

BALANCE SHEET CHANGES IN THE TURKISH BANKING SECTOR IN THE FACE OF
FX RATE VOLATILITY

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FX RATE VOLATILITY**

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ABSTRACT

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In this thesis, we aim to see the changes in the various balance sheet items of the Turkish banking sector and the exchange rate between January 2008 and December 2021. The analysis of balance sheet items is conducted in the thesis including the Granger Causality method. Other than balance sheet items, the ratio of foreign borrowings to total assets, and the ratio of Turkish Lira denominated deposits to total loans are also included in the thesis to assess the changes in the balance sheet items of the Turkish banking sector. Our results show that in the face of increasing exchange rates, the banks try to limit their foreign borrowings and started to increase their deposits to fund the loan channels.

Keywords: Foreign exchange, balance sheet, Turkish banking sector

ÖZ

KUR OYNAKLIĞI KARŞISINDA TÜRK BANKACILIK SEKTÖRÜNÜN BİLANÇO DEĞİŞİMİ

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Bu çalışma, Türk bankacılık sektörünün kur değişimi göz önüne alındığında bilanço verilerinin seyrini incelemektedir. Çalışma Ocak 2008 ve Aralık 2021 arası aylık bankacılık sektörü bilançosunu veri seti olarak kullanmaktadır. Bilanço kalemlerinin değişimleri ve kur arasındaki Granger Causality analizleriyle bankacılık sektörünün bilançosundaki değişimler irdelenmektedir. Kullanılan kalemlerin yanı sıra yurtdışı borçların toplam varlıklara oranı ve Türk Lirası cinsi mevduatların toplam kredilere oranı rasyoları oluşturulmuştur. Çalışma sonucunda yapılan analiz, bankacılık sektörünün kur artışları karşısında yurtdışı borçlarını azaltmaya çalıştığına ve yükümlülüklerini fonlamada yurtdışı borçlanma yerine mevduata yöneldiğine işaret etmektedir.

Anahtar Kelimeler: Döviz kuru, bilanço, Türk bankacılık sektörü

To My Mother

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LIST OF ABBREVIATIONS

ARCH	Autoregressive Conditional Heteroskedasticity
CBRT	Central Bank of the Republic of Turkey
CODAS	Combinative Distance-based Assessment
CoVaR	Conditional Value at Risk
EDDS	Electronic Data Delivery System
FB	Foreign Borrowing
FX	Foreign Exchange
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GARCH-M	Generalized Autoregressive Conditional Heteroskedasticity in Mean
HEGY	Hylleberg Engle Granger Yoo Test Result
ITARA	Indifference Threshold-based Attribute Ratio Analysis
LDR	Loan to Deposit Ratio
MENA	Middle East and North Africa
MES	Marginal Expected Shortfall
OLS	Ordinary Least Squares
RMB/USD	Renminbi/United States Dollar
ROA	Return on Assets
ROC	Rank Order Centroid
SII	Systemic Impact Index
TA	Total Assets
TL	Total Loans
TD	Total Deposits
USD/TL	United States Dollar / Turkish Lira
VaR	Value at Risk
VAR	Vector Autoregressive Model

CHAPTER 1

INTRODUCTION

In this thesis, we study the balance sheet changes in the Turkish banking sector. The study is conducted as a time series analysis of the balance sheet items in the Turkish banking sector. Moreover, the thesis includes the US Dollar/Turkish Lira exchange rate as a proxy for the exchange rate changes in the Turkish economy. The thesis aims to show the changes in bank policies made after the rapid depreciation of the Turkish Lira. Since foreign currency-denominated liabilities increase the exchange rate risk for the sector, we included the exchange rate as a proxy for the risk factor. Amid the rapid dollarization and the high inflation rate, Turkish banks are exposed to exchange rate risk. The roots of these risks need to be analyzed through a historical perspective beginning from the 2008 Mortgage crisis aftermath, which resulted in a serious amount of liquidity injection by monetary authorities when foreign borrowing had become attractive and cheap for Turkish banks.

Since it was easier for the banks to access debt options than to accumulate more deposits, this method was applied to extend the credit pool of the banks. As a result, the risks related to the Turkish economy were lower, and the exchange rates were relatively stable at the beginning of the 2010s. Combined with the positive real interest rates, this formed an access opportunity for Turkish banks to foreign funds in foreign currencies. However, after it was seen that the crisis' adverse effects started to disappear and an increase in the interest rates was necessary, which resulted in pressure on the

Turkish Lira, a risky environment for the Turkish banking sector occurred. Since this opportunity was used a lot in the previous years, now Turkish banks deal with the increased exchange rate risk with very high levels of leverage compared to the beginning of the 2010s. The rapid depreciation of the Turkish Lira combined with the high level of external borrowing creates a hazardous environment for Turkish banks. This study, however, does not focus on the micro-level of the individual banks in Turkey but instead follows a more general path to explain the overall risks in the sector.

Currency trading and bank deposits are the main operations in the foreign exchange market. With the increased internationalization of trades of goods and services, the exchange rates at which one currency is converted to another play an important role in determining the relative prices of those goods and services in different parts of the world. Therefore, understanding the dynamics of exchange rate movements is critical. Moreover, these rates are determined in the market by the forces of supply and demand.

According to McConnell et al. (2009), in the long run, four major factors affect the exchange rate: productivity, relative price levels, tariffs and quotas, and preferences for domestic versus foreign goods. The effect of these factors on the exchange is examined holding the others constant. It can be said that the factors for increasing the demand for domestic goods will also trigger an appreciation in the local currency against the foreign currencies. However, anything that will increase the consumption of foreign goods will tend to depreciate the local currency. In line with the purchasing power parity, the relative price level is an important factor in explaining the exchange rate changes. A decrease in a country's price level creates an appreciation effect in domestic currency, whereas an increase in a country's overall price level causes depreciation in domestic currency.

Trade barriers are another factor for exchange rate changes. For a hypothetical case, if it is assumed that the US has trade barriers against Turkey in car production, this would increase the demand for US cars even if the US dollar appreciates. So, it can be said that trade barriers tend to appreciate local currencies in the long run.

Preferences over the goods produced are another important determinant of the exchange rates. For a local currency to appreciate, the country should be a net exporter, whereas the high level of demand for imported goods and services tends to depreciate the local currency in the long run.

Productivity is also associated with the exchange rate. An increase in the productivity of tradable goods tends to decrease the overall prices in a country. Therefore, increased productivity causes the local currency to appreciate in the long run.

Other than tradable goods, there is another factor that is important in explaining the exchange rate changes. The relative return on foreign currency is an important indicator for investors. An investment decision to hold a currency by an investor is decided by the interest rate offered for that currency. Moreover, since these interest rates affect the demand for the currencies, the interest rate changes affect the exchange rate.

It can be said that there is a positive relationship between the domestic interest rate and the value of the domestic currency. If the domestic interest rate increases, then the domestic currency will appreciate. Such is true if the interest rate offered for the foreign currency remains the same. On the other hand, a decrease in the domestic currency's interest rate will result in a decline in that currency's value against foreign currencies since the demand for the domestic currency will decline. Again these conclusions made on the basis that everything else other than interest rates is constant.

On the other hand, an increase in the interest rates for the foreign currency causes the domestic currency to depreciate against the foreign currency. Conversely, a decrease in the interest rates for foreign currency will cause an appreciation effect in the value of the domestic currency.

Another element that is important for the exchange rate changes is inflation. Inflation can be defined as the overall price increase. Although it is an essential part of an economy to have inflation to keep the economy growing, it also means a decrease in

the value of the domestic currency. Holding everything else constant, inflation causes a reduction in the value of the domestic currency against the foreign currencies.

Moreover, foreign exchange operation is an important part of the banking sector. Given the increased globalization of financial operations, banks play a big role in integrating the different parts of the world. Therefore, changes in exchange rates can play a major role in bank performance. In countries where the exchange rate is fragile, rapid depreciation can create pressure on the banking sector. Turkish economy experienced such a rapid depreciation and this may affect the bank performance adversely. Moreover, the increased availability of foreign funds at a low-interest rate also increased the share of foreign funds in the Turkish banking sector. Such increased borrowing may cause vulnerability in the sector. Therefore, it is important to analyze the riskiness of the sector. An increased share of foreign funds and a volatile exchange rate can increase the sensitivity to exchange rate shocks.

This thesis contributes to the literature by identifying the policy shifts of the Turkish banking sector from balance sheet items. We analyze the moves made by the sector rather than focusing solely on the policy implications. Instead of focusing on the micro-level risks of the Turkish banking sector, this thesis studies the industry-level foreign exchange risk. In addition to focusing on the balance sheet items, some causality analyses are done as well. Such kind of analysis is important to see whether one of the items in the model helps explain the other item in the model. The Granger causality test is a statistical hypothesis test for determining whether one-time series is useful in forecasting another. In other words, in the relationship between the two time series, the series may be related to past lags of the other series. Results of this study indicates that short-term needs of the sector increased. Exchange rate increases results in a decrease in the foreign borrowings of the sector.

According to the results of this study, some macroprudential policies can be advised to reduce the foreign exchange risk of the sector.

The analyses are held for the January 2008 and December 2021 period via monthly and quarterly data. As well as assessing the FX risk of the sector, the thesis also focuses on the policy shifts made by the sector in the same period. Money market statistics and borrowing activities of the banks are assessed to see the policy shifts in the sector.

CHAPTER 2

LITERATURE REVIEW

There is huge literature regarding the bank performance and the banking sector risk. In this part of the thesis, some studies are quoted based on the topic they cover, the countries they inspected, and the methods they use. The quoted papers are grouped in terms of the topic they cover. To give a better picture regarding the topics at hand, different papers are added into the literature review investigating different countries with different methods. The first topic covered in this part is the systemic risk.

Huang et al. (2019) study the systemic risk in the Chinese banking system for 16 banks by estimating the marginal expected shortfall (MES), the systemic impact index (SII), the vulnerability index (VI), and the conditional value at risk (CoVaR) for the 2007-2014 period to capture different aspects of the systemic risk. Their findings indicate that systemic risk in the Chinese banking system declined following the global financial crisis, however, began to rise in 2014. A similar study analyzes the Korean banking sector. Yun and Moon (2014) use MES and CoVaR to examine the systemic risk in the Korean banking sector. Their analyses show that, firstly, although these two systemic risk measures are different in defining the contributions to systemic risk, both are qualitatively similar in explaining the cross-sectional differences in systemic risk contributions across banks. Secondly, it is found that certain bank characteristic variables such as size and leverage ratio are essential to explain systemic risk contributions. Elnahass et al. (2022) investigate the effect of systemic risk for 14 countries in the Middle East and North Africa (MENA) region between 2010 and 2018 by using CoVaR analyses, and state that high systemic risk for the banks escalate the

instability of financial markets. Sengul and Yilmaz (2019) study the systemic risk in the Turkish banking sector using MES and Δ CoVaR values for six Turkish banks. Their findings indicate that although the measures contribute separate rankings for the systemic risks, they are qualitatively similar in explaining the cross-sectional differences in systemic risk contributions. The study shows that the VaR of an individual bank affects the bank's systemic risk contribution in terms of cross-sectional and time-series dimensions. In addition, the authors did not find a close link between leverage ratios and systemic risk contributions although an increase in leverage ratios causes an increase in systemic risk contribution in the long term. Lastly, it is found that the size of a bank is weakly related to systemic risk contribution.

Wang et al. (2015) use the Merton model to estimate the systemic risk of China's banking industries. They choose the data of Chinese listed banks on a 5-year basis (2007-2011). The model focuses on the change in bank asset price and view of the risk infection. The authors conclude that the probability of a crisis in the Chinese banking system is low in terms of asset value analysis. However, it is also advised to prevent risk by improving single bank risk resisting ability, improving asset pricing mechanism, blocking risk transmission channels, and strengthening external supervision.

Another study done by Fan et al. (2021) investigate the systemic risk of the Turkish banking sector by a systemic risk measurement framework of the fractional Brownian motion method. The study focuses on the period between 2014 and 2019. The results suggest that the systemic risk peaked in 2017, and between 2016 and 2018, the banking sector was unstable. However, after the government stimulation, the overall risks were reduced.

The next topic at hand is the dollarization since it is a topic related to exchange rate.

De Nicolo et al. (2005) study the effect of deposit dollarization on the financial deepening of the onshore financial system, the causes of deposit dollarization, and banking risk for 100 countries between 1990 and 2001. Their findings suggest that

dollarization helps the economy to have more monetary depth than otherwise in inflationary environments. Ozsoz (2008) investigates the effects of financial dollarization on commercial bank performance between 1991 and 2004. The study is conducted with bank-level data in 11 developing countries, and it shows that dollarization is not directly related to bank profitability. The analysis of loan-loss provisions indicates the significant effect of FX deposits on the changes in the banks' bad loans to their overall loan portfolio ratios.

Işık and Şendeniz-Yüncü (2022) study the effect of dollarization on bank performance in Turkey between 2012-2017. Quarterly data for 26 banks are used in the study. Return on assets (ROA) and return on equity (ROE) measures are used to assess the effect of dollarization on bank profitability. Both static and dynamic panel data analysis are conducted in the paper. It is found that dollarization has a negative impact both on banks' return on assets (ROA) and return on equity (ROE). Moreover, in dollarized economies, the exchange rate risk is transferred to credit risk via bank loans.

Caglayan et al. (2021) examine dollarization in Turkish banking sector between 2002 and 2018 with quarterly data. The authors state a significant currency mismatch problem in banks' balance sheets. It is argued that less than 30% of the foreign-denominated deposits turn into foreign-denominated credit. Moreover, for banks, a greater currency imbalance signals that they are more likely to extend their domestic currency loans. Deposit dollarization helps the banks profit more from their domestic currency-denominated loans, but this method also increases the exposure to the exchange rate risk.

As a potential risk management tool, the financial derivatives is also an important tool for the banking sector as mentioned below. This topic is included in the literature review part due to its importance in terms of risk management.

Li and Yu (2010) study the impact of derivatives on U.S bank holding companies. They found that having larger values on non-traded derivatives signals to a better bank performance. Moreover, a discrepancy between the positions taken by the participative

banks and dominant banks is found. While dominant banks use derivatives as an instrument to hedge against risk, participative banks take speculative positions in the name of risk management. The authors state that the intention to use the derivatives contracts is important. If they are used to hedge against the underlying risks, it can be beneficial for the banks.

Adkins, Carter, and Simpson (2007) study the effect of managerial incentives on derivatives use and the use of FX derivatives by large US bank-holding companies. The authors use a Heckit model to separate the factors for a possible derivatives use by bank holding companies and extent of derivatives use. The data is from 1996 to 2000. It is found that higher institutional ownership positions signals more derivatives use by the bank holding companies to ensure stable cash flows. Similarly, Higher ownership of insiders is also indicates the higher levels of hedging. Moreover, the bonuses offered to managers also encourages them to use derivatives for hedging purposes to ensure good performance of the company.

Although this thesis focuses on the exchange rate related policies of the Turkish banking sector, it is important to see the banking sector overall performance. The studies below are focusing on the overall performance of the Turkish banking sector. These studies are important in the sense that they give a bigger picture regarding the bank performance in Turkey, rather than focusing solely on one aspect.

Demir (2021) analyzes the financial performance of the Turkish banking sector between 2009 and 2019 using “Multi-Criteria Decision Making” methods. For the evaluation, 14 financial criteria are used in a proposed model. After determining the model's weights by Rank Order Centroid (ROC) and Indifference Threshold-based Attribute Ratio Analysis (ITARA) methods, the weights are combined based on the Bayesian approach to find the final weight coefficients. After observing the most critical performance criteria, lastly, the Combinative Distance-based Assessment (CODAS) method is used to analyze the performance of the Turkish banking sector. The analyses indicate a significant instability in the Turkish banking sector.

Saniç and Şendeniz-Yüncü (2021) study the bank profitability in Turkey between 2007 and 2016. The sample includes 26 commercial banks in Turkey from which 7 of them are large and 19 of them are small. The authors aim to assess the explanatory power of capital adequacy ratio on bank profitability in Turkey. Moreover, the effect of bank size and openness to trade on profitability is studied. Return on assets, return on equity and net interest margin are the profitability measures used to conduct the analyses. It is found that there is a positive relationship between the capital adequacy ratio and bank profitability. The positive relationship between the openness to trade and bank profitability is also documented in the paper. In addition, bank size is an important factor affecting the profitability dynamics.

Not to solely focus on the banking sector performance, real economy side is also included in this part. Below are quoting two papers regarding the real economy and macroeconomic indicators.

Şendeniz-Yüncü (2020) study the effect of the financial structure on the real economy for 23 emerging economies between 1980-2017 via Panel least squares and Generalized Method of Moments (GMM). The paper stated that although until 1995, Turkey experienced a bank-based structure, after 1995 a market-based structure is observed. It was also interesting to observe a bank-based structure in Turkey again after 2012. The author indicates that as a country moves away from the optimal financial structure, its economic development is negatively affected. It is said that rather than following the strategies from the developed economies, emerging economies should follow a tailor-made program for a higher level of economic development.

Schularick and Taylor (2012) study credit growth with money, credit, and macroeconomic indicators. They analyze these indicators for 14 countries between 1870 and 2008. Their findings suggest that credit growth is a powerful indicator when predicting financial crises. Another finding of the study is documented to be large financial systems are inclined to have more crises. According to the article, the authors argue that endogenous credit growth can generate economic instability although

detailed research is suggested. However, it should be noted that not every credit growth is a signal of crisis. In periods of financial development and innovation, credit growth can boost economic activity.

Lastly, the effects on exchange rate on the banking sector are included. To give a better picture, different countries and methods are included in the literature review. This side of the literature review is longer since it is the most related part regarding the topic of this thesis.

Osundina, Ademola, Jayeoba, and Olayinka (2016) study the effects of exchange rate changes in the Nigerian banking system between 2005 and 2014. In the study, exchange rate volatility is measured by the yearly return of the US Dollar to the Naira. To assess the bank's performance, two aspects are taken into consideration namely bank profitability and liquidity. The return on assets (ROA) is used to test the effects of exchange rate on bank profitability, while loan to deposit ratio (LDR) is used as a variable for bank liquidity. Their results support the traditional view that exchange rate fluctuations can result in uncertainty in profits and lessen international trade. Such fluctuations also prevent banks from obtaining the desired level of profits from the exchange rate market. Another finding was that the depreciation of the Naira causes a fall in the liquidity of Nigerian banks. It is stated that the Nigerian banking system is crucial to the Nigerian economy, therefore, to strengthen the Nigerian banking sector by appreciating Naira, the Nigerian government should implement policies to reduce the level of imports and support local businesses.

Wong, Wong, and Leung (2009) study the foreign exchange risk exposure of the Chinese banking sector. The study is conducted with the data of 14 Chinese banks using the equity price data in the Chinese stock market and the Hong Kong stock market. They state that the increasing internationalization of Chinese banks with the absence of local market instruments to hedge the exchange rate risk may mean that Chinese banks' exposure to exchange rate fluctuations increases over time. As mentioned in the study by Chamberlain et al. (1997), authors mentioned that it is difficult to obtain the

overall exchange rate exposure of the Chinese banking sector solely from the accounting data. It is mainly since rather than holding foreign-related assets or liabilities, Chinese banks tend to have credits given to the exporters and importers which creates an indirect foreign exchange rate exposure for the Chinese banking sector. As a result, the competitiveness and the profitability of importer/exporter firms create a foreign exchange rate risk for the Chinese banking sector. As more information on Chinese banks became available starting in 2005 since these banks became publicly traded on the Chinese stock exchange.

The capital market approach is used in the study to assess the foreign exchange rate exposure of Chinese banks. There are some reasons why this method is utilized in the paper. Firstly, the estimates obtained with this method are forward-looking and can be used to assess the default risk of Chinese banks. Moreover, this method solves the problem of lack of observations in the cash flow method. As a result of these facts, the authors used the capital market method to conduct their analyses. Their results indicate a positive relationship between the foreign exchange rate risk and bank size. Authors say that this is mainly due to the larger banks tend to have more involvement in foreign exchange operations. Another reason is that, as mentioned above, larger banks tend to have more business with international corporations, for which competitiveness and profitability are important to the banks.

Moreover, the banks listed in the Chinese stock exchange have more exposure to the exchange rate risk than their Hong Kong stock exchange listed counterparts. As mentioned above, this can be attributed to the lack of instruments available in the local market to hedge against the exchange rate risk for Chinese banks. Another reason may be the lack of experience in managing the exchange rate risk.

The empirical results indicate that the negative exchange rate risk is more prevalent in the Chinese banking sector. Since lower equity values mean more default risk, the findings mean that an appreciation of the renminbi is likely to increase the default risk of Chinese banks.

Agarwal (2021) studies the foreign exchange risk of banks and the effects of exchange rate shocks on the real economy. It is argued that the net foreign currency position of banks is an important channel for transferring the exchange rate effect to the real economy. It is stated that the exchange rate effect on output is dependent upon the net positions of the banks. However, it is stated that there have been relatively few works done regarding this subject. This is attributed to the lack of availability of data on the micro-level currency risk exposure of banks. Another reason is that it is hard to isolate and assess the effect of the impact of the exchange rate on the real economy. Researchers resolved the microdata problem by collecting a micro-level data set on banks' exposure to foreign exchange rates and bank-firm relationships. This is done to find out the causal impact of currency appreciation on banks' lending behavior and the real economy. To find a natural experiment-like setting authors focused on the period of currency appreciation in Switzerland.

Firstly, it is tested whether the local currency appreciation affects the real economy through the banks' lending behavior in Switzerland. Secondly, researchers use the periods of local currency depreciations across countries to see if the heterogeneity in the reaction of output to currency depreciations can be explained by the bank lending channel. The results suggest that the net foreign exchange exposure of the banking sector is important in transferring the exchange rate shocks to the real economy via banks' lending behavior both in the Swiss Franc appreciation case and the cross-country depreciation examples. The expected drawbacks of Swiss Franc appreciation are offset by the positive effect of domestic banks' lending behavior.

Atindehou and Gueyie (2001) studies the exchange rate sensitivity of Canadian chartered banks for the 1988-1995 period using the three-factor asset pricing model (interest rate, market, and exchange rate). Their main objective is to see whether Canadian banks' stock reactions differ in local currency appreciation and depreciation cases. The results suggest that the US dollar/Canadian dollar exchange rate is a factor

in explaining the Canadian banks' stock returns. The exchange rate factor is also complementary to the traditional factors which are market and interest rate indices. The most exchange risk exposure for Canadian banks are coming from the US dollar/Canadian dollar exchange rate. However, this study lacks an analysis of the off-balance sheet items and other instruments used for hedging purposes.

Au Yong, Faff, and Chalmers (2009) investigate whether the actions taken in the derivatives market are related to Asia-Pacific banks' interest rate and exchange rate risk. The activities in the derivatives market reduce the short-term interest rate exposure of Asia-Pacific banks while there is no significant effect in the long term. The speculative use of derivatives might be the reason behind their non-significant effect of them on the long-term interest rate risk. The effect of the use of derivatives on the exchange rate risk is not significant.

A similar study done by Choi and Elyasiani (1997) focuses on the derivatives, interest rate, and exchange rate risk of banks. The study uses monthly data for 59 large US banks and covers the period from January 1975 to December 1992. Although traditional studies analyze the effect of off-balance sheet items, these researches do not have a particular focus on the risks listed above. The study conducts an estimation of the effects of both on-balance and off-balance sheet items on the interest rate and exchange rate exposure. It is unique in terms of including the estimates of the impacts of off-balance sheet items on the interest rate and exchange rate risk. Dependencies across equations are taken into account as well as heteroscedasticity and serial correlation. Firstly, the beta values are estimated for interest rate and exchange rate risk for individual banks. Secondly, the betas are calculated as a function of derivative and bank-specific basic risk variables.

The results indicate that the beta values for the FX rate and interest rate vary significantly across periods and banks. The authors state that this is stemming from the individual positions of banks. The results prove the importance of traditional balance sheet variables and derivatives variables in explaining the bank-specific betas for both

exchange rates and interest rates. The use of derivatives contracts adds significant systemic risk for the banks. Exchange rate derivatives have a bigger effect on the systemic exposure of banks when compared to interest rate derivatives.

Martin and Mauer (2003) study the short-term and long-term exchange rate exposure of US banks based on a cash flow approach. The paper focuses on 105 US banks over the 10 years between 1988 and 1998. It is found that domestic banks are exposed to the exchange rate risk more than international banks. Therefore, the paper suggests that economies of scale may be attainable in banking as well. It is stated that it can be hard for domestic banks to implement exchange rate management necessities because they have relatively low volumes in exchange rate operations. However, stricter measures for FX risk management should be implemented according to the authors.

Another important point was made regarding the long-term exposures of domestic US banks. Long-term FX exposures are more widespread than short-term exposures. Combining the lack of resources to implement the necessary exchange rate risk management, the findings regarding the long-term exposures are consistent with the empirical results from the paper. In addition, since the long-term FX rate risk is more prevalent than short-term risk, it can be inferred that shorter-term risks are easier to identify, hedge and manage.

Abbassi and Bräuning (2023) study the effect of the exchange rate risk and currency mismatch risk on the credit supply. In other words, the researchers focus on the effect of a bank's exchange rate risk on the real economy. Findings suggest that foreign currency risk affects the real economy adversely by causing a reduction in credit lines. To be more specific, when the exchange rate moves adversely, currency mismatches create losses for the banks. As a result, the lending activity reduces, and firms' ability to invest declines which results in reduced economic activity. To test this, authors focused on the aftermath of the Brexit referendum when the result of it caused a shocking decrease in the value of the British Pound. The resulting realization of

currency mismatch caused the banks to decrease their lending activities. As a result, the firms were able to invest less and this triggered a reduction in economic activity.

The result of this study is important since it is indicating that exchange rate shocks are not transmitted only through firms but also by banks that have unbalanced net foreign currency positions. To have a complete view of the macroeconomic scope, the authors suggest that these findings should be taken into consideration.

Hahm (2004) investigates the exchange rate and interest rate risks of the Korean banking sector before the 1997 crisis. The author indicates that the unanticipated moves in interest rates and exchange rates may trigger a serious deterioration in the bank balance sheet. It is stated that if the assets of a bank have a longer duration than liabilities, then a sudden increase in market interest rates affects the bank's balance sheet adversely. Indirect effects include a decrease in the cash flows of the banks.

On the other hand, a sudden decrease in the value of the local currency may affect the bank balance sheet negatively if the FX-denominated liabilities of the banks are more than FX-denominated assets. An indirect effect of FX risk for the banks in emerging economies is stemming from the non-financial firms since generally they carry large amounts of foreign debt. The foreign exchange exposure of those firms may cause defaults on their loans. In turn, those defaults may trigger a substantial worsening of the bank balance sheet as the quality of assets decreases. Another point made in the paper is that an unanticipated depreciation can cause an increase in interest rates since the increase in import prices may trigger the same response in inflationary expectations.

The author uses the sensitivity of stock returns as a measure of exposure. The study follows a similar method that is used in the paper by Choi et al. (1992). The sensitivity of the Korean banking sector to the interest rate and the exchange rate is analyzed in a three-factor model where the market portfolio returns, interest rate, and exchange rate factors are used. These three factors are included in the sensitivity estimate of bank stock returns to assess the interest rate and exchange rate exposure of the sector in Korea. Different industries and periods were taken into account for the analysis. For

the 1994-1997 period, the interest rate and exchange rate exposures increased according to the findings of the study. The sudden depreciation of the Korean Won and the high-interest rate policies played an important role in turning the currency crisis into a complete financial crisis.

Karasoy (1995) studies the Turkish banking sector's exchange rate risk management with a portfolio model. Both the foreign exchange and domestic currency-denominated items are included to analyze how a change in interest rates in foreign and domestic currencies and the volatility affect the portfolio structure of a Turkish bank. It is indicated that state and private Turkish banks are more sensitive to changes in interest rates than the changes in the volatility of exchange rates. In contrast, the exchange rate risk and the interest rate changes are highly effective in explaining foreign banks' foreign exchange rate behavior.

Research done by Keshtgar et al. (2020) focuses on the impact of exchange rate volatility on banks in Iran. They used exchange rates to assess the determinants of bank performance. The study is done for the period 2007-2017 for 14 Iranian banks. Since they found that the exchange rate data have heterogeneity in variance, the ARCH model is utilized and the GARCH method is used to derive the exchange rate fluctuations using panel data. It is found that the exchange rate fluctuations increase the ratio of lending to total deposits which in turn increases the financial gap. As a result, this movement in the above-mentioned ratio creates credit risk for the banking sector in Iran. Another finding is that exchange rate volatility affects the return of capital adversely.

Another study by Chamberlain, Howe, and Popper (1997), studies the exchange rate risk exposure of US and Japanese banks and the relationship between exchange rate risk and different accounting measures of risk. The latter analysis is conducted only for US banks. The authors aim to weigh the usefulness of accounting measures. They compare the exchange rate sensitivity of selected US and Japanese banks' equity returns. The Japanese and the US examples are chosen to get a better understanding of

the international differences in exchange rate risk. To assess the exchange rate risk correctly, they observe the sensitivity of the changes in total bank value as the exchange rate changes. Therefore, they define the exchange rate risk as the regression of banks' assets on the exchange rate. It is found that, although the US bank equity returns move with the exchange rate, few of the Japanese banks do so. The authors claim that this difference may arise from the operational and regulatory differences between the two countries. The relationship between the net foreign asset position and its foreign exchange risk exposure is negative. Banks with off-balance sheet items in terms of foreign currencies are less exposed to foreign exchange risk which is consistent with off-balance sheet hedging. The accounting measures give a partial explanation of the foreign exchange risk of banks since cash flows, and competitiveness of banks are affected by exchange rate changes. Therefore, it can be said that the net foreign assets positions of the banks are not good enough to explain all the exchange rate risks that a bank bears. In the study, the example of a US domestic bank was given. Although this bank did not have any foreign exchange risk accounting-wise, it still was exposed to currency risk. If it is assumed that this bank gave a credit to a US-based exporter, then this bank would be exposed to the currency risk as well as the exporter itself. If the US Dollar appreciates, then the competitiveness of the exporter may weaken. The increased level of default risk of the exporter would mean a higher level of currency risk for the bank in this example. The authors also mention that the accounting-based exchange rate risk exposure is the easiest to spot.

Bleaney, Bougheas, and Skamnelos (2008) focus on the interaction between currency crises and exchange rate crises. They state that the literature is divided into two different categories in terms of the assumptions made. In the first category, it is assumed that a currency mismatch risk arises from the foreign loans taken by the domestic banks, which have domestic currency-denominated assets consisting of borrowings to domestic agents. In the second category, it is assumed that banking systems are not exposed to such a risk. The authors state that they have the latter assumption for their paper. The paper contributes to the literature in three ways. Firstly,

they prove that the panic started in either banking or the foreign sector can spread to the other even in cases where the two do not correlate to each other. They study the domestic depositor's role in currency and banking crises. Moreover, they consider bank deposits as a source of currency speculation. So rather than solely focusing on the foreign deposits of domestic banks as a variable for twin crises, they take a different approach to test their case. This view also differs from analyzing the foreign exchange exposure to bank assets. The last contribution of the article to the literature is studying the effects of a "suspension of convertibility" of bank deposits on the foreign exchange market. Their findings suggest that the interaction between the currency peg and the stability of the banking system is evident if bank deposits are used for currency speculation. Furthermore, bad news about the banking system may trigger a response from the depositors which may create enough liquidity to cause a speculative attack on the exchange rate. According to them, high expected gains from exchange rate movements may disrupt the soundness of the banking system. If the expectation is that the other depositors are going to have such expectations, then there will be twin crises, otherwise, since the trust in the exchange rate regime continues, there will be no crises at all. According to the findings, if the banking sector has a strong basis, then "suspension of convertibility" may protect the sector from currency speculation. If the basis of the sector is not good enough, then the suspension of convertibility will not be able to prevent the exchange rate from floating.

Another study done by Ye and Hutson (2011) focuses on the FX risks of the Chinese banking sector in a managed exchange rate environment. They use a three-factor capital market approach model, including the market return, interest rate, and exchange rate factors in the model. The authors add the dual listing component (Chinese and Hong Kong stock exchanges) to widen the scope of the paper. It is done so by adding the market portfolio returns for both stock exchanges. The study examines 14 Chinese banks' foreign exchange risk between 2005 and 2009 using daily data.

They found that most of those banks are highly exposed to exchange rate risk. Although it is generally assumed that Chinese banks would suffer less from exchange rate changes as the RMB/USD exchange rate is heavily controlled, such is not the case according to the findings of this paper. The authors state that in an economic environment where globalization plays a key role in trade, the controlled exchange rates do little to relieve the exchange rate exposure. The resulting decline in global demand after the 2008 crisis appears to create pressure on the exporter firms in China. As a result, the indirect foreign exchange exposure of Chinese banks significantly increased. As China will get more integrated into the global economy by further internalization of banks and financial liberalization, the resulting increased and more complicated exchange rate risks should be carefully managed. The authors state that better risk management systems will be an important duty for the Chinese banking sector to accomplish.

Another finding is regarding the hedging activities of the Chinese banking sector. It is found that there is a significant exchange rate exposure after the hedging is taken into account. This is a clear indication that the Chinese banking sector is not very successful to hedge against the foreign exchange rate risk. This is partially attributed to the lack of adequate risk management tools in China. The authors suggest a detailed study to test whether Chinese banks can manage their exchange rate risk efficiently.

In terms of policy implications, the authors suggest a wider usage of risk management tools. Another suggestion is that the regulators should be aware of both indirect and direct exchange rate exposure.

Ryan and Worthington (2004) study the interest rate, foreign exchange rate, and market risks in the Australian banking sector. The authors use a version of the Generalised Autoregressive Conditional Heteroskedasticity in Mean (GARCH-M) model to test the risks mentioned above. The paper covers the period 1996 to 2001. Australian bank stock to the three risks mentioned above is tested in the study. Authors use daily data in their analysis. Australian bank portfolio returns, short, medium, and long-term

interest rates, a market accumulation index, and a foreign exchange index are used to conduct the analysis.

The authors focus on the Australian banking sector to look into a different environment. They state that the majority of the studies were conducted on North American cases. In this sense, this study is an important one for focusing on a different part of the world. Moreover, another important aspect of the paper is regarding its focus on the exchange rate risk of the Australian banking sector. It quantifies the exchange rate risk of the Australian banking sector which makes this paper a unique one in its area. It is found that market risk is an important concept in explaining bank stock returns. The same is true for short and medium terms interest rates. However, the long-term interest rates and the foreign exchange rate are not significant enough to make an impact on the bank stock returns.

One limitation of this paper is that it focuses on the Australian banking sector as a whole, rather than assessing the risks of each bank. Another paper regarding this issue can be constructed to have a better and more detailed look into the Australian banking sector.

Kasman, Vardar, and Tunç (2011) study the foreign exchange rate and interest rate risk of Turkish banks by using bank stock returns. Ordinary Least Squares (OLS) and the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) methods are employed to conduct the analysis. The analysis is done for the 13 Turkish banks that are listed on the Istanbul Stock Exchange for the period 27 July 1999 and 9 April 2009. The data used for the paper includes daily closing prices for the stocks, the closing price of the bank index, interest rates, and exchange rates.

Results of the paper suggest that the interest rate and exchange rate risk have a significant negative impact on bank stock returns. The strongest impact on the bank stock return comes from the market returns rather than interest rates and exchange rates. Findings for the Turkish banks are consistent with the emerging financial markets where there are not many hedging options in derivatives markets to hedge against

interest rate and exchange rate risk. The predictable effects of interest rate and exchange rate changes on stock returns suggest a close monitoring of the investors' portfolio.

Choi, Elyasiani, and Kopecky (1992) study with a multifactor model to assess the sensitivity of bank stock return to interest rate, exchange rate, and market risks. The study includes the monthly data of the 48 largest banks in the US for the period January 1975 to December 1987.

To provide estimations for the unforeseen components of the market risk, interest rate, and exchange rate risk, the authors created a micro model. Both actual and unexpected values are used to conduct the analysis. Although the findings of the paper are consistent with the literature, the exchange rate-related indications are important. According to the results, the impact of the exchange rate variable differs between different periods. A partial explanation for this is given as the changing net foreign currency positions of the US banks. However, these findings do not give insight into the size of the hedged positions in the US banking sector. In conclusion, the exchange rate risk should not be omitted when analyzing the returns of the bank stocks.

A similar study is conducted by Sukcharoensin (2013), which focuses on the market, interest rate, and exchange rate risk of Thai banks. The author employs the GARCH approach. The data contains ten banks for the sample period between 4 January 2005 and 31 May 2012. The stock return data is daily in this study.

The findings suggest that large banks are more exposed to market risk than medium or small-sized banks. Moreover, large banks tend to take advantage of the changes in interest rates since they are more competitive. On the other hand, small and medium-sized banks may suffer from adverse exchange rate changes and this may result in inefficient management of interest rate risk. Therefore, there are both negative and positive effects of interest rate changes on banks. Large and medium-size banks do not have a significant exchange rate exposure according to the findings. The author relates

this to the effective hedging of the foreign exchange exposure of the banks. However, for small banks, there is a significant exchange rate risk.

Grammatikos, Saunders, and Swary (1986) focus on the risk and return of the US banks in terms of foreign currencies by including both the foreign exchange rate and foreign currency interest rate in their model. Researchers use five foreign currencies in their paper, namely the British pound, the German mark, the Japanese yen, the Canadian dollar, and the Swiss franc. The monthly data is obtained for the period between December 1975 and November 1981. The analysis is done by assessing the exposure of US banks against the failure of foreign currency portfolios.

According to the results, by adjusting their foreign currency positions, the US bank may achieve considerable risk reductions. In addition, the returns from the foreign currency portfolio were positive in face of expected exchange rate changes and surprise exchange rate changes. However, the surprise movements in foreign currency interest rates harmed the foreign currency portfolio. Moreover, the overall returns of the portfolio were positive. On the other hand, the return performance was relatively poor when adding the risk adjustments into the analysis. According to the results, a possible failure of a representative bank in a foreign country had a low level of impact on the US banks since those banks have the necessary funds to cushion such losses.

However, there are a few limitations of this study. One of them is not considering the indirect effects such as confidence problems among investors. If such a problem occurs, then the withdrawals of funds from the banking sector may increase the pressure on the US banks. In addition, default and country-specific risks are ignored in the paper. Also, an individual bank-level study might give more insight into the exchange rate portfolio performances of different banks in the US.

Hooy, Tan, and Nassir (2004) study the sensitivity of Malaysian banks' stocks to interest rate and exchange rate. They use the GARCH method. It is found that there

were no significant differences in terms of exposure for the Malaysian commercial banks before and after the Asian crisis. Some bank policies that are implemented seem to have a large negative impact on the sector. These policies include capital controls, a forced banking consolidation program, and a fixed exchange rate policy. Before the 1997 Asian crisis, financial risk factors did not affect Malaysian commercial bank stocks. The resulting overpricing of banks' stocks meant that the risks related to Malaysian commercial banking are not fully recognized. However, after the crisis, the risks are better recognized and priced for Malaysian bank stocks. Therefore, increased risk awareness will increase the efficiency of capital allocation. As a challenge of globalization, the Malaysian banking sector will manage the risks better in the long run according to the article.

Tai (2000) studies the impact of the market, interest rate, and exchange rate on the pricing of US commercial bank stocks. 31 commercial bank stocks are used in the study. Three different methods are employed in the paper. Results from the nonlinear seemingly unrelated regression method indicate that the interest rate risk is the sole priced factor in the three factor model. Another method called "pricing kernel" which was taken from the study of Dumas and Solnik (1995) is employed in the study. The results obtained from this method reveal that there is significant exchange rate risk for US banks regardless of being a regional or large bank. The last estimation method employed is the GARCH-M method. The results indicate the impact of interest rate and exchange rate risk change over time.

CHAPTER 3

DATA AND METHODOLOGY

To see the effects of the FX debt level of Turkish banks on the riskiness of the banking sector, monthly data is used between January 2008 and December 2021. The large dataset helps us to see the change in the riskiness of the sector. The data sources are the Central Bank of the Republic of Turkey (CBRT) Electronic Data Delivery System (EDDS) database and Data Query System of The Banks Association of Turkey.

Table 3.1: Variable Names and Descriptions

Variable	Description
DB/TB	The ratio of domestic borrowings to total borrowings of Turkish banking sector
Derivatives Assets	Total derivatives assets of Turkish banking sector
Derivatives Liabilities	Total derivatives liabilities of Turkish banking sector
FB/TA	The ratio of foreign borrowings to total assets of Turkish banking sector
FB/TB	The ratio of foreign borrowings to total borrowings of Turkish banking sector
Foreign Currency Deposits	Total foreign currency deposits in the Turkish banking sector
FX Rate (US Dollar/Turkish Lira)	US Dollar/Turkish Lira exchange rate
Net Position on Money Markets	Difference of assets and liabilities of Turkish banks on money markets
Short-Term Financing	Net position of Turkish banks on repo markets
TD/TL	The ratio of total deposits to total loans in the Turkish banking sector
Total Deposits	Total deposits in the Turkish banking sector
Turkish Lira Deposits	Total Turkish Lira deposits in the Turkish banking sector

Table 3.2: Descriptive Statistics

Variable	Min	Max	Mean	Median	Std. Dev	#of obs.
DB/TB	0.04	0.13	0.07	0.07	0.03	168
Derivatives Assets	967,878	237x10 ⁶	26x10 ⁶	12x10 ⁶	36x10 ⁶	168
Derivatives Liabilities	1,713,274	112x10 ⁶	18x10 ⁶	9x10 ⁶	21x10 ⁶	168
FB/TA	0.06	0.14	0.10	0.09	0.02	168
FB/TB	0.68	0.95	0.85	0.86	0.08	168
Foreign Currency Deposits	142x10 ⁶	3.093x10 ⁶	741x10 ⁶	479x10 ⁶	670x10 ⁶	168
FX Rate	1.17	13.53	3.40	2.31	2.32	168
Net Position on Money Markets	-177x10 ⁶	12x10 ⁶	-25x10 ⁶	2,484	43x10 ⁶	168
Short-Term Financing	18x10 ⁶	531x10 ⁶	109x10 ⁶	86x10 ⁶	88x10 ⁶	168
TD/TL	0.84	1.49	1.04	1.00	0.20	168
Total Deposits	335x10 ⁶	4.683x10 ⁶	1.479x10 ⁶	1.112x10 ⁶	1.084x10 ⁶	168
Turkish Lira Deposits	193x10 ⁶	1.808x10 ⁶	738x10 ⁶	632x10 ⁶	424x10 ⁶	168

Firstly, we need to outline the currency risk for the Turkish banks. In our analysis, after liquidity options became available for Turkish banks, they used foreign borrowing methods heavily to increase resources. When the US Dollar / Turkish Lira exchange was relatively stable, this might have been a profitable method for the Turkish banks to follow; however, after the Turkish economy became more fragile and the Turkish Lira started to lose value, the above-mentioned method may create problems for the Turkish banks. The ratio of foreign debt to total credits was about 90 percent for a long

time between January 2008 and May 2013. Although the ratio started to decline over time, still a very huge portion of the debt was foreign currency denominated.

Second, the gradual increase in the short-term needs of the Turkish Banks can also be observed in our data. Moreover, the increasing level of short-term needs can be observed from Figure 1. Since Open Market Operations are important to keep the financial markets stable, this side of the balance sheet signals an important need for the banking sector. The movements in this data can give us a clue regarding the increased short-term needs of the Turkish banking sector (see Figure 1).

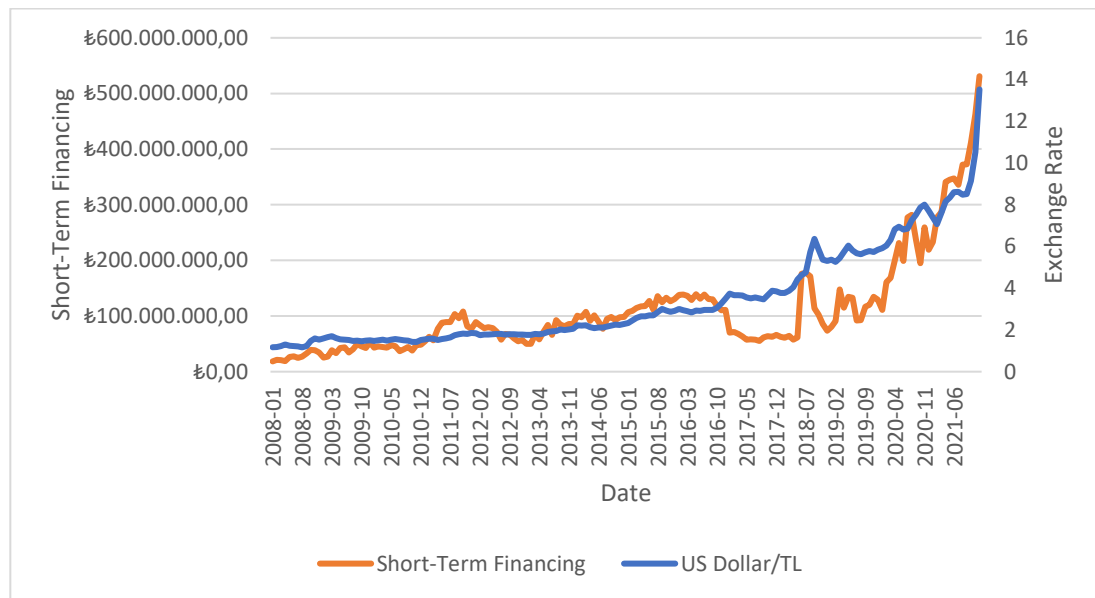


Figure 1 Short-Term Financing and FX Rate

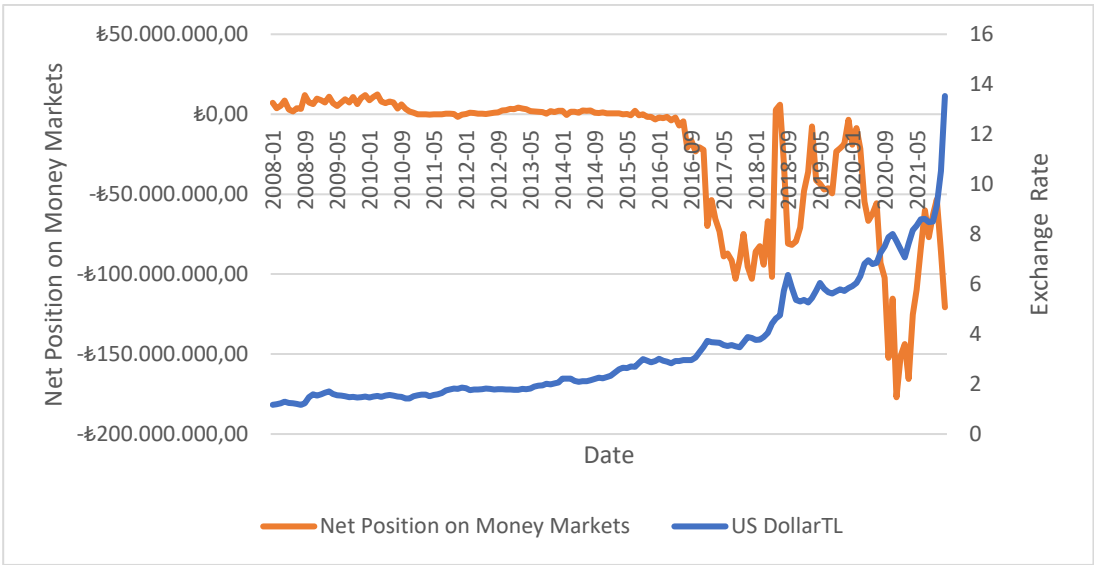


Figure 2 Net Position on Money Markets and FX Rate

Another proof of the increasing needs of Turkish banks can be seen in the net position in the money markets. In Figure 2, with some exceptions, the sector was lending to the market until September 2015; however, after that, it started to borrow from the market. There is an increase in the amount borrowed over time especially after July 2016 whereas the amount lent remained stable. After July 2016, the debt from the money market increased by more than 300%, from 7 billion TL to 23.4 billion TL. Banks changed their positions in money markets. The increasing needs of the sector pushed the lending from the money markets. The amount lent to the market stayed around 2 to 4 billion TL whereas, with some outliers, the amount borrowed was 73 billion TL on average.

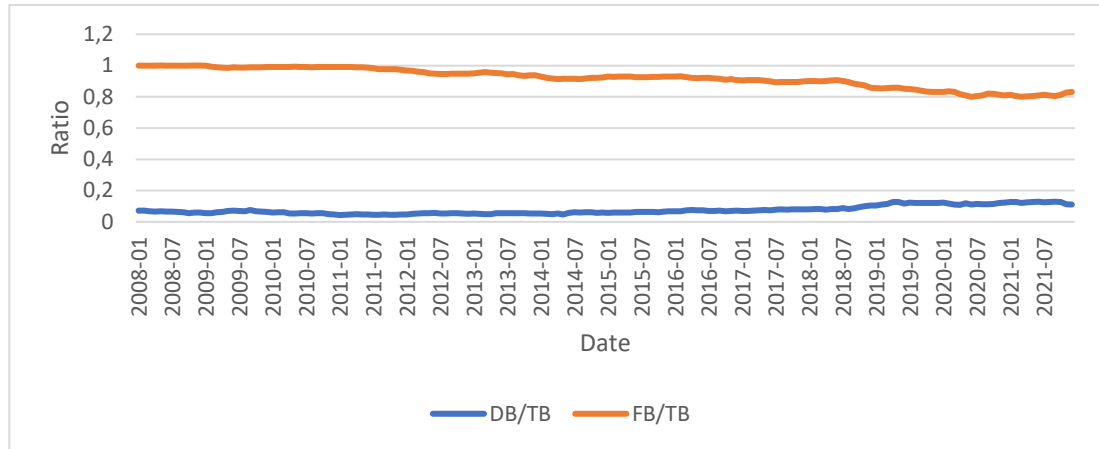


Figure 3 Distribution of Domestic and Foreign Borrowing

Figure 3 shows the proportions of domestic and foreign borrowings of the banks. It can be seen that there is a slight increase in the domestic borrowings. In addition, the foreign borrowing is reduced.

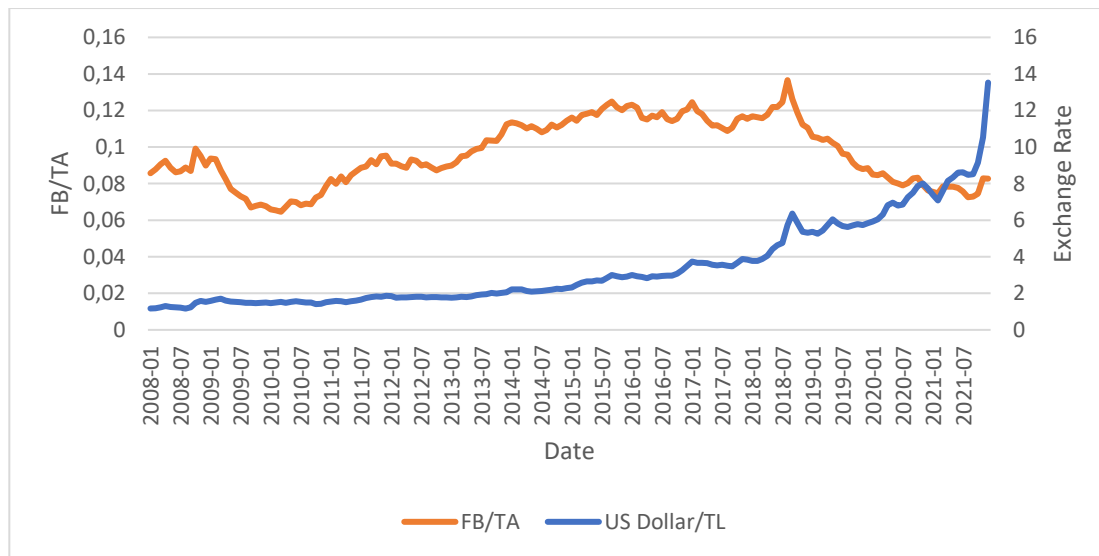


Figure 4 FB/TA and FX Rate

As the exchange rate increases, it is expected that due to the increased levels of currency mismatch risk, Turkish banks will try to close their foreign borrowings to reduce their risk. However, in Figure 4, in the last 3 months of 2021, there is an increase in the FB/TA ratio due to the increase in the exchange rate. Between November and

December 2021, the US Dollar/TL exchange rate increased to 29%. There is a 20% decrease in both foreign borrowings and total assets that are expressed in terms of US Dollars, whereas an increase is observed in both items in terms of Turkish Liras. Since all of the foreign borrowings are denominated in foreign currency unlike the total assets, a rapid increase in the exchange rate causes the FB/TA ratio to increase. In total assets, there are TL-denominated items, and an increase in those items (like credits) compensates for the exchange rate effect although not fully. Therefore, this unexpected movement in the ratio can be explained as the exchange rate effect on the FB/TA ratio.

Moreover, the Turkish banking sector's domestic debt levels have risen between January 2008 and December 2021. Therefore, it can be said that banks are trying to reduce their foreign debts and turn those liabilities into TL-denominated debt. Although the level of domestic debt is relatively low compared to foreign debt, it has risen from 3.5 billion TL to 115 billion TL over 13 years.

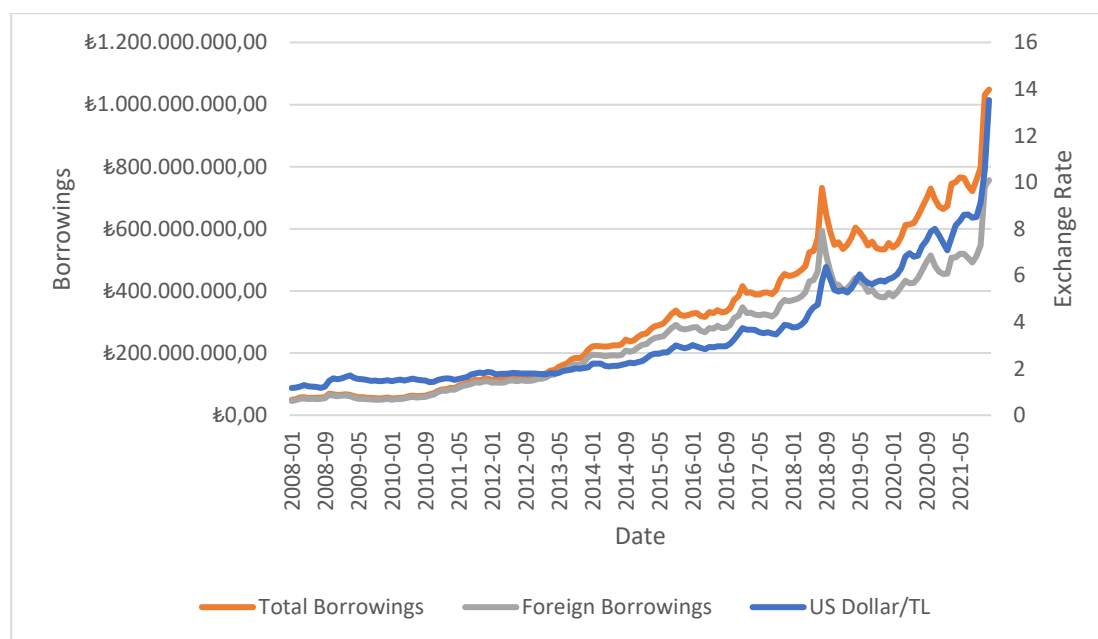


Figure 5 Foreign and Total Borrowings (TL) and FX Rate

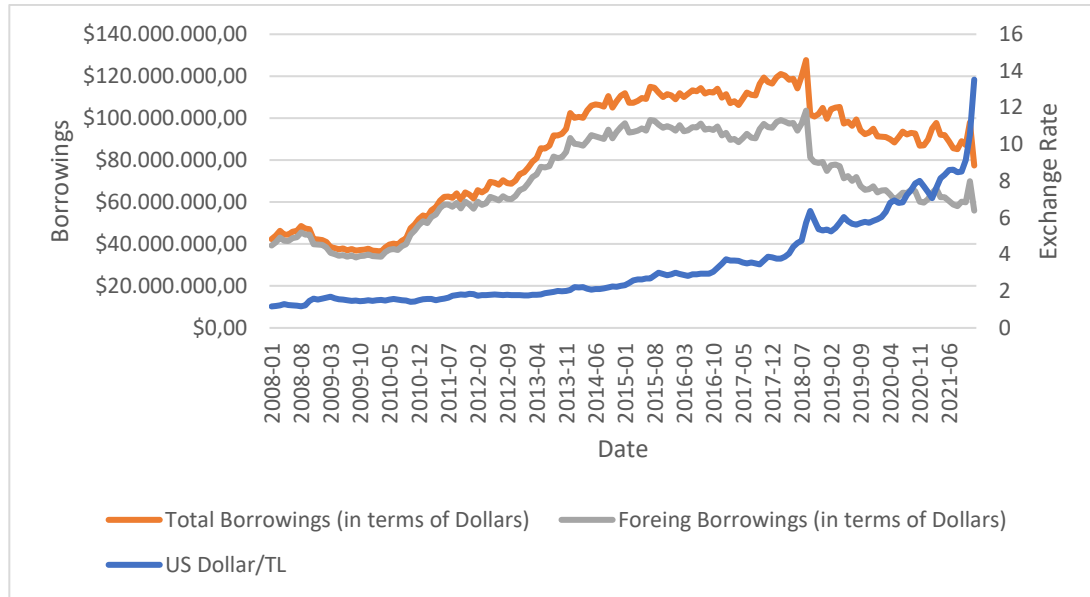


Figure 6 Foreign and Total Borrowings (\$) and FX Rate

Figures 5 and 6 show that; although an increase in the foreign borrowings in terms of Turkish Lira is evident in the data, when we turn this debt into US Dollars terms, there is a decrease in the foreign borrowings. This implies that the depreciation of TL surpasses the decrease in foreign borrowings. In these two figures, the exchange rate risk becomes obvious. This reduction in the number of foreign borrowings points out a switch in Turkish banks' policies. There are 2 sources of liabilities for banks to support their credit channels: foreign borrowings, and deposits. Since the foreign borrowings are reduced in terms of US Dollars, it can be said that the banks reduce their foreign debts and aim to increase the proportion of the funds taken from deposits to give credit.

Figure 5 presents that the exchange rate follows the pattern of the level of foreign debt. Banks have a very high level of foreign debt, which requires high demand for foreign currencies since these debts require regular payments. In our case, the US Dollar / Turkish Lira exchange rate follows the pattern of the foreign-denominated debts of the banking sector with a small lag. This indicates that banks form their expectations accordingly.

It is also important to make interpretations from the comparison of the credit and deposit pool of the Turkish banking sector. The main tool for this part of the data analysis is the ratio of total deposits to total credits. This ratio will show how the Turkish banks are mobilizing their main source of operation. A very low ratio would indicate that banks are not making full use of their resources. A very high ratio would signal a proxy for risk. The time series on this ratio will show the responses of the banking system as well. Therefore, it is expected that the ratio will be useful to gauge the Turkish banking system's health by showing the sector's ability to cover its borrowings with its deposits. Although the maturity of the said instruments should be considered to provide a more detailed analysis, it is not within the scope of this study.

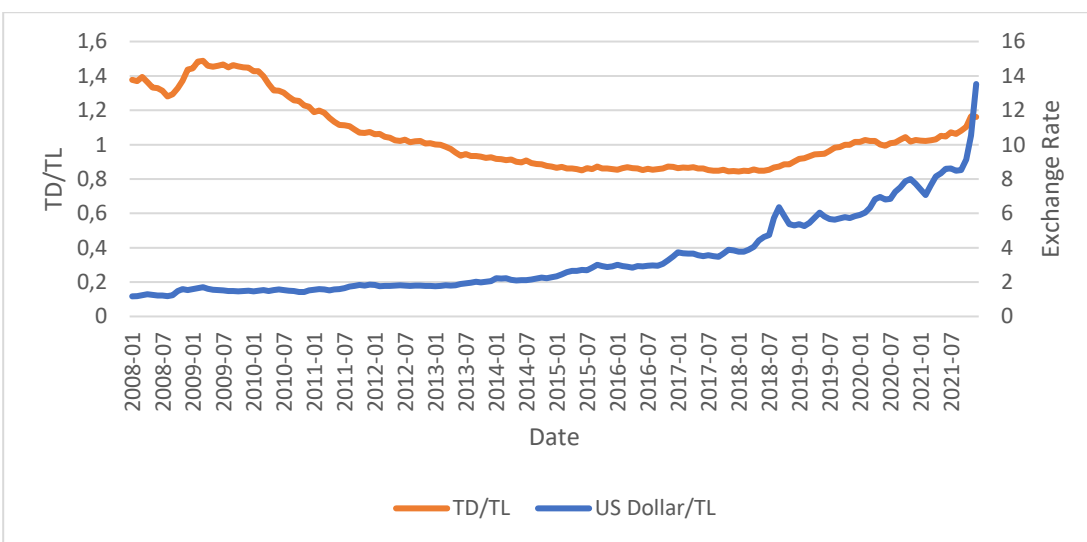


Figure 7 TD/TL and FX Rate

In Figure 7, it is seen that in January 2008, Turkish banks have a ratio that is bigger than 1. This indicates that the level of total deposits is bigger than total credits. The ratio reaches its peak in March 2009 at a level of 1.49, then it starts to decline. It continues to fall until January 2018 declining to 0.84. After January 2018, there is an increasing trend in the ratio. The ratio exceeds 1 in December 2019 and continues to increase with small ups and downs. Moreover, there is a shift in banks' policies in January 2018. Until January 2018, the ratio continues to decline. After that, banks

started to increase their deposits faster than they did before. Although the level of credit continues to increase, the level of deposits increases faster after January 2018 and the ratio of total deposits to total credits starts rising.

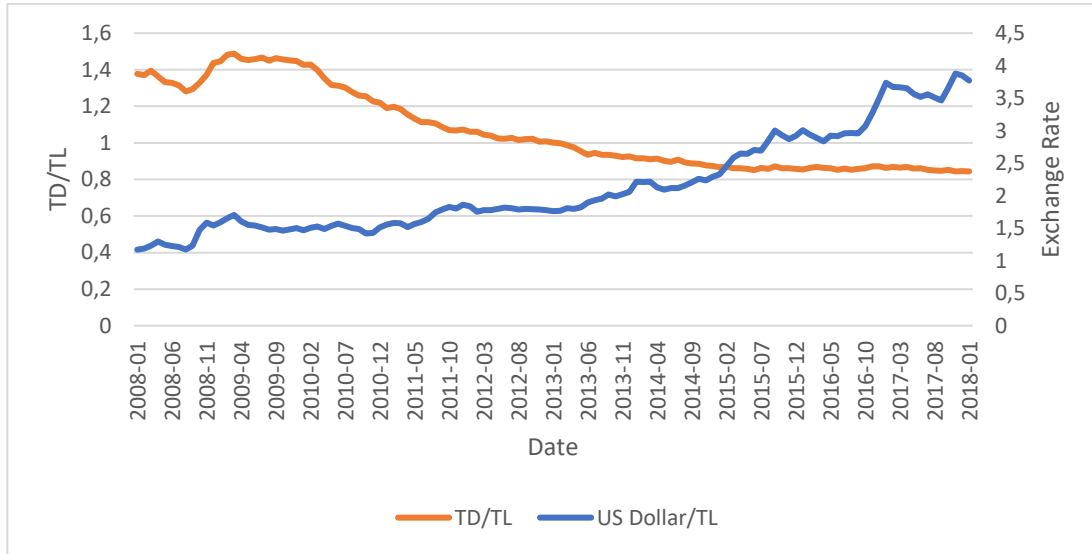


Figure 8 Before Minimum of TD/TL

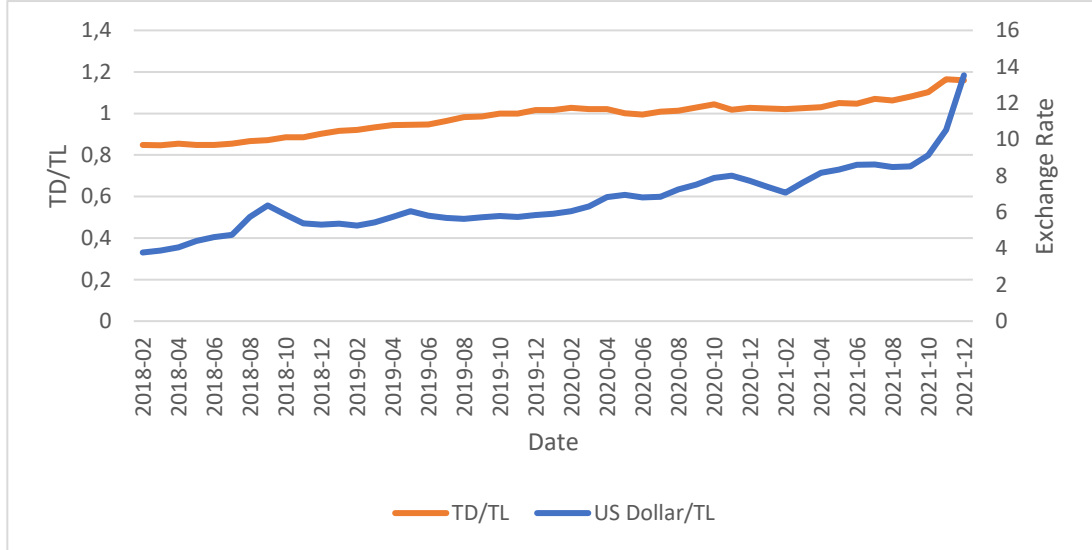


Figure 9 After Minimum of TD/TL

To see the policy shift clearly, the time series of the total deposits to total credits ratio is divided into two separate categories. The first part covers the period between January

2008 and January 2018 in Figure 8. The end of the first period is decided upon the point where the total deposits to total credits ratio hit its lowest point. The second part starts in February 2018 and ends in December 2021 in Figure 9.

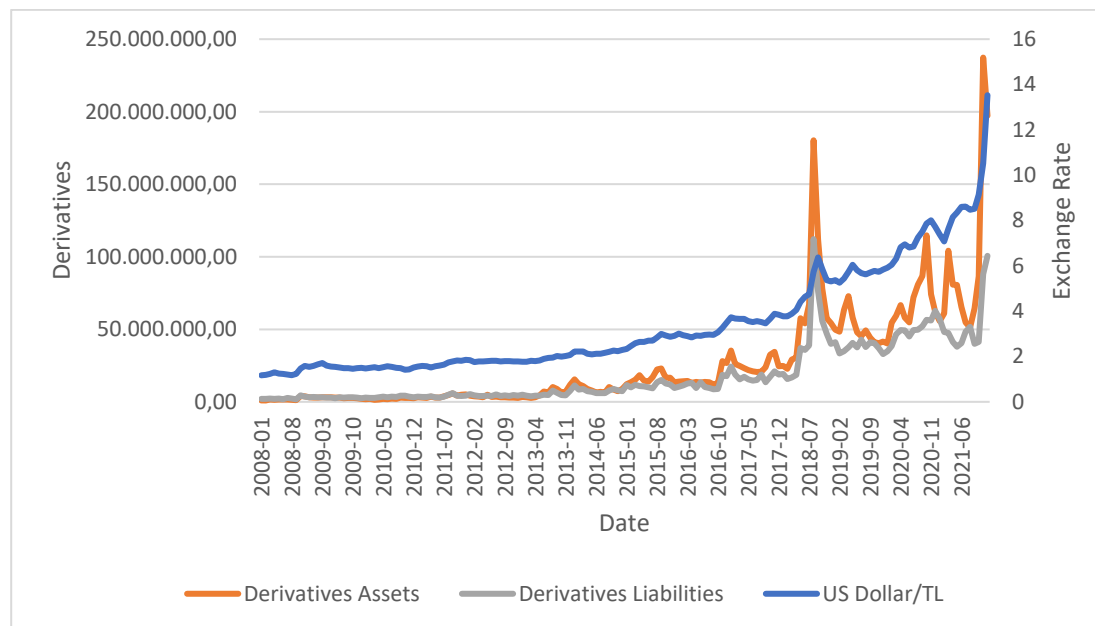


Figure 10 The Derivatives Assets and Liabilities and FX Rate

It can be seen from figure 10 that volume of the assets and liabilities in derivatives products is very small compared to other balance sheet items. The figure 10 shows that the assets exceed the liabilities after May 2013 with some exceptions. The rapid changes in both assets and liabilities indicate that banks adjust their derivatives positions in the face of adverse exchange rate movements. It is important to note that as the volume of derivatives positions increase, the exchange rate also increases. Moreover, the US Dollar/TL exchange rate follows the changes in derivatives assets and liabilities. A similar case was observed in Figure 3 where the US Dollar / Turkish Lira exchange rate follows the pattern of the foreign-denominated debts of the banking sector with a small lag. Including the analysis of Figure 10, we can say that the banks form their expectations accordingly in the face of adverse exchange rate movements.

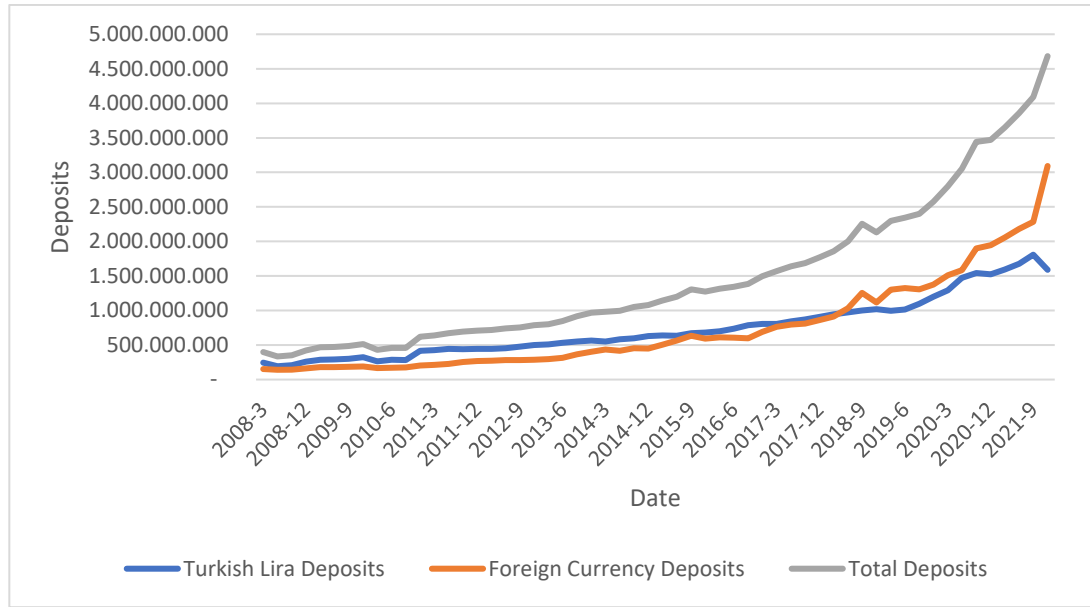


Figure 11 The Distribution of Turkish Lira and Foreign Currency Deposits

As can be seen from Figure 11, foreign currency deposits have an increasing trend. Since the Turkish Lira depreciates rapidly against US Dollar, it can be inferred that the investors were buying US Dollar to escape the losses from holding the Turkish Lira. On the other hand, holding foreign currency reserves are much less risky than extending foreign currency credits since the interest rate offered to foreign exchange deposits is less than those for the credits. Overall, an increase in the total deposits can be seen from the figure.

The causality test is done according to the model proposed by Granger (1969). According to this model, if the variable y_{2t} is helpful in forecasting a time series variable y_{1t} , then y_{2t} is causal for y_{1t} . Denoting by $y_{1,t+h|\beta_t}$ the optimal h -step forecast of y_{1t} at origin t based on the set of all the relevant information in the universe β_t , we may define y_{2t} to be Granger-noncausal for y_{1t} if and only if

$$y_{1,t+h} = y_{1,t+h|\beta_t \setminus \{y_{2,s}|s \leq t\}}, \quad h = 1, 2, \dots \quad (1)$$

If β_t contains past values of y_1 and y_2 only, that is, $\beta_t = \{(y_{1,s}, y_{2,s})' | s \leq t\}$, and $(y_{1t}, y_{2t})'$ is generated by a bivariate VAR(p) process of the form:

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \sum_{i=1}^p \begin{bmatrix} a_{11,i} & a_{12,i} \\ a_{21,i} & a_{22,i} \end{bmatrix} \begin{bmatrix} y_{1,t-i} \\ y_{2,t-i} \end{bmatrix} + u_t \quad (2)$$

then (1) can be shown to be equivalent to $\alpha_{12,i} = 0, i = 1, 2, \dots$

In other words, y_{2t} is not Granger-causal for y_{1t} if its lags do not appear in the y_{1t} equation.

The hypothesis used for testing the causality is as follows:

H0: X does not Granger-cause Y.

HA: X does Granger-cause Y.

In this part, we are using the Granger-causality test to see relationship between the selected variables in this thesis. The causality analysis is important to see whether one time series is important in forecasting another time series. This relationship will be tested first between the exchange rate and foreign borrowing. Then the same test will be done between the series exchange rate and deposits.

Before conducting the Granger Causality analysis, the time series which will enter the equation should be statistically stationary.

Firstly, I have taken the natural logarithm of the series of foreign borrowing which consists of the sum of the borrowings taken from the banks abroad and the borrowings taken from other institutions and funds abroad. After taking the logarithm, I tested both series for stationarity.

Table 3.3: HEGY Test Results for Series Exchange Rate

HEGY test results for Series Exchange Rate		
Variable	Statistic	p-value
Non-seasonal Unit Root Test Statistic	3.452	0.10
Seasonal Unit Root Test Statistic	4.378	0.01

After using the HEGY test to test stationarity it is seen that the exchange rate series has a non-seasonal unit root. To make the series stationary, the second-order differencing is done. Afterwards, the series exchange rate is tested again to see whether the stationarity condition is met or not.

Table 3.4: HEGY Test Results for Series Differenced Exchange Rate

HEGY test results for Series Differenced Exchange Rate		
Variable	Statistic	p-value
Non-seasonal Unit Root Test Statistic	-4.213	0.01
Seasonal Unit Root Test Statistic	5.312	0.01

Since the p-value is smaller than 0.05, it can be said that the series became stationary after taking the second-order difference.

Moreover, after taking the natural logarithm of the series of foreign borrowings, I tested it for stationarity.

Table 3.5: HEGY Test Results for Series Logarithm of Foreign Borrowings

HEGY test results for Series Logarithm of Foreign Borrowings		
Variable	Statistic	p-value
Non-seasonal Unit Root Test Statistic	-2.499	0.10
Seasonal Unit Root Test Statistic	15.585	0.01

It can be said that the series is not stationary. The same test is conducted after taking the second order difference to ensure the stationarity condition is met.

Table 3.6: HEGY Test Results for Series Differenced Logarithm of Foreign Borrowings

HEGY test results for Series Differenced Logarithm of Foreign Borrowings		
Variable	Statistic	p-value
Non-seasonal Unit Root Test Statistic	-5.880	0.01
Seasonal Unit Root Test Statistic	27.173	0.01

It can be seen that after taking the first difference, the stationarity is established in the series. To decide upon the order selection for the causality analysis, another analysis is conducted.

Table 3.7: Selection Criteria for Granger Causality Analysis

Selection Criteria				
Criteria	AIC(n)	HQ(n)	SC(n)	FPE(n)
Lag	3	3	3	3

Since SC(n) offers lag 3, the order that the causality should rely upon is chosen as 3. SC(n) is chosen the decide on the order since it is the most conservative one.

Table 3.8: Results of Granger Causality Analysis of Exchange Rate and Foreign Borrowings

Granger Causality Test Results for Exchange Rate and Foreign Borrowings	
F-Statistic	4.931
p-value	0.003

The first causality test is conducted between the exchange rate and the foreign borrowings series. Since the p-value is smaller than 0.05, it can be said that there is a causality relationship. To see whether there is a feedback system between the series, the reverse analysis is conducted.

Table 3.9: Results of Granger Causality Analysis of Foreign Borrowings and Exchange Rate

Granger Causality Test Results for Foreign Borrowings and Exchange Rate	
F-Statistic	19.216
p-value	0.00

From the table above, it is seen that the p-value is smaller than 0.05, indicating a bidirectional causality between the exchange rate and foreign borrowings series.

Next, I included the series of deposits to test the causality relationship between the exchange rate and total deposits. First, I tested the series deposits to see if it is stationary or not.

Table 3.10: HEGY Test Results for Series Logarithm of Deposits

HEGY test results for Series Logarithm of Deposits		
Variable	Statistic	p-value
Non-seasonal Unit Root Test Statistic	2.040	0.10
Seasonal Unit Root Test Statistic	19.619	0.01

After taking the second-order difference, it is seen that the series deposits became stationary since the p-value is less than 0.05.

Table 3.11: HEGY Test Results for Series Differenced Logarithm of Deposits

HEGY test results for Series Differenced Logarithm of Deposits		
Variable	Statistic	p-value
Non-seasonal Unit Root Test Statistic	-4.558	0.01
Seasonal Unit Root Test Statistic	30.168	0.01

After knowing that both the exchange rate and deposits series became stationary, I used the SC(n) model selection criteria for causality analysis.

Table 3.12: Selection Criteria for Granger Causality Analysis

Selection Criteria				
Criteria	AIC(n)	HQ(n)	SC(n)	FPE(n)
Lag	3	3	3	3

The model offers lag 3 to conduct the analysis.

Table 3.13: Results of Granger Causality Analysis of Exchange Rate and Deposits

Granger Causality Test Results for Exchange Rate and Deposits	
F-Statistic	4.293
p-value	0.006

Table 3.14: Results of Granger Causality Analysis of Deposits and Exchange Rate

Granger Causality Test Results for Deposits and Exchange Rate	
F-Statistic	24.572
p-value	0.00

It can be seen that there is a bidirectional causality since both p-values are smaller than the critical value of 0.05.

CHAPTER 5

CONCLUSION

In this thesis a balance sheet analysis is done. It is expected that the Turkish banking sector would adjust its positions as exchange rate changes. Monthly and quarterly data is used for the analysis. The time span is between January 2008 and December 2021. The quarterly data is only used for the analysis of the distribution of deposits. It is seen that as exchange rate increases, the amount of foreign currency deposits also increases. This outcome is expected since in Turkey, foreign currency deposit is a main source of investment. Although this change can be attributed to the exchange rate increase, another reason behind this outcome is the negative interest rates offered for the Turkish Lira. The results of the analysis suggests that banks change their positions as exchange rate changes adversely. All the credit funding channels are included in the analysis. Those are the funds taken by the banking sector, and deposits of the banks. Moreover, two ratios are introduced to assess the bank performance. The first one is the ratio of foreign borrowings to total assets (FB/TA) and the second one is the ratio of total deposits to total loans (TD/TL). The FB/TA ratio is used to see the size of the foreign borrowings compared to total assets. It is seen that as the exchange rate changes, the ratio declines since the banks close their foreign borrowings. However, the actions taken by the banks were limited as the exchange rate increase offsets the decline in foreign borrowings. In short, although the foreign borrowings decline in terms of US

Dollars, there is an increase in the same variable in terms of Turkish Liras, which is the effect of the exchange rate increase.

Over the 13 years, it is seen that banks are changing their positions. As the exchange rate increases, the weight and amount of foreign borrowings in the Turkish banking sector decrease. Short-term needs increased as money market statistics indicate. The ratio of total deposits to total loans first decreases and then increases. As banks are reducing their foreign borrowings, this is an expected outcome.

Granger-causality analysis is also conducted in this thesis. This test is done to see whether the series included in the analysis is important to forecast another series. This test is first conducted between the exchange rate and foreign borrowings. Then the same test is conducted between the exchange rate and deposits. It is seen that in both cases, the series have bidirectional causality.

Since Turkey is considered a fragile economy, foreign exchange risk management gained importance. The same applies to banks also since they are actively involved in the foreign currency market. In the long run, the Turkish banking sector must develop and employ efficient risk management methods to manage the exchange rate risk. One method for hedging such a risk is to be active in the derivatives market.

In emerging markets, the amount of national savings is not enough to support economic growth alone. Therefore, it is usually necessary to borrow from foreign funds. However, since these funds have a speculative and short-term basis, they create a fragile system against adverse foreign exchange movements. As is seen from the figures that are presented in the fourth chapter, after the increased availability of foreign funds the Turkish banking sector's foreign borrowings increased quickly. However, such high levels of foreign borrowing made the sector vulnerable to adverse foreign exchange movements.

In the face of such risks, it is advised that banks should follow international standards for managing foreign currency exposure. Another suggestion regarding this may be

restrictions on foreign currency operations of the banking sector to reduce the exposure. Such restrictive actions may be imposed upon the banking sector from the respective balance sheets of the individual banks.

As a further study, an analysis can be conducted to see whether such high levels of debt may cause cyclical foreign borrowing. Due to the increased risks of the Turkish economy, this means borrowing from higher interest rates. Even if we assume that the amount borrowed would be used to pay back a portion of the foreign debt, the interest payments will have an impact on the liabilities of the Turkish banks. Additionally, future research can investigate whether Turkish banks use these short-term funds to pay their foreign borrowings. If this is true, a maturity mismatch risk arises. Although it is evident that the short-term needs of banks increased, a detailed analysis is needed to show if these funds are used for paying foreign borrowings back. Further analysis can be conducted to see if Turkish banks used foreign borrowings to give credit in terms of Turkish Liras, how these foreign funds are utilized, and if the Turkish banking sector managed the currency mismatch risks by adjusting its positions. There is an increased demand for TL-denominated funds from the Turkish banking sector. This increased demand may be inflationary since the real interest rates are negative in Turkey. Another study can be conducted to predict certain variables in this thesis. Therefore, the causality analysis would be taken one-step further. Another research may focus on the effects of Exchange Rate Protected Deposit Accounts (Kur Korumalı Mevduat). Since this was implemented in December 2021, its effects cannot be seen in this thesis.

Although this thesis focuses on the changes in bank balance sheets, there are other factors influencing the balance sheet changes. Those factors such as political and macroeconomic risks are not within the scope of this study. A limitation is that the individual bank performances are not included and the level of dollarization is not studied. It would be interesting to analyze to see which banks are contributing most to the FX risk.

There are some policy implications for the banking sector. According to the results of this study, some macroprudential policies can be advised to reduce foreign exchange risk of the sector.

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APPENDIX

Table A.1: Literature Review

Variable Names and Descriptions			
Study	Topic	Method	Country
Huang et al. (2019)	Systemic risk	MES, SII, VI, CoVaR	China
Yun and Moon (2014)	Examine the systemic risk	MES, CoVaR	Korea
Elnahass et al. (2022)	The effect of systemic risk	CoVaR	14 countries
Sengul and Yilmaz (2019)	the systemic risk in the Turkish banking sector	MES, Δ CoVaR	Turkey
Wang et al. (2015)	estimate the systemic risk of China's banking industries	Merton Model	China
Fan et al. (2021)	the systemic risk of the Turkish banking sector	Fractional Brownian motion method	Turkey
De Nicolo et al. (2005)	the effect of deposit dollarization on the financial deepening of the onshore financial system, the causes of deposit dollarization, and banking risk	Various measures for dollarization	100 countries
Ozsoz(2008)	the effects of financial dollarization on commercial bank performance	Regression	11 developing countries
Işık and Şendeniz-Yüncü (2022)	the effect of dollarization on bank performance in Turkey	Panel Data	Turkey
Caglayan et al. (2021)	dollarization in Turkish banking sector	Regression	Turkey
Li and Yu (2010)	the impact of derivatives on bank holding companies	Panel Data	United States
Adkins, Carter, and Simpson (2007)	the effect of managerial incentives on derivatives use and the use of FX derivatives by large US bank-holding companies	Heckit Model	United States
Demir (2021)	the financial performance of the Turkish banking sector	Multi-Criteria Decision Making	Turkey

Saniç and Şendeniz-Yüncü (2021)	the bank profitability in Turkey	Panel Data	Turkey
Şendeniz-Yüncü (2020)	the effect of the financial structure on the real economy	Panel Least Squares, GMM	23 countries
Schularick and Taylor (2012)	credit growth with money, credit, and macroeconomic indicators	Panel Data	14 countries
Osundina, Ademola, Jayeoba, and Olayinka (2016)	the effects of exchange rate changes in the Nigerian banking system	Panel Data	Nigeria
Wong, Wong, and Leung (2009)	the foreign exchange risk exposure of the Chinese banking sector	Capital Market Approach	China
Agarwal (2021)	the foreign exchange risk of banks and the effects of exchange rate shocks on the real economy	Panel Data	43 countries
Atindehou and Gueyie (2001)	the exchange rate sensitivity of Canadian chartered banks	Three Factor Asset Pricing Model	Canada
Au Yong, Faff, and Chalmers (2009)	whether the actions taken in the derivatives market are related to Asia-Pacific banks' interest rate and exchange rate risk	Estimation	10 Asia-Pacific countries
Choi and Elyasiani (1997)	the derivatives, interest rate, and exchange rate risk of banks	Regression, Estimation	United States
Martin and Mauer (2003)	the short-term and long-term exchange rate exposure of US banks based on a cash flow approach	Cash Flow Approach	United States
Abbassi and Bräuning (2023)	the effect of the exchange rate risk and currency mismatch risk on the credit supply	Panel Data	Germany
Hahm (2004)	the exchange rate and interest rate risks of the Korean banking sector before the 1997 crisis	Three Factor Portfolio Model	Korea
Karasoy (1995)	the Turkish banking sector's exchange rate risk management with a portfolio model	Portfolio Model	Turkey
Keshtgar et al. (2020)	the impact of exchange rate volatility on banks in Iran	ARCH, GARCH	Iran
Chamberlain, Howe, and Popper (1997)	the exchange rate risk exposure of US and Japanese banks and the relationship between exchange rate risk and different accounting measures of risk	Time Series Regression	United States and Japan
Bleaney, Bougheas, and Skamnelos (2008)	the interaction between currency crises and exchange rate crises	Authors develop their own model for assessment	N/A

Ye and Hutson (2011)	the FX risks of the Chinese banking sector in a managed exchange rate environment	Three-factor capital market approach model	China
Ryan and Worthington (2004)	the interest rate, foreign exchange rate, and market risks in the Australian banking sector	GARCH-M	Australia
Kasman, Vardar, and Tunç (2011)	the foreign exchange rate and interest rate risk of Turkish banks by using bank stock returns	OLS, GARCH	Turkey
Choi, Elyasiani, and Kopecky (1992)	the sensitivity of bank stock return to interest rate, exchange rate, and market risks	Multifactor Model	United States
Sukcharoensin (2013)	the market, interest rate, and exchange rate risk of Thai banks	GARCH	Thailand
Grammatikos, Saunders, and Swary (1986)	the risk and return of the US banks in terms of foreign currencies	Portfolio Model	United States
Hooy, Tan, and Nassir (2004)	the sensitivity of Malaysian banks' stocks to interest rate and exchange rate	GARCH	Malaysia
Tai (2000)	impact of the market, interest rate, and exchange rate on the pricing of US commercial bank stocks	GARCH-M, Nonlinear seemingly unrelated regression, Pricing Kernel	United States
