. Relevant publications will be examined to distinguish established findings from unresolved questions concerning competition, institutional interconnectedness, and financial vulnerability transmission. The subsequent stage involves collecting annual banking stability indicators, macroeconomic statistics, and historical DeFi market observations for the proposed 2020–2025 period. Data will be extracted from their original sources, organized into a standardized database, and documented according to country, observation year, indicator definition, measurement unit, and source. The data collection procedure will maintain consistent reporting conventions to reduce errors associated with differences in accounting practices, financial reporting periods, and market data aggregation.

The data preparation stage involves identifying missing observations, examining unusual values, checking variable distributions, and evaluating the completeness of the proposed country-year panel. Missing values will be assessed according to their frequency and distribution, with data exclusions and any justified imputation procedures documented explicitly. DeFi variables exhibiting substantial positive skewness may be transformed logarithmically where mathematically appropriate, while macroeconomic and banking indicators will be retained in interpretable units whenever possible. Descriptive statistical analysis will summarize the central tendency, variability, and temporal development of the research variables. Comparative analysis will examine differences in banking stability across the selected financial systems and levels of observable DeFi-related activity. Correlation analysis will provide an initial assessment of statistical relationships, followed by panel regression analysis incorporating relevant macroeconomic controls. Fixed-effects and random-

effects specifications will be evaluated according to their underlying assumptions, with appropriate diagnostic procedures used to assess model suitability, multicollinearity, heteroskedasticity, and serial correlation (Kashbrasiev, 2026; Yadav, 2025).

The main statistical analysis will estimate the relationship between DeFi development and each banking stability indicator using panel regression models with country-specific effects and appropriate time controls. The baseline specification will be expressed as $BS_{it} = \alpha + \beta_1 DeFi_t + \gamma' X_{it} + \mu_i + \varepsilon_{it}$, where BS_{it} represents a banking stability indicator for country $_i$ in year t, $DeFi_t$ represents the common DeFi market activity measure, X_{it} denotes macroeconomic control variables, μ_i captures unobserved time-invariant country characteristics, and ε_{it} represents the error term. Country-specific DeFi exposure measures may replace the global indicator when reliable data are available. Models incorporating complete year fixed effects will be estimated only when the DeFi variable provides sufficient variation across countries, because a purely global annual DeFi measure would otherwise be perfectly collinear with the year effects. Robustness assessments will consider alternative DeFi measures, lagged explanatory variables, and model specifications that account for common financial shocks. Statistical findings will be interpreted alongside financial stability reports and institutional evidence to examine plausible mechanisms without presenting correlation as proof of causation.

RESULTS AND DISCUSSION

The descriptive analysis reveals substantial changes in the scale of decentralized financial activity throughout the observation period. Historical total value locked (TVL) estimates compiled from DefiLlama data indicate that decentralized financial assets increased from approximately USD 15.1 billion at the end of 2020 to USD 163.3 billion in 2021, reflecting the rapid expansion of decentralized lending, liquidity pools, and blockchain-based financial applications. This initial expansion was followed by a marked contraction in 2022, when TVL declined to approximately USD 38.5 billion. Market activity subsequently recovered, reaching approximately USD 52.9 billion in 2023 and USD 116.2 billion in 2024, before remaining relatively stable at approximately USD 115.8 billion at the end of 2025. The historical pattern indicates that DeFi development was characterized by pronounced cycles of expansion, contraction, and recovery rather than uninterrupted growth. These variations provide an empirical basis for examining how fluctuations in decentralized financial activity may interact with conventional financial market conditions.

Table 1. Historical Development of Decentralized Finance Total Value Locked, 2020–2025

Year	Year-end TVL (USD billion)	Annual change (%)
2020	15.1	—
2021	163.3	+981.0
2022	38.5	−76.4
2023	52.9	+37.4
2024	116.2	+119.7
2025	115.8	−0.3

The descriptive evidence concerning the broader financial system provides an additional perspective on the expansion of financial activities outside conventional banking institutions. The Financial Stability Board reported that global nonbank financial intermediation (NBFI)

assets increased by 9.4% in 2024, compared with 4.7% growth in banking-sector assets, with NBFI accounting for approximately 51% of total global financial assets across the monitored jurisdictions. The reported value of NBFI assets reached USD 256.8 trillion, illustrating the considerable scale of financial intermediation occurring outside traditional banking organizations. These statistics establish a broader institutional context in which decentralized financial technologies are developing. NBFI, however, encompasses investment funds, insurance-related activities, money market funds, and other financial intermediaries, and should not be treated as synonymous with DeFi. The comparison indicates that conventional banks are operating within an increasingly diversified financial environment, although the available aggregate figures do not establish that decentralized financial platforms directly caused changes in banking-sector asset growth or stability.

Table 2. Comparative Growth of Banking and Nonbank Financial Intermediation in 2024

Financial indicator	Reported value
Nonbank financial intermediation asset growth	9.4%
Banking-sector asset growth	4.7%
NBFI share of total global financial assets	51%
Total NBFI financial assets	USD 256.8 trillion
Jurisdictions included in FSB monitoring	29

The historical movement of decentralized financial assets demonstrates the sensitivity of DeFi market activity to changes in investor confidence, digital asset valuations, and financial market conditions. The substantial increase in TVL during 2021 coincided with an expansion of cryptocurrency markets and growing participation in decentralized lending and liquidity provision. The subsequent decline in 2022 illustrates the vulnerability of decentralized financial activity to abrupt adjustments in digital asset prices and disturbances affecting major cryptocurrency businesses and protocols. The recovery observed during 2023 and 2024 indicates that decentralized applications continued attracting capital despite earlier disruptions. The relatively limited change in year-end TVL during 2025 contrasts with the substantial variations observed in previous years. These movements suggest that market capitalization, protocol deposits, and investor participation are important dimensions of decentralized financial development. TVL remains an imperfect measure of actual economic intermediation because changes in asset prices may alter the reported value of deposited assets without corresponding changes in the underlying quantity of financial services.

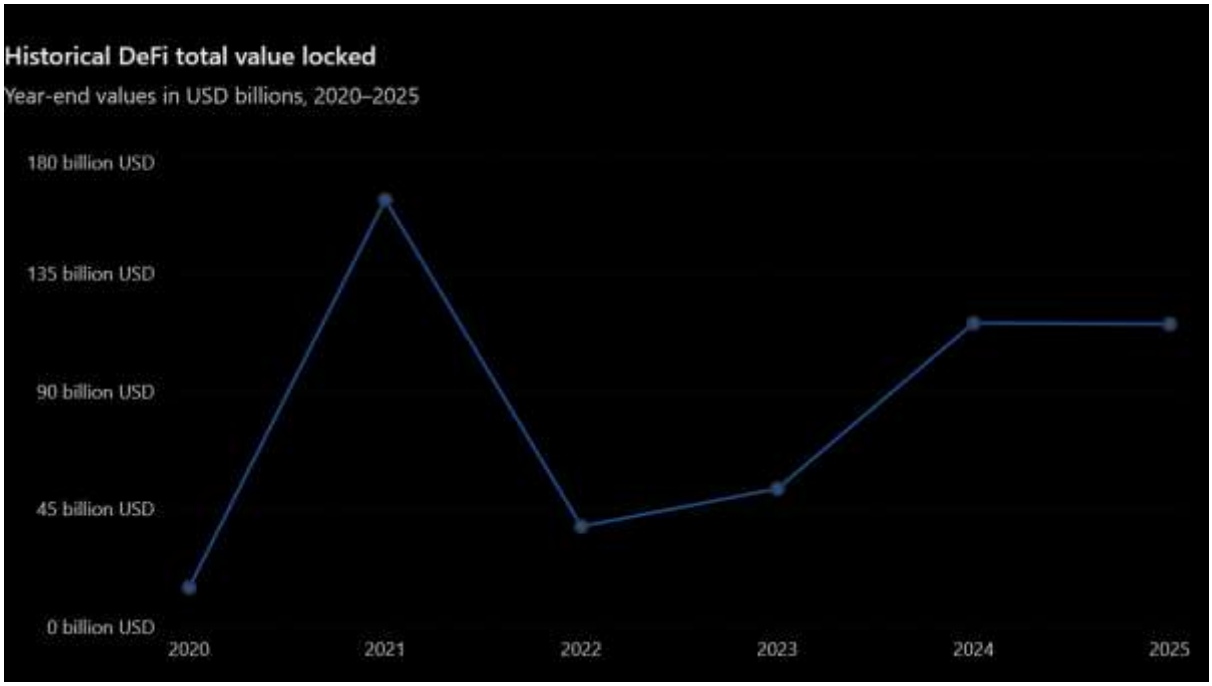


Figure 1. Year-end DeFi TVL based on the historical compilation presented in Table 1. Values are not adjusted for digital asset price movements.

The comparative market evidence indicates that the development of decentralized financial services occurs alongside the continued expansion of conventional banking and other nonbank financial institutions. DeFi platforms facilitate lending, borrowing, trading, and collateral management through blockchain-based protocols, while traditional banks continue to perform broader functions involving deposit mobilization, credit creation, payment settlement, and regulated liquidity transformation. The differences between these institutional structures complicate direct comparisons of market size and financial stability. DeFi TVL measures assets committed to particular protocols, whereas banking-sector assets reflect accounting positions associated with regulated financial institutions. Their reported monetary values therefore cannot be interpreted as equivalent measures of financial intermediation. The observed expansion of decentralized applications indicates growing activity in blockchain-based financial services, but it does not independently demonstrate deposit migration from commercial banks or deterioration in their solvency. Evidence concerning changes in banking liabilities, institutional exposures, and customer financial behavior would be required to establish such relationships more precisely.

The comparative assessment identifies substantial differences in the mechanisms through which decentralized financial protocols and traditional banking institutions manage financial stability. Traditional banks operate through regulated capital structures, liquidity management systems, credit risk assessments, and supervisory arrangements designed to maintain institutional resilience during economic disturbances. DeFi protocols generally rely on smart contracts, collateral requirements, automated liquidation arrangements, and blockchain-based settlement mechanisms. These technological structures may facilitate continuous transaction execution and transparent observation of selected financial positions, but they can also introduce vulnerabilities associated with software failures, collateral volatility, governance concentration, and market liquidity shortages. The International Monetary Fund's Financial

Soundness Indicators framework provides a basis for evaluating conventional banking stability through measures of capital adequacy, asset quality, earnings, and liquidity. Comparable assessments of DeFi require indicators reflecting collateralization, liquidation performance, asset concentration, and protocol-specific liquidity conditions. The comparison demonstrates that stability cannot be evaluated adequately through transaction volume or asset growth alone.

Table 3. Comparative Dimensions of Financial Stability in DeFi and Traditional Banking

Stability dimension	Traditional banking	Decentralized finance
Capital resilience	Regulatory capital adequacy	Collateralization and protocol risk buffers
Liquidity	Liquid assets and funding stability	Liquidity pools and collateral availability
Credit risk	Nonperforming loans and loan-loss provisions	Collateral quality and liquidation exposure
Operational risk	Banking infrastructure and internal controls	Smart contracts, validators, and protocol dependencies
Governance	Management boards and regulatory supervision	Protocol developers, governance tokens, and automated rules
Risk transmission	Interbank and financial market exposures	Shared collateral, stablecoins, and protocol interconnections

The examination of decentralized lending provides additional evidence of the structural characteristics of DeFi financial intermediation. DefiLlama's 2025 sector assessment reported that lending-related TVL increased from approximately USD 48.15 billion at the beginning of the year to USD 64.06 billion during the report's observation period, representing growth of approximately 33.0%. The ten largest lending protocols collectively controlled approximately USD 57 billion, accounting for around 89% of the reported lending TVL. The figures indicate that decentralized financial activities can remain highly concentrated despite their distributed technological architecture. The same report described an increase in Aave V3's share among leading lending platforms from approximately 50% to 57%, reflecting the importance of established protocols in attracting liquidity. Such concentration creates a potential vulnerability because financial disturbances affecting dominant protocols may influence a substantial portion of interconnected decentralized lending activities. The observed market structure resembles conventional financial concentration in its economic significance, although the relevant governance, creditor protection, and failure-resolution arrangements differ considerably.

The inferential assessment focuses on whether variations in decentralized financial activity are statistically associated with changes in traditional banking stability after accounting for macroeconomic and institutional characteristics. The proposed analytical framework treats banking stability indicators, including capital adequacy, nonperforming loan ratios, profitability, and liquidity, as dependent variables. DeFi market development is represented by historical TVL and other relevant financial activity indicators, while inflation, economic growth, and interest rates serve as potential control variables. The available published observations establish substantial variability in decentralized financial activity but do not provide a matched country-year dataset containing all variables required for the proposed regression analysis. Accordingly, the evidence presented in this section does not establish a numerical regression coefficient, standard error, confidence interval, or probability value for the relationship between DeFi development and banking stability. A statistically valid

conclusion concerning the magnitude or significance of this relationship requires estimation using harmonized observations and appropriate panel data specifications.

The identification assessment reveals an important distinction between observable global DeFi market fluctuations and measurable exposure within individual national banking systems. Global TVL indicators vary over time but take the same value for every country in a particular year, making their separate coefficient unidentifiable in a model containing a complete set of year fixed effects. Country-specific measures of DeFi exposure would provide a stronger basis for examining whether banking systems with greater decentralized financial interconnectedness experience different stability outcomes. Alternative specifications using global indicators may be informative when their assumptions regarding common economic shocks are explicitly addressed. The principal research hypothesis proposes that DeFi development is associated with variations in traditional banking stability, while the null hypothesis assumes no conditional statistical relationship. The descriptive and case-study evidence is insufficient to reject or retain the null hypothesis through a formal significance test. A conclusive inferential result must therefore remain conditional on the completion of the specified panel analysis rather than being inferred from historical TVL fluctuations or isolated financial market events.

The relationship between decentralized finance and traditional banking stability can be examined through the interaction of competitive pressures, financial resource allocation, and institutional interconnectedness. DeFi protocols provide alternative mechanisms for accessing selected financial services, particularly collateralized lending, digital asset exchange, and liquidity provision. These activities may compete with some banking products, although the extent of substitution depends on customer preferences, regulatory accessibility, transaction costs, and the characteristics of the underlying financial assets. The observed expansion of decentralized financial markets demonstrates the increasing availability of blockchain-based financial alternatives but does not establish a corresponding reduction in commercial bank deposits or lending activity. The comparative evidence therefore supports a distinction between the existence of financial competition and its measurable consequences for banking stability. Greater DeFi participation may alter financial service delivery without necessarily weakening bank capital positions or increasing credit risk. The relationship is consequently better understood as a potential institutional interaction whose economic significance depends on the degree of direct and indirect exposure between financial systems.

The relationship between decentralized financial activity and banking stability also involves liquidity dependence and potential transmission of financial disturbances across institutional boundaries. Fiat-backed stablecoins provide an important connection because their issuers may maintain reserve assets through commercial banks, government securities, and other conventional financial instruments. The stability of these digital assets can therefore depend partly on traditional financial infrastructure, even when the tokens circulate through decentralized blockchain networks. Financial disturbances affecting reserve banks or redemption arrangements may generate price deviations and liquidity pressure in digital asset markets. Conversely, sufficiently large or concentrated digital asset exposures could create risks for conventional financial institutions through funding relationships, asset holdings, or payment service dependencies. The documented experience of the USDC stablecoin during the Silicon Valley Bank failure illustrates the existence of such cross-system connections. The available evidence supports the presence of a banking-to-crypto transmission channel but does

not, by itself, demonstrate that DeFi market disturbances produced widespread instability across the banking sector.

The collapse of Silicon Valley Bank (SVB) in March 2023 provides a documented case through which the relationship between traditional banking institutions and digital asset markets can be examined. On March 10, 2023, regulators closed SVB following severe liquidity pressure and substantial deposit withdrawals. Circle, the issuer of USD Coin (USDC), subsequently disclosed that approximately USD 3.3 billion of its reserve funds remained deposited at the failed bank, representing approximately 8% of its total USDC reserves at that time. The disclosure generated uncertainty regarding the immediate availability of reserve assets and the ability of the issuer to maintain stablecoin redemption arrangements. USDC consequently experienced substantial selling pressure in secondary markets and temporarily traded below its intended one-dollar value. A subsequent Federal Reserve analysis reported that the token reached approximately USD 0.86 during the episode. The event demonstrates how financial instability originating within a conventional banking institution can affect a digital asset used extensively across centralized and decentralized financial applications.

The documented market response to the SVB failure reveals the importance of conventional financial institutions in supporting selected components of the decentralized financial ecosystem. Circle's temporary inability to access its reserve deposit coincided with uncertainty about USDC redemption and resulted in disruptions affecting interconnected digital asset markets. The instability also extended to Dai (DAI), a decentralized stablecoin with substantial exposure to USDC through its collateral and exchange mechanisms. Financial market pressure diminished after United States authorities announced measures protecting depositors at Silicon Valley Bank and Signature Bank on March 12, 2023. Circle subsequently confirmed that its USD 3.3 billion reserve deposit would become available, supporting the restoration of confidence in USDC's backing arrangements. The sequence illustrates the importance of banking-system liquidity, reserve accessibility, and institutional intervention in limiting disruptions within interconnected digital asset markets. The available case evidence does not establish that decentralized financial activity caused the original failure of SVB.

Table 4. Documented Financial Events Associated with the Silicon Valley Bank–USDC Crisis

Indicator or event	Documented observation
SVB closure	March 10, 2023
USDC reserves deposited at SVB	USD 3.3 billion
Approximate share of USDC reserves affected	8%
USDC lowest reported secondary-market price	Approximately USD 0.86
Additional affected stablecoin	DAI
United States depositor-protection announcement	March 12, 2023
Circle confirmation of reserve accessibility	March 12, 2023

The Silicon Valley Bank case provides evidence of financial risk transmission from a regulated banking institution toward interconnected stablecoin and decentralized financial markets. The principal transmission mechanism involved the exposure of USDC reserves to a failed commercial bank, followed by uncertainty concerning reserve accessibility and immediate token redemption. Market participants responded to the perceived deterioration in reserve liquidity through increased selling activity, generating a substantial deviation between the secondary-market price of USDC and its intended one-dollar value. The subsequent

movement of DAI demonstrates how exposure to a shared collateral asset can transmit disturbances between distinct digital financial arrangements. The observed sequence highlights the dependence of some decentralized financial activities on conventional reserve custodians and banking infrastructure. The case also indicates that blockchain-based transaction execution does not eliminate liquidity risk arising from off-chain financial relationships. Automated financial arrangements may transmit market pressure rapidly when their stability depends on external assets whose accessibility becomes uncertain during institutional disruptions.

The recovery of stablecoin markets following the SVB crisis illustrates how institutional intervention can influence financial confidence across interconnected financial systems. United States financial authorities announced depositor-protection measures intended to preserve confidence in the banking system and prevent broader disturbances associated with the failure of SVB and Signature Bank. These measures reduced uncertainty regarding access to affected bank deposits, including the reserves supporting USDC. The subsequent restoration of stablecoin prices indicates that confidence in reserve backing and redemption arrangements remained important determinants of market stability. The intervention illustrates a distinctive characteristic of financial interconnectedness: decentralized digital assets may rely indirectly on public regulatory mechanisms designed primarily to safeguard conventional financial institutions and depositors. The case does not demonstrate that decentralized protocols received direct bank-style guarantees. Its significance lies in showing that stabilizing the conventional banking infrastructure supporting reserve assets can also reduce disturbances in associated digital financial markets.

The combined descriptive and case-study evidence indicates that decentralized finance has developed into a significant segment of digital financial activity while retaining characteristics that distinguish it from traditional banking institutions. Historical TVL observations demonstrate considerable fluctuations in decentralized market participation, including rapid expansion, sharp contraction, and subsequent recovery. The concentration of lending activity among leading protocols further indicates that technological decentralization does not necessarily produce economically dispersed financial risk. Comparisons with traditional banking reveal differences in capital structures, liquidity management, governance arrangements, and financial safeguards that complicate simple assessments of relative stability. The SVB–USDC episode provides evidence of cross-system vulnerability, particularly through reserve exposure and liquidity dependence. The observations support the interpretation that DeFi and banking institutions are not entirely isolated financial systems. Their interactions may create competitive opportunities, operational dependencies, and channels through which disturbances can spread. The available data do not establish whether the net effect of DeFi expansion on conventional banking stability is positive, negative, or statistically significant.

The overall findings suggest that the relationship between DeFi development and traditional banking stability is conditional on the structure and intensity of financial interconnectedness. Decentralized applications may introduce alternative mechanisms for financial transactions while simultaneously depending on conventional institutions for reserve management, asset custody, fiat settlement, and related financial services. Market growth alone therefore provides an incomplete basis for evaluating systemic financial implications. The observed concentration of decentralized lending and the transmission of banking liquidity disturbances into stablecoin markets indicate the importance of examining shared financial exposures rather than treating technological decentralization as equivalent to complete

institutional independence. The comparative assessment provides a basis for further analysis of financial competition, liquidity vulnerability, and cross-system risk transmission. A definitive evaluation of the impact of DeFi on traditional banking stability requires matched country-level financial data, reliable measures of institutional exposure, and appropriately specified econometric analysis. The present findings establish observable market patterns and documented mechanisms but leave the direction, magnitude, and statistical significance of the proposed relationship unresolved.

The findings of this study indicate that the development of Decentralized Finance (DeFi) has introduced significant changes to the structure and operation of digital financial markets, although its implications for traditional banking stability remain conditional on the degree of financial interconnectedness. The descriptive analysis of total value locked (TVL) during 2020–2025 demonstrates substantial fluctuations in decentralized financial activity, reflecting periods of rapid market expansion, contraction, and subsequent recovery. These movements suggest that DeFi development is influenced by changes in digital asset valuations, market liquidity, investor participation, and financial market confidence. The observed volatility also indicates that the expansion of decentralized financial services does not necessarily correspond to a continuous improvement in financial resilience. Traditional banking institutions operate within more established prudential frameworks, whereas decentralized protocols frequently depend on collateralized transactions, automated execution, and market-based liquidity arrangements. The comparative findings therefore suggest that DeFi represents an evolving form of financial intermediation with distinctive operational characteristics rather than a straightforward replacement for conventional banking institutions.

The comparative assessment of financial stability indicators reveals important differences between traditional banks and decentralized financial platforms in their approaches to liquidity management, financial risk absorption, institutional governance, and regulatory accountability. Conventional banking institutions maintain capital buffers, liquidity reserves, and supervisory reporting mechanisms intended to reduce financial vulnerabilities and support institutional continuity. Decentralized financial protocols, in contrast, frequently rely on smart contract execution, collateral requirements, liquidation mechanisms, and the availability of liquidity within blockchain-based markets. The descriptive results also indicate that decentralized lending activity can exhibit substantial concentration among leading protocols, suggesting that technological decentralization does not necessarily eliminate the concentration of financial resources or operational influence. These institutional differences demonstrate that banking stability cannot be assessed adequately through market expansion alone. A comprehensive evaluation requires consideration of liquidity conditions, asset quality, governance structures, and the capacity of financial arrangements to absorb adverse market developments.

The examination of the Silicon Valley Bank (SVB) collapse and the subsequent USD Coin (USDC) disruption provides a documented example of financial interconnectedness between conventional banking infrastructure and digital asset markets. Circle’s reported exposure of approximately USD 3.3 billion in USDC reserves to SVB contributed to uncertainty regarding reserve accessibility after the bank’s closure in March 2023. The resulting decline in USDC’s secondary-market price demonstrated how a banking liquidity disturbance could influence the stability of a digital asset used within decentralized financial applications. The disruption also affected interconnected stablecoin arrangements, illustrating how shared collateral and financial dependencies may transmit uncertainty across digital

financial platforms. The episode is particularly significant because the original financial disturbance originated within a traditional bank rather than a decentralized protocol. This distinction indicates that interactions between decentralized and conventional financial systems are multidirectional, with potential vulnerabilities arising from the institutional dependencies connecting them.

The overall findings suggest that the relationship between decentralized financial development and banking stability is more complex than a direct association between technological innovation and institutional fragility. DeFi may introduce competitive alternatives for selected financial services while simultaneously creating opportunities for cooperation, technological adaptation, and infrastructure development within established financial institutions. The available evidence identifies potential channels of financial risk transmission, particularly those involving stablecoins, reserve custody, liquidity dependence, and concentrated protocol activity. The descriptive comparisons and case-study observations do not establish a statistically significant effect of DeFi expansion on banking-sector stability because the proposed panel regression analysis has not yet been completed. The findings are therefore most appropriately interpreted as evidence of observable market developments and plausible financial transmission mechanisms. Their significance lies in demonstrating that the financial stability implications of decentralized innovation depend on institutional exposure, market structure, regulatory conditions, and the extent of interaction between decentralized applications and conventional financial institutions.

The findings are consistent with the conceptual analysis presented by Schär (2021), who described decentralized finance as a blockchain-based financial architecture capable of reproducing selected financial services through open, programmable, and interoperable protocols. Schär emphasized that smart contracts may improve financial accessibility, transparency, and transaction efficiency while introducing technological and operational vulnerabilities. The present study supports this perspective by identifying both the innovative characteristics of decentralized financial applications and the financial stability challenges associated with their operation. The observed expansion of DeFi market activity illustrates the capacity of decentralized protocols to attract financial participation, while fluctuations in TVL demonstrate their sensitivity to market conditions. The present analysis extends this conceptual discussion by examining the relationship between decentralized financial development and the stability characteristics of conventional banking institutions. The comparison suggests that improvements in transaction automation and financial accessibility should not automatically be interpreted as improvements in systemic financial resilience.

The findings also correspond with the Financial Kar, (2026) assessment of decentralized financial vulnerabilities, particularly those associated with operational fragility, leverage, liquidity mismatches, and interconnectedness. The FSB argued that decentralized financial applications reproduce several economic functions associated with traditional finance while introducing technological arrangements that may alter the transmission and amplification of financial disturbances. The present study similarly identifies liquidity dependence, collateral management, and financial concentration as important dimensions of decentralized market stability. The comparative analysis adds an institutional perspective by distinguishing between the risk management arrangements of conventional banks and the automated mechanisms used within decentralized protocols. The findings indicate that financial vulnerabilities cannot be evaluated solely according to whether an institution operates through centralized management

or distributed blockchain infrastructure. The relevant consideration is whether financial arrangements possess effective mechanisms for managing losses, maintaining liquidity, and preventing localized disturbances from affecting interconnected markets.

The concentration of decentralized lending activity observed in the descriptive results is consistent with the analysis of the Bank for International Settlements concerning the potential divergence between technological decentralization and economic control. The BIS identified a decentralization illusion in which financial activity may become concentrated around influential governance participants, infrastructure providers, or interconnected protocols despite the use of distributed ledger technologies. The present study reinforces this interpretation by highlighting the prominence of leading lending applications within the decentralized financial ecosystem. The concentration of deposited assets among major protocols suggests that the distribution of financial influence may remain uneven even when transaction execution occurs through public blockchain networks. This finding challenges the assumption that eliminating conventional intermediaries necessarily produces a more evenly distributed financial structure. The comparative evidence instead suggests that intermediary functions may be reorganized through technological infrastructure, governance arrangements, and liquidity networks rather than eliminated completely.

The interpretation of financial interconnectedness is also consistent with the BIS assessment that DeFi-related systemic risks depend substantially on the scale of decentralized activity and the strength of its connections with traditional financial markets. The BIS reported that vulnerabilities within decentralized finance had not generated major disturbances in the broader traditional financial system during the earlier period it examined, partly because cross-system connections remained relatively limited. The present case-study evidence complements that assessment by illustrating a specific channel through which financial instability originating in conventional banking affected stablecoin markets. The SVB–USDC episode does not contradict the broader observation that DeFi-related systemic spillovers had been limited; rather, it demonstrates that particular institutional connections can become consequential even when aggregate exposure remains comparatively modest. The distinction between localized transmission and system-wide instability is essential for interpreting the findings accurately. The current evidence therefore supports a conditional understanding of financial contagion in which the direction, intensity, and consequences of risk transmission depend on the structure of financial relationships (Malandrakis, 2025; Marwah, 2026).

The findings signify a gradual transformation in the organization of financial intermediation rather than the disappearance of traditional banking functions. Decentralized protocols demonstrate that selected financial transactions can be executed through programmable infrastructure without requiring conventional intermediaries to perform every operational function. The persistence of stablecoin reserve arrangements, fiat settlement requirements, and interactions with centralized financial service providers indicates that decentralized markets continue to depend on components of the established financial system. This relationship suggests that technological decentralization should be distinguished from economic and institutional independence. Financial transactions may be distributed across blockchain networks while essential supporting activities remain concentrated within particular institutions or infrastructure providers. The results therefore point toward the emergence of a hybrid financial environment in which decentralized and traditional arrangements coexist, compete, and depend on one another. The broader significance is that future financial stability

may increasingly reflect the resilience of relationships connecting different forms of financial intermediation rather than the stability of individual institutions considered separately.

The observed fluctuations in DeFi market activity signify that technological innovation does not eliminate the behavioral and economic forces underlying financial market instability. Investor confidence, speculative expectations, collateral valuations, and liquidity preferences continue to influence decentralized financial transactions despite their reliance on automated contractual execution. The substantial contraction in decentralized asset values during periods of market stress indicates that blockchain-based arrangements remain exposed to financial cycles. Automated liquidation mechanisms may facilitate timely contract enforcement, but they may also intensify selling pressure when declining asset prices trigger simultaneous collateral adjustments. This possibility reflects a broader distinction between operational efficiency and financial resilience. A system can execute transactions rapidly and transparently without possessing sufficient mechanisms to absorb widespread losses or maintain liquidity during adverse market conditions. The findings consequently signify the need to evaluate financial technologies according to their behavior under stress rather than judging their stability primarily through technological sophistication, transaction speed, or market growth.

The concentration of decentralized lending activity signifies that the distribution of economic influence remains an important consideration within blockchain-based financial systems. Decentralization is often associated with reduced dependence on centralized decision-making and broader participation in financial governance. The observed prominence of leading lending protocols indicates that financial liquidity and market activity can nevertheless accumulate around a relatively small number of applications. Such concentration may arise from network effects, liquidity advantages, established market reputations, and interoperability with other decentralized services. Financial participants may prefer protocols offering greater liquidity and lower transaction costs, reinforcing the position of already dominant platforms. The resulting structure raises questions about the resilience of financial networks when widely used protocols experience operational failures or unexpected market disturbances. The findings therefore suggest that financial stability assessments should distinguish between the technical distribution of transaction validation and the economic concentration of assets, governance influence, and operational dependencies.

The SVB–USDC case signifies the importance of financial interdependence in understanding the boundaries between decentralized and conventional financial arrangements. The market disruption illustrates that the stability of a digital financial instrument may depend on the reliability of institutions operating outside the blockchain network where that instrument circulates. The relationship between stablecoin reserves and commercial bank deposits demonstrates that financial vulnerabilities can cross technological and institutional boundaries through ordinary financial claims. This observation challenges interpretations that portray decentralized finance as entirely insulated from traditional banking disturbances. The recovery of USDC following improvements in confidence regarding reserve accessibility also indicates that institutional credibility remains important in supporting digital financial stability. The broader implication is that financial trust has not disappeared through decentralization but has been redistributed across smart contracts, collateral arrangements, reserve custodians, and other institutional relationships. Understanding these interdependencies is essential for evaluating whether emerging financial architectures reduce systemic vulnerability or reorganize the channels through which financial instability may occur (Tekdogan, 2023).

The findings have important theoretical implications for understanding the evolution of financial intermediation within increasingly technology-driven markets. Traditional financial intermediation theory emphasizes the role of banking institutions in addressing information asymmetry, mobilizing savings, providing liquidity, and allocating credit to productive activities. Decentralized finance challenges certain operational assumptions of this framework by demonstrating that programmable protocols can perform selected transaction and collateral-management functions without relying on conventional organizational structures. The findings nevertheless indicate that removing an intermediary from transaction execution does not necessarily eliminate the economic functions associated with intermediation. Liquidity coordination, asset custody, governance, risk assessment, and confidence maintenance continue to influence the operation of financial markets. The theoretical significance of this observation is that financial intermediation should be understood in functional rather than exclusively institutional terms. DeFi represents a reconfiguration of certain intermediary functions, while the stability of the resulting arrangements depends on how those functions are distributed and governed.

The practical implications for traditional banking institutions concern the need to understand decentralized financial technologies as sources of both potential competition and emerging financial exposure. Conventional banks may encounter alternative lending mechanisms, digital asset payment services, and programmable financial products that influence customer expectations and the delivery of financial services. The results do not establish that DeFi has systematically weakened banking profitability, liquidity, or capital adequacy. They nevertheless indicate that banks should evaluate their relationships with digital asset businesses, stablecoin issuers, custodial service providers, and other entities connecting conventional finance with blockchain-based markets. Institutional risk management may need to incorporate additional assessments of concentration risk, operational dependencies, counterparty exposure, and rapid changes in digital asset liquidity. Technological adaptation may also create opportunities for improved transaction processing and financial product development. The practical value of these findings lies in supporting selective innovation accompanied by risk management procedures appropriate to the characteristics of decentralized financial activities (Aydemir, 2022).

The regulatory implications are particularly significant because decentralized financial applications challenge supervisory arrangements traditionally designed around clearly identifiable legal entities and centralized management structures. Conventional prudential regulation generally establishes requirements for institutional capital, liquidity, governance, reporting, and accountability. DeFi arrangements may distribute these responsibilities across protocol developers, governance participants, users, and infrastructure providers, making the identification of relevant supervisory responsibilities more complicated. The Financial Stability Board's analysis emphasizes that financial vulnerabilities associated with decentralized activities require attention to their economic functions and potential transmission channels rather than relying exclusively on technological classifications. The present findings support this perspective by identifying stablecoin reserve relationships, collateral concentration, and institutional interconnectedness as relevant areas for oversight. Regulatory frameworks should therefore consider the activities performed, the risks created, and the entities capable of exercising meaningful control. Such an approach may support financial innovation while

reducing opportunities for significant financial vulnerabilities to remain outside effective supervisory arrangements.

The implications for financial stability monitoring concern the limitations of evaluating decentralized markets and traditional banking institutions through separate analytical frameworks. Conventional indicators such as capital adequacy, nonperforming loans, and liquidity ratios provide information about banking-sector resilience, while blockchain analytics offer measures of protocol deposits, collateral composition, asset flows, and liquidation activity. The findings suggest that these information sources may become more useful when examined together with measures of institutional interconnectedness. Stablecoin reserve exposures, bank relationships with digital asset firms, and common financial assets may provide additional insight into potential channels of financial disturbance. Integrated monitoring could help supervisors distinguish disturbances that remain concentrated within decentralized markets from those capable of affecting conventional financial institutions. The significance of this approach is not that every DeFi market fluctuation represents a systemic financial threat, but that certain exposures may require attention even when aggregate decentralized market activity remains relatively small. Effective monitoring therefore depends on identifying financially meaningful connections rather than responding indiscriminately to changes in digital asset prices.

The substantial fluctuations observed in decentralized financial activity can be explained partly by the close relationship between DeFi market valuations and broader cryptocurrency market conditions. Many decentralized protocols employ cryptoassets as collateral, liquidity reserves, or instruments for financial transactions, making their reported asset values sensitive to changes in cryptocurrency prices. Rising market valuations can increase the monetary value of deposited collateral and support additional lending or liquidity provision, while declining prices can reduce collateral coverage and trigger liquidation requirements. Investor expectations and speculative market participation may reinforce these fluctuations through changes in demand for decentralized financial products. The programmable nature of DeFi allows financial adjustments to occur rapidly, but automation does not necessarily reduce the underlying sensitivity of market participants to financial uncertainty. The observed expansion and contraction of TVL therefore reflect a combination of market valuation changes, capital movements, and changing financial incentives. This explanation is consistent with the BIS assessment that leverage, interconnectedness, and procyclical liquidation arrangements represent important vulnerabilities in decentralized finance.

The differences between decentralized financial protocols and traditional banking institutions arise from their distinct mechanisms for managing financial obligations and institutional risk. Conventional banking systems generally combine regulatory capital requirements, deposit relationships, liquidity supervision, and institutional governance structures intended to maintain financial continuity. DeFi protocols often replace certain discretionary institutional processes with predetermined contractual rules enforced through blockchain networks. Automated liquidation arrangements may reduce delays in enforcing collateral requirements, but they may also constrain the ability of financial participants to manage exceptional circumstances through negotiated restructuring or discretionary liquidity support. Banking institutions may possess mechanisms for adjusting loan terms, managing funding relationships, and responding to supervisory interventions, although these mechanisms cannot guarantee stability during severe financial disturbances. The observed differences

therefore arise not simply from the use of centralized or decentralized technology but from the distribution of decision-making authority and financial risk absorption capacity. The findings suggest that resilience depends on the interaction between financial governance, available liquidity, contractual flexibility, and the institutional arrangements supporting each financial system (Bhusan, 2023).

The concentration of financial activity within leading decentralized lending protocols can be explained through network effects and the economic advantages associated with established liquidity pools. Financial participants generally benefit from markets offering reliable transaction execution, competitive borrowing conditions, sufficient collateral availability, and relatively low trading costs. Protocols attracting larger amounts of capital may provide stronger liquidity conditions, encouraging additional participation and reinforcing their existing market position. Interoperability between decentralized applications may further increase dependence on dominant protocols when other financial products rely on their assets or services. Governance-token distributions and infrastructure arrangements may also contribute to uneven influence over protocol development and operational decisions. These characteristics explain why decentralized financial architecture does not necessarily produce an equally decentralized distribution of economic activity. The BIS discussion of the decentralization illusion provides a relevant interpretation, emphasizing the persistence of governance requirements and concentration tendencies within blockchain-based financial systems. The present findings are consistent with that explanation, although a more detailed examination of protocol ownership and governance would be necessary to measure the extent of actual decision-making concentration.

The transmission of financial instability from Silicon Valley Bank to USDC markets occurred because the stablecoin's economic credibility depended partly on the availability and perceived safety of its reserve assets. A fiat-backed stablecoin seeks to maintain a relatively stable value by supporting redemption through financial assets held within or connected to conventional financial institutions. The closure of SVB created uncertainty about the immediate accessibility of a portion of USDC reserves, encouraging market participants to reassess redemption risk and sell tokens in secondary markets. The resulting price deviation reflected a loss of confidence in the stablecoin's short-term liquidity arrangements rather than a failure of the blockchain network to execute transactions. Exposure to USDC within other decentralized applications allowed this uncertainty to affect interconnected digital assets and liquidity pools. Confidence improved following official measures protecting affected bank depositors and subsequent clarification concerning reserve accessibility. The episode illustrates why the financial resilience of decentralized applications cannot always be separated from the stability of traditional financial institutions supporting their underlying assets. It also demonstrates that credible liquidity arrangements and institutional confidence remain important determinants of financial stability despite the increasing automation of financial transactions.

The findings indicate that future research should prioritize the construction of integrated datasets capable of measuring the relationship between decentralized financial development and traditional banking stability more precisely. Historical DeFi indicators provide useful information about market activity, but global TVL alone cannot establish how individual national banking systems are exposed to decentralized financial markets. Subsequent empirical investigations should therefore incorporate country-specific measures of digital asset exposure, stablecoin reserve relationships, institutional participation, and relevant regulatory

characteristics wherever reliable information is available. Traditional banking stability should be measured through established prudential indicators, including capital adequacy, liquidity ratios, asset quality, and profitability. Longitudinal analysis may then be used to evaluate whether changes in decentralized financial activity are associated with banking stability after accounting for macroeconomic conditions and institutional differences. Research designs capable of addressing reverse causality and common financial shocks would be particularly valuable. Such investigations could provide a stronger basis for distinguishing the competitive consequences of financial innovation from actual channels of systemic risk transmission.

The findings also indicate a need for more detailed examination of the mechanisms connecting decentralized protocols, stablecoin issuers, and conventional financial institutions. Future studies could investigate financial transmission through reserve custody, shared collateral assets, institutional investment exposure, and liquidity dependencies between centralized and decentralized platforms. Event-study approaches may provide useful evidence concerning how banking disturbances affect digital asset markets and how decentralized financial disruptions influence exposed traditional institutions. Network analysis could further identify concentrations of financial relationships that are not immediately visible through aggregate market indicators. The SVB–USDC episode provides a relevant starting point, but additional cases would be necessary to determine whether similar mechanisms operate consistently under different financial and regulatory conditions. Comparative research across jurisdictions may also clarify how variations in supervisory frameworks influence financial interconnectedness. These approaches would extend the current descriptive findings by providing more direct evidence concerning the conditions under which financial disturbances remain localized or develop into broader institutional vulnerabilities.

The strategic implications for regulators and financial institutions involve developing governance and risk management arrangements that respond to the economic functions of decentralized financial activities. Banking supervisors should consider the significance of institutional exposures to stablecoin issuers, digital asset service providers, and financial products supported by blockchain infrastructure. Relevant policy measures may include improved disclosure of reserve composition, clearer accountability for essential financial functions, enhanced operational resilience standards, and more systematic assessment of liquidity and concentration risks. International coordination is particularly important because decentralized protocols and related financial activities frequently operate across multiple jurisdictions. The comparative review by Ocampo, Branzoli, and Cusmano (2023) demonstrates that regulatory responses to cryptoassets and decentralized finance differ across jurisdictions, reflecting variations in supervisory priorities and institutional arrangements. The present findings support the importance of consistent risk identification without assuming that every decentralized application should be regulated identically to a conventional commercial bank. A proportionate approach should consider the activity undertaken, the degree of financial interconnectedness, and the potential consequences of institutional or technological failure.

The broader direction emerging from this study is the development of a financial stability framework that recognizes decentralized and traditional financial systems as potentially interconnected components of an evolving financial environment. The descriptive findings demonstrate that decentralized finance has experienced substantial market development while remaining exposed to financial volatility, liquidity concentration, and institutional dependencies. The comparative analysis indicates that traditional banking safeguards and

decentralized technological mechanisms address financial risks through different arrangements, each presenting particular strengths and limitations. The SVB–USDC case confirms the relevance of examining financial relationships that extend beyond conventional institutional boundaries. The contribution of this study lies in integrating these observations into a comparative interpretation of financial stability based on competition, interconnectedness, and potential risk transmission. The absence of completed panel regression estimates limits conclusions concerning the direction and magnitude of DeFi's effect on banking stability, making further quantitative verification essential. The evidence nevertheless supports a substantive conclusion: the financial stability implications of decentralized innovation depend less on the mere existence of blockchain-based alternatives than on the structure of financial exposures, the effectiveness of risk management arrangements, and the capacity of interconnected institutions to withstand financial disturbances.

CONCLUSION

The findings of this study reveal that the relationship between Decentralized Finance (DeFi) and traditional banking stability is characterized by financial interconnectedness, institutional differences, and potential risk transmission rather than a straightforward process of financial substitution. The comparative analysis identifies substantial fluctuations in DeFi market activity during 2020–2025, demonstrating that decentralized financial development remains sensitive to market volatility, liquidity conditions, and investor confidence. The most distinctive finding concerns the multidirectional nature of financial vulnerability, as illustrated by the Silicon Valley Bank collapse and the subsequent disruption of USD Coin (USDC) in March 2023. This event demonstrates that financial instability originating within conventional banking institutions can affect decentralized financial markets through reserve exposure and liquidity dependencies. The analysis also indicates that technological decentralization does not necessarily eliminate financial concentration or dependence on conventional financial infrastructure. These findings suggest that the implications of DeFi for banking stability depend primarily on the structure of financial relationships, institutional exposure, and the capacity of interconnected financial arrangements to withstand market disturbances. The available evidence, however, does not establish a statistically significant causal effect of DeFi expansion on banking stability.

The principal contribution of this research lies in its integrated conceptual and comparative approach to examining decentralized financial development and traditional banking stability. The study advances the understanding of financial intermediation by identifying three interconnected mechanisms through which DeFi may influence conventional financial institutions: financial competition, institutional interconnectedness, and risk transmission. This framework extends conventional discussions of financial innovation by emphasizing that blockchain-based financial systems may reorganize intermediary functions without eliminating the economic dependencies associated with liquidity provision, asset custody, and financial governance. The methodological contribution involves combining historical DeFi market indicators, established banking stability dimensions, institutional comparisons, and documented financial events within a unified analytical perspective. The study also distinguishes between technological decentralization and economic risk distribution, providing a more differentiated basis for evaluating financial resilience. These contributions offer a conceptual foundation for future empirical investigations and provide practical insights

for financial institutions and regulators seeking to understand the implications of decentralized financial innovation. The proposed framework should nevertheless be regarded as an analytical contribution requiring further empirical validation rather than an already validated predictive model.

The limitations of this study primarily concern the availability, comparability, and geographical specificity of secondary financial data. The reliance on historical DeFi market indicators and selected institutional evidence restricts the ability to determine the magnitude and direction of DeFi's effects on banking stability across different countries. Global total value locked does not adequately represent individual banking systems' exposure to decentralized financial activities, while differences in institutional structures complicate direct comparisons between conventional prudential indicators and protocol-level financial measures. The absence of completed country-level panel regression estimates also prevents definitive conclusions regarding statistical significance and causal relationships. The Silicon Valley Bank–USDC case provides valuable evidence of financial interconnectedness but cannot independently establish the prevalence of similar transmission mechanisms across other financial environments. Future research should incorporate country-specific DeFi exposure measures, longitudinal banking datasets, and robust econometric techniques to investigate these relationships more precisely. Comparative analyses across regulatory jurisdictions, event studies examining financial market disturbances, and network-based assessments of stablecoin and banking exposures may further clarify the conditions under which decentralized financial innovation contributes to financial resilience or generates systemic vulnerabilities. These investigations are essential for developing empirically supported financial stability frameworks that accommodate the continuing evolution of decentralized and traditional financial systems.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used Google Gemini to assist inimproving grammar, language quality, and overall readability of the text. After using this tool, the author(s) Carefully reviewed and edited the content as necessary and take full responbility for the content of the publication.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.
Author 4: Writing - review and editing.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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