Examining the Impact of Banking Activity Expansion on Electronic Banking Risk

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Abstract: With the expansion of banking activities, the stock returns of bank shareholders are also affected. As fluctuations in bank stock returns increase over the long term, the cash flows of banks are influenced, which may lead to an increase in the growth rate of banks' economic value added. Given the diversification of income sources, the expansion of banking activities, and the level of investment in various economic sectors, the liquidity entering the market increases, ultimately contributing to a rise in the inflation rate. The proportion of independent board members can be considered a factor influencing the establishment of a balance between income diversification and banking activity expansion. The objective of this study is to examine the impact of banking activity expansion on electronic banking risk. This research is a library-based and analytical-causal study, utilizing panel data analysis. The financial data of 10 banks listed on the Tehran Stock Exchange were analyzed over the period from 2016 to 2021. The research sample consists of 60 bank-year observations. The findings indicate that income diversification influences bank risk. Additionally, based on the analysis conducted regarding the confirmation of the second research hypothesis, it was concluded that the expansion of banking activities affects bank risk. Furthermore, the results regarding the confirmation of the third research hypothesis suggest that income diversification impacts bank returns.

Keywords: Risk, banking activity expansion, electronic banking

1. Introduction

Banks, in their pursuit of increasing revenue, also assume various types of risks. Whenever the level of bank risk rises due to their activities, the scope of banking operations expands proportionally [1]. The expansion and diversification of banking activities influence bank shareholders' stock returns [2]. As fluctuations in bank stock returns increase over the long term, the banks' cash flows are affected, which may lead to an increase in the growth rate of their economic value added [3]. Income diversification can occur through investments in different sectors of the economy. Banks, in line with their long-term strategies, increase their capital expenditures and attempt to enhance dividend payouts to shareholders over various periods (Beck et al., 2020). To improve efficiency and productivity, banks increase their capital ratio and, through diversification and banking activity expansion, aim to reduce operational risks [4]. In most cases, the expansion of banking activities enhances bank performance and, at different time intervals, may significantly affect stock returns, thereby boosting their expected performance [1, 5]. Inflation is a key factor influencing banking activity growth rates, and as risk increases, inflation rates also rise, ultimately leading to a reduction in the banks' capital expenditure ratio [6].

The literature on banking risk management, income diversification, and banking performance presents a range of findings based on empirical studies using financial and econometric models. Gholi Baglou (2021) examined the effectiveness of monetary policy in regulating legal reserves and its balance sheet effects in the banking sector, concluding that the tipping point for non-performing loan ratios impacting profit and loss occurs below 7% [7]. Abbasgholipour (2010) identified key factors for improving banking performance, including modern banking resource mobilization, global banking indicators, risk management, and optimization strategies [8]. Kashanipour and Ghazizadeh (2008) conducted a Delphi survey identifying 18 key variables for measuring bank branch efficiency, with four crucial financial ratios determined using the Analytic Hierarchy Process (AHP) [9]. Barba et al. (2021) highlighted that financial flexibility and regulatory frameworks improve bank returns and efficiency [1]. Maudos (2020) investigated European banks and found that revenue structure fluctuations impact profitability and ultimately reduce banking risk, with risk being influenced by cash flow volatility and stock price fluctuations. Köhler (2020) studied the effect of banking risk on business model flexibility, concluding that increased risk enhances business model adaptability and performance, though it may also influence banking activity expansion positively or negatively [4]. Beck et al. (2020) emphasized that modern banking facilitates digital expansion, influencing operational efficiency [10]. Claessens and Van Horen (2020) found that increased banking activities positively affect liquidity ratios and assets, while excessive debt levels negatively impact performance [6]. Ghalibaf Asl and Babalouyan (2020) explored bank stock valuation models, emphasizing fundamental valuation approaches due to regulatory complexities [11]. Karimzadeh et al. (2019) examined macroeconomic factors affecting bank stock indices, revealing that inflation and exchange rates negatively impact stock prices, while interest rates and GDP growth have positive effects. Sheikh et al. (2018) found that inflation affects financing through bank debt more than equity issuance. Abounoori et al. (2017) identified a long-term positive relationship between nominal interest rates and inflation in Iran’s banking system, with inflation inversely related to deposit growth [12]. Alvani et al. (2016) evaluated bank branch efficiency, finding structural factors such as asset composition and technology adoption critical [13]. Khoshsima and Shahiki Tash (2016) analyzed the impact of credit, operational, and liquidity risks on banking efficiency, concluding that parametric methods provide superior efficiency rankings [14]. Overall, the literature demonstrates the interconnectedness of risk, banking strategies, regulatory environments, and macroeconomic conditions in shaping banking performance.

Given the above considerations, the primary research question of this study is to examine the impact of income diversification and banking activity expansion on the risk and return of banks listed on the Tehran Stock Exchange. Additionally, this study will analyze the influence of variables such as capital ratio, bank size, and capital expenditure ratio on the relationship between income diversification, banking activity expansion, and risk-return dynamics. Risk in banks is a highly significant factor affecting fluctuations in bank stock returns. An increase or decrease in bank risk impacts the capital ratio, which may, in turn, lead to fluctuations in capital expenditures [1]. As capital expenditure ratios fluctuate, bank stock returns are significantly affected, and in the long run, a decrease in dividend payouts could either raise or lower stock returns [3]. Given the importance of these issues, the primary objective of this study is to examine the impact of banking activity expansion on electronic banking risk.

2. Methodology

The research methodology, in terms of its nature and content, follows a correlational approach, employing an ex-post facto method to investigate the relationships between variables. This study is an applied research project that utilizes real-world data and various statistical methods to test hypotheses within a positivist theoretical framework.

In any research study, obtaining accurate information relevant to the research objectives is of fundamental importance. In this study, a library-based method has been used to examine the theoretical foundations and review prior research, drawing on specialized books, academic articles in Persian and English, and dissertations. Since the data related to the variables in this research include numerous accounting items presented in the audited financial statements of banks, the required data have been manually extracted from financial statements available on research management, development, and Islamic studies websites affiliated with the Securities and Exchange Organization of Iran at www.rdis.ir, the Codal system for comprehensive issuer information at www.codal.ir, the Iranian Financial Information Processing Center at www.fipiran.com, and compact discs from the Securities and Exchange Organization. These sources are considered to have greater reliability than other available resources. Additionally, other required financial statement data of banks have been collected from the Tehran Stock Exchange database and the Rahavard Novin software, in formats such as PDF and Excel. The collected data include income statements, balance sheets, profit forecasts, and other financial reports.

Using the collected data from the research sample, which consists of 60 bank-year observations over the period from 2016 to 2021, the study hypotheses are tested. The hypothesis testing method in this study is based on panel data analysis, conducted using software tools including SPSS 22, EViews 8.1, and Minitab 17.1. Initially, to enhance understanding of the statistical population and the studied variables, a summary of descriptive statistics of the research variables is provided, and the normality of the distribution of dependent variables is tested. Following this, based on the classification of the research hypotheses, hypothesis tests are reported, and the results are analyzed.

The statistical population of this study includes all banks listed on the Tehran Stock Exchange. According to the official website of the Securities and Exchange Organization of Iran, as of the end of 2021, the listed banks consisted of 10 banks categorized into two groups: state-owned institutional shareholders and privately-owned institutional shareholders. Therefore, in this study, all banks listed on the Tehran Stock Exchange over a six-year period, from 2016 to 2021, constitute the research population.

In this study, a total of 10 state-owned and private banks have been selected as the research sample. The following table presents the distribution of sample members by ownership type.

Table 1. Frequency of Sample Members by Ownership Type

Row	Bank Name	Sample Observation
1	Bank Eghtesad Novin	6
2	Bank Saderat Iran	6
3	Bank Tejarat	6
4	Bank Mellat	6
5	Bank Parsian	6
6	Bank Karafarin	6
7	Bank Pasargad	6
8	Post Bank of Iran	6
9	Bank Ansar	6
10	Bank Sina	6
Total		60

Research Variables and Model

The variables in this study are classified into three categories:

Dependent Variable:

- Bank risk for bank *i* in year *t* (Risk_(i,t)).

Independent Variables:

- Banking activity expansion for bank *i* in year *t* (Efficiency_(i,t)).

Control Variables:

- Equity ratio of bank *i* in year *t* (Equity_(i,t)).
- Bank size of bank *i* in year *t* (Size_(i,t)).
- Ratio of independent board members of bank *i* in year *t* (Bankingfreedom_(i,t)).
- Ratio of property, plant, and equipment of bank *i* in year *t* (Propertyright_(i,t)).
- Capital expenditure ratio of bank *i* in year *t* (Capitalstringent_(i,t)).
- Growth rate of bank *i* in year *t* (GDPgrowth_(i,t)).
- Inflation rate of bank *i* in year *t* (Inflation_(i,t)).

Operational Definitions of Research Variables

Bank Risk (Risk_(i,t)): In this study, bank risk is calculated using the following formula:

ln(σ(R_(d"is," t)))*(i,t) = (UE_i)/(UE*(i,t)-1)

Sharpe, in his research leading to the Capital Asset Pricing Model (CAPM), demonstrated that the expected return of an individual security equals the risk-free return plus the security's relative risk (β) multiplied by the difference between market portfolio return and the risk-free return, as follows:

UE_ri = r_f - β_i (r_m - r_f)

where:

- *E_ri* = expected return risk
- *r_f* = risk-free return of an asset
- *β_i* = relative risk of the security
- *r_m* = market portfolio return

The total portfolio risk-return rate (total return rate) is obtained by summing price changes and cash dividends while considering the capital invested:

rm = (Σc_(i,t)D_(i,t) - Σx_i p_i) / (c_(i,t) p_(i,t)-1) + (TEP_t - TEP_(t-1)) / (TEP_(t-1))

where:

- *TEP_t* = stock index at the end of the day
- *TEP_(t-1)* = stock index at the beginning of the day
- *X_i P* = cash contributions of shareholders in capital increases
- *C_i* = number of shares in the period
- *D_it* = cash dividend per share
- *P_it* = share price in the period
- *t* = examined period

Stock Return Calculation: The total return ratio from an investment in a specific period relative to the invested capital is calculated as follows:

R_t = ((P_t - P_(t-1)) + DPS_t) / P_(t-1)

where:

- R_t = common stock return in period t
- P_t = common stock price in period t
- $P\_(t-1)$ = common stock price in period $t-1$
- DPS_t = common stock dividend per share in period t

Banking Activity Expansion (Efficiency_(i,t))

If a bank has extensive banking activities in various economic sectors, it is assigned a value of 1; otherwise, it is assigned 0.

Equity Ratio (Equity_(i,t))

The equity ratio is calculated as the shareholders' equity divided by the total book value of bank assets.

Bank Size (Size_(i,t))

Bank size is measured as the natural logarithm of the total book value of assets.

Ratio of Independent Board Members (Bankingfreedom_(i,t))

The ratio of independent board members is calculated as the number of independent board directors divided by the total number of board members in the year prior to the current year.

The calculation formula for board independence is as follows:

Bankingfreedom_(i,t) = number of non-executive board members / total number of board members in the prior year

Ratio of Property, Plant, and Equipment (Propertyright_(i,t))

This ratio is calculated as the total value of property, plant, and equipment divided by the book value of bank liabilities.

Capital Expenditure Ratio (Capitalstringent_(i,t))

Capital expenditure refers to the costs associated with fixed investments in banks. It is calculated using the ratio of fixed capital expenditures to banks' fixed capital.

Bank Growth Rate (GDPgrowth_(i,t))

The bank's growth rate is determined by the change in operating cash flows, calculated as follows:

GS_(i,t) = (S_(i,t) - S_(i,t-1)) / S_(i,t-1)

where:

- $GS\_(i,t)$ = operating cash flows of bank i in year t
- $S\_(i,t)$ = operating cash flows of bank i in year t
- $S\_(i,t-1)$ = operating cash flows of bank i in year $t-1$

Inflation Rate (Inflation_(i,t))

The inflation rate is defined as the annual inflation rate reported by the Central Bank of the Islamic Republic of Iran for the given year.

Research Model

To test the first to fourth hypotheses, Models 1 and 2, as outlined below, will be used. If the coefficients β_i (coefficients of independent variables) are statistically significant at a 95% confidence level, the corresponding research hypotheses will be confirmed.

Research Hypothesis Model:

Risk_(i,t) = α_0 + β_1 CBB_(i,t) + β_2 Efficiency_(i,t) + β_3 Equity_(i,t) + β_4 Size_(i,t) + β_5 Bankingfreedom_(i,t)

- β_6 Propertyright_(i,t) + β_7 Capitalstringent_(i,t) + β_8 GDPgrowth_(i,t) + β_9 Inflation_(i,t) + ε_(i,t)

where:

- *i* represents the bank (cross-sectional units), and *t* represents the year.
- *ε_(i,t)* is the random error term for bank *i* in year *t*.

3. Findings and Results

In general, methods used to process and summarize collected data are referred to as descriptive statistics. This type of statistics is solely concerned with describing the population or sample and aims to calculate the parameters of the research population or sample (Azar & Momeni, 2010, p. 8). In the descriptive statistics section, data analysis is conducted using central tendency indicators such as mean and median, as well as dispersion indicators including standard deviation, skewness, and kurtosis. Among these, the mean is the primary central indicator, representing the average value of the data. If data points are arranged in order along an axis, the mean is precisely the point of equilibrium or the center of the distribution. Standard deviation is a measure of dispersion that indicates the spread of data points. Skewness measures the degree of asymmetry in the data distribution, serving as an indicator of symmetry. If the population follows a symmetric distribution, the skewness coefficient is zero. If the population is skewed to the left, the skewness coefficient is negative, and if it is skewed to the right, the coefficient is positive. Kurtosis measures the dispersion of the population relative to a normal distribution. A summary of the descriptive statistics of the model variables, after screening and removing outliers, is presented in Table 2using SPSS 22 software.

Table 2. Descriptive Statistics of Research Variables

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum	Skewness	Kurtosis
Bank Risk	60	0.3339	0.1484	0.0157	0.5987	-0.366	-0.562
Bank Return	60	0.0204	0.0206	0.0021	0.0929	1.205	1.285
Income Diversification	60	0.5833	0.4971	0.0000	1.0000	-0.347	-1.946
Banking Activity Expansion	60	0.5500	0.5016	0.0000	1.0000	-0.206	2.026
Equity Ratio	60	0.5622	0.1671	0.0414	0.8327	-0.753	0.320
Bank Size	60	5.4943	0.5972	4.5518	7.2960	0.855	0.812
Ratio of Independent Board Members	60	0.5422	0.1476	0.2688	0.9176	0.636	0.010
Capital Expenditure Ratio	60	0.3301	0.2568	0.0320	0.3543	1.310	3.063
Growth Rate	60	0.1126	0.1182	0.0014	0.6782	2.394	8.143
Inflation Rate	60	0.3900	0.3313	0.0057	0.6592	0.741	-0.418
Ratio of Property, Plant, and Equipment	60	0.2282	0.2044	0.0219	0.8343	1.287	0.891

According to Table 2, the mean bank risk and bank return of the sample banks are 0.3339 and 0.0204, respectively, with minimum and maximum values of 0.0021 and 0.5987. Analyzing the skewness and kurtosis of this variable, which should be 0 and 3, respectively, to indicate a normal distribution, reveals that this variable does not follow a normal distribution. Based on the descriptive statistics in Table 2, the mean income diversification and banking activity expansion of the sample companies during the study period were both positive, with values of 0.5833 and 0.5500, respectively. Additionally, the mean values for the equity ratio, bank size, ratio of independent board members, capital expenditure ratio, growth rate, inflation rate, and ratio of property, plant, and equipment were 0.5622, 5.4943, 0.5422, 0.3301, 0.1126, 0.3900, and 0.2282, respectively.

In this section, the necessary model estimation approach for each research hypothesis is first determined. Then, the research model is estimated, and the results are interpreted. Additionally, for each hypothesis, statistical assumption tests—including residual normality, residual variance homogeneity, residual independence, and model linearity—are conducted, with explanations and results provided. All these tests are analyzed using EViews 8.1 software. Finally, the research hypotheses are formulated as follows:

First Hypothesis: Income diversification affects bank risk.

Second Hypothesis: Banking activity expansion affects bank risk.

Third Hypothesis: Income diversification affects bank returns.

The purpose of the first hypothesis test is to examine the effect of income diversification on bank risk, and its statistical hypothesis is defined as follows:

H_0: Income diversification has no significant effect on bank risk.

H_1: Income diversification has a significant effect on bank risk.

This hypothesis is estimated using panel data with Model (1), and if the coefficient β_1 is statistically significant at the 95% confidence level, the hypothesis is confirmed.

$Risk_{(i,t)} = \alpha_0 + \beta_1 CBB_{(i,t)} + \beta_2 Efficiency_{(i,t)} + \beta_3 Equity_{(i,t)} + \beta_4 Size_{(i,t)} + \beta_5 Bankingfreedom_{(i,t)}$

- $\beta_6 Propertyright_{(i,t)} + \beta_7 Capitalstringent_{(i,t)} + \beta_8 GDPgrowth_{(i,t)} + \beta_9 Inflation_{(i,t)} + \varepsilon_{(i,t)}$

To determine whether the panel data method is suitable for estimating the model, the Chow test (or restricted F test) is used. Additionally, the Hausman test is applied to determine whether a fixed-effects or random-effects model is more appropriate for estimation.

The results of these tests are presented in Table 3.

Table 3. Results of the Chow and Hausman Tests for Model (1)

Test	Observations	Statistic	Statistic Value	Degrees of Freedom	P-Value
Chow	60	F	3.3113	(41,9)	0.0040
Hausman	60	χ^2	13.8897	9	0.0263

According to the Chow test results and its P-Value (0.0040), the null hypothesis (H_0) is rejected at the 95% confidence level, indicating that the panel data method is appropriate for this estimation. Furthermore, based on the Hausman test results and its P-Value (0.0263), which is less than 0.05, the null hypothesis (H_0) is rejected at the 95% confidence level, and the alternative hypothesis (H_1) is accepted. Therefore, the model must be estimated using the fixed-effects method.

To assess the validity of the model and examine classical regression assumptions, it is necessary to conduct tests in addition to checking for multicollinearity among the independent variables included in the model. These tests include assessing the normality of residuals, homoscedasticity, independence of residuals, and the absence of model specification errors (linearity of the model). Various tests can be used to examine the normality of error terms, one of which is the Jarque-Bera test, which has also been employed in this study. The results of the Jarque-Bera test indicate that the residuals obtained from the model estimation follow a normal distribution at the 95% confidence level, as the test probability value (0.1758) is greater than 0.05.

Another classical regression assumption is the homoscedasticity of residuals. If the variances are heteroscedastic, the linear estimator will be biased and will not have the minimum variance. In this study, the Breusch-Pagan test was used to examine homoscedasticity. Given that the significance level of this test is less than 0.05 (0.0056), the null hypothesis of variance homogeneity is rejected, indicating that the model suffers from heteroscedasticity. To address this issue, the Generalized Least Squares (GLS) estimation method was used.

Additionally, in this study, the Durbin-Watson (D-W) test was applied to assess the independence of residuals, which is one of the key assumptions of regression analysis and is referred to as autocorrelation. Based on the initial model estimation results, the Durbin-Watson statistic is 1.93. Since this value falls between 1.5 and 2.5, it can be concluded that the residuals are independent of each other.

Furthermore, the Ramsey test was conducted to determine whether the model has a linear relationship and whether the research model has been correctly specified as linear or nonlinear. Given that the significance level of the Ramsey test (0.1553) is greater than 0.05, the null hypothesis of this test, which states that the model is linear, is confirmed, and no model specification error exists.

Based on the results of the Chow and Hausman tests, as well as the results of the classical regression assumption tests, Model (1) of the study is estimated using panel data with fixed effects. The model estimation results are presented in Table 4. The estimated model, using EViews 7 software, is as follows:

$Risk_{(i,t)} = 0.4233 + 0.0818CBB_{(i,t)} + 0.1205Efficiency_{(i,t)} + 0.1241Equity_{(i,t)} + 0.0087Size_{(i,t)}$

- $0.0649Bankingfreedom_{(i,t)} + 0.0628Propertyright_{(i,t)} - 0.3258Capitalstringent_{(i,t)}$
- $0.0958GDPgrowth_{(i,t)} + 0.1718Inflation_{(i,t)} + \varepsilon_{(i,t)}$

Table 4. Results of the First Hypothesis Test Using the Fixed Effects Method

Variable	Coefficient	t-Statistic	P-Value	Relationship
Constant Term	0.4233	2.5158	0.0159	Positive
Income Diversification	0.0818	2.9256	0.0101	Positive
Banking Activity Expansion	0.1205	3.3179	0.0048	Positive
Equity Ratio	0.1241	3.2554	0.0064	Positive
Bank Size	0.0087	4.3376	0.0003	Positive
Ratio of Independent Board Members	-0.0649	-3.8495	0.0005	Negative
Capital Expenditure Ratio	0.0628	1.0543	0.2979	Insignificant
Growth Rate	-0.3258	-2.8525	0.0068	Negative
Inflation Rate	0.0958	2.1011	0.0418	Positive
Ratio of Property, Plant, and Equipment	0.1718	2.1476	0.0377	Positive
R-Squared	0.6063			
F-Statistic (P-Value)	3.5088 (0.0004)			

Examining the overall significance of the model, since the P-Value of the F-Statistic is less than 0.05 (0.0004), the significance of the entire model is confirmed at the 95% confidence level. The R-Squared value indicates that 60.63% of the variation in bank risk is explained by the independent variables included in the model.

Examining the significance of the coefficients, based on the results presented in Table 4, since the P-Value for the t-statistic of the income diversification variable is less than 0.05 (0.0101), the significant effect of income diversification on bank risk is confirmed at the 95% confidence level. Therefore, the first research hypothesis is accepted, and it can be concluded with 95% confidence that income diversification has a significant effect on bank risk. The positive coefficient of this variable (0.0818) indicates a direct impact of income diversification on bank risk, meaning that a one-unit increase in income diversification leads to a 0.0818 unit increase in bank risk. Thus, based on the conducted analysis, it is concluded that income diversification affects bank risk.

The purpose of testing the second hypothesis is to determine whether banking activity expansion has a significant effect on bank risk. The statistical hypothesis is stated as follows:

H_0: Banking activity expansion has no significant effect on bank risk.

H_1: Banking activity expansion has a significant effect on bank risk.

This hypothesis is estimated using panel data in Model (1). If the coefficient β_2 is statistically significant at the 95% confidence level, the hypothesis will be confirmed.

$Risk_{(i,t)} = \alpha_0 + \beta_1 CBB_{(i,t)} + \beta_2 Efficiency_{(i,t)} + \beta_3 Equity_{(i,t)} + \beta_4 Size_{(i,t)} + \beta_5 Bankingfreedom_{(i,t)}$

- β_6 Propertyright_(i,t) + β_7 Capitalstringent_(i,t) + β_8 GDPgrowth_(i,t) + β_9 Inflation_(i,t) + ε_(i,t)

Examining the significance of the coefficients based on the results presented in Table 4, the P-Value for the t-statistic of the banking activity expansion variable is less than 0.05 (0.0048). Consequently, the significant effect of banking activity expansion on risk is confirmed at the 95% confidence level. Therefore, the second research hypothesis is accepted, and it can be concluded with 95% confidence that banking activity expansion has a significant effect on bank risk. The positive coefficient of this variable (0.1205) indicates a direct impact, meaning that a one-unit increase in banking activity expansion leads to a 0.1205 unit increase in bank risk. Based on the conducted analysis regarding the confirmation of the second hypothesis, it can be concluded that banking activity expansion affects bank risk.

The purpose of testing the third hypothesis is to determine whether income diversification has a significant effect on bank returns. The statistical hypothesis is stated as follows:

H_0: Income diversification has no significant effect on bank returns.

H_1: Income diversification has a significant effect on bank returns.

This hypothesis is estimated using panel data in Model (2). If the coefficient β_1 is statistically significant at the 95% confidence level, the hypothesis will be confirmed.

return_(i,t) = α_0 + β_1 CBB_(i,t) + β_2 Efficiency_(i,t) + β_3 Equity_(i,t) + β_4 Size_(i,t) + β_5 Bankingfreedom_(i,t)

- β_6 Propertyright_(i,t) + β_7 Capitalstringent_(i,t) + β_8 GDPgrowth_(i,t) + β_9 Inflation_(i,t) + ε_(i,t)

The results of the Chow test (to determine whether the panel data method or the pooled data method should be used) and the Hausman test (to determine whether the fixed effects or random effects model should be used in the panel data method) for Model (2) are presented in Table 5.

Table 5. Results of the Chow and Hausman Tests for Model (2)

Test	Statistic	Statistic Value	Degrees of Freedom	P-Value
Chow	F	0.2404	(41,9)	0.0061
Hausman	χ^2	2.9838	9	0.0049

According to the results of the Chow test and its P-Value (0.0061), the null hypothesis (H_0) is rejected at the 95% confidence level, indicating that the panel data method is appropriate. Furthermore, based on the results of the Hausman test and its P-Value (0.0049), which is less than 0.05, the null hypothesis (H_0) is rejected at the 95% confidence level, and the alternative hypothesis (H_1) is accepted. Therefore, the model must be estimated using the fixed effects method.

In examining classical regression assumptions, the results of the Jarque-Bera test indicate that the residuals from the model estimation follow a normal distribution at the 95% confidence level, as the test probability value (0.1194) is greater than 0.05. Additionally, given that the significance level of the Breusch-Pagan test is less than 0.05 (0.0178), the null hypothesis of variance homogeneity is rejected, indicating that the model suffers from heteroscedasticity. To address this issue, the Generalized Least Squares (GLS) estimation method was used.

For autocorrelation testing of model residuals using the Durbin-Watson (D-W) statistic, the Durbin-Watson statistic value was found to be 2.26. Since this value falls between 1.5 and 2.5, it can be concluded that the residuals are independent.

Additionally, since the significance level of the Ramsey test is greater than 0.05 (0.2480), the null hypothesis of this test, which states that the model is linear, is confirmed, and no model specification error exists.

Based on the results of the Chow and Hausman tests, as well as the results of the classical regression assumption tests, Model (2) of the study is estimated using panel data with fixed effects.

The estimation results of the model are presented in Table 6.

Table 6. Results of the Third Hypothesis Test Using the Fixed Effects Method

Variable	Coefficient	t-Statistic	P-Value	Relationship
Constant Term	0.0476	3.2918	0.0036	Positive
Income Diversification	0.0093	3.6103	0.0050	Positive
Banking Activity Expansion	0.0042	4.2754	0.0004	Positive
Equity Ratio	0.0024	2.1538	0.0185	Positive
Bank Size	0.0068	3.2741	0.0098	Positive
Ratio of Independent Board Members	-0.0001	-4.0097	0.0003	Negative
Capital Expenditure Ratio	-0.0001	-0.1090	0.9137	Insignificant
Growth Rate	0.0670	2.4496	0.0187	Positive
Inflation Rate	0.0004	3.0540	0.0072	Positive
Ratio of Property, Plant, and Equipment	-0.0043	-2.3057	0.0013	Negative
R-Squared	0.5435			
F-Statistic (P-Value)	11.7334 (0.0000)			

The estimated model, using EViews 7 software, is as follows:

return_(i,t) = 0.0476 + 0.0093CBB_(i,t) + 0.0042Efficiency_(i,t) + 0.0024Equity_(i,t) + 0.0068Size_(i,t)

- 0.0001Bankingfreedom_(i,t) - 0.0001Propertyright_(i,t) + 0.0670Capitalstringent_(i,t)
- 0.0004GDPgrowth_(i,t) - 0.0043Inflation_(i,t) + ε_(i,t)

Examining the overall significance of the model, since the P-Value of the F-Statistic is less than 0.05 (0.0000), the significance of the entire model is confirmed at the 95% confidence level. The R-Squared value indicates that 54.35% of the variation in bank returns is explained by the independent variables included in the model.

Examining the significance of the coefficients based on the results, the P-Value for the t-statistic of the income diversification variable is less than 0.05 (0.0050). Consequently, the significant effect of income diversification on bank returns is confirmed at the 95% confidence level. Therefore, the third research hypothesis is accepted, and it can be concluded with 95% confidence that income diversification has a significant effect on bank returns. The positive coefficient of this variable (0.0093) indicates a direct impact, meaning that a one-unit increase in income diversification leads to a 0.0093 unit increase in bank returns. Based on the conducted analysis regarding the confirmation of the third hypothesis, it can be concluded that income diversification affects bank returns.

4. Discussion and Conclusion

Electronic banking is defined as the tools, techniques, and automated solutions used to directly deliver various traditional and modern banking products and services to customers through interactive communication channels. Electronic banking includes systems that enable customers, individuals, or commercial and non-commercial enterprises to access their accounts and financial transactions or obtain information about banking products and services through private and public information networks such as the Internet. Major developments in today's business environment, such as globalization and rapid technological advancements, have increased competition and made management in organizations more challenging. In this business environment, management and employees must be capable of handling complex and ambiguous interdependencies between technology, data, tasks, activities, processes, and individuals. Organizations in such environments require managers who can recognize and address these inherent complexities in their critical decision-making processes. Effective risk management, based on a sound conceptual framework, forms a crucial part of this decision-making process.

The Basel Committee has identified principles related to risk management in electronic banking, which can help banking institutions enhance their understanding of electronic banking policies and processes. However, since the conditions of each bank differ, each bank needs a specific approach suitable for the scale of its electronic banking operations. The challenges of banking risk management include the intangible nature of risks relative to revenues and the necessity of providing foundations for risk modeling through academic models. Given that banks are exposed to various types of risks, asset and liability risk management is a fundamental and essential component of banking operations. Effective analysis of banking activities requires a thorough understanding and evaluation of existing risks.

Risk identification and management is one of the modern approaches used to enhance organizational effectiveness and efficiency. Risk management involves assessing risks and then adopting strategies to mitigate them. Risks can be categorized based on their likelihood of occurrence and impact, leading to a risk portfolio and the implementation of appropriate strategies, such as risk transfer, avoidance, reduction, or acceptance. In a broad sense, risk or uncertainty refers to an outcome differing from expectations. From a financial perspective, risk is the deviation of actual returns from expected returns. Risk can be considered in any domain, including banking and banking operations. Given their critical role in the economic system, banks receive special attention in this regard. The existence of risk in banks can be explained by their function: on one hand, banks collect public capital, for which they bear responsibility, and on the other hand, they use this capital to conduct banking operations and engage in economic activities.

Examining the significance of coefficients, the P-Value of the t-statistic for the banking activity expansion variable is less than 0.05 (0.0048). As a result, the significant effect of banking activity expansion on risk is confirmed at the 95% confidence level. Therefore, the second hypothesis of the study is accepted, and it can be stated with 95% confidence that banking activity expansion has a significant impact on bank risk. The positive coefficient of this variable (0.1205) indicates a direct effect, meaning that a one-unit increase in banking activity expansion leads to a 0.1205 unit increase in bank risk. Based on the conducted analyses regarding the confirmation of the research hypothesis, it can be concluded that banking activity expansion affects bank risk.

The results of this hypothesis align with the prior findings [4, 10] but contradict some other findings [6].

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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