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Merger and Acquisition Regulation and Financial Stability in Iranian Banks

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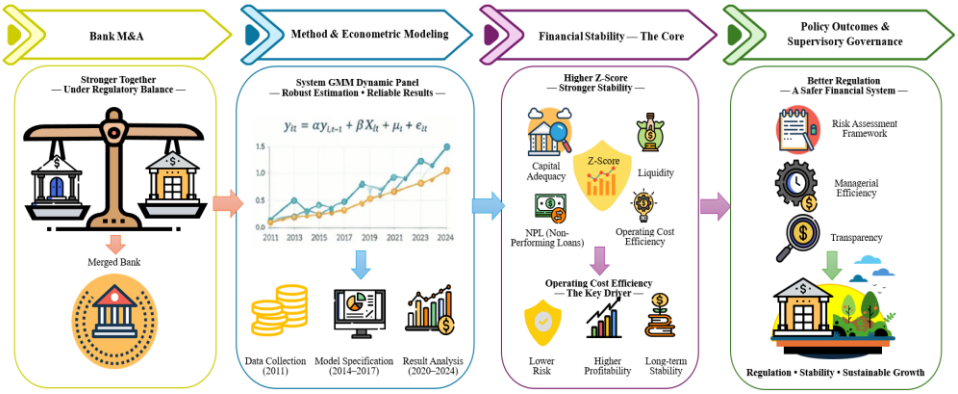
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A B S T R A C T

This study investigates the impact of banking merger and acquisition (M&A) regulations on the financial stability of Iranian banks, a critical concern given the sector's recent struggles with balance sheet imbalances, liquidity constraints, and macroeconomic volatility. Employing an analytical-quantitative approach, this research utilizes panel data from ten selected banks between 2011 and 2024 (1390–1403), applying the system generalized method of moments to assess the relationship between M&A frameworks and stability. The model measures financial stability via the Z-score index, incorporating capital adequacy, liquidity, non-performing loans, and operating costs as explanatory variables. Empirical results reveal that, among these factors, operating costs exert a statistically significant positive effect on financial stability, while other variables lacked sufficient significance. Model validation confirmed the suitability of instrumental variables and the absence of second-order autocorrelation. Ultimately, these findings suggest that the efficacy of M&A policies is contingent upon robust regulatory quality, managerial efficiency, and rigorous cost control. Consequently, the study emphasizes that strengthening post-merger supervision, improving information transparency, and establishing a comprehensive risk assessment framework are essential policy prerequisites for fostering a sustainable and resilient banking sector in the face of ongoing economic pressures.



1. Introduction

The banking industry, as the vital artery of the economy, plays an unparalleled role in the optimal allocation of resources, capital mobilization, and the facilitation of financial transactions. However, the successive occurrence of financial crises and the accumulation of frozen assets have made the restructuring of financial intermediaries an inevitable necessity. In this context, the approach of Mergers and Acquisitions (M&A) is recognized as one of the most efficient strategic tools for financial restructuring, efficiency enhancement, and overcoming accumulated imbalances. By creating operational synergies, reducing sunk costs, and diversifying asset portfolios, this approach provides a suitable platform for reviving unbalanced banks and enhancing their competitive power in the money market [1,2].

In recent years, the Iranian banking system has faced numerous structural challenges, including the accumulation of non-performing loans, insufficient capital, and maturity mismatches between assets and liabilities, which threaten the financial stability of the entire network [3,4]. The banks studied in this research include a diverse spectrum of state-owned commercial banks (Melli and Sepah), state-owned specialized banks (Maskan and Export Development), privatized and private banks (Mellat, Tejarat, Pasargad, Parsian, and Iran Zamin), as well as Qard al-Hasan banks (Mehr Iran), each grappling with varying degrees of liquidity crisis and capital erosion. In this context, balance sheet imbalances have made the concept of financial stability and its assessment through health indicators, such as capital adequacy ratios and the Z-score index, a focal point for monetary policymakers.

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Global experience shows that the successful implementation of the M&A process is impossible without a coherent, dynamic, and efficient regulatory framework from the Central Bank. Banking regulation is tasked with preventing the contagion of systemic risk by formulating strict prudential regulations, continuously monitoring post-merger risks, and requiring banks to comply with international standards such as those of the Basel Committee. In the Iranian economy, the lack of comprehensive and localized guidelines in the field of bank mergers has doubled the operational and legal risks of this process; a matter that underscores the necessity of redefining the Central Bank's regulatory role in order to protect depositors' rights and maintain money market stability [5-7].

Given the sanction conditions, structural inflation, and the heavy reliance of the real sector of the Iranian economy on bank financing, the sustainability and stability of the banking system play a vital role in maintaining the country's economic tranquility. In such an environment, addressing the issue of M&A and scientifically measuring its effects on financial stability is not merely a choice, but a strategic necessity for policymakers. A review of past experiences, especially the major merger of banks affiliated with the armed forces into Sepah Bank that occurred in the late 1390s, shows that analyzing balance sheet implications and evaluating the Central Bank's regulatory capacity in curbing post-merger imbalances can prevent the waste of public resources and the occurrence of larger crises [1,4,6]. The broader macroeconomic environment is also shaped by energy-market programs and policy decisions, including analyses of U.S. party energy programs and the global oil market. and of the effects of U.S. government policies on the security of Iranian crude-oil markets [8,9].

The main objective of this study is to measure and analyze the direct and indirect effects of regulatory indicators and M&A events on the financial stability of 10 selected Iranian banks over the period from 1390 to 1403. Accordingly, the central research question is formulated as follows: "What effect has the regulation of bank mergers and acquisitions had on the financial stability of selected Iranian banks (including Tejarat, Export Development, Mellat, Melli, Sepah, Pasargad, Parsian, Mehr Iran, Iran Zamin, and Maskan banks) during the 1390-1403 period?" In this pursuit, efforts are made to explain the effectiveness of regulatory laws on key stability variables, including capital adequacy ratios and bank profitability fluctuations under merger conditions.

Although numerous studies have been conducted in the field of bank mergers or financial stability in Iran, examining the simultaneous effects of "prudential regulation" and "merger events" on financial stability while focusing on the institutional diversity of banks (state, private, and Qard al-Hasan) over a long 14-year period (1390-1403) is a clear research gap that this study addresses. The main innovation of this paper is the design of a composite index for regulation and the application of panel data models using EViews 12 software to control for individual bank heterogeneities. This method allows for a more accurate assessment of the dynamic behavior of bank balance sheets in the face of regulatory laws and structural M&A developments.

1.1. Theories of Mergers and Acquisitions in Banking

Mergers and acquisitions in the banking sector serve as a key tool for ensuring financial stability and rectifying structural flaws beyond a mere firm-level strategy for increasing market share, and due to the systemic role of banks in credit creation and the safeguarding of public deposits, they directly impact indicators such as capital adequacy, asset quality, and operational efficiency, so that in Iran's economy, with the emergence of challenges like the accumulation of non-performing loans and unbalanced balance sheets in the 2010s, this mechanism became an inevitable necessity for the monetary policymaker, culminating in the merger of armed forces-affiliated banks and credit institutions into Bank Sepah as one of the largest corrective measures in the history of Iran's banking system for risk management and systemic stability enhancement [10-12].

Mergers and acquisitions in banking are explained within the framework of various theories. These theories seek to explain why banks move toward merger, what benefits are expected from it, and under what conditions merger may lead to improvement or weakening of financial stability. Among the most widely used theories, three approaches—"synergy hypothesis," "market power hypothesis," and "diversification hypothesis"—occupy a special place [13-15]. Accordingly, Table 1 addresses these theories.

Table 1. Theories of Mergers and Acquisitions in Banking

Theoretical Axis	Sub-axis	Summary Definition and Mechanism	Potential Positive Effects	Risks and Limitations	Regulatory Considerations
Synergy Hypothesis	Operational Synergy	Reduction of costs and increase in productivity through the elimination of overlaps and the integration of systems.	Reduction in service costs, economies of scale, and improvement in operational performance.	Transition costs, technology integration, retraining, and organizational culture change.	Supervision of integration implementation and operational risk management.
	Financial Synergy	Improvement of the capital structure and reduction of financing costs.	Increased capital adequacy, liquidity, and lending capacity.	Transfer of losses and low-quality assets to the sound bank.	Accurate asset valuation and the requirement for capital increases.
	Managerial Synergy	Transfer of managerial capabilities and internal controls from the stronger bank to the weaker bank.	Management reform, reduction of inefficiency, and strengthening of financial discipline.	Transfer of managerial weaknesses to the entire merged bank.	Assessment of management quality and post-merger implementation capacity.
Market Power Hypothesis	Market Power Creation Mechanism	The merger is undertaken to increase market share and pricing power.	Stabilization of profit margins and reduction of destructive competition under certain conditions.	Reduced competition, rent-seeking, weakened innovation, and increased customer costs. Abuse of a dominant position and increased systemic risk.	Antitrust assessment and monitoring of anticompetitive behavior.
Diversification Hypothesis	Diversification and Credit Risk	Diversification of the lending portfolio reduces dependence on a single sector.	Reduction of credit concentration and sectoral vulnerability.	Superficial diversification without genuine risk control.	Monitoring the composition and quality of the credit portfolio.
	Income Diversification	Increase in non-interest income sources, such as fees and foreign exchange services.	Reduced dependence on interest income and increased profit stability.	Entry into new areas without adequate infrastructure and increased operational risk.	Supervision of infrastructure, internal controls, and income transparency.
	Limitations of Diversification	Diversification does not always reduce risk and may make the bank more complex.	It contributes to stability only when supported by strong risk management.	Greater complexity, weakness in risk identification, and difficulty in supervision.	Strong internal controls and continuous risk monitoring.

Source: Refs [13-15]

1.2. Banking Regulation and Its Role in Mergers and Acquisitions

Banking regulation, as a vital mechanism for preserving the health of the financial system and protecting deposits, is implemented through strict supervisory standards such as compliance with the capital adequacy ratio (above 8 percent according to Basel rules), continuous assessment of health indicators, and monitoring of stability indicators to control systemic risk. Bank mergers and acquisitions without such strict supervision are accompanied by the risk of transferring crises from one entity to another; therefore, to ensure financial sustainability, a precise assessment of hidden liabilities, non-performing loans, and liquidity conditions in the pre-merger, during-merger, and post-merger stages is mandatory to prevent the contagion of potential failures to the broader economy [2,16,17]. Accordingly, banking regulation and its role in mergers and acquisitions are presented in Table 2.

Table 2. Banking Regulation and Its Role in Mergers and Acquisitions

Main Axis	Sub-axis	Core Concept and Logic	Link to Bank Merger	Effect on Financial Stability	Regulatory Notes
Basel regulations	Basel I	The first international capital adequacy framework, developed in 1988, emphasizing that banks must hold minimum capital against risk-weighted assets	In bank mergers, the combination of assets and liabilities can change the merged bank's capital adequacy ratio	If the merged bank still has sufficient capital after absorbing the target bank's assets, its resilience increases	Before the merger, the capital adequacy ratio of the new bank should be calculated based on risk-weighted assets
	Capital adequacy ratio in Basel I	The capital adequacy ratio shows what share of risk-weighted assets is covered by bank capital; the Basel I minimum standard is 8 percent	The entry of the target bank's high-risk assets can increase the denominator and reduce the acquiring bank's capital adequacy	Lower capital adequacy can increase the bank's inability to absorb losses	The central bank should estimate the merged bank's required capital before the merger and require recapitalization if needed
	Basel II	A more developed framework than Basel I that, in addition to minimum	A merger changes not only credit risk but also operational,	Comprehensive risk assessment can prevent crisis	The regulator should assess not only capital, but also the merged

		capital requirements, emphasizes prudential supervision and market discipline	technological, legal, compliance, and reputation risk	transmission and operational disruption	bank's managerial, operational, and control capacity
	Three pillars of Basel II	Includes minimum capital requirements, the supervisory review process, and market discipline through information disclosure	In bank mergers, disclosure and prudential supervision play an important role in reducing ambiguity and maintaining public trust	Greater transparency can prevent deposit outflows, market rumors, and instability	The central bank should manage disclosure of financial information, asset quality, and the merger plan in a controlled and transparent way
	Operational risk in Basel II	Risk arising from human error, system failures, internal processes, or external events	Integration of IT systems, transfer of accounts, contract harmonization, and branch consolidation can be sources of operational risk	Service disruption can reduce depositor confidence and threaten liquidity stability	The regulator should review the operational risk and IT management plan before the merger
	Basel III	Designed after the 2008 global financial crisis and emphasizes capital quality, leverage ratio, liquidity, resilience, and systemically important banks	The merged bank usually becomes larger, more complex, and more systemically important	Compliance with Basel III can increase the bank's resistance to liquidity, capital, and market shocks	The central bank should monitor the merged bank's capital, liquidity, leverage, and funding structure
	Capital quality in Basel III	Basel III emphasizes higher-quality capital, especially core capital	Merging an unhealthy bank with the acquiring bank may increase nominal capital but weaken the true quality of capital	High-quality capital strengthens loss-absorbing capacity	Identifying hidden losses, fictitious assets, and reserve shortages before the merger is essential
	Leverage ratio	The leverage ratio was introduced to control excessive asset growth relative to capital	A merger may rapidly expand the bank's balance sheet	A sharp increase in leverage can make the bank more vulnerable to shocks	The regulator should prevent balance sheet expansion without sufficient capital backing
	Liquidity coverage ratio	A measure of a bank's ability to meet net cash outflows over 30 days using high-quality liquid assets	During a merger, depositor distrust may increase deposit withdrawals	An adequate liquidity coverage ratio can reduce the likelihood of a liquidity crisis	The central bank should assess high-quality liquid assets and potential deposit outflows under stress scenarios
	Net stable funding ratio	A measure of the long-term stability of a bank's funding sources	A merger may alter the funding structure and increase dependence on unstable sources	An appropriate net stable funding ratio strengthens funding stability and reduces structural liquidity risk	The central bank should assess the composition of deposits, liabilities, and stable funding of the new bank
	Application of Basel regulations in Iran	Full implementation of Basel regulations in Iran faces challenges such as frozen assets, non-performing loans, directed lending obligations, administered pricing, and weak transparency	Despite implementation challenges, the prudential logic of Basel still applies to bank merger assessment	Using Basel logic can prevent nominal mergers and transfer of imbalance	Merging an unhealthy bank should be accompanied by recapitalization, asset transparency, and financial restructuring
	Capital adequacy	The bank's ability to absorb potential losses and continue operations	Absorption of accumulated losses, low-quality assets, or doubtful receivables of the target bank can reduce the new bank's capital adequacy	Higher capital adequacy increases resilience and lowers bankruptcy risk	Before the merger, actual capital and recapitalization needs should be assessed
	Asset quality	Asset quality is measured through non-performing loans, frozen assets, loan concentration, and provisioning	One of the most important merger risks is transferring low-quality assets to the acquiring bank	Poor asset quality can weaken the merged bank's profitability, capital, and liquidity	Independent asset valuation and identification of doubtful receivables before the merger are necessary
Banking health indicators	Management quality	Managers' ability to control risk, allocate resources, comply with regulations, and implement strategies	Bank mergers are complex and require professional management, organizational coordination, and strong internal controls	Weak management can create operational disruption, customer dissatisfaction, and higher risk	The central bank should assess corporate governance quality, managerial experience, and merger execution capacity
	Profitability	The bank's ability to generate sustainable profit from banking and non-banking activities	A merger can improve profitability through lower costs and higher efficiency, but may also raise transition costs and recognized losses	Sustainable profitability strengthens internal capital and reduces fragility	The merger's effects on costs, revenues, non-performing loans, and efficiency should be reviewed
	Liquidity	The bank's ability to meet deposit withdrawals and short-term obligations	Uncertainty during the merger can worry depositors and trigger funding outflows	Adequate liquidity prevents the merger from turning into a trust crisis and deposit crisis	The central bank should manage emergency liquidity support, communication, and deposit flow monitoring
	Sensitivity to market risk	The bank's vulnerability to changes in interest rates, exchange rates, asset prices, and macroeconomic conditions	A merger may increase the size of assets and liabilities sensitive to market movements	High sensitivity to market shocks can threaten the bank's stability	Stress scenarios for interest rate, exchange rate, and asset price shocks are essential for the merged bank
	Before the merger	The central bank should review the financial, operational, ownership, and supervisory status of the banks involved	This stage is important for identifying risks, setting merger conditions, and preventing imbalance transfer	Accurate pre-merger assessment prevents the creation of a larger but riskier bank	Reviewing capital adequacy, asset quality, liquidity, corporate governance, market concentration, and balance sheet restructuring plans is necessary
	Preventing a nominal merger	A nominal merger means a change in name and legal structure without fixing financial problems, fictitious assets, or weak risk management	Such a merger only changes the appearance and transfers prior risks to the new bank	A nominal merger can increase systemic risk	The central bank should condition the merger on real balance sheet repair, recapitalization, and asset transparency
Role of the central bank	During the merger	The central bank must supervise the transfer of assets, liabilities, deposits, contracts, employees, systems, and customer rights	This is the most operationally sensitive stage of the merger	Continuity of banking services and maintenance of public trust prevent deposit outflows and instability	Monitoring account transfer, public communication, liquidity control, and technology risk is essential
	Public communication management	Transparent and controlled communication is necessary to prevent rumors and depositor concerns	In bank mergers, informational ambiguity can cause a bank run	Public trust is one of the main conditions for the liquidity stability of the merged bank	The central bank should provide a single, clear, and reassuring message about depositor rights
	After the merger	The central bank should continuously evaluate the merged bank's performance	Merger success is not only measured by legal completion, but by the new bank's financial and operational performance	Post-merger supervision can prevent renewed risk accumulation and imbalance	Monitoring capital adequacy, profitability, liquidity, non-performing loans, balance sheet growth, and merger objectives is necessary
Iran's experience	Merger of armed forces-affiliated banks into Bank Sepah	One of the largest and most important bank merger cases in Iran in the late 2010s	This merger involved transferring several banks and credit institutions into Bank Sepah in terms of branches, deposits, customers, employees, and systems	This experience can have dual effects on financial stability, both restructuring and risk transfer	A precise assessment of the merger's effects on banking health indicators and financial stability is necessary

Institutional restructuring	The merger aimed to reduce institutional fragmentation and concentrate supervision over affiliated banks and institutions	The multiplicity of affiliated financial entities could make effective supervision difficult	Concentrated supervision and reduced fragmentation can strengthen institutional stability	Reporting standards, risk management, and lending policies of the merged banks should be unified
Maintaining depositor confidence	In mergers involving financial ambiguity, reassuring depositors is critically important	If depositors are not confident about the new bank, deposit outflows may rise	Maintaining public trust prevents liquidity crises	The central bank and relevant institutions must guarantee depositor rights and communicate effectively
Operational and technological complexity	The merger of several banks required integration of banking systems, accounts, contracts, branches, employees, assets, and liabilities	This shows that bank mergers are not merely legal actions, but multidimensional processes	Poor management of this stage can cause service disruption and lower public trust	An operational, technology, human resources, and risk control plan must be designed before implementation
Potential implications for financial stability	The merger of affiliated banks into Bank Sepah may on one hand increase supervision concentration and trust, and on the other hand create balance sheet pressure	Transferring low-quality assets, hidden losses, or accumulated obligations to the acquiring bank is a major risk	The final effect on financial stability depends on asset quality, recapitalization, transparency, and post-supervision	Empirical analysis of effects on indicators such as capital adequacy, ROA, non-performing loans, liquidity, and Z-score is necessary

Source: Refs [2,16,17]

1.3. Financial Stability in Banking

Financial stability is a multidimensional concept that refers to the ability of the financial system to perform its core functions even in the face of shocks. A stable financial system must be able to mobilize and allocate resources efficiently, carry out payments safely and continuously, manage risks, and prevent the contagion of crises among financial institutions. At the bank level, financial stability means the ability of the bank to fulfill its obligations, maintain capital adequacy, control credit risk, provide liquidity, sustain profitability, and withstand economic shocks. A stable bank is one that can continue its operations without crisis even under recession, rising non-performing loans, exchange rate fluctuations, changes in interest rates, or deposit outflows [18-20]. Accordingly, the key components and indicators of financial stability in banking are presented in Table 3.

Table 3. Financial Stability in Banking

Component / Indicator	Description	Importance in Financial Stability	Implication for Bank Mergers	Regulatory Considerations
Z-Score	An indicator measuring the bank's distance from insolvency, combining profitability, capital, and risk simultaneously	The higher the value, the lower the probability of insolvency and the greater the financial stability; the bank has more capacity to absorb losses	It can serve as the primary indicator to measure the merger's impact on financial stability, showing how much more resilient the merged bank has become	The regulator must monitor changes in this indicator before and after the merger to determine the real impact of the merger on bank health
Capital Adequacy Ratio	An indicator measuring the capacity of the bank's capital to cover the risk of its assets	A higher ratio indicates greater bank strength in facing loan defaults, asset depreciation, and financial shocks	In a merger, the capital adequacy ratio may decline due to an increase in risk-weighted assets	Before the merger, the impact of the merger on the capital of both the acquiring bank and the new bank must be calculated, requiring recapitalization if necessary
Return on Assets (ROA)	The primary indicator of bank profitability, reflecting the bank's efficiency in using assets to generate profit	Sustainable profitability increases the bank's capacity to strengthen internal capital, absorb losses, and maintain operations	Mergers can increase profitability through economies of scale and improved management, but they may also generate superficial and unsustainable profitability	Return on assets must be analyzed alongside indicators such as capital adequacy, non-performing loans, and profit volatility
Non-Performing Loans (NPL) Ratio	An indicator of asset quality and credit risk, showing what portion of loans is not repaid on time	An increase in this ratio indicates a decline in asset quality and an increased probability of credit losses	In a merger, the target bank may have high NPLs, and transferring them could weaken the asset quality of the new bank	The regulator must clarify and value the true quality of assets and the volume of non-performing loans before the merger
Liquidity Ratio	An indicator of the bank's ability to meet short-term obligations and respond to deposit withdrawals	Sufficient liquidity is essential to prevent a crisis of confidence and failure to meet obligations	During the merger process, depositor concerns may lead to resource outflows and liquidity pressure	The central bank must monitor the bank's access to liquid resources, credit lines, and liquid assets throughout all stages of the merger
Theoretical Relationship between Mergers and Financial Stability	A conditional and non-deterministic relationship that can either strengthen or weaken stability	Financial stability changes depending on the execution quality of the merger, the condition of the banks, and the macroeconomic environment	A merger can strengthen stability through recapitalization, improved management, diversification, and economies of scale, or weaken it through the transfer of unhealthy assets, over-concentration, and organizational complexity	The quality of central bank supervision, balance sheet transparency, recapitalization plans, risk management, corporate governance, and operational integration capacity are key determinants of the merger outcome
Regulatory Role in Bank Mergers	Regulation can play a moderating or determining role in the relationship between mergers and financial stability	Effective regulation reduces the likelihood of fragility and increases the probability of merger success	A merger without sufficient supervision may merely transfer the weak bank's problems to the new bank	Strict supervision, asset transparency, recapitalization, risk control, and post-merger monitoring are essential for merger success

Source: Refs [18-20]

2. Materials and Methods

The present study is applied in terms of purpose and quantitative and analytical in terms of method. The main objective of the study is to investigate the impact of bank merger and acquisition regulations on the financial stability of Iran's banking system and to evaluate the role of this policy in reducing systemic vulnerabilities and strengthening financial sustainability. To achieve this objective, a panel data econometric approach is employed. By combining the time-series and cross-sectional dimensions, panel data make it possible to simultaneously examine changes in variables over time and differences among banks. Compared with purely cross-sectional or time-series data, they provide more information, higher degrees of freedom, and more efficient estimates. This approach also makes it possible to control for unobserved heterogeneity and bank-specific characteristics.

In the first stage, the static model of the study is estimated using conventional panel data methods. Subsequently, given the dynamic nature of banks' financial stability and the possibility of endogeneity between the explanatory variables and the dependent variable, the final model is estimated using the System Generalized Method of Moments, or System GMM. This method makes it possible to control for the dynamic effects of the dependent variable, banks' unobserved heterogeneity, reverse causality, measurement error, and omitted-variable bias. More generally, optimization studies illustrate the use of multi-objective modeling and design selection in complex systems; the cited application concerns offshore liquefaction rather than banking or panel-data estimation [21].

2.1. Statistical Population and Scope of the Study

The statistical population of the study consists of commercial and specialized banks operating in Iran's banking system. The research sample comprises 10 banks, including Tejarat Bank, Export Development Bank of Iran, Bank Mellat, Bank Melli Iran, Bank Sepah, Bank Pasargad, Parsian Bank, Mehr Iran Qard-al-Hasan Bank, Iran Zamin Bank, and Bank Maskan.

The temporal scope of the study covers the period from 2011 to 2025. This period was selected because it encompasses major structural developments in Iran's economy and banking system, including the intensification of economic sanctions, exchange-rate fluctuations, changes in the general price level, banking regulatory reforms, and frequent changes in monetary and supervisory policies. These developments may directly or indirectly affect banks' performance, risk-taking behavior, and financial stability.

The required data were collected annually from banks' audited financial statements, official reports of the Central Bank of the Islamic Republic of Iran, banks' annual reports, and the Comprehensive Database of All Listed Companies, known as CODAL. The criteria for including banks in the sample were their operation during the period under study and the sufficient and continuous availability of the information required to calculate the research variables. After data collection, the data were cleaned and organized into a bank-year panel dataset.

2.2. Conceptual and Operational Definitions of the Variables

The dependent variable of the study is bank financial stability, which is measured using the Z-Score index. This index is one of the commonly used measures of bank stability and distance from insolvency and indicates a bank's ability to absorb losses and withstand financial shocks. The Z-Score is calculated as follows:

$$Z - Score_{it} = \frac{ROA_{it} + CAR_{it}}{\sigma(ROA_i)} \quad (1)$$

In this equation, ROA_{it} represents the return on assets of bank i in year t, CAR_{it} represents the bank's capital adequacy ratio, and $\sigma(ROA_i)$ represents the standard deviation of the return on assets of bank i over the period under study. A higher Z-Score indicates a greater distance from insolvency and, consequently, greater financial stability. Conversely, a lower value of this index indicates a higher probability of financial distress and greater vulnerability to shocks.

Capital adequacy is the main independent financial variable in the model. This variable indicates a bank's ability to absorb unexpected losses and protect depositors and creditors and is calculated as the ratio of regulatory capital to risk-weighted assets.

Non-performing loans, liquidity, and operating expenses are also included in the model as explanatory and control variables. The operational definitions of the research variables are presented in the following table 4.

Table 4. Research Variables Are Presented

Variable Type	Variable	Symbol	Operational Definition
Dependent	Financial stability	Z-Score	The sum of return on assets and the capital adequacy ratio divided by the standard deviation of return on assets
Independent	Capital adequacy	CAR	The ratio of regulatory capital to risk-weighted assets
Control	Non-performing loans	NPL	The ratio of non-performing loans to total loans granted
Control	Liquidity	LIQ	The ratio of liquid and near-liquid assets to total assets
Control	Operating expenses	COST	The ratio of operating expenses to the bank's total assets or operating income
Policy	Merger and acquisition regulations	MAR	A dummy variable or index representing the implementation of bank merger and acquisition regulations

The non-performing loans variable reflects the quality of a bank's assets. An increase in this ratio generally indicates higher credit risk, deterioration in the quality of the loan portfolio, and weaker bank financial stability. The liquidity variable indicates a bank's ability to meet its short-term obligations. Adequate liquidity can increase the bank's resilience against unexpected withdrawals and funding shocks. Nevertheless, maintaining excessive liquid assets may reduce the bank's profitability.

Operating expenses also represent an indicator of managerial efficiency and the bank's cost structure. An uncontrolled increase in operating expenses may reduce the bank's profitability and loss-absorbing capacity. However, certain operating expenses, such as expenditures on technology development, risk management, and supervisory infrastructure, may improve efficiency and strengthen financial stability in the long run.

To measure the effect of merger and acquisition regulations, the policy variable MAR is included in the model. If the relevant regulations were implemented from a specific year onward, this variable may be defined as a dummy variable, taking the value of zero for the years before the implementation of the regulations and the value of one for the implementation year and subsequent years. If a quantitative index of the intensity or quality of regulatory implementation is available, it may be used instead of the dummy variable.

2.3. Econometric Model Specification

The baseline model for examining the factors affecting banks' financial stability is specified as follows:

$$Z - Score_{it} = \alpha + \beta_1 CAR_{it} + \beta_2 NPL_{it} + \beta_3 LIQ_{it} + \beta_4 COST_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

In this model, i denotes the bank, t denotes the year, α is the intercept, β_1 to β_4 are the coefficients of the explanatory variables, μ_i represents bank-specific unobserved effects, λ_t represents common time effects, and ε_{it} is the error term.

Given the main objective of the study, namely examining the impact of merger and acquisition regulations, the policy model of the study is extended as follows:

$$Z - Score_{it} = \alpha + \beta_1 MAR_{it} + \beta_2 CAR_{it} + \beta_3 NPL_{it} + \beta_4 LIQ_{it} + \beta_5 COST_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

In this equation, the coefficient β_1 represents the effect of implementing merger and acquisition regulations on banks' financial stability. A positive and statistically significant coefficient indicates that the implementation of the regulations is associated with an increase in banks' financial stability. A negative and statistically significant coefficient may indicate a decline in .financial stability during the period in which the regulations were implemented

Because a bank's financial stability in each period may be influenced by its stability in the previous period, the dynamic model of the study is defined by including the first lag of the dependent variable as follows:

$$Z - Score_{it} = \alpha + Z - Score_{i,t-1} + \beta_1 MAR_{it} + \beta_2 CAR_{it} + \beta_3 NPL_{it} + \beta_4 LIQ_{it} + \beta_5 COST_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (4)$$

The coefficient ρ indicates the persistence of financial stability over time. The inclusion of the lagged dependent variable among the explanatory variables causes the conventional fixed-effects or random-effects estimators to become biased. Therefore, the dynamic model is estimated using the System GMM method.

2.4. Data Analysis Procedures

Before estimating the models, the statistical characteristics of the data are examined. First, descriptive statistics, including the mean, median, maximum, minimum, and standard deviation of the variables, are calculated to provide an initial picture of the distribution and dispersion of the data. The correlation matrix of the variables is then examined [22].

To prevent spurious regression estimates, the stationarity of the variables is assessed using the Levin–Lin–Chu and Im–Pesaran–Shin panel unit root tests. The null hypothesis in these tests indicates the presence of a unit root and the non-stationarity of the variable. If the test probability value is less than 5 percent, the null hypothesis is rejected, and the variable is considered stationary. The tests are initially conducted for the variables in levels, $I(0)$, and, where necessary, for their first differences, $I(1)$.

To examine multicollinearity among the explanatory variables, the Variance Inflation Factor is employed:

$$VIF = \frac{1}{1 - R_j^2} \quad (5)$$

In this equation, R_j^2 is the coefficient of determination obtained by regressing explanatory variable j on the other explanatory variables. A VIF value of less than 10 indicates that no severe multicollinearity exists among the explanatory variables.

After conducting the preliminary tests, the Hausman test is used to select between the fixed-effects and random-effects models. The null hypothesis of this test indicates the appropriateness of the random-effects model and the absence of correlation between bank-specific effects and the explanatory variables. If the probability value is greater than 0.05, the null hypothesis is not rejected, and the random-effects model is selected. Conversely, a probability value of less than 0.05 indicates that the fixed-effects model is more appropriate.

2.5. Estimation of the Dynamic System GMM Model

Given the possibility of a bidirectional relationship between financial stability and variables such as capital adequacy, liquidity, non-performing loans, and operating expenses, the explanatory variables may be endogenous. For example, just as an increase in capital adequacy may improve financial stability, the bank's financial stability position may also influence decisions concerning capital holdings. Moreover, the inclusion of the lagged dependent variable in the model makes conventional panel data estimators inconsistent.

To address these issues, the final model is estimated using the System Generalized Method of Moments. This method simultaneously estimates the equation in levels and the equation in first differences and uses appropriate lags of the variables as internal instruments. The differenced equation of the model is expressed as follows:

$$\Delta Z - Score_{it} = \rho Z - Score_{i,t-1} + \beta_1 \Delta MAR_{it} + \beta_2 \Delta CAR_{it} + \beta_3 \Delta NPL_{it} + \beta_4 \Delta LIQ_{it} + \beta_5 \Delta COST_{it} + \Delta\varepsilon_{it} \quad (6)$$

In addition to controlling for endogeneity, System GMM makes it possible to eliminate unobserved fixed effects, reduce omitted-variable bias, and obtain more consistent estimates. To prevent excessive instrument proliferation, the number of instrumental lags is restricted, and, where supported by the software, the instrument matrix is collapsed.

2.6. Diagnostic Tests for the GMM Model

The validity of the System GMM results is assessed using the Hansen test and the Arellano–Bond serial correlation tests. The Hansen test is used to evaluate instrument validity and overidentifying restrictions. The null hypothesis of this test states that the instruments used are valid and uncorrelated with the error term. Therefore, the statistical insignificance of the Hansen test and a probability value greater than 0.05 provide evidence supporting the validity of the instruments.

The AR(1) and AR(2) tests are also conducted to examine first-order and second-order serial correlation in the differenced error terms. In GMM models, statistical significance of the AR(1) test is generally expected. However, the

AR(2) test should not be statistically significant. The statistical insignificance of AR(2) indicates the absence of second-order serial correlation in the error terms and suggests that the selected lags can serve as valid instruments.

In the initial estimation of the random-effects model, the Durbin–Watson statistic is reported for a preliminary assessment of serial correlation in the error terms, while the F-statistic is reported to examine the overall significance of the model. All research hypotheses are tested at the 95 percent confidence level, and a probability value of less than 0.05 is considered the criterion for statistical significance.

2.7. Software and Research Implementation Process

The data are analyzed using EViews 12. The research implementation process includes data collection and cleaning, construction of the panel dataset, calculation of the variables, presentation of descriptive statistics, implementation of stationarity tests, examination of multicollinearity, selection of the appropriate panel data model, initial estimation of the fixed-effects or random-effects model, estimation of the dynamic System GMM model, and implementation of the Hansen, AR(1), and AR(2) diagnostic tests.

Essential Considerations for Finalizing the Methodology

In the initial text, the objective of the study is to investigate merger and acquisition regulations; however, the proposed equation does not include a variable for measuring these regulations. Therefore, to align the model with the study's objective, the MAR variable was added to the model. The final definition of this variable must be determined based on the exact date of the enactment or implementation of the regulations, their scope of application, and the manner in which the policy was implemented.

Furthermore, the period from 2011 to 2025, when both the starting and ending years are included, comprises 15 years rather than 14 years. If data for one of these years are not included in the sample, the omitted year must be specified. Otherwise, the study period should be reported as a 15-year period. The operational definition of the COST variable must also be precisely determined based on the actual research data, either as the ratio of operating expenses to total assets or as the ratio of operating expenses to operating income.

3. Results and Discussion

The results of the Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS) unit root tests indicated that the variables of Operating Expenses, Capital Adequacy, Liquidity, and Non-Performing Loans (NPLs) are stationary at level. This implies that the mean and variance of these variables remained relatively stable over the studied period, and any shocks to them did not leave a permanent effect on their trends. Conversely, the Financial Stability variable was found to be non-stationary at level but became stationary after first-differencing. Therefore, the Financial Stability variable is integrated of order one $I(1)$, while the other variables are integrated of order zero $I(0)$.

Table 4. Results of Unit Root Tests for Panel Variables

Variable	Levin-Lin-Chu (LLC)		Im-Pesaran-Shin (IPS)	
	p-value at level $I(0)$	p-value at 1st Diff $I(1)$	p-value at level $I(0)$	p-value at 1st Diff $I(1)$
Operating Expenses	0.0009	0.0000	0.0009	0.0000
Financial Stability	0.8274	0.0000	0.1262	0.0000
Capital Adequacy	0.0020	0.0000	0.1217	0.0000
Liquidity	0.0000	0.0000	0.0000	0.0000
Non-Performing Loans	0.0562	0.0000	0.0016	0.0000

Source: Research Findings

Subsequently, to investigate the presence of multicollinearity among the explanatory variables, the Variance Inflation Factor (VIF) test was conducted. The results showed that the values for all model variables are less than the critical threshold of 10; thus, there is no serious multicollinearity problem, and the explanatory variables provide distinct information in explaining banks' financial stability.

Table 5. Hausman Test

Test Summary	p-value	Chi-Sq. Statistic
	0.7589	0.9439

Source: Research Findings

The Hausman test results showed a p-value of 0.9439, which is greater than the 5% error level. Therefore, the null hypothesis regarding the appropriateness of the Random Effects (RE) model is not rejected, and the Random Effects model was selected as the appropriate estimation pattern. The estimation results of the Random Effects model indicated that among the variables examined, only Operating Expenses had a positive and significant effect on the financial stability of banks ($p = 0.005$). Other variables, including Liquidity, Capital Adequacy, and Non-Performing Loans, were not statistically significant. Additionally, the F-statistic p-value of 0.0409 indicates that the model overall possesses statistical significance. The Durbin-Watson statistic was 2.07, indicating the absence of serious autocorrelation in the model's disturbance terms.

Table 6. Results of the Random Effects Model

Variable	Coefficient	t-Statistic	p-value
Liquidity	74390.1713	0.2943	0.7689
Capital Adequacy	6301361.3494	0.8934	0.3732
Operating Expenses	714864.712	2.8532	0.0050
Non-Performing Loans	-30.1168	-0.3088	0.7578
Constant (Intercept)	-3850907.6733	-2.1037	0.0372

Source: Research Findings

Given the potential for endogeneity between the explanatory variables and the dependent variable, as well as the dynamics of bank financial stability, after the initial Random Effects estimation, the final estimation was performed using the System Generalized Method of Moments (System GMM). The validity of the instruments used was examined through the Hansen test, and the presence of first and second-order autocorrelation was checked using AR(1) and AR(2) tests. The results of the System GMM estimation showed that the Hansen test was not significant, indicating that the instruments used are sufficiently valid. Furthermore, the AR(1) test was significant at the 5% level, while the AR(2) test was non-significant, reflecting the absence of second-order autocorrelation in the disturbance terms. Consequently, the model estimations are econometrically valid and reliable.

4. Conclusions

The findings of this study show that the financial stability of Iranian banks is not merely a function of traditional banking indicators, but also depends on the quality of regulation, managerial efficiency, and the manner in which merger and acquisition policies are implemented. During the period under review, the Iranian banking system faced challenges such as balance sheet imbalances, liquidity constraints, rising operating costs, and pressures arising from macroeconomic developments. In such conditions, bank merger and acquisition policy can be used as a tool to reorganize the structure of the banking system, reduce the dispersion of weak institutions, and strengthen financial resilience. However, the findings of the study indicate that the effectiveness of this policy depends above all on how it is regulated and implemented. The experience of the banks studied shows that improvements in financial stability are observed more often in banks that have been able to manage their operating costs efficiently after structural reforms. This suggests that mergers and acquisitions can lead to greater financial stability only when accompanied by reforms in managerial structure, improved efficiency, and cost control; otherwise, transferring problems from one bank to another may create new risks for the banking system. Bank mergers and acquisitions should not be regarded merely as a legal or ownership-based action, but rather as part of a comprehensive regulatory strategy aimed at increasing efficiency, reducing systemic risk, and strengthening public confidence in the banking network. In a situation where the Iranian economy is faced with exchange rate shocks, financial constraints, and frequent changes in the business environment, the existence of a coherent regulatory framework for guiding the merger and acquisition process can play an important role in preserving financial stability and preventing the spread of banking crises.

Bank merger and acquisition can lead to strengthened financial stability only when implemented within a precise, phased, and risk-based regulatory framework. Accordingly, the following recommendations are proposed with the aim of increasing the effectiveness of merger and acquisition policy in the Iranian banking system:

- The Central Bank should develop a clear framework for evaluating banks subject to merger and acquisition so that decision-making is not based solely on the transfer of ownership, and the banks' capital position, asset quality, and profitability capacity are also taken into account.
- Post-merger supervision should be strengthened; because a significant portion of banking risks emerges in the stage after the consolidation and integration of operations, systems, and managerial structure.
- Capital adequacy requirements for merged banks should be increased so that the new bank has sufficient capacity to absorb potential losses and withstand financial shocks.
- A program for reducing operating costs should be made mandatory as part of the merger process; because the findings of the study show that efficiency in cost management is one of the important factors in strengthening financial stability.
- An early warning system should be established to identify high-risk banks so that regulatory intervention occurs before liquidity and credit problems turn into a widespread crisis.
- Information transparency of banks involved in mergers and acquisitions should be increased so that depositors and investors are aware of the true condition of the banks and bank runs are prevented.
- The merger and acquisition process should be aligned with broader financial stability policies; such that this policy is pursued alongside the reform of banks' balance sheet structure, reduction of non-performing loans, and improvement of corporate governance.

Author Contributions

All authors contributed equally to the conception, preparation, and writing of this manuscript.

Conflict of Interest

The authors, while observing publication ethics in the referencing, declare the absence of interest of conflict.

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