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FACTORS AFFECTING CAPITAL ADEQUACY RATIO

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Abstract

In this study, the influence of deposit asset ratio, loan asset ratio, loan to deposit ratio, equity ratio, financial assets ratio on capital adequacy ratio was investigated. In the research, the data of 25 banks operating in Turkiye for the period of 2012 and 2021 was analyzed with panel data analysis method using the R-Studio Program. As a result of the study, it was found that the deposit asset ratio, loan asset ratio, loan to deposit ratio, equity ratio, financial assets ratio simultaneously affect the capital adequacy ratio significantly. It was observed that the effect of deposit asset ratio on capital adequacy ratio is statistically insignificant and positive. The effect of loan asset ratio on capital adequacy ratio is statistically insignificant and negative. The loan to deposit ratio is a significant and positive effect on capital adequacy ratio. The effect of equity ratio on capital adequacy ratio is statistically insignificant and negative. The financial assets ratio is a significant and positive effect on capital adequacy ratio. The aim of this study is to determine the effects of deposit, loan, equity, and financial asset ratios on capital adequacy by using panel data analysis method and to contribute to other researchers.

Keywords: Capital adequacy ratio, CAR, Loan to deposit ratio, LDR, Equity ratio, Financial assets ratio

INTRODUCTION

The capital adequacy ratio, in the simplest terms, is the rate at which banks hold enough capital (equity) to cover the credit risk, market risk and operational risk they face. A bank may run into insolvency difficulties and enter a liquidity crisis due to unexpected deposit withdrawals and/or inability to meet loan demands. In such a case, the capital adequacy ratio is an indicator that the

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bank can sustain itself with its capital. Capital adequacy is much more important for banks. Banks use the financial leverage effect at a higher rate than companies. Financial leverage is a criterion for determining the amount of debt use in a company's resource structure. The ratio of banks' debts to total assets -unlike other companies- reaches 90%. In other words, 10% of total assets are covered by equity and banks continue their activities with this low capital base. Therefore, capital adequacy criteria are introduced. In general, capital adequacy in the banking legislation of each country is a ratio whose minimum measures are determined. This ratio is considered as a guarantee when the bank fails for various reasons. The Basel Committee on Banking Supervision was established in 1974 under the Bank for International Settlements located in Basel, Switzerland. It is an international organization that aims to create international standards in areas such as risk management and capital adequacy, aiming for banks to comply with these standards at an optimal level. Due to the inadequacy of the old capital adequacy standards, a reorganization was made by the Basel Committee on Banking Supervision within the framework of the Basel Capital Agreement prepared in 2001. The criteria determined by this regulation are used as a benchmark in many countries and Turkiye as an indicator of the soundness of the financial structures of the banks. BASEL criteria, which express capital adequacy ratios, are used by Banking Regulation and Supervision Agency in the supervision of banks in Turkiye. In this study, the effects of deposit asset ratio, loan asset ratio, loan to deposit ratio, equity ratio, and financial assets ratio on capital adequacy ratio were investigated.

LITERATURE REVIEW

Studies on capital adequacy ratio were researched and tried to be summarized below.

Bateni, Vakilifard, and Asghari (2014) investigated the effect of bank size, loan asset ratio, equity ratio, return on assets, return on equity, deposit asset ratio, risk asset ratio on capital adequacy ratio in 6 Iranian private banks between years 2006 and 2012. Panel data analysis was used in the study. They concluded that bank size had negative effect on capital adequacy ratio, and equity ratio, return on assets, return on equity, loan asset ratio had positively influence on capital adequacy ratio. Deposit asset ratio and risk asset ratio had no significant effect on capital adequacy ratio.

Shingjergji and Hyseni (2015) analyzed the relationship between the capital adequacy ratio and six independent variables of return on assets, return on equity, non performing loans, bank size, equity multiplier, loan to deposit ratio from the period of first trimester of 2007 until the third trimester of 2014 in the Albanian banking system. Linear regression analysis (ordinary least squares) was applied. They concluded that return on assets and return on equity have negative and statistically insignificant effect on capital adequacy ratio, and non performing loans, loan to

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deposit ratio, equity multiplier have negative and significant effect on capital adequacy ratio. The bank size independent variable had a positive and significant impact on capital adequacy ratio.

Abusharba, Triyuwono, Ismail, and Rahman (2013) examined the effect of return on assets, non performing financing, deposits, financing to total deposits, operational efficiency on capital adequacy ratio in 11 Islamic Commercial Banks in Indonesia between the years 2009 and 2011. Multiple regression analysis was applied. It was concluded that return on assets has positive and significant impact on capital adequacy ratio, non performing financing has negative and significant effect on capital adequacy ratio, deposit structure has positive and statistically insignificant influence on capital adequacy ratio, financing to deposit ratio has positive and significant influence on capital adequacy ratio, operational efficiency has negative and statistically insignificant impact on capital adequacy ratio.

El-Ansary and Hafez (2015) investigated the relationship between capital adequacy ratio as dependent variable and independent variables of assets management quality, profitability (return on assets and return on equity), liquidity, credit risk, size (total assets), net interest income growth, management quality by using financial data of 33 banks (represent 83% of operating commercial banks)in Egypt between the years 2003 and 2013. Multiple regression analysis was applied. The results (2003 to 2013) showed that earning assets/total assets ratio is not significantly correlated with the capital adequacy ratio, securities/total assets ratio has positive and significant effect on capital adequacy ratio, net loans/total assets ratio has negative and statistically insignificant impact on capital adequacy ratio, loans loss reserves/total loans ratio is not significantly correlated to the capial adequacy ratio, provisions/total loans is significantly correlated with capital adequacy ratio, loans/deposits ratio has positive and significant effect on capital adequacy ratio, return on assets is positively and significantly correlated with capital adequacy ratio, return on equity and change in interest income are negatively and insignificantly correlated with capital adequacy ratio, asset size is negatively and significantly correlated with capital adequacy ratio. In addition, multiple regression analysis was performed before and after the 2008 financial crisis in their study.

Irawati, Maksum, Sadalia and Muda (2019) examined the effect of capital adequacy ratio, non performing loan, managerial ownership, audit committee, and size variables on return on asset by using secondary data of 30 banks listed on Indonesia Stock Exchange between the years 2011 and 2015. Panel Least Squares method was applied. Results stated that capital adequacy ratio, managerial ownership and size have positive and significant impact on financial performance. Non performing loan has a negative insignificant impact on financial performance, and audit committee has positive insignificant impact on banking financial performance.

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Dreca (2014) investigated the relationship between the independent variables of bank size(total assets), deposits to total assets ratio, loans to total assets ratio, loan loss provision to total loans ratio, return on assets, return on equity, net interest income to total assets ratio, equity to total liabilities ratio and dependent variable of capial adequacy ratio by using the secondary data of 10 banks in Bosnia and Herzegovina. The panel data analysis method was used. The results showed that bank size, deposits to total assets ratio, loans to total assets ratio, return on assets, return on equity, equity to total liabilities ratio have significant effect on capital adequacy ratio, loan loss provision to total loans ratio and net interest income to total assets ratio have insignificant effect on capital adequacy ratio. Size, deposits to total assets ratio, loans to total assets ratio, return on assets have negative impact on capital adequacy ratio, loan loss provision to total loans ratio, return on equity, net interest income to total assets ratio, equity to total liabilities ratio have positive impact on capital adequacy ratio.

Abba, Zachariah, and Inyang (2013) analyzed the relationship between banking risks and capital adequacy ratio by using data of 12 commercial banks operated in Nigerian banking industry between the years 2007 and 2011. Multiple regression analysis was applied. The results showed that negative and significant relationship between risk weighted asset/total asset ratio and capital adequacy ratio, negative relationship between total deposits/total assets ratio and capital adequacy ratio, and positive relationship between capital adequacy ratio and annual inflation rate.

Abba, Okwa, Soje, and Aikpitanyi (2018) analyzed the influence of risk weighted asset ratio, deposit to assets ratio, return on assets, asset quality ratio on capital adequacy ratio by using data of 12 selected banks in Nigerian Deposit Money Banks between the years 2005 and 2014. Panel multiple regression model was used. According to the results, there is a positive and significant relationship between risk weighted assets ratio and capital adequacy ratio, positive and significant relationship between deposit to asset ratio and capital adequacy ratio, positive and significant relationship between profitability and capital adequacy ratio, negative and significant relationship between asset quality ratio and capital adequacy ratio.

Yahaya, Mansor, and Okazaki (2016) examined the relationship between total assets, total loans, total deposit, return on assets, return on equity, deposit to asset ratio and the dependent variable of capital adequacy ratio by using data of 64 regional banks in Japan for period from 2005 to 2014. Panel data regression method was used. They also investigated the relationship between inflation rate, real exchange rate, unemployment rate, money supply, gross domestic product and the dependent variable of capital adequacy ratio. They concluded that total loans, total deposits, gross domestic product, money supply, real exchange rate have negative relationship with capital adequacy ratio, return on equity and deposit to asset ratio have positive relationship with capital adequacy ratio.

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Vu and Dang (2020) identified the relationship between the dependent variable of capital adequacy ratio and ten independent variables of bank size, deposit, lending, loan loss reserves, liquidity, return on assets, return on equity, net interest margin, bad debt ratio, leverage by using data of 31 Vietnamese state and privately owned commercial banks between the years 2011 and 2018. Panel data analysis method was used. The results showed that size, deposit, loan, liquidity, net interest margin, non performing loan have insignificant effect on capital adequacy ratio. Leverage, loan loss reserves, return on equity have negative impact on capital adequacy ratio. Return on assets has positive impact on capital adequacy ratio. Loan loss reserves, return on assets, return on equity, leverage have significant effect on capital adequacy ratio.

Digdowiseiso (2021) examined the impacts of capital adequacy ratio, non performing loan, loan to deposit ratio, and return on asset on the stock prices of 24 banking companies listed on Indonesia Stock Exchange between the years 2015 and 2019. Panel data regression method was applied. The results showed that capital adequacy ratio, non performing loan, loan to deposit ratio, and return on asset partially have positive and insignificant impact on stock prices. Capital adequacy ratio, non performing loan, loan to deposit ratio, and return on asset simultaneously have significant impact on stock prices.

Pham and Nguyen (2017) analyzed the relationship between dependent variable of capital adequacy ratio and six determinants of bank size (total assets), leverage (equity/total liabilities ratio), loan loss reserves (loan loss provision/total loans), net interest margin ratio, loans/assets ratio, cash and precious metals/total asset ratio by using data of 29 commercial banks in Vietnam (2011 to 2015). Fixed effect model was used. It was found that net interest margin ratio, cash and precious metals/total asset ratio have positive and significant effect on capital adequacy ratio. Size and leverage have insignificant effect on capital adequacy ratio. Loan loss reserves and loans/total assets ratio are negatively impact on capital adequacy ratio.

Usman, Lestari, and Puspa (2019) investigated the impact of six independent variable of bank size, leverage, loan loss reserves, net interest margin, loan assets ratio, liquidity on capital adequacy ratio by using data of 27 Indonesian conventional banks listed on the Indonesia Stock Exchange between the years 2007 and 2018. Panel data regression analysis was applied. The results indicated that bank size, leverage, loan loss reserve, net interest margin, and loan asset ratio have significant effect on capital adequacy ratio. Liquidity (total loans/total deposits) has insignificant effect on capital adequacy ratio.

METHODOLOGY

In this study, capital adequacy ratio, total deposits/total assets, total loans/total assets, total loans/total deposits, equity/total assets, financial assets(net)/total assets ratios of 25 banks

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operating in Turkiye were used. These banks consist of 3 state-owned deposit banks, 8 privately-owned deposit banks, 1 bank transferred to savings deposit insurance fund, 12 foreign capital banks established in Turkiye, and 1 foreign banks opening branches in Turkiye. 25 banks were selected among the 49 banks operating in Turkiye due to the completeness of the data. Annual data between 2012 and 2021, including these years, is taken from the website of The Banks Association of Turkiye, www.tbb.org.tr

The data source contains 11 years of data between 2011 and 2021. The analysis is limited to 10 years of data. Compared to micro panels, cross-section dependence is a problem in macro panels with long time series. The use of a period of 10 years or 11 years of data does not make a significant difference in the results of increased precision in estimates. However, the focus of the study is data from a large cross-section of banks observed for a 10-year period, rather than a small cross-section of banks observed for many time periods.

Capital Adequacy Ratio (CAR)

The capital adequacy standard ratio expresses the percentage value found by dividing the total amount of shareholders' equity by the total amount subject to risk, consisting of the amount subject to credit risk, amount subject to operational risk and amount subject to market risk. Basel II is the second of the advisory Basel Agreements on banking laws and regulations issued by the Basel Committee on Banking Supervision. The limit for capital adequacy with Basel II is currently 8%. In other words, the capital adequacy of a bank should be above 8%. It is planned to apply this ration as 12% in the coming years. In Turkiye, the Banking Regulation and Supervision Agency demands that the capital adequacy ratio of banks be 12% in practice. According to the article of the banking law under the title of "capital adequacy", banks are obliged to calculate, achieve and report the capital adequacy ratio to be determined not less than 8%. The main purpose of the capital adequacy practice in banks is to ensure that the banks continue their activities with a sound financial structure and to prevent the savers from being harmed.

Deposit Asset Ratio (DAR)

Deposits constitute the item with the highest weight in the total resources of commercial banks. Time deposits, regardless of their size, are considered the most important source of funds for commercial banks all over the world. It is seen that banks generally follow an interest policy that is directly proportional to the maturity length. Banks fund their placements by increasing the interest rates they pay on deposits as the maturity lengthens, and they try to extend the maturity of the deposits they use. Thus, while activating the capital accumulation

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process on the one hand, they also try to optimize resource utilization. Formula: Total deposits/total assets

Loan Asset Ratio (LAR)

The most important item in the assets of commercial bank balance sheets is loans. Loans are classified according to their maturity structure and segmentation. The maturity structure of loans is important in terms of maturity matching of resources and usage. The qualitative structure of loans, on the other hand, is based on the maturity structure and the characteristics of the customers to whom the loan is given. Long term and high amount commercial loans are taken for purposes such as fixed capital investments, renovation investments, foreign trade activities, financial leasing. Such loans are called corporate loans. Consumer, automobile, housing loans, and credit cards are loans for individual customers and are called individual loans. The process of interbank transactions, which is included in the credit processes, is also important. Banks place their resources to other banks in order to evaluate their liquid resources. They establish a loan disbursement process for the banks to which the loan will be extended. The loan disbursement process includes the determination of which resources will be transferred to which banks, within which limits, in certain periods. Formula: Total credits/total assets

Loan to Deposit Ratio (LDR)

This ratio is also known as the deposit to loan conversion ratio. Credit deposit ratio LDR is one of the main indicators that measure the liquidity status banks. The main source of loans is deposits. This ratio shows the extent to which banks have converted the deposits they have collected into loans. A high loan to deposit ratio poses a significant risk for the bank. The increase in loans, which shows that customers tend to borrow rather than save, adversely affect the liquidity ratio of the bank, causing liquidity problems and causing the bank to borrow external resources. When the loan to deposit ratio is low, it will mean that the bank is not using its resources well. Formula: total loans/total deposits

Equity Ratio (EQR)

Equity refers to the amount paid by the shareholders to the business when the shares are purchased and the earnings of the business since its establishment. It is the amount paid by the shareholders to the company to buy the shares that the company sells to raise its capital, in addition, the earnings that the company has retained over the years are also included in the equity. Equity is the sum of paid in capital and retained earnings. Retained earnings are not just

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the last year's retained earnings, but the sum of all undistributed profits over the life of the company. Equity is calculated by subtracting total liabilities from total assets. It is the amount of capital investments made by business or bank owners and partnerships in the business at the balance sheet date. Equity, especially the bank's paid in capital, is of great importance even though its share in total liabilities is low. A strong capital structure acts as a buffer in adverse situations that the bank will face. Bank capital is the most important factor for both bank partners and bank lenders. According to the banking law applied in Turkiye, the total of loans that can be extended by banks to a real or legal person or a risk group cannot exceed 25% of the equity. Formula: equity/total assets

Financial Assets Ratio (FAR)

The most important income generating assets of banks after loans are their investments in securities. Short term and highly liquid fixed income government securities in the bank's securities portfolio are an important return option for the bank. Securities provide the bank with an alternative return option in case loan rates fall, while also reducing the cost of funds set aside for the possibility of loss. The fact that banks perform capital market transactions as intermediary institutions ensures the transfer of idle bank funds to the capital market. Thus, on the one hand, the efficiency of the capital markets is increased, on the other hand, banks are provided with services such as financial consultancy, portfolio management, and public offering intermediation to their customers, and the bank also gains income from these services. It is important for the bank's asset management that the bank diversifies its securities portfolio within the framework of risk and return balance. The secondary operation of the banks, which primarily focus on meeting their credit needs, is the management of their securities portfolios. By purchasing securities, banks can keep them in their portfolios until they mature, sell them or act as an intermediary in public offering. Mortgage backed securities, debt securities with a maturity longer than one year issued by joint stock companies or public institutions, and foreign securities have an important place in the bank's securities portfolio, which mainly consists of treasury bills and government bonds. Formula: financial assets(net)/total assets

Model of the research

Analysis was done according to time and units. The data formed by combining time series and cross section data is called pooled data. The time and cross-section dimensions of pooled data may differ. The pooled data that shows the change of the same set of units over time while the cross-section units remain the same is called panel data. In panel data, the index "i" is used for cross-section units and "t" for time series. Since it shows the change according to

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both time and unit, it is necessary to use double indices when expressing panel data. The panel data model is a regression model estimated with panel data. Therefore, the tests for the regression model, one dependent variable, one or more independent variables, functional shape, assumptions, error term, etc. are the same for panel data models. Since the variables in the model will show the change according to both units and time, the sub-indices "i" for units and "t" for time circuits are used, while the panel regression model with dependent variable Y and independent variable X will be as follows:

$Y_{it} = \alpha_{it} + \beta_{it}X_{it} + u_{it}$

i=1,…,N and t=1,…T (N is the number of units, T is the number of time circuits)

u_{it} is the error term, α_{it} is the constant parameter and β_{it} is the slope parameter.

The variables used in this study are shown in the table below.

Table 1. Variables of the research

Variables	
Capital Adequacy Ratio (CAR)	Dependent Variable
Deposit Asset Ratio (DAR)	Independent Variable
Loan Asset Ratio (LAR)	Independent Variable
Loan to Deposit Ratio (LDR)	Independent Variable
Equity Ratio (EQR)	Independent Variable
Financial Assets Ratio (FAR)	Independent Variable

The panel linear regression model with 5 independent variables is as follows.

$Y_{it} = \beta_0 + \beta_1X_{1it} + \beta_2X_{2it} + \beta_3X_{3it} + \beta_4X_{4it} + \beta_5X_{5it} + u_{it}$

Y_{it} = Capital Adequacy Ratio (CAR)

X_{1it} = Deposit Asset Ratio (DAR)

X_{2it} = Loan Asset Ratio (LAR)

X_{3it} = Loan to Deposit Ratio (LDR)

X_{4it} = Equity Ratio (EQR)

X_{5it} = Financial Assets Ratio (FAR)

RESULTS AND DISCUSSION

Panel data analysis was performed using R studio program. The line plot separated by color for each bank is shown below. The blue dashed line shows the overall trend in the data that considers all banks simultaneously. In fact, it is a fitted regression line of a linear model between capital adequacy ratio and year. On average, the capital adequacy ratio increases over time.

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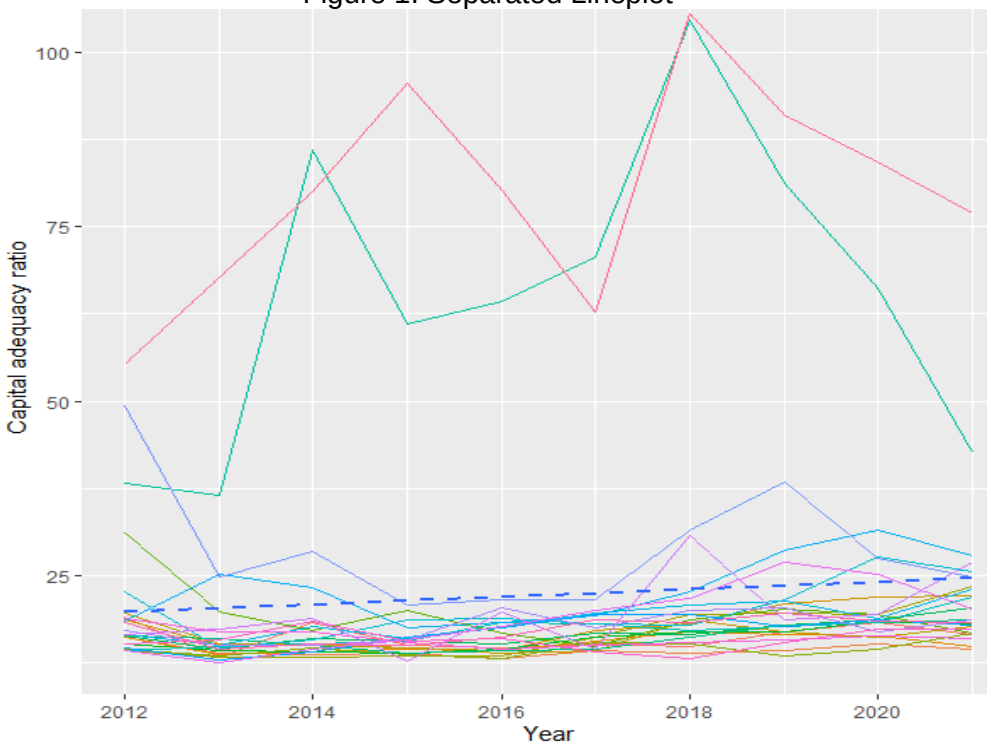
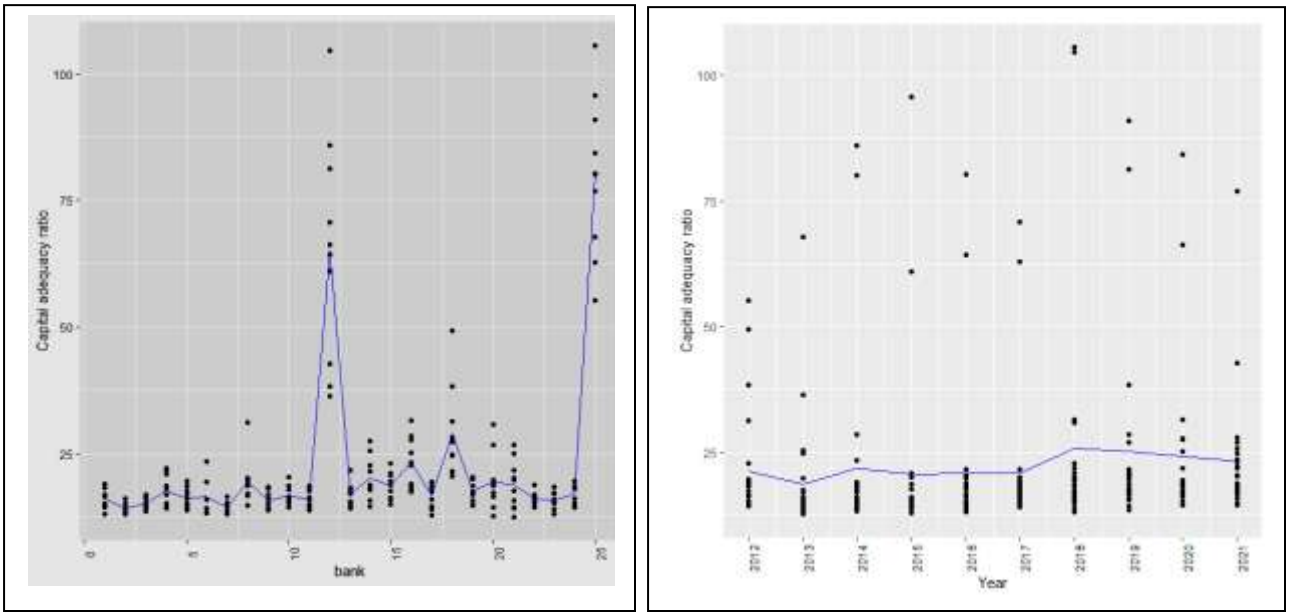
Figure 1. Separated Lineplot



As seen in the first graph below, the heterogeneity across banks is shown by a line plot. The blue line combines the mean values of capital adequacy ratio using all available years across banks. The same is true for the time dimension. The blue line in the second graph combines the mean values of capital adequacy ratio using all available banks across years.

Figure 2. Heterogeneity across banks and years



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The table 2 contains the minimum value, median value, average value, and maximum values of the variables.

Table 2. Data Statistics Summary

	MIN.	MEDIAN	MEAN	MAX.
CAR	12.57	17.13	22.16	105.50
DAR	1.174	61.073	58.953	84.528
LAR	0.1395	62.5289	57.6376	82.5772
LDR	1.081	103.47	118.153	1683.669
EQR	2.881	11.254	13.546	76.362
FAR	0.6101	19.7969	23.9190	98.1713

The minimum value of the CAR dependent variable is 12.57, the maximum value is 105.50, the median value is 17.13, and the mean value is 22.16. The minimum value of the DAR variable is 1.174, the maximum value is 84.528, the median value is 61.073, and the mean value is 58.953. The minimum value of the LAR variable is 0.1395, the maximum value is 82.5772, the median value is 62.5289, and the mean value is 57.6376. The minimum value of the LDR variable is 1.081, the maximum value is 1683.669, the median value is 103.47, and the mean value is 118.153. The minimum value of the EQR variable is 2.881, the maximum value is 76.362, the median value is 11.254, and the mean value is 13.546. The minimum value of the FAR variable is 0.6101, the maximum value is 98.1713, the median value is 19.7969, and the mean value is 23.9190.

In panel data analysis, the panel data model is selected first. Pooled, fixed effect, and random effects models are tested with each other and it is decided which model is more suitable for the data. In this study, the panel data tests seen below were applied in R Studio Program.

Table 3. Panel data analysis tests applied in R Studio Program

Applied Panel Data Analysis Tests		
Fixed Effect Model	**Random Effect Model**	**Other tests**
Pooled OLS (Ordinary Least Square)	Random Effects	Breusch Pagan LM Cross sectional dependence test
Fixed Effects between estimator	Pooled OLS (Ordinary Least Square)	Pesaran CD (cross sectional dependence) test

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First difference estimation	Breusch Pagan Lagrange Multiplier Test	Breusch Godfrey/Wooldridge test for serial correlation
Least Squares Dummy Variable Estimation Model		Breusch Pagan test for heteroskedasticity
Fixed effects within model		**For fixing problems:**
F test for individuals effects		vcovHC function
F test for fixed time individual effects		
Breusch Pagan Lagrange Multiplier (LM) Test for time effects		
Hausman Test		

Table 3…

Breusch-Pagan Lagrange Multiplier (LM) Test

Breusch-Pagan Lagrange Multiplier (LM) test is used to decide between a random effects regression and a simple OLS (Ordinary Least Squares) regression. The null hypothesis of the LM test is that there is no significant difference between the units, that is, there is no panel effect.

Table 4. Breusch Pagan LM Test Results

Lagrange Multiplier Test (Breusch-Pagan)		
data: Y ~ X1 + X2 + X3 + X4 + X5		
chisq = 112.23	df = 1	p-value < 2.2e-16
alternative hypothesis: significant effects		

Hypotheses are;

H_0: There is no panel effect, unit effect is not statistically significant, OLS model is selected.

H_1: There is panel effect, unit effect is statistically significant, random effect model is selected.

Here, since the p value is less than 0.05, the null hypothesis is rejected and it is concluded that random effects are appropriate. Below are the OLS regression best-fitting line graphs of the variables used in the analysis.

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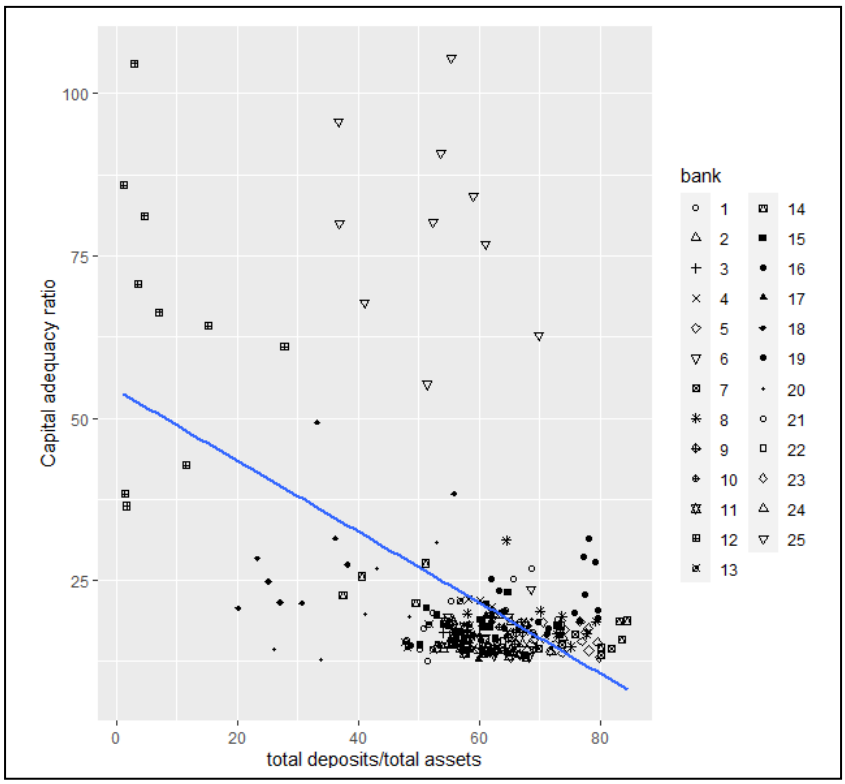
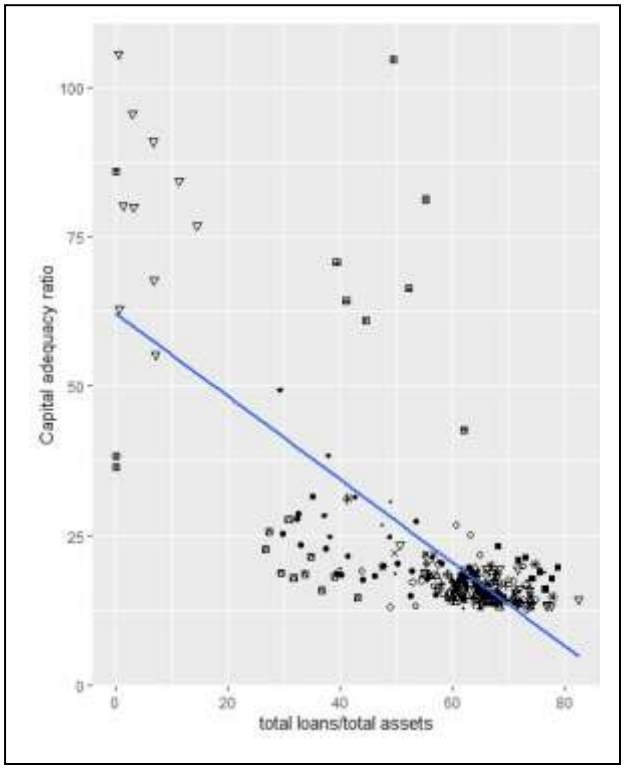
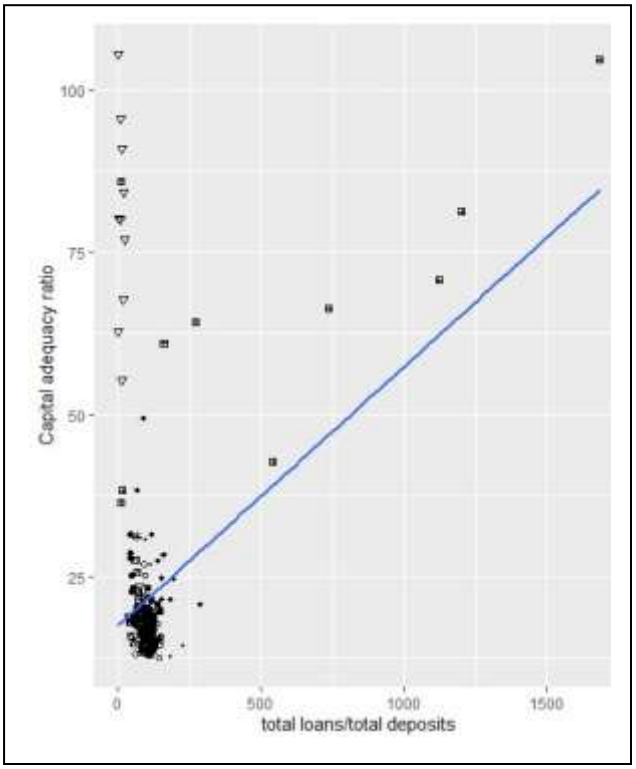
Figure 3. OLS Regression







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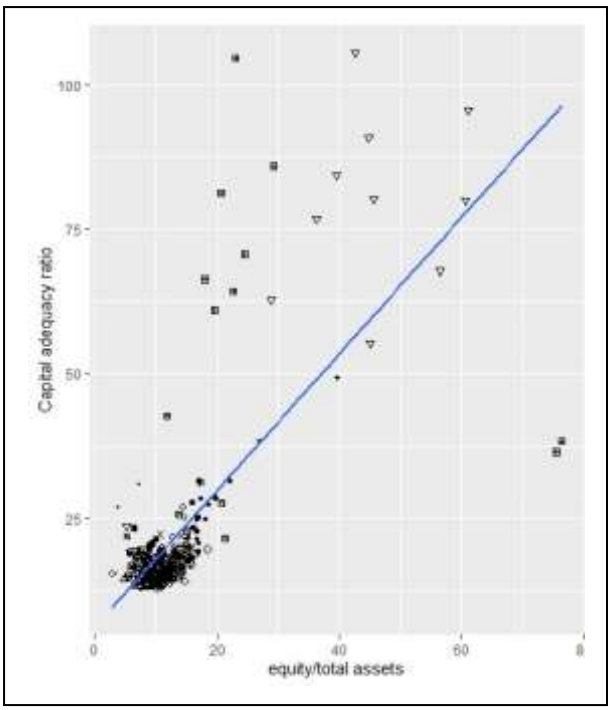

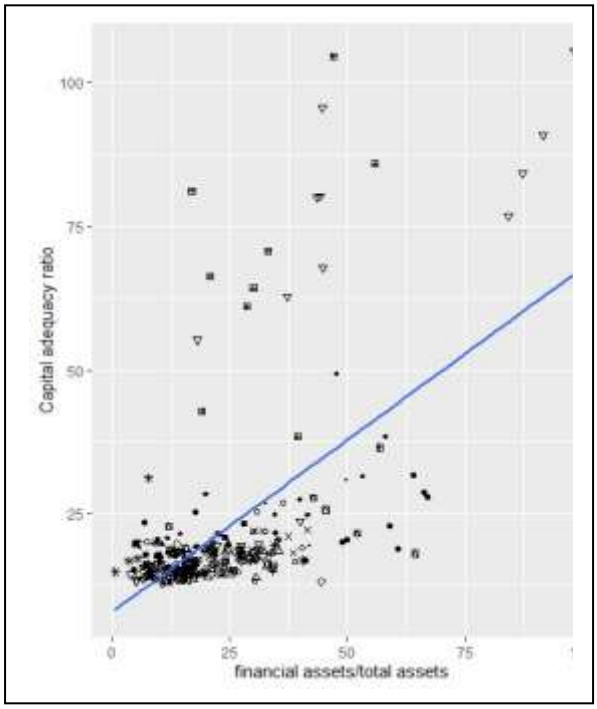

Random Effect Model Test

If the data to be used in the model are chosen randomly or as representative from the population, the random effects model is preferred instead of the fixed effects model. In the random effect model, the changes that occur according to units or units and time are shown in the error term of the model. Heterogeneity is not the expected value of the dependent variable, as in fixed effect models. It is included in the model with the help of the variance of the dependent variable. In random effects models, in contrast to fixed-effects models, unit and time effects are added to the model as a random variable as a component of the error term. Thus, the loss of degrees of freedom encountered in fixed effect models is avoided. The results of the random effects model applied to the panel data set are shown in Table 5 below.

Table 5. Random Effect Model Results

Oneway (individual) effect Random Effect Model (Swamy-Arora's transformation)	
Balanced Panel:	n = 25, T = 10, N = 250
R-Squared:	0.5506
Adj. R-Squared:	0.54139
Chisq: 298.941 on 5 DF	p-value: < 2.22e-16

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Hypotheses are;

H_0: The model is insignificant.

H_1: The model is significant.

Since the p value is less than 0.05 significance level, the basic hypothesis H_0 is rejected and H_1 is confirmed. The random effect model is significant.

Fixed Effect Model Test

The coefficients of fixed effect models vary according to units, time, or units and time. Fixed effects model; is a linear regression model of the constant term varying along units. The model established to determine the change according to units or time is called the single factor fixed effect model, and the model established to determine the change according to units and time is called the two factor fixed effect model. The fixed effects model is also called the within estimator or least squares dummy variable (LSDV) model. The fixed effect model is suitable for investigating causal relationships. The results of the fixed effects model applied to the panel data set are shown in Table 6 below.

Table 6. Fixed Effect Model Results

Oneway (individual) effect Within Model				
Balanced Panel:		n = 25, T = 10, N = 250		
Residuals:				
Min.	1st Qu.	Median	3rd Qu.	Max.
-19.268806	-1.486935	0.090801	1.510370	27.812522
Coefficients:				
	Estimate	Std. Error	t-value	Pr(>|t|)
X1	0.0031793	0.0474044	0.0671	0.94659
X2	-0.1384380	0.0577297	-2.3980	0.01732 *
X3	0.0279762	0.0033691	8.3037	1.026e-14 ***
X4	-0.0546853	0.0661565	-0.8266	0.40936
X5	0.1813794	0.0299052	6.0651	5.686e-09 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				
Total Sum of Squares: 8845.4			Residual Sum of Squares: 5240.3	
R-Squared: 0.40756			Adj. R-Squared: 0.32947	
F-statistic: 30.2692 on 5 and 220 DF p-value: < 2.22e-16				

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Hypotheses are;

H_0: The model is insignificant.

H_1: The model is significant.

Since the p value is less than 0.05 significance level, the basic hypothesis H_0 is rejected and H_1 is confirmed. The fixed effect model is significant.

Testing for fixed effects with pFtest

pFtest is used to decide between fixed effects regression and OLS regression.

Table 7. pFtest (fixed,ols) Results

F test for individual effects		
data: Y ~ X1 + X2 + X3 + X4 + X5		
F = 17.045	df1 = 24 df2 = 220	p-value < 2.2e-16
alternative hypothesis: significant effects		

Hypotheses are;

H_0: OLS model is better than fixed effect model

H_1: Fixed effect model is better than OLS model

Since the p value is less than 0.05 significance level, the basic hypothesis H_0 is rejected and H_1 is confirmed. The fixed effect model is a better choice.

Hausman Test

When establishing panel data models, the Hausman test is used to choose the fixed effect or random effect model.

Table 8. Hausman Test Results

Hausman Test		
data: Y ~ X1 + X2 + X3 + X4 + X5		
chisq = 149.24	df = 5	p-value < 2.2e-16
alternative hypothesis: one model is inconsistent		

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Hypotheses are;

H_0: Random Effect Model is appropriate than Fixed Effect Model, it is decided that the error term components are unrelated to the independent variables and the random effect model is preferred.

H_1: Fixed Effect Model is appropriate than Random Effect Model, it is decided that the error term components are related to some independent variables and the fixed-effects model is preferred.

Since the p value is less than 0.05 significance level, the basic hypothesis H_0 is rejected and H_1 is confirmed. The fixed effect model is used. The method followed so far is shown in the table below.

Table 9. Determining the model to be used in the research

Random Effect Model **OR** OLS Model	Fixed Effect Model **OR** OLS Model
Random Effect Model	Fixed Effect Model
Random Effect Model **OR** Fixed Effect Model	
Hausman Test	
Fixed Effect Model	

Time-fixed effects test

Breusch-Pagan Lagrange Multiplier Test was applied.

Table 10. Lagrange Multiplier Test Results

Lagrange Multiplier Test - time effects (Breusch-Pagan) For balanced panels		
data: Y ~ X1 + X2 + X3 + X4 + X5		
chisq = 0.45953	df = 1	p-value = 0.4978
alternative hypothesis: significant effects		

The hypotheses are:

H_0: Time-fixed effects are no needed

H_1: Time-fixed effects are needed

Since the p value is greater than 0.05 significance level, the basic hypothesis H_0 can not be rejected. There is no need to use time-fixed effects.

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Testing for cross-sectional dependence

Breusch-Pagan Lagrange Multiplier Test and Pesaran Cross Sectional Dependence (CD) test were applied. These tests are used to test whether the residuals are correlated across entities. Cross-sectional dependence is also called contemporaneous correlation.

Table 11. Breusch-Pagan Test Results

Breusch-Pagan LM test for cross-sectional dependence in panels		
data: Y ~ X1 + X2 + X3 + X4 + X5		
chisq = 460.86	df = 300	p-value = 6.396e-09
alternative hypothesis: cross-sectional dependence		

Table 12. Pesaran CD Test Results

Pesaran CD test for cross-sectional dependence in panels	
data: Y ~ X1 + X2 + X3 + X4 + X5	
z = 7.2386	p-value = 4.532e-13
alternative hypothesis: cross-sectional dependence	

The hypotheses for both tests are:

H_0: There is no cross-sectional dependence. Residuals across entities are not correlated.

H_1: There is cross-sectional dependence. Residuals across entities are correlated.

Since both p values are less than 0.05 significance level, the basic hypothesis H_0 is rejected and H_1 is confirmed. There is cross-sectional dependence.

Serial Correlation Test

Breusch-Godfrey/Wooldridge test was applied for testing serial correlation.

Table 13. Breusch-Godfrey/Wooldridge Test Results

Breusch-Godfrey/Wooldridge test for serial correlation in panel models		
data: Y ~ X1 + X2 + X3 + X4 + X5		
chisq = 44.961	df = 10	p-value = 2.21e-06
alternative hypothesis: serial correlation in idiosyncratic errors		

The hypotheses are:

H_0: There is no serial correlation

H_1: There is serial correlation

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Since p value is less than 0.05 significance level, the basic hypothesis H_0 is rejected and H_1 is confirmed. There is serial correlation.

Heteroskedasticity Test

Breusch-Pagan test was applied for testing heteroskedasticity.

Table 14. Breusch-Pagan Test Results

Breusch-Pagan test		
data: Y ~ X1 + X2 + X3 + X4 + X5 + factor(bank)		
BP = 837.55	df = 29	p-value < 2.2e-16

The hypotheses are:

H_0: There is no heteroskedasticity

H_1: There is heteroskedasticity

Since p value is less than 0.05 significance level, the basic hypothesis H_0 is rejected and H_1 is confirmed. There is heteroskedasticity.

Providing control for fixing problems

If the error terms of different observations of the same entity are related, the standard errors need to be adjusted. In the dataset used in this study, a bank is observed at 10 different time points, and therefore the observations for the same individuals are not independent. This leads to the serial correlation problem of residuals. Clustered standard errors should be used to solve this problem.

vcovHC function in R Studio program was used in order to correct the standard errors for the fixed effect model. Table 15 shows the results of the corrections.

Table 15. Cluster robust standard error

Coefficients:				
	Estimate	Cluster Std. Error	t-value	Pr(>|t|)
X1	0.0031793	0.086651	0.037	0.9710
X2	-0.1384380	0.102831	-1.346	0.1908
X3	0.0279762	0.003359	8.328	1.54e-08 ***
X4	-0.0546853	0.291755	-0.187	0.8529
X5	0.1813794	0.068738	2.639	0.0144 *

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Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 4.881 on 220 degrees of freedom
Multiple R-squared(full model): 0.9221 Adjusted R-squared: 0.9118
Multiple R-squared(proj model): 0.4076 Adjusted R-squared: 0.3295
F-statistic(full model, *iid*):89.79 on 29 and 220 DF, p-value: < 2.2e-16
F-statistic(proj model): 5655 on 5 and 24 DF, p-value: < 2.2e-16

Table 15…

The comparison of Table 6 and Table 15 is shown below.

Table 16. Fixed effect model results after correction

Coefficients:

	Fixed Effect Model Results				**Fixed Effect Model Resuls after correction with vcovHC function**			
	Estimate	Std. Error	t-value	Pr(>|t|)	Estimate	Cluster Std. Error	t-value	Pr(>|t|)
X1	0.0031793	0.0474044	0.0671	0.94659	0.0031793	0.086651	0.037	0.9710
X2	-0.1384380	0.0577297	-2.3980	0.01732 *	-0.1384380	0.102831	-1.346	0.1908
X3	0.0279762	0.0033691	8.3037	1.026e-14 ***	0.0279762	0.003359	8.328	1.54e-08 ***
X4	-0.0546853	0.0661565	-0.8266	0.40936	-0.0546853	0.291755	-0.187	0.8529
X5	0.1813794	0.0299052	6.0651	5.686e-09 ***	0.1813794	0.068738	2.639	0.0144 *
	R-Squared: 0.40756				Multiple R-squared(full model): 0.9221			
	Adj. R-Squared: 0.32947				Adjusted R-squared: 0.9118			
	F-statistic: 30.2692 on 5 and 220 DF				F-statistic(full model, *iid*):89.79 on 29 and 220 DF			
	p-value: < 2.22e-16				p-value: < 2.2e-16			

The effect of deposit asset ratio on capital adequacy ratio is positive. The coefficient of β_1 is 0.0031793. According to the double-sided test results in the corrected model output, the probability value of t statistics used for parameter significances expressed with Pr is 0.9710. Usually, the statistical probability value of t is compared with 0.01 or 0.05 according to the significance level used in the study. If these probability values are smaller than the specified level of significance, it is decided that the parameter under consideration is significant. The t statistics probability value of the parameter of the DAR variable is greater

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than 0.05 significance level. 0.9710>0.05. This shows that the β_1 parameter is not statistically significant.

The effect of the loan asset ratio on the capital adequacy ratio is negative. The coefficient of β_2 is -0.1384380. The t statistics probability value is 0.1908. The t statistics probability value of the parameter belonging to the LAR variable is greater than 0.05 significance level. 0.1908>0.05. This shows that the β_2 parameter is not statistically significant.

The effect of loan deposit ratio on capital adequacy ratio is positive. The coefficient of β_3 is 0.0279762. The probability value of t statistics is 1.54e-08. The t statistics probability value of the parameter belonging to the LDR variable is less than 0.05 significance level. 1.54e-08<0.05. This shows that the β_3 parameter is statistically significant.

The effect of equity ratio on capital adequacy ratio is negative. The coefficient of β_4 is -0.0546853. The t statistics probability value is 0.8529. The t statistics probability value of the parameter belonging to the EQR variable is greater than 0.05 significance level. 0.8529>0.05. This shows that the β_4 parameter is not statistically significant.

The effect of financial assets ratio on capital adequacy ratio is positive. The coefficient of β_5 is 0.1813794. The t statistics probability value is 0.0144. The t statistics probability value of the parameter belonging to the FAR variable is less than 0.05 significance level. 0.0144<0.05. This shows that the β_5 parameter is statistically significant.

The Multiple R-squared value is the coefficient of determination that shows the power of the independent variables in the model to explain the dependent variable. The coefficient of determination of the model was found to be 0.9221. 92.21% of the variation in CAR is explained by the independent variables in the model. The adjusted coefficient of determination value is 0.9118. This value is always obtained less than the coefficient of determination. The F test statistic value is 89.79. The probability value of this test was obtained as < 2.2e-16.

Hypotheses are;

H_0: The model is insignificant.

H_1: The model is significant.

< 2.2e-16<0.05 Since the probability value of the F test statistic is less than 0.05 significance level, the basic hypothesis H_0 is rejected and H_1 is confirmed. The model is significant. All of the independent variables of the model established in this study simultaneously affect the dependent variable of capital adequacy ratio.

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CONCLUSION

In this study, the relationship between the capital adequacy ratio and total deposits/total assets, total loans/total assets, total loans/total deposits, equity/total assets, financial assets/total assets ratios of 25 banks operating in Turkiye between the years 2012 and 2021 was investigated. As a result of the panel data analysis performed using R Studio Program, it was found that the deposit asset ratio, loan asset ratio, loan to deposit ratio, equity ratio, financial assets ratio simultaneously affected the capital adequacy ratio significantly. The deposit asset ratio had positive and statistically insignificant effect on capital adequacy ratio. The effect of loan asset ratio on capital adequacy ratio was observed to be negative and statistically insignificant. The effect of loan to deposit ratio on capital adequacy ratio was found to be positive and significant. The equity ratio had negative and statistically insignificant effect on capital adequacy ratio. The financial assets ratio had positive and significant effect on capital adequacy ratio. %92.21 of the change in capital adequacy ratio was explained by the independent variables used in the model.

It is seen that the findings obtained from this study are consistently with the literatures. The finding of positive and statistically insignificant effect of deposit asset ratio on capital adequacy ratio is consistent with the following studies: Abusharba, Triyuwono, Ismail, and Rahman (2013), Vu and Dang (2020), Bateni, Vakilifard, and Asghari (2014). The positive effect of deposit asset ratio on capital adequacy ratio is consistent with the findings of Abba, Okwa, Soje, and Aikpitanyi (2018), Yahaya, Mansor, and Okazaki (2016). The negative and statistically insignificant effect of loan asset ratio on capital adequacy ratio is in line with research conducted by El-Ansary and Hafez (2015), Vu and Dang (2020). The negative effect of loan asset ratio on capital adequacy ratio is consistent with the findings of Dreca (2013), Pham and Nguyen (2017), Usman, Lestari, and Puspa (2019). The significant and positive effect of loan to deposit ratio on capital adequacy ratio is in line with research conducted by El-Ansary and Hafez (2015). The significant effect of loan to deposit ratio on capital adequacy ratio is consistent with the findings of Shingjergji and Hyseni (2015). The positive effect of loan to deposit ratio on capital adequacy ratio is in line with the research conducted by Usman, Lestari, and Puspa (2019). The significant and positive effect of financial assets ratio on capital adequacy ratio is consistent with the findings of El-Ansary and Hafez (2015).

Today, increasing competition and resource costs reduce the profitability of banks. The decrease in the capital base reduces the resistance of the banks against the negativities they may encounter. Banks must achieve an optimal capital base by changing the outsourcing equity ratio so that the average cost of capital falls and the bank's profitability can be increased. According to the results, the partial effect of loan to deposit ratio and financial assets ratio on

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capital adequacy ratio is positive and significant. The loan to deposit ratio is one of the main indicators of the structural liquidity situation of banks. There is a general acceptance that the loan deposit ratio should be kept at ideal levels (80%-90%) and should not exceed 100%. The main source of loans is deposits. But, as banks have sources of funds other than deposits, they also invest in assets other than loans, primarily securities. The most important income generating assets of banks after loans are their investments in securities. Short-term and highly liquid fixed income government securities in the bank's securities portfolio are an important return option for the bank. Securities offer the bank an alternative return option in case loan interest rates drop. It also reduces the costs of funds allocated in response to the possibility of loss. It is necessary for the bank to diversify its securities portfolio within the framework of risk and return balance. The secondary field of activity of banks, which primarily focuses on meeting their loan needs, is to ensure the efficient management of their securities portfolios.

FURTHER STUDIES

In this study, state-owned deposit banks, privately-owned deposit banks, banks transferred to the savings deposit insurance fund, and foreign capital banks established in Turkiye were analyzed together. In another study, these groups could be analyzed separately to compare results. A graphical correlation matrix can be created and the results evaluated.

It was concluded that there is no need to use time-dependent effects in the fixed-effects model in the analysis. If a conclusion is reached in the random effect model or fixed effect model that requires time-dependent effects to be taken into account, unlike this study, the results including the presence of time effects will need to be analyzed, interpreted and included in the results.

In the research, the suitability of the results of ordinary least square, fixed effects between estimator, first difference estimation, least squares dummy variable estimation tests was observed and the analysis continued. In another study, a detailed examination and discussion can be applied by focusing on the contents of these tests.

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