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Determination of Factors Affecting Capital Adequacy Using the Elastic Net Regression Method

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Abstract

The capital adequacy ratio is applied to banks as a legal obligation. Although the minimum rate of capital required to be held according to the legal arrangement is 8%, much higher rates are always applied in the Turkish banking sector. The factors affecting this ratio, which ex-ceeds the minimum amount, and the reasons for this apart from the legal requirement have been discussed in studies. The aim of this study was to determine the financial indicators that explain and affect the capital adequacy levels of banks, which are the leading financial institutions. Therefore, in this research, capital adequacy ratios were taken as the dependent variables, while balance sheet structure, asset quality, liquidity, profitability, income-expenditure structure and sector shares were taken as the independent variables. The method of calculating the ratios is similar way with each other and so, high correlation between them creates a methodological constraint. But, in the study, Elastic Net Regression analysis, which is a combined application of the ridge and lasso regression methods used in cases of the multicollinearity problem, was used. As a result of the study, it was revealed that in all of the models created for four capital adequacy ratios, equity-related ratios explained capital adequacy the most and that profitability ratios affected capital adequacy the most.

Keywords: *Turkish Banking Market, Capital Adequacy, Basel Criteria, Elastic Net Regression Method.*

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Sermaye Yeterliliğini Etkileyen Değişkenlerin Elastik Net Regresyon Yöntemi İle Belirlenmesi

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Öz

Sermaye yeterliliği bankacılık sektöründe bir zorunluluk olarak uygulanmaktadır. Bankaların minimum elinde bulundurması gereken sermaye düzeyi %8 olması yasal bir zorunluluktur. Fakat Türk bankacılık sisteminde bu oranın daha yüksek olması istenmektedir. Literatürde genellikle, bu oranın zorunluluk hali ile birlikte değişkenleri etkileyen diğer oranlar da incelenmiştir. Bu çalışmada finansal kurumların başında gelen bankaların sermaye yeterlilik düzeylerini açıklayan ve etkileyen finansal göstergelerin belirlenmesi amaçlanmaktadır. Dolayısıyla bu araştırmada sermaye yeterlilik oranları bağımlı; bilanço yapısı, aktif kalitesi, likidite, karlılık, gelir-gider yapısı ve sektör payları bağımsız değişken olarak ele alınmıştır. Değişkenlerin birbiri ile benzer şekilde hesaplanması ve dolayısıyla aralarında yüksek korelasyon olması yöntemsel açıdan bir kısıt oluşturmaktadır. Ancak çalışmada, çoklu doğrusal bağlantı problemi halinde kullanılan ridge ve lasso regresyon yöntemlerinin karma uygulaması olan Elastik Net Regresyon analizi kullanılmıştır. Araştırma sonucunda; dört sermaye yeterlilik oranına göre oluşturulan modellerin tamamında sermaye yeterliliğini en çok öz kaynak ile ilgili oranların açıkladığı ve en çok kârlılık oranlarının sermaye yeterliliğini etkilediği bulgularına ulaşılmıştır.

Anahtar Kelimeler: *Türkiye Bankacılık Piyasası, Sermaye Yeterliliği, Basel Kriterleri, Elastik Net Regresyon Yöntemi*

Introduction

Banking is one of the most important sectors for global economies and is also one of the major sources of economic income. For this reason, changes and innovations in the banking sector are constantly monitored both on a national level and in the world. In order to provide confidence to the public, banks have to continually perform risk audits. Since manipulative and misleading information can cause loss of public confidence, banks are obliged to perform detailed audits when both obtaining credit and providing credit. If banks do not have effective risk auditing mechanisms, problems such as inadequate credit standards, weak portfolio management and delays in loan repayments can appear.

The risks faced by banks are separated into groups. These risks are credit risk, national risk, transfer risk, liquidity risk, market risk and operational risk. Credit risk results from customers acting contrary to banking rules and not fulfilling their responsibilities on time. In order to minimize credit risk, bank staff must allow the use of credit by observing the principles of security, mobility, loan distribution and suitability of collateral. National risk is the possibility that obligations encountered in international operations cannot be fulfilled on time. Transfer risk is the possibility that a customer using credit cannot carry out his obligations or obtain the required foreign currency when paying his external debts. Liquidity risk is the risk arising from the possibility of banks experiencing cash flow problems. Market risk is the risk that appears due to banks being affected by a number of factors in the market. These factors consist of interest rate risk, equity position risk, exchange rate risk, commodity risk and specific risk. Operational risk is the risk originating from banks' own endogenous variables. Included within this risk are personnel risk, organizational risk, technological risk, legal risks and extraordinary situations originating from outside the bank such as flooding, robbery, etc. (Yazıcı, 2011, p.88-92).

Banks are intermediary institutions that transfer the funds they have collected from the public to the individuals or institutions that require them. Therefore, it is important for society that banks should be trustworthy. For individuals and institutions in society to trust banks, the banks must be audited on an international scale. Only in this case do citizens

entrust their money and other valuable possessions to banks. For banks to be trustworthy, however, the most important condition is that they should have an accurate and consistent risk management system (Pritchard, 2005, p.9).

To be able to be manage risk on an international scale, the Basel Committee on Banking Supervision (BCBS) was established in 1974 in the city of Basel in Switzerland by the Bank for International Settlements (BIS). The aim of this committee is to enable banks to exchange ideas on a national and international scale and to determine minimum capital adequacy, which is very important for banks. Although the Basel Committee's decisions are advisory in nature, banks that do not comply with these regulations are removed from the international banking system and their national risks are negatively affected. The Basel Committee has set the Basel I, Basel II and Basel III criteria up to the present day, and is still working on the Basel IV criteria, which, therefore, have not yet been implemented. The important subject in all of these criteria is that of what percentage minimum capital adequacy should be, since compliance with minimum capital adequacy is one of the key factors in having an effective risk management system. The aim of the Basel Committee is for all banks to be adequately audited and for no banks to avoid audit (Arslan, 2007, p.50-51).

The aim of this study is to examine the factors that explain and affect the level of capital adequacy, which is of great importance in the banking sector. Therefore, following the theoretical information, a literature review is included in the study. Next, elastic net regression analysis is applied using ratios considered to be related to capital adequacy. In the final section of the study, the conclusions reached based on the obtained findings are included.

Capital Adequacy

For banks to be able to achieve an effective risk management system, they need to have a solid financial structure. The main indicator of a solid financial structure is capital adequacy. Capital adequacy is a ratio that will protect account holders against risks that can be encountered by financial institutions such as crises and bankruptcies and has the characteristic of a

safeguard against risks. The minimum capital adequacy ratio is set as 8% in all the Basel Criteria. Although this ratio appears as 10.5% in the Basel III criteria, a 2.5% share of this is the capital buffer. Therefore, the minimum capital adequacy ratio that should be kept for banks is 8% (Kaya, 2007, p.5; Penikas, 2015, p.16).

Assessment of capital adequacy is carried out in two stages. The first stage involves determining a bank's total present value and the real or economic value of its debts. The second stage is the identification and measurement of all interrelated risks. These consist of the main banking risks such as credit, liquidity, national, interest rate, leverage factor, monetary and potential risks (resulting from liabilities), and are also classified as a bank's portfolio risk (Gardener, 1988, p.5). As can be seen, banks' ability to offset expected and unexpected losses depends to a large extent on their having adequate capital.

Table 1. Dependent and independent variables used in the study

Dependent Variables	**Independent Variables**					
Capital adequacy	***Balance sheet structure***	***Asset quality***	***Liquidity***	***Profitability***	***Income-expenditure structure***	***Sector shares***
Capital Adequacy ratio (CAR)	Obtained loans / total assets (OC/TA)	Total loans and receivables/ total assets (TLR/TA)	Liquid assets/ total assets (LA/TA)	Mean return on assets (MRA)	Interest income/ total assets (II/TA)	Total assets (TA)
Shareholders' equity/ total assets (SE/TA)	Total deposits / total assets (TD/TA)	Total loans and receivables/ total deposits (TLR/TD)	Liquid assets/ short-term liabilities (LA/STL)	Continuing operations pre-tax profit / total assets (COPTP/TA)	Interest expenses / total assets (IE/TA)	Total loans and receivables (TLR)
(Shareholders' equity – fixed assets) / total assets (SE-FA/TA)		Non-performing loans(net)/ total loans and receivables (NPL/TLR)		Net profit (loss) for the period / paid-up capital (NPP/PC)		Total deposits (TD)
Shareholders' equity / (Deposit + non-deposit sources) (SE/D+ND)						

In this study, in the regression analysis used to test the determinants of capital adequacy, the variables have been separated into two parts as dependent and independent variables. These variables are presented in Table 1 below.

In Table 1, the dependent and independent variables are shown and are separated into groups. Capital adequacy, which constitutes the main aim of the study, consists of 4 variables, and in determining which variables these are, the Banks Association of Turkey was referred to. The independent variables were determined in a similar way and are separated into 6 groups. Balance sheet structure consists of 2 variables, while asset quality is made up of 3 variables, liquidity consists of 2 variables, profitability of 4 variables, income-expenditure structure of 3 variables, and sector shares of 3 variables. The main aim of the study was based on determining the variables, which are the independent variables, that affect capital adequacy and 4 independent variables were used for determining this aim.

Literature Review

While studies conducted to determine capital adequacy in the Turkish banking sector are found in the literature, this study is different from the studies in the literature in terms not only of the method used, but also of the sample level and period, and of the variables used.

Afşar and Karaçayır (2018) tested the determinants of the capital adequacy ratio in the Turkish banking sector using panel data analysis of monthly data for the period from April 2002 to January 2017. It was seen that the capital adequacy ratio was not determined only by the Basel criteria. The results of the analysis revealed that lending rate, and deposit and asset size negatively affected the capital adequacy ratio, whereas return on assets positively affected it.

Ak Bingül (2018) examined the interaction between risk and capital adequacy in the banking system. The study was carried out on a theoretical basis and policy recommendations regarding the risk-capital adequacy relationship were made in line with the conceptual framework. Recommendations were made with regard to increasing capital size via merger and

performing effective risk management in order to increase competition in banking.

Çatıkkaş, Yatbaz and Duramaz (2018) investigated the effects of capital adequacy on the Turkish banking sector. The research was carried out as a comparative study of participation banks and traditional banks. To make the comparison, changes were examined with ratio analysis. Capital adequacy ratio showed a decreasing tendency in both participation banks and traditional banks. The main reason for this was suggested to be the increase in interest and share incomes with loans and receivables items. When considered with respect to the two bank groups, the capital adequacy ratio showed less of a decrease in participation banks because share income increased more. Moreover, it was seen that despite the credit increase, equity profit did not increase and that the decrease in capital adequacy did not affect profitability.

In their study, Hazar et all. (2018) analyzed the risks determining capital adequacy ratio in the banking sector. In the study, the data of 22 banks collecting deposits between 2004 and 2015 were utilized. While determining the risks affecting capital adequacy ratio, the path analysis technique was used. The results of the analysis revealed that in order to minimize the effects of the risks they encountered, banks increased their equity.

Reis and Kötüoğlu (2016) examined capital adequacy behavior in the Turkish banking sector, and investigated changes in the capital adequacy ratio and the factors affecting this ratio. As a result of the regression analysis used, it was revealed that profitability, liquidity and non-performing loans ratio positively affected capital adequacy, whereas size of assets did not affect capital adequacy.

Karahanoğlu (2015) estimated capital adequacy ratios. To carry out this estimation, 14 development and investment banks in Turkey were used in the sample and the analysis was performed with monthly data from the period between January 2011 and September 2014. The Markov chain method was used to carry out the analysis. As a result of the Markov chain analysis, it was predicted that the capital adequacy ratios of the development and investment banks would decrease.

Li et al. (2015) attempted to measure the optimal capital adequacy ratio. In answer to the international financial developments following the global financial tsunami in 2008, it was stressed in the 2010 Basel III criteria that

banks needed to increase their minimum capital and that a 10.5% rate by the year 2019 was targeted. The study discusses two important questions: (1) Is the 8% capital adequacy ratio set in the Basel II criteria too low to direct banks heading towards the efficiency limits? (2) Is the 10.5% capital adequacy ratio set in the Basel III criteria so strict that it could affect banks' efficiency? To find the answers to these questions, the data of 93 Taiwanese banks during the 2007-2009 time period were subjected to analysis. The empirical results revealed that 93.5% of the banks had capital adequacy ratios above the 8% requirement in the Basel II criteria. About 88% of the banks had a standard ratio of capital adequacy of over 10.5%. Moreover, about 73% of the banks needed to raise ratios set in the Basel criteria in order to obtain optimal CAR ratios. Therefore, the higher CAR ratios required by the Basel III criteria enabled the Taiwanese banking industry to reach the efficiency limits.

El-Ansary & Hafez (2015) attempted to establish the determinants of the capital adequacy ratios of Egyptian banks. The study includes data for 36 banks covering the years 2004-2013. While the dependent variable for the study was the CAR, the independent variables were return on assets, profitability, liquidity, loan loss provision as a measure of credit risk, net interest margin growth, size, loans/assets ratio, and deposits/assets ratio. Moreover, determinants of CAR before and after the 2007-2008 international financial crises were examined. It was determined that for the whole 2003-2013 period, liquidity, size and quality of management were the most significant variables. The results for the period before 2008 show that asset quality, size and profitability were the most significant variables. The results for the period after 2009 show that asset quality, size, liquidity, management quality and credit risk were the most significant variables that explained the variance in Egyptian banks' CAR.

Fatima (2014) examined capital adequacy, which is an indicator of financial stability for banks. The capital adequacy ratio (CAR) is one of the safeguards that protect banks' financial stability when absorbing a reasonable loss. The requirements for capital adequacy are the criteria that have existed for a long time and are specified by the Basel Committee. The study highlights various components of regulatory capital and defines the basics of Basel's norms with regard to the minimum capital requirements for banks. Moreover, the study analyzed the trend in CAR values for the

top 10 commercial banks in India. The study concluded that while the Central Bank of India was calculated in the lowest position, the ICICI Bank maintained the highest CAR ratio.

Dreca (2013) estimated the determinants of capital adequacy ratio in selected Bosnian banks. The research consists of a data set covering 10 banks over a six-year period. The factors affecting CAR were capital structure, size of the bank, profitability indicators, participation of deposits and loans in total asset, and leverage. It is stated that in terms of profitability, lower CAR is more preferable, and that therefore, banks should decide which variables to use in order to reach the targeted CAR level according to this variable.

In their research, Bialas & Solek (2010) examined the emergence and evolution of the capital adequacy ratio. The standard capital adequacy ratio (CAR) determines the ratio of a bank's core capital to its assets and off-balance liabilities weighted according to risk. The core capital of a bank is expected to absorb potential losses that might occur due to the risk involved in banking activities. It has been determined that the value of this coefficient cannot be lower than 8%. The subject of the research is the fact that the way of calculating this ratio has changed over the years. In the study, the situation of the Polish and Ukrainian banking sector was also analyzed with regard to the coefficient in question.

Methodology

Regression analysis is a technique that is useful for understanding the cause and effect relationship between dependent variables and independent variables. When a regression model is being created, the model becomes more complex as the number of data and the variables increase, and major optimization problems are encountered (Zou & Hastie, 2005, p.303). Moreover, in cases where assumptions such as constant variance, multicollinearity and normality are not met, classical regression analysis falls short (Ogutu et al., 2012). Therefore, it is necessary for high coefficients in the model to be corrected, that is, to be penalized.

Corrections in ridge regression analysis are made with squared values, while in lasso regression, they are made with absolute values. ENET con-

sists of mixed modelling of the ridge and lasso biased estimation regression methods (Zou & Hastie, 2003). Basically, simple linear regression analysis is represented as follows:

1. $\boldsymbol{y = \beta_0 + \beta_1 x_1 + \varepsilon}$

Representation of the same equation as a matrix is as follows:

2. $$\begin{bmatrix} \boldsymbol{y_1} \\ \cdots \\ \boldsymbol{y_n} \end{bmatrix} = \begin{bmatrix} \boldsymbol{1} & \cdots & \boldsymbol{x_1} \\ \cdots & \cdots & \cdots \\ \boldsymbol{1} & \cdots & \boldsymbol{x_n} \end{bmatrix} \begin{bmatrix} \boldsymbol{\beta_1} \\ \cdot\cdot \\ \cdot\cdot \\ \boldsymbol{\beta_n} \end{bmatrix} + \begin{bmatrix} \boldsymbol{\varepsilon_1} \\ \cdots \\ \boldsymbol{\varepsilon_n} \end{bmatrix}$$

The β coefficient in this is obtained with equation 3:

3. $\boldsymbol{\beta = (X'X)^{-1}X'Y}$

Classical regression analysis is performed with the above equation. However, in cases where the independent variables have a high degree of correlation with each other, invalid results may be obtained. Therefore, in the ridge regression method, errors are expected to be minimized by adding a square biased parameter to equation 3. Accordingly, the considered equation is formed like this:

4. $\boldsymbol{\widehat{\beta}(ridge) = \arg min \|y - x\beta\|^2 + \lambda\|\beta\|^2}$

As can be seen in the above equation, in ridge regression, squared correction is made in addition to classical regression. Here, the $\lambda \geq 0$ penalty is expressed as the correction or complexity coefficient. At the same time, largeness of this value means that the correction will also be large. The equation for lasso regression analysis, which is another type of biased regression analysis, is as follows:

5. $\boldsymbol{\widehat{\beta}(lasso) = \arg min \|y - x\beta\|^2 + \lambda\|\beta\|}$

In the above equation, unlike in ridge regression analysis, correction in lasso regression is made according to absolute value. Accordingly, the essential is for the margin of error obtained with the least squares method to be kept to a minimum. In elastic net regression analysis, mixed modelling of these two techniques is applied. Therefore, the equation for the method at this stage is as follows (Zhang et al., 2017):

6. $\widehat{\boldsymbol{\beta}}(\boldsymbol{elastiknet}) = \mathbf{arg}\,\boldsymbol{min}\|\boldsymbol{y} - \boldsymbol{x\beta}\|^2 + \boldsymbol{\lambda_1}\|\boldsymbol{\beta}\|^2 + \boldsymbol{\lambda_2}\|\boldsymbol{\beta}\|$

As can be seen in equation 6, in elastic net regression analysis, calculation is made with a mixed structure of the ridge and lasso biased estimators. Therefore, in ENET, estimation is made based on the λ_1 and λ_2 parameters. In the equation, in cases where $\lambda = 0$ is taken, ridge is used as the regression, whereas when $\lambda = 1$ is taken, lasso is used. Although this parameter for ENET is found by means of testing in the literature, it is generally considered as 0.5, which is the mean value (Cho et al., 2009).

Findings

The aim of this study is to examine the factors that determine and affect banks' capital adequacy ratios. The original aspect of the study is, from a financial viewpoint, the creation of four different models, and from a methodological viewpoint, the fact that for the first time in the literature, elastic regression analysis has been applied to this subject. For this purpose, the 27 banks included in the following table with capital located and actively operating in Turkey form the scope of the study.

Table 2. Banks included in scope of study

No	**Public Capital Deposit Banks**	No	**Foreign Capital Banks**
1	Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	13	Alternatifbank A.Ş.
2	Türkiye Halk Bankası A.Ş.	14	Arap Türk Bankası A.Ş.
3	Türkiye Vakıflar Bankası T.A.O.	15	Burgan Bank A.Ş.
	Private Capital Deposit Banks	16	Citibank A.Ş.
4	Adabank A.Ş.	17	Denizbank A.Ş.
5	Akbank T.A.Ş.	18	Deutsche Bank A.Ş.
6	Anadolubank A.Ş.	19	HSBC Bank A.Ş.
7	Fibabanka A.Ş.	20	ICBC Turkey Bank A.Ş.
8	Şekerbank T.A.Ş.	21	ING Bank A.Ş.
9	Turkish Bank A.Ş.	22	MUFG Bank Turkey A.Ş.
10	Türk Ekonomi Bankası A.Ş.	23	Odea Bank A.Ş.
11	Türkiye İş Bankası A.Ş.	24	QNB Finansbank A.Ş.
12	Yapı ve Kredi Bankası A.Ş.	25	Rabobank A.Ş.
		26	Turkland Bank A.Ş.
		27	Türkiye Garanti Bankası A.Ş.

As seen in Table 2, 3 public, 9 private and 15 foreign capital banks have been taken into consideration. Furthermore, the study encompasses the period between 2008-2017. The data for the study were accessed from the Banks Association of Turkey.

The descriptive statistical values of the variables determined in the study in Table 1 are shown in Table 3 below.

Table 3. Descriptive statistics of variables

TA		**TLR**		**II/TA**		**IE/TA**		**MRA**	
Max	100.0	Max	100.0	Max	23.2	Max	17.9	Max	10.1
Min	0.0	Min	0.0	Min	1.2	Min	0.0	Min	0.0
Mean	9.0	Mean	8.9	Mean	8.8	Mean	4.3	Mean	1.6
SD	22.5	SD	22.5	SD	2.9	SD	2.3	SD	1.4
COPTP/TA		**NPP/PC**		**LA/TA**		**LA/STL**		**TLR/TA**	
Max	15.1	Max	792.6	Max	95.0	Max	43.449.7	Max	84.7
Min	0.0	Min	0.0	Min	8.6	Min	14.0	Min	0.0
Mean	1.9	Mean	51.7	Mean	35.6	Mean	418.1	Mean	54.3
SD	1.7	SD	87.8	SD	19.6	SD	2.964.2	SD	20.4
TLR/TD		**NPL/TLR**		**TD/TA**		**OC/TA**		**CAR**	
Max	646,933.9	Max	92.8	Max	84.5	Max	76.5	Max	595.4
Min	0.0	Min	0.0	Min	0.0	Min	0.0	Min	12.2
Mean	2,842.4	Mean	2.5	Mean	55.6	Mean	13.1	Mean	29.3
SD	38,301.4	SD	10.1	SD	20.2	SD	12.6	SD	50.1
SE/TA		**SE-FA/TA**		**SE/D+ND**					
Max	95.7	Max	91.4	Max	44.100.9				
Min	4.2	Min	1.4	Min	4.7				
Mean	18.1	Mean	14.6	Mean	277.3				
SD	19.2	SD	18.5	SD	2.630.7				
SD: Standart Deviation									

As can be seen in Table 3, the data for the variables contain extreme values and appear far from normal distribution. Moreover, according to the correlation analysis between the variables, a strong correlation is found among variables such as TLR, TA, II/TA, IE/TA, MRA, COPTP/TA and TLR/TA in particular. This also reveals the multicollinearity problem which is one of the assumptions of classical regression analysis. Therefore, in this study, instead of classical regression analysis, elastic net regression analysis, which is obtained by dealing with ridge and lasso logistic regression analysis together, was applied.

Elastic net regression analysis is a method used as an alternative to classical regression analysis in cases of multicollinearity. In this study, capital adequacy ratios are taken as dependent variables, while the other ratios included in Table 1 are taken as independent variables. Accordingly, four separate regression models have been created, and the obtained results are shown in Table 4 below.

As seen in Table 4, the banks' capital adequacy status has been examined with four dependent variables and a separate regression model has been created for each. If a general assessment is made, it is seen that the MRA, COPTP/TA, LA/TA, II/TA and NPL/TLR ratios were the most effective in all capital adequacy ratios, since all these ratios increase the capital adequacy ratio and are positive indicators for the banking sector. While the MRA, COPTP/TA and II/TA ratios generally affect capital positively in all sectors, NPL/TLR is a positive indicator that is effective only in the banking sector. One of the banking sector's most important financial tools and services is credit, and it is predicted that as the amount of credit increases, when returns are taken into account, a capital increase in banking will be enabled. On the other hand, it is seen that the IE/TA, TLR/TA, OC/TA and TD/TA ratios had the least effect on capital adequacy. IE/TA is an expense item; however, the TLR/TA, OC/TA and TD/TA ratios are ratios that belong to the banking sector. The fact that these 3 ratios had little effect on capital stems from the fact that net non-performing loans, which is the NPL/TLR ratio, are used as an indicator of capital adequacy, and that the other 3 ratios only give information about the amount of deposits and credit.

Table 4. Elastic net regression analysis results

	Dependent Variables							
	CAR		**SE/TA**		**SE-FA/TA**		**SE/D+ND**	
Constant	2.9E+01	OOI	2.3E+07	OOI	2,0E+01	OOI	2,8E+08	OOI
OC/TA	-5.4E-3	11	-4.2E+0	11	-4,1E-0	11	-2,1E-29	11
II/TA	7.8E-37	4	1.0E+0	3	9,1E-02	3	7,0E-29	3
IE/TA	-8.0E-3	14	-3.9E+0	14	-4,5E-0	14	-1,9E-28	14
LA/STL	8.9E-39	6	2.8E+02	6	3,1E-04	6	3,8E-31	6
LA/TA	1.7E-36	3	7.8E+04	5	8,0E-02	4	3,4E-29	5
NPP/PC	-7.4E-3	8	-4.4E+0	8	-3,7E-0	8	-1,6E-30	8
MRA	1.0E-35	1	6.3E+05	1	6,1E-01	1	3,6E-28	1
COPTP/TA	5.5E-36	2	4.6E+05	2	4,4E-01	2	2,9E-28	2
NPL/TLR	2.5E-37	5	8.1E+04	4	7,7E-02	5	3,5E-29	4
TLR/TA	-1.5E-3	13	-7.3E+0	12	-7,3E-0	12	-3,4E-29	12
TLR/TD	1.7E-40	7	1.0E+01	7	1,2E-05	7	-3,7E-35	7
TLR	-1.1E-3	10	-7.5E+0	9	-7,3E-0	9	-4,4E-30	10
TD/TA	-1.4E-3	12	-7.8E+0	13	-7,9E-0	13	-3,5E-29	13
TA	-1.0E-3	9	-7.7E+0	10	-7,4E-0	10	-4,4E-30	9
R^2 Levels	% 53.91		% 73.28		% 90.29		% 19.27	

OOI: Order of Importance

At the same time, while the MRA, COPTP/TA, LA/TA, II/TA, NPL/TLR, LA/STL and TLR/TD ratios had a positive effect on capital adequacy, the NPP/PC, TA, TLR, OC/TA, TD/TA, TLR/TA and IE/TA ratios had a negative effect. Capital adequacy ratio is generally affected by equity and risk-weighted asset items.

Examining the significance levels of the regression models, it was found that, with regard to capital adequacy, CAR explained 53.91%, SE/TA explained 73.28%, SE-FA/TA explained 90.29% and SE/D+TD explained %19.27. The reason why equity ratios were the variables that most explained capital adequacy is because banks with high liquidity do not need to borrow and are more in need of equity.

Conclusion

The capital adequacy ratio is applied to banks as a legal obligation. Although the minimum rate of capital required to be held according to the legal arrangement is 8%, much higher rates are always applied in the Turkish banking sector. The factors affecting this ratio, which exceeds the minimum amount, and the reasons for this apart from the legal requirement have been discussed in studies.

The aim of this study was to determine the factors affecting capital adequacy in 27 banks with capital located and actively operating in Turkey. Accordingly, capital adequacy was examined with the CAR, SE/TA, SE-FA/TA and SE/D+MD ratios. The ratios considered to affect these ratios, namely OC/TA, II/TA, IE/TA, LA/STL, LA/TA, NPP/PC, MRA, COPTP/TA, NPL/TLR, TLR/TA, TLR/TD, TLR, TD/TA and TA, were discussed as the independent variables of the study. Furthermore, elastic net regression analysis, which is used in cases of multicollinearity, was applied in the study.

According to the results obtained, it was seen that the banks' capital adequacy was best explained by the SE-FA/TA and SE/TA ratios. Moreover, it was determined that the MRA, COPTP/TA, II/TA and NPL/TLR ratios had strong positive effects on capital adequacy. According to the explanation levels obtained with the four regression models, it was seen that capital adequacy was best explained by equity-related ratios. Regarding banks that operate in the Turkish banking sector, it can be stated that clear

increases in equities offset all risk increases. Therefore, it is considered that in the Turkish banking sector, not individual risks or sources of risks, but equities can be the key determinant of capital adequacy.

The study contributes to the literature due to the fact that more than one dependent and independent variable were used as explanatory variables for the Turkish banking sector and that this emerged as significant. Moreover, the fact that the study was made on the basis of all banks is important in terms of making an evaluation of the banking sector in general. In further studies, the factors affecting capital adequacy of groups of banks in the sector can be compared. The research period can be extended to encompass crisis periods as well. Moreover, capital adequacy behaviors of Turkey can be compared with those of other developing countries.

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