MUHAMMED HASAN YILMAZ FACTORS IMPACTING BANK NET Bilkent University 2017

FACTORS IMPACTING BANK NET INTEREST MARGIN AND THE ROLE OF MONETARY POLICY: EVIDENCE FROM TURKEY

A Master's Thesis

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The Graduate School of Economics and Social Sciences

of

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I certify that I have read this thesis and have found that is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science in Management.

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ABSTRACT

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In this thesis, we study factors affecting net interest margin (NIM) of commercial banks in Turkey. Especially, our results highlight the relation between unconventional monetary policy shocks and bank margins. To this end, first, we conduct an identification analysis about which parameters of asymmetric interest corridor framework are important in explaining variations in NIM. Using industry-level data, we show that there exists a pass through from BIST interbank overnight repo/reverse repo market rate and weighted average cost of funding (WACF) to bank loan and deposit rates. As a result of reduced-form Vector Autoregression (VAR) analysis we find the existence of a transmission mechanism from BIST rate and WACF to commercial loan rate, consumer loan rate and deposit rate. Same pass through to loan and deposit rates is also shown in individual bank level with the Panel Vector Autoregression (Panel VAR) analysis in the case of 16 commercial banks in Turkey during the period 2011Q1-2016Q1. After the identification analysis, we examine the relationship between NIM and policy rates through System Generalized Method of Moments techniques by controlling bank specific, industry

related and macroeconomic factors. We find that a change in the monetary policy rate has significant and positive impact on NIM. Among bank-specific factors, equity ratio and operating expenses are found to be significantly affecting NIM during the sample period. Our empirical findings also stress the significance of lag values of NIM. Estimations conducted with standardized variables indicate that economic significance of lag values and bank specific variables are larger than that of policy.

Keywords: Monetary Policy, Net Interest Margin, Panel Data Analysis, Pass-Through, Time Series Analysis

ÖZET

BANKA NET FAİZ MARJLARINI ETKİLEYEN FAKTÖRLER VE PARA POLİTİKASININ ROLÜ: TÜRKİYE HAKKINDA BULGULAR

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Bu tezde Türkiye bankacılık sektörünün net faiz marjı (NFM) üzerinde etkili olan faktörler incelenmektedir. Özellikle, geleneksel olmayan para politikası şokları ile banka faiz marjları arasındaki ilişki çalışılmıştır. Bu amaçla öncelikle asimetrik faiz koridoru çerçevesinin hangi parametrelerinin banka NFM'lerindeki değişimleri açıklamada önemli olduğunu belirlemek için bir tanımlama analizi yapılmıştır. Toplu sektör verisiyle yapılan analizde, BIST bankalararası gecelik repo/ters repo piyasası faiz oranından ve ağırlıklı ortalama fonlama faizinden; banka kredi ve mevduat faizlerine geçişkenlik olduğu gösterilmiştir. İndirgenmiş form Vektör Özbağlanım Analizi sonuçlarına göre; BIST faizinden ve ağırlık ortalama fonlama faizinden; ticari kredi, tüketici kredisi ve mevduat faizlerine doğru bir aktarım mekanizması bulunmaktadır. Aynı geçişkenlik, 16 mevduat bankasının verileriyle 2011Q1-2016Q1 dönemi için yapılan Panel Vektör Özbağlanım analiziyle de kanıtlanmıştır. Tanımlama analizinden sonra; NFM ve politika faizleri arasındaki ilişki bankaya özgü, sektörle ilgili ve makroekonomik nitelikteki faktörler kontrol edilerek, Sistem Momentler Metodu teknikleri kullanılarak incelenmiştir. Para

politikası faizlerindeki değişimin NFM'yi anlamlı ve pozitif yönde etkilediği bulunmuştur. Bankaya özgü faktörler arasında, sermaye oranı ve operasyonel maliyetlerin örneklem döneminde marjları anlamlı bir şekilde etkilediği bulunmuştur. Ampirik sonuçlar, NIM'in gecikmeli değerlerinin anlamlı olduğunu göstermektedir. Standardize edilmiş değişkenlerle yapılan tahminler, gecikmeli değerlerin ve bankaya özgü faktörlerin iktisadi anlamlılık düzeylerinin politika faizlerinkinden yüksek olduğunu göstermektedir.

Anahtar kelime: Faiz Geçişkenliği, Net Faiz Marjı, Para Politikası, Panel Veri Analizi, Zaman Serisi Analizi

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CHAPTER I

INTRODUCTION

Financial institutions have been performing a valuable role in the functioning of modern economies. As a core component of financial system, banks provide an intermediation between savers like households and fund users like firms and government. By collecting deposits and extending loans, savings in an economy can be more efficiently allocated to real investment through which economic growth can be achieved.

Several values created by banking services are the reasons behind the efficiency of the financial intermediation process. One value is about the information asymmetry. Financial transactions between lenders and borrowers can be subject to certain costs caused by informational asymmetry. Especially when informational asymmetry exists in the pre-contract period, then adverse selection problem could happen. In this context, financial institutions can sort out the differences between credit-worthiness of borrowers. If informational asymmetry occurs in post-contract period, then moral hazard costs will be faced (the risk that borrowers will take actions that are against the interest of lenders).

Hence, when savers provide funds to users, some action should be taken about the proper use of funds given the fact that several risky projects are available with differing risk and return prospects. Since individual lenders are constrained by information asymmetry, they tend to avoid bearing monitoring cost. This tendency of being a free-rider in lending market would result in no monitoring action (Allen & Carletti, 2008). Financial institutions can undertake this function as they have the benefit of size.

Second value is about reducing liquidity concerns and price risk about financial assets. Banks are traditionally used as a platform for making transactions on debt and equity instruments. When a financial asset is less liquid, meaning that it is not easily convertible into cash; then there could be price risk. In other words, illiquid assets would have a sale price which will be lower than the purchase price of the same assets. Banks can decrease price risk as they diversify away some part of their portfolio risk by holding a vast number of financial securities in their portfolio. Financial institutions are also known to have other functions such as maturity intermediation, transmission of monetary policy and payment services.

Considering the fact that financial institutions have valuable contributions to the functioning of the financial system, tracking the efficiency of financial intermediation holds an importance. Bank profitability is an informative aspect of this efficiency. In the literature, bank profitability measured by net interest margin (NIM) is taken as an indicator of efficiency. However, wider interest margins are regarded as having negative implications on the intermediary role of collecting deposits and allocating loans. In the case of higher margins, savers would be less encouraged to deposit funds due to lower return and investors would be less encouraged to obtain loans due to higher paybacks.

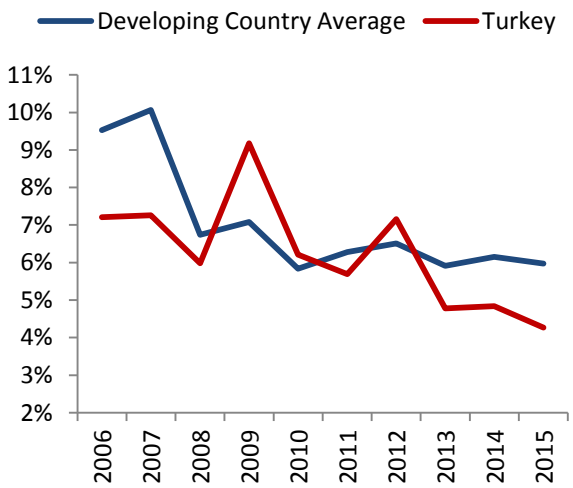
Such a situation would harm the financial deepening and development through financial exclusion. For instance, Demirgüç-Kunt and Huizinga (2000) find that banks tend to have higher margins in underdeveloped financial systems, while no such relation is observed in developed countries. Higher margins would also restrain the level of real savings and investments (Brock & Suarez, 2000; Barajas, Steiner, & Salazar, 1999). On the other hand, bank profitability may have positive impacts on capital adequacy ratios by increasing capital accumulation. Hence, banking system of a country can be strengthened in the form of higher capital buffers against external shocks (Brock & Suarez, 2000; Barajas et al., 1999). These side effects of the trend in profitability of banking sector emphasize the importance of the investigation of possible determinants of NIM, especially for the policy implication.

When the cross-country data for the Turkey and emerging markets is examined, in terms of the changes in bank spread[1] (ex-ante definition of NIM) and return to asset ratio[2] (as an indicator of bottom-line profitability), we observe that bank margins and profitability in Turkey has a unique feature. As it can be seen in Figures 1 and 2, interest margins have been decreasing both for Turkey and developing countries. However, the speed at which bank margin is contracting is different. Spread is being narrowed at a faster pace in Turkey than other developing countries. As a different measure of bank profitability, return on asset ratio is also decreasing for Turkey and other emerging markets. However, when we examine the last decade, we see that the decrease in bank profitability is higher

[1] In Figure 1, developing countries' average spread gives the mean value for 11 developing countries which are Argentina, Brazil, Indonesia, Latvia, Mexico, Poland, Romania, Russia, Slovak Republic, South Africa and Uruguay.

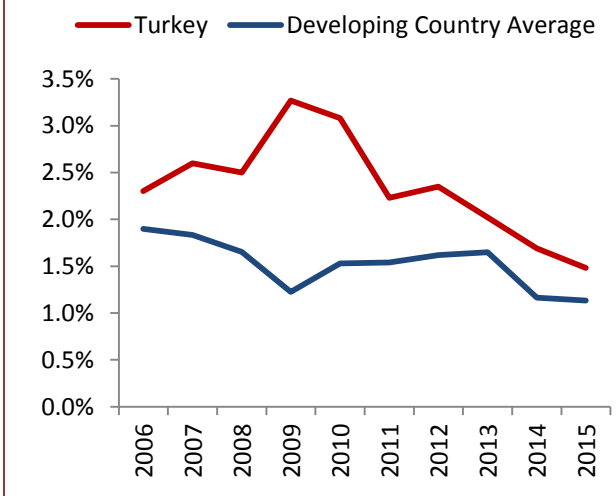
[2] In Figure 2, developing countries' average ROA gives the mean value for 19 developing countries which are Argentina, Brazil, Chech Republic, China, Indonesia, Morocco, Philippines, South Africa, Colombia, Hungary, Malaysia, Mexico, Peru, Poland, Romania, Russia, Chile, Thailand and Ukraine.

for Turkey than other countries. This divergence of Turkey from peer countries is especially evident after 2011.



Source: IMF Financial Soundness Indicators

Figure 1: Spread Between Average Lending and Deposit Rate



Source: Fitch Connect Database

Figure 2: Return on Assets

Simultaneously, Turkey is following a different trend than other emerging markets in terms of financial development and access to bank financing which might be considered as side effects of profitability of banking sector. Appendix A illustrates bank credits extended to private sector (as a percentage of GDP) and the banking sector assets (as a percentage to GDP) for Turkey and selected emerging countries. It also presents equity to assets ratio for the banking systems as well as the capital adequacy ratio calculated by dividing the equity to risk weighted assets. From these figures, it can be inferred that not only in terms of profitability but also with respect to the financial deepening and bank capitalization, Turkish banking system is displaying a divergence.

After the end of 2010, Turkey has been exercising an asymmetric interest corridor system with active liquidity management in which there is more than one short term rate which

may be qualified as policy rate including BIST overnight repo/reverse repo interest rate and CBRT weighted average cost of funding (WACF). Through active liquidity policy of Central Bank of Turkey (CBRT), the monetary policy stance can be altered at a daily frequency manifested in several rates. Thus, parameters of corridor system of CBRT do seem relevant in the process of monetary policy transmission. By means of the pass through towards loan and deposit rates, monetary policy rates are expected to influence bank profitability. Thus, in this thesis, we aim to explore statistical and economic significance of this recent unconventional monetary policy on net interest margins (NIMs) of commercial banks in Turkey for the period 2011Q1-2016Q1. First, we identify which policy rates might be used in our empirical model to examine NIM. Hence, an important part of this thesis is devoted to examine which short term rates have explanatory power for NIM. Within this context, the level of pass through from identified policy rates to bank loan and deposits rates is investigated to test whether policy rate has significance in the pricing of loans and deposits, i.e., the calculation of bank NIM.

We may summarize our main research questions as follows:

- Which parameters of the asymmetric interest corridor system are important in explaining bank NIM?
- What are the other determinants of bank NIM in Turkish banking sector for the period between 2011Q1 and 2016Q1.

According to our empirical analysis, BIST overnight rate and WACF are found as key policy rates in explaining NIM. When we examine the deposit and loan rates of individual commercial banks, which are hand-collected by footnotes of their financial

statements, we observe that any shock to BIST rate and WACF are transmitted significantly to loan and deposit rates during the period 2011Q1-2016Q1. Thus, for the period when asymmetric interest corridor is exercised, BIST overnight rate and WACF are considered as relevant parameters for examining the effect of unconventional monetary policy on net interest margins of commercial banks in Turkey.

Dynamic panel estimations for net interest margin show that BIST overnight repo/reverse repo interest rate and CBRT WACF are found to be positively and significantly affecting NIM of commercial banks during the time period of 2011Q1-2016Q1. Moreover, well-capitalized banks have significantly higher profitability during the sample period. Interestingly, banks which are incurring more operational expenses such as branching, employee, overheads and amortization (which are extensively related to loan extension and deposit collection activities) are found to have higher profitability as they involve in more retail banking activities. These findings can be considered as unexpected since increasing operating expenses may suggest operational inefficiency of banks. However, during the examined period, banks are increasing their branch networks and banking personnel to achieve higher profitability from interest earning activities[3]. Finally, we find no significant result for the liquidity position and funding riskiness of banks, and financial sector concentration.

The remaining parts of this thesis are structured as follows. Chapter II includes a review of theoretical and empirical literature. Chapter III conducts a financial ratio analysis for bank profitability in Turkey for last decade. In Chapter IV, descriptive and econometric

[3] The impact of operating expenses on bottom-line profitability measure, i.e. return on assets or equity is not the scope of this study.

analyses are conducted to assess policy rate variables. Furthermore, the rationale and dynamics of asymmetric interest corridor as well as the transmission of monetary policy stance to loan and deposit rates are also stressed with aggregate sector and individual bank-level data. Chapter V provides information about data and methodology of dynamic panel regressions, whereas Chapter VI summarizes results of panel data estimations. Last chapter will make the conclusion and mention about further research agenda.

CHAPTER II

LITERATURE REVIEW

In this part of the thesis, theoretical and empirical literature for interest margins of the banks are explored. As it is stated in the Introduction part, the chosen variable of interest is net interest margin (NIM) since it is not only an indicator of profitability of banks as business entities, but it is also an informative proxy for cost of financial intermediation. From a purely financial analysis standpoint, researchers often utilize different measures of banks' ability to produce earnings like net income (NI), return on assets (ROA), return on equity (ROE) etc. However, in this study, we are more focused on the factors driving NIM[4]. In particular, our interest lies on finding the nature of the relation between central bank policy rate and bank NIM given the fact that Turkey has adopted a multi-dimensional interest rate framework since the end of 2010.

The works in the literature which consider NIM as dependent variable mainly use two different calculation methods for it: ex-post and ex-ante. Demirgüç- Kunt and Huizinga

[4] Hereafter, the terms bank profitability, net interest margin (NIM) and margin are used interchangeably.

(1999) describes ex-post measure as the ratio of "the difference between realized interest income and interest expense" to the total assets of the bank[5]. On the other hand, ex-ante measure is described as the difference between rates charged on loans and rates charged on deposits. Equation 1 and 2 show these definitions.

$$\text{NIM}\textit{(ex-post)}=(\text{Interest Income-Interest Expense})/(\text{Total Assets}) \quad (1)$$

$$\text{NIM }\textit{(ex-ante)}=\text{Loan Rate-Deposit Rate} \quad (2)$$

One important caveat is that commercial banks are extending different types of loans (and are offering different types of deposits) with varied maturity and interest rate structure (fixed or floating). Ex-ante spreads also do not take possible loan losses into account. Since loan defaults are not incorporated in ex-ante definitions and interest income and loan losses associated with a particular lending activity tend to materialize in different times, the definition for NIM used in this study is ex-post one.

The balance sheet items from which the definition of ex-post margin extracted can be summarized as follows.

- Interest earning activities such as extending credits, holding bonds, engaging in interbank loans given to other institutions and,
- Interest expense activities such as deposits and interbank loans obtained from other institutions.

[5] In a group of works, total equity is used as a normalizing factor in the denominator, but results are mostly found to be robust for that case (Abreu & Mendes, 2001).

2.1 **Theoretical Literature**

Theoretical attempts to make sense of NIM started with the pioneer work of Ho and Saunders (1981). Their model regards the bank as a risk-averse dealer operating in financial markets. In their work, key role of banking is given as providing service to both depositors and borrowers. There are some restrictive assumptions embedded in this model. For instance, a financial institution is assumed to have a homogenous product portfolio. A typical bank is assumed to operate in a single period and it decides on deposit and loan rates at the start of the period to maximize the wealth at the end of the period. However, since loan demand and deposit supply are random during that period, any surplus or deficit of funds are invested or funded by engaging transactions in money market (any surplus is reinvested and any deficit is refinanced at the risk free rate). Thus, financial institution has a burden of reinvestment and refinancing risk. To account for that risk, it is a rational behavior for risk averse expected utility maximizer entity to charge a positive margin. Optimal spread in Ho and Saunders (1981) model is found as:

$$Loan\ Rate = Risk\ Free\ Rate + a \tag{3}$$

$$Deposit\ Rate = Risk\ Free\ Rate - b \tag{4}$$

$$Optimal\ Spread = a + b = (\alpha/\beta) + (1/2) * (R\sigma^2 Q) \tag{5}$$

Here, α/β is the margin required by risk-neutral bank taken competitive conditions into consideration. It is also the representation of the monopoly power of the banks. In this context, α and β are the intercept and slope terms of the symmetric loan/deposit arrival functions. R stands for the bank management's level of risk aversion, Q symbolizes the

average size of transactions undertaken by the bank and lastly, σ^2 represents the dispersion of loan and deposit rates. Here, a and b represent the margin added on risk-free rate to calculate loan rate and the margin deducted from risk-free rate to calculate deposit rate respectively.

Two-step estimation approach to this model is widely used in the literature to apply the model setup to the data so as to draw inferences (see Doliente, 2005). In the first step, NIM is regressed for a cross-section of bank level data on bank specific variables such as the ratio of total assets to equity and the ratio of non-performing loans to total loans. Constant term from these regressions represents a measure of the portion of spread that is not attributable to bank-level characteristics. In the second step, constant terms are regressed on macroeconomic variables such as the volatility of interest rates. New constant term arising from second step regressions represent the portion of the spread which is neither explained by bank specific factors nor by volatility of rates. That is why; it is named as "pure spread" and it captures the impact of market structure[6]. This pure spread is regarded as a compensation of the inventory risk that are arising from the randomness of the loan/deposit transaction requests from customers.

Risk-averse dealer model is extended further with later works. For instance, McShane and Sharpe (1985) apply a differentiated version of this model to Australian commercial banks. In their framework, the uncertainty is not rooted in dispersion of money market rates, instead it is related to the dispersion of loan and deposit rates. One other variation they make in the model is related to the product portfolio. They include cash and short

[6] Two step procedure is also employed in other studies (Brock & Suarez, 2000; Saunders & Schumacher, 2000; Drakos, 2003).

term money market assets as well as the shareholders' funds into the balance sheet composition of the typical bank in the model. The specification composed in this study theoretically argues that spread between loan and deposit rates is related to the power of the banks in loan and deposit markets. Similar to the original model, risk aversion, volatility of interest rates and average transaction size are considered. In addition to the development of a model to explain bank margins, McShane and Sharpe (1985) study eight Australian trading banks. They find that bank's risk aversion, interest rate volatility and average transaction size are affecting NIM positively.

Allen (1988) later modified theoretical model by arguing that the products of banks are not homogenous and by incorporating the cross-elasticity of demand for products into the framework. Assuming that a bank is providing multiple types of loans, then any adjustment for the rate charged on a particular loan (for instance, an increase in the discount of one particular type of loan) is argued to affect the demand for the other loan category. The finding from this work points out that pure spreads can be diminished thanks to the portfolio diversification effect.

Bank dealership framework is also adjusted to account for the credit risk by Angbazo (1997). The interaction between interest rate risk and the credit risk is also incorporated in their specification. One additional purpose of their work is to assess the impact of credit cycles on NIM. To shed more light on these issues, they also conduct an empirical investigation with US commercial banks for the period 1989-1993. Their analysis yields the conclusion that banks adjust NIM to reflect the changes in default risk premium and interest rate risk premium. In terms of the impact of the credit cycle, the findings show

that if the trough phase in the credit cycle is accompanied with increasing overall risk perception then NIM inflates.

As a later addition to the theoretical efforts in modeling NIM, Maudos and Guevera (2004) consider average operating costs as an explanatory factor for NIM. By referring to the productive nature of banks in terms of facilitating the process of intermediation between deposits and loans, operating costs are assumed to be a function of loans extended and deposits collected. The equation for optimal interest margin is established to be a positive function of average operating costs. Maudos and Guevera (2004) argue that financial institutions which are operating with high level of unit costs would facilitate intermediation process through higher margins taking market power and other risks into consideration. Apart from theoretical consideration, their study undertakes a test with the banking data of five developed European countries and found that operating expenses in addition to the other bank-based and market structure variables from the original model are significant in determining NIM. Specifically, higher concentration in banking industries of these countries (resulted from a wave of mergers and company acquisitions) assessed by a direct measure of competition that is Lerner Index contributed positively to the margins; while downward trend in credit risk, cost structure and volatility of interest rates put downward pressure on the spreads. Their justification for the addition of operating costs to the theoretical model is also based on the significant result from the empirical quest.

Similar to the Allen (1988), Valverde and Rodriguez (2007) adjust the composition of the bank products in the original model. In this way, they include interest earning assets other than loans and fee income activities (named as non-traditional activities) in the

framework. Their extension to the model involves a proposition that utilization of non-traditional activities is expected to reduce the NIM. The empirical analysis presented in this study is focusing on the seven developed European countries' banking sector by using multiple definitions of NIM such as loan to deposit spread, gross income to total assets ratio (this definition particularly includes non-traditional activities) and the spread between bank loan rates and interbank money market rate. According to the estimation results, it is found that non-traditional banking activities which are sources of fees and commissions income decrease the interest margins. One other important conclusion of this work is that non-traditional activities are important for strengthening the market power of banks.

2.2 **Empirical Literature**

In this part, some examples of the empirical works regarding to the determinants of NIM are presented. Mostly, empirical works are designed with single step regression technique by incorporating the bank specific variables derived from theoretical models as well as the industry related and macroeconomic forces. Especially, we mention the cross-country studies in addition to the works done with Turkish banking data.

Among empirical works which are using cross-country banking data, Demirgüç-Kunt and Huizinga (1999) has a framework which is based on a behavioral model of the financial institutions in which several potential motives of the bank profitability are explored (Brock & Suarez, 2000). That framework classifies factors impacting the margin into three groups: bank-specific, industry-related and macroeconomic. In their setting, banking data from 80 countries for the period between 1988 and 1995 are used in the

analysis where the econometric method utilized is weighted least squares (WLS). Their portfolio of explanatory variables is extensive and is ranged from financial ratios to industry indicators, from competition-related elements to macroeconomic forces. They show that margins of the banks are being affected by bank specific variables, macroeconomic forces, taxing practices and reserve requirements.

Claessens, Demirgüç-Kunt and Huizinga (2000) focus on the role of bank ownership status and financial sector structure. The data belonging to 80 developing and developed countries is analyzed and it is found that the role of bank ownership on bank profits depends on the status of country itself. Results are in line with the fact that foreign banks appear to operate with wider margins than domestic banks in emerging markets, while opposite is true for developed countries. Furthermore, operating cost structure proxied by the ratio of overhead expenses to total assets, GDP growth, inflation and interest rates are found to be positively associated with bank margins. Demirgüç-Kunt, Laeven and Lavine (2003) start from the data of 72 countries and aim to assess the role financial sector concentration on bank profitability while bank specific factors such as bank size, liquidity, equity ratio and overhead expenses are added to the model and while macroeconomic factors and institutional quality of countries are controlled. They ascertain that the degree of concentration in the industry is increasing NIM.

Brock and Suarez (2000) examine the trend of NIM in Latin American countries and try to understand the factors behind the persistently high margins during that time despite the financial liberalization, abolishment of credit controls and revoke of interest rate ceilings. They use abovementioned two step approach and reveal that the ratio of non-performing loans to total loans is negatively; on the other hand, high operating costs, capital ratio,

liquidity ratio, interest rate volatility and inflation rate are positively associated with bank spreads. As a work interested in the behavior of bank NIM within a country group, Kasman, Vardar, Tunç and Okan (2010) examine 29 member countries of European Union (EU) to assess the determinants of commercial bank NIM. The methodology they follow comprises the division of sample period into two, specifically two sub-periods of 1995-2000 and 2001-2006. Such a division is deemed necessary to assess the impact of banking sector consolidation in EU on NIM. Moreover, countries in the sample are categorized into two groups which are old and new members of EU. According to the results of pooled OLS regressions, in both sub-periods, bank controls such as operating cost and credit risk are found to contribute positively to bank margins. While again in both sub-periods, bank size and managerial efficiency are detected to be contributing bank margins negatively. In terms of the old and new member country comparison in EU banking system, especially the impact of macroeconomic variables are not robust suggesting that there exists no economic and financial convergence among members of the EU.

As a study for OECD countries, Hawtrey and Liang (2008) conduct an analysis with banking sector data of 19 countries. By applying static linear panel estimation methods, they diagnose that widely referred bank specific variables controlling bank size, operating expenses and credit risk are related to bank NIM positively. One other example of studies which are working with very large cross-country banking data is that of Chen and Liao (2011). Their analysis with banking data of commercial banks, savings banks and bank holding companies in 70 countries for the period between 1992 and 2006 has an aim to identify empirical factors explaining NIM, ROA and ROE. When we look at the results

related to NIM, it is observed that bank specific variables such as operation costs, bank size, credit risk, liquidity risk and capital strength are found as significant empirical determinants of NIM. Moreover, foreign banks are found to be more profitable than their domestic counterparties. In terms of the macro-level variables, GDP growth, inflation rate, regulatory quality and government effectiveness have a negative influence on bank profitability.

2.3 **Empirical Literature for Turkey**

Although there is vast amount of single country studies, there are very few regarding to the margins of Turkish banking system. Apart from cross-country studies, we cover some of the works aiming to find determinants of NIM in the context of Turkey. For instance, Kaya (2002) investigate the determinants of bank profitability measures for the period 1997-2000 with the quarterly data set of 44 Turkish banks. Two step method applied in Ho and Saunders (1981) and Brock and Suarez (2000) are also used in this study. Their findings from the first step regressions show that NIM is positively related to capital adequacy, liquidity ratio and the market share of individual banks in whole banking sector. The positive association between pure margin and inflation as well as the public sector debt is supported with the results of second step regressions.

As a work covering more recent time period, Aysan, Dalgıç and Demirci (2010) analyze the determinants of commercial bank NIM for the period after 2001 crisis in Turkey. Single step approach with fixed effects panel regressions yields the conclusion that risk aversion which is proxied by equity ratio and implicit interest payments are important bank-level variables. Additionally, sector concentration measured by Herfindahl and

Hirschman Index (HHI) is found to be positively affecting bank margins. Inflation, real GDP growth rate and interbank interest rates appear to be significant macro controls in that study. As a side aim, this work also incorporates a dummy variable in its specification to find the behavior of NIM during global financial crisis time. It is observed that during crisis time, bank NIM in Turkey is increased. Kansoy (2012) also examine the bank margins in Turkish commercial banks. By employing static and dynamic linear panel estimations, they find that bank NIM in Turkey is related to overhead expenses, size of the bank operations, asset quality, risk aversion, inflation and GDP growth. One important finding in this context is that lag of the NIM turns out to be significant explanatory variable in the dynamic setting.

Ganioğlu and Us (2014) look at the banking structure of Turkey from different perspectives including asset quality, capital adequacy, funding risk, liquidity and more importantly profitability. They run static panel regressions for the periods both before and after the global crisis. They find that, before the crisis, the ratio of other operating expenses to total assets (as a representation of cost structure), inflation and reserves of banks denominated in TL as significant variables, while credit risk, other operating expenses and policy rate are significant determinants after the crisis. Similarly, Us (2015) detect credit risk, inflation and other operating expenses as determinants of NIM by using dynamic panel methods.

2.4 **Bank Interest Rate Channel and the Role of Interest Rates for NIM**

As it is stated in the Introduction part, focal point of this thesis is to assess the impact of monetary policy on the banking sector. From a mechanical perspective, the level of effect

created in NIM through changes in policy rate depends on the pass through from policy rate to bank loan and deposit rates which directly designates the level of interest income earned and the level of interest expenses incurred. Since the ex-post definition of NIM specified in this quest involves with the interest income and expense, pass through of policy rate plays a vital role. Thus, as a side analysis, the level of pass through from policy rate to bank loan and deposit rates are examined in Chapter IV in detail.

The relation between policy rate and market rates is widely examined theoretically under the concept of interest rate channel of monetary transmission mechanism. As Mishkin (1996) state monetary policy stance has influence on real phenomena like total demand and inflation as well as the financial dynamics through several channels. Apart from credit channel (which is composed of bank lending channel and balance sheet channel), equity price channel and exchange rate channel; interest rate channel is effective in transmitting the monetary policy alterations to the rest of the economy. Under interest rate channel, monetary policy stance is first transmitted to the short term nominal market rates as well as the bank lending and deposit rates. In the second step, changes in the short term nominal interest rates are transmitted to the long term real interest rates depending on the inflation expectations. In turn, any change in long term real rates is reflected in the real aggregates such as investment and output. Our focus in this thesis is mainly concentrated on the earlier stages of interest rate channel which emphasizes the pass through between monetary policy rate and banking rates.

There are some empirical works related to the abovementioned concept of pass through. De Bondt (2002) uses error correction model and Vector Autoregressive (VAR) model for the relation between market interest rates and retail banking rates in the Euro Area.

They find that both in short and long term, there exists a pass through from market interest rates representing the monetary policy stance to bank loan and deposit rates. Additionally, this study includes a co-integration analysis between retail bank and comparable market based interest rates. Kwapil and Scharler (2006) empirically compare the interest rate pass through in US and Europe with Autoregressive Distributed Lag (ARDL) model. They use monthly data for the period January 1995-September 2003. They find that average pass through from market rates to lending and deposit rates in the long run is lower in Europe than US. Hristov, Hülsewig and Wollmershauser (2014) use panel VAR approach to the data of 11 European countries for the period between 2003 and 2012. Their main finding is that there exists a pass through from market based policy rate to retail bank interest rates. However, due to financial crisis, pass through started to be less complete after the crisis. Especially, widening interest margins are found to be due to structural shocks and extra unidentified shocks.

Turning to the empirical literature for NIM, Demirgüç-Kunt and Huizinga (1999) was among the first to establish an association between bank profits and real interest rates. After this study, by including some proxies like "1-year Treasury bill discount rate" or "standard deviation of 90-day bill rate", some other works of the literature have also tried to reveal the relationship between policy rate and volatility of interest rates on bank margins. However using indirect proxies to mimic the behavior of policy rate does not capture all the characteristics of the impact of monetary policy on spreads. Especially, in a country like Turkey where unconventional monetary policies like asymmetric interest rate corridor and active liquidity management are used, using indirect proxies would be likely to significantly diminish the explanatory power of empirical analysis. Because of

this reason and the unique application of monetary policies in Turkey, one chapter of this thesis is devoted to an empirical identification strategy to detect policy rate variables by using time-series analysis techniques.

There are some works which try to differentiate policy rate variable over time by considering the application of interest rate corridor. Ganioğlu and Us (2014), for instance, use BIST rate for the period of 2002-2010; one week repo rate for the period of 2010Q2-2011Q4 and weighted average funding rate from 2012Q1 and onwards. Their results show a positive relation between policy rates and NIM which points out the fact that banks are pricing loans and deposits asymmetrically in the case of a policy tightening characterized by rising interest rates. For cross-country setup, in the study of Borio, Gambacorta and Hofmann (2015), the impact of short term interest rates and the term structure captured by the shape of yield curve on different bank profitability measures (such as NIM, non-interest income to total assets ratio and ROA) are investigated. They used dynamic GMM methods to explore abovementioned relations by utilizing the annual data of a sample of 109 large banks of 14 major advanced countries for the period 1995-2012. These banks belong to countries which are Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, UK, US, Austria, Australia and Spain. They find a robust positive relation between short term rates and NIM as well as a positive association between short term rates and ROA.

CHAPTER III

BANK PROFITABILITY RATIOS AND FINANCIAL STABILITY

In this part of the thesis, profitability of banks is examined through ratio analysis in connection with financial stability. The concept of financial stability and how monetary authorities respond to it are firstly examined. Then, the trend and dispersion of profitability ratios, which are among indicators monitored for financial stability, are provided in the context of Turkey on the aggregate industry level.

The term "financial stability" is somewhat new concept on which there is no exact consensus about its definition among monetary and regulatory authorities around the world. Key objective of all central banks around the world that is price stability, for instance, has more or less uniform definition. That is, taking necessary measures by formulating a sound monetary policy to prevent highly inflationary environment. The success of a central bank to sustain price stability is measured by the rate of change in a particular price index, whether a Consumer Price Index or a Wholesale Price Index or

some other form of calculating inflation[7]. On the other hand, defining which characteristics of an economy determine the degree of financial instability is vague.

There are some attempts to diagnose the financial stability based on some financial and economic phenomenon. Allen and Wood (2006) define financially instable structure as the one where means of payments are unavailable[8] to facilitate money transfer among households, firms and other economic entities. Additionally, the definition of Allen and Wood (2006) implies that the financial instability coming from an unexpected shock prevents efficient allocation of savings to investment opportunities. Financial asset prices become more volatile and unpredictable in such instances. One definition of financial instability is that of European Central Bank (ECB). ECB describes financial stability as "a condition in which the financial system - intermediaries, markets themselves and market infrastructures - can withstand shocks without major disruption in financial intermediation and in the general supply of financial services" (*Financial Stability and Macroprudential Policy*, n.d.)[9].

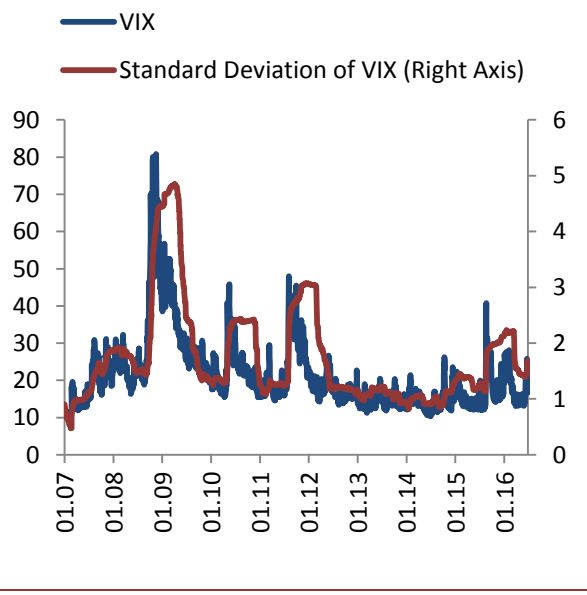
2008 Global Financial Crisis was a turning point for how monetary authorities perceive and act upon financial stability. The crisis which originated in the mortgage market of US was spilled over to whole US financial sector through high level of securitization, excess risk taking and enormous leverage of investors and intermediaries. This situation caused an illiquid money market and left bank balance sheets full of toxic assets. The collapse of

[7] Even among the countries which have similar economic structure, there are different ways of measuring inflation. Rajan (2016) mentions about the use of Wholesale Price Index to do inflation calculations in India (a Fragile Five country), while Turkey (another Fragile Five country) utilizes CPI. (http://www.bis.org/review/r160628f.htm)

[8] During Irısh bank strike of 1970 and Greek default in 2015, majority of the customary means of payments had not been available.

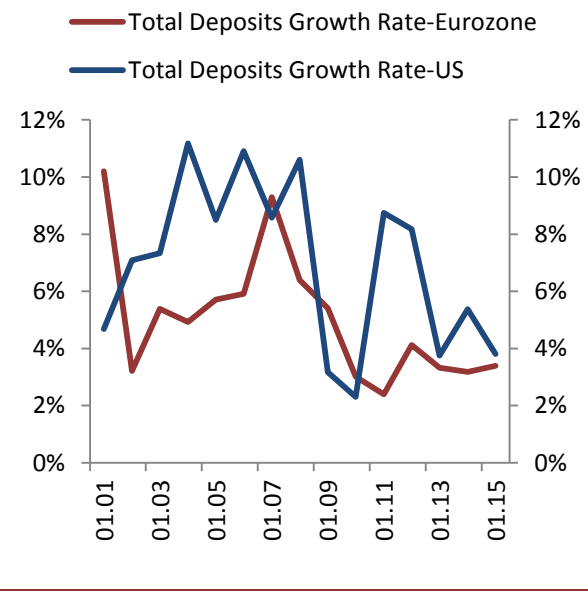
[9] (https://www.ecb.europa.eu/ecb/tasks/stability/html/index.en.html)

Lehman Brothers on September 2008 was marked as an indicator of seriousness of the crisis and the impact was carried to Europe and other parts of the world by creating systemic risk as financial markets were interconnected deeply. The financial instability caused by "Great Recession", as termed, is observed in financial and economic indicators of US and global data.



Source: Bloomberg

Figure 3: Volatility Index and Its Standard Deviation[10]



Source: Bloomberg

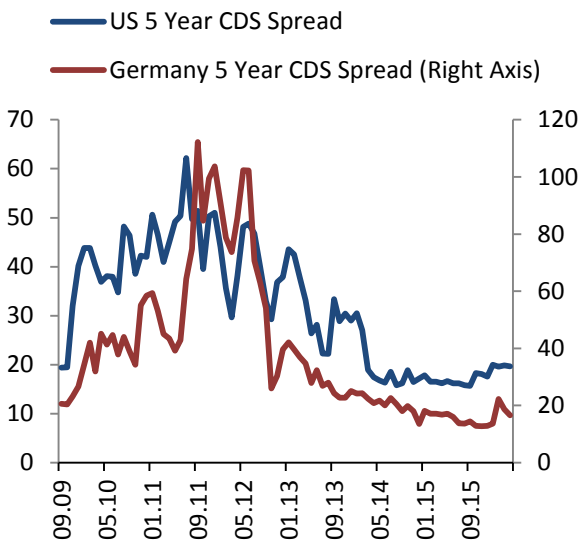
Figure 4: Growth Rate of Commercial Bank Deposits (year-on-year)

Volatility Index (VIX) is an indicator for global risk appetite and financial stress level. As Kara (2012) states, level of VIX is a broad representation of risk in the global economy, whereas standard deviation of VIX is an indicator of uncertainty in the global economy. The fact that a financially instable environment was created after 2008 crisis is evident in sudden increase of VIX in Figure 3. The sudden spike in the VIX data on September 2008 implies the rising level of risk as well as the uncertainty in the global

[10] Volatility Index (VIX) is defined as 1-month implied volatility of the option contract written on S&P 500 Index.

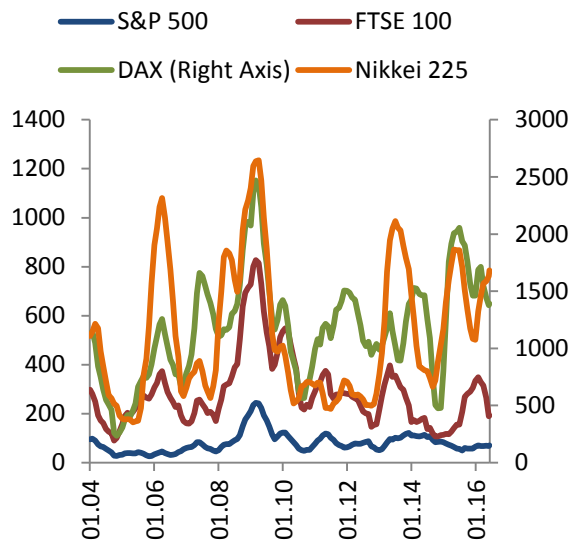
markets. It can also be seen as an externality of fragile financial markets conditions observed in almost last ten years.

One component of financial stability definition of Allen and Wood (2006) is undisturbed transformation of funds into investments through financial institutions. Figure 4 presents the rate of growth of aggregate commercial bank deposits in US and Europe (which are two biggest economic zones affected by the global crisis severely). Not only for US, but also for Eurozone countries as a whole, the ability of banking system to collect funds in the form of deposits, which are most stable and core source of funding for banks as Hahm, Shin and Shin (2012) describe, crippled. The deposit growth rate decreased from 10% levels in before crisis period to 4% levels in after-crisis period.



Source: Bloomberg

Figure 5: Credit Default Swap Spreads (basis points)



Source: Bloomberg, Author's Own Calculations

Figure 6: Volatility of Stock Indices of Selected Developed Countries (12-month standard deviation)

Especially, during economic turmoil, country-specific risk level can be inflated which may affect a foreign investor to bring funds and capital to a particular country.

Financially instable economies are also characterized with high level of country-specific risk. Whether or not recent 2008 crisis contributed to the financial instability through increasing sovereign risk is clearly evident in Figure 5, in which premiums on 5-year credit default swap contracts are scattered. Especially, initial periods after crisis witnessed a sudden increase in CDS spreads in US and in Germany (as a proxy for Eurozone).

To describe a financially instable framework, Allen and Wood (2006) mention the role of volatility in finance asset prices as well. Figure 6 displays the 12-month standard deviation of stock market indices of selected developed countries which belong to US (S&P 500), UK (FTSE_100), Germany (DAX) and Japan (Nikkei-225). It can be said that during "Great Recession", volatility for stock indices increased substantially which allowed for a financially instable situation.

We have covered extensively the definition of financial instability concept and how well time period of 2008 crisis fits that concept. Global economic turbulence observed in the crisis was a key turning point for how monetary authorities approach to financial stability. The importance of including financial stability as a policy goal along with traditional price stability aim started to be understood after this period. There appeared a view that financial stability should be incorporated into policy-reaction functions of central banks and other monetary authorities (Bayoumi, Dell'Ariccia, Habermeier, Mancini-Griffoli, & Valencia, 2014). Moreover, adding a second target to the monetary policy makers' agenda requires the composition and implementation of macro-prudential tools including regulatory and supervisory policies in the banking sector to ensure financial stability. Before that period, neither financial stability nor asset prices were

integrated to the objective function of central banks which apply traditional inflation-targeting framework (Kara, 2012). Additionally, implementing new monetary policy and macro-prudential measures naturally requires a well-coordinated institutional framework (Agenor, Alper, & Silva, 2013).

In Turkey, CBRT is a major part of such framework in the quest of providing financial stability. In this context, one of the responsibilities of CBRT is closely monitoring financial intermediary services to improve the functioning of financial transactions. CBRT implemented several policies in last couple of years to this end.

Firstly, inflation-targeting monetary policy structure was altered to accommodate complementary policy tools. The gap between overnight lending and borrowing rates had been widened to create a mechanism to adjust volatility of short-term money market rates in response to global and domestic developments. In that way, the inflow of short term funds was limited because of the low rate of returns and high volatility of money market rates. Excessive and volatile inflows were result of accommodative monetary policies of industrialized countries to overcome the impact of crisis. This step was necessary as excessive fund flows that are transformed into loans caused problems with respect to current account deficit, credit growth and household indebtedness. The rationale of the asymmetric interest rate corridor based on this discussion is examined in Chapter 4.

Secondly, macro-prudential policies were implemented by CBRT to restore financial stability. For instance, Reserve Option Mechanism (ROM) allowing banks to place a portion of TL required reserves in the form of foreign exchange and gold was put into practice. Some examples of other measures can be listed as changes made in reserve

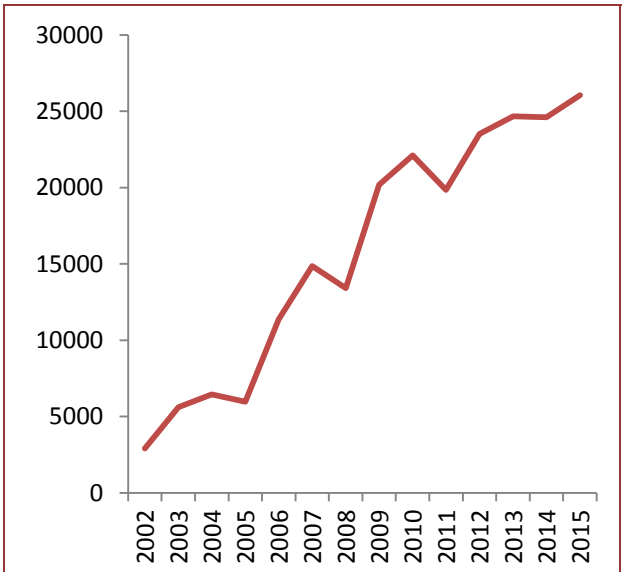
requirement rules, regulations encoded to limit borrowing capacity and installments (*CBRT and Financial Stability,* n.d.)[11].

An integral responsibility of CBRT in terms of financial stability is to monitor financial institutions and this aim is somewhat related to bank profitability. CBRT is following developments about financial institutions through its Financial Stability Report. Similar to other examples of such reports, this one is specifically designed to follow the trend of data developments in terms of specific aspects of financial industry. Report also focuses on the pre-determined risk types that financial institutions face such as credit risk, liquidity risk, interest rate risk, currency risk, capital adequacy and, more importantly for our discussion, profitability. Hence, banking sector has been closely monitored by CBRT[12].

In this chapter, we try to summarize how bank profitability evolves over time in detail. Data includes total items in the sense that it is composed of both TL and FX components. FX items are transformed into Turkish lira as banks report their data to BRSA in that way. Hence, we make no adjustment to account for possible currency or parity impact on data.

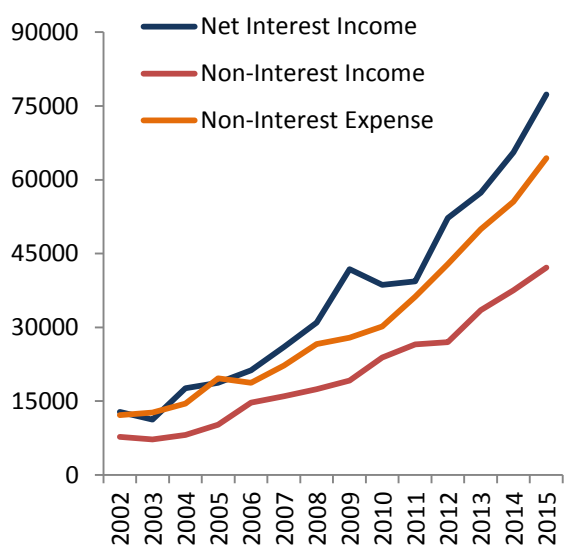
[11] (http://www.tcmb.gov.tr/wps/wcm/connect/TCMB+TR/TCMB+TR/Main+Menu/Para+Politikasi/Finansal+Istikrar/Merkez+Bankasi+ve+Finansal+Istikrar)

[12] For the rest of this chapter, by using the monthly aggregate sector data obtained from Banking Regulation and Supervision Agency (BRSA), we conduct ratio analysis of some profitability measures which are also preferred in Financial Stability Report (Financial Stability Report, n.d.).



Source: BRSA

Figure 7: Net Income (million TL)



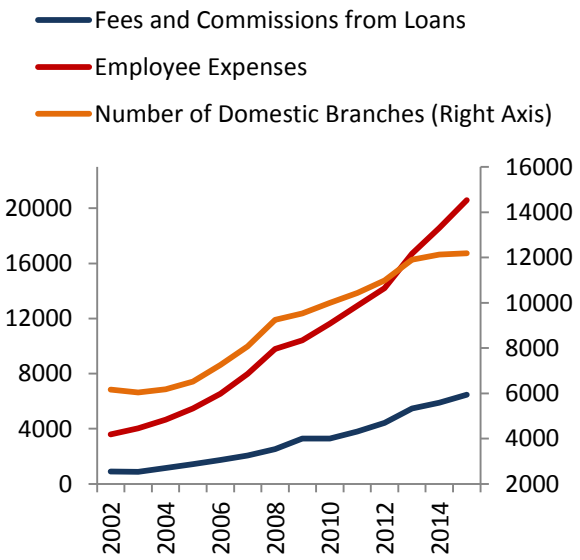
Source: BRSA

Figure 8: Components of Net Income (million TL)

Net income of Turkish banks has a strong upward trend, despite there exists some periods of moderation in profit generation ability of banks, as seen in Figure 7. Despite the fact that, net income is stable during the period of stabilization and recovery after 2001 crisis (period until the year 2005), an accelerated trend is observed especially after 2005. Global financial crisis and European sovereign debt crisis seem to intervene that trend and, the cumulative change in net income becomes slower and it even declines during the years 2008 and 2011.

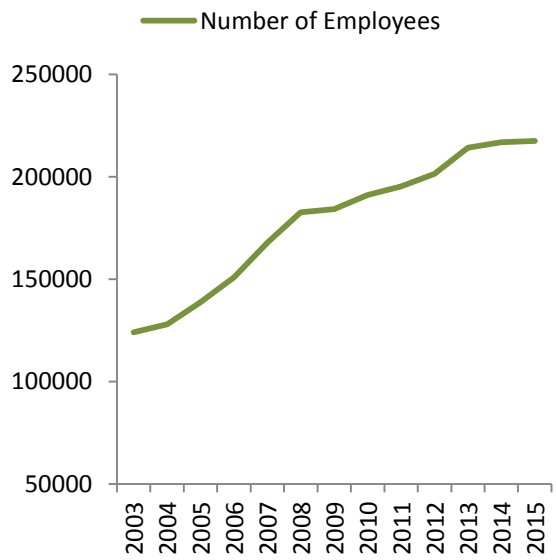
Banks have two main income and expense sources. The main operation of banks involving collecting deposits and extending credits is also the main source of net income. In Figure 8, the fact that net interest income being higher than the difference between non-interest income and non-interest expense, especially after 2006, is supporting this argument. Banking activities other than lending is contributing negatively to net income

as non-lending expense is larger than non-lending income throughout whole sample. The stable trend of non-interest income shows that Turkish banks are not able to extract too much economic value from non-lending activities.



Source: BRSA

Figure 9: Components of Non-Interest Items and Branch Network (million TL, units)

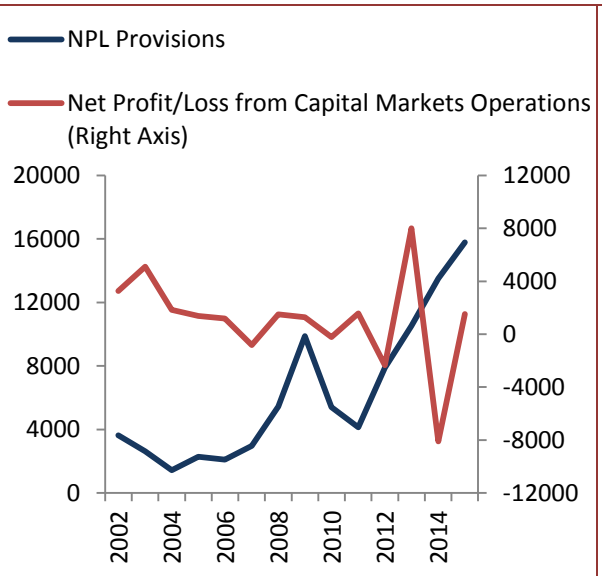


Source: BRSA

Figure 10: Number of Employees in the Banking Sector

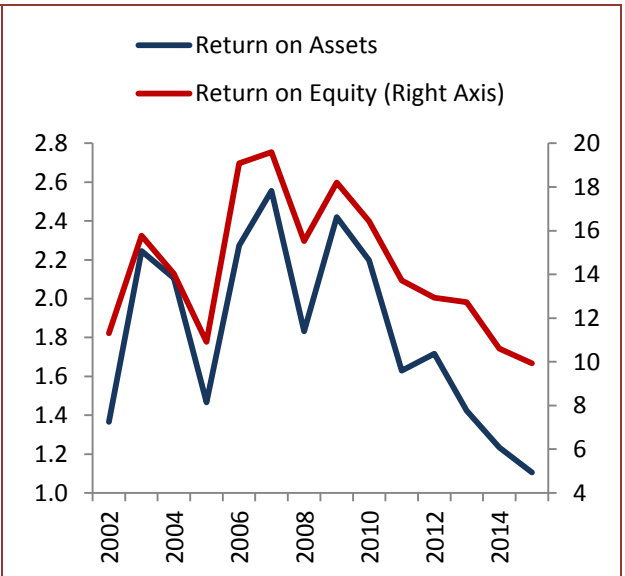
Despite the fact that, there is a maturing trend with which Turkish banks enlarge their branch network after 2013, employee expenses which is an overhead cost category that is directly linked to the branching activity increase substantially, as observed in Figure 9. One factor in this development is the increase in number of people employed in the sector, as seen in Figure 10. On the other hand, fees and commissions can be regarded as an important component of non-interest income sources. As Demirgüç-Kunt and Huizinga (2010) state, recent developments in the banking sector in terms of operational diversity enhanced some banks to adapt a range of activities such as commercial banking,

investment banking and insurance. As activity mix is enlarged, non-interest income sources derived from activities like underwriting securities or asset management become more visible. In the case of Turkey, fees and commissions (as an important component of non-interest income[13]) are not increasing at a faster rate.



Source: BRSA

Figure 11: NPL Provisions and Profit/Loss from Capital Markets Operations (million TL)



Source: BRSA

Figure 12: ROA and ROE (percentage)

Banks keep provisions to protect their net income from losses caused by default of firms and households on their debt. One indicator of this careful stance of banks can be seen in Figure 11 where non-performing loan (NPL) provisions have upward trend especially after 2011. Moreover, this situation is also in line with the view that credit risk could be related to bank profitability. Moreover, the income stream from capital market operations is volatile especially for the last five years when even occasional losses are observed.

[13] As of March 2016, fees and commissions constitute 14.7% of all of the non-interest income.

Lastly, two alternative measures of bank profitability are presented in Figure 12. It is evident that both return on equity (ROE) and return on assets (ROA) have been declining after 2009. As of 2009, ROE was at around 18% while it is decreased to 9.9% in recent times. Similarly, ROA decreased from the levels of 2.4% to the 1.1%.

When we summarize these observations from ratio analysis, we can say that:

- Turkish banking sector has an increasing net income level in spite of the periods during 2008 global financial crisis and recent European sovereign debt crisis that resulted phases of maturing speed in profit creation.
- Turkish banks rely mostly on interest bearing items in revenue creation. The higher level of net interest income from net non-interest income in the examined sample period is in line with that argument.
- Turkish banks are not productive in terms of revenue creation from activities that do not involve interest. Banks are incurring losses that are more than corresponding revenues from non-interest activities. When we examine the components of non-interest income, we see that slow-growing fee and commissions income is contributing to the narrow scope of business model Turkish banks have.
- Despite the maturing trend of the expansion on bank branch network and number of employees, employee expenses are increasing substantially.
- Turkish banks are becoming more aware of credit risk especially after global financial crisis that is manifested in accelerating level of NPL provisions. Income stream from capital markets operations is very volatile, especially during recent years.

- Bottom-line profitability measures of ROA and ROE have significant downward trend, especially for the last six years.

Hence, in this thesis, we concentrate mainly on explaining the factors that may affect the trend of net interest income of Turkish commercial banks during 2011-2016 using quarterly data. As emphasized in the introduction chapter, we try to understand the role of unconventional monetary policy exercised by CBRT after 2011 on net interest income of commercial banks. We have no intention to answer lessening bottom-line profitability ratios of Turkish banks which might be another research question.

CHAPTER IV

POLICY RATE AND LOAN/DEPOSIT RATES

The impact of Central Bank policy rate on bank net interest margin is a focal point of this study. Testing the significance of the impact of policy rate on net interest income of commercial banks creates a complication in the case of Turkey given the fact that CBRT has been conducting an unconventional monetary policy characterized by an asymmetric interest rate corridor system with active liquidity management. The nature of monetary policy followed in Turkey since 2010 brings several short term interest rates into the picture for which an additional analysis is required to reveal the level of their impact on bank lending and deposit rates.

In this chapter of the thesis, firstly, we are describing the reasons why such unconventional policies are adopted and how did those measures serve in macroeconomic structure. Then we define the asymmetric corridor system, its mechanics and interest rate parameters; not only those which are officially determined by CBRT but also those which are influenced by CBRT decisions. In the later part of this chapter, the transmission

mechanism of chosen parameters of interest corridor framework to bank commercial loan, consumer loan and deposit rates are explored. These relations are evaluated with a reduced-form VAR model on the aggregate banking sector level. We end this chapter by a panel VAR analysis with the bank level data to see the existence of pass through from policy rates to loan and deposit rates on the individual bank level.

4.1 Interest Rate Corridor System In Turkey

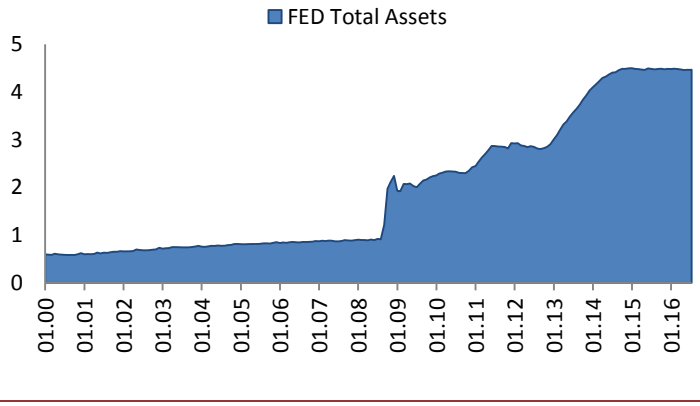
4.1.1 Motivation

In the contemporary understanding of implementing monetary policy, a target overnight rate is aimed to be achieved by policy makers. A target is set and then money market rates are forced to float closely to policy rate through liquidity operations. In keeping money market rates closer to targeted policy rate, two methods are generally used which are reserve averaging and corridor system. Corridor system is preferred by central banks of some developed countries (Whitesell, 2006)[14]. As a natural implication of traditional corridor system, central bank lending rate constitutes a ceiling for overnight interest rates while borrowing rate of a central bank constitutes a floor (Whitesell, 2006). In this traditional sense of rate corridor framework, central bank's target interest rate is positioned at the midpoint of the corridor. Aftermath of the global crisis, the framework is different in Turkey since it has an asymmetric structure and involves with different parameters.

As emphasized in Chapter III, global financial crisis in 2008 was a turning point when the importance of financial stability was comprehended by monetary authorities. Especially,

[14] Noticeable examples of monetary authorities with corridor framework are Federal Reserve, Bank of England and European Central Bank.

the unconventional measures taken by developed countries' central banks had created new economic dynamics for emerging markets. Due to the quantitative easing policies of developed countries to cope with the impact of crisis, abundance of liquidity was emerged. This created a high volatility of capital flows to emerging countries given the fragile financial conditions in the aftermath of crisis. As it can be seen in Figure 13, the size of the balance sheet of Federal Reserve (FED) displays an indicator of quantitative easing and the availability of liquidity in global markets.

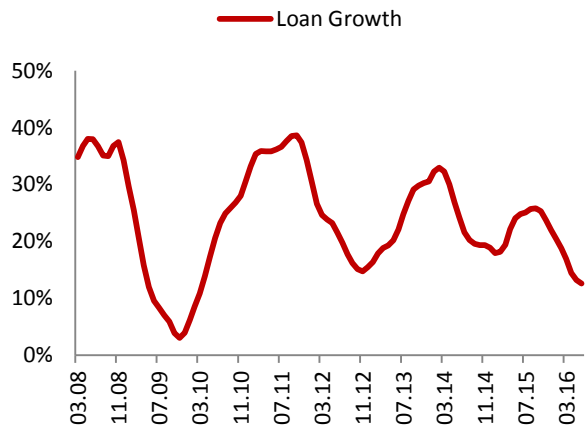


Source: Bloomberg

Figure 13: FED Balance Sheet Size (million USD)

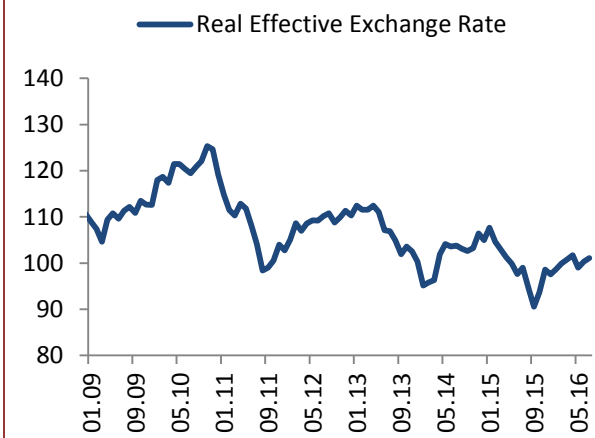
The volatility of short term capital flows to emerging countries increased not only in equities but also in fixed income securities, especially after the implementation of second quantitative easing program in US in 2010. After the crisis, changes in global liquidity conditions also affected the macro balances of developing countries such as Turkey. As it can be seen in Figure 14, year-on-year loan growth increased to the levels of 40% caused by the fact that high level of capital inflows eased the access to finance, which in turn enhanced domestic consumption. However, such excessive level of loan growth created financially instable environment. During the same period, capital inflows to Turkey

resulted an appreciation in Turkish lira characterized by the increasing demand for Turkish Lira denominated financial assets (see Figure 15).



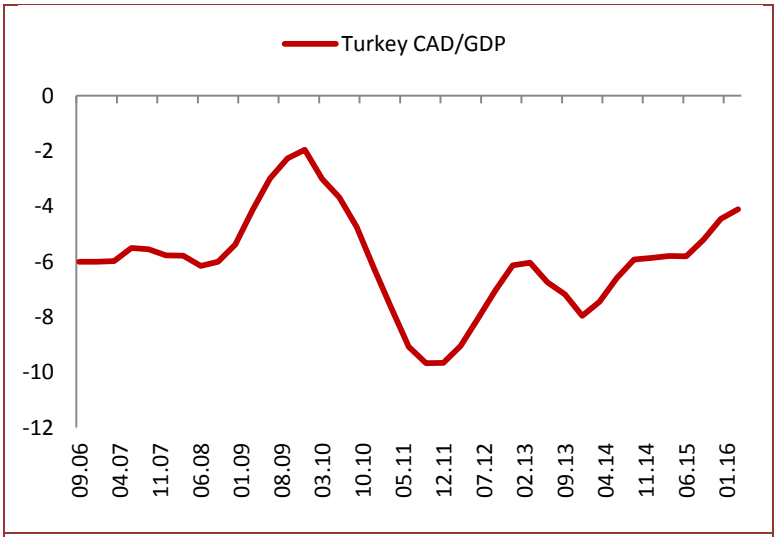
Source: BRSA

Figure 14: Total Loan Growth (year-on-year change, 3-month moving average)



Source: CBRT

Figure 15: CPI Adjusted Real Effective Exchange Rate (2010=100)



Source: Bloomberg

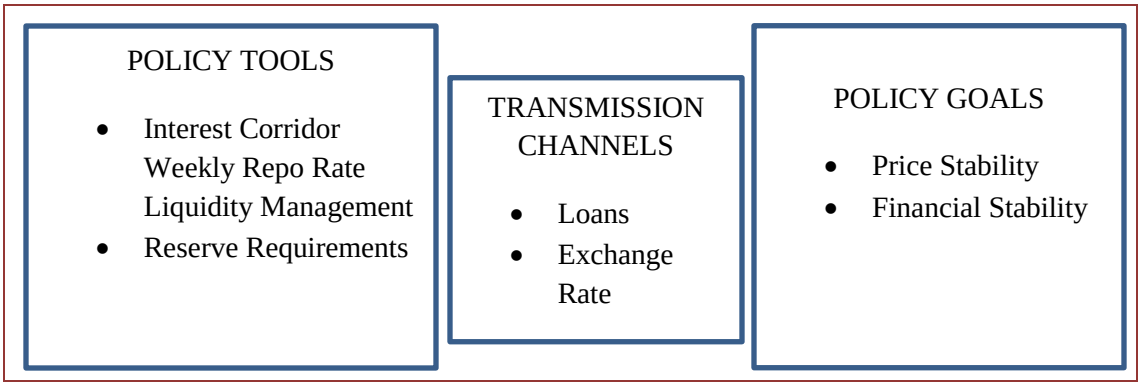
Figure 16: Current Account Deficit to GDP (percentage)

Eventually, strong demand for imported goods through very high level of loan growth as well as the upward pressure on Turkish Lira resulted a rising level of current account

deficit as a percentage of GDP[15], as shown in Figure 16. Widening current account deficit and the use of short-term capital inflows as a sole financing method for current account increased the fragility of Turkish economy to the sudden changes of global risk appetite. Furthermore, the maturity and currency mismatches in the balance sheets of banks and non-financial firms in Turkey at that time amplified the fragility to "sudden stops" in capital flows. Conventional monetary policies generally were dictated to sustain low level of policy rates to control the overvaluation in exchange rate and to restore current account balance. However this would keep domestic demand to be high and price stability not to be achieved.

In the case of conventional monetary policy and single policy rate, financial variables like loan growth and financial asset prices are not incorporated in the objective function of monetary authority. With the new corridor framework, CBRT adopted policies with multi-tools after the end of 2010, aiming to achieve more balanced growth structure and sustainable current account balance. Two main sub-goals of monetary authority added with this understanding are "decreasing and controlling short-term capital inflows" and "slowing the loan growth". CBRT's policy tools and goals in the new framework are shown in Figure 17.

[15] The negative impact of consumer loan growth on current account deficit is documented in Turkey (Alioğulları, Başkaya, Bulut, & Kılınç, 2015).



Source: Kara (2012)

Figure 17: Policy Tools and Goals of CBRT in New Framework

4.1.2 New Framework

Before going into the mechanics and interest rate parameters of the new corridor system, we explain the main differences between old and new framework. In the new system, Monetary Policy Committee (MPC) of CBRT can make interventions to the monetary policy stance on the daily and weekly basis by adjusting the composition of short term funding as well as the effective funding rate. However, in the old system monetary stance is determined only on monthly basis in the official MPC meetings. Thus, new framework provides flexibility in responding to sudden changes in global risk appetite and capital flows.

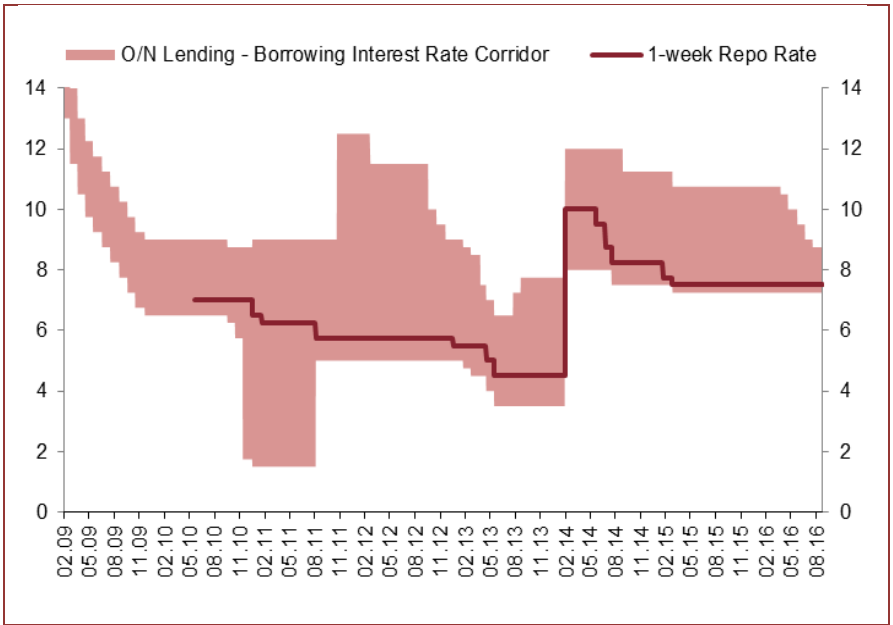
There is another difference in the new system. Asymmetric interest rate corridor allows CBRT to affect both loan and exchange rate channels separately. In terms of loan channel, CBRT can adjust the cost of its funding provided to the financial institutions on the daily basis, so it can alter the marginal cost of credit allocation of banks which have liquidity deficit (those banks which should borrow funds for liquidity management purposes). By increasing or decreasing the uncertainty about the CBRT funding, loan

growth can be controlled by the CBRT. Similarly, a countercyclical strategy can be applied in the asymmetric interest rate corridor system in terms of capital inflows and exchange rate appreciation. Large interest corridor combined with CBRT's ability of daily adjustment of the interest rate occurred in the money market through liquidity operations enable policy makers to counter capital flow and exchange rate volatility. To this end, CBRT can enlarge the corridor to the lower side and can increase the volatility of interest rates during periods when capital flows are strong. CBRT can also enlarge the corridor to the upper side and can decrease the volatility of interest rates during periods when capital flows are weak. For example, towards the end of 2010, corridor was enlarged (volatility of rates were increased) downward to combat with high level of incoming short-term funds; while corridor was narrowed (volatility of rates were decreased) when Eurozone crisis hit in 2011 and affected global risk taking appetite (Kara, 2012).

4.1.3 The Mechanism

Interest rate corridor in Turkey started in May 2010 when 1-week repo funding structure was established as a funding tool. Before that period, CBRT borrowing rate (the rate applied when CBRT borrows the excess liquidity of banks) which is the lower bound of the corridor was the effective policy rate (Ünalmış, 2015). The reason why CBRT borrowing rate can be considered as the policy rate for that period lies on the liquidity position of the banking sector. After 2001 crisis, destabilization of bank balance sheets resulted a net liquidity surplus of banks. Hence, CBRT lending rate (upper bound of the corridor) was relatively ineffective (Kara, 2015). On the other hand, since the end of 2010, Turkish banks has liquidity deficit so CBRT is the net provider of liquidity in the

market. After this period, CBRT borrowing rate became relatively ineffective. It should be noted that symmetric corridor applied before mid-2010 had a passive role in the standard inflation targeting regime (Binici, Erol, Kara, Özlü, & Ünalmış, 2013). In this study, we take the effective initiation of new system from the end of 2010, as CBRT has actively used the new corridor system from this date. At the end of 2010, CBRT widened the corridor downwards, increased the volatility of interest rates and reserve requirement ratios to cope with capital flows and to limit excessive credit growth (Binici et al., 2013). Thus, in our empirical analysis, we will not start our sample period from the second quarter of 2010 but we will choose first quarter of 2011 as starting point for our sample (see also official parameters of the corridor presented in Figure 18).



Source: CBRT

Figure 18: Official Interest Corridor Parameters

Two official parameters of the interest rate corridor, which are CBRT lending and CBRT borrowing rate can be considered as inputs for econometric analysis. However, as

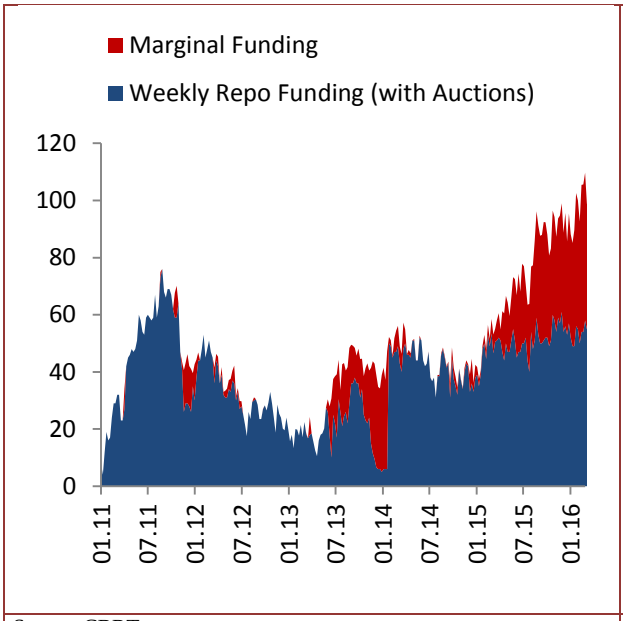
emphasized in Kara (2015) and Binici, Kara and Özlü (2016), there are other short term interest rates which are not officially announced by CBRT but are determined indirectly by CBRT liquidity policies in new framework. One such rate is CBRT's weighted average cost of funding (WACF). Funding methods of CBRT determine the level of WACF. Currently, there are two methods by which CBRT can provide liquidity to financial institutions. First method is through one-week repo funding. After the policy change in May 2010, repurchase agreement transactions are started to be used with which banks can obtain liquidity from CBRT by borrowing for one-week period and pledging Treasury bills as collateral. These repo funding is done through quantity auctions. In quantity auctions, CBRT announces auction amount daily and then each bank has the right to bid up to the announced liquidity amount. All bids are fulfilled in this method and if total bids exceed announced auction amount, then liquidity is distributed to each bank according to the ratio calculated by multiplying bank's bid amount with the ratio of auction amount divided by total bids (Küçük, Özlü, Talaslı, Ünalmış, & Yüksel, 2014).

Second method is called marginal funding. If one-week repo transactions do not cover funding need of the system, then financial institutions would borrow from money markets. If that is not deemed enough too, then CBRT is engaging another funding method in the interval of overnight period. As it is the case since 2015Q1, there could be times when CBRT does not provide all the liquidity needs of the system with weekly repo funding. In such cases, banks utilize marginal funding opportunity, which is also a repo transaction on overnight basis that is backed by Treasury bills as collateral (Ünalmış, 2015; Kara, 2015). The cost of utilizng marginal funding is the upper bound of the corridor that is CBRT lending rate. Despite the fact that CBRT has been using one-

week repo transactions as sole funding method for some time; marginal funding is also extensively utilized since 2015Q1. Thus, there appears an average funding cost of banks[16] which is calculated as a linear combination of cost of two funding methods, that is weighted by the relative importance of particular funding method (weekly or overnight) in whole funding structure of CBRT. WACF is considered important in the loan and deposit pricing of banks since one important components of banks' short term funding in Turkey is CBRT sources (Kara, 2015). Equation 6 shows the calculation of WACF (Binici et al., 2016), while Figure 19 and Figure 20 shows the funding composition of CBRT and the payables to CBRT on the liability side of the aggregate balance sheet of banks.

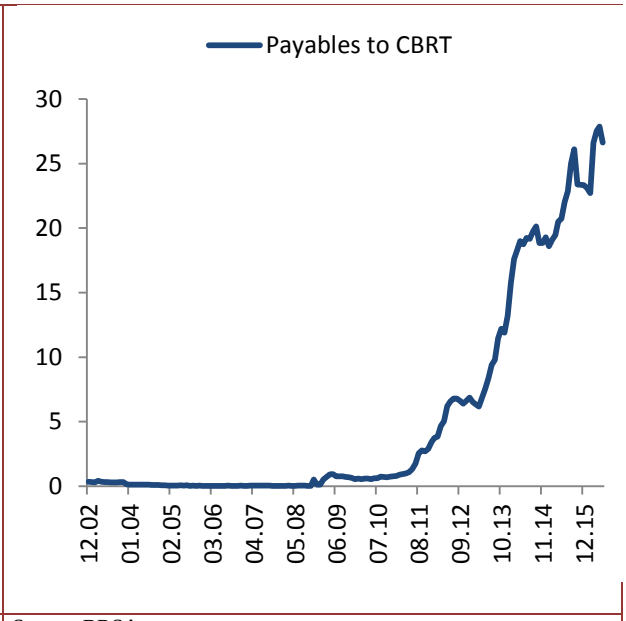
$$\text{WACF} = \frac{\text{Weekly Repo} * \text{Weekly Repo Rate} + \text{Overnight Funding} * \text{Marginal Funding Rate}}{\text{Total Funding of CBRT}} \quad (6)$$

[16] Effective cost of funding for banks when they are borrowing short term liquidity from CBRT.



Source: CBRT

Figure 19: Funding Composition of CBRT (weekly, billion TL)



Source: BRSA

Figure 20:Total Payables to CBRT (monthly, billion TL)

Apart from CBRT lending, CBRT borrowing and WACF; last parameter of corridor system is BIST overnight rate. Although this is not an officially announced rate by CBRT like WACF, it is indirectly determined by the liquidity policy. Banks can borrow from short-term sources other than CBRT in money markets (Ünalmış, 2015). There are two overnight money markets operating under BIST (Küçük et al., 2014; Kara, 2015; Binici et al., 2016). First one is the BIST repo/reverse repo market. In this market, not only banks but also other non-bank financial institutions like investment funds and brokerage firms are allowed to engage in transactions. The transactions in this market are subject to reserve requirements (Küçüksaraç & Özel, 2013). Because of the transaction costs arising from reserve requirement rules, interest rate in this market is relatively lower than the rate incurred in the other BIST money market (Ünalmış, 2015). Second market is called BIST interbank repo/reverse repo market. In this market, only banks are allowed to make transactions and they are not subject to reserve requirements. Since this market is the

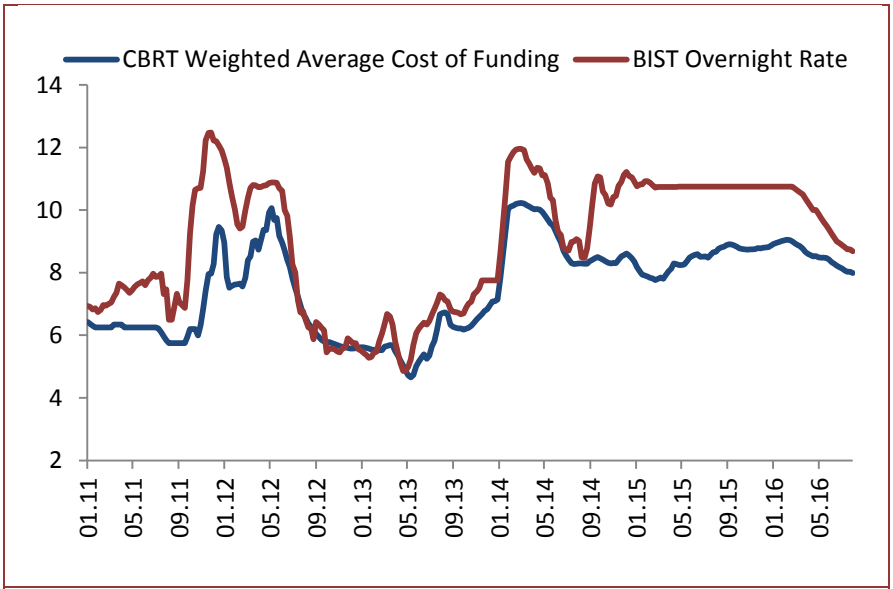
largest organized repo market in Turkey (transactions in this market are in the form of repurchase agreement transactions), overnight rate incurring this market is taken as a benchmark for other money market instruments in Turkey (Küçüksaraç & Özel, 2013; Küçük et al., 2014). One other money market from which banks can obtain short term liquidity is cross currency swap market, in which banks which have foreign funds can turn them into Turkish lira to allocate loans denominated in local currency. Küçüksaraç and Özel (2013) use Pesaran, Shin and Smith (PSS) co-integration method to prove that there exists a long term relation between BIST overnight rates and cross-currency swap rates. Banks also regard BIST rate as reference rate for funding from non-CBRT sources (Binici et al., 2016). Because of its informative nature and its exemption from reserve requirement costs, we will take this variable as a candidate in our analysis.

As described in Kara (2015) and Ünalmış (2015), the rate in BIST Interbank Repo/Reverse Repo Market is determined by supply/demand interaction in funds market[17]. Ünalmış (2015) basically adds the existence of non-CBRT sources to the representation of Kara (2015) where CBRT is the sole provider of short term funds. In this setup, supply curve of liquidity is a step function where CBRT provides certain amount through one-week repo facility at constant rate (curve is horizontal here), non-CBRT sources provide certain amount (supply curve is upward sloping as when price of funds increases, banks would supply more funds to each other) and CBRT can cover remaining liquidity needs at marginal interest rate. On the other hand, demand function for funds derived from banks' behavior is downward sloping until the lower bound of the corridor from which demand line is horizontal as no bank can borrow funds at more

[17] Demand and supply interaction is depicted in Kara (2015) and Ünalmış (2015). Their representations are provided in Appendix B.

advantageous rate than CBRT. By not covering all the liquidity needs of banks, CBRT can let the demand for funds line to cross the supply of funds line at such interest level that CBRT can direct the BIST overnight rate to be occurred in the upper bound of the corridor which is the cost of marginal funding. Hence, the level of BIST overnight rate can be determined by CBRT via corridor setup and the composition of funding policy (Binici et al., 2016). The reference nature of BIST overnight rate that is charged in interbank transactions is important in this context.

As it is stated before, in the asymmetric corridor system, short term money market rates can be realized in levels that are quite different from the levels of official interest rates. Küçük et al. (2014) investigate the impact of CBRT liquidity policies on the spread between BIST overnight rate and WACF and find that composition, maturity and costs of CBRT funding are effective in determining BIST spread (see Figure 21 for BIST overnight rate and WACF).



Source: CBRT

Figure 21: CBRT Weighted Average Cost of Funding and BIST Interbank Overnight Rate (weekly flow values, 4-week moving average)

4.1.4 Empirical Evidence

As explained in Section 4.1.3, official and implied parameters of interest corridor can be listed as:

- CBRT Lending Rate
- CBRT Borrowing Rate
- CBRT Weighted Average of Cost of Funding (WACF)
- BIST Interbank Repo/Reverse Repo Market Overnight Rate

To our knowledge the effect of corridor parameters on net interest income of commercial banks has not been investigated in the context of Turkey. However, there are some empirical works that are mainly conducted to determine the impact of corridor parameters on bank loan and deposit rates. Binici et al. (2013) assessed the transmission mechanism of policy rates to commercial loan and deposit rates by using VAR models. Their study includes two sub-period in the sample, one is before May 2010 (before the initiation of asymmetric corridor), and other one is after November 2010 (after the initiation of asymmetric corridor). They used bank level data about rates charged on commercial loans with differing maturities and deposits with three months maturity. Their findings indicate that both commercial loan rates and deposit rates react significantly to CBRT WACF in first sub-period while this impact disappears in the second sub-period. Additionally, they reveal that commercial loan rate becomes responsive to upper bound of the corridor and deposit rate becomes responsive to BIST interbank rate in the second sub-period when corridor system is adopted. Apart from transmission analysis, they also conduct a panel data analysis with bank level data for the period between December 2012

and November 2013. They found that in explaining commercial loan rates; CBRT lending rate, CBRT borrowing rate and reserve requirement ratio are significant factors. Furthermore, in explaining deposit rate; WACF, CBRT borrowing rate and reserve requirement ratio have statistically significant coefficients. In another study, Binici et al. (2016) tests same relation with bank-level data for the period between June 2010 and December 2014. Their results indicate that BIST overnight rate and WACF are important in explaining commercial and consumer loan rates; whereas, WACF is found to be influential for the pricing of deposit rates. Alper and Çapacıoğlu (2016) also find that BIST rate and WACF are significant explanatory factors for deposit rate.

4.2 Transmission Mechanism of Policy Rates On Industry Level

In this thesis, we have reduced form VAR model with industry level data to reveal the pass through in the transmission mechanism from chosen parameters of the interest rate corridor of CBRT to loan and deposit rates.

We use weekly aggregate level data of BIST overnight rate, CBRT WACF, bank loan rates and bank deposit rates[18]. The sample period is between 2011W1 and 2016W13. CBRT Electronic Data Dissemination System provides flow interest rate data on weekly basis. Interest rates on commercial and consumer loans as well as deposit rates are taken from this source. All loan and deposit rates are Turkish lira denominated. Consumer loan rates represent interest rates charged for housing loans, vehicle loans and general-purpose loans. BIST overnight rate and CBRT WACF are also obtained from the same source.

[18] CBRT borrowing rate is excluded in this analysis considering the fact that there exists a liquidity deficit instead of surplus in the banking sector in Turkey during the time when asymmetric interest corridor has been utilized. CBRT lending rate is also excluded as WACF is already representing two main funding structure of CBRT which are weekly repo funding and overnight funding.

In order to examine the transmission mechanism of CBRT policy rates to bank loan and deposit rates, two reduced form VAR models are considered. First model employs BIST overnight rate as a policy rate, while second one replaces BIST rate with WACF[19]. According to summary statistics in Table 1, commercial and consumer loans seem to be priced more frequently than deposits as the standard deviation of these particular lending groups are higher than the deposit rate in the sample period. When we examine the average value for the rates charged on different types of loans, it is evident that consumer loan rate is higher than that of commercial loan rate. Highest values of the loan rates during the sample period show that there were periods when interest rates on loans diverged notably from short term policy rates.

Table 1: Summary Statistics and Sources for Variables Used in VAR Estimation

Variable	Obs	Mean	Std. Dev.	Min	Max	Source
BIST Overnight Rate	273	8.92	2.19	4.27	12.49	CBRT
CBRT WACF	273	7.49	1.51	4.52	11.93	CBRT
Commercial Loan Rate	273	12.83	2.17	8.09	17.01	CBRT
Consumer Loan Rate	273	14.21	2.06	9.93	18.34	CBRT
Deposit Rate	273	8.83	1.30	5.59	11.15	CBRT

First, we conduct Augmented Dickey-Fuller (ADF) tests to see whether data is stationary[20]. According to ADF test with intercept as well as the intercept and trend (see

[19] Orderings in VAR models are determined as follows: BIST rate, deposit rate, commercial loan rate and consumer loan rate as well as WACF, deposit rate, commercial loan rate, consumer loan rate respectively. Policy rates are assumed to be most exogenous variables as in the context of interest rate channel of monetary transmission, changes in moentary policy through altering of money supply would have an impact on real and nominal longer term rates (Mishkin, 1996). Furthermore, impulse responses are examined (see Appendix E). Different ordering alternatives are tried and no significant change is observed in impulse responses.

[20] ADF tests allow the data to be modeled with a dynamic structure as indicated below.

$$\Delta y_t = \varphi y_{t-1} + \sum_{i=1}^{p} \alpha_i * \Delta y_{t-1} + u_t$$

Table 2), all interest rates are found to contain unit root. When respective interest rates are differenced, they appear to be stationary. Alternative method to assess the nature of the data in terms of the stationarity is KPSS test (Kwiatkowski, Phillips, Schmidt, & Shin, 1992). Null hypothesis of this test is that data is stationary. Results of the KPSS test are presented in Appendix C. These results are mostly in line with the results of ADF test. However, there are contradictions for WACF (when trend and intercept structure are assumed) and for consumer loan rate (when intercept structure is assumed). Differing results might be due to the problems regarding to the structure of sample data including possible structural breaks and outliers. This point is addressed with a multiple breakpoint analysis.

Table 2: ADF Test Results

		Applied to Levels		**Applied to Differences**	
		t-statistics	p-value	t-statistics	p-value
BIST Rate	Intercept	-2.25	0.1890	-21.57	0.0000***
	Trend and Intercept	-2.50	0.3271	-21.53	0.0000***
CBRT WACF	Intercept	-2.13	0.2305	-20.18	0.0000***
	Trend and Intercept	-2.94	0.1503	-20.15	0.0000***
Commercial Loan Rate	Intercept	-1.89	0.3323	-14.54	0.0000***
	Trend and Intercept	-2.03	0.5817	-14.51	0.0000***
Consumer Loan Rate	Intercept	-1.78	0.3891	-8.33	0.0000***
	Trend and Intercept	-1.77	0.7162	-8.32	0.0000***
Deposit Rate	Intercept	-1.96	0.3005	-4.97	0.0000***
	Trend and Intercept	-2.31	0.4218	-4.97	0.0003***

*,** and *** denote significance at 10%, 5% and 1% levels respectively.

Before the impulse response functions are created to evaluate the pass-through of monetary policy stance to bank loan and deposit rates as a part of interest rate channel of

ADF tests decide between null hypothesis stating that data generating process has unit root (integrated with order 1, denoted as I(1)) and alternative hypothesis proposing that data generating process is stationary (integrated with order 0, denoted as I(0)).

monetary transmission mechanism, the existence of structural breaks and outliers in the sample data is examined by employing multiple breakpoint tests. In order to detect the possible structural breaks in the data, the methodology developed by Bai and Perron (1998, 2003) is used. In their setting, different regimes are evaluated by taking potential breaks in the data into consideration. Furthermore, model parameters are categorized in a way that some are regime specific, while some are assumed to be same across regimes.

Bai and Perron (1998) developed a global optimization procedure to determine the number of multiple breaks in the data series which in turn minimizes the residual sum of squares. In this thesis, we utilize the F-test to evaluate the validity of null hypothesis stating that there are no breaks against the alternative hypothesis pointing out that there exist structural breaks in the data series. Hence, null hypothesis of F-test assumes that regime specific parameters are same across different regimes. Additionally, BIC developed by Yao (1988) and LWZ information criteria developed by Liu, Wu and Zidek (1997) are examined. Table 3 summarizes estimated break dates for two interest corridor parameters, commercial loan rate, consumer loan rate and deposit rate. These break dates are controlled with dummy variables in VAR models.

Table 3: Multiple Breakpoint Test Results and Number of Estimated Breaks				
Variables	**SIC**	**LWZ**	**F-test**	**Breaks**
BIST Rate	3	3	5	10/14/2011, 7/20/2012, 4/26/2013, 1/31/2014, 12/05/2014
CBRT WACF	4	4	5	11/25/2011, 8/31/2012, 12/13/2013, 9/19/2014, 6/26/2015
Commercial Loan Rate	4	4	3	10/28/2011, 11/16/2012, 1/03/2014, 6/19/2015
Consumer Loan Rate	4	4	0	10/14/2011, 10/12/2012, 1/10/2014, 6/26/2015
Deposit Rate	4	4	4	11/18/2011, 9/21/2012, 1/31/2014, 6/26/2015

One particular break date prevailing for almost all data series coincides with January 2014 when CBRT took a swift policy action by increasing one week repo rate by 550 basis points, increasing overnight borrowing rate by 450 basis points and increasing overnight lending rate by 425 basis points in order to cope with quickly depreciated Turkish Lira as anecdotal evidence shows. CBRT also utilized other policy tools such as reserve requirements and direct FX selling auctions as a part of policy action at that time. Secondly, October and November 2011 appear to be break dates. During that time, another swift policy action was taken when interest corridor is enlarged upward while CBRT lending rate is increased by 350 basis points in order to overcome the problems regarding to the weakening capital flows due to European Sovereign Debt Crisis.

Thirdly, June 2015 is identified as a common break date for different interest rates. Around that time, Turkey was suffered from a heightened political risk together with tight financial conditions characterized by weakening economic activity, low level of consumer confidence and lack of strong credit demand. These internal factors appear to be contributing rising loan and deposit rates while CBRT did not take a strong policy

action during that particular time period. Lastly, time period covering August and December 2013 are found to be potential break dates. As it is widely known, in the second half of 2013, volatility in the global markets are increased due to the Fed's policy guidance of a reduction in asset purchasing program and gradual increase in policy rates. This period is widely named as "Taper Tantrum" when emerging markets were heavily affected in terms of the macro-financial balances. Furthermore, Turkey was also faced with heightened political risk at that time.

As stated before, choice of lag length which describes how many lags of each endogenous variable should be included in the estimation setting holds importance. Enders (2004) argues that setting an upper limit would be appropriate in deciding for lag length. Suggested upper limit is defined as $T^{(1/3)}$ where T represents the number of observations available in the sample data. Akaike Information Criterion (AIC) is employed to determine the lag length (see Appendix D). When upper limit of the test is increased, lag length appears to be robust. Furthermore, diagnostics analysis is performed by autocorrelation tests and the display of inverse roots of the AR characteristic polynomial (see Appendix D).

VAR model with BIST is estimated by including dummy variables representing break dates (of these variables) as exogenous factors. VAR analysis results show that there exists a pass through from BIST overnight rate to commercial loan rates that are charged by banks. In Figure 22, the accumulated impulse-response function for that relation is provided. It can be seen that commercial loan rate is significantly reacting to the impulses in BIST overnight rate especially after fourth week. After three months, the impact is stabilized. Impulse-response function states that for the first three months, the response

level is 0.19, i.e., one unit standard deviation shock coming to BIST rate is transmitted as 19 basis points response in commercial loan rate in three month period.

In Figure 23, the pass through between BIST rate and consumer loan rate is evaluated. Accumulated response of consumer loan rate to impulse in BIST overnight rate indicates that transmission is significant after second week and transmission appears to be saturated around three months. The response level in this time interval is 0.208, i.e. shock is transmitted as 20.8 basis points response in consumer loan rate. Similarly, impulse response function is created for the relation between BIST rate and deposit rate (see Figure 24) from which it can be inferred that there exists a pass through from BIST rate to deposit rate. Pass through is especially significant for the whole first quarter after which the impact is stabilized.

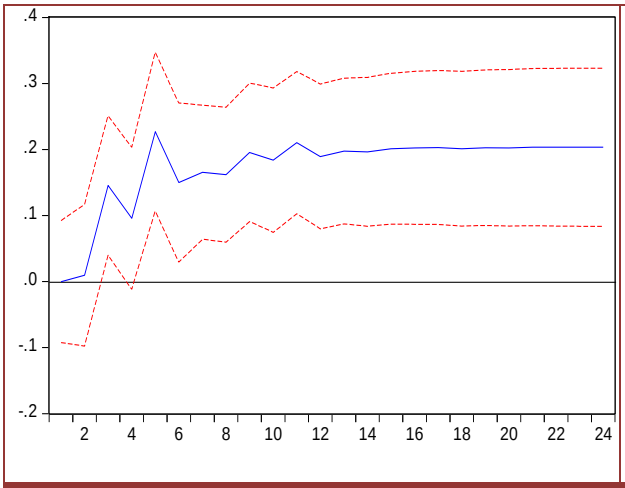


Figure 22: Accumulated Response of Commercial Loan Rate to One Unit Cholesky Standard Deviation Impulse in BIST Rate

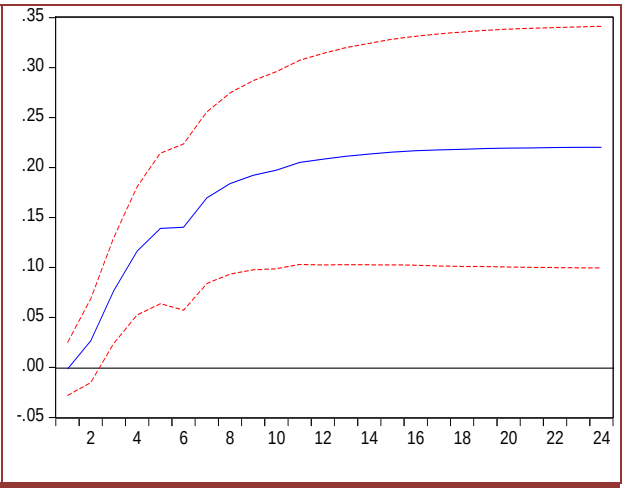


Figure 23: Accumulated Response of Consumer Loan Rate to One Unit Cholesky Standard Deviation Impulse in BIST Rate

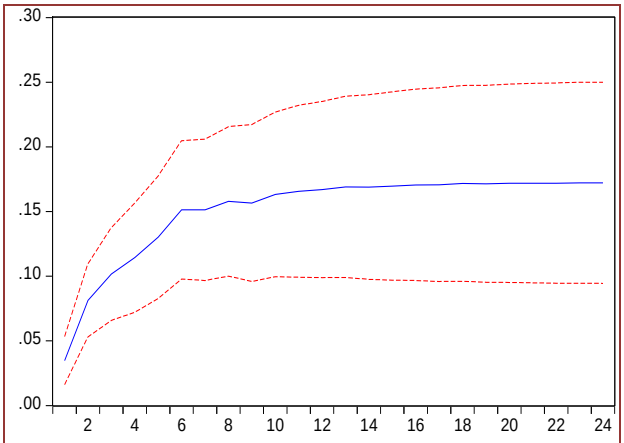


Figure 24: Accumulated Response of Deposit Rate to One Unit Cholesky Standard Deviation Impulse in BIST Rate

Our data also enables us to investigate the transmission mechanism between CBRT WACF and interest rates charged on loans as well as the interest rates given to deposits. To this end, VAR model is estimated by utilizing CBRT WACF and loan/deposit rates. By referring to multiple breakpoint test results, respective dummy variables are added to the model specifications. When we focus on the WACF as a potential policy rate component, it is evident that a pass-through mechanism can be observed from WACF to commercial loan rate (see Figure 25). One unit standard deviation shock coming to former is transmitted as 16.8 basis points response for the latter in three months.

The pass through from WACF to consumer loan rate is more robust compared to the commercial loan rate (see Figure 26). Despite positive significant reaction of consumer loan rate to the impulse in WACF during initial periods, the impact is stabilized after three months. For the first three months, accumulated response is 13.4 basis points in the presence of one unit standard deviation shock coming to WACF. Lastly, impulse response function that is presented in Figure 27 shows that a pass through from WACF to

deposit rate is valid considering the fact that any shocks coming to WACF is transmitted to deposit rate significantly, especially for the first three months. However, similar to the relation with consumer loan rate, the impact is stabilized after three months period.

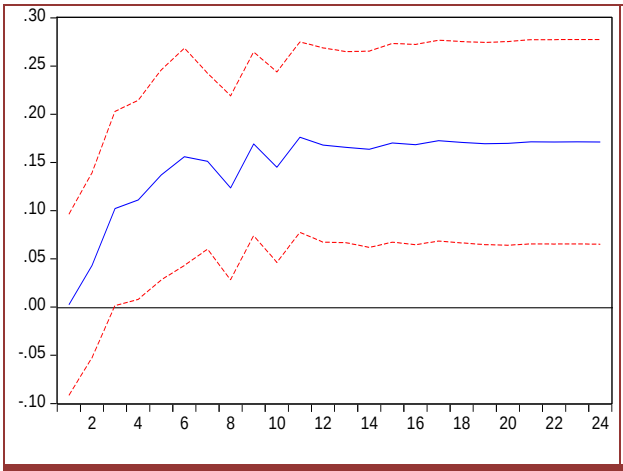


Figure 25: Accumulated Response of Commercial Loan Rate to One Unit Cholesky Standard Deviation Impulse in WACF

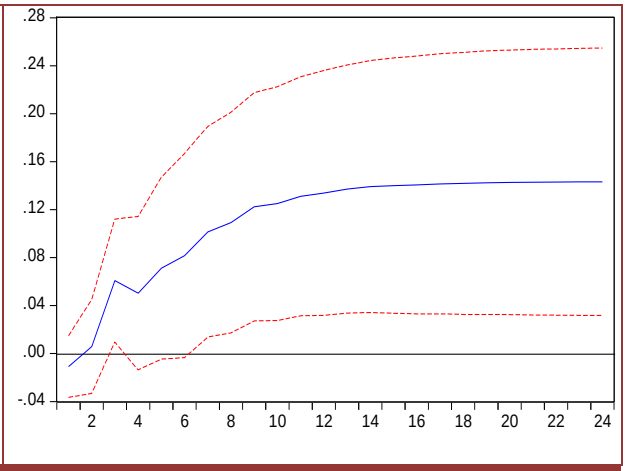


Figure 26: Accumulated Response of Consumer Loan Rate to One Unit Cholesky Standard Deviation Impulse in WACF

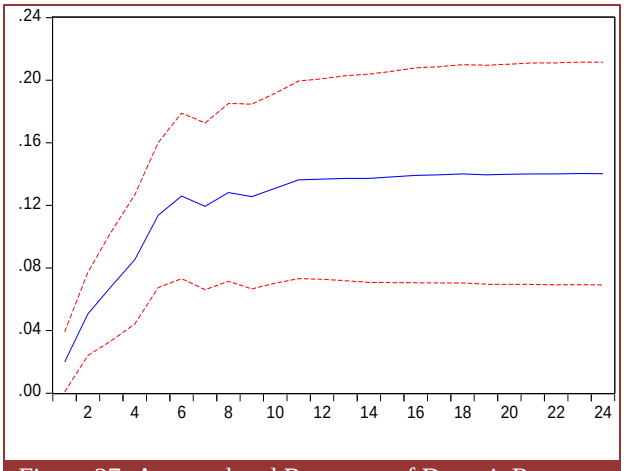


Figure 27: Accumulated Response of Deposit Rate to One Unit Cholesky Standard Deviation Impulse in WACF

4.3 Transmission Mechanism of Policy Rates On Bank Level

In this section, we try to show transmission relation from policy rates to bank loan and deposit rates with bank-level data, as a robustness analysis. Since bank-level interest rate data is publicly available only with quarterly frequency, empirical works in this section are done with quarterly data. To this end, bank-level quarterly loan and deposit rate data are collected from footnotes of financial statements of individual banks. Banks in Turkey are publishing footnotes in consolidated financial reports in addition to financial tables to inform investors about certain risks that banks bear. In this context, information about liquidity risk, leverage risk, credit risk and foreign currency risk are provided in the footnotes. Our focus is to extract information from footnotes about interest rate risk. In footnotes, average rate charged or incurred in interest-bearing assets or liabilities of bank balance sheets are reported. Since rates charged on different types of loan (such as commercial or consumer loans) and deposits (such as commercial or savings deposits) are not provided in balance sheets, robustness of the pass-through in that categorization can not be made in this part.

Our sample for this analysis covers the period between 2011Q1 and 2016Q1, which is in line with the sample of econometric analysis in the former section. This sample period also corresponds to the time span when asymmetric interest corridor was actively used. As it is seen in Table 4, our sample includes 16 Turkish commercial banks. This sample is comprehensive and representative in the sense that listed banks possess 91.04% of the total assets, issue 90.31% of the total loans and collect 95.48% of the total deposits in the Turkish banking industry.

Table 4: Information About Banks in the Sample of Panel VAR Analysis (values are denominated in TL)								
Bank	**Foundation Year**	**Ownership Status**	**Assets**	**Share in Total Sector**	**Loans**	**Share in Total Sector**	**Deposits**	**Share in Total Sector**
Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	1863	public	310,022	13.57%	193,159	13.00%	191,846	14.86%
Türkiye İş Bankası A.Ş.	1924	private	276,020	12.08%	176,237	11.86%	157,795	12.23%
Türkiye Garanti Bankası A.Ş.	1946	foreign	264,330	11.57%	163,990	11.04%	149,021	11.55%
Akbank T.A.Ş.	1948	private	241,041	10.55%	142,647	9.60%	140,476	10.88%
Yapı ve Kredi Bankası A.Ş.	1944	private	223,066	9.77%	150,917	10.16%	133,628	10.35%
Türkiye Halk Bankası A.Ş.	1938	public	195,328	8.55%	132,720	8.93%	125,862	9.75%
Türkiye Vakıflar Bankası T.A.O.	1954	public	189,829	8.31%	125,638	8.46%	115,506	8.95%
Finans Bank A.Ş.	1987	foreign	87,354	3.82%	58,408	3.93%	50,572	3.92%
Denizbank A.Ş.	1997	foreign	86,912	3.80%	53,751	3.62%	50,501	3.91%
Türk Ekonomi Bankası A.Ş.	1927	private	74,886	3.28%	54,884	3.69%	46,495	3.60%
ING Bank A.Ş.	1984	foreign	46,828	2.05%	34,853	2.35%	22,484	1.74%
HSBC Bank A.Ş.	1990	foreign	30,443	1.33%	18,853	1.27%	18,172	1.41%
Şekerbank T.A.Ş.	1953	private	23,049	1.01%	15,869	1.07%	13,817	1.07%
Alternatifbank A.Ş.	1991	foreign	12,805	0.56%	8,290	0.56%	6,487	0.50%
Anadolubank A.Ş.	1996	private	10,553	0.46%	6,944	0.47%	7,196	0.56%
ICBC Turkey Bank A.Ş.	1986	foreign	7,116	0.31%	4,446	0.30%	2,402	0.19%
Cumulative Market Shares				**91.04%**		**90.31%**		**95.48%**
Total Sector			**2,284,222**		**1,485,626**		**1,290,655**	

There are some important details about the reported data and how we transform them to be suitable for empirical analysis. For example, Garanti Bank does not report one single interest rate for loan and deposit items in its balance sheet but an interest interval for each quarter. Hence, respective loan and deposit rate intervals for Garanti Bank are transformed by taking the average of the interval in each quarter. For Finansbank, sample data does not include credit cards in loan item. Hence loan rate calculated for Finansbank are exempted from credit cards. In terms of the deposit rates, due to unavailability; we use rates charged on interbank and other deposits for ING Bank, Alternatifbank and Anadolubank for certain periods. To construct the series for ICBC Turkey, for the period before 2015Q3, Tekstilbank's data is used[21].

Table 5: Summary Statistics and Sources for Variables Used in Panel VAR Estimation

Variable	Obs	Mean	Std. Dev.	Min	Max	Source
BIST Overnight Rate	336	9.28	1.95	6.26	11.98	Financial Statements of Banks
CBRT WACF	336	7.69	1.54	5.11	10.27	Financial Statements of Banks
Loan Rate	336	13.46	1.99	9.11	27.86	Financial Statements of Banks
Deposit Rate	336	8.80	2.14	3.01	13.51	Financial Statements of Banks

The methodology employed is panel VAR estimation. The analysis is conducted with Stata software and the code used in the panel VAR analysis is obtained from Cagala and Glogowsky (2014). Panel stationarity tests are applied to the data in levels as an initial

[21] With the decision of BRSA taken in April 2015, Industrial and Commercial Bank of China (ICBC) was allowed to purchase %75.50 of shares of Tekstilbank. Share purchasing was approved in the general assembly meeting of Tekstilbank in May 2015.

step. First chosen method to assess panel stationarity of data is Levin, Lin and Chu (2002) test. Levin-Lin-Chu (LLC) test assumes that there exists a common unit root structure hence the autoregressive component of data generating process is accepted as constant across banks. Null hypothesis of the test indicates the unit root, while alternative hypothesis is in line with the conclusion that data is stationary[22]. Schwarz Information Criterion is used to determine the number of lags included in the test equation. As seen in Table 11, all variables are stationary in levels. Furthermore, same data is also tested with Im, Peseran and Shin (2003) methodology. Difference of this method from LLC test is that individual unit root processes are allowed. Autoregressive component is assumed to be panel specific instead of constant across units. Based on the test statistics in Table 6, we do not apply any transformation to the data before analyzing them with panel VAR methods. In this part, four panel VAR models are estimated between each chosen parameter of interest corridor system (BIST rate and WACF) and bank loan/deposit rates.

[22] Despite the fact that policy rates and loan/deposit rates are found to be nonstationary in levels in the previous section with aggregate banking sector data, in this context, they appear to be panel stationary in levels with bank level data. This contradiction might be due to differences in frequencies. In VAR analysis with industry level data, series are in weekly frequency with no panel structure. However, the analysis in this section involves with a data set with quarterly frequency and cross sectional dimension.

Table 6: Panel Unit Root Test Results					
		Levin-Lin-Chu Test Statistic	**p-value**	**Im-Peseran-Shin Test Statistic**	**p-value**
BIST Overnight Rate	Without Time Trend	-4.3856	0.0000***	-3.4429	0.0003***
	With Time Trend	-2.5745	0.0050***	-4.4560	0.0000***
CBRT Lending Rate	Without Time Trend	-5.5537	0.0000***	-2.4640	0.0069***
	With Time Trend	-3.6047	0.0002***	-2.5400	0.0055***
CBRT WACF	Without Time Trend	-7.1240	0.0000***	-2.9109	0.0018***
	With Time Trend	-6.1859	0.0000***	-3.8603	0.0001***
Loan Rate	Without Time Trend	-3.1807	0.0007***	-2.3660	0.0090***
	With Time Trend	-1.8863	0.0296**	-3.2069	0.0007***
Deposit Rate	Without Time Trend	-2.3413	0.0096***	-2.3146	0.0103**
	With Time Trend	-3.0171	0.0013***	-4.3399	0.0000***
*,** and *** denote significance at 10%, 5% and 1% levels respectively					

Use of panel VAR models in the applied studies to examine cross-sectional heterogeneities is relatively new. One application area of this model is macroeconomic dynamics of country groups. For instance, Canova, Ciccarelli and Ortega (2007) utilize panel VAR approach to examine the nature of business cycles in European countries. Mehrara and Mohaghegh (2011) examine the impact of oil shocks on macroeconomic variables in the case of oil exporting countries (12 OPEC members and 8 non-OPEC oil producing countries).

Panel VAR models are also widely used as tools to analyze macro-financial linkages. Especially, the impact of external developments to the domestic financial sector and

markets in emerging countries is widely investigated. The study of Love and Ariss (2014) assesses the macro-financial linkages in the case of Egypt through panel VAR method. By utilizing a panel of Egyptian banks for the period 1993-2010, they find that a positive shock to capital inflows and economic growth improves the quality of loan portfolio in the banking system. Similarly, Espinoza and Prasad (2010) use panel VAR method on the banking data of Gulf Cooperation Council (GCC) countries for the period 1995-2008. Their results are displaying a feedback effect between bank balance sheet losses and economic activity. Among the cross-country studies, Bouvet, Brady and King (2013) focus linkages across European countries in terms of the sovereign debt and country-specific risks. Macro-financial contagion is found to be evident among European countries, since panel VAR model shows that rise of sovereign bond spread and debt to GDP ratio affect fiscal and economic outcomes of member countries.

In this thesis, we conduct panel VAR estimation to analyze the monetary transmission mechanism between policy rate proxies and loan/deposit rate. In the literature, there are studies that panel VAR is also used to this end. For example, Miyajima, Mohanty and Yetman (2014) examine the effectiveness of the impact of US monetary policy on Asian economies using cross country data. Their findings show that a change in long-term US bond yields affected domestic short term interest rates and domestic long-term bond yields of sample countries. Moreover, Stakenas and Stasiukynaitė (2016) find that a monetary policy shock occurred in the Euro Zone affected the GDP and credit stock variables in Lithunia. Assenmacher-Wesche and Gerlach (2008) study the transmission of monetary policy shock from US (in addition to credit, housing market and equity shocks) to 17 industrialized countries through a panel VAR model. Leroy and Lucotte (2015)

analyze the pass-through in the interest rate channel of the monetary policy framework, by establishing a panel VAR model between bank interest rates and Euro overnight index average money market rate as an indicator of monetary policy.

In this context, first, we examine the results of the estimation between policy rate and bank loan/deposit rates when BIST rate is taken as an indicator monetary policy stance (see Figure 28 and 29). Impulse response function displays the initial reaction of loan rate to changes in BIST rate and the level of response increases at initial periods. However, after certain time, the impact gets weaker and eventually becomes insignificant. On the other hand, the response of deposit rate to one unit standard deviation shock in BIST rate seems to be evident. Secondly, CBRT WACF is considered as a monetary policy rate. Composed impulse-responses with CBRT WACF are depicted in Figure 30 and 31. Similar to the impact of BIST rate, significant impact of WACF on loan rate is observed at initial periods, but the impact saturates and turns out to be insignificant in later periods. The pass-through between WACF and deposit rate is also evident in this context.

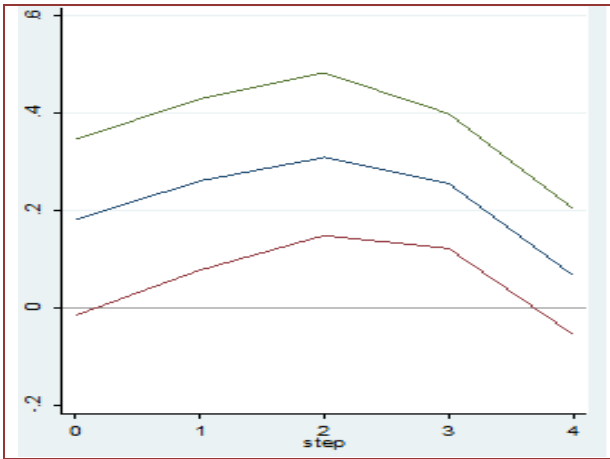


Figure 28: Response of Loan Rate to One Unit Standard Deviation Impulse in BIST Rate

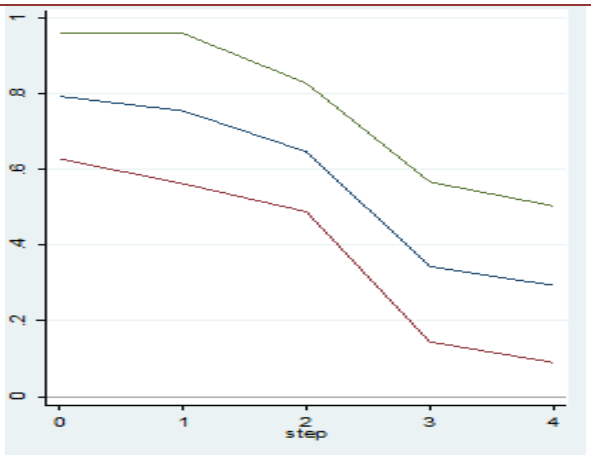


Figure 29: Response of Deposit Rate to One Unit Standard Deviation Impulse in BIST Rate

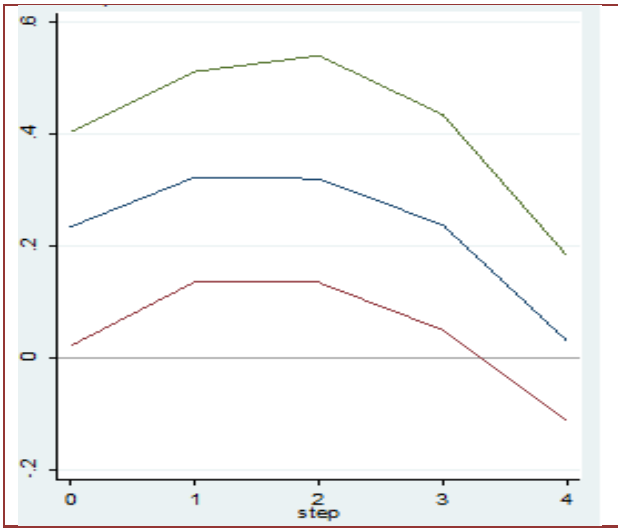


Figure 30: Response of Loan Rate to One Unit Standard Deviation Impulse in CBRT WACF

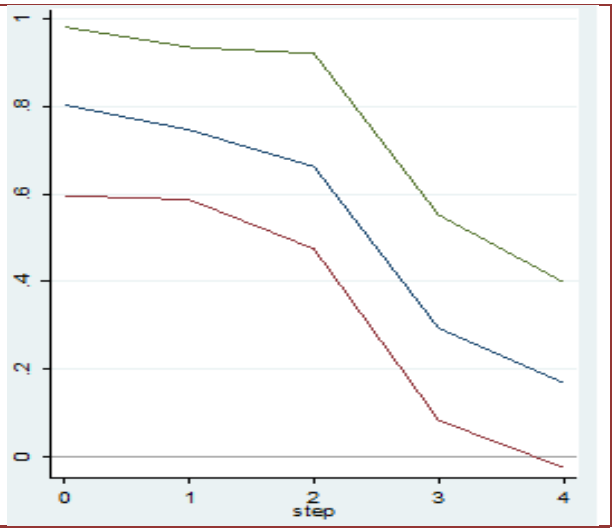


Figure 31: Response of Deposit Rate to One Unit Standard Deviation Impulse in CBRT WACF

Overall, we argue that bank-level data indicate the existence of pass through from corridor parameters to bank loan and deposit rates for the period between 2011Q1 and 2016Q1 (when interest corridor system was used as an active policy tool). However, the trend and magnitude of pass-through differ across different specifications and policy rate compositions. This situation prevents us from revealing the true nature of the relation between net interest margin and policy rate stance. Hence, econometric estimations seem to be required by controlling several factors with panel data methods as we present in Chapter VI.

CHAPTER V

DATA, EMPIRICAL MODEL AND METHODOLOGY

5.1 **Data and Model**

In this chapter, we have an econometric model to examine the association between unconventional monetary policy indicators and commercial banks' net interest income. We have a panel data of 16 Turkish commercial banks for the period between 2011Q1 and 2016Q1. In order to construct the model, we start with a larger set of independent variables using previous studies in the literature and finally specify our main model considering multicollinearity problem among variables, especially the ones with CBRT policy rates.

So, reflecting the arguments from the original model of Ho and Saunders (1981), variables representing the risk aversion (capital to asset ratio), size of the transactions (natural logarithm of total assets), interest rate risk (policy rate and slope of the yield curve) and market power of banks (HHI and concentration ratio for three biggest banks (CR3)) are included in the data collection process.

Regarding to the structure of the banking sector in Turkey, use of core funding components such as deposits becomes a vital issue[23]. By nature, deposits are accepted as stable funding sources for which the borrowing costs are cheaper compared to other types of funding such as interbank borrowing and issue of debt securities. Turkish banks do not seem to utilize these alternative funding methods extensively. Appendix H displays the total amount of outstanding debt securities issued by financial corporations of selected emerging markets as of 2016Q1. Compared to their peers in other emerging markets, Turkish banks are not using security issues extensively as a funding method. The banking data also shows that loan to deposit ratio is higher in Turkey when compared to peer countries (see Appendix H). Because of the importance of deposits, we account for the impact of funding risk, i.e., ratio of deposits to total assets on NIM.

Several bank specific variables such as operating cost structure (proxied by the ratio of other operating expenses to total assets), credit risk (measured by the ratio of gross non-performing loans to total loans (NPL)), liquidity ratio (calculated by the ratio of liquid assets to total assets) and diversification effect in terms of the revenue sources (determined by the net fees and commissions income normalized by total assets) are also included. In order to control for macroeconomic forces, quarterly GDP growth rate and inflation rate are considered as major indicators that may affect net interest income of the commercial banks in Turkey.

As mentioned before, to ease the multicollinearity problem, we examine the correlation among the variables (see Appendix F). Among the bank specific factors, NPL ratio and

[23] As of April 2016, deposits compromise 59 % of the all liability items and 53% of the all liability and equity items in the aggregate industry level balance sheet.

net fees and commissions income to total assets ratio are highly correlated with other operating expenses to total assets ratio. Important portion of operating expenses are related to the branching activities, overhead costs, human resources and loan extension[24]. Because of its relevance to the loan extension and deposit collection of Turkish commercial banks, we include operating expense to total asset ratio in the final specification of our empirical analysis. In the case of Turkish banks, interest incurring activities are main sources of income while non-interest items contribute bottom-line net profit negatively. In other words, on the aggregate level, there is net income obtained from interest incurring activities and net loss obtained from non-interest activities. Furthermore, some other non-traditional activities such as trust services and wealth management are not developed too much in the context of Turkey. Hence, net fees and commission income to total assets ratio and NPL ratio are excluded.

In order to control for the effect of securities held to maturity on interest income, we kept liquidity ratio of banks as another control variable in our regression. In this way, we also aim to see how banks' net interest income is affected if they do not want to invest all of their available funds to loans in Turkey. On the other hand, two different proxies to measure the level of concentration in the banking sector are calculated. When we examine the correlation of HHI and CR3 (concentration ratio of three largest banks) with other variables in the data set, it is seen that especially CR3 is highly correlated with "defined" policy rate series. Moreover, CR3 has larger correlation with other variables. Hence to account for market structure of our banking sector, we employed HHI as one of

[24] Appendix G indicates the composition of this income statement items with detail for a particular bank.

the independent variables. We exclude inflation and the slope of the yield curve from our model for the sake of multicollinearity concern.

Lastly, we embedded two lags of the NIM as regressors to incorporate the possibility of persistence in NIM. As Kansoy (2012) emphasizes, static models might not be able to investigate potential dynamism in bank NIM. In Turkey, average maturity for deposits is around three months. Similarly, average maturity period for commercial loans which are mostly priced with floating interest rate structure is also around three months. Thus, repricing decisions made in one quarter interval might induce some persistence into the NIM. Hence, to capture persistence of bank margins over time, it is assumed that the current values of NIM are being determined by previous margin values as in Valverde and Rodriguez (2007). In this case, use of dynamic panel methodology can yield consistent and unbiased estimates as claimed by Borio et al. (2015). Hence, we estimate our with dynamic panel data methods.

The final specification in dynamic panel estimation is as follows:

$$NIM_{it}=\alpha+\beta_1(NIM)_{it-1}+\beta_2(NIM)_{it-2}+\beta_3(\text{Policy Rate})_t+\beta_4(\text{Operating Expenses})_{it}+\beta_5(\text{Equity Ratio})_{it}+\beta_6(\text{Deposit Ratio})_{it}+\beta_7(\text{Liquidity Ratio})_{it}+\beta_8(HHI)_t+\beta_9(\text{GDP Growth})_t+\mu_i+\varepsilon_{it} \quad (7)$$

where μ_i represents individual bank effects and ε_{it} is random disturbance term. Definition of the series and descriptive statistics are provided in Table 7 and Table 8.

Table 7: Definition and Sources of Data Series Used in Panel Data Analysis		
Variable	**Definition**	**Source**
NIM	Interest income minus interest expense divided by total assets	Bank Association of Turkey
BIST Rate	Interbank repo/reverse repo market rate charged in BIST	CBRT
WACF	Weighted average cost of funding from CBRT funding channels	CBRT
Operating Expenses	The ratio of other operating expenses to total assets	Bank Association of Turkey
Equity Ratio	The ratio of shareholders' equity to total assets	Bank Association of Turkey
Liquidity Ratio	The ratio of liquid assets to total total assets	Bank Association of Turkey
Deposit Ratio	The ratio of deposits to total assets	Bank Association of Turkey
HHI	Herfindahl and Hirschman Index divided by 1000	Author's Calculations
GDP Growth	Quarter-on-quarter change in GDP (2009 constant prices)	TurkStat

Table 8: Summary Statistics of Variables in Panel Regressions (in percentages)						
Variable		**Mean**	**Std. Dev.**	**Min**	**Max**	**Observations**
NIM	overall	1.027	0.216	0.657	1.83	336
	between		0.147	0.831	1.24	16
	within		0.163	0.613	1.75	21
Operating Expenses	overall	0.725	0.212	0.381	1.691	336
	between		0.194	0.445	1.071	16
	within		0.098	0.396	1.481	21
Equity Ratio	overall	11.124	2.192	5.730	18.573	336
	between		1.808	7.598	15.122	16
	within		1.316	4.411	15.594	21
Liquidity Ratio	overall	31.197	7.877	13.280	58.871	336
	between		7.091	17.344	46.375	16
	within		3.843	19.370	43.693	21
Deposit Ratio	overall	59.919	6.593	33.759	83.674	336
	between		4.999	52.409	69.644	16
	within		4.469	30.951	75.793	21
HHI	overall	10.401	0.167	10.185	10.803	336
	between		0	10.401	10.401	16
	within		0.167	10.185	10.803	21
GDP Growth	overall	1.495	1.659	-2.476	4.219	336
	between		0	1.495	1.495	16
	within		1.659	-2.476	4.219	21
BIST Rate	overall	9.285	1.953	6.260	11.980	336
	between		0	9.285	9.285	16
	within		1.953	6.260	11.980	21
WACF	overall	7.697	1.548	5.110	10.270	336
	between		0	7.697	7.697	16
	within		1.548	5.110	10.270	21

5.2 **Methodology**

Difference generalized method of moments (GMM) approach developed by Holtz-Eakin, Newey, and Rosen (1988) and Arellano and Bond (1991) as well as the system generalized method of moments (GMM) approach developed by Arellano and Bover (1995) and Blundell and Bond (1998) are general dynamic panel estimators. These estimators are designed for settings where explained variables are dynamic (meaning they

are being dependent on their own past realizations) and explanatory variables are not strictly exogenous (meaning they are correlated with the past and present realizations of the error term).

Arellano-Bond estimation involves a transformation of regressors (mostly by differencing) and an application of GMM. Hence, it is called difference GMM (Roodman, 2006). Modeling through fixed effects, despite the fact that underlying data generating process is dynamic by nature, creates a correlation between error term and regressors because of the demeaning attempt of dependent and independent variables in fixed effects estimation. Since demeaning operation creates a set of regressors which are not distributed independently of the disturbance term, coefficient estimator for lagged dependent variable is inconsistent (Nickell, 1981).

The solution to this evident problem is to apply a transformation to the model. First differencing to the original model is mostly used in the practice to remove the unobserved individual effect. Another method used to transform variables in the original model is forward orthogonal transformation which is an alternative to differencing. It is being proposed by Arellano and Bover (1995) to preserve degrees of freedom in unbalanced panels (as cited in Roodman (2006)). Forward orthogonal transformation subtracts the average of all future observations of a variable from its contemporaneous value to conduct the transformation. Since our data set is a balanced panel, we utilize differencing as a way of transformation. When model is transformed, then it becomes eligible for instrumental variable estimation. Difference GMM method is doing this by establishing a system of equations (for each time period) and by economizing internal instruments (lagged values of instrumented variables) to make the estimation. Arrelano-Bond method

forms moment conditions by utilizing lagged level values of the dependent variable and pre-determined variables (but not strictly exogenous) with first-differences of disturbance terms.

On the other hand, lagged levels of the regressors sometimes might be poor and inadequate instruments for the first-differenced explanatory variables, particularly if values are displaying behavior closer to random walk processes (Roodman, 2006). System GMM method, developed by Arellano-Bover and Blundell-Bond, augments Arellano-Bond estimator by making an additional assumption that first differences of instruments are not related with the unobserved individual effects. In this way, it can increase the efficiency of the estimation by introducing more instruments. System GMM estimator utilizes the original levels equation to generate a system of two equations one of which is in the form of differences and other is in the form of levels. Variables in the differenced equation are instrumented by the lagged level values, while variables in the levels equation are instrumented by the lagged difference values (Roodman, 2006). In our panel estimations, we follow the approach of Borio et al. (2015) and use system GMM estimator[25].

In the dynamic GMM estimation, it is well-documented that instruments should be relevant and valid, i.e, they should be correlated with regressors and should be unrelated to the errors. Thus, we use Sargan test of the overidentifying restrictions to test the

[25] There are some additional considerations in using dynamic panel estimation techniques. We choose to conduct two-step estimation in which covariance matrix is proxied in a way that two-step GMM estimator reaches to the covariance matrix of the moment conditions by economizing the first-step residuals, as Judson and Owen (1996) states. In other words, an initial GMM regression is performed by replacing covariance matrix by a reasonable but arbitrary positive-definite matrix; next, residuals from the first step estimation is used to construct a sandwich proxy for covariance matrix and GMM estimation is re-run to obtain coefficients estimates. These coefficient estimates are robust to any pattern of heteroscedasticity and cross-correlation in the modeling of sandwich covariance matrix estimator (Roodman, 2006).

validity of the instruments. Sargan test has the null hypothesis of joint validity of the moment conditions (identifying restrictions) as well as the exogeneity of instruments (Roodman, 2006). We report the results of the Sargan test in the next chapter when we report the estimations.

Last diagnostic consideration of the dynamic panel models is the AR test for autocorrelation of the residuals. In the construction of the dynamic panel models, when variables are transformed, residuals of the differenced equation embody serial correlation. However, if the assumption of serial independence of the errors in the original model can be guaranteed, then then differenced residuals should not display the significant behavior of autoregressive process with order of two, in short AR(2). If significant AR(2) behavior is observed, then second lags of the endogenous variables can not be used as an instrument for their current realizations. Results of this test are also reported in the next chapter.

CHAPTER VI

EMPIRICAL RESULTS

In this chapter, we report the results of the estimations involving the empirical model constructed in the previous chapter. To determine the role of two parameters of the asymmetric interest rate corridor of CBRT and the impact of the predetermined variables on bank net interest margin (NIM), we conduct two dynamic panel estimations using two different policy rates: BIST interbank repo/reverse repo market and CBRT weighted average cost of funding (WACF).

As Roodman (2009) states, dynamic panel models are more appropriate when they are applied to panels with small time and large cross-sectional unit dimensions. Here, we have a panel for which the time dimension is larger than the number of banks included. In order to not face with too many instruments considering the sample size and the degrees of freedom of the employed banking data, an adjustment is made in terms of

instruments[26]. Moreover, diagnostics tests for the estimation setups are reviewed. In both models, we fail to reject the null hypothesis of Sargan test of overidentifying restrictions. Hence, it implies that the instruments are appropriate. The null hypothesis of Arellano-Bond test for autocorrelation applied to the differenced residuals is the non-existence of autocorrelation. We also fail to reject this null hypothesis for both models.

Table 9: System GMM Results

	(1) **NIM**
NIM(-1)	0.5097*** (0.159)
NIM(-2)	0.1735 (0.128)
BIST Rate	0.0196*** (0.003)
Operating Expenses	0.2602** (0.113)
Equity Ratio	0.0391*** (0.013)
Liquidity Ratio	0.0057 (0.004)
Deposit Ratio	-0.0004 (0.003)
HHI	0.1695 (0.345)
GDP Growth	-0.0061** (0.002)
Constant	-0.0238 (0.033)
Degrees of Freedom	304
# of Banks	16
Sargan Test (p-value)	0.99
Arellano-Bond AR(2) Test (p-value)	0.17

*,** and *** denote significance at 10%, 5% and 1% levels respectively. Standard errors are given in parantheses

[26] In the first model, at most one lagged levels of the dependent variable is used as instruments; in the second model, at most two lagged levels of the dependent variables is used as instruments. For further discussion please see Roodman (2009).

As seen in the results in Table 9, for the period 2011Q1-2016Q1 when asymmetric interest corridor with active liquidity management has been utilized as a monetary policy composition, BIST rate is statistically significant in determining net interest margins of commercial banks in Turkey. As a parameter of the corridor structure, BIST rate is previously found to be affecting pricing decisions of banks about loan and deposits. Additionally, monetary policy stance described by the BIST rate appears to have an influence on bank profitability measured by NIM. Positive coefficient on this variable hints that any monetary policy tightening manifested by higher BIST rate do contribute the banking sector margins.

As also seen in Table 9, previous quarter's NIM is found to be positive and statistically significant[27]. Our findings are in line with the view that the persistence of NIM is relatively high. However, second lag of the NIM is not found to be statistically significant in determining contemporaneous values.

Among the bank specific variables, equity ratio is found to be positive and statistically significant at 1% significance level. In other words, well capitalized banks appear to be more profitable. Firstly, positive coefficient is compatible with the earlier theoretical models. Particularly, it can be claimed that risk aversion behavior displayed by banks in Turkey results to hold a premium margin over what a risk neutral bank would require within this sample period (Ho & Saunders, 1981; McShane & Sharpe, 1985; Allen, 1988;

[27] First of all, there appears to be no articulating theory about the dynamic natüre of the NIM. Prior, we stressed the nature of the average maturity (one quarter) and the floating interest rate pricing structure of commercial loans (an important loan category in the loan portfolio of commercial banks) as well as the average maturity (one quarter) of deposits. In addition to this match in average maturity, considering the fact that some of the newly offered loans and deposits are in the form of roll-overs and banks are trying to preserve a certain spread in loan extension and deposit collection; NIM might be affected by its previous values.

Angbazo, 1997; Maudos & Guevera, 2004). Secondly, as empirical works stress, well-capitalized banks would have low level of expected bankruptcy costs for themselves as well as their customers. Higher capital ratios also indicate that if a bank is well capitalized with regard to its perceived risk, thereby confirming long-term bank solvency; then this situation is directly represented in the form of lower cost of funding for banks. Hence, there would be room to achieve wider interest margins (Abreu & Mendes, 2001). Positive relation between this proxy and NIM is evident in cross-country empirical studies (Demirgüç-Kunt & Huizinga, 1999; Brock & Suarez, 2000; Kasman et al., 2010). Same positive association is also observed in empirical studies focusing on single country banking systems (Williams, 2007; Maudos & Solis, 2009; Aysan et al., 2009; Kansoy, 2012).

NIM is found to be significantly related to operating expenses of commercial banks[28]. As mentioned in the Chapter V, closer examination of the components of this series for the context of Turkish banks shows that other operating expenses is mostly related to costs of branching and loan extension/deposit collection activities such as employee, overheads and amortization expenses. These components of total cost are defined as widely controllable and responsive to the actions of bank management (Marinkovic & Radovic, 2014) Therefore, its level is determined by the scope of interest incurring operations of commercial banks. This situation can also be attributed to the choice of business models for banks. If the specialization of the banking sector leans more towards retail activities, then larger operational costs will be faced than the systems where banks that are more oriented toward wholesale markets (Brock & Suarez, 2000). Banking sector in Turkey is

[28] Operating expenses are classified as “other operating expenses”.

importantly focused on retail activities. A positive association is found between operating expenses and net interest income for Turkish banks. In addition to this argument, empirical studies are in favor of the argument that these expenses are passed on to customers through higher margins. In other words, banks with higher costs would have to operate with considerably higher intermediation margins to preserve bottom-line profitability (Maudos & Guevera, 2004; Williams, 2007; Maudos & Solis, 2009). Nevertheless, we have to be cautious about the impact of operating expenses on bank profitability. In our empirical analysis, we only show that increasing operating expenses helps achieving higher net interest income during 2011Q1-2016Q1 in Turkey. Further analysis has to be done to understand how these expenses are improving bottom-line profitability, i.e., return on assets of Turkish banking system or not.

Among the other variables included in the regression, only GDP growth rate is determined as a significant factor, albeit at 10% significance level. Negative association between NIM and economic activity shows that bank profitability is following a counter-cyclical trend in the examined time period. Our model finds no significant results for the liquidity position, funding risk and financial sector concentration.

Table 10: System GMM Results	
	(1) **NIM**
NIM(-1)	0.4503*** (0.144)
NIM(-2)	0.1527 (0.101)
WACF	0.0233*** (0.004)
Operating Expenses	0.2647** (0.112)
Equity Ratio	0.0429*** (0.013)
Liquidity Ratio	0.0048 (0.003)
Deposit Ratio	-0.0010 (0.003)
HHI	0.1580 (0.163)
GDP Growth	-0.0033 (0.002)
Constant	-0.0215 (0.014)
Degrees of Freedom	304
# of Banks	16
Sargan Test (p-value)	0.99
Arellano-Bond AR(2) Test (p-value)	0.17

*,** and *** denote significance at 10%, 5% and 1% levels respectively. Standard errors are given in parantheses

Same model is estimated using CBRT WACF as policy rate instead of BIST rate. As seen in Table 10, we have similar findings. First, we observe that there is a positive association between WACF and NIM showing that as an indication of monetary policy stance under corridor framework, any increase in WACF is expected to increase bank margins. Especially, when we consider the pass through from WACF to loan/deposit rates (demonstrated in Chapter IV), banks appear to adjust their margins in the case of any monetary policy tightening through the pricing of loans and deposits.

Persistence of NIM is again observed in the statistically significant coefficient of first lag of NIM, whereas second lag has no explanatory power for contemporaneous value. In terms of the bank specific variables, level of risk aversion and operating expenses related to branching activities are positively and significantly associated with NIM. Different than previous findings, quarterly GDP growth is no longer found to be a significant factor.

As further analysis, we consider and calculate the standardized variables, i.e., standard scores[29]. The models with two policy rates are re-estimated whose results are presented in Table 11. In both models, the economic significance of lag values of NIM as well as bank specific variables such as operating expenses and equity ratio are observed to be larger than that of policy rates. This result appears to be robust across different choice of monetary policy rate (BIST rate and WACF). However, all these results presented in this chapter should be interpreted carefully considering the fact that there exists no consensus for the modeling of NIM, the length of the period examined related to interest corridor is limited and publicly available banking data of Bank Association of Turkey is in quarterly frequency.

[29] The coefficients for economic significance interpretation are obtained by utilizing standardized variables $Z=(X-\mu)/\sigma$ where X indicates the variable series, μ refers to the mean and σ represents the standard deviation. Similar method is used by Almarzoqi and Ben Naceur (2015) in which statistical and economic significance of factors determining NIM are presented together in the case of Caucasus and Central Asia countries.

Table 11: Estimation Results with Standardized Variables		
Variable	Coefficients	
NIM(-1)	0.4230***	0.3497***
NIM(-2)	-0.0024	-0.0396
BIST Rate	0.1363*	
WACF		0.1693***
Operating Expenses	0.3786***	0.3671***
Equity Ratio	0.5937**	0.5604***
Liquidity Ratio	0.5911	0.9221
Deposit Ratio	0.0837	0.2175
HHI	-0.1668	0.1294
GDP Growth	-.0034	0.0112
*,** and *** denote significance at 10%, 5% and 1% levels respectively.		

CHAPTER VII

CONCLUSION

Net interest margin (NIM) of banks is seen as an informative proxy for the cost of financial intermediation process which is an important side of the efficiency of how well financial institutions are conducting their role of transforming savings into investments. Typically, net interest income is a major portion of bank profitability. Hence, bank profitability measured by NIM has also different implications on financial system and institutions. Since bank profits are an important source to be added to bank capital, capital buffers of the banking system might be hurt due to lower level of profitability. On the other hand, decreasing NIM might be beneficial for the financial development as the cost of intermediation process become more affordable and the access of business entities to bank financing in the form of loans might be enhanced. Hence, the identification of factors influencing net interest margins of banks seems to be an important issue at any point in time. When we examine the banking data belonging to last decade, profitability of Turkish banks seems to be different than other developing countries. In particular,

when we compare the declining trend of NIM in other developing countries, we observe that this trend is more noticeable in Turkey. So, the aim of this thesis is to explore the recent unconventional monetary policy in Turkey and try to link whether this policy change plays a role in explaining net interest margin of commercial banks in Turkey. In the new system implemented in Turkey, there exists more than one short term policy rates. Therefore, in examining the association between monetary policy and NIM, we conduct additional analysis to assess the pass through from parameters of the interest corridor to the bank loan and deposit rates. We argue that Turkey presents an interesting case to study since she has adopted an unconventional monetary policy tool named asymmetric interest corridor with active liquidity management after the end of 2010.

As market-based measures of the cost of accessing short term liquidity obtained from CBRT for banks, BIST overnight interbank repo/reverse repo market rate and WACF (that represents the weighted average of the interest rates charged on one week repo funding and marginal funding facilities of CBRT) are considered as candidates of new monetary policy stance. By utilizing weekly aggregate banking sector data belonging to the period of 2011W1-2016W13, our reduced form VAR estimations show that there exists pass through from BIST rate to commercial loan rate, consumer loan rate and deposit rate. Same relation is found for WACF. Additionally, pass through is evaluated with the use of individual bank level data about loan and deposit rates which are hand-collected from the notes to financial statements in quarterly frequency for the period 2011Q1-2016Q1, our panel VAR estimations suggest that pass through mechanism (towards loan and deposit rates) is effective when BIST rate and WACF are taken as policy rates.

On the other hand, review of theoretical and empirical literature reveals that modeling efforts for bank margins requires the incorporation of bank specific, industry related and macroeconomic forces. In order to assess the role of two interest rates (summarizing the monetary policy stance under corridor framework) on bank NIM, dynamic panel data estimation is done for Turkish banks for the period 2011Q1-2016Q1. Because of the data unavailability and the existence of high correlation among several variables, we have a rather simple specification including operating expenses, bank equity ratio, liquidity position and funding risk of banks, economic growth and monetary policy stance for explaining net interest margins of Turkish banks. However, the main variables of interest are monetary policy stance indicators: BIST rate and WACF.

The models with BIST rate and WACF as policy rates show that there is a positive and significant association between these rates and net interest margins of banks. The persistence in bank margins as well as the role of operating expenses, capitalization of banks are highlights of our findings. The estimations using standardized variables (Z-scores) suggest that the impact of lag values of NIM and bank specific variables are more prominent than that of policy rates.

There are obviously some limitations of this study. For example, a structural analysis can be made to separate demand-driven and supply-driven forces impacting bank NIM. However, due to data and space limitations, these works are beyond the scope of this thesis and left for future research. In order to shed more light on policy implications about this issue, more work can be done to detect the factors impacting bank margins and to test how fast changes in monetary policy stance are transmitted to loan and deposit rates through high frequency data with more indicative nature.

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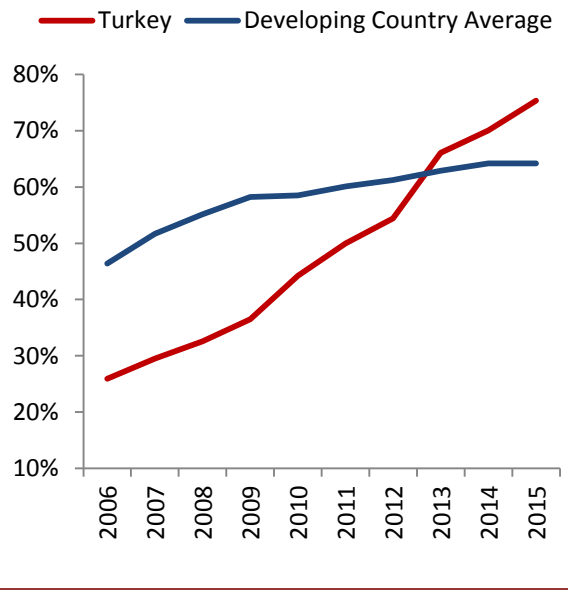
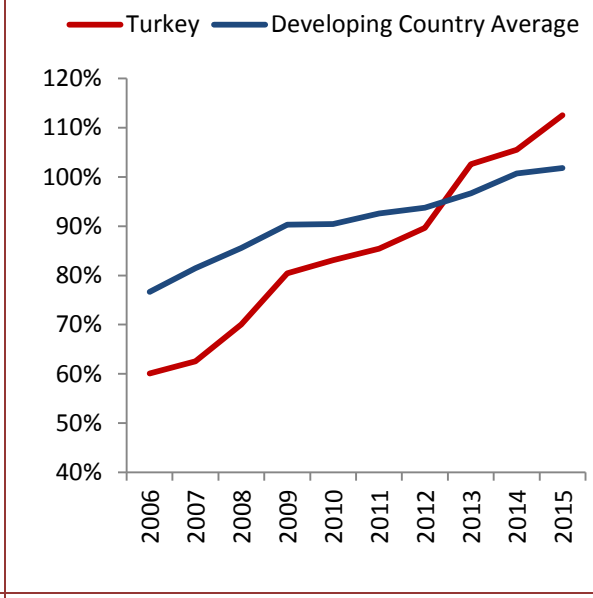
APPENDIX A: Cross-Country Comparison of Ratios Related to Bank Equity and Financial Deepening



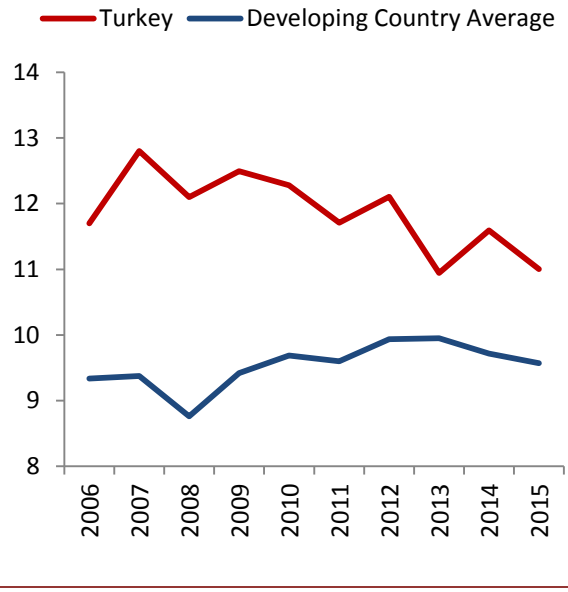
Source: Fitch Connect Database

Bank Credits to Private Sector/GDP



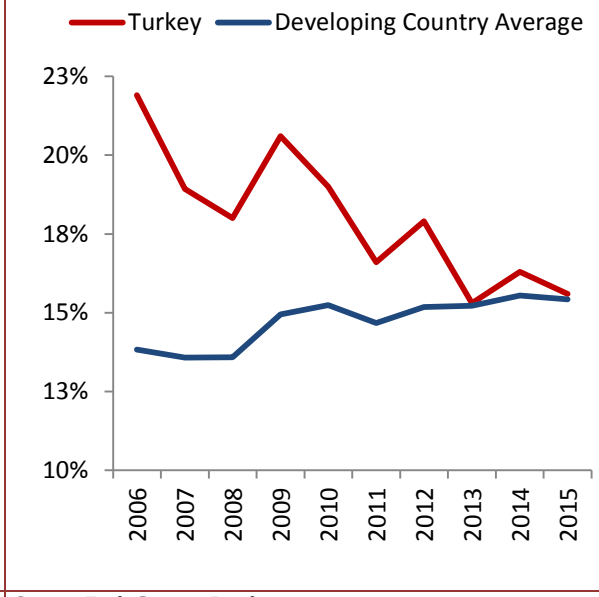
Source: Fitch Connect Database

Total Banking Assets/GDP



Source: World Bank Databank

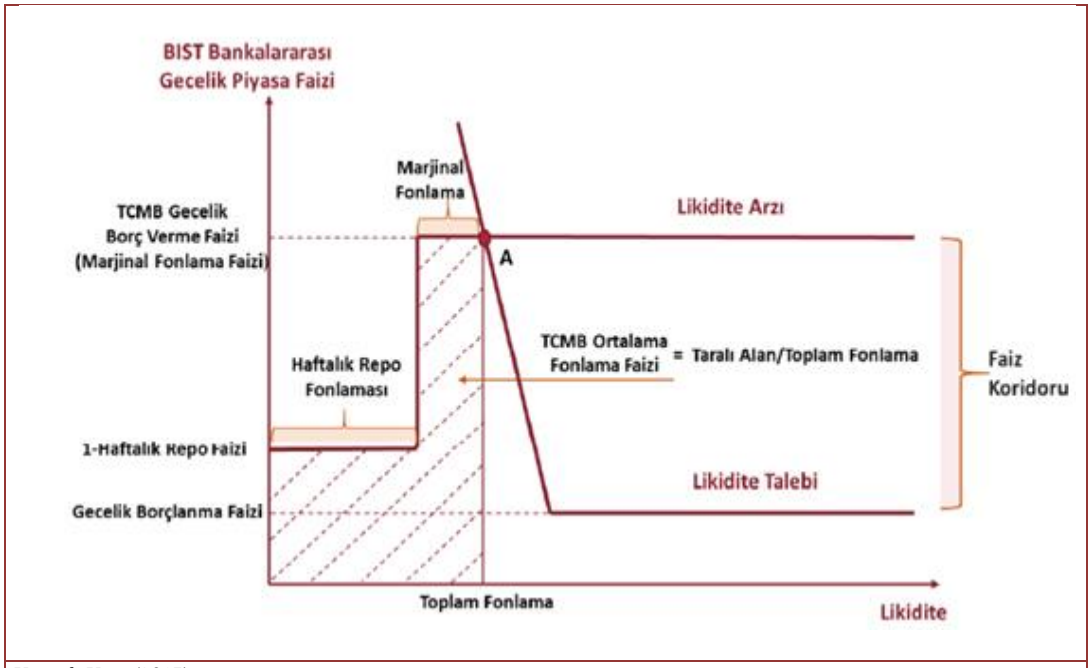
Equity to Total Assets



Source: Fitch Connect Database

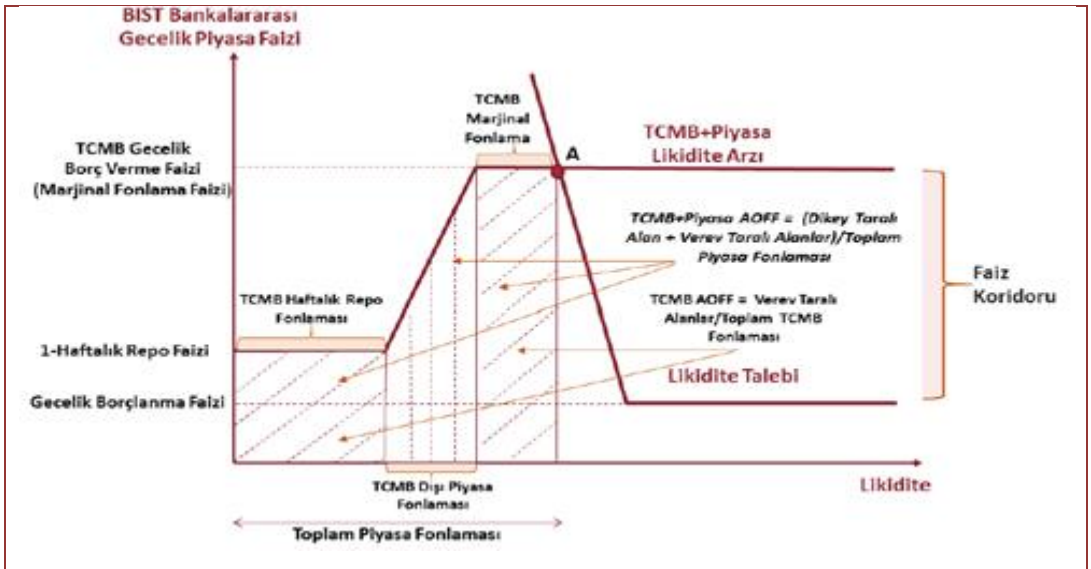
Capital Adequacy Ratio

APPENDIX B: Determination of BIST Overnight Rate through Fund Demand and Fund Supply Interaction



Kaynak:Kara (2015)

Determination of Short Term Money Market Rate



Kaynak:Ünalmış (2015)

Determination of Short Term Money Market Rate

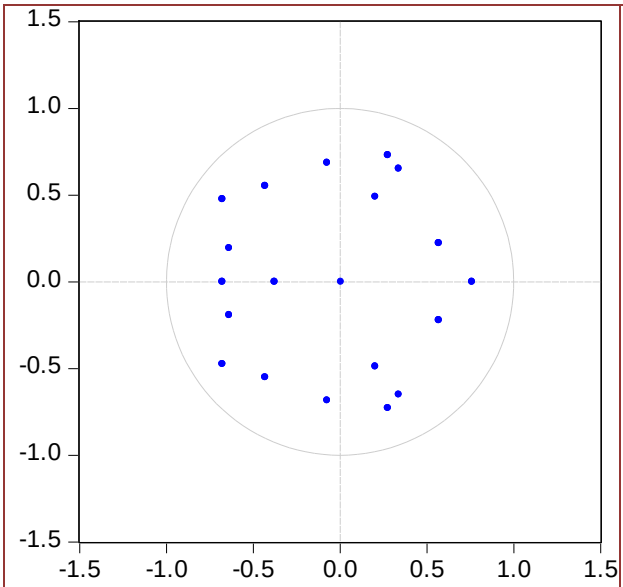
APPENDIX C: KPSS Test Results

KPSS Test Results		
		Applied to Levels
		Test Statistics (LM Statistics)
BIST Overnight	Intercept	0.62**
	Trend and Intercept	0.18**
CBRT WACF	Intercept	0.70**
	Trend and Intercept	0.11
Commercial Loans	Intercept	0.54**
	Trend and Intercept	0.13*
Consumer Loans	Intercept	0.18
	Trend and Intercept	0.17**
Deposit	Intercept	0.56**
	Trend and Intercept	0.21**
*,** and *** denote significance at 10%, 5% and 1% levels respectively.		

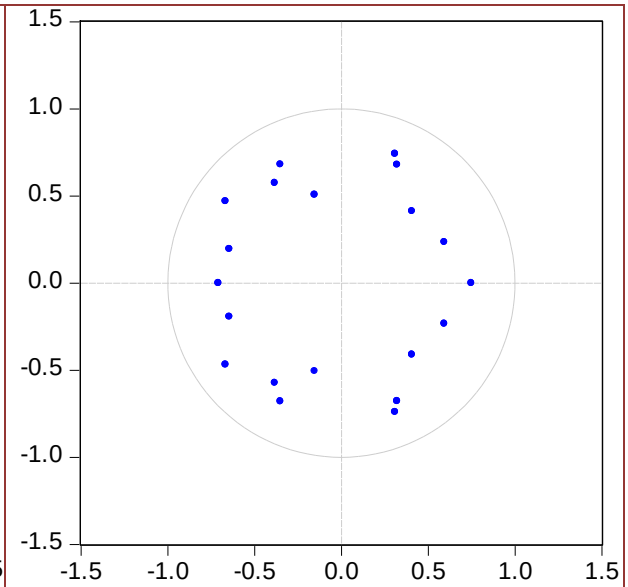
APPENDIX D: Diagnostics and Lag Length Criteria for VAR Estimations

AIC Values for VAR Estimation with BIST Overnight Rate	
Lag	**AIC**
0	4.637254
1	3.890067
2	3.732279
3	3.634796
4	3.594082
5	3.520428*
6	3.603338

AIC Values for VAR Estimation with WACF	
Lag	**AIC**
0	3.780525
1	2.973690
2	2.778706
3	2.730043
4	2.634896
5	2.548261*
6	2.609682



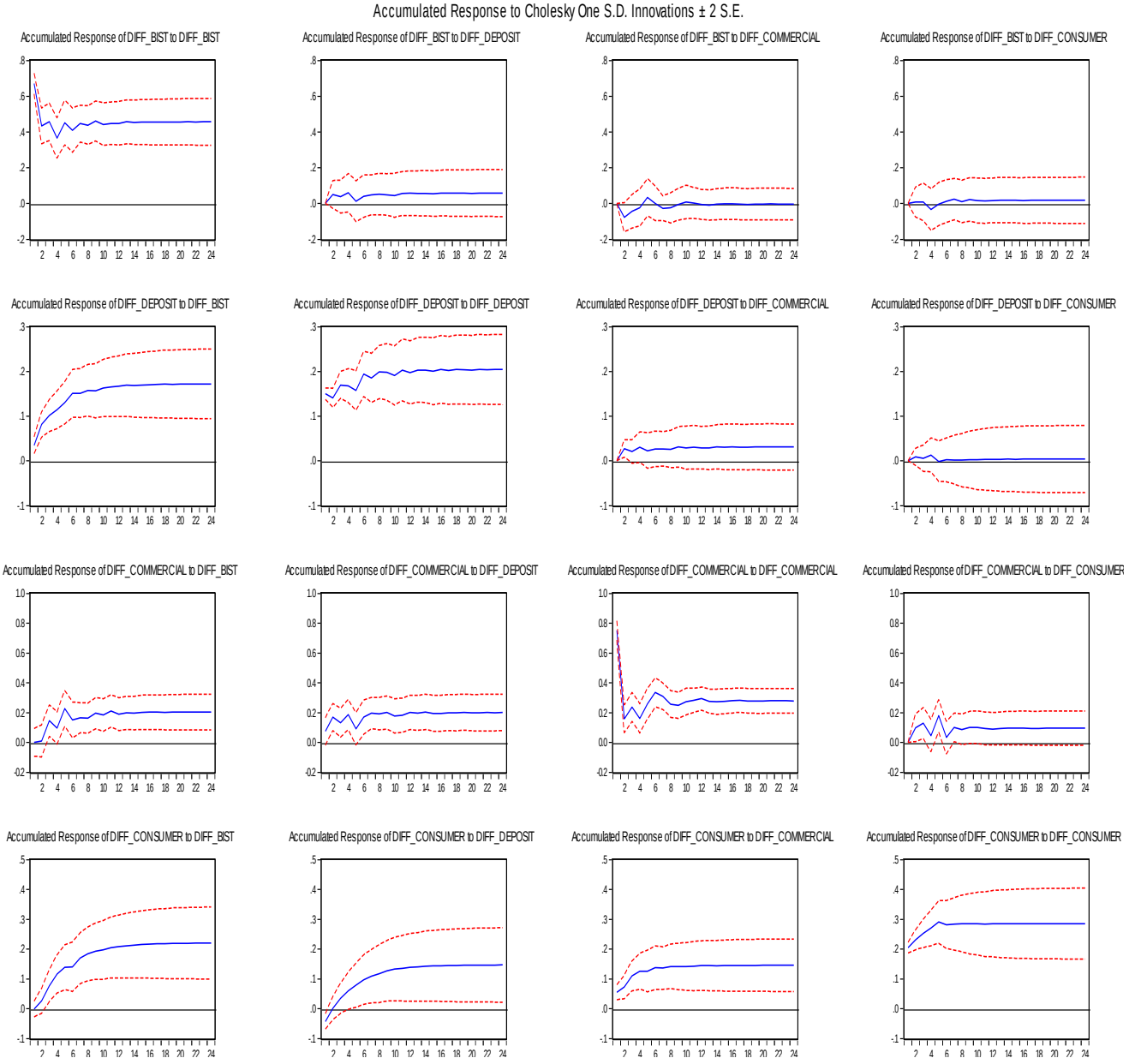
Inverse Roots of the AR Characteristic Polynomial- VAR with BIST Rate



Inverse Roots of the AR Characteristic Polynomial- VAR with WACF

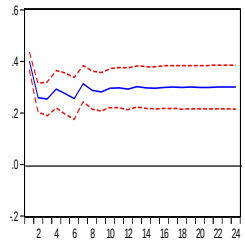
Autocorrelation LM Tests			
VAR with BIST Rate		**VAR with WACF**	
Lags	p-value	Lags	p-value
1	0.0968	1	0.0751
2	0.4510	2	0.9732
3	0.1548	3	0.3710
4	0.2733	4	0.4507
5	0.5566	5	0.3302
6	0.9617	6	0.5080

APPENDIX E: Impulse-Response Functions

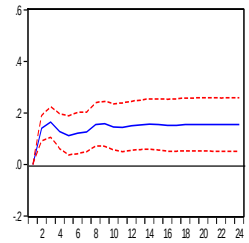


Accumulated Response to Cholesky One S.D. Innovations ± 2 S.E.

Accumulated Response of DIFF_WACF to DIFF_WACF



Accumulated Response of DIFF_WACF to DIFF_DEPOSIT



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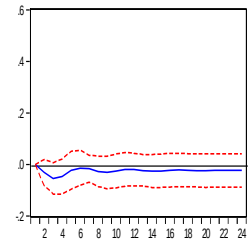

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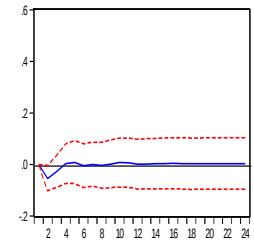

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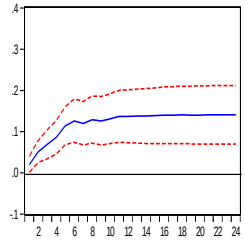

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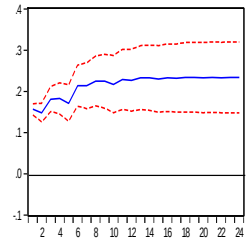

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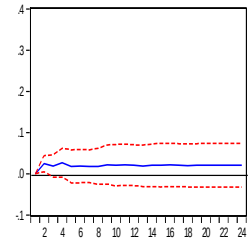

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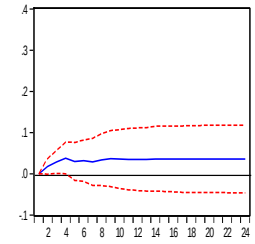

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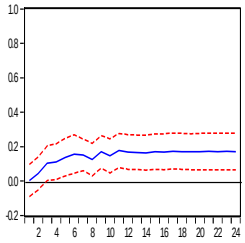

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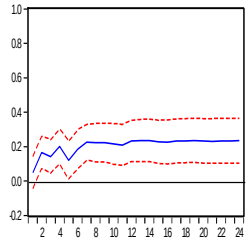

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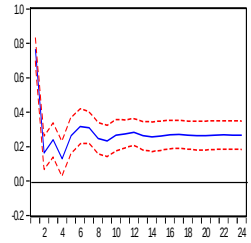

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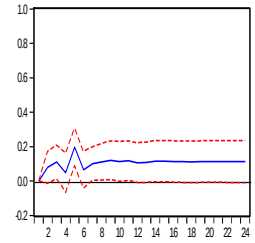

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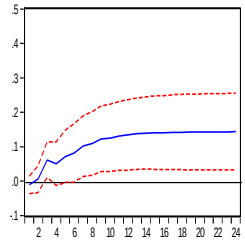

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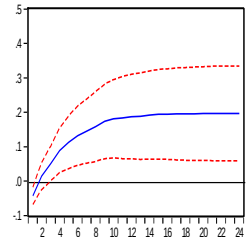

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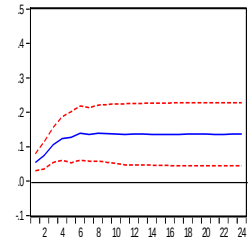

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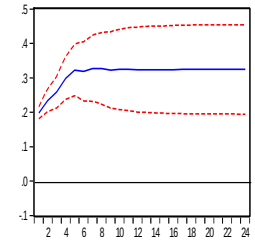


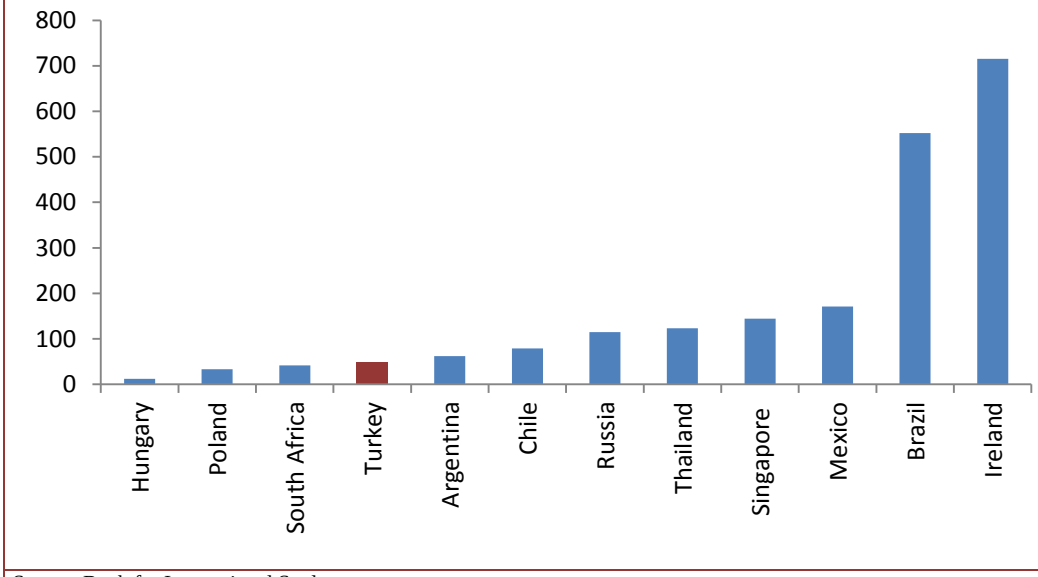
APPENDIX F: Correlation Matrix

Correlation Matrix of Variables in the Panel Regressions														
	Other Operating Expenses	**Equity Ratio**	**NPL Ratio**	**Net Fees and Comissions**	**Deposit Ratio**	**Liquidity Ratio**	**Bank Size**	**CR(3)**	**HHI**	**GDP Growth Rate**	**Inflation**	**Slope of the Yield Curve**	**BIST Rate**	**WACF**
Other Operating Expenses	1.00													
Equity Ratio	0.14	1.00												
NPL Ratio	0.49	-0.003	1.00											
Net Fees and Comissions	0.39	0.09	0.26	1.00										
Deposit Ratio	-0.12	0.26	-0.02	-0.13	1.00									
Liquidity Ratio	-0.27	-0.09	-0.26	0.16	0.03	1.00								
Bank Size	-0.56	-0.24	-0.47	0.19	0.01	0.30	1.00							
CR(3)	0.10	0.19	-0.06	0.10	0.18	0.22	-0.17	1.00						
HHI	0.07	0.15	-0.03	0.08	0.14	0.19	-0.14	0.95	1.00					
GDP Growth Rate	0.01	0.02	-0.04	0.02	-0.003	0.02	-0.03	0.12	0.07	1.00				
Inflation	-0.05	-0.09	-0.03	-0.02	-0.04	-0.04	0.04	-0.34	-0.37	-0.13	1.00			
Slope of the Yield Curve	0.02	0.14	0.02	0.05	0.07	0.08	-0.07	0.35	0.27	0.11	-0.55	1.00		
BIST Rate	-0.09	-0.21	0.03	0.07	-0.11	-0.11	0.10	-0.43	-0.34	-0.25	0.56	-0.75	1.00	
WACF	-0.08	-0.20	0.02	-0.06	-0.10	-0.09	0.09	-0.35	-0.29	-0.39	0.48	-0.71	0.95	1.00

APPENDIX G: Details of Other Operating Expenses

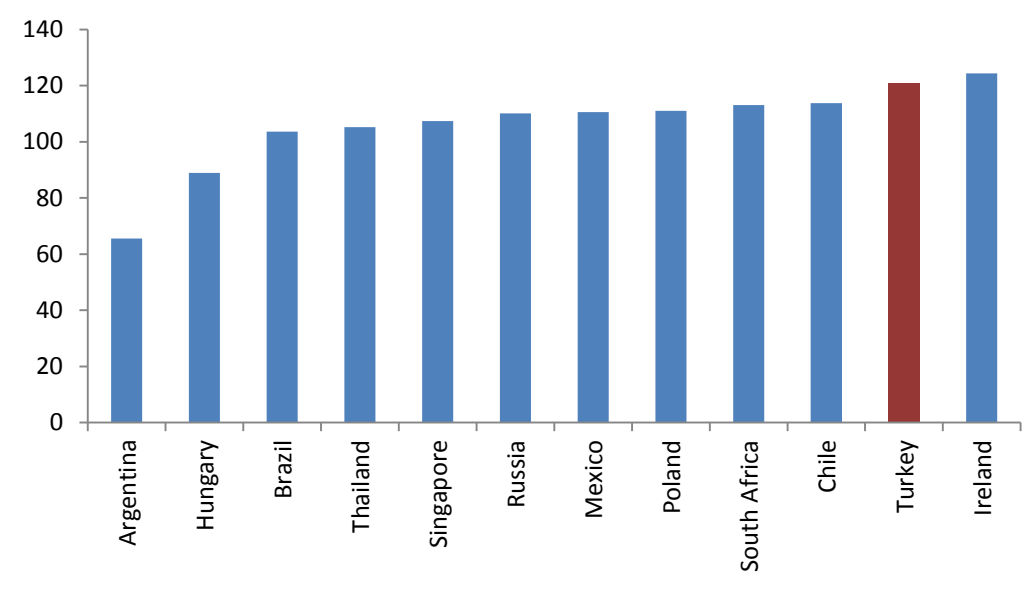
Other Operating Expenses of Ziraat Bank as of 2016Q1 (million TL)		
	Current Period	**Previous Period**
Employee Expenses	**607**	**531**
Provision for Seniority Indemnity	25	22
Amortization Expenses for Tangibles	72	54
Amortization Expenses for Intangibles	9	9
Operational Expenses	**322**	**251**
Leasing Expenses	53	41
Maintenance Expenses	20	16
Advertisement Expenses	20	13
Other Operational Expenses	228	181
Other	**646**	**508**
Savings Deposit Insurance Fund (SDIF) Rediscount Expenses	111	83
Expenses Related to Taxes and Duties	109	100

APPENDIX H: Debt Securities Issued by Banks and Loan to Deposit Ratios



Source: Bank for International Settlements

Total Debt Securities Issued by Financial Corporations (billion USD, as of 2016Q1)



Source: Fitch Connect

Loan to Deposit Ratio (percentage, as of 2015Q4)