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PRIMARY RESEARCH

Does asset diversification in banks reduce risk? Turkey case

Adalet Hazar [1*], Senol Babuscu [2], M. Oguz Koksal [3], M. Agah Tekindal [4]

[1, 2] Baskent University, Ankara, Turkey

[3] Ziraat Bank, Ankara, Turkey

[4] Selcuk University, Konya, Turkey

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Abstract

In this study, the relationship between balance sheet items in terms of credit risk and market risk is tried to be measured by panel data analysis. The banking sector is one of the leading sectors in a country's economy. The fact that banks are financially sound ensures their sustainability on the one hand and a sustainable profit level on the other. This study investigates whether the diversification of banks' asset items has a financial impact on the risk level. In this context, panel data analysis was conducted by considering the data of the 15 largest banks operating in the Turkish Banking Sector for the period 2008-2017, and the relationship between banks' asset diversification and riskiness was investigated. While this relationship was found in some banks, it was observed that some banks did not. This study has outlined policy implications and opened up avenues for future research.

INTRODUCTION

Portfolio diversification is often used by individual and institutional investors to achieve optimal results under various economic conditions. Portfolio diversification is frequently used by individual and institutional investors to achieve optimal results under various economic conditions. If assets in a portfolio have different responses to current market conditions, the investor may have an opportunity to minimize the risk. One way to minimize portfolio risk is to allocate investments to some non-interrelated sector indices based on a specific market condition on the local stock exchange (Eyuboglu & Eyuboglu, 2019; Mohd Saman, Abdullah, Baba, Shaifuddin, & Mokhtar, 2015).

One of the most important results of modern portfolio management is that the risk of a portfolio can be less than the risk of the assets that create it by appropriate diversification, and under certain conditions, the risk of the portfolio can be reduced to zero (Buyuksalvarci, 2010). The theoretical case for income diversification seems to be supported by Markowitz's portfolio theory and the conventional wisdom of seeking not to put all one's eggs in the same basket (Herlinda & Imam, 2018; Kiweu, 2012).

Diversification can be defined as the increase in the number of new products, types of services, and their incomes resulting from both traditional activities and technology-oriented innovations of banks, as a variety of methods (Dilmaç, Gülcü, & Sume, 2018; Kitdumrongthum & Thechatakerng, 2018). The aim of diversification is to reduce the risk as stated in theory on the one hand and to make the gain as satisfactory as possible on the other. The basic product of banks is undoubtedly loans and deposits. The weight of the loan is undoubtedly high in bank balance sheets. As a matter of fact, in the Turkish Banking Sector, the weight of the loan in total assets has been 47.7% lowest and 66.9% highest in the last 15 years. In this context, loans, which have a significant weight in the financial statement, are also items that need to be managed well because they are risky assets. In fact, the share of non-performing loans in total loans in the banking sector was between 2.7% and 5.4% in that period, respectively.

*corresponding author: Adalet Hazar
†email: adalethazar@gmail.com

In addition to the default risk of the loans extended by banks, there is also an aspect that affects the market risk posed by the interest, exchange rate and liquidity risks they assume due to the high share of the loan in income assets as it affects the maturity gap in the balance sheet. Therefore, banks accept their asset structure as a portfolio and try to diversify their asset items to the extent permitted by market conditions in order to implement good risk management. The main question of this study is that the asset diversification of banks in terms of managing credit and market risk is actually a diversification? Because, as a result, it can be seen that the asset diversification of the banks that do not reduce the risk despite diversification does not comply with the diversification theory. Otherwise, it is thought that information can be obtained that the diversification activities of the banks, which have achieved a positive improvement in risk level as a result of diversification, are suitable for the purpose.

LITERATURE REVIEW

In a study conducted by Dilmaç et al. (2018), the effects of profitability and income diversification on the growth performance of Turkish banks investigate. For this purpose, 19 banks operating in the sector are obtained from the second and third quarter financial data for 2015, and the obtained data are analyzed by data envelopment analysis. In the data envelopment analysis, the variables of profitability, income diversification, and growth are adhered to, and the changes are analyzed by measuring the relative performance of the data in these periods. According to the findings, it is concluded that foreign banks are more effective than private banks and public banks. The underperformance of public banks, compared to private and foreign banks, indicates that the increase in profitability, interest and interest income inputs is not adequately reflected in the output of growth.

Guerry and Wallmeier (2017) examined the effect of diversification on bank value. In the studies, it is aimed to differentiate the effect of diversification on the basis of bank types (investment/commercial). As a result of the analysis, it was concluded that the effect of diversification is not affected by geographical or regulatory factors.

In their study, Edirisuriya, Gunasekarage, and Dempsey (2015) analyzed panel data of 84 banks whose shares were traded on the stock exchange in Bangladesh, India, Pakistan and Sri Lanka between 1999 and 2012. In the study, using product variables such as income and asset diversification, equity, and cost of revenues, product diversification, performance, and stock market response on public banks in South Asian countries were investigated. As a result of the study, it is concluded that the stock exchange value and solvency increase when banks diversify interest income yielding products, but there is a negative relationship between stock exchange value and solvency with further product diversification.

A study by Alam (2012) analyses and compares efficiency and risk-taking of 165 commercial banks and 70 Islamic banks from 11 emerging markets between 2000 and 2010. This paper also analyzes the relationship between risk and efficiency within the two banking systems. Empirical evidence shows that bank inefficiency and risk are positively related to conventional banks and inversely related to Islamic banks, which highlight the inherent difference between risk–efficiency relationships among these two distinct bank types. The mean cost efficiency scores for the conventional banking industry are higher than Islamic banking sector while, Islamic banks' profit efficiency scores have outperformed conventional banks' profit efficiency scores. His evidence also shows that environmental factors can considerably prejudice banking efficiency scores.

Kiweu (2012) investigates whether the diversification of income sources for Kenyan banks leads to better earnings and reduced individual bank and systemic risks in his study. The study seeks to analyze the extent to which the observed shift toward fees-based income-generating activities has improved bank performance and reduced volatility of revenue. The findings show that there are few benefits, if any, to be expected from income diversification from traditional banking although there is growing importance of non-interest income during the study period 2000–2010. The benefits of the evolution of non-interest income do not seem to fully offset the increase in risk that come with fee-based income. A positive correlation between net interest income and non-interest income seems to exist, a finding that suggests that non-interest income may not be used to stabilize total operating income. The findings also reveal that lending rates are significantly correlated with net interest income, and the relationship is negative, meaning that more lending takes place when interest rates are favorable.

Turkmen and Yigit (2012) examines the effect of sectoral and geographical diversification on the performance of Turkish banks and try to show how diversification affects banks' performance in their study. The study asks whether diversification via sectoral and geographical credits helps banks. To investigate the relationship between the credit diversification and performance of 50 Turkish banks between the time period of 2007 and 2011, data sources of

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Banking Regulation and Supervision Agency (BRSA), The Banks Association of Turkey (BAT), and Istanbul Stock Exchange (ISE) is used. The study is analyzed on 40 banks' data. In the present study, Return on Assets (ROA) and Return on Equity (ROE) are used as measure of performance, and Herfindahl Index (HI) is used as a measure of diversification of banks. The number of credits and the number of credits that banks let borrowers' use are employed as control variables. According to the result of the analysis it is determined that dependent variables ROA and ROE are explained by diversification.

Bebczuk and Galindo (2008), analyzed sectoral diversification of Argentine banks and suggested that larger banks benefit more from diversification than smaller ones and that the benefits of diversification are greater during the downside of the business cycle.

Chiorazzo, Milani, and Salvini (2008) analyzed the non-interest income and profitability data of Italian banks by using the panel regression method between 1993 and 2003. They found that although the relationship between non-interest income and profitability was stronger in large banks, there was a limit to the gains from diversification as size increased. However, they stated that small-scale banks could gain from the increase in non-interest incomes only if there were very little non-interest income share in the initial phase.

Laeven and Levine (2007) paper investigates whether the diversity of activities conducted by financial institutions influences their market valuations. They find that there is a diversification discount: The market values of financial conglomerates that engage in multiple activities, e.g., lending and non-lending financial services, are lower than if those financial conglomerates were broken into financial intermediaries that specialize in the individual activities. While difficult to identify a single causal factor, the results are consistent with theories that stress intensified agency problems in financial conglomerates engaged in multiple activities and indicate that economies of scope are not sufficiently large to produce a diversification premium.

Acharya, Hasan, and Saunders (2006) performed one of the first and important studies about diversification on banks' credit portfolio. They analyzed Italian banks and found that both industrial and sectoral diversification reduces bank returns while producing riskier loans.

Kocaman, Babuscu, and Hazar (2018), in her study, she aimed to investigate whether the asset diversity have has any impact on ROA and ROE. For this purpose, the panel data analysis was used to analyze the quarterly period data of 10 banks operating in the banking sector between 2010-2017. In conclusion, she determined that asset diversity has no effect on ROA and ROE. However, macroeconomic variables such as inflation, GDP and interest rates have significant effects on ROE. In addition to macroeconomic variables, capital ratio have significant effects on ROA.

RESEARCH METHODOLOGY

In this study, the existence of the relationship between balance sheet items in terms of credit risk and market risk is tried to be measured by panel data analysis.

In the analysis, the data of the 15 largest banks in the Turkish Banking Sector have been used. The total sector share of these banks is 90.1%.

Method

Panel data, defined as time series of cross-sections or cross-section data of time series (Greene, 2003), can be interpreted as the expression of horizontal cross-sectional observations consisting of units such as firms, countries, and households (Baltagi, 2008).

Panel regression models using data sets containing horizontal cross-sectional and time-series combinations include many methods such as one-way and two-way fixed effects and random effects model, dynamic panel analysis, Generalized Least Squares. In this study, one-way fixed effects and random-effects models were used.

Panel unit root test

In this study, the panel unit root test is performed primarily to test the stability of the variables, and panel unit root test proposed by Im, Pesaran, and Shin (2003) is used.

Im et al. (2003) in the panel unit root test using the Dickey-Fuller (ADF) test statistics for each unit in the panel calculates ADF and looks at the average test statistics of ADFs (Saracoglu & Dogan, 2005).

For the application of panel unit root test, y_{it} is defined as:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + e_{it}, i = 1, ..., N, t = 1, ..., T,$$

In the first order autoregressive process, including *N* horizontal section and *T* time series (Im et al., 2003). In the said test,

H1: $\beta i = 0$, for all İ

H2: $\beta i < 0, i = 1, 2, ...N_1, \beta i = 0, i = N_1+1, N_1+2, ...N.$

Acceptance of the hypothesis H1 indicates the presence of the panel unit root, whereas the acceptance of the alternative hypothesis states that there is no panel unit root. Im et al. (2003) test the hypothesis "there is no unit root" with t-bar statistics.

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One way fixed effects model

In the panel data model, the variables are represented by two subscripts, which represent both time and cross-section, unlike time series and cross-sectional data. The following ($Y_{it} = \alpha_i + X'_{it}\beta + e_{it}$) model is the fixed effects model to show *i* sections and *t* time from the subscripts: The fixed effects models that provide the following basic assumptions are estimated with the intra-group estimator and dummy variable Least Squares Estimator (LSDV) (Greene, 2003).

$$Y_{it} = \alpha_i + X'_{it}\beta + e_{it} \quad (1)$$

$i = 1, ...N$
$t = 1, ...T$
$E(e_{it}) = 0, Cov(e_{it}, e_{jt}) = 0, Var(e_{it}) =$
$\sigma_e^2 veE(X_{it}, e_{it}) = 0$
In the model;
X_{it} represents the explanatory variables vector;
Y_{it} represents the dependent variable;
β represents slope coefficients; e_{it} represents error term, and α_i (fixed term) represents the unit effect.
In this study, the effect of time and units is analyzed, assuming that the fixed term is fixed over time and can change for each unit and assuming that it is fixed between units and can change over time. In order to determine the coefficients of ($Y_{it} = \alpha_i + X'_{it}\beta + e_{it}$) model with the intra-group estimator, the mean values of individual observations should be deduced from each individual observations. Then, using this converted data, estimation is made using the least-squares method (Kennedy, 2006).
The model was analyzed according to the group effect, which assumes that the fixed term can be fixed over time but can change for each unit and the time effect, which assumes that the fixed term can be fixed between units but can change for over time.
An alternative method is to use the Least Squares estimator that contains a dummy variable for each unit to express the differences between the fixed terms in the model. This method, expressed as LSDV, can lead to a decrease in the degree of freedom and multiple linear correlation problems due to the use of many dummy variables (Kennedy, 2006). When a dummy variable is used for each unit, the fixed effects model shown by Equation 1 can be written as follows (Pazarlioglu & K, 2007).

$$Y_{it} = \alpha_1 D_1 + ... + \alpha_N D_N + X'_{it}\beta + e_{it} \quad (2)$$

In both models, it is assumed that differences between units or times are due to differences between fixed terms (Greene, 2003). Therefore, it is assumed that variable coefficients do not change between units or times. In addition, in this study, in order to investigate the group effect, the fixed term was assumed fixed over time, but it was assumed that it could change for each unit. In order to investigate the effect of time, it is assumed that the fixed term is constant for units and variable over time.
In order to determine whether there is a difference between the units in the fixed effects model, a group significance test is required. Under the null hypothesis that the fixed term is the same between units, the following *F* statistics are obtained (Greene, 2003).

$$F_{(N-1,NT-N-K)} = \frac{(R^2_{LSDV} - R^2_{Pooled})/(N-1)}{(1-R^2_{LSDV})/(NT-N-K)} \quad (3)$$

In statistic *F* 3,
R^2_{LSDV} indicates the determination coefficient of LSDV model,
R^2_{Pooled} indicates the coefficient of determination obtained from the estimation of panel data by OLS;
T indicates the observation value of each unit,
N indicates the number of units (groups) and
K indicates the number of explanatory variables. If the obtained *F* statistics is greater than the table value, the null hypothesis will be rejected. In this case, it will be accepted that there is a group effect; in other words, there is a difference between units.
The same test statistic is used to determine whether there is a difference over time. In this case, however, the LSDV model uses the model in which the fixed term changes over time and the null hypothesis is that the fixed term does not change over time.

One way random effects model

Another model to be used in practice is the random-effects model. If the individual effects are not related to the explanatory variables in the model and the fixed terms of the units are distributed randomly with respect to the units, the structure of the model should be adapted accordingly (Greene, 2003).
In random-effect models, variations in cross-sections and/or time are included as a component of the term error in the model. The reason for this is the loss of a degree of freedom encountered in fixed-effect models disappeared in random-effect models (Baltagi, 2008).
In this study, a one-way random-effects model was used. In other words, when *i* shows sections and time *t*, the following model (4) is estimated, indicating that the difference between the sections is a component of the error terms in

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the model.

$$Y_{it} = \alpha + X'_{it}\beta + (\mu_i + v_{it}) \quad (4)$$

$i = 1, ...N$
$t = 1, ...T$
$E(u_i) = (v_{it}) = 0, Cov(u_t, v_{jt}) =$
$\sigma_{u,v}, Var(u_i) = \sigma_u^2 veE(X_{it}, u_t) = 0$
In the model,
X_{it} is the vector of explanatory variables;
Y_{it} is the dependent variable;
β is the variable coefficients and α is the fixed term
Here, it is assumed that the variances of error terms are distributed independently and identical to equal zero. μ_i is the error term with unobservable random differences in units, while v_{it} is the term containing the remaining errors. The individual error terms (μ_i) expressing the cross-sectional effect are not interrelated and are not related to the panel error term (v_{it}). Under the normal distribution assumptions, the model (5), which consists of a combination of two error terms, is obtained from the model.

$$Y_{it} = \alpha_i + X'_{it}\beta + e_{it} \quad (5)$$

$$e_{it} = \mu_i + v_{it} \quad (6)$$

In this model, error terms consist of two components, and variance (6) of error terms does not show fixed variance and zero covariance characteristics.
Therefore, the Least Squares estimator cannot be applied to this model because the error terms do not have the desired properties; Methods such as the Generalized Least Squares Method and the Appropriate Generalized Least Squares Method can be applied. In order to apply the Generalized Least Squares method from these models, the error terms variance components must be known. In this study, Swamy and Arora (1972) and Wallace and Hussain (1969) methods were used to determining variance components. Swamy and Arora (1972) proposed to obtain variance components using in-group and inter-group regression models (Baltagi, 2008). In this study, the unit effect was estimated by the method of Swamy and Arora (1972) and the time effect was estimated by the method of Wallace and Hussain (1969).

Hausman test

The fixed-effects model included in panel data analysis is a frequently used model with desirable features in terms of statistical properties. However, if the random-effects model gives more effective results than the fixed effects model, then the random effects model should be used. Therefore, it may be necessary to identify the more effective between the two models, both of which are consistent but have different efficacy. In the literature, the Hausman test that complies with the chi-square distribution with k degrees of freedom is used for this efficacy test (Baltagi, 2008).
In the Hausman test, while the null hypothesis showing that the coefficients obtained from the random-effects model and the coefficients obtained from the fixed effects model are the same, the inability to reject the fixed effects model shows that the random-effects model gives more effective results.

Data Set

In the analysis, 2 of the financial data belonging to the period 2008-2017 were considered as dependent, and 9 were considered as independent variables. Dependent variables are weighted data of credit risk undertaken by banks according to BASEL regulation credit risk/equity and market risk data/equity data. The independent variables are; Non-Interest Income/Non-Interest Expenses, Liquid Assets/Short Term Liabilities, Liquid Assets/Asset, Derivative Products/Equity, Loan/Asset, Non-Performing Loans/Loans, Financial Assets/Asset and Active Diversification Value.
Laeven and Levine (2007) investigated the effect of the diversification strategy applied by financial institutions on the market values covering 43 countries between 1998 and 2002 in their study. The asset diversification was formulated for the first time in this study. The formula for asset diversification was also used in our study. Asset diversification (1- ((Net Loans - Other Income Assets)/Total Income Assets) is calculated with the help of the formula.
The data used in this analysis is mainly the Banks Association of Turkey from the web page (www.tbb.org.tr) were obtained. Some of the variables in the following table were found as calculated on the Banks Association of Turkey webpage; some variables are still calculated by us considering the main data contained in this website.
The data used in the analysis are the term data of the banks specified in the table below. It was collected from 2008 to 2017.

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TABLE 1. Variables used in the analysis and explanation

	Variable	Definition	Source/Calculation Method
Dependent	Credit Risk/Equity	Crdequity?	These data were taken as calculated from the Banks Association of Turkey website.
	Market Risk/Equity	Marequity?	These data were taken as calculated from the Banks Association of Turkey website.
	Cost to Income	Cti?	These data were taken as calculated from the Banks Association of Turkey website.
	Liquid Assets/Short Term Liabilities	Liquid_st?	These data were taken as calculated from the Banks Association of Turkey website.
	Liquid Assets/Total Assets	Liquid_ass?	These data were taken as calculated from the Banks Association of Turkey website.
	Derivatives/equity	Der_eq?	Calculated by us using the data in the financial statements.
	Loans/Total Assets	Loans_ass?	These data were taken as calculated from the Banks Association of Turkey website.
Independent	Non-Performing Loans/Loans	Nonperf_loans?	These data were taken as calculated from the Banks Association of Turkey website.
	Financial Assets (Net)/Asset	Fina_ass?	These data were taken as calculated from the Banks Association of Turkey website.
	Asset Diversity	Asset_div?	It has been calculated by us using the data in the financial statements according to the following formula (Laeven & Levine, 2007). (1- ((Net Loans - Other Income Assets)/Total Income Assets) Net Loans: Total loans - NPL provisions Other Income Assets: All interest income assets except loans in assets. Total income assets: All interest income assets in the asset.

TABLE 2. Banks under analysis

The name of the Bank	Definition
Akbank	_Ak
Alternatif	_Alternatif
Anadolubank	_Anadolu
Denizbank	_Denizbank
Finansbank	_finans
T. Garanti Bankasi	_Garanti
T. Halk Bankasi	_halk
HSBC	_HSBC
ING	_ing
T. Is Bankasi	_is
Sekerbank	_seker
TEB	_teb
Vakifbank	_vakif
Yapi ve Kredi Bankasi	_ykb
TC Ziraat Bankasi	_ziraat

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RESULTS AND DISCUSSION

At this stage of the analysis, unit root test analyses were conducted for the determination of stationarity for all variables. The table below shows the results.

One of the prerequisites required for panel data analysis, the unit root test result showed that both ADF and Phillips Perron (PP) tests ($p < 0.05$) indicated that the panel data was stationary.

TABLE 3. ADF and PP unit root test results of variables to Newey-West and Bartlett Kernel panel data

Variables		χ^2	*p*	Sections	Obs
Credit Risk/Equity	ADF	69,82	0.0000	15	131
	PP	45,8248	0.0266	15	135
Market Risk Equity	ADF	102,281	0.0000	15	131
	PP	157,113	0.0000	15	135
Cost to Income	ADF	45,5881	0.0280	15	131
	PP	48,0309	0.0163	15	135
Liquid Assets/Short Term Liabilities	ADF	50,7319	0.0086	15	131
	PP	53,5572	0.0043	15	135
Liquid Assets/Total Assets	ADF	100,422	0.0000	15	131
	PP	87,7949	0.0000	15	135
Derivative/Equity	ADF	77,4159	0.0000	15	131
	PP	53,4218	0.0280	15	135
Loans/Total Assets	ADF	109,878	0.0163	15	131
	PP	164,71	0.0086	15	135
Non-Performing Loans/Loans	ADF	53,1851	0.0043	15	131
	PP	55,6279	0.0000	15	135
Financial Assets(Net)/Asset	ADF	58,3289	0.0000	15	131
	PP	61,1542	0.0014	15	135
Asset Diversity	ADF	108,019	0.0000	15	131
	PP	95,3919	0.0000	15	135

ADF: ADF unit root test
PP: PP unit root test

Credit risk/equity dependent variable analysis results

The results of the analysis of the Credit Risk/Equity variable, which is the dependent variable in the panel data analysis are given below.

Panel data estimation results from combined data; The independent variables Credit/Asset, NPL (Gross)/Total Credit, and Asset Diversity have a significant effect on the Credit Risk/Equity dependent variable ($p < 0.05$). The explanatory power of the variables is R^2 = 42.27%.

TABLE 4. Panel data analysis between credit risk/equity and other variables

Variable	Coefficient	Std.Error	*t*-Statistic	*p*
Ctı?	0.341027	0.844270	0.403932	0.6869
Liquid_st?	0.027990	1.050916	0.026634	0.9788
liquid_ass?	0.433733	2.229335	0.194557	0.8460
Der_eq?	-0.010393	0.011322	-0.918004	0.3602
Loans_ass?	7.992600	0.783071	10.20674	0.0000
Nonperf_loans?	-6.743953	3.290344	-2.049620	0.0422
Fina_ass?	-0.536464	1.023602	-0.524095	0.6010
Asset_dıv?	0.989701	0.646187	1.531601	0.0178

$p < 0.05$

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TABLE 4. Continue...

Variable	Coefficient	Std.Error	*t*-Statistic	*p*
R-squared	0.422774	Mean dependent var		557.1780
Adjusted *R*-squared	0.394319	S.D. dependent var		88.65905
S.E. of regression	68.99937	Akaike info criterion		11.35793
Sum squared resid	676049.7	Schwarz criterion		11.51850
Log likelihood	-843.8448	Hannan-Quinn criter.		11.42316
Durbin-Watson stat	1.097219			

$p < 0.05$

TABLE 5. Panel data analysis between credit risk/equity and other ındependent variables-Hausman test

Test Summary	χ^2	*S.D*	*p*
Hausman Test	9.918676	8	0.2708

Parameters will be estimated with fixed effect and random effect models used to see individual effects in panel data. First, it is necessary to decide which of these two models (fixed effect, random effect) is statistically valid. For this, the Hausman test will be applied. In the Hausman test, the absence hypothesis is established as "random effect model" and the alternative hypothesis is as "fixed effect model". *p* (significance level) value and table value (α) are compared from the output. In our example; $p = 0.2708 > 0.050$, so H_0 hypothesis is acceptable.

So it can be said that there is a random effect. In this case, it is necessary to estimate the model with a random effect. Random effect estimation results are given below.

TABLE 6. Random effect panel data analysis between credit risk/equity and other ındependent variables

Variable	Coefficient	Std. Error	*t*-Statistic	*p*
C	-15.06330	227.6902	-0.066157	0.9473
Ctı?	0.437399	1.019056	0.429220	0.6684
Liquid_st?	-0.557579	1.057101	-0.527460	0.5987
Liquid_ass?	2.378053	2.323362	1.023540	0.3078
Der_eq?	0.000768	0.012163	0.063174	0.9497
Loans_ass?	8.062410	2.178063	3.701642	0.0003
Nonperf_loans?	-11.31149	3.996761	-2.830165	0.0053
Fina_ass?	-1.015634	1.749016	-0.580689	0.0424
Asset_dıv?	0.982084	0.771709	1.272610	0.0205
Random Effects (Cross)				
_AK-C	-8.759023			
_ALTERNATIF--C	20.48163			
_ANADOLU--C	-59.57939			
_DENIZBANK--C	0.942279			
_FINANS--C	-11.83172			
_GARANTI--C	-22.31008			
_HALK--C	15.78967			
_HSBC--C	-22.57507			
_ING--C	-21.72321			
_IS--C	7.786113			
_SEKER--C	47.28617			
_TEB--C	-18.91400			

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TABLE 6. Continue...

Variable	Coefficient	Std. Error	*t*-Statistic	*p*
_VAKIF--C	41.88601			
_YKB--C	27.02277			
_ZIRAAT--C	4.497860			
		Effects Specification		
			S.D.	Rho
Cross-section random			32.55037	0.2163
Idiosyncratic random			61.95517	0.7837
		Weighted Statistics		
R-squared	0.427794	Mean dependent var		287.3310
Adjusted *R*-squared	0.395328	S.D. dependent var		80.21445
S.E. of regression	62.37528	Sum squared resid		548585.2
F-statistic	13.17684	Durbin-Watson stat		1.315270
Prob (*F*-statistic)	0.000000			
		Unweighted Statistics		
R-squared	0.402792	Mean dependent var		557.1780
Sum squared resid	699452.5	Durbin-Watson stat		1.031575

When we look at the non-periodically random-effect panel data analysis, NPL (Gross)/Total Loans, Credit/Total Asset, Financial Assets (Net)/Total Assets, Asset Diversity variables were found to be significant ($p < 0.05$) effect. In this case, the non-periodic disclosure rate was determined as 42.78%.

Regardless of NPL (Gross)/Total Loans, Credit/Total Asset, Financial Assets (Net)/Total Assets, Asset Diversity of Akbank, Alternatifbank, Anadolubank, Denizbank, HSBC Bank, ING Bank, Şekerbank, Türk Ekonomi Bankası, T C Ziraat Bankası, T Garanti Bankası, T Halk Bankası, T İş Bankası, T Vakıflar Bankası and Yapı ve Kredi Bank can be estimated the sector's Credit Risk/Equity variable by 42.78% in the long run.

Estimation equations can be used as specified in Appendix 1.

Market risk/equity dependent variable analysis result

The results of the analysis of the Market Risk/Equity variable, which is a dependent variable in panel data analysis, are given below.

TABLE 7. Panel data analysis between market risk/equity and other variables

Variable	Coefficient	Std. Error	*t*-Statistic	*p*
Ctı?	0.084699	0.158744	0.533557	0.5945
Liquid_st?	-0.478448	0.197599	-2.421304	0.0167
Liquid_ass?	1.372295	0.419172	3.273821	0.0013
Der_eq?	-0.004354	0.002129	-2.045473	0.0427
Loans_ass?	-0.040447	0.147237	-0.274703	0.7839
Nonperf_loans?	-0.481990	0.618669	-0.779075	0.4372
Fina_ass?	-0.226548	0.192464	-1.177094	0.2411
Asset_dıv?	0.159300	0.121500	1.311117	0.0199
R-squared	0.289525	Mean dependent var		18.44467
Adjusted *R*-squared	0.149572	S.D. dependent var		14.06836
S.E. of regression	12.97366	Akaike info criterion		8.015577
Sum squared resid	23900.83	Schwarz criterion		8.176144
Log likelihood	-593.1683	Hannan-Quinn criter.		8.080810
Durbin-Watson stat	1.263912			

$p < 0.05$

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Panel data estimation results from combined data; The independent variables Liquid Assets/Short Term Liabilities, Liquid Assets/Total Assets, Derivatives/Equity, Asset Diversity have a significant effect on Market Risk/Equity dependent variable ($p < 0.05$). The explanatory power of the variables is R^2 = 28.95%.

TABLE 8. Panel data analysis between market risk/equity and other ındependent variables-Hausman test

Test Summary	χ^2	*S.D*	*p*
Hausman Test	5.027718	8	0.7546

Parameters will be estimated with fixed effect and random effect models used to see individual effects in panel data. First, it is necessary to decide which of these two models (fixed effect, random effect) is statistically valid. For this, the Hausman test will be applied. In the Hausman test, the absence hypothesis is established as "random effect model" and the alternative hypothesis is as "fixed effect model". *p* (significance level) value and table value (α) are compared from the output. In our example; $p = 0.7546 > 0.050$, so H1 hypothesis is acceptable.

So it can be said that there is a random effect. In this case, it is necessary to estimate the model with a random effect. Random effect estimation results are given below.

TABLE 9. Panel risk analysis with random effect between market risk/equity and other ındependent variables

Variable	Coefficient	Std. Error	*t*-Statistic	*p*
C	-99.11633	40.75926	-2.431750	0.0163
Ctı?	0.244369	0.183963	1.328354	0.1862
Liquid_st?	-0.255486	0.185912	-1.374227	0.1716
Liquid_ass?	1.236501	0.412131	3.000263	0.0032
Der_eq?	-0.001540	0.002194	-0.701999	0.4838
Loans_ass?	0.906105	0.386767	2.342766	0.0205
Nonperf_loans?	-0.148060	0.793006	-0.186707	0.8522
Fina_ass?	0.438954	0.315422	1.391642	0.1662
Asset_dıv?	0.244278	0.134739	1.812973	0.0020
Random Effects (Cross)				
_AK--C	-8.745862			
_ALTERNATIF--C	-5.942797			
_ANADOLU--C	22.77355			
_DENIZBANK--C	-3.971464			
_FINANS--C	2.551573			
_GARANTI--C	-4.014402			
_HALK--C	2.388675			
_HSBC--C	1.752387			
_ING—C	-6.901685			
_IS-C	4.471696			
_SEKER--C	-2.273389			
_TEB-C	-7.300628			
_VAKIF--C	-5.552444			
_YKB-C	0.002979			
_ZIRAAT-C	10.76181			
	Effects Specification			
			S.D	Rho
Cross-section random			10.02854	0.4798
Idiosyncratic random			10.44297	0.5202

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TABLE 9. Continue..

Variable	Coefficient	Std. Error	*t*-Statistic	*p*
		Weighted Statistics		
R-squared	0.291571	Mean dependent var		5.769015
Adjusted *R*-squared	0.145703	S.D. dependent var		11.17875
S.E. of regression	10.33231	Sum squared resid		15052.69
F-statistic	4.176548	Durbin-Watson stat		1.857085
Prob (*F*-statistic)	0.000165			
		Unweighted Statistics		
R-squared	0.132354	Mean dependent var		18.44467
Sum squared resid	25586.82	Durbin-Watson stat		1.092521

When we look at the panel data analysis with non-periodic random effect, Liquid Assets/Total Assets, Credit/Total Asset, Asset Diversity variables significantly ($p < 0.05$) affect the Market Risk/Equity dependent variables. In this case, the non-periodic disclosure rate was 29.15%.

Regardless of Liquid Assets/Total Assets, Credit/Total Asset, Asset Diversity of Akbank, Alternatifbank, Anadolubank, Denizbank, HSBC Bank, ING Bank, Şekerbank, Türk Ekonomi Bankası, T C Ziraat Bankası, T Garanti Bankası, T Halk Bankası, T İş Bankası, T Vakıflar Bankası and Yapı ve Kredi Bank can be estimated the sector's Market Risk/Equity variable by 29.15% in the long run.

Estimation equations can be used as specified in Appendix 2.

CONCLUSION

In this study conducted by taking into account the data of the banks, which constitute a significant part of the Turkish Banking Sector, the most significant outputs obtained as a result of the analysis are as follows:

It has been discussed in various academic studies that there are many different variables that affect the risks that banks assume due to their activities. The difference in this study is particularly related to whether asset diversification has an impact on credit risk and market risk. In this study, the relationship between credit risk and asset diversification questioned is based on both the sector and large-scale banks.

In this study conducted by using Panel Data Analysis, it was seen that the asset diversification decreased the risk in some banks, whereas in some banks, the effect was lower. According to Modern Portfolio Theory, diversification is expected to reduce the risk. However, in this study, this result has not been achieved in some banks. Based on the data obtained, it is considered that it is important to take into account the correlation between the asset items when banks are diversifying assets.

IMPLICATIONS

In the studies conducted with the perspective of asset diversification, it is generally seen that issues such as firm value, profitability, and performance are prioritized. In this study, it is thought that questioning the relationship between diversification and balance sheet risk level will contribute to the literature.

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APPENDIX 1

Credit risk/equity
Crdequity?_ak = -8.75902284748 - 15.0633047609 + 0.437399314309*ctı_ak - 0.557578615499*liquid_st?_ak + 2.37805333996*liquid_ass?_ak + 0.000768352224413*der_eq_ak + 8.06240989335*loans_ass?_ak -11.3114938859*nonperf_loans?_ak - 1.01563363452*fina_ass?_ak + 0.982084324913*asset_dıv_ak
Crdequity?_alternatıf = 20.4816256512 - 15.0633047609 + 0.437399314309*ctı_alternatıf -0.557578615499*liquid_st?_alternatıf + 2.37805333996*liquid_ass?_alternatıf + 0.000768352224413*der_eq_alternatıf + 8.06240989335*loans_ass?_alternatıf - 11.3114938859*nonperf_loans?_alternatıf - 1.01563363452*fina_ass?_alternatıf + 0.982084324913*asset_dıv_alternatıf
Crdequity?_anadolu = -59.5793900452 - 15.0633047609 + 0.437399314309*ctı_anadolu -0.557578615499*liquid_st?_anadolu + 2.37805333996*liquid_ass?_anadolu + 0.000768352224413*der_eq_anadolu + 8.06240989335*loans_ass?_anadolu - 11.3114938859*nonperf_loans?_anadolu - 1.01563363452*fina_ass?_anadolu + 0.982084324913*asset_dıv_anadolu
Crdequity?_denızbank = 0.942278740467 - 15.0633047609 + 0.437399314309*ctı_denızbank - 0.557578615499*liquid_st?_denızbank + 2.37805333996*liquid_ass?_denızbank + 0.000768352224413*der_eq_denızbank + 8.06240989335*loans_ass?_denızbank - 11.3114938859*nonperf_loans?_denızbank - 1.01563363452*fina_ass?_denızbank + 0.982084324913*asset_dıv_denızbank
Crdequity?_fınans = -11.8317195172 - 15.0633047609 + 0.437399314309*ctı_fınans - 0.557578615499*liquid_st?_fınans + 2.37805333996*liquid_ass?_fınans + 0.000768352224413*der_eq_fınans + 8.06240989335*loans_ass?_fınans - 11.3114938859*nonperf_loans?_fınans - 1.01563363452*fina_ass?_fınans + 0.982084324913*asset_dıv_fınans
Crdequity?_garantı = -22.310079941 - 15.0633047609 + 0.437399314309*ctı_garantı - 0.557578615499*liquid_st?_garantı + 2.37805333996*liquid_ass?_garantı + 0.000768352224413*der_eq_garantı + 8.06240989335*loans_ass?_garantı - 11.3114938859*nonperf_loans?_garantı - 1.01563363452*fina_ass?_garantı + 0.982084324913*asset_dıv_garantı
Crdequity?_halk = 15.7896694624 - 15.0633047609 + 0.437399314309*ctı_halk - 0.557578615499*liquid_st?_halk + 2.37805333996*liquid_ass?_halk + 0.000768352224413*der_eq_halk + 8.06240989335*loans_ass?_halk - 11.3114938859*nonperf_loans?_halk - 1.01563363452*fina_ass?_halk + 0.982084324913*asset_dıv_halk
Crdequity?_hsbc = -22.5750713876 - 15.0633047609 + 0.437399314309*ctı_hsbc - 0.557578615499*liquid_st?_hsbc + 2.37805333996*liquid_ass?_hsbc + 0.000768352224413*der_eq_hsbc + 8.06240989335*loans_ass?_hsbc - 11.3114938859*nonperf_loans?_hsbc - 1.01563363452*fina_ass?_hsbc + 0.982084324913*asset_dıv_hsbc
Crdequity?_ıng = -21.723211224 - 15.0633047609 + 0.437399314309*ctı_ıng - 0.557578615499*liquid_st?_ıng + 2.37805333996*liquid_ass?_ıng + 0.000768352224413*der_eq_ıng + 8.06240989335*loans_ass?_ıng - 11.3114938859*nonperf_loans?_ıng - 1.01563363452*fina_ass?_ıng + 0.982084324913*asset_dıv_ıng
Crdequity?_ıs = 7.7861134287 - 15.0633047609 + 0.437399314309*ctı_ıs - 0.557578615499*liquid_st?_ıs + 2.37805333996*liquid_ass?_ıs + 0.000768352224413*der_eq_ıs + 8.06240989335*loans_ass?_ıs - 11.3114938859*nonperf_loans?_ıs - 1.01563363452*fina_ass?_ıs + 0.982084324913*asset_dıv_ıs
Crdequity?_seker = 47.286174111 - 15.0633047609 + 0.437399314309*ctı_seker - 0.557578615499*liquid_st?_seker + 2.37805333996*liquid_ass?_seker + 0.000768352224413*der_eq_seker + 8.06240989335*loans_ass?_seker - 11.3114938859*nonperf_loans?_seker - 1.01563363452*fina_ass?_seker + 0.982084324913*asset_dıv_seker
0.557578615499*liquid_st?_teb + 2.37805333996*liquid_ass?_teb + 0.000768352224413*der_eq_teb + 8.06240989335*loans_ass?_teb - 11.3114938859*nonperf_loans?_teb - 1.01563363452*fina_ass?_teb + 0.982084324913*asset_dıv_teb
Crdequity?_teb = -18.9140047744 - 15.0633047609 + 0.437399314309*ctı_teb - crdequity?_vakıf = 41.8860064082 - 15.0633047609 + 0.437399314309*ctı_vakıf - 0.557578615499*liquid_st?_vakıf + 2.37805333996*liquid_ass?_vakıf + 0.000768352224413*der_eq_vakıf + 8.06240989335*loans_ass?_vakıf - 11.3114938859*nonperf_loans?_vakıf - 1.01563363452*fina_ass?_vakıf + 0.982084324913*asset_dıv_vakıf
Crdequity?_ykb = 27.0227719798 - 15.0633047609 + 0.437399314309*ctı_ykb - 0.557578615499*liquid_st?_ykb + 2.37805333996*liquid_ass?_ykb + 0.000768352224413*der_eq_ykb + 8.06240989335*loans_ass?_ykb - 11.3114938859*nonperf_loans?_ykb - 1.01563363452*fina_ass?_ykb + 0.982084324913*asset_dıv_ykb
Crdequity?_zıraat = 4.49785995522 - 15.0633047609 + 0.437399314309*ctı_zıraat - 0.557578615499*liquid_st?_zıraat + 2.37805333996*liquid_ass?_zıraat + 0.000768352224413*der_eq_zıraat + 8.06240989335*loans_ass?_zıraat - 11.3114938859*nonperf_loans?_zıraat - 1.01563363452*fina_ass?_zıraat + 0.982084324913*asset_dıv_zıraat

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APPENDIX 2

Market risk/equity
Marequity?_ak = -8.74586150309 - 99.1163283893 + 0.244368616634*ctı_ak - 0.255485716003*liquid_st?_ak + 1.23650075475*liquid_ass?_ak - 0.00154014037379*der_eq_ak + 0.906105199571*loans_ass?_ak - 0.148059982734*nonperf_loans?_ak + 0.438954017819*fina_ass?_ak + 0.244277762161*asset_dıv_ak
Marequity?_alternatıf = -5.94279744876 - 99.1163283893 + 0.244368616634*ctı_alternatıf - 0.255485716003*liquid_st?_alternatıf + 1.23650075475*liquid_ass?_alternatıf - 0.00154014037379*der_eq_alternatıf + 0.906105199571*loans_ass?_alternatıf - 0.148059982734*nonperf_loans?_alternatıf + 0.438954017819*fina_ass?_alternatıf + 0.244277762161*asset_dıv_alternatıf
Marequity?_anadolu = 22.7735469098 - 99.1163283893 + 0.244368616634*ctı_anadolu - 0.255485716003*liquid_st?_anadolu + 1.23650075475*liquid_ass?_anadolu - 0.00154014037379*der_eq_anadolu + 0.906105199571*loans_ass?_anadolu - 0.148059982734*nonperf_loans?_anadolu + 0.438954017819*fina_ass?_anadolu + 0.244277762161*asset_dıv_anadolu
Marequity?_denızbank = -3.97146369597 - 99.1163283893 + 0.244368616634*ctı_denızbank - 0.255485716003*liquid_st?_denızbank + 1.23650075475*liquid_ass?_denızbank - 0.00154014037379*der_eq_denızbank + 0.906105199571*loans_ass?_denızbank - 0.148059982734*nonperf_loans?_denızbank + 0.438954017819*fina_ass?_denızbank + 0.244277762161*asset_dıv_denızbank
Marequity?_fınans = 2.5515734777 - 99.1163283893 + 0.244368616634*ctı_fınans - 0.255485716003*liquid_st?_fınans + 1.23650075475*liquid_ass?_fınans - 0.00154014037379*der_eq_fınans + 0.906105199571*loans_ass?_fınans - 0.148059982734*nonperf_loans?_fınans + 0.438954017819*fina_ass?_fınans + 0.244277762161*asset_dıv_fınans
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Marequity?_ıng = -6.90168477585 - 99.1163283893 + 0.244368616634*ctı_ıng - 0.255485716003*liquid_st?_ıng + 1.23650075475*liquid_ass?_ıng - 0.00154014037379*der_eq_ıng + 0.906105199571*loans_ass?_ıng - 0.148059982734*nonperf_loans?_ıng + 0.438954017819*fina_ass?_ıng + 0.244277762161*asset_dıv_ıng
Marequity?_ıs = 4.47169626202 - 99.1163283893 + 0.244368616634*ctı_ıs - 0.255485716003*liquid_st?_ıs + 1.23650075475*liquid_ass?_ıs - 0.00154014037379*der_eq_ıs + 0.906105199571*loans_ass?_ıs - 0.148059982734*nonperf_loans?_ıs + 0.438954017819*fina_ass?_ıs + 0.244277762161*asset_dıv_ıs
Marequity?_seker = -2.273388927 - 99.1163283893 + 0.244368616634*ctı_seker - 0.255485716003*liquid_st?_seker + 1.23650075475*liquid_ass?_seker - 0.00154014037379*der_eq_seker + 0.906105199571*loans_ass?_seker - 0.148059982734*nonperf_loans?_seker + 0.438954017819*fina_ass?_seker + 0.244277762161*asset_dıv_seker
Marequity?_teb = -7.30062806956 - 99.1163283893 + 0.244368616634*ctı_teb - 0.255485716003*liquid_st?_teb + 1.23650075475*liquid_ass?_teb - 0.00154014037379*der_eq_teb + 0.906105199571*loans_ass?_teb - 0.148059982734*nonperf_loans?_teb + 0.438954017819*fina_ass?_teb + 0.244277762161*asset_dıv_teb
Marequity?_vakıf = -5.5524437248 - 99.1163283893 + 0.244368616634*ctı_vakıf - 0.255485716003*liquid_st?_vakıf + 1.23650075475*liquid_ass?_vakıf - 0.00154014037379*der_eq_vakıf + 0.906105199571*loans_ass?_vakıf - 0.148059982734*nonperf_loans?_vakıf + 0.438954017819*fina_ass?_vakıf + 0.244277762161*asset_dıv_vakıf
Marequity?_ykb = 0.00297918156981 - 99.1163283893 + 0.244368616634*ctı_ykb - 0.255485716003*liquid_st?_ykb + 1.23650075475*liquid_ass?_ykb - 0.00154014037379*der_eq_ykb + 0.906105199571*loans_ass?_ykb - 0.148059982734*nonperf_loans?_ykb + 0.438954017819*fina_ass?_ykb + 0.244277762161*asset_dıv_ykb
Marequity?_zıraat = 10.7618118681 - 99.1163283893 + 0.244368616634*ctı_zıraat - 0.255485716003*liquid_st?_zıraat + 1.23650075475*liquid_ass?_zıraat - 0.00154014037379*der_eq_zıraat + 0.906105199571*loans_ass?_zıraat - 0.148059982734*nonperf_loans?_zıraat + 0.438954017819*fina_ass?_zıraat + 0.244277762161*asset_dıv_zıraat

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