

Investigating the Impact of Income Diversification Strategies on Efficiency in Banks Admitted to the Tehran Stock Exchange Between 2011 and 2021

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Abstract

The banking industry is one of the most important pillars of the economy of any country, which plays a decisive role in the economic development and growth of countries due to the provision of various financial and credit services. With the globalization of the banking industry, it is very important to use income diversification strategies to improve value and efficiency. Using the data and information obtained from the financial statements of banks, this research has investigated the effect of income diversification strategies on efficiency in banks admitted to the Tehran Stock Exchange. The statistical population of this research includes all the banks admitted to the Tehran Stock Exchange during 2011-2021, and 10 banks were selected as a statistical sample using the targeted elimination method. In this research, the data envelopment analysis (DEA) approach was used to measure efficiency, and the autoregressive model approach with distributed intervals (ARDL) was used to estimate the research model. The present research findings showed that the strategy of income diversification (interest and non-interest) both in the short term and in the long term has a positive and significant effect on the efficiency of banks admitted to the Tehran Stock Exchange.

Keywords: Diversification strategies, interest income diversification, non-interest income diversification, efficiency.

Introduction

Banks are one of the oldest, most active, and most widespread financial intermediaries that play an undeniable role in the collection and distribution of financial resources. In today's economic systems, the role of financial systems, money and capital markets and, accordingly, financial and credit institutions, headed by banks, is of great importance (De Jonghe et al., 2020).

On the other hand, with the increasing advancement of technology and the change in providing banking services from traditional banking to electronic banking, the competition between banks and other financial institutions has intensified in providing better and faster electronic services;

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Meanwhile, more successful institutions are those that are more efficient in their performance (Sandhu & Arora, 2022; Windasari et al., 2022). One of the aspects of checking the performance of banks is to check their efficiency. Efficiency is aimed at maximizing the result of the organization or economic entity. Any action to improve and enhance the efficiency of the banking system will improve the flow of savings, investment, and allocation of resources, and the potential, scattered, and latent facilities in the country will be used for progress and public welfare (Rehman et al., 2022; El-Chaarani et al., 2022). Efficiency is aimed at maximizing the result by the organization or economic entity and is related to concepts such as effectiveness and productivity, and at the same time, it is different from these concepts. According to Farrell (1957), the efficiency of a company includes technical efficiency, allocation efficiency, and economic (cost) efficiency; Technical efficiency shows the ability of a company to obtain maximum output using a certain amount of inputs and a certain level of technology; Allocative efficiency reveals the ability of a company to use optimal ratios of inputs according to their prices, and economic efficiency is obtained from the product of technical efficiency and allocative efficiency (Färe & Karagiannis, 2022; Hatami-Marbini & Arabmaldar, 2021).

In the research that has been carried out in the field of efficiency in the banking industry, there are two general attitudes to mean the outputs and inputs of banks. These two attitudes are classified under the headings of interface attitude and production attitude in research. In the intermediation approach, banks, acting as service-providing intermediaries, collect deposits and convert them into interest-bearing assets such as loans, securities, and other investments. The results are based on the monetary amount and currency of each country in the calculations and models. In this view, inputs include capital, labor, and deposits, and outputs include loans and economic partnerships (Batir et al., 2017). In the production approach, banks are considered producers of lending and deposit maintenance services that use their capital and labor to provide services. In this method, the results are measured according to the number of accounts. From the production perspective, bank inputs include capital labor and the like, but deposits are not considered as inputs (Tarkhani et al., 2020).

One of the effective factors in banks' efficiency is income diversification strategies. Diversified banks can benefit from the application of managerial abilities and skills in different products and markets, and by expanding their operations in different products or markets, diverse banks can reduce the risk of bankruptcy. The former argues that different business activities involve different degrees of risk-taking. In addition, business diversification is one of the strategies that banks use to deal with uncertainty and may help improve their future performance (Yavas et al., 2019).

Technological progress and deregulation cause significant changes in the banking structure. On the other hand, it can be seen that the banking industry has undergone fundamental, rapid, and complex changes and transformations, such as mergers, acquisitions, structural reforms, deregulation, and increasing competition. In response to increasing competition and maintaining their position in the market, many commercial banks are seeking to apply income diversification strategies (Wu et al., 2020). The competition in financial markets in the optimal allocation of financial resources has attracted more depositors to banks; Because it has prompted the banks to increase the number of applicants for banking facilities by increasing creativity in using various tools. The income structure includes two types of interest and non-interest income (Adesina, 2021). The structure of interest income includes lending activities and traditional activities of banks; But the structure of non-interest income includes fee income, commission, foreign exchange income, etc. The issue of income diversification can be of great importance for banks, especially domestic banks that have always taken a lot of risks due to unfavorable economic conditions. Also, the high ratio of non-current facilities in the country's banking network requires that banks focus more on other (non-shared) income that they can earn through various financial services. Therefore,

diversification of incomes by increasing the share of non-shared incomes, especially fee incomes, can be considered as a good strategy for banks (da Costa et al., 2023).

According to the above explanations, this research examines the effect of income strategies on efficiency in banks admitted to the Tehran Stock Exchange by using data and information obtained from financial banks and raises the question of whether there is income diversity and does this diversity of income have an effect on the efficiency of banks admitted to the Tehran Stock Exchange. After the introduction, in the second part, the theoretical foundations of institutional quality, financial development, and economic growth are stated, and after a review of empirical studies, in the third part, the research model and methodology are mentioned. In the fourth part, the experimental research of the model is presented and finally, this research ends with conclusions and suggestions.

Literature Review

Efficiency

Efficiency is aimed at maximizing the result by an organization or an economic entity and is related to concepts such as effectiveness and productivity and at the same time, it is different from these concepts. The effect of the degree and extent of achieving the set goals is obtained and it shows how much of the efforts made have achieved the expected results. However, efficiency is related to the correct use of resources. Productivity is a combination of efficiency and effectiveness and includes both categories (El-Chaarani et al., 2022). Efficiency is an economic concept that shows the performance of a wide range of economic activities in the context of a company an economic sector or a national or regional economy. In theoretical texts, this economic concept has been defined and evaluated by separating technical, allocative, and economic efficiency. (Aparicio et al., 2023). Technical efficiency indicates the ability of a company to produce the highest amount of product or output by using a certain amount of production factors or using the lowest amount of production factors to produce a certain amount of output, which can be calculated either according to the ratio of the actual amount The obtained outputs are expressed as the optimal amount (maximum) of outputs at a certain level of production factors or in terms of the ratio of the actual amount of consumption of production factors to the optimal amount (minimum) of their consumption at a certain level of outputs (Cao et al., 2021). Allocative efficiency (price efficiency) is another aspect of the concept of efficiency that shows the ability of a company to use the optimal combination of production factors according to their relative prices. Economic efficiency is obtained from the product of technical and allocation efficiency. In economic efficiency, the optimal combination of production factors is taken into consideration both in terms of their relative prices and in terms of minimizing their use to produce a certain amount of output (Simar & Wilson, 2020; Kumbhakar & Tsionas, 2020).

Performance measurement has always been the focus of researchers due to its importance in evaluating the performance of an organization or company. In 1957, Farrell measured the efficiency of a production unit using a method similar to efficiency measurement in engineering topics. The case that Farrell intended to measure efficiency included an input and an output. Charnes et al. (1978) developed Farrell's view and presented a model that was able to measure performance with multiple inputs and multiple outputs. This model was named Data Envelopment Analysis (DEA) (Sinuany-Stern, 2023; Lee, 2023; Kaffash et al., 2020).

DEA is a non-parametric technique for measuring the relative efficiency of a set of homogeneous units with definite inputs and outputs. Charnes et al. (1978) proposed a linear programming model known as the CCR model to calculate efficiency. In 1993 and 1994, Ali and Sifford modified the CCR model. Since the presentation of the initial models, many improvements and improvements have been made in these models, and many applications of this technique have been shown in the field of efficiency measurement and other fields. Since 1978, the use of data envelopment analysis techniques has been expanding rapidly, and so far, many developments have taken place in theoretical and practical aspects of data envelopment analysis models. As an example of DEA models for comparing and evaluating various organizations and industries such as the banking industry, post office, agriculture, insurance, sports, manufacturing, healthcare (hospitals and clinics), education (schools and universities), transportation, stock market, electricity production (power plants), oil (refineries) and many other applications have been used (Nepomuceno et al., 2023; Wigati et al., 2023; Harikumar & Saleeshya, 2021).

To calculate the efficiency of each method, inputs (inputs) and outputs (outputs) must be specified. The nature of inputs and outputs of any economic unit, including a bank, depends on the expectations and definition of that economic unit. By changing the definition of the bank, the nature of the bank's data and outputs will also change. In the economic literature related to banking activity, the bank has been given more attention from two perspectives. In the first point of view, the bank is considered a production unit (production point of view), and in the second point of view, the bank is considered a financial institution (intermediary point of view) (Sufian et al., 2016); Also, sometimes other opinions have been raised, which are as follows:

Production attitude: In the production attitude, the bank is like a service company. In general, in this view, banks are considered service institutions that produce different types of deposits and facilities using their capital and labor force. In this method, physical variables such as manpower, capital, raw materials, space, and information systems were used as inputs and services provided to customers in the form of providing facilities and keeping funds of various types of deposits. And their use in different investments is considered as the bank's earnings. This attitude prevailed in the banking literature until the 1980s (Tecles & Tabak, 2010).

Intermediary approach: In this method, banks are considered as fund collectors. Based on this method, banks use their capital and labor to invest the collected deposits on behalf of the people in various projects. Banks are considered as an intermediary institution of financial services. In this approach, labor force, capital, and bank deposits are used as inputs, and facilities and investments are used as bank outputs. In general, the intermediary attitude includes three theories; Income theory, consumer spending theory, and added value theory (Sun et al., 2017).

Operational attitude (theory based on income): In this approach, banks, like business units, with the financial goals of earning income to manage business affairs, bear the entire cost (loss observation). For this basis, the total income (interest or without interest) of the bank statement and the total expenses (interest and operating expenses) of the bank institution are considered (Othman et al., 2017).

The attitude of risk management: In the approach of risk management, all assets and liabilities of the bank, in terms of the risk of the collected resources and the facilities provided, are the output of the bank, and the capital facilities of the bank are the inputs of the bank (Bonin et al., 2005).

Modern attitude: In this attitude, efforts are made to complete some risk scales, such as intermediary costs (representation and brokerage) and the quality of banking services. In this theory, individual components of CAMELS (CAMELS stand for Capital, Asset Quality, Management, Earnings, Liquidity, and Sensitivity to Market Risk.) from financial tables of banks are used as variables in operational analysis (Boateng et al., 2019; Sun et al., 2017).

Diversity strategy

The vulnerability of specialized companies to the rapid and unexpected changes in the environment has caused diversification to be proposed as a necessary basis for ensuring the growth and survival of companies in the field of global competition since the end of the 20th century. The increase in the business environment and the internationalization of companies has caused companies to try to respond to the multiple needs of their customers and thereby increase customer loyalty to the business unit (Adesina, 2021).

Ramanujam & Varadarajan (1989) consider diversification as the extent to which firms engage in different business activities at the same time. Diversification is divided into two parts: homogeneous diversification and heterogeneous diversification.

Homogeneous diversification occurs when a company has different business units and produces diverse products, and at the same time, all inputs are somehow related to each other. In other words, homogeneous diversification occurs when a company diversifies in its existing industries (Wu et al., 2020). On the other hand, the heterogeneous diversification strategy causes the company's products to diversify in areas that have little in common with each other. In other words, the heterogeneous diversification strategy is a type of strategy in which there is no connection between the existing activities and the new activities of the company (Cohen et al., 2022; Ely & Thomas, 2020).

Choosing a diversification strategy and moving towards it is always accompanied by a multitude of positive and negative opinions. On the one hand, the proponents of the diversification strategy consider it justified by reasons such as overcoming competitive pressures in the value chain, optimizing the holding portfolio, balancing the risk or the high transaction cost of the market, and on the other hand, the opponents of this strategy consider it to be justifiable for reasons such as the difficulty of managing diverse portfolios. The low efficiency of multi-line holdings, the formation of non-economic relationships in the portfolio, and the destruction of value are cited (Park and Jang, 2013). If one cannot get caught in the trap of radical opinions on both ends of this spectrum, it is very likely that one can find a situation in which one can make a wise and logical decision about applying a diversification strategy (Erdorf et al., 2013). What becomes important in such a situation is the extent and method of diversification, which many studies have been done, but there is no universal pattern or rule about it. According to economic logic, companies and business enterprises seek to grow their business and choose diverse and different paths for growth. These choices may be one or more examples of such cases: increasing production or service capacity (for example: increasing production capacity from 2,000 tons of iron ore to 5,000 tons), increasing non-technological variety of products and services (for example product variety by producing shirts in different colors and designs), increasing the technological diversity of products and services (for example diversity in the product by producing versions with different performance levels of a mobile phone), increasing the diversity of the market for products and services (for example: diversity in the market with Obtaining contracting projects and engineering services in different countries). However, the options available to commercial enterprises are not limited to these few items (Hunjra et al., 2020). Historically, many companies and business enterprises have paid special attention to the diversification strategy to grow in parallel with the above strategies. In general, diversification means expanding the range of businesses, and in the strategic management of holding companies, it is a subset of a broader concept called portfolio strategy (Erdorf et al., 2013).

One of the factors that has always been at the center of the attention of financial institutions before and after the global financial crises with the increase in competition between banks is the

use of income diversification strategies. The competition in the financial markets for the optimal allocation of financial resources has led banks and financial institutions to attract more applicants by using various tools and innovative services. The progress of technology during the last few decades has caused banks to distance themselves from their traditional role, which was based on the creation of financial intermediation, and along with the change of technology, create new and diverse activity spaces for themselves (Nguyen, 2018).

In the past, banks used to collect surplus resources from customers, and by granting facilities to other customers, they performed their traditional duty, which is financial intermediation. But today, in addition to financial mediation, banks focus more on providing diverse services, which are mainly based on new technologies, and it has caused banks to offer a wide range of products and services to their customers (Qatawneh & Makhoul, 2023; Zouari-Hadiji, 2023).

Therefore, banks need to offer new products and services to their customers over time and in sync with the emergence of new technologies. Diversification of incomes and transition from traditional activities can be very important for banks from two aspects. First, the issue of banks' competition with each other, has become much more complicated with the development of technology, and banks need to increase customer satisfaction to maintain and improve their market share by providing new and diverse services. In this regard, it should be noted that nowadays fintech has emerged as a competitor of banks by providing new and attractive financial services, which doubles the importance of diversifying services and products for banks. Another aspect that emphasizes the necessity of diversifying the income of banks is the issue of reducing risk and increasing the stability of banks by diversifying the products and services that can be offered to customers (Piseditasalai & Edirisuriya, 2020).

Kamalian et al. (2021) research regarding the analysis of the current situation in Iran's banking system shows that although it has not led to an outright crisis due to the state banks and the financial support of the central bank, Iran's economy has suffered a banking crisis. The results of the research show that the capital adequacy and efficiency variables have a positive and significant effect on the return on equity during the banking crisis, but on the other hand, the level of bank concentration (Lerner) during the banking crisis has a significant negative effect on the return on equity.

Gholizadeh et al. (2021) in the study investigating the impact of income diversification strategies on the market power of the banking system using two adjusted Herfindahl-Hirschman indices to measure income diversification strategies, realized that the diversification strategy of non-interest income has a positive and significant effect on the banking system with market power; Of course, the results of the research did not confirm the effect of profit diversification strategy on market power.

The findings of Duho et al. (2023) show that income diversification is associated with better loan quality and credit risk management. Market risk increases with the level of income diversification of microfinance companies. Hunjra et al. (2020) analyzed the impact of income diversification, corporate governance, and regulations on the risk-taking of banks in 10 emerging Asian countries from 2010 to 2018. They showed that interest-free income diversification ultimately leads to greater risk-taking. The results indicate that both measures of income diversity affect banks' risk-taking.

Wu et al., (2020) considering efficiency as a conduit, show the impact of banks' business diversification on their risk, using bank-level data from more than 1,000 commercial banks in 39 emerging economies over the period 2000-2016. that increasing business diversity has two competitive effects on bank risk. The direct effect of increased diversification strengthens banks' stability but is offset by the indirect effect whereby reduced efficiency, which results from greater

diversification, increases banks' riskiness. Therefore, the overall benefits of banking business diversification on bank stability depend on the trade-off between the two competing forces.

Pisedtasalasai & Edirisuriya's (2020) research on the diversity and performance of Sri Lankan banks showed that there is a significant two-way relationship between banking diversity and performance. The performance of Sri Lankan banks has improved significantly with their diversification efforts. On the other hand, the results showed that banks' performance has a positive and significant effect on diversity. These findings show that banks with high profitability have a greater ability to diversify their operations. In addition, private sector banks, both listed and unlisted, are significantly more diversified than their public sector counterparts, but their performance is not necessarily superior to that of public sector banks. This may be a result of the economic climate and public perception that has allowed state-owned banks to have significant market power over the country's private sector banks.

Yang et al. (2020) found that diversification strategies are associated with increased systematic risk. They argued that this effect is more strongly observed in large and medium-sized banks. In addition, during the credit crisis of 2007-2009 and the European debt crisis of 2010-2013, the effect of bank diversification strategies on systematic risk was seen more.

Moudud-UI-Huq et al. (2019) also investigated the impact of diversification strategies on the performance and risk-taking of banks. They examined bank data from ASEAN-5 and BRICS countries for the period between 2007 and 2015. The results indicate that compared to two different regions, BRICS banks obtain the highest profit compared to ASEAN-5 by applying both diversification strategies to improve bank profitability, and efficiency and reduce risk-taking behavior.

Ndungu & Muturi (2019), in the study of the effect of interest and non-interest income diversity on the asset returns of Kenyan commercial banks, showed that there is a correlation between income diversity in both interest and non-interest modes. In addition, they found that the relationship between asset returns and interest income diversity is positive.

Nguyen (2018) investigated the diversity and efficiency of banks in six ASEAN countries. The results showed that banks with more diversified income have lower cost efficiency, while banks with more diversified assets only have lower sustainable cost efficiency. Banks with more diversity have higher profit efficiency, while banks with more diversified assets only have higher sustainable profit efficiency. Banks with a diversity of financial resources with the majority ownership of the government show higher cost efficiency but lower profit yield compared to other banks, while both financing and asset diversity make foreign banks have lower profits.

Methodology

Since this research uses past information to test hypotheses, it is a type of post-event research. This research is quasi-experimental in the field of accounting financial research. The statistical population of this research includes all the banks admitted to the Tehran Stock Exchange during the period between 2011 and 2021.

The reasons for choosing the mentioned community are: a) availability of stock market information; b) correctness of stock market information; c) high reliability and validity of stock market information.

The sampling method in this research is systematic screening or elimination, and to screen the society, the sampling includes banks that have all the conditions. According to the above limitations, the statistical sample of the research is 10 member banks of Tehran Stock Exchange.

In this research, the relationship between independent and dependent variables is based on the following regression model:

$$\text{Performance}_{it} = \alpha_{it} + \alpha_1 \text{diversification}_{it} + \alpha_4 \text{LEV}_{it} + \alpha_5 \text{ROE}_{it} + \alpha_6 \text{SIZE}_{it} + \alpha_7 \text{MB}_{it} + \varepsilon_{it} \quad (1)$$

The dependent variable

The dependent variable in this research is bank efficiency. Today, banks and financial institutions act as intermediaries of funds instead of producing loans. The intermediary banking approach estimates the efficiency of banks in converting resources into assets. On the other hand, the production approach integrates credit risk to monitor bank performance. Since the credit risk component is not the focus of this research and the mediation approach to analyze and measure the performance of banks using the criteria of the Data Envelopment Analysis (DEA) approach seems more acceptable, this research uses It justifies the mediation approach. In the production approach, the DEA method is used to measure the production efficiency of banks. In this research, the following input and output variables are used to calculate efficiency.

a) Input vectors

- 1- Workforce: It is measured by employee costs (the number of full-time employees on the payroll).
- 2- Fixed capital: It is measured by location costs and fixed assets.
- 3- Customer and short-term financing funds: it is measured by the sum of deposit (demand and term) and non-deposit funds until the end of the relevant year.

b) Output vectors

- 1- Total loan: both short-term and long-term loans.
- 2- Other profitable assets: loans to specific sectors (direct and specialized loans), funds sold between banks, and investment securities (treasury and other securities).
- 3- Off-balance sheet items: guarantees and letters of commitment (guarantee, bank acceptance, letter of credit, guaranteed advance payment, endorsements, etc.), commitments, foreign exchange transactions, and interest rates, as well as other activities Off-balance sheet.

Independent variable

The independent variable in this research is income diversification strategy. In order to measure diversification strategies according to Lin et al. (2020) article, two income diversification strategies (*HHINOI*) and non-interest income diversification (*HHINON*) have been used, which are estimated as follows:

$$HHINON = 1 - \left[\left(\frac{Fee_{it}}{NON_{it}} \right)^2 + \left(\frac{Trade_{it}}{NON_{it}} \right)^2 + \left(\frac{Other_{it}}{NON_{it}} \right)^2 \right] \quad (2)$$

$$HHINOI = 1 - \left[\left(\frac{Lone_{it}}{EA_{it}} \right)^2 + \left(\frac{OEA_{it}}{EA_{it}} \right)^2 \right] \quad (3)$$

Where, *Fee* represents the fee received, trade is the result of currency exchange, other represents other fees and income received, *NON* is the total non-interest income of the bank, *NOI* is the sum of interest and non-interest income, *EA* is the total of granted facilities and other income-generating

assets, *LOAN* is the representative of granted facilities and *OEA* represents other income generating assets.

Control variables

MB: It is the growth opportunity of the bank and is calculated from the ratio of the market value to the book value of the bank.

LEV: is the bank's financial leverage and is obtained by dividing the book value of total liabilities by total assets at the end of the year.

ROE: represents the return on equity and is calculated by dividing the profit before unexpected items by the book value of equity at the end of the year.

SIZE: is the logarithm of the market value of equity at the end of the year (bank size).

The present research has used the autoregressive model approach with distributional breaks (ARDL) to investigate the cointegration of variables. Most of the recent studies point out that the ARDL model is superior to other common methods such as the Engel and Granger methods for investigating co-accumulation (Ebrahimi et al., 2019). The first reason is that it can be used regardless of whether the variables in the model are stable. Another reason is that this method is relatively more effective in small or limited samples compared to other methods. Therefore, this method has been used in this research, it should be kept in mind that ARDL method cannot be used if there is instability of variables. The general form of the ARDL model (p, q_1, q_2, \dots, q_k) can be expressed as follows.

$$\varphi(L, P)Y_t = \sum_{i=1}^k \beta_i(L, q_i)X_{it} + \delta W_t + \mu_t \quad (4)$$

$$Q(L, P) = 1 - \varphi_1 L - \varphi_2 L^2 - \dots - \varphi_p L^p \quad (5)$$

$$\beta_i(L, q_i) = \beta_{i0} + \beta_{i1}L + \beta_{i2}L^2 + \dots + \beta_{iq_i}L^{q_i} \quad i = 1, 2, 3, \dots \quad (6)$$

In the above relationship, L represents the first-order time interval operator, so that $LY = Y_{t-1}$, represents the dependent variable, X_{it} represents the vector of explanatory variables, q_i is the number of optimal intervals related to each of the explanatory variables, P is the number The optimal interval related to the dependent variable and W_t is a vector of deterministic variables such as latitude from the origin, seasonal variables, time trends or exogenous variables with fixed intervals. The relevant equation is estimated using Eviews software (McCullough, 1999). To detect the long-term relationship, the t-statistic value can be compared with the critical quantities provided by Banerjee et al. (1992). The value of the t statistic for testing the hypothesis of the existence of a long-term relationship ($H_0: \sum_{i=1}^p \varphi_i - 1 \geq 0$) is calculated as follows:

$$t = \sum_{i=1}^p \hat{\beta}_i - 1 / \sum_{i=1}^p S_{\hat{\beta}_i} \quad (7)$$

Where, $S_{\hat{\beta}_i}$ is the standard deviation of the coefficients of the dependent variable intervals. If the calculated t statistic value is greater than the critical value, the null hypothesis of no long-term relationship is rejected and we accept the existence of a long-term relationship. In addition, Eviews software provides an error correction model (ECM) according to the selected model. In order to derive the error correction model based on the ARDL (p, q_1, q_2, \dots, q_k) model, the variables $W_t, Y_t, X_{1t}, \dots, X_{kt}$ are considered in terms of values with a break and their first order difference, and the model from following ECM relationship is obtained.

$$\Delta Y_t = -\varphi(L, P)ECM_{t-1} + \sum_{i=1}^k \beta_{i0} \Delta X_{it} + \delta \Delta W_t - \sum_{j=1}^{p-1} \varphi^L_j \Delta Y_{t-j} - \sum_{i=1}^k \sum_{j=1}^{q_{t-1}} \beta_{ij} \Delta X_{i,t-j} + U_t \quad (8)$$

The above equations are estimated by Ordinary Least Squares (OLS) method and by performing the necessary tests, the short-term dynamic structure of the model is determined. In the error correction model, ECM_{t-1} represents the speed of adjustment towards long-term equilibrium. This coefficient shows what share of the imbalance of the dependent variable Y_t during the previous period is corrected in the current period. It is expected that the sign of this variable is negative and its value is between zero and -1 (Tarkhani et al., 2020).

Finding

Result and Discussion

Before estimating the research model, it is necessary to test the significance of the variables used in the estimations. In this study, Chu test was used to test the unit root of the data.

The results of Table 1 and checking the values of the calculated statistics and their acceptance probability show that all the variables are at the significance level because the probability values of all the variables were less than 0.05.

Table 1. Unit root test

Variable name	Coefficient	Probability
Performance	-9.41	0.00
Diversification of interest income	-15.06	0.00
Diversity of non-interest income	-21.72	0.00
Bank size	-10.32	0.00
Financial Leverage	-18.91	0.00
Bank growth opportunity	-31.08	0.00
Return on equity	-6.49	0.00

To test the normality of the data, the test of the normality of the residual sentences using the Jarco-Bera test was used (Table 2). The null hypothesis indicates the normality of the distribution of errors. In this distribution, if the probability level for each variable is greater than 5%, the null hypothesis will be accepted and the one hypothesis based on non-normality of the error distribution will be rejected.

Table 2. Normality test of statistical distribution

Title of exam	Probability
Jarek-bra	0.28

The Jarco-Bera normality test shows that the statistical distributions of the research are normal because the probability level for the distribution is greater than the 5% level. Next, it is necessary to test the non-collinearity between the independent variables. Variance inflation factor has been used to check the presence or absence of collinearity between research variables. The variance inflation factor in linear regression models is one of the estimation methods of the model parameters, the least squares method. One of the issues and problems that can challenge this

method is the existence of a phenomenon called collinearity. One of the ways to detect the presence of collinearity, which is widely used, is to use the variance inflation factor. This factor shows how much the variance of the estimated coefficients is inflated compared to the case where the estimated variables are not linearly correlated.

Table 3 shows the variance inflation factor (VIF) statistics of the research variables. The allowed value of VIF is less than 10 and since the values in Table 3. are less than 10, as a result, there is no collinearity between the research variables.

Table 3. Variance inflation factor (VIF) test

Variable name	VIF
Diversification of interest income	1.946
Diversity of non-interest income	1.784
Bank size	1.882
Financial Leverage	1.784
Bank growth opportunity	1.901
Return on equity	1.873

In order to check the homogeneity of variance between research variables, which is one of the main assumptions of classical regression, White's test was used, and its results are presented in Table 4. This test is used to test the variance of heterogeneity in linear regression models and examines the dependence of the variance of the residual value obtained from linear regression on the explanatory variables of the model.

Table 4. Heterogeneity of variance test

Title of exam	Probability
White	0.21

As can be seen in Table 5, Because the probability of the calculation statistic is greater than 0.05, there is no heterogeneity of variance. ARDL is used to fit the model

Table 5. Estimation of the research model

Variable	Coefficient	t-statistic	Probability
Diversification of interest income	0.112	3.53	0.0005
Diversity of non-interest income	0.032	5.98	0.0000
Bank size	0.021	1.77	0.0775
Financial Leverage	-0.056	-1.13	0.2559
Bank growth opportunity	0.141	0.82	0.4088
Return on equity	0.215	2.66	0.0080
The first order break of interest income diversification	0.211	2.92	0.0037
First order break of non-interest income diversity	0.109	2.83	0.0049
First order interval of bank size	0.115	0.35	0.7198
The first order break of financial leverage	-0.098	-1.92	0.0544
First order interruption of the bank's growth opportunity	0.221	0.62	0.5345
First-order intercept of return on equity	0.339	2.83	0.0049
fixed sentence	0.518	6.98	0.0000
ECM	-0.72	1.07	0.0000

The results of the estimation test in the research model show that the strategy of income diversification (interest and non-interest) both in the short term and in the long term has a positive and significant effect on the efficiency of banks admitted to the Tehran Stock Exchange. Such that one unit increase in short-term and long-term interest income diversity increases banking efficiency by 0.11 and 0.21%, respectively, and one unit increase in non-interest income diversity in the short-term and in the long term, it increases banking efficiency by 0.03 and 0.10 percent, respectively. In the following, the ECM has been used to investigate how the short-term imbalance in banking efficiency leads to long-term balance. The ECM coefficient shows that in each period, how many percent of the short-term imbalance is adjusted to reach the long-term balance. Based on the results, the ECM coefficient is equal to -0.72 and considering that the significance level of the coefficients is less than 0.05%, it is significant. This figure indicates that in each period 72% of the short-term imbalance of banking efficiency is adjusted to reach the long-term balance; Therefore, it can be said that the adjustment towards equilibrium is done relatively quickly.

One of the important results of globalization of the banking industry is the implementation of diversity policies in banking, which is very important for bank managers, shareholders and economists. This article investigated the effect of income diversification strategy on banking efficiency using the ARDL model during the period of 2010-2015. This research is important from the point of view that in Iran, there have been few researches about the effect of income diversity on bank efficiency. The findings of the present research showed that the strategy of income diversification (interest and non-interest) both in the short term and in the long term has a positive and significant effect on the efficiency of banks admitted to the Tehran Stock Exchange. In fact, the greater the variety of incomes, the better services are provided to customers, and as a result, the attractiveness of services increases the demand for services and has a positive effect on the efficiency of the bank. The results of this research are in line with the findings of Nguyen (2018), Ndungu & Muturi (2019), Pisetsalasai & Edirisuriya (2020), and Moudud-Ul-Huq et al., (2019).

Conclusion

The banking industry is considered one of the most important sectors of the country's economy, which can provide the grounds for economic growth and prosperity by properly organizing and managing its resources and expenses. Bank efficiency is considered from different perspectives. Banking efficiency can indicate the structure of banking resources and the financing of bank assets. According to the literature of banking health and efficiency, basic capital can help banks to compensate for financial losses, and capital can be a factor that reduces the transmission of shocks and reduces the risk of banks' lending process. The trend of financial efficiency or inefficiency in the banking sector is not only from the decisions taken in the monetary and banking fields with a direct impact on both borrowers and lenders, the amount of savings, cost, profitability, efficiency and financial ratios.

Banking is affected, but macroeconomic variables are also the most important factors affecting the financial efficiency of the banking sector and ultimately the occurrence of financial crises in countries. In the conditions of recession and prosperity, countries adopt different economic policies, each of which affects the banking efficiency. On the other hand, with the increase in the inflation rate, the cost of money (real interest) has decreased, and this increases the willingness to receive loans, and this affects banking risk and stability in this sector. The increase in the unemployment rate and government budget deficit also causes the government to turn to expansionary policies and borrowing from banks in order to increase employment or reduce the

government budget deficit, which can affect the risk and efficiency of banks. In countries like Iran that follow the state banking system, banking efficiency is largely influenced by monetary policies, which are more than anything else influenced by the economic conditions of the country and the government.

Business diversification is one of the strategies that banks use to deal with uncertainty and may help improve their future performance. Technological progress and deregulation cause significant changes in the banking structure. Therefore, if banks expand their activities to other business areas sooner, they can acquire the necessary skills to make efficient business decisions in these new areas. Finally, when a particular business area flourishes, banks will be ready to compete and benefit from additional profits. In other words, this argument considers diversity as an investment to create skills that can help banks to take advantage of future opportunities to create additional value for their shareholders. Also, financial deregulation has encouraged commercial banks in many countries to diversify their business activities in a wide range of functions, such as activities related to securities, insurance, foreign exchange, derivatives, capital management, investment, financial planning and many other off-balance sheet activities.

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