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Study of the Relationship between Credit Diversification Strategy and Banks' Credit Risk and Return: Evidence from Tehran Stock Exchange (TSE)

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Abstract

The effect of banks' credit portfolio diversification on return on asset, return on equity and credit risk is investigated in this study. The sample is comprised of seven banks listed in Tehran Stock Exchange (TSE) whose data has been accessible between the years 2009 and 2014. According to the type of data and analysis methods, panel data multivariate regression method was used in this study. Results show that there is a significant relationship between credit portfolio diversification and risk; furthermore, it is the size that influences return on equity (ROE) and return on asset (ROA) of banks and in fact, there is no statistically significant relationship between use of diversification strategy in banks' credit portfolio and their ROA and ROE.
Keywords: Credit diversification; Credit risk; Herfindahl-Hirschman Index; Return on equity (ROE); Return on asset (ROA)

1. Introduction

In the real world, we witness two types of approach and strategy in banks. We know these two approaches as diversification and concentration strategies. On the one hand, in many countries laws limit the bank exposure to a single borrower (Basel, 1991). On the other hand, some banks decide to get involved in the sectors at which they are specialized and in which they feel a competitive advantage (Chen, Wei, Zhang & Shi, 2013). The 2008 global financial crisis took place partly due to excessive exposure to the risk of real estate industry, which is closely related

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to macroeconomics (Demyanyk & Van Hemert, 2011). This crisis which was brought about due to the concentration of credit portfolio greatly influenced the entire U.S. banking industry. It was afterward that the strategy of concentration vs. diversification changed into one of the most important issues raised on the issue of economic stability.

Whether banks should diversify their credit portfolio or focus on firms with whose business they are familiar, is a question that many researchers have focused on. However, no consensus has been so far achieved on the answer to this question since the findings of different countries have some differences with one another and the obtained evidence support both views. On the one hand, the traditional banking theory suggests that the banks should diversify their credit portfolio in order to reduce the credit risk; this suggestion is also according to the portfolio theory (Markowitz, 1959). Based on the theory of asymmetric information, diversification reduces the costs of financial intermediation (Diamond, 1984). In practice, Basel Committee on Banking Supervision (1991) has reported that many banking crises in the past three decades have occurred as a result of concentration, meaning that risk is highly related to diversification.

On the other hand, corporate finance theory says that if firms focus their activities in special sectors where they are specialized or familiar, they can make use of the additional benefits of reduced costs (Acharya, Hasan, & Saunders, 2006). Furthermore, the strategy of diversification is less attractive as it leads to the creation of competition (Winton, 1999). The empirical evidence supporting this view can be found in Italy's banking sector, Germany and Brazil's banking sectors and small European banks ((Tabak, Fazio, & Cajueiro, 2011); (Hayden, Porath, & Westernhagen, 2007)).

Diversification in the bank is done with the goal of reduction of volatility of the bank operations through reduction of concentration of sources (deposits), costs (credits) and the proceeds from funds (Berger & Young, 2001). By creating diversification in their deposits, banks intend to reduce exposure to the risk of liquidity. The bank is exposed to the risk of liquidity when its borrowing power is low or costly and also when customers' unanticipated withdrawals or acceptable loan applications increase (Rose & Hudgins, 2010). Diversification in deposits is obtained by reduction of deposit absorption ratio from one special source (individual, business or general sector) at the local or international level, direction of customers' deposits to certain accounts (visual, savings and long-term) or publication of warrant on those deposits. The goal of these techniques is improvement of the efficiency of bank borrowing and eventually reduction of weighted average of capital cost.

The goal of credit portfolio diversification activities is reduction of risk of borrowers' non-fulfillment of their obligations. This is done through allocation of the proceeds of the deposit and non-deposit credits to different groups of customers in new geographical sectors or regions or through introduction of new types of credits (Jahn, Memmel, & Pfingsten, 2013). Through specialization of credit portfolio, credit risk can be reduced as well. With the reduction of the diversification ratio of credit types or diversification ratio of customers whose qualification for credit is approved, specialization can be achieved. Thus, the bank's power and experience for monitoring of dubious credit requests increases (Alshomaly, 2014).

With regard to the issues raised, present study attempted to investigate the relationship between the use of diversification strategy in credit portfolio, and ROA and ROE of the banks listed in TSE.

2. Theoretical Principles and Research Background

Over the last three decades, most banks all over the world have become diversified in terms of activity or geographical presence. In fact, faced with increased competition by other financial institutions and world markets or improvement of risk-adjusted performance, banks have turned to diversification. Over the recent years, many studies have been conducted in the field of benefit and cost of use of diversification and its impact on the performance of banks. On the other hand, another important issue that has been considered by scholars in the recent years is whether selection of diversification can decrease or increase risk. Subsequently, some domestic and foreign studies conducted in this field will be investigated.

Jahn et al. (2013), in a study entitled "Bank's concentration versus diversification in the loan portfolio: new evidence from Germany", investigated the effect of credit portfolio concentration on credit risk. They divided the short-term and long-term credits of the years 2003 to 2011 of German banks to 23 different industries. The results showed that the banks that are specialized in lending to a special industry are faced with less credit risk than the

average credit risk of the banking system. Also, standard deviation of the loss of credit has been less in most concentrated banks. However, they state that it should not lead to the perception that specialization in lending to special industries is free of risk; rather, banks should, between an estimation about benefit and cost, have presentation of diversified or concentrated credit portfolio.

Tabak et al. (2011) investigated the effect of credit portfolio concentration of Brazilian banks on their risk and return. They conducted their study by means of the panel data of these banks and by relying on borrower economic sectors. According to them, credit portfolio concentration increases return and reduces the risk of non-fulfilment of obligations; also, they realized that foreign and public banks are less often influenced by the degree of diversification. Moreover, their studies show that after the emergence of international financial crisis and particularly after the bankruptcy of Lehman Brothers Bank, the process of centralization in credit policies has been increasing.

Rossi, Schwaige and Winkler (2009) analyzed the effects of diversification of credit portfolio on risk, efficiency and bank capital. In their work, they took into account credit portfolio diversification in terms of industry and size of the borrowing companies. In this study, the data of Austria's commercial banks from 1997 to 2003 had been collected. Their results show that although diversification negatively affects cost efficiency, efficiency increases the banks' profit and reduces the bank's realized risk. Also, diversification seems to positively affect the bank capital.

Baele et al. (2007), in a study entitled "does the stock market evaluate bank diversification?", investigated whether diverse banks basically have a competitive advantage or not with their competitors in terms of long-term performance and risk. They conducted their studies on 17 European banks for the 6-year interval (1989-2004) using panel data multivariate regression method. The results indicated that diversification has positively affected the long-term performance of banks. Furthermore, the effect of diversification on the banks' systematic risk has been increasing and its effect on their (special) risk has been mostly non-linear and sloping downward.

Laeven & Levine (2007), in their study, analyzed the effect of diversification of financial institutions' activities on their market value. They realized that the market value of diverse financial institutions that are involved in diverse activities is less than that of financial intermediaries specialized in specialized activities.

Kamp et al. (2007) studied the effect of diversification on the risk-return characteristics of German banks. The study intended to determine whether the benefits of risk sharing are more than specialization or not. They used the seasonal data of borrowers for determination of degree of diversification of banks' credit portfolio and realized that the return on specialized banks has become slightly more than that of diverse banks. Also, specialized banks have less cost of non-current receivables and ratio of non-performing credits. However, standard deviation of these two ratios has been less in diversified banks.

Acharya et al. (2006), in a study entitled "the effects of concentration and diversification on the bank's risk and return: some evidence from the unique bank's credit portfolios", investigated whether selection of diversification by the bank leads to higher return and lower risk or not. The statistical sample included 105 Italian banks whose data was collected for the years 1993 to 1999. They conclude that diversification does not necessarily lead to better performance or higher security for the banks.

3. Research Methodology

As the goal of the present study is investigation of the effect of "credit portfolio diversification" on "return" and "credit risk", it is "applied" in terms of goal and is "correlational" in terms of data collection method and is of the type of "regression analysis" among correlational studies.

In this study, based on the type of data and existing analysis methods, the panel data method has been used since in order to investigate the relationship between credit portfolio diversification and credit risk and return, independent and dependent variables are investigated from two different aspects. On the one hand, the variables are investigated among different companies and on the other hand they are analyzed in the period of 2009 to 2014.

The research data includes the data of audited financial statements of the banks listed in TSE for the period of 2009 to 2014. The data related to the credits provided for different industries has been extracted from the information resources of the central bank; net profit, total assets and equity have been extracted from Rahavard Novin Software and the data related to deferred and total credits have been extracted from the notes to financial statements.

In order to assess credit portfolio diversification, Herfindahl-Hirschman Index (Al-Shomaly 2014) has been used (Equation (1))

$$hhi_{cr} = \sum_{i=1}^{6} \left(X_i/Q\right)^2$$

(1)

hhi_{cr} : Refers to credits based on Herfindahl Index for bank i in the year t

X_i : Refers to the credits provided for a special industry (agriculture, industry and mining, building and housing, commerce, services and industry) by the bank.

Q : Refers to the total credits provided by the bank

In order to assess the credit risk, risk index (Acharya et al., 2006) has been used as Equation (2).

$$RISK = \frac{total\ defferd\ debt}{total\ assets}$$

(2)

In order to assess the return, net ROA and net ROE (Acharya et al., 2006) have been used as Equation (3) and Equation (4)

$$ROE = \frac{net\ income}{total\ equity}$$

(3)

$$ROA = \frac{net\ income}{total\ assets}$$

(4)

The variables of SIZE, BRRATIO and EMPRATIO (Acharya et al., 2006) have been calculated as Equations (5), (6), (7).

$$SIZE = log(total\ assets)$$

(5)

$$BRRATIO = \frac{number\ of\ branches}{total\ assets}$$

(6)

$$EMPRATIO = \frac{number\ of\ employees}{total\ assets}$$

(7)

4. Model Estimate and Testing of the Hypotheses

In panel analysis, one of the most fundamental issues discussed is determination of the amount of intercept and whether the model is fitted with similar intercepts (model without effects or integrated) or with dissimilar intercepts (model with effects or panel); thus, the process of model selection is as follows:

First stage: Presence of effects is tested against the model without effects (Limer test)

Second stage: The model with random effects is tested against the model with fixed effects (Hausman test)

The other hypotheses of Limer test are as Equation (8)

$$\begin{cases} H_0: & \text{The model is suitable without effects} \\ H_1: & \text{The model is suitable with effects} \end{cases}$$

(8)

In case the probability for the above test is less than 0.05, H_0 will be rejected at 95% level of confidence (i.e., the model is suitable with fixed or random effects); otherwise, it will not be rejected (i.e., the integrated model is suitable).

Subsequently, in case of use of the model with effects, the next question is whether the model with fixed effects is suitable or the model with random effects. In order to answer this question, the model with random effects has been tested against the model with fixed effects by means of Hausman test. H_0 and the contrary hypothesis in Hausman test are as Equation (9).

$$\begin{cases} H_0: & \text{The model is suitable with random effects.} \\ H_1: & \text{The model is suitable with fixed effects.} \end{cases}$$

(9)

In case the probability for the above test is less than 0.05, H0 will be rejected at the 95% level of confidence (i.e., the model is suitable with fixed effects); otherwise, it will not be rejected (i.e., the model is suitable with random effects).

After the selection of the model with fixed or random effects, the model fit will be done with Equation (10).

$$\begin{cases} H_0: & \text{There is no significant model.} \\ H_1: & \text{There is a significant model.} \end{cases}$$

(10)

Main hypothesis 1: There is a significant statistical relationship between credit portfolio diversification and credit risk. In order to assess the first hypothesis, the following model has been used.(Equation (11))

$$RISK_{i,t} = \alpha_0 + \alpha_1 HHI_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 BRRATIO_{i,t} + \alpha_4 EMPRATIO_{i,t} + \varepsilon_{i,t}$$

(11)

The results of testing hypothesis 1 have been shown in tables 1 and 2:

Table 1. Limer test for selection of the suitable risk model (model with effects or model without effects)

Effects Test	Statistic	d.f.	Prob.
Cross-section F	28.31	(6.31)	0.0000
Cross-section Chi-square	78.49	6	0.0000

The probability equals 0.000; thus, H0 based on the use of the model without effects will be rejected and the model with (panel) effects is suitable.

Table 2- Hausman test for selection of suitable risk model (model with fixed effects or model with random effects)

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	6.21	4	0.18

The probability equals 0.18; thus, H0 will not be rejected. So, the model with random effects is the most suitable model.

The results of the model fit with random effects have been shown in table 3.

Table 3- Model fit with random risk effects

Variables	Coefficient	Std.Error	t-Statistics	Prob.
C	0.33	0.13	2.46	0.018
HHI	-0.08	0.08	-1.003	0.32
SIZE	-0.03	0.02	-1.41	0.16
BRRATIO	-0.23	10.69	-0.02	0.98
EMPRATIO	0.04	1.23	0.033	0.97
Weighted Statistics				
R-Squared		0.13		
Prob(F- statistics)		0.23		
Durbin-Watson stat		1.07		

The probability of the fitted model (0.23) indicates that at the 95% level of confidence there is no significant model. When the model is not significant, this means that none of the variables of the model are significant. This issue has been shown in table 3.

Main hypothesis 2: There is a statistically significant relationship between credit diversification and ROA.

In order to evaluate the main hypothesis 2, two minor hypotheses are used.

Minor hypothesis 1-2: There is a statistically significant relationship between credit diversification and ROE.

In order to evaluate the minor hypothesis 1-2, the following model will be used (Equation (12))

$$ROA_{i,t} = \alpha_0 + \alpha_1 HHI_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 BRRATIO_{i,t} + \alpha_4 EMPRATIO_{i,t} + \varepsilon_{i,t} \tag{12}$$

The results of testing the above model have been shown in tables 4 and 5:

Table 4. Limer test for selection of suitable model of ROA (model with effects or model without effects)

Effects Test	Statistic	d.f.	Prob.
Cross-section F	5.59	(6,31)	0.0005
Cross-section Chi-square	30.82	6	0.0000

The probability equals 0.0005. Thus, H0 based on the use of the model without effects will be rejected and the model is suitable with (panel) effects.

Table 5.Hausman test for selection of suitable model of ROA (model with fixed effects or model with random effects)

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	33.36	4	0.000

The probability equals 0.000. Thus, H_0 will be rejected. So, the model with fixed effects is the most suitable model.

Table 6. Model fit with the fixed effects of asset efficiency

Variables	Coefficient	Std.Error	t-Statistics	Prob.
C	-8.6	3.17	-2.71	0.01
HHI	-2.71	1.58	-1.71	0.09
SIZE	1.88	0.58	3.22	0.003
BRRATIO	297.53	192.31	1.54	0.13
EMPRATIO	-23.79	23.07	-1.03	0.31
Weighted Statistics				
R-Squared		0.65		
Prob(F- statistics)		0.000054		
Durbin-Watson stat		2.11		

The probability of the fitted model (0.000054) indicates that there is a significant model at the 95% level of confidence. Also, the probability of independent variables indicates that there is a statistically significant relationship only between size and ROA.

Minor hypothesis 2-2: There is a statistically significant relationship between credit diversification and ROA.

In order to evaluate the minor hypothesis 2-2, the following model is used(Equation (13))

$$ROE_{i,t} = \alpha_0 + \alpha_1 HHI_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 BRRATIO_{i,t} + \alpha_4 EMPRATIO_{i,t} + \varepsilon_{i,t} \tag{13}$$

The results of testing the above model have been shown in tables 7 and 8.

Table 7. Limer test for selection of suitable model of net ROE (model with effects or model without effects)

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.17	(6.31)	0.07
Cross-section Chi-square	14.73	6	0.022

The probability equals 0.07. Thus, H_0 based on the use of the model without effects will not be rejected and the model is suitable without effects.

Table 8.Model fit with fixed effects of shareholders' equity

Variables	Coefficient	Std.Error	t-Statistics	Prob.
C	-88.69	38.24	-2.31	0.02
HHI	-11.97	19.03	-0.62	0.53
SIZE	18.64	7.03	2.64	0.01
BRRATIO	2573.79	2315.36	1.11	0.27

EMPRATIO	-195.16	277.86	-0.70	0.48
Weighted Statistics				
R-Squared		0.44		
Prob(F- statistics)		0.02		
Durbin-Watson stat		1.90		

The probability of the fitted model equals 0.02. Thus, at the 95% level of confidence, H_0 will be rejected and the model is significant. Based on the probability of the research variables, there is a statistically significant relationship only between size and return on equity.

5. Conclusion

Based on the fitted models, unlike the previous studies (Jahn et al., 2013) there is no statistically significant relationship between credit portfolio diversification and credit risk. Furthermore, like the study by Acharya et al. (2006), there is no statistically significant relationship between the use of diversification strategy in banks' credit portfolio, and their ROE and ROA. Rather, what affects ROE and ROA is the bank size (logarithm of total assets). It is noteworthy that according to the model without effects and the relationship between credit portfolio diversification and ROE, this result is the same for all the banks under study.

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