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Analysis of the Relationship between Profitability and Foreign Exchange Positions, Asset Quality, and Loan Growth in the Banking Sector

Bankacılık Sektöründe Karlılık ile Döviz Pozisyonları, Aktif Kalitesi ve Kredi Büyümesi Arasındaki İlişkinin Analizi

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Abstract

Purpose: This study aims to investigate the relationship between the banking profitability indicators and the foreign exchange positions, asset quality, and loan growth indicators of banks using the data for Turkey between 2007: Q2 – 2020: Q3.

Design/Methodology: In the study, the models with two dependent variables and seven independent variables were established. The ARDL method and Toda-Yamamoto causality test were conducted on the models.

Findings: It was detected that a negative relationship existed between the profitability indicators of banks and their foreign exchange positions as well as asset quality indicators in the long-run, however, a positive relationship existed between loan growth and profitability. Similar results emerged for the long-term relationship in the short-run. According to the causality test result, it was concluded that a bilateral causal relationship existed between profitability indicators and non-performing loans/capital ratio, but there was a unilateral causality between foreign currency loans/total loans, non-performing loans/total loans, sectoral distribution of loans/total loans and total loans/GDP variables.

Limitations: The limitations involve the fact that indicators based on the study are obtained from the IMF's official website and the data on Turkey begins at 2007:Q2, claiming a time constraint on the variables. It can be said that there is a country limitation, since the variables are utilized merely for Turkey.

Originality/Value: The absence of studies modelling internal variables such as banks' foreign exchange positions and qualities as explanatory variables are observed. It is thought that the explanatory variables pertinent to the banking profitability in the analysis part may contribute to the literature since none of them have been considered for the same model in the previous studies.

Keywords: Profitability, Foreign Exchange Positions, Asset Quality, Loan Growth

Öz

Amaç: Bu çalışma, Türkiye için 2007: Q2-2020: Q3 dönemine ait üç aylık veriler ile bankacılık sektörü karlılık göstergelerinin bankaların döviz pozisyonları, aktif kalitesi ve kredi büyümesi göstergeleri arasındaki ilişkiyi araştırmayı amaçlamaktadır.

Tasarım/Yöntem: Çalışmada, iki bağımlı değişkene ve yedi bağımsız değişkene sahip modeller oluşturulmuştur. Modellere ARDL yöntemi ve Toda Yamamoto testi kullanılmıştır.

Bulgular: Analiz sonuçlarına göre, uzun dönemde bankaların karlılık göstergeleri ile döviz pozisyonları ve aktif kalitesi göstergeleri arasında negatif yönlü bir ilişki olduğu ancak kredi büyümesi ile karlılık arasında pozitif bir ilişki olduğu sonucuna ulaşılmıştır. Kısa dönemde uzun dönemli ilişkiye paralel sonuçlar ortaya çıkmıştır. Nedensellik testi sonucuna göre karlılık göstergeleri ile takipteki krediler/sermaye oranı arasında çift yönlü nedensellik ilişkisi olduğu ancak döviz kredileri/ toplam krediler, takipteki krediler/ toplam krediler, kredilerin sektörel dağılımı/toplam krediler ve toplam krediler/GSYİH değişkenleri arasında tek yönlü nedensellik ilişkisi olduğu sonucuna ulaşılmıştır.

Sınırlılıklar: Çalışmanın sınırlılıkları, çalışmada temel alınan göstergeler IMF'nin resmî sitesinden elde edilmiştir ve Türkiye ile ilgili veriler 2007 yılı ikinci çeyreğinde başlamaktadır. Bu nedenle değişkenlerle ilgili zaman kısıtı olduğu söylenebilir. Çalışmada kullanılan değişkenler sadece Türkiye için kullanılmasından dolayı ülke kısıtı olduğu da söylenebilir.

Özgünlük/Değer: Bankaların döviz pozisyonları ve kalitesi gibi içsel değişkenlerini açıklayıcı değişken olarak modelleyen çalışmaların eksikliği gözlemlenmiştir. Çalışmanın uygulama kısmındaki bankaların kârlılığına yönelik açıklayıcı değişkenlerin daha önceki çalışmaların hiçbirinde aynı modelde yer almamış olması bakımından literatüre katkıda bulunabileceği düşünülmektedir.

Anahtar Kelimeler: Karlılık, Döviz Pozisyonları, Aktif Kalitesi, Kredi Büyümesi

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1. INTRODUCTION

Banks constitute a large portion of the financial system. According to the data obtained at end of 2020, the Turkish banking sector accounts for approximately 93 percent of the financial sector's asset size. It is also important for the country's economy that the banks, which have such a tremendous share, have sound and lucrative structures. The ratio of the Turkish banking sector's assets to the gross domestic product is calculated as 22 percent by the end of 2020. Rajan and Zingales (1998), King and Levine (1993), Levine (2005), and Demirgüç-Kunt and Maksimovic (1998) pointed out that a positive association existed between the improvement of the banking sector and economic development.

Having a robust banking structure is closely pertinent to the profitability level of the sector. Profitability is an indicator of the competitiveness of the banks in the sector and the quality of their asset management. It is also the determinant of the risk-bearing capacity and the possibility of strengthening the capital structure. In the international literature, the majority of the studies conducted on profitability analysis of the banking sector are seen to deal with the impacts of the real sector on profitability. The absence of studies modelling internal variables such as banks' foreign exchange positions and qualities as explanatory variables are observed. This study aims to detect association between the banking profitability indicators and the foreign currency positions, asset quality, and loan growth indicators of banks. The fact that banks incur high exchange rate and asset quality risks by constantly enhancing their foreign exchange open positions may cause to negative impacts for both the banking sector and the overall economy due to sudden changes that may emerge through either international or domestic markets. Determining the relationship is crucial for both bank managers and national as well as international investors. It is thought that the explanatory variables pertinent to the banking profitability in the analysis part may contribute to the literature since none of them have been considered for the same model in the previous studies. In the study, certain questions to which responses have been sought are as follows; (1) Are there short-, long-term associations, and causality between the indicators of banks' profitability and the indicators of foreign exchange positions? (2) Are there short-, long-term associations, and causality between the indicators of banks' profitability and asset quality indicator? (3) Are there short, long-term associations, and causality between the indicators of banks' profitability and the loan growth indicator? To this end, the relationships among the quarterly data and variables are analyzed.

In the first part of the study, literature reviews are introduced. In the second part, the dataset and methodology used are explained. In the third part, the analysis findings are revealed. The last part involves overall conclusions, discussions, and limitations.

2. LITERATURE REVIEW

There are various factors affecting the banks' profitability. Nonetheless, return on equity (ROE) and return on assets (ROA) are utilized to assess and measure bank performance based on profitability. Globalization has led to the increase of these factors and caused some of them to gain more importance. According to Short (1979), the factors affecting the profitability of each bank are distinctive. Depending on whether the bank is public- or privately-owned, there is a difference between the profits it makes. He also stated that the profitability of banks would have increased along with the rise in the leverage ratio. Athanasoglou et al. (2006) examined the profitability determinants in Southeast European countries using the variables over the period 1998-2002, and concluded that credit risk adversely affects the profitability indicators. Sufian (2009) explicated the bank profitability determinants of commercial banks in Malaysia using the variables between 2000-2004, and concluded that banks with credit risk and high borrowing had low profitability levels, whereas banks with more diversification of banking activities could have high profitability levels. Flamini et al. (2009) analyzed the profitability determinants of 389 commercial banks in 41 Sub-Saharan countries between 1998-2006. Different from the overall literature, they detected a positive association between credit risk and bank profitability. Arif and Anees (2012) examined the profitability determinants of 22 banks in Pakistan between 2004-2009. According to the multiple regression results, it was concluded that non-performing loans enhanced the liquidity gap, and the liquidity risk negative affected the profitability. Berrios (2013) examined the association between profitability, liquidity, and credit risk of 40 banks between 2005-2009, and concluded that credit risk and liquidity risk were negatively associated with

profitability. Osuagwo (2014) examined the profitability determinants for the Nigerian banking sector using the obtained data over the period 1980-2010. According to the obtained findings using the linear regression model, credit risk and other endogenous variables determined bank profitability to a large extent. Moreover, the exchange rate was important as a bank profitability determinant. Novaili et al. (2015) scrutinized the factors influencing bank profitability in Tunisia. The regression analysis results revealed that a negative association existed between profitability and bank size as well as sectoral concentration. Nevertheless, they concluded that a positive association existed between profitability and bank capitalization, privatization, as well as pricing. Laryea et al. (2016) investigated the effect of NPLs on profitability of 22 banks operating in Ghana between 2005-2010, and detected a negative association between NPLs and profitability. Gökçe and Sarıtaş (2017), examined the impacts of exchange rate changes on the balance sheet of private banks in Turkey. According to the findings obtained by using the quantile regression model, exchange rate fluctuations lead changes in the balance sheets of the banks. Particularly, they concluded that the increase in the exchange rate boosted the rate of non-performing loans. Hakimi and Zaghdoudi (2017), in their study, investigated the profitability of 10 Tunisian banks between 1990-2013. According to the analysis results, it was concluded that profitability and the bank size, liquidity risk, financial crises, and inflation were negatively related, whereas capital adequacy and sectoral concentration were positively related. Partovi and Matousek (2019) examined the association between the efficiency of the Turkish banking sector and non-performing loans using the obtained during the period 2002-2017. It was determined that NPLs had an adverse impact on profitability according to the results obtained from the panel data. Moreover, considering the data envelopment analysis results, they detected that the efficiency levels of Turkish banks differed by the current ownership.

It is seen that most of the studies that have been on the banks' profitability determinants involve liquidity risk and credit risk. In those studies, indicators based on banking sector's financial structures and macroeconomic variables have been used. Upon examining the literature, the following hypotheses emerge in the study.

H_1: A negative association exists between banks' foreign exchange positions and profitability.

H_2: A negative association exists between asset quality risk and profitability.

H_3: A positive association exists between loan growth and profitability.

3. EMPIRICAL ISSUES

3.1. Data Collection

The relationship between profitability indicators and the foreign exchange positions as well as asset quality indicators of banks in Turkey is investigated. The variables include the quarterly data between 2007: Q2–2020: Q3. FX liabilities/total liabilities, FX loans/total loans, and net foreign exchange short position/capital ratio are the ones used for the FX positions of banks in the study. The variables used for the asset quality of banks are NPLs/capital, sectoral distribution of loans/total loans ratio, and NPLs/total loans. The variables used for profitability are ROA and ROE. Moreover, the total loans/GDP ratio is used as an explanatory variable to represent the loan growth in the sector. The sub-indicators and acronyms are given below.

Table 1: Sub-indicators, Acronyms, and the Variables

Sub-indicators	Acronym	Definition
Profitability Indicators	ROA	Return on assets
	ROE	Return on equity
Foreign Exchange Positions	FXLO	Foreign exchange loans/Total loans
	FXLI	Foreign exchange liabilities/Total liabilities
	PRD	Net foreign exchange open position/Capital
Asset Quality	NPLC	NPLs/Capital
	NPLL	NPLs /Total Loans
	SDL	Sectoral Distribution of Loans/ Total Loans
Loan Growth	LGDP	Toplam loans/GDP

Source: IMF and BIS

The ROA indicator is utilized to analyze the efficiency of banks in utilizing their assets. The ROE indicator is utilized to analyze the efficiency of banks in utilizing their capital. The FX loans/total loans ratio analyzes the share of FX loans in total loans. The relative importance of FX deposits in total resources is analyzed by The FX liabilities/total liabilities ratio. The net FX short position/capital ratio measures the possible vulnerability of capital to FX rate fluctuations. The NPLs/equity ratio analyzes the potential effect of NPLs on capital. The NPLs/total loans ratio indicates the share of NPLs in total loans. It analyzes the asset quality in the loan portfolio (IMF Guide, 2006). Sectoral distribution of loans/total loans ratio indicates the share of loans extended to the domestic sector in total loans. The total loans/GDP ratio indicates the loan growth in the sector (BDDK, 2015).

3.2. Methodology and Model Specification

Classical cointegration tests which examined the long-term associations among variables, required the variables to be integrated of the same order. However, Pesaran, Shin, and Smith (2001) analyzed the ARDL, which yielded substantial results even if the analyzed time-series were integrated of the different orders, such as I(1) and I(0). Although unit root testing was not required in this method, the performance of unit root testing was still recommended to avoid misapplication, estimation, and interpretation, in case the variables are I(2). Because, if the variables are I(2), the ARDL method cannot be employed (Pesaran et al., 2001).

Models were established in compliance with Athansoglou et al. (2006), Sufian (2009), Flamini et al. (2009), and Osuagwo (2014) to analyze the association between the profitability indicators and the foreign currency positions, asset quality as well as loan growth indicators of banks. The employed model in the study is chosen to be a model that includes merely the variables pertinent to the banking sector. It is tried to determine the banking sector variables that are associated with profitability indicators. The ARDL model and its phases established for the model with two dependent variables along with seven independent variables are presented below.

$$\Delta ROA_t = \alpha 0 + \sum_{i=1}^{m} \beta_{1i} \Delta ROA_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta FXLO_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta FXLI_{t-i} + \sum_{i=0}^{r} \beta_{4i} \Delta PRD_{t-i} + \sum_{i=0}^{h} \beta_{5i} \Delta NPLC_{t-i} + \sum_{i=0}^{w} \beta_{6i} \Delta NPLL_{t-i} + \sum_{i=0}^{x} \beta_{7i} \Delta SDL_{t-i} + \sum_{i=0}^{y} \beta_{8i} \Delta LGDP_{t-i} + S_1 ROA_{t-1} + S_2 FXLO_{t-1} + S_3 FXLI_{t-1} + S_4 PRD_{t-1} + S_5 NPLC_{t-1} + S_6 NPLL_{t-1} + S_7 SDL_{t-1} + S_8 LGDP_{t-1} + \mu_t \quad (1)$$

$$\Delta ROE_t = \alpha 0 + \sum_{i=1}^{m} \beta_{1i} \Delta ROE_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta FXLO_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta FXLI_{t-i} + \sum_{i=0}^{r} \beta_{4i} \Delta PRD_{t-i} + \sum_{i=0}^{h} \beta_{5i} \Delta NPLC_{t-i} + \sum_{i=0}^{w} \beta_{6i} \Delta NPLL_{t-i} + \sum_{i=0}^{x} \beta_{7i} \Delta SDL_{t-i} + \sum_{i=0}^{y} \beta_{8i} \Delta LGDP_{t-i} + S_1 ROE_{t-1} + S_2 FXLO_{t-1} + S_3 FXLI_{t-1} + S_4 PRD_{t-1} + S_5 NPLC_{t-1} + S_6 NPLL_{t-1} + S_7 SDL_{t-1} + S_8 LGDP_{t-1} + \mu_t \quad (2)$$

The conditional long-run ARDL model can be estimated, once cointegration is established, as follows:

$$ROA_t = \alpha 0 + \sum_{i=1}^{m} \beta_{1i} ROA_{t-i} + \sum_{i=0}^{n} \beta_{2i} FXLO_{t-i} + \sum_{i=0}^{p} \beta_{3i} FXLI_{t-i} + \sum_{i=0}^{r} \beta_{4i} PRD_{t-i} + \sum_{i=0}^{h} \beta_{5i} NPLC_{t-i} + \sum_{i=0}^{w} \beta_{6i} NPLL_{t-i} + \sum_{i=0}^{x} \beta_{7i} SDL_{t-i} + \sum_{i=0}^{y} \beta_{8i} LGDP_{t-i} + \mu_t \quad (3)$$

$$ROE_t = \alpha 0 + \sum_{i=1}^{m} \beta_{1i} ROE_{t-i} + \sum_{i=0}^{n} \beta_{2i} FXLO_{t-i} + \sum_{i=0}^{p} \beta_{3i} FXLI_{t-i} + \sum_{i=0}^{r} \beta_{4i} PRD_{t-i} + \sum_{i=0}^{h} \beta_{5i} NPLC_{t-i} + \sum_{i=0}^{w} \beta_{6i} NPLL_{t-i} + \sum_{i=0}^{x} \beta_{7i} SDL_{t-i} + \sum_{i=0}^{y} \beta_{8i} LGDP_{t-i} + \mu_t \quad (4)$$

The error correction equation obtained from the models is as follows.

$$\Delta ROA_t = \alpha 0 + \sum_{i=1}^{p-1} \beta_{1i} \Delta ROA_{t-i} + \sum_{i=0}^{p-1} \beta_{2i} \Delta FXLO_{t-i} + \sum_{i=0}^{p-1} \beta_{3i} \Delta FXLI_{t-i} + \sum_{i=0}^{P-1} \beta_{4i} \Delta PRD_{t-i} + \sum_{i=0}^{p-1} \beta_{5i} \Delta NPLC_{t-i} + \sum_{i=0}^{p-1} \beta_{6i} \Delta NPLL_{t-i} + \sum_{i=0}^{p-1} \beta_{7i} \Delta SDL_{t-i} + \sum_{i=0}^{p-1} \beta_{8i} \Delta LGDP_{t-i} + \gamma ECT_{t-1} + \mu_t \quad (5)$$

$$\Delta ROE_t = \alpha 0 + \sum_{i=1}^{p-1} \beta_{1i} \Delta ROE_{t-i} + \sum_{i=0}^{p-1} \beta_{2i} \Delta FXLO_{t-i} + \sum_{i=0}^{p-1} \beta_{3i} \Delta FXLI_{t-i} + \sum_{i=0}^{P-1} \beta_{4i} \Delta PRD_{t-i} + \sum_{i=0}^{p-1} \beta_{5i} \Delta NPLC_{t-i} + \sum_{i=0}^{p-1} \beta_{6i} \Delta NPLL_{t-i} + \sum_{i=0}^{p-1} \beta_{7i} \Delta SDL_{t-i} + \sum_{i=0}^{p-1} \beta_{8i} \Delta LGDP_{t-i} + \gamma ECT_{t-1} + \mu_t \quad (6)$$

In the established models; α is the constant term, S_1, S_2, S_3, and S_4 represent long-term coefficients; Δ stands for the difference of the variables; and μ_t is the error term. The coefficients indicate the lag lengths, and optimal lag length value is found in pursuant of information criteria such as Hannan-Quinn, Schwarz, and Akaike. By detecting the lag length, it is determined whether the model contains an autocorrelation problem or not. Following are the F statistic test hypotheses;

H_0: $S_1 = S_2 = S_3 = S_4 = 0$ (7)

H_1: $S_1 \neq S_2 \neq S_3 \neq S_4 \neq 0$

The H_0 hypothesis implies that a cointegration occurs among the variables, while the H_1 hypothesis states that no cointegration occurs.

If the estimated F-statistic value exceeds the upper bound, H_0 is not accepted and cointegration occurs between the estimators and dependent variable. H_0 cannot not be rejected if the lower bound exceeds the F-statistic value. However, no definite interpretation can be made if it remains between the lower and upper bounds, so other tests must be applied.

Along with the development of the Granger (1988) causality test, it is also possible to analyze the causality relationship among non-stationary series. For the analysis of non-stationary series, the series should be integrated of the same order and a cointegration should exist among the series. Besides, employing the method developed by Toda and Yamamoyo (1995), while the condition of being integrated of the same order is not required, the existence of cointegration among these series is not needed. The following is the bivariate model in which the X and Y variables would be investigated in terms of the T-Y approach:

$$Y_t = \lambda_1 + \sum_{i=1}^{k} \alpha_{1i} Y_{t-i} + \sum_{j=k+1}^{k+d_{max}} \alpha_{2j} Y_{t-j} + \sum_{i=1}^{k} \beta_{1i} X_{t-i} + \sum_{j=k+1}^{k+d_{max}} \beta_{2j} X_{t-j} + e_{1t} \quad (8)$$

$$X_t = \lambda_2 + \sum_{i=1}^{k} \alpha_{2i} Y_{t-i} + \sum_{j=k+1}^{k+d_{max}} \alpha_{2j} Y_{t-j} + \sum_{i=1}^{k} \beta_{2i} X_{t-i} + \sum_{j=k+1}^{k+d_{max}} \beta_{2j} X_{t-j} + e_{2t} \quad (9)$$

Here, *k* denotes optimal lag length, and d_{max} is the highest of the varying order of integration. Also, the error terms e_{1t} and e_{2t} are assumed to have zero mean and fixed covariance matrix. The T-Y method has two phases. In the first phase, a VAR model is established, which yields results sensitive to the lag length. With the AIC and SIC, *k* and d_{max} are determined. In the second phase, the T-Y causality test, after determining *k* of the VAR model and *dmax* of the studied series, a VAR model with size ($k+d_{max}$) is estimated by employing the SUR method.

4. EMPIRICAL RESULTS

In the first phase, the existence of either a short- or long-term association among the independent variables and profitability indicators is investigated. In the second phase, the presence of causality between the variables is analyzed.

4.1. Unit Root Result

In the performed analyses, the non-stationary of the series leads to unreliable results regarding the variables. Therefore, it is elementary to firstly explicate the stationarity features. The Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests are performed for explicating associations between the countercyclical capital buffer and bank performance. Upon performing the PP and ADF tests, a hypothesis is established whether the time series contains unit roots.

H_0: The series contains unit roots

H_1: The series does not contain unit roots

Table 2: The PP and ADF Unit Root Tests

Variables		ADF-t statistic (at level)	ADF-t statistic (1^{st} difference)	PP-t statistic (at level)	PP-t statistic (1^{st} difference)
ROA		-2.4283 (0)	-6.6587 (0) ***	-2.4937 (2)	-6.9300 (1) ***
ROE		-2.6560 (0)	-6.9306 (0) ***	-2.6803 (2)	-6.754506 (5) ***
FXLO		-2.8421 (0)	-7.5713 (0) ***	-2.8521 (2)	-7.5713 (0) ***
FXLI		-2.6224 (0)	-6.8225 (0) ***	-2.7431 (2)	-6.8148 (2) ***
PRD		-3.9698 (0) **	-10.8839 (0) ***	-4.0299(4) **	-10.8839 (0) ***
NPLC		-2.8663 (1)	-4.3042 (0) ***	-2.3402 (3)	-4.2819 (1) ***
NPLL		-2.8945 (1)	-3.4068 (0) *	-1.9963 (4)	-3.3786 (1) *
SDL		-2.6399 (0)	-6.8009 (1) ***	-2.5520 (5)	-7.8172 (8) ***
LGDP		-2.5919 (0)	-6.8811 (0) ***	-2.6726 (1)	-6.8731 (3) ***
Significance Level	**1%**	-4.140858	-4.144584	-4.140858	-4.144584
	5%	-3.496960	-3.498692	-3.496960	-3.498692
	10%	-3.177579	-3.178578	-3.177579	-3.178578

As presented in Table 2, since the t values of the ROA, ROE, FXLI, FXLO, TKC, TKL, SD, and CGDP variables at the level are below the critical bound values, it is not possible to reject H_0. The H_0 would be rejected since the t value exceeds the bound value upon taking the first difference of the series. Since the t statistical value of the PRD variable exceeds the bound value, it is asserted that the H_0 iswould be rejected.

4.2. Cointegration Analysis: The ARDL Bounds Test

After determining the stationarity levels of the variables, cointegration analysis is performed to detect a long-term association. The cointegration relationship is examined with the ARDL Bounds Test since the model is not I(2). The optimal lag length is found to be 4 upon giving a maximum of 8 lag lengths in accordance with the AIC.

Table 3: The ARDL Bounds Test

Model Estimation	**Model 1. ROA= *f* (FXLO, FXLI, PRD, NPLC, NPLL, SDL, LGDP)** **Model 2. ROE= *f* (FXLO, FXLI, PRD, NPLC, NPLL, SDL, LGDP)**	
Lag Structure	2, 4, 4, 0, 3, 4, 4, 3	
F-statistics	**Model 1.** 4.861091 **Model 2.** 5.211384	
k*	7	
Levels of Significance	**Critical bounds levels**	
	I(0) Bound	**I(1) Bound**
10%	1.92	2.89
5%	2.17	3.21
2.5%	2.43	3.51
1%	2.73	3.90

Note: *(*k*) represents the number of independent variables which explain the dependent variables

According to Table 3, the statistical values of F in Model 1 and Model 2 are calculated as 4.861091 and 5.211384. Since these values exceed the upper critical bound values at a 1% significance level, cointegration exists in both models. In other words, since [F> I (1)], the hypothesis implying nonexistence of cointegration is rejected. This result allows the establishment of long- and short-term ARDL models among the variables.

4.3. The ARDL Short And Long Term Results

Long-term coefficients of ARDL (2,4,4,4,4,4,3,4) determined upon finding proper lag lengths are presented below.

Table 4: Long-Term Coefficients

Model 1		ROA		Model 2		ROE	
Variable	**Coefficient**	**t-Statistic**	**Prob**	**Variable**	**Coefficient**	**t-Statistic**	**Prob**
FXLO	-0.095197	-3.001060	0.0077***	**FXLO**	-0.809531	-3.405093	0.0032***
FXLI	-0.467369	-3.503843	0.0025***	**FXLI**	-3.875101	-3.872794	0.0011***
PRD	-0.021580	-0.565058	0.5790	**PRD**	-0.046772	-0.162732	0.8725
NPLC	-0.531272	-4.101978	0.0007***	**NPLC**	-5.211231	-5.357724	0.0000***
NPLL	-0.929702	-4.440847	0.0003***	**NPLL**	-8.131277	-5.228044	0.0001***
SDL	-2.904784	-4.072432	0.0007***	**SDL**	-24.83130	-4.666091	0.0002***
LGDP	0.135183	3.353272	0.0035***	**LGDP**	1.246024	4.150188	0.0006***
C	295.3048	4.092435	0.0007***	**C**	351.0277	4.672535	0.0002***

The coefficient results of Model 1 and 2 determine that the ratios such as FXLO, FXLI, NPLC, NPLL, and SDL have negative relationships with long-term ROA and ROE at 1% significance level. It is asserted that a positive association exists between the LGDP ratio and long-term profitability indicators at a 1% level. The findings related to the ARDL ECM, which indicate the short-term relationship of the variables, are presented (see Table 5).

Table 5: Short -Term Estimation-Error Correction Model Test Results

Model 1		ROA		Model 2		ROE	
Variable	**Coefficient**	**t-Statistic**	**Prob**	**Variable**	**Coefficient**	**t-Statistic**	**Prob**
ΔFXLO	-0.029729	-1.682272	0.1098	**ΔFXLO**	-0.294006	-2.086182	0.0515*
ΔFXLI	-0.117727	-4.480953	0.0003***	**ΔFXLI**	-1.171915	-5.661994	0.0000***
ΔPRD	-0.022748	-1.226345	0.2359	**ΔPRD**	-0.070908	-0.475070	0.6405
ΔNPLC	-0.164258	-1.797444	0.0891*	**ΔNPLC**	-1.022276	-1.414477	0.1743
ΔNPLL	-0.136877	-0.672053	0.5101	**ΔNPLL**	-2.989658	-1.817879	0.0858*
ΔSDL	-0.494288	-2.693729	0.0148**	**ΔSDL**	-4.563789	-3.168274	0.0053***
ΔLGDP	0.004152	0.278119	0.7841	**ΔLGDP**	0.189898	1.592992	0.1286
ECT (-1)	-1.013957	-7.467885	0.0000***	**ECT (-1)**	-1.051755	-7.678254	0.0000***

According to the ECM presented in Table 5, the ECT coefficients are calculated as -1.013957 for Model 1 and -1.051755 for Model 2. For the error correction mechanism to function, this coefficient must be statistically significant and negative. The coefficient being higher than 1 in the models means that the extraordinary situations that occur in the short run will be adapted quickly in the next year. According to the findings of the study, the EC coefficient is significant at the 1% level, negative as anticipated, and higher than 1. According to these results, the divergence from the short-term equilibrium would be corrected and the convergence toward equilibrium is faster in the long-run.

The short-term coefficient results for Model 1 and Model 2 determine that a negative association exists between the banks' profitability indicators and short and long foreign exchange positions, and asset quality indicators. The results are similar to the long-term coefficient results. Some diagnostic tests are also required to decide whether autocorrelation or heteroscedasticity problem exists in the residuals of the model, and also for specification error, normality problem, and parameter stability.

Table 6: Diagnostic Tests for the ARDL Model

	Model l		Model 2	
Tests	**F-statistic**	**P-Value**	**F-statistic**	**P-Value**
J–B normality test	1.662795	0.4354	1.618006	0.4453
Breusch–Godfrey LM test	0.606645	0.5572	0.969058	0.4006
Heteroscedasticity Test Breusch-Pagan	0.905340	0.6076	0.478796	0.9652
Ramsey RESET	0.882869	0.3606	0.456674	0.5083

According to the diagnostic test results, there are no results violating the model's reliability. No autocorrelation, heteroscedasticity, and normal distribution are found in the model. CUSUM and

CUSUM-SQ tests are performed to determine whether or not the predicted parameters in the models are stable.

Figure 1: Model 1 CUSUM

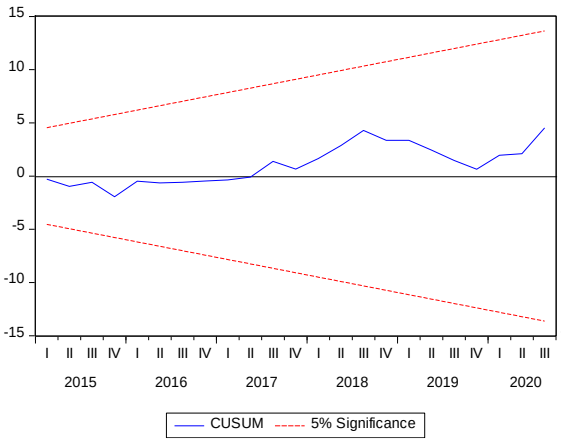


Figure 2: Model 1 CUSUM-SQ

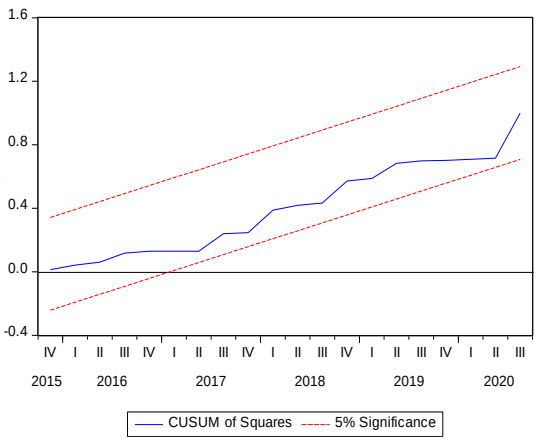


Figure 3: Model 2 CUSUM

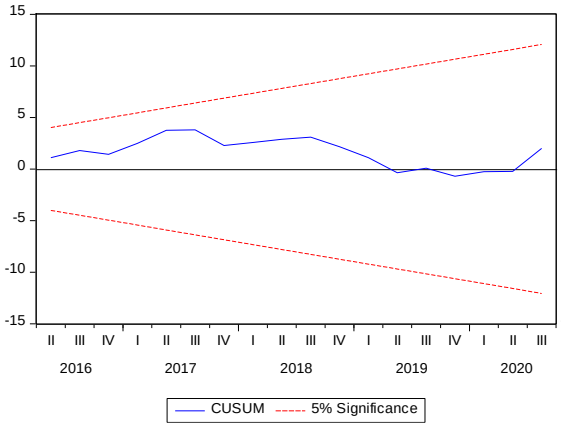
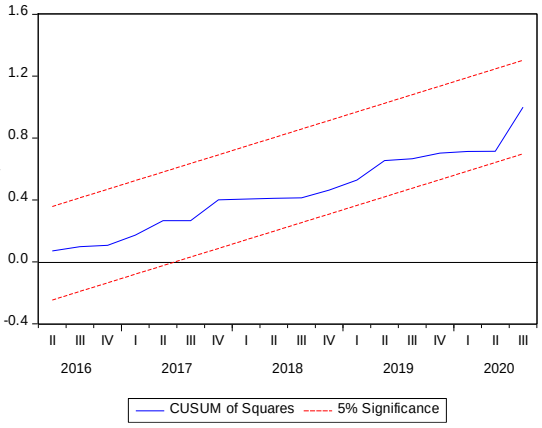


Figure 4: Model 2 CUSUM-SQ



Dashed lines in graphs illustrate 95% confidence interval and the solid lines illustrate the parameter estimates. Since the estimations in the graphs of both models remain within the confidence interval, the parameter estimations fulfil the stability condition.

4.4. T-Y Causality Test

The PP and ADF test findings indicate that the maximum integration levels of the variables (d) do not exceed 1 (d_{max}=1). 5 different criteria, such as FPE, LR, AIC, SIC, and HQ are utilized to find optimal lag length for VAR. Optimal lag lengths regarding for the models are presented below:

Table 7: Selection of Optimal Lag Lengths Regarding VAR Model for Models 1 and 2

Model 1 Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-585.1213	NA	2.778406	23.72485	24.03077	23.84135
1	-240.5061	565.1688	3.83e-05	12.50025	15.25356*	13.54872
2	-150.6196	118.6502	1.65e-05	11.46478	16.66549	13.44524
3	-54.74947	95.87014*	8.10e-06	10.18998	17.83807	13.10242
4	53.09644	73.33522	5.33e-06*	8.436142*	18.53162	12.28056*
Model 2 Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-691.4663	NA	195.5230	27.97865	28.28458	28.09515
1	-344.7378	568.6347	0.002474	16.66951	19.42283*	17.71799
2	-251.1512	123.5343	0.000920	15.48605	20.68675	17.46651
3	-156.1247	95.02651*	0.000467	14.24499	21.89308	17.15742
4	-44.18135	76.12148	0.000261*	12.32725*	22.42274	16.17167*

Note: * denotes the optimal lag lengths for the relevant information criteria.

Table 7 presents that the optimal lag length is 4 regarding the AIC, FPE, and HQ criteria for Model 1; 1 according to the SC criterion; whereas 3 in accordance with the LR criterion. The optimal

lag length for Model 2 is the same as for Model 1. Since d_{max} of the variables is 1, the VAR ($k + d_{max}$) calculated at the level for the T-Y causality test in Model 1 and Model 2 is VAR (5) ($k + d_{max} = 5$) according to the AIC, FPE, and HQ criteria; whereas VAR (4) ($k + d_{max} = 4$) according to the LR criterion, and VAR (2) ($k+ d_{max} =2$) according to the SC criterion. The estimated VAR (5) result is stable; however, VAR (2) and VAR (4) test results are not.

Table 8: T-Y Causality Test

Causality Direction Model 1	**Null Hypothesis (H_0)**	**Prob.**	**Chi-sq**	**Decision**
ROA→FXLO	ROA =/=> FXLO	0.0934*	2.814793	Reject H_0
FXLO→ROA	FXLO =/=> ROA	0.9186	0.010438	Accept H_0
ROA→FXLI	ROA =/=> FXLI	0.3025	1.063256	Accept H_0
FXLI→ROA	FXLI =/=> ROA	0.3243	0.971364	Accept H_0.
ROA→PRD	ROA =/=> PRD	0.3877	0.746069	Accept H_0
PRD→ROA	PRD =/=> ROA	0.4741	0.512352	Accept H_0
ROA→NPLC	ROA =/=> NPLC	0.0004***	12.63033	Reject H_0
NPLC→ROA	NPLC =/=> ROA	0.0086***	6.899457	Reject H_0
ROA→NPLL	ROA =/=> NPLL	0.0000***	19.21965	Reject H_0
NPLL→ROA	NPLL =/=> ROA	0.3396	0.911920	Accept H_0
ROA→SDL	ROA =/=> SDL	0.6100	2.695533	Accept H_0
SDL→ ROA	SDL =/=> ROA	0.0170**	12.04675	Reject H_0
ROA→LGDP	ROA =/=> LGDP	0.4326	0.615739	Accept H_0
LGDP→ ROA	LGDP =/=> ROA	0.0936*	2.811943	Reject H_0
Causality Direction Model 2	**Null Hypothesis (H_0)**	**Prob.**	**Chi-sq**	**Decision**
ROE→FXLO	ROE =/=> FXLO	0.1110	2.539884	Accept H_0
FXLO→ROE	FXLO =/=> ROE	0.9524	0.003557	Accept H_0
ROE→FXLI	ROE =/=> FXLI	0.1632	1.944736	Accept H_0
FXLI→ROE	FXLI =/=> ROE	0.3620	0.830970	Accept H_0
ROE→PRD	ROE =/=> PRD	0.5560	0.346696	Accept H_0
PRD→ROE	PRD =/=> ROE	0.3131	1.017471	Accept H_0
ROE→NPLC	ROE =/=> NPLC	0.0001***	14.89389	Reject H_0
NPLC→ROE	NPLC =/=> ROE	0.0043***	8.154806	Reject H_0
ROE→NPLL	ROE =/=> NPLL	0.0000***	20.21331	Reject H_0
NPLL→ROE	NPLL =/=> ROE	0.2512	1.316490	Accept H_0
ROE→SDL	ROE =/=> SDL	0.6348	2.555018	Accept H_0
SDL→ ROE	SDL =/=> ROE	0.0000***	32.96269	Reject H_0
ROE→LGDP	ROE =/=> LGDP	0.6788	0.171425	Accept H_0
LGDP→ ROE	LGDP =/=> ROE	0.0654*	3.395867	Reject H_0

Note: → signifies the causality direction.

The causality test results suggest that merely 11 causal associations that are investigated for Models 1 and 2 can be supported. The first causal relationship for Model 1 emerges at 10% level and confirms a causality from the ROA to foreign exchange loans/total loans ratio. The second causal relationship is a bilateral causality between the ROA ratio and the non-performing loans/capital ratio at a 1% significance level. The third one is from ROA ratio to non-performing loans/total loans ratio. The fourth one is a unilateral causality from sectoral distribution of loans/total loans ratio to ROA ratio at 5% significance level. It is indicated that a causal relationship exists among the three ratios of the asset quality and the ROA ratio. The final causal relationship for Model 1 is a unilateral causality running from the total loans/GDP ratio, which represents loan growth at the 10% significance level, to the ROA ratio. Upon examining the causality test for Model 2, unlike Model 1, no causality is detected among the variables representing the foreign exchange positions of banks and the ROE ratio. The first causal relationship for Model 2 is bilateral causality between ROE ratio and non-performing loans/capital ratio at a 1% significance level. The second one is a unilateral causality running from ROE ratio to non-performing loans/total loans ratio at a 1% significance level. The third one is a unilateral causality from the sectoral distribution of loans/total loans to ROE at a 1% level. As in Model 1, it is indicated that causality also exists among the variables of the asset quality and the ROE ratio in Model 2. The last causal relationship for Model 2 is a unilateral causality running from total loans/GDP ratio to ROE ratio at 10% level, as in Model 1. The significant short- and long-term results are confirmed by the test.

5. CONCLUSION AND DISCUSSION

The presence of a financially sound banking structure is among the main pillars of sustainable economic development. Increases in loans facilitate investment and consumption activities, hence, contribute to the financial deepening. On the other hand, excessive loan growth tends to be related to financial fragility. This situation may cause crises in the banking sector by enhancing the systematic risk. In light of this information, a response is sought to the question of whether or not an association exists between profitability indicators and the asset quality as well as foreign currency positions of banks in this study. Upon considering the relevant literature, the variables pertinent to asset quality and foreign exchange positions that may influence the profitability of banks between 2007: Q2- 2020: Q3 are determined. Moreover, the loan growth variable is used as the explanatory variable. Two established models in this regard are analyzed with the ARDL method and the T-Y causality test. It is concluded that cointegration relationships exist among the variables in both models. A negative association is detected between the profitability indicators and the variables used for the foreign exchange positions of banks. The finding suggests that the Turkish banking sector is highly sensitive to exchange rate risk. Foreign exchange liabilities of banks and the ratio of foreign capital in the Turkish banking sector are quite high. Possible sudden exchange rate volatility affects the profitability adversely by increasing the equity costs of the banks. Another result obtained is that a negative association exists between profitability indicators and variables representing asset quality risks. Increases in NPLs adversely influence banking profitability. Besides, the sectoral distribution of loans representing loan diversification/total loans ratio adversely affects profitability indicators. It indicates that the loan diversification is expanding especially towards the sectors that are competitive and have less loan experience. This situation causes the profit of the banking sector to decrease and the loan quality to deteriorate. Another result suggests that while a significant and positive relattionship between profitability indicators and loan growth exists in the long-run, no significant association is detected in the short-run. Increases in the loan volume of banks would boost bank profitability under the conditions of financial stability. Upon considering the T-Y test results, the presence of a causal relationship between the ROA ratio and foreign currency liabilities, asset quality risk as well as loan growth indicators is determined. Also, a causal relationship is found between ROE ratio and asset quality risk as well as loan growth indicators.

The results exhibit similarities with the results of previous studies on banking sector profitability such as Athansoglou et al. (2006), Arif and Anees (2012), Osuagwo (2014), and Partovi and Matousek (2019); whereas having certain differences with the results of Flamini et al. (2009), Sufian (2009) and Hakimi and Zaghdoudi (2017). Studies, in general, indicated that banks with credit risk and high borrowing rates had low profitability levels and that foreign exchange rate was a determinant of bank profitability. Moreover, studies stated that non-excessive loan growth would have had a positive effect on banking profitability.

Policy recommendations and the fact that Turkey is characterized as a fragile country due to its high exchange rate and current account deficit by international organizations render the issue of hedging from exchange rate risk crucial. Therefore, the banking sector needs to concentrate and specialize in the futures market. Furthermore, the adoption of international standards on risk management within the scope of Basel III would make the infrastructure of the banking sector more substantial and contribute to the internationalization process.

The limitations involve the fact that the indicators based on the study are obtained from the IMF's official website and the data on Turkey begins at 2007:Q3. Therefore, it would be stated that a time constraint exists on the variables. It can be said that there is a country limitation. In future studies, it may be suggested to make comparisons by carrying out researches regarding the bank profitability in various countries, since the variables are utilized merely for Turkey.

Ethics Statement: *In this study, no method requiring the permission of the "Ethics Committee" was used.*

Etik Beyan: *Bu çalışmada "Etik Kurul" izini alınmasını gerektiren bir yöntem kullanılmamıştır.*

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