

# Examining the Effect of Interest Rate Suppression on Credit Risk in the Banking Industry with a Focus on Financial Inclusion: A Simultaneous Equations Approach

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## ABSTRACT

**Objective:** This study aims to examine the impact of interest rate suppression on credit risk in the banking industry, focusing on the moderating role of financial inclusion.

**Methodology:** The study employed a two-stage least squares (2SLS) approach within a simultaneous equations framework, using panel data from 15 banks listed on the Tehran Stock Exchange over a nine-year period (2014–2022). Key variables, including non-performing loans (NPL), provisions for doubtful debts (BDTC), interest rate suppression (INDEX), and financial inclusion (OWN), were analyzed. Interaction terms were included to assess the moderating effects of financial inclusion on the relationship between interest rate suppression and credit risk.

**Findings:** The results indicate that interest rate suppression negatively affects both the NPL and BDTC ratios, with significant reductions of 0.05% and 0.08%, respectively, for a 1% increase in the suppression index. Financial inclusion reduces the NPL ratio by 0.04% and the BDTC ratio by 0.05% per 1% increase in financial inclusion, contributing to a more stable banking environment. Furthermore, the interaction of interest rate suppression and financial inclusion mitigates credit risks, reducing the NPL ratio by 0.03% and the BDTC ratio by 0.07% for a 1% increase in the interaction term.

**Conclusion:** Interest rate suppression and financial inclusion exhibit contrasting effects on banking stability. While interest rate suppression decreases profitability and alters lending behaviors, financial inclusion mitigates credit risk by diversifying lending practices and expanding access to financial services. Policymakers should prioritize balancing interest rate policies with initiatives to enhance financial inclusion to stabilize and strengthen the banking system.

**Keywords:** Interest rate suppression, Financial inclusion, Credit risk, Banking industry, Financial modelling.

## 1 Introduction

One of the key sectors of the economy is the financial sector, which plays a significant role in providing capital to achieve macroeconomic goals, including economic growth. From a theoretical perspective, the financial sector facilitates the efficient allocation of financial resources between borrowers and lenders. Global financial crises, such as the Asian financial crisis (1997–1998) and the global financial crisis (2007–2008), highlight that financial stability is a persistent threat in this sector, influenced by various factors. The dimensions of financial stability have been extensively examined in empirical studies (Nie, 2023; Taheri et al., 2023). A financial system is considered stable when it can facilitate the economy's functioning and absorb financial fluctuations and shocks, whether endogenous or resulting from unforeseen significant events (Jamir, 2024; Sevilla et al., 2025).

Moreover, studies suggest that financial repression undermines the stability of the financial system by disrupting money and credit markets and misallocating resources (Kamijani et al., 2008; Karimi, 2022). Interest rate suppression reduces income for banks, primarily derived from the difference between the interest paid on deposits and the interest received on loans. When interest rates are artificially kept low, banks must exert more effort to maintain their profit margins. This condition may reduce their lending capacity, as lower profitability might force banks to tighten lending standards or limit the credit they extend (Hosseinioust & Saatian, 2020; Kamalvand & Nazanini, 2019).

Interest rate suppression can alter banks' lending behavior. While temporarily lower interest rates may boost borrowing in the short term, they may lead banks to become more risk-averse over time, particularly if banks anticipate that lower rates will not result in sustainable economic growth. Consequently, banks may tighten their lending criteria, making it more challenging for individuals and businesses—especially financially vulnerable ones—to access credit (Hassan et al., 2011; Heidari Dizgarani, 2014).

Financial inclusion emerged prominently in the late 20th century with the advent of microcredit movements in the 1970s but gained global recognition in 2005 when the United Nations emphasized its importance in achieving developmental goals. This emphasis led to its integration into various global development programs, including the Sustainable Development Goals (SDGs) adopted in 2015, which explicitly aim to provide universal access to financial

services. According to the World Bank (2018), financial inclusion is defined as individuals' and businesses' access to and use of affordable and high-quality financial products and services—such as payments, bank accounts, credit, and insurance—delivered responsibly and sustainably to meet their needs. As evident from this definition, financial inclusion is conceptually at odds with interest rate suppression, particularly in financial systems and the provision of financial services.

Financial inclusion can enhance the stability of banks by diversifying their funding sources. By expanding their customer base to include previously unbanked populations, banks can mobilize more deposits into the banking system. This increase in the deposit base provides cheaper funding options for banks, thereby reducing their likelihood of bankruptcy (Mekki, 2017; Mekki & Samir, 2020).

The literature on financial inclusion and its interaction with banking dynamics highlights several key findings. Karimi (2022) demonstrated that financial inclusion positively impacts government tax revenues, including corporate and personal income taxes, using an ARDL model. Esmailian and Sefidbakht (2022) explored the interplay between bank market structure, financial inclusion, and financial stability, finding that bank profitability and savings in financial institutions are positively correlated, while cash assets to deposits and short-term financing have an inverse relationship with concentration (Karimi, 2022). Balonjad-Nouri and Shajaripour (2022) concluded that increased banking sector competition enhances financial inclusion, while financial development positively affects inclusion when credit-to-GDP ratios are considered (Balonjad Nouri & Shajari Pour, 2022). Akbarinejad Toghdeemi (2022) found that corporate social responsibility positively influences financial performance, stability, and inclusion, with organizational citizenship behavior playing a mediating role. Ghosh (2022) showed that financial inclusion positively impacts banking stability despite interest rate suppression, supporting its role as a stabilizing factor (Akbarinejad Taghdimi, 2022).

As outlined in the general definitions of interest rate suppression and financial inclusion, these two financial-economic phenomena operate in opposition, particularly in financial systems. While financial inclusion is expected to enhance and improve financial operations, interest rate suppression often leads to constraints and limitations in providing financial services. This raises the question of the effectiveness of the interaction between financial inclusion and interest rate suppression and its manifestation in banking

stability. Investigating the individual effects of financial repression and financial inclusion on the banking industry and, more importantly, exploring how financial inclusion moderates the relationship between interest rate suppression and banking behavior addresses a research gap. To clarify this relationship, the present study examines the impact of interest rate suppression on banks' behavior and then considers the interactive effect of financial inclusion on this relationship for banks listed on the Tehran Stock Exchange.

## 2 Methods and Materials

This research is both applied and mixed-method in nature, encompassing qualitative and quantitative dimensions. The statistical population includes all banks and financial institutions. Due to the unavailability of financial statements for certain state-owned banks not listed on the Tehran Stock Exchange (TSE), systematic sampling was employed. The sample includes 15 banks and financial institutions that are listed on the TSE and have accessible financial data. Considering a nine-year study period (2014–2022), the final dataset comprises 135 firm-year observations (15 banks  $\times$  9 years).

Data collection was conducted using library resources, public announcements by the TSE, corporate databases available on the official TSE website, and relevant financial analysis software. Initially, literature and theoretical frameworks related to the research topic were compiled from academic sources. Subsequently, the main research process involved extracting financial data from the reports of TSE-listed companies. The extracted data were summarized and categorized using spreadsheet tools and analyzed using statistical software to determine the mathematical relationship between independent and dependent variables.

To analyze the impact of interest rate suppression on banking behavior with a focus on financial inclusion,

regression modeling was used. Variables were categorized as dependent, independent, and control variables. The dependent variables represent banking behavior indicators, such as the ratio of non-performing loans and provisions for doubtful debts. The independent variables include measures of interest rate suppression and financial inclusion, while control variables account for bank-specific characteristics such as size, deposit-to-asset ratios, and cost-to-income ratios.

An interaction term between interest rate suppression and financial inclusion was included to explore the moderating effects of financial inclusion on the relationship between interest rate suppression and banking behavior. Interaction terms in regression models allow for analyzing how the effect of one independent variable on the dependent variable changes depending on the level of another independent variable.

This research employed a regression approach capable of handling simultaneous interactions and providing a comprehensive view of the relationships among variables. Using this approach ensures robust and nuanced insights into the dynamics between interest rate suppression, financial inclusion, and banking behavior.

## 3 Findings and Results

Following the approach of prior studies, financial inclusion in this research was assessed using indicators across three dimensions: penetration, access, and usage. For penetration, the growth rate of bank accounts was used; for access, the growth rate of ATMs and bank branches were considered; and for usage, the growth rate of bank deposits was utilized. [Table 1](#) outlines the variables used in calculating the financial inclusion index.

**Table 1**

*Variables Used in the Financial Inclusion Index*

| Symbol | Variable                     | Row |
|--------|------------------------------|-----|
| DG     | Growth rate of bank deposits | 1   |
| AN     | Growth rate of bank accounts | 2   |
| ATMN   | Growth rate of ATMs          | 3   |
| BN     | Growth rate of bank branches | 4   |

The calculation of the financial inclusion index was conducted using the Principal Component Analysis (PCA)

method. [Table 2](#) presents the results from the PCA estimation.

**Table 2***Results of the PCA Estimation Model*

| Components | Variance Explained by Components | Share of Variance Explained | Cumulative Variance Explained | Cumulative Share of Variance Explained |
|------------|----------------------------------|-----------------------------|-------------------------------|----------------------------------------|
| DG         | 7.207840                         | 0.4240                      | 7.207840                      | 0.4240                                 |
| AN         | 2.894772                         | 0.2703                      | 10.10261                      | 0.5943                                 |
| ATMN       | 1.558430                         | 0.1917                      | 11.66104                      | 0.6859                                 |
| BN         | 1.472866                         | 0.1266                      | 13.13391                      | 0.7726                                 |

The results of the PCA method indicate that the first component, the growth rate of bank deposits (DG), explains approximately 42% of the variance. The second component, the number of bank accounts (AN), explains 27%, the third component, the number of ATMs (ATMN), explains 19%, and the fourth component, the number of bank branches (BN), explains 12%. Given its 42% contribution to the variance, the first component (DG) can serve as the primary index for the other variables. Ultimately, the first

component, the growth rate of bank deposits (DG), is used as a composite index for other variables.

After collecting the data and calculating the variables used in the research, the descriptive parameters for each variable were computed. Table 3 presents the descriptive statistics of the dependent, independent, and control variables for all observations. These parameters include measures of central tendency, such as mean and median, as well as measures of dispersion, such as standard deviation and skewness.

**Table 3***Descriptive Statistics of Research Model Variables*

| Variable | Definition                | Mean    | Median  | Max     | Min     | Std. Dev | Skewness | Kurtosis | Observations |
|----------|---------------------------|---------|---------|---------|---------|----------|----------|----------|--------------|
| SIZE     | Bank size                 | 6.61685 | 6.50998 | 7.99579 | 5.68083 | 0.64515  | 0.27616  | 1.76777  | 135          |
| NPL      | Non-performing loans      | 0.5298  | 0.56961 | 0.76409 | 0.21185 | 0.25122  | -0.3797  | 2.16214  | 135          |
| BDTC     | Doubtful debts            | 0.04368 | 0.03329 | 0.20149 | 0.01391 | 0.04204  | 1.73974  | 6.42118  | 135          |
| DTA      | Deposit-to-asset ratio    | 0.66405 | 0.67362 | 0.84824 | 0.06106 | 0.16309  | -1.0825  | 4.85532  | 135          |
| CTR      | Cost-to-income ratio      | 0.51109 | 0.5205  | 0.73474 | 0.17817 | 0.14277  | 0.22009  | 3.25697  | 135          |
| INDEX    | Interest rate suppression | 0.77778 | 1       | 1       | 0       | 0.41729  | -1.3363  | 2.78571  | 135          |
| OWN      | Financial inclusion       | 0.41039 | 0.37986 | 0.87269 | 0.01717 | 0.2263   | 0.46785  | 2.66756  | 135          |

This section examines the stationarity of variables in the panel data used in this study. Stationarity implies that the mean, variance, and covariance of variables remain constant over time and across years, ensuring that the inclusion of

these variables in the model does not lead to spurious regression. In this research, the Levin-Lin-Chu test was employed to assess stationarity.

**Table 4***Stationarity Test Results for Variables*

| Variable                  | Symbol | Levin-Lin-Chu Statistic | p-Value | Result     |
|---------------------------|--------|-------------------------|---------|------------|
| Bank size                 | SIZE   | -8.05                   | 0.0000  | Stationary |
| Non-performing loans      | NPL    | -3.10                   | 0.0086  | Stationary |
| Doubtful debts            | BDTC   | -3.25                   | 0.0006  | Stationary |
| Deposit-to-asset ratio    | DTA    | -3.74                   | 0.0001  | Stationary |
| Cost-to-income ratio      | CTR    | -7.53                   | 0.0000  | Stationary |
| Interest rate suppression | INDEX  | -7.65                   | 0.0000  | Stationary |
| Financial inclusion       | OWN    | -2.92                   | 0.0318  | Stationary |

The results of the F-Limer test for the research model are presented in Table 5. This test determines whether the model

should be estimated using a pooled or panel data approach. Since the p-value for the test statistic is less than 0.05, the

null hypothesis of pooled data is rejected, and panel data estimation is selected.

**Table 5**

*F-Limer Test Results for Research Models*

| Test Type | Model | Statistic | p-Value | Conclusion        |
|-----------|-------|-----------|---------|-------------------|
| F-Limer   | First | 8.11      | 0.0000  | Panel data method |

Given the use of panel data in this study, the Hausman test was conducted to choose between the fixed effects and random effects models. The results indicate that if the p-value is less than 0.05, the fixed effects model is appropriate;

otherwise, the random effects model is used. Since the sampling in this study was based on systematic elimination, the random effects model was ultimately applied.

**Table 6**

*Hausman Test Results*

| Test Type | Statistic | Degrees of Freedom | p-Value | Conclusion                     |
|-----------|-----------|--------------------|---------|--------------------------------|
| Hausman   | 35.13     | 17                 | 0.012   | Panel data with random effects |

The results from [Table 6](#) indicate that the model follows a random effects approach. The probability associated with the Hausman statistic is less than 0.05, confirming that the research equations were estimated using the fixed effects model.

The estimation in this study utilized the simultaneous equations method with panel data. Panel data econometrics

assumes that the data used are cross-sectionally independent. However, this assumption might not hold, so the first step in econometric analysis is to diagnose cross-sectional dependence or independence. In this study, Pesaran's cross-sectional dependence test (2021) was applied, and the results are presented in [Table 7](#).

**Table 7**

*Pesaran Cross-Sectional Dependence Test Results for Variables in the System of Equations*

| Variables                 | Symbol | Pesaran Test Statistic | Significance (p-Value) |
|---------------------------|--------|------------------------|------------------------|
| Bank size                 | SIZE   | 21.63                  | 0.000                  |
| Non-performing loans      | NPL    | 3.74                   | 0.000                  |
| Doubtful debts            | BDTC   | 26.42                  | 0.000                  |
| Deposit-to-asset ratio    | DTA    | 17.12                  | 0.000                  |
| Cost-to-income ratio      | CTR    | 3.66                   | 0.000                  |
| Interest rate suppression | INDEX  | 13.09                  | 0.000                  |
| Financial inclusion       | OWN    | 12.02                  | 0.000                  |

The null hypothesis in this test states that no cross-sectional dependence exists among the variables. As shown in [Table 7](#), the p-values for the Pesaran test statistic are less than 0.05, leading to the rejection of the null hypothesis and confirming cross-sectional dependence among the variables.

When cross-sectional dependence is present in panel data, conventional panel unit root tests, such as Levin-Lin (LL) or Im-Pesaran-Shin (IPS), may yield misleading results. To

address this issue, alternative tests like the Pesaran (2007) and Hadri-Rao (2008) unit root tests are used to ensure stationarity. The advantage of the Hadri-Rao test is that it simultaneously accounts for structural breaks and cross-sectional dependence. Hence, this study employed the Hadri-Rao unit root test to ensure robust stationarity analysis.

**Table 8***Hadri and Rao Unit Root Test Results (2008) for Variables in the System of Equations*

| Variable | CI: 99% | CI: 97.5% | CI: 95% | CI: 90% | p     | HR    | Result     |
|----------|---------|-----------|---------|---------|-------|-------|------------|
| SIZE     | 20.297  | 16.567    | 13.937  | 9.348   | 1.000 | 0.359 | Stationary |
| NPL      | 16.607  | 10.065    | 4.229   | 10.065  | 1.000 | 0.267 | Stationary |
| BDTC     | 7.245   | 9.470     | 4.839   | 9.470   | 1.000 | 0.139 | Stationary |
| DTA      | 18.014  | 10.370    | 2.682   | 10.370  | 1.000 | 0.207 | Stationary |
| CTR      | 39.907  | 13.814    | 2.909   | 13.814  | 1.000 | 0.267 | Stationary |
| INDEX    | 30.594  | 29.507    | 3.272   | 29.507  | 1.000 | 0.312 | Stationary |
| OWN      | 10.070  | 14.401    | 3.198   | 14.401  | 1.000 | 0.316 | Stationary |

Based on Table 8, the critical values for all variables exceed the stationarity test statistics. Therefore, the null hypothesis is not rejected, and all variables are stationary. Before estimating the model within the simultaneous equations system, the identifiability of the equations must be

determined using the order and rank conditions. According to these conditions, as presented in Table 10, the equations used in the system are over-identified, making them estimable.

**Table 9***Identifiability of Variables in the Simultaneous Equations System*

| Condition | Number of Endogenous Variables Minus One (1M-) | Number of Exogenous Variables Left Out of the Equation (K-k) | Identifiability |
|-----------|------------------------------------------------|--------------------------------------------------------------|-----------------|
| Order     | 24                                             | 5                                                            | Over-identified |
| Rank      | 4                                              | Exactly or Over-identified                                   |                 |
| Combined  | Over-identified                                |                                                              |                 |

The next step involves estimating the simultaneous equations system using two-stage least squares (2SLS) with panel data. Table 10 presents the estimation results. The F-

Limer and Hausman tests were employed to determine the appropriate estimation method (panel data or pooling).

**Table 10***Estimation Results of the Simultaneous Equations System*

| Variables | Coefficient | t-Statistic | p-Value |
|-----------|-------------|-------------|---------|
| C(1)      | 0.013272    | 2.121823    | 0.0123  |
| C(2)      | -0.056250   | -5.174793   | 0.0000  |
| C(3)      | -0.451778   | -2.264097   | 0.0239  |
| C(4)      | -0.037300   | -2.383387   | 0.0301  |
| C(5)      | 0.065389    | 1.913392    | 0.0561  |
| C(6)      | -0.013586   | -3.261162   | 0.0000  |
| C(7)      | -0.133458   | -2.423560   | 0.0156  |
| C(8)      | 0.024911    | 2.251156    | 0.0246  |
| C(9)      | -0.086837   | -4.299276   | 0.0000  |
| C(10)     | -0.057506   | -4.316094   | 0.0000  |
| C(11)     | -0.075914   | -2.939726   | 0.0050  |
| C(12)     | 0.015275    | 2.664498    | 0.0079  |
| C(13)     | -0.030608   | -2.428950   | 0.0037  |
| F-Limer   | 8.11        | -           | 0.0000  |
| Hausman   | 35.13       | -           | 0.0120  |

$$NPL = C(0) + C(1)*INDEX + C(2)*OWN + C(3)*INDEX*OWN + C(4)*SIZE + C(5)*DTA + C(6)*CTR$$

$$R^2 = 0/78 \quad \text{Adj } R^2 = 0/73 \quad D.W = 1/85$$

$$BDTC = C(7) + C(8)*INDEX + C(8)*OWN + C(10)*INDEX*OWN + C(11)*SIZE + C(12)*DTA + C(13)*CTR$$

$$R^2 = 0/87 \quad \text{Adj } R^2 = 0/84 \quad D.W = 1/93$$



Based on the results in Table 11, it is observed that in the equation where the ratio of non-performing loans to total loans (NPL) is the dependent variable:

- **Interest Rate Suppression (INDEX):** Interest rate suppression has a negative effect on the NPL ratio in the selected banks under study. Specifically, a 1% increase in the interest rate suppression index results in a 0.05% reduction in the NPL ratio. This effect is significant at the 99% confidence level. Under conditions of interest rate suppression, significant reductions in banking operations occur due to pressures on the profit margins of banks and increased operational risks. Consequently, overall banking activities, including deposit collection and loan issuance, decline, ultimately leading to a reduction in the NPL ratio. This conclusion aligns with the findings of Colho, Rostui, and Zamil (2023).
- **Financial Inclusion (OWN):** Financial inclusion has a negative effect on the NPL ratio in the selected banks under study. Specifically, a 1% increase in the financial inclusion index results in a 0.04% reduction in the NPL ratio. This effect is significant at the 95% confidence level. Financial inclusion, directly associated with the increased

provision of financial services by banks, expands access to loans and deposits for a larger number of individuals. This expansion reduces the concentration of services and fragments service provision, thereby lowering the risk of non-performing loans. These findings are consistent with the studies conducted by Tratour (2021) and Django, Madaleno, and Botelho (2022).

- **Interaction of Interest Rate Suppression and Financial Inclusion (INDEX\*OWN):** The interaction term has a negative effect on the NPL ratio in the selected banks under study. Specifically, a 1% increase in the interaction index leads to a 0.03% reduction in the NPL ratio. This effect is significant at the 95% confidence level. The interplay between the opposing forces of reduced banking operations due to interest rate suppression and improved operations driven by financial inclusion ultimately results in a reduced NPL ratio under conditions of interest rate suppression. This reduction is a positive indicator of banking operations and reflects a decrease in banking risk. These findings are consistent with the study by Ghosh (2022).

**Table 11**

*The Effect of Financial Inclusion on the Relationship Between Interest Rate Suppression and Non-performing Loan Status (NPL) in Banks*

| Variable                   | Formula                            | Interest Rate Suppression (INDEX) | Financial Inclusion (OWN) | Interaction of Interest Rate Suppression and Financial Inclusion (INDEX*OWN) | Explanation                                                                               |
|----------------------------|------------------------------------|-----------------------------------|---------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Non-performing Loans (NPL) | Non-performing loans / Total loans | Negative effect                   | Negative effect           | Negative effect                                                              | Under conditions of interest rate suppression, financial inclusion reduces the NPL ratio. |

**Table 12**

*The Effect of Financial Inclusion on the Relationship Between Interest Rate Suppression and Non-performing Loan Status (NPL) in Banks*

| Variable                   | Factor                                                                                                                      | Type of Effect  | Effect Magnitude |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| Non-performing Loans (NPL) | Interest rate suppression under banking operations                                                                          | Positive effect | 0.0015           |
|                            | Financial inclusion under banking operations                                                                                | Negative effect | -0.0004          |
|                            | Interaction of interest rate suppression and financial inclusion under banking operations                                   | Negative effect | -0.03            |
| Explanation                | Under conditions of interest rate suppression, financial inclusion reduces the NPL ratio by considering banking operations. |                 |                  |

Based on the results in Table 12, it is observed that in the equation where the ratio of provisions for doubtful debts to total loans (BDTC) is the dependent variable:

- **Interest Rate Suppression (INDEX):** Interest rate suppression negatively affects the BDTC ratio in the selected banks under study. A 1% increase in

the interest rate suppression index leads to a 0.08% reduction in the BDTC ratio, significant at the 99% confidence level. Under conditions of interest rate suppression, the significant reduction in banking operations due to pressure on banks' profit margins and increased operational risks results in decreased deposits and loan issuance. Ultimately, this leads to a reduction in the BDTC ratio. This conclusion is consistent with the findings of Colho, Rostui, and Zamil (2023).

- **Financial Inclusion (OWN):** Financial inclusion negatively impacts the BDTC ratio in the selected banks under study. A 1% increase in the financial inclusion index results in a 0.05% reduction in the BDTC ratio, significant at the 99% confidence level. Financial inclusion, which directly expands financial services provided by banks, leads to a

broader dispersion of loans and deposits across more individuals. This dispersion reduces the concentration of services, thereby decreasing the BDTC ratio.

- **Interaction of Interest Rate Suppression and Financial Inclusion (INDEX\*OWN):** The interaction term negatively affects the BDTC ratio in the selected banks under study. A 1% increase in the interaction index reduces the BDTC ratio by 0.07%, significant at the 99% confidence level. The interplay of reduced banking operations due to interest rate suppression and increased banking activities due to financial inclusion ultimately results in a reduction of the BDTC ratio under conditions of interest rate suppression. This reduction is viewed positively in banking operations and reflects a decrease in banking risk.

**Table 13**

*The Effect of Financial Inclusion on the Relationship Between Interest Rate Suppression and the Status of Provisions for Doubtful Debts (BDTC) in Banks*

| Variable                             | Formula                                     | Interest Rate Suppression (INDEX) | Financial Inclusion (OWN) | Interaction of Interest Rate Suppression and Financial Inclusion (INDEX*OWN) | Explanation                                                                                |
|--------------------------------------|---------------------------------------------|-----------------------------------|---------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Provisions for Doubtful Debts (BDTC) | Provisions for doubtful debts / Total loans | Indirect relationship             | Negative effect           | Negative effect                                                              | Under conditions of interest rate suppression, financial inclusion reduces the BDTC ratio. |

**Table 14**

*The Effect of Financial Inclusion on the Relationship Between Interest Rate Suppression and the Status of Provisions for Doubtful Debts (BDTC) in Banks*

| Variable                             | Factor                                                                                                                       | Type of Effect  | Effect Magnitude |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| Provisions for Doubtful Debts (BDTC) | Interest rate suppression under banking operations                                                                           | Positive effect | 0.0024           |
|                                      | Financial inclusion under banking operations                                                                                 | Negative effect | -0.0005          |
|                                      | Interaction of interest rate suppression and financial inclusion under banking operations                                    | Negative effect | -0.07            |
| Explanation                          | Under conditions of interest rate suppression, financial inclusion reduces the BDTC ratio by considering banking operations. |                 |                  |

#### 4 Discussion and Conclusion

The primary objective of this study was to examine the effect of interest rate suppression on credit risk in the banking industry with a focus on financial inclusion. The results revealed that the interaction term of interest rate suppression and financial inclusion has a negative effect on the ratio of non-performing loans (NPL) to total loans in the

selected banks under study. Specifically, a 1% increase in this interaction term reduces the NPL ratio by 0.03%. This effect was statistically significant at the 95% confidence level. The reduction in NPLs under conditions of interest rate suppression is attributed to decreased loan issuance activities by banks. In contrast, financial inclusion, by increasing the provision of banking services, reducing banking concentration, and distributing loans among a larger number



of customers, decreases the proportion of non-performing loans. Ultimately, under conditions of interest rate suppression, financial inclusion reduces the NPL ratio.

Additionally, the study found that the interaction term of interest rate suppression and financial inclusion negatively affects the ratio of provisions for doubtful debts (BDTC) to total loans in the selected banks. A 1% increase in this interaction term reduces the BDTC ratio by 0.07%, a result that was statistically significant at the 99% confidence level. The reduction in doubtful debt provisions under interest rate suppression conditions results from decreased loan issuance activities. Conversely, financial inclusion, by increasing the breadth of banking services, reducing concentration, and distributing loans among more customers, significantly lowers the likelihood of loans becoming doubtful. Thus, under conditions of interest rate suppression, financial inclusion reduces the BDTC ratio.

Interest rate suppression reduces profitability for banks, which primarily earn income from the difference between the interest paid on deposits and the interest earned on loans. Interest rate suppression can alter banks' lending behavior. While lower interest rates may boost borrowing in the short term, they can lead banks to become more risk-averse over time. Overall, while interest rate suppression can act as a short-term economic stimulus, its long-term effects on banks include reduced profitability, increased loan defaults, changes in lending practices, and exacerbated inequalities in wealth allocation. These factors create a complex environment in which banks must balance the challenges of maintaining financial stability with meeting economic demands under low-interest conditions. The findings of this study align with prior findings (Akbarinejad Taghdimi, 2022; Balonjad Nouri & Shajari Pour, 2022; Gulcay & Hamed Ahmad, 2021; Hosseinidoust & Saatian, 2020; Mekki, 2017; Mekki & Samir, 2020; Mousavi et al., 2021; Nazarian et al., 2013; Rahmani et al., 2018; Shahabadi et al., 2021; Yousefi Ghaleroudkhani et al., 2021).

Financial inclusion allows banks to access a broader customer base, including previously unbanked populations. This expansion can increase deposits, providing banks with a more stable and diversified funding source. Research has shown that financial inclusion positively impacts banking performance. Overall, financial inclusion acts as a catalyst for improving banking stability and performance by expanding the customer base and diversifying funding sources. However, it requires careful management to mitigate potential risks associated with increased lending and competition. The long-term benefits of financial

inclusion depend on the effective implementation of strategies aligned with sound risk management practices. The findings of this study are consistent with prior findings (Akbarinejad Taghdimi, 2022; Gulcay & Hamed Ahmad, 2021; Mousavi et al., 2021; Najafi et al., 2019; Shahabadi et al., 2021; Yousefi Ghaleroudkhani et al., 2021).

It is recommended that national policymakers consider interest rate conditions, their divergence from inflation rates, and the breadth of financial services to improve and stabilize the banking system, particularly concerning the management of doubtful debt provisions and non-performing loans in Iranian banks.

This study was conducted using data from selected banks listed on the Tehran Stock Exchange and does not encompass all active banks in Iran. Thus, caution should be exercised in generalizing the results to the entire banking system in the country. The temporal scope of this study is from 2014 to 2022, so caution should also be exercised in generalizing the findings to periods before 2014 or after 2022.

### Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

### Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

### Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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### Declaration of Interest

The authors report no conflict of interest.

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### Ethical Considerations



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- Sevilla, J., Ruiz-Martin, C., Nebro, J. J., & Lopez-Paredes, A. (2025). Resilience of Spanish Firms: a comparative analysis of large and small businesses in the face of 2008 financial crisis and COVID-19. *International Journal of Production Management and Engineering*, 13(1), 45-58. <https://doi.org/10.4995/ijpme.2025.21740>
- Shahabadi, A., Moradi, A., & Momivand, G. (2021). The Cross-Effect of Financial Development and Good Governance on Innovation in Efficiency-Oriented Countries. *Journal of Innovation Management*, 9(4), 67-88. <https://www.magiran.com/paper/2283634/%d8%a7%d8%ab%d8%b1-%d9%85%d8%aa%d9%82%d8%a7%d8%b7%d8%b9-%d8%aa%d9%88%d8%b3%d8%b9%d9%87-%d9%85%d8%a7%d9%84%db%8c-%d9%88-%d8%ad%da%a9%d9%85%d8%b1%d8%a7%d9%86%db%8c-%d8%ae%d9%88%d8%a8-%d8%a8%d8%b1-%d9%86%d9%88%d8%a2%d9%88%d8%b1%db%8c-%d8%af%d8%b1-%da%a9%d8%b4%d9%88%d8%b1%d9%87%d8%a7%db%8c-%d9%85%d9%86%d8%aa%d8%ae%d8%a8-%da%a9%d8%a7%d8%b1%d8%a7%db%8c%db%8c-%d9%85%d8%ad%d9%88%d8%b1>
- Taheri, H. R., Piri, P., Naderi, A., & Esmaily, N. (2023). Forecasting The Financial Crisis in Iran According to The Slope of The Yield Curve and The Bank Credit Index: A Machine Learning. Approach. *Iranian Journal of Economic Studies*, 12(1), 217-248. <https://doi.org/10.22099/ijes.2024.51275.1973>
- Yousefi Ghaleroudkhani, M. A., Tehrani, R., & Mirlouhi, S. M. (2021). Examining the Impact of Financial Performance Criteria on the Financial Sustainability of Banks During Financial Crises. *Modares Humanities Quarterly (Management Research in Iran)*, 25(2), 1-21. [https://mri.modares.ac.ir/article\\_554.html](https://mri.modares.ac.ir/article_554.html)