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IMPACT OF CBT RESERVE REQUIREMENTS ON BANK LOANS BETWEEN 2008 and
2016 AS A MACRO PRUDENTIAL POLICY TOOL

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MAKRO İHTİYADİ POLİTİKA ARACI OLARAK TCMB ZORUNLU KARŞILIKLARININ
2008 İLE 2016 YILLARI ARASI BANKA KREDİLERİNE ETKİSİ

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- 5) bank loans

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LIST OF ABBREVIATIONS

AVERAGE_FX_RR	: Average Foreign Currency Reserve Requirements
AVERAGETLRR	: Average Turkish Lira Reserve Requirements
BRSA	: Banking Regulation And Supervision Agency Of Turkey
BOJ	: Bank Of Japan
CBT	: The Central Bank Of The Republic Of Turkey
COSTBASEFX	: Cost Base Foreign Currency Reserve Requirements
COSTBASETL	: Cost Base Turkish Lira Reserve Requirements
DSGE	: Dynamic Stochastic General Equilibrium Modeling
ECB	: The European Central Bank
EM	: Emerging Markets
EURIBOR	: Euro Interbank Offered Rate
EVDS	: The Central Bank Of The Republic Of Turkey Electronic Data Delivery System
FED	: The Federal Reserve / Central Bank Of The United States
FX	: Foreign Exchange / Foreign Currency
FXINTERESTRATE	: Foreign Currency Interest Rates
FXLOANCHANGE	: Foreign Currency Loans Change
IPINDEX	: Industrial Production Index
LIBOR	: The London Interbank Offered Rate
ROC	: Reserve Option Coefficient
ROM	: Reserve Option Mechanism
RR	: Reserve Requirements
RRR	: Reserve Requirement Ratios
TBA	: The Banks Association of Turkey
TL	: Turkish Lira
TUIK	: Turkish Statistical Institute

ABSTRACT

The utilisation of reserve requirements as a prudential monetary policy, especially in emerging countries, has increased following the global financial crisis of 2008-2009. Central Bank of Turkey used reserve requirements, among other things, in order to contain the impact of the crisis. This practice evolved after 2010 when it was considered that signs of recovery were beginning to appear. In this paper, the Central Bank of Turkey's practices and their impacts are investigated on bank loans which have recorded considerable growth due to capital inflows. The Bank often used financial innovations such as ROM or adjusted reserve application framework in order to maintain financial stability. Further, cost of reserve requirements is not same for each bank but depends on how much banks use Central Bank's innovative applications. Since banks' main goal is profit maximisation, cost based reserve requirements tend to be lower than policy ratios. That is not to say, however, that there is no cost to banks from such utilisation. Using reserve requirements options will necessarily affect liquidity positions and profit maximisation efforts for banks. The vector auto regression model with four main variables is used to reveal the relation between RR and growth of bank loans. Although reserve requirements prove effective for some periods, it is argued that there is no conclusive evidence to prove that it would help contain an overheated economy.

Keywords: reserve requirements, bank loans, cost of reserve requirements, monetary transmission channels, vector auto regression.

ÖZET

Zorunlu karşılıkların bir makro ihtiyati politika aracı olarak kullanımı, 2008-2009 küresel finans krizini takip eden dönemde, başta gelişmekte olan ülkelerde olmak üzere artmıştır. Türkiye Cumhuriyet Merkez Bankası da zorunlu karşılıkları krizin etkilerini kontrol altına almak amacıyla kullanmıştır ve bu kullanım 2010 yılından sonra normalleşme sinyalleri alındığı varsayımı ile değişiklik göstermiştir. Bu çalışmada, Türkiye Cumhuriyet Merkez Bankası pratiği ve bunun sermaye akımları nedeniyle büyüme rekorları da kıran, banka kredileri üzerindeki etkisini incelenmiştir. Banka finansal istikrarı korumak amacıyla, ROM gibi finansal yenilikleri veya zorunlu karşılık oranları değişimlerini sık sık kullanmıştır. Bu nedenle, zorunlu karşılıkların maliyeti her banka için aynı değildir ve merkez bankasının yeni finansal imkanlarını ne kadar kullandığına bağlıdır. Bankaların ana amacı kar maksimizasyonu olduğu için maliyet bazlı zorunlu karşılık oranı politika, zorunlu karşılık oranından daha düşük oluşmaktadır. Diğer taraftan bu zorunlu karşılıklar bankalar açısından bu tür uygulamaların maliyetinin olmadığı demek değildir. Zorunlu karşılık imkanlarının kullanımı, bankaların likidite pozisyonlarını ve kar maksimizasyonu gayretlerini etkileyecektir. Çalışmada zorunlu karşılıklar ve banka kredileri büyümesi arasındaki ilişki ortaya koymak için dört değişkenli vektör otoregresyon modeli kullanılmıştır. Her ne kadar bazı dönemlerde zorunlu karşılıkların etkili olduğu gözükse de ekonomik ısınmayı kontrol altına almaya yardımcı olacak bir uygulama olarak etkinliğine dair kesin kanıtın söz konusu olmadığı vurgulanmaktadır.

Anahtar kelimeler: zorunlu karşılıklar, banka kredileri, zorunlu karşılıkların maliyeti, parasal aktarım mekanizması, vektör otoresgresyon.

INTRODUCTION

Reserve requirements are used as a monetary policy instrument exclusively for banking system as well as for whole financial system. It is an effective tool for central banks mainly in emerging countries but also used in developed economies.

As a macro prudential macro-economic policy tool, regulatory authorities increasingly fell back on reserve requirement application in line with other prudential monetary policies. Following the global financial crisis dated with US investment bank Lehman Brother's collapse, global financial markets were exposed to huge volatility and risk off mode. The biggest central banks, particularly USA Central Bank FED, EU Central Bank ECB and Japan Central Bank BoJ, started to enlarge their balance sheets with quantitative easing measures and to decrease interest rate levels towards zero, even to negative territory in the case of ECB and BoJ. In that environment, global capital owners who were looking for safe havens oriented their funds into the emerging economies (EMs) which were relatively isolated from crisis. Capital flow into emerging markets caused higher volatility in FX rates and also in banking loans since there was an abundance of liquidity. Cheaper and abundant foreign capital flows brought about a rising money supply in the market. Thus, central banks of EMs needed to take action and measures in order to maintain the health of local financial systems and to mitigate any systemic risk.

Central Bank of Republic of Turkey (CBT) started to apply unorthodox stability programs to maintain a sustainable growth locally. During the initial stages of the crisis, it tried to provide liquidity for banking system by decreasing required reserve ratios and freed blocked liquidity in central bank accounts. Later, Central Bank resorted to reserve requirement policies again but this time to control rapid capital inflows and contain excessive credit growth by changing reserve scope and increasing ratios.

In this study, the purpose is to investigate CBT's reserve requirement applications' impact, as a macro prudential policy tool, over banks' balance sheet by exploring bank loans reactions to ratio changes within the required reserve goals framework. The scope of the study is between 2008 and 2016 which starts with global financial crisis till 2016 year end. Data was obtained from CBT, Banking Regulation and Supervision Agency (BRSA), Turkish Statistical Institute (TUIK) and Turkish Banking Association (TBA) databases. The analysis is done for both Turkish Lira (TL) and foreign currency balances separately. To analyse data, two complementary methods will be utilised. Firstly, event analysis will be applied to display reserve ratio changes impact on specific times and secondly, a vector auto regression model will be used to investigate loan balances against reserve requirement changes as well as interest rate and economic activity indicators. For the purposes of this study, reserve requirements are grouped under three categories: averages, marginal and cost-effective series with Turkish Lira and foreign currency segregation.

The first part of the study will include literature review about reserve requirement applications. As a macro prudential policy tool, reserve application conceptual framework and its institutional practice in Turkey will be reviewed in the second chapter. The following chapter aims to provide some information about Turkish banking sector structure. Bank loans will be analysed in that section too. In the fourth and last section, an empirical analysis of the relationship between reserve requirements and loan growth is applied by taking into consideration two other macro-economic variables; policy interest rate and industrial production index. The conclusion presents a combined review of previous sections and argues that from a policy perspective, next to its benefits, reserve requirements also have costs for the system that CBT needs to follow closely in order not to distort financial intermediation. Still, little is clear about its effectiveness.

CHAPTER I

1. RESERVE REQUIREMENTS IN LITERATURE

In the literature, reserve requirement (RR) is reviewed mostly within both institutional framework and its practices. We can argue that the focus of these reviews was the negative impact of reserve requirements over the financial intermediation function of banks. Over the last 30 years, the literature on reserve requirements question has evolved in line with the developments in financial area. In studies conducted in 1970s and 1980s, discussions were mostly about *raison d'être* of a required reserve application. In general, it was considered as a hidden tax which constituted the axe of discussions. In recent studies, the emphasis appears to be on the role of reserve applications as a whole and examining the impact on financial system empirically. Multivariable regression models and case study methods are used to examine RR.

In a working paper published by IMF, Simon T. Gray (2011) describes the reason of reserve requirements applications under three topics: prudential, monetary control and liquidity management.

Prudential role of reserve requirement application may be considered as holding cash like high liquid assets with central bank in order to cover unexpected cash outflows. It can be seen as a safety measure which lowers default risk for banks as depository institutions. Although, in general, prudential approach seems effective, Hein and Stewart (2002) suggested that financial markets are not always acting accordingly. In their study, they

examined the relationship between short term interbank interest rates and US Treasury bond rates following FED's reserve ratio adjustments and finally demonstrated that FED's reserve ratio adjustments played a contrary role since markets didn't react as they are in a safer zone following FED's adjustments.

Hazar and Yenice (2015) also considered that reserve requirement application's prudential role is not essential. In their study, they researched reserve requirements impact on Turkish banks' balance sheets by using regression forecast model and argued that capital adequacy regulations, deposit insurance and central bank liquidity windows weaken the prudential role for reserve requirements.

Liquidity management purpose is also one of the reasons for reserve requirements. It may be considered as a tool to sterilise the excess or missing required reserve balances impacting over inflation or foreign exchange rates. Gray (2011) indicates that it is possible to contain short term interest rate volatility in order to support financial markets by using reserve requirements in sense of liquidity management. This approach seems to be generally accepted in the literature. In a study where liquidity and reserve requirements in Brazil were reviewed, Robitaille (2011) suggests that since financial markets are not developed enough in emerging markets, liquidity management may be the main reason for reserve requirement applications.

As a monetary control mechanism, reserve requirements application is discussed under two topics: money multiplier and impact on interest margins. As general information in textbooks, money supply effect of reserve requirements is presented as equation (1). In the textbooks, this equation seems the simple way to show that the upper bound of loan balances may be designated by reserve ratios.

$$\text{Money Supply (MS)} = \left(\frac{1}{RRR} \right) \text{Monetary Base (MB)} \quad (1)$$

Recently, using reserve requirements to contain money supply seems a common policy in the literature and in practices especially in emerging countries. In his study where reserve requirements developments within monetary policies were treated, Carrera (2013) expressed that central banks control money supply, short term interest rates and loan growth by using reserve requirements.

In different studies, reserve requirements were also treated as a tool to control capital inflows. Hoffmann and Loeffler (2014) studied 28 emerging economies reserve requirements applications in line with capital flows triggered by low interest rates policies in developed economies. Results present that emerging countries are effectively using RR to contain speculative capital flows and maintain healthy financial markets.

In a research where Montoro and Moreno (2011) studied South America economies, it was demonstrated that reserve application adjustments help monetary authorities to stabilise capital movements and interbank markets by controlling money supply.

The former CBT governor Başçı (2010) is also explaining that CBT used reserve requirements as a main tool for financial stability while interest rates were used for price stability. Besides, Glocker and Towbin (2012) developed a DSGE model to examine reserves effects and came to the conclusion that in case of foreign currency borrowing and financial stability target, reserve requirements impact as a monetary control tool increases. However, reserve requirement application is not without cost. In the same study where authors analysed the effectiveness of reserve requirements for price and financial stability, the model results show that applying required reserve has a cost over banks' loan prices but that differs according to banks' place in the financial system. In other words, it depends on bank's monopolisation scale. Similarly,

Robitaille (2011) discussed that if reserve ratios are applied symmetrically over whole banking system, it may have a bigger impact on smaller banks since bigger banks have more capacity to collect longer term deposits or funding sources than smaller banks.

Reinhart and Reinhart (1999) study on reserve requirements as a tool to deal with capital movements is one of the main studies on reserve requirements' cost on margins. They conclude that reserve ratio increases cause a rising margin between deposits and loan interest rates. In that study, transitivity of reserve requirements cost into the deposits and loan rates through two scenarios. The first one is the market where banks are decision makers over deposit rates and in competition for loans and the second one is the market where banks are decision makers for loan rates and in competition for deposits. They came to the conclusion that reserve requirements cause a decrease in deposit interest income in the first scenario and cause an extra cost on top of loan rates in the second scenario.

Similarly, based on Colombia case, where Vargas and Cardozo (2012) analysed the case when higher reserve ratios necessitate new funding, it was presented that the final impact of reserve applications over banks assets and liabilities depends on funding substitution for deposits. In Turkey, Mutlutürk (2012) analysed CBT's reserve requirement application between 2010 and 2011 where it changed ratios significantly, and concluded that higher reserve ratios increased deposit costs for banks and thus forced banks to find alternative funding sources. But that pushed local regulators and CBT to take additional actions which complicated reserve requirement framework too.

Another work in Turkey is done by Alper, Binici, Demiralp, Kara and Özlü (2014) to reveal the interaction between reserve requirements and bank loans. They identify a new transition channel called as liquidity channel and concluded that banks react notably to reserve applications changes. "Liquidity

channel” which implies imperfect substitution between deposits and central bank funding analysis presents that higher required reserves reduce banks’ liquidity and credit supply (Alper et al., 2014, p4).

Tovar Mora, Garcia-Escribano, & Vera Martin (2012) examined Latin American countries in a cross-country approach to reveal reserve requirement effects and conclude that its impact is transitory while RRs play a complementary role to monetary policy.

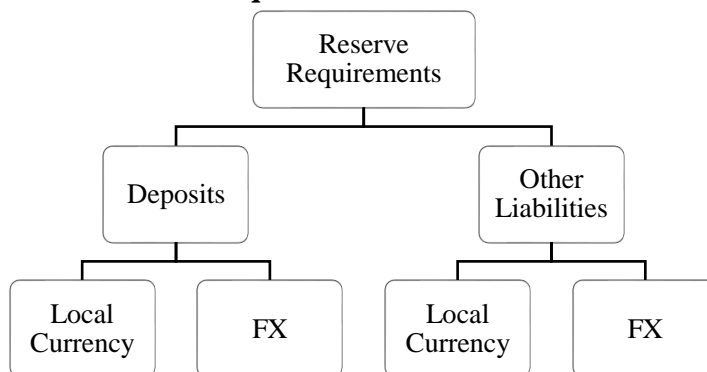
In the literature, in general, it is well accepted that reserve requirements are not without cost and as indicated by Feinman (1993), the higher the level of reserve ratios, the higher the cost imposed on the real economy and depositors. On the other hand, it is also well accepted that higher ratios help local authorities to contain financial risks and maintain stability.

CHAPTER II

2. RESERVE REQUIREMENTS: CONCEPTUAL FRAMEWORK AND IMPLEMENTATION IN TURKEY AS A MACROPRUDENTIAL MEASURE

As a general definition, reserve requirements refer to holding a certain fraction of banks' and other depository institutions' deposits in reserve, in very secure assets and mainly keep them with central bank (Feinman (1993)). Reserve requirement concept and its rationale evolved significantly since 1970s because financial systems changed and knowledge about how required reserves affect economies has increased too. Figure 2-1 demonstrates general coverage area of reserve requirements in banks' liabilities. In current applications, it is not only about deposits but also covering other funding sources like bank borrowings and may differ based on currencies as well.

Figure 2-1: Reserve Requirements on Banks Liabilities



Source : Tovar Mora, Garcia-Escribano, & Vera Martin (2012)

Reserve requirements have been always considered as a part of the monetary policies. In today's world, most of central banks apply reserve requirements as a policy tool. Gray (2011) demonstrates in his working paper on reserve requirements utilisation all over the world that 90 countries out of 121 apply it. But it also should be indicated that its utilisation as a macro prudential policy tool is different between EMs and industrial countries (Cordella, T. F., Federico, P., Vegh, C., Vuletin, G. 2014). There are important differences like ratio levels, coverage domains, maintenance periods or interest rate remuneration for reserves. Gray (2011) discusses that the differences are originating from central banks' distinctive targets. However, its role as a monetary policy tool diminished through developing other regulations and financial innovations such as capital adequacy ratios or deposit insurances. Over the past two decades, central banks shifted from control over reserves to control over short term interest rates and financial stability. Another reason why it seems less important, especially for developed economies, is because reserve requirements are used as a hidden tax on depositors. Although in some countries like Turkey, we observe quite high reserve requirement ratios, there is a trend toward lower reserve ratios. We may think the reason behind this trend as being in a very competitive global financial system, applying higher ratios can seriously distort financial intermediation role of banks. Because it is not without cost for banks and much of the cost is reflected to customers via lower deposit rates or higher loan rates.

On the other hand, reserve requirements are a monetary policy tool and even with different goals, it serves to control money supply. Central Banks aim to control money supply through money multiplier which was simply demonstrated in equation 1 above. In case of a tight monetary policy, increasing reserve ratios limit usable money, in other words, banks' usable funds for loan books decline and thus central bank can control economic activities. That also helps Central Bank to affect liquidity and interest rates.

Besides, as mentioned above it was not without cost and the additional cost caused by reserve requirement affects the potential of bank loans negatively. Banks use liquidity which has always a funding cost and holding a fraction of their funds untouchable in reserve accounts may increase all in cost of funding. Therefore, in order to stay profitable, banks may be pushed to increase loan rates depending on their own position in the system and reserve requirements remuneration by central banks. We can also argue that prudential role may be important only for foreign currency liabilities in emerging countries where accessing liquidity is limited.

In the next sections we will investigate RR impact on banks' available liquidity via cost and liquidity transmission mechanism.

2.1: Impact on Money Supply Through Multiplier Effect

Money multiplier subject is one of the main topics in money and banking literature. In macro-economic models, at least in simple ones, reserve requirement effects are considered through the money multiplier (Carpenter and Demiralp, 2010). The assumption behind the money multiplier is that banks' available liquidity is determinant for the money which banks lend and central banks control money base unilaterally. In general, we argue that money multiplier designates money supply and reserve requirements generate a direct and tight linkage between liquidity and available cash (Carpenter and Demiralp, 2010). In theory, the place of reserve requirements in money supply process is described as shown in equation 1 above. Thereby, money supply is determined by money base affected with a money multiplier. In the equation (1), $\frac{1}{RRR}$ stands as money multiplier and based on this, money multiplier (m) equation is shown in the literature as below equation (2) (Mishkin, 2011)

$$m = \frac{MS}{MB} \quad (2)$$

However, since this equation does not include excess reserve and households' cash demand, to have more realistic one it is necessary to include these two items as well. Following Talaslı (2012)'s study, we can develop equation (2) as below:

$$MB = C + RR_T \quad (3)$$

In the equation; C demonstrates cash need of households and RR_T demonstrates total reserve requirements including minimum and excess balances. We may show it in an equation as below:

$$RR_T = RR_{min} + ER \quad (4)$$

RR_{min} identifies the minimum reserve balances and ER denotes excess reserve balances held by banks.

In literature, RR_{min} , ER , and C are considered as a function of deposit amount and can be demonstrated as in equation (5) where D stands for deposits and RRR stands for RR ratio.

$$RR_T = (RRR \times D) + (ER \times D) \quad (5)$$

If we reform equation (3) accordingly we can formulate money base as:

$$\begin{aligned} MB &= (C \times D) + (RRR \times D) + (ER \times D) \\ &= D \times (C + RR + ER) \end{aligned} \quad (6)$$

Money supply, on the other hand, is considered as sum of cash need and deposits and shown as in equation (7).

$$MS = C + D = (C * D) + D = D * (C + 1) \quad (7)$$

Then, we can re arrange money multiplier equation (2) as below.

$$m = \frac{MS}{MB} = \frac{Dx(C + 1)}{Dx(C + RR + ER)} = \frac{C + 1}{C + RR + ER} \quad (8)$$

Consequently, the determination of monetary supply level depends on the central banks' behaviours as well as households and on banks. When we reformulate the deposit multiplier by taking into account banks and people behaviours, we have the monetary multiplier which presents the level of change of one unit base money increase. As is shown in the money multiplier equation 8, banks reserve need and people's cash needs affect the monetary multiplier in the negative direction.

It is also possible to present the impact of reserve requirements on money multiplier via a simple banking sector balance sheet. The sector balance sheet includes central bank and commercial banks' balance sheets in a consolidated way (Talash, 2012, p.4).

Table 2-1: Banking system consolidated balance sheet

Central Bank Balance Sheet	
Net Foreign Assets	Currency Issued
Credit to Banking Sector	Free Deposits
<i>Open Market Transactions</i>	=
<i>Late Liquidity Window</i>	Monetary Base
Othe Items	Public Sector Deposits
Banking Sector Balance Sheet	
Cash	Current Account Deposits
	Time Deposits
Free Deposits to Central Bank	Loans from Central Bank
	<i>Open Market Transactions</i>
Loans	<i>Late Liquidity Window</i>
Consolidated Balance Sheet	
Net Foreign Assets	Cash Emission
	Current Account Deposits
Net Other Items	Time Deposits
	=
Loans	Money Supply

Source: Talash, CBT, 2012

In Table 2-1, reserve requirements balances are identified as Free Deposits in central bank balance sheet liability side. Central bank follows banks required reserves under this account. Following the equation (3), currency issued (emission which can be identified as cash need) and reserve requirements form money base in the liability side of central bank balance sheet.

Money supply, on the other hand, can be stated on the liability side of consolidated balance sheet. Cash and Emission plus Current and Time Deposits compose money supply. Due to balance sheet equation principle, any change in assets affects directly money supply. Central Banks affect money supply by changing their balance sheet sizes with open market operations (Talashi, 2012). Any reserve requirement ratio increase brings about a declining money multiplier effect via increasing money base and vice versa.

Therefore, in an environment where money supply is limited, if money base is rising by increasing reserve requirements, commercial banks' loan growth may be restricted. Because, banks will be pushed to hold higher reserve balances with central bank.

2.2: Impact on Loan Supply Through Cost Channel

Another effect of reserve requirements on bank balance sheet is due to its cost. Banks collect fund from depositors or borrow directly from market and pays interest for those funding. While they hold a fraction of their funds with central bank as required reserve, if they are not remunerated or remunerated with a lower rate than their original costs then the margin between deposit and loans will be affected (Talashi, 2012). Here, central bank policy interest rates are also important because banks can borrow from central bank against collateral at that rate and therefore can cover their reserve need from central bank. If central bank pays its policy interest rate to reserve balances, we can argue that RR cost

may be eliminated or decreased significantly. However, as is the case in Turkey currently, if banks' cost rate is higher than central bank remuneration rate then reserve requirements application creates an extra funding cost for banks.

In the literature Monti-Klein banking model is used to explain banking system functions and we will use it also to display reserve requirements cost impact on banks' balance sheet. It is a widely used model and suggested by Klein and Monti in 1971 and 1972 (Dvořák, 2005). The assumption behind this model is that banks are seeking profit maximization and the system where they are operating in has a monopolistic structure. Powerful authorities control enters and exit, and they are obstacle in front of constitution of full competition.¹ Due to its simplicity, this model is very useful to examine banking sector but also its loan-deposit interaction assumption is debated. It is worth to state that whether loans and deposits are interdependent or dependent question depends on country and/or bank specific conditions.

We can follow Alper et al. (2014) study to show reserve requirements effect on loans with in Monti-Klein model. In compliance with the model, we will analysis reserve requirements changes impacts based on a simplified bank balance sheet described in table 2-2. According to the model, a bank can have three type assets; loans, fixed income portfolio and reserve requirements held at free account with central bank. These assets are funded by deposits and repo with central bank against bonds given as collateral. As mentioned before, required reserve balances are a proportion of deposits ($RR \times D$).

¹ For details see Dvořák, Pavel. Rethinking the Monti-Klein model of banking industry: new insights about the separability of loans and deposits decisions'. (Charles University Discussion Paper No. 2005. Vol. 138). Praha: Czech Republic

Table 2-2: Simplified Bank Balance Sheet

Assets	Liabilities
Loans (K)	Deposits (D)
Free Securities (B^L)	Repo (R)
Securities Pledged as Collateral (B^{IL})	
Reserve Requirements (RR)	

Source: Alper et al. (2014)

Loans, deposits, collateralised funding, loan interest rates (i^K) and deposit rates (i^D) are model's endogenous elements. Reserve requirements ratio (RRR) and central bank policy interest rate (i^{CB}) are exogenous elements.

Total fixed income portfolio is displayed as B which consists of free securities and pledged as collateral:

$$B = B^L + B^{IL} \quad (9)$$

We can show above table as below equation:

$$K + B + RRR * D = D + R \quad (10)$$

The assumption behind the model is that there is a monopolistic market both for loans and deposits and also both loan and deposit balances are function of interest rates (Dvořák, 2005).

$$K = K(i^K) \quad (11)$$

$$D = D(i^D) \quad (12)$$

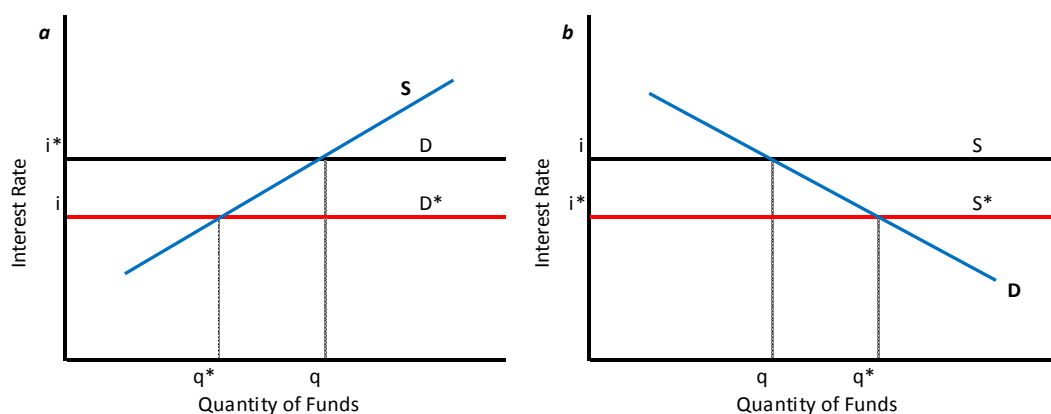
Thus, under balance sheet balance principle, according to model, a profit function can be displayed as below without a bank have liquidity shortfall.

$$\Pi = K(i^K) + B(i^B) + D(RRR)(i^{CB}) - D(i^D) - R(i^{CB}) \quad (13)$$

i^B stands for return on bonds.

As financial intermediary institutions, banks seek to maximise their profit by determining their loan and deposit rates. Banks funding sources, in the model, are deposit and central bank funds. As Vargas and Cardozo (2012) expressed, the substitution level of these two sources for a bank is crucial regarding reserve requirements cost impact. Under normal circumstances, average loan tenor is longer than average deposit tenors. Central bank funds have shorter tenor than average deposits, mainly overnight or weekly funds. In balance sheet management area, due to tenor differentiations, funding from central bank is considered as an option for short term and day to day liquidity management rather than a replacement for deposits. Because, dependency on shorter term funding source like central bank sources increases interest rate risk (Vargas and Cardozo, 2012). Thus, Alper et al. (2014) argued, since central bank funding can't be a sustainable alternative for deposits, any increase in reserve requirements necessitates additional funding which also affects deposits and loans interest rates. In the profit function in equation 13, a reserve increase may be compensated by increasing deposits or shifting from loan to required reserve balances due to its cost.

Figure 2-2: Impact of reserve requirements on deposit and loan rates



Source: Hein and Stewart (2002)

In the above Figure 2-2a, under the assumption that deposit rates are determined by the market and reserve requirement costs are reflected to the depositors, it was illustrated that the decrease on deposit returns from i^* to i would result in a decrease on the deposit offers from q to q^* then deposit amount shifts down from D to D^* . On the other hand, while there is consensus in the literature that reserve cost is a tax, there is no clear evidence of the inverse relationship between reserve ratio changes and deposit returns.

In the case of Figure 2-2b, due to decreasing deposit offers depending on lower interest income, loan supply will also decline from q^* to q and the cost will rise from i^* to i for borrowers. While in the first chart the cost was reflected to depositors, in Figure 2-2b, the cost is reflected to the borrowers because the quantity of usable funds is absorbed by the central bank via reserve requirement applications. In both a and b cases, reserve requirements costs will have a direct or indirect effect (via useable deposit amount) on loan balances for a bank.

Since deposits are the main funding sources for loans, in this case, there would not be enough fund to cover current loan balances and/or new loan requests, any reserve requirement increase will have a restrictive impact on loan balances.

The main two traditional funding sources are deposits and central bank credit for banks. Since central bank sources are shorter term options compared to deposits, the substitution degree between them is determinant for the monetary transmission of reserve requirement. If they don't substitute themselves with a high ratio then if reserve requirement ratio increases it won't be replaced with borrowing from central bank and may cause cost increase for deposit accounts. As it was indicated by Alper et al. (2014) in their study, both bank loans and deposit market will be affected together.

It was explained above, the substitution level between deposit and central bank sources is crucial to calculate reserve requirement effect on bank loans. Alper et al. (2014) call reserve requirement ratio increase's impact on credit growth as "liquidity channel". If the required extra liquidity is put up from central bank sources, since it will be a collateralised funding, bank is left with less liquidity buffers to use against unexpected liquidity shocks. Thus, the cost of central bank funding will be increased due to liquidity risk which causes an increase in bank's lending rate or it will prefer to slow its credit growth.²

The funding composition is a crucial management area for banks due to liquidity constraints. Each bank needs to have a strong liquidity position which must be in line with the regulations such as net stable funding ratio and liquidity coverage ratio. As Alper et al. (2014) indicated in their study, switching from deposit to central bank to cover reserve requirement need may deteriorate bank's liquidity position. In practice, increasing deposit balance takes longer time than addressing to central bank liquidity facilities. Therefore, in case of a tightening in reserve requirements, banks prefer central bank to fulfil their need immediately.

As a consequence, the cost channel effect of RR may be summarised as that if central bank increases reserve requirement ratio, even we assume that short term money market interest rates remain unchanged during that time, it may have a restrictive impact on loan balances as that will limit disburseable money and may change banks' balance sheets. Thus, apart from interest rates, quantitative policies affect loan balances as well.

² See Alper et al. (2014) for details about liquidity channel.

2.3: Implementation of Reserve Requirements in Turkey

Reserve requirement regulations in Turkey are set by the Central Bank of the Republic of Turkey (CBT). Although there has been a required reserve management in Turkey for a long time, the current application is regulated by the communique dated 2005 and number 1 which was published based on the article 40 of the CBT law. Turkish banks are required to hold a predetermined amount of cash averaged over 14 days maintenance period beginning on Friday and ending on Thursday. The liabilities subject to reserve requirements are calculated on Friday every two weeks and comprised of the balance sheet items presented in the table 2-3 by taking into account the accounting standards and record – keeping of banks and financing companies, including the liabilities of foreign branches and excluding obligations to Central Bank, the Treasury, domestic banks and headquarters and branches of banks established by the international agreements in Turkey.³

Before the global crisis in 2008-2009, CBT used reserve management system mainly for the prudential reasons. The main goal was to defend banking system against default risk (Talışlı, 2012). The short term interest rates were the main instrument in a conventional monetary management framework. After the global credit crunch and following the developed countries central banks' quantitative easing policies, CBT put in place several changes in reserve requirement applications. Especially after 2010, CBT used it more actively in various dimensions (Alper et al 2014).

³ <http://www.tcmb.gov.tr/wps/wcm/connect/TCMB+EN/TCMB+EN/Main+Menu/MONETARY+POLICY/Reserve+Requirement+Ratios/> accessed 08 April 2017.

Table 2-3: Balance Sheet Items Subject To Reserve Requirement

-
- a *Deposits / Participation funds*
 - b *Funds from repo transactions*
 - c *Loans obtained (except the loans guaranteed by the Treasury)*
 - d *Securities issued (net)*
 - e *Subordinated debt that is not taken into account in the calculation of own funds*
 - f *Liabilities to the head office abroad (net)*
 - g *Debt to contracted merchants due to credit card transactions*
 - h *Borrower funds of investment banks*
-

Sources: Central Bank of Turkey

While global financial markets and especially banking sectors were being shaken by the credit crunch and later on by debt crisis in Europe, liquidity was the main issue for the system; not only the quantity of the liquidity but also its flow between markets were pushing central banks to take unorthodox action and apply special measures for their local markets. The CBT adopted a new policy strategy to contain macro-financial risks and to address the challenges posed by volatile capital flows. To this end, “the price stability was modified by incorporating financial stability as a supplementary objective” (Kara, 2016, p.85). CBT announces its RR framework on its own website as following: “In line with the new strategy that took effect in the last quarter of 2010, the CBT developed a new policy framework towards reducing macro financial risks within the limits of favorable inflation outlook. Accordingly, in addition to the traditional policy instrument of the one-week repo auctions rate, reserve requirements were introduced as an active tool.”⁴ In order to help the Turkish banking sector in terms of liquidity and cost of liquidity, next to interest rate policy, CBT used reserve requirement system effectively.

4

<http://www.tcmb.gov.tr/wps/wcm/connect/TCMB+EN/TCMB+EN/Main+Menu/MONETARY+POLICY/Reserve+Requirement+Ratios/> accessed 08 April 2017.

In December 2008, CBT announced that it decreased reserve requirement ratios for foreign currency denominated liabilities by 200 basis points (bps) in order to loosen the credit crunch crisis impact on the local economy and to pump liquidity to the banking sector. Thus, CBT provided the banking system with foreign currency liquidity amounting to USD 2.5 billion.⁵ Almost one and half year later, CBT disclosed its monetary policy normalisation strategy and indicated that in line with the improving normalisation in global markets, it would withdraw gradually foreign currency liquidity assured via easing reserve requirement and decided to increase ratios for foreign currency liabilities in April 2010. Thus, foreign currency reserve ratios increased again to the level before global financial crisis as illustrated in Table 2-4.

Meanwhile, in order to reduce intermediation costs and support effective functioning of the credit market, the Central Bank reduced the Turkish Lira required reserve ratio, from 6% to 5% on 16 October 2009, thus provided the banking system with TL 3.3 billion worth of permanent liquidity.⁶ Same with foreign currency reserve ratios, CBT started to normalize Turkish Lira reserve ratios by increasing it gradually in 2010 during exit strategy from the exceptional monetary policy applied since the crisis. The bank decision was also based on the argument that banking sector was recording an excessively strong credit growth.

⁵ Central Bank of Turkey Monetary and Exchange Rate Policy For 2010, published on its website, <http://www.tcmb.gov.tr/wps/wcm/connect/tcmb+en/tcmb+en/main+menu/publications/basic+policy+readings/monetary+and+exchange+rate+policy+texts> accessed on 09 April 2017.

⁶ CBT 2009 Financial Stability Report Vol.9, Published on its website, <http://www.tcmb.gov.tr/wps/wcm/connect/TCMB+TR/TCMB+TR/Main+Menu/Yayinlar/Raporlar/Finansal+Istikrar+Raporu/2009/Sayi+9/> accessed on 08 April 2017.

Table 2-4: FX Reserve Requirement Ratios (%)

	Deposit			Other Liabilities			
	Demand Deposit and up to 1 year Deposits	with 1-year and longer	up to 1 year	up to 3 year	longer than 3 year		
<i>Before Crisis</i>	11.00	11.00	11.00	11.00	11.00		
28/11/2008	9.00	9.00	9.00	9.00	9.00		
30/04/2010	9.50	9.50	9.50	9.50	9.50		
06/08/2010	10.00	10.00	10.00	10.00	10.00		
01/10/2010	11.00	11.00	11.00	11.00	11.00		
29/04/2011	12.00	11.00	12.00	11.50	11.00		
22/07/2011	12.00	10.00	12.00	10.00	9.00		
05/08/2011	11.50	9.50	11.50	9.50	8.50		
30/09/2011	11.00	9.00	11.00	9.00	6.00		
21/12/2012	11.50	9.00	11.50	9.50	6.00		
01/02/2013	12.00	9.00	12.00	10.00	6.00		
01/03/2013	12.50	9.00	12.50	10.50	6.00		
24/05/2013	13.00	9.00	13.00	11.00	6.00		
	Demand Deposit and up to 1 year Deposits	with 1-year and longer	up to 1 year	up to 2 year	up to 3 year	up to 5 year	longer than 5 year
13/02/2015	13.0	9.0	18.0	13.0	8.0	7.0	6.0
13/03/2015	13.0	9.0	20.0	14.0	8.0	7.0	6.0
09/10/2015	13.0	9.0	25.0	20.0	15.0	7.0	5.0
17/11/2016	12.5	8.5	24.5	19.5	14.5	6.5	4.5
30/12/2016	12.0	8.0	24.0	19.0	14.0	6.0	4.0

Source: Central Bank of Turkey

Additionally, with a view to preventing fluctuations in overnight interest rates and enhancing the flexibility of the banks' liquidity management, the Central Bank announced that it would introduce flexibility in the provision of the TL required reserve liabilities. Accordingly, banks will be allowed to carry over 10% of the required reserves for any period to the following period or carry over the excess amounts, which cannot exceed 10% of the required reserves for any period to the following period.

CBT used reserve requirement system very actively as a policy instrument to counterbalance macro economical risks as well as financial risks starting from 2010. In December 2010, it kicked off the new reserve requirement framework by applying tenor differentiation on Turkish Lira deposits subject to reserve. In the new framework, reserve ratios are settled according to tenors, longer ratios for short term deposits and longer terms have lower ratios as shown in Table 2-5. This was done for the first time in Turkey. Later on, in April 2011, it was decided to apply tenor fraction on foreign currency liabilities too as shown in Table 2-4.

Table 2-5: TL Reserve Requirement Ratios (%)

	Deposit						Other Liabilities		
	Demand Deposit	up to 1 month	up to 3-month	up to 6-month	up to 1-year	with 1-year and longer	up to 1 year	up to 3 year	Longer than 3 year
<i>Before Crisis</i>	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
02/10/2009	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
01/10/2010	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
12/11/2010	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
07/01/2011	8.0	8.0	7.0	7.0	6.0	5.0	8.0	8.0	8.0
04/02/2011	12.0	10.0	9.0	7.0	6.0	5.0	9.0	9.0	9.0
01/04/2011	15.0	15.0	13.0	9.0	6.0	5.0	13.0	13.0	13.0
29/04/2011	16.0	16.0	13.0	9.0	6.0	5.0	13.0	13.0	13.0
30/09/2011	16.0	16.0	12.5	9.0	6.0	5.0	11.0	8.0	5.0
28/10/2011	11.0	11.0	11.0	8.0	6.0	5.0	11.0	8.0	5.0
01/02/2013	11.3	11.3	11.3	8.3	6.3	5.0	11.3	8.0	5.0
01/03/2013	11.5	11.5	11.5	8.5	6.5	5.0	11.5	8.0	5.0
12/08/2016	11.0	11.0	11.0	8.0	4.5	4.5	11.0	7.5	4.5
09/09/2016	10.5	10.5	10.5	7.5	5.5	4.0	10.5	7.0	4.0

Source: Central Bank of Turkey

Since therefore, CBT applied tenor fraction both for local currency and foreign currency liabilities subject to reserve requirement. The main reason of this new framework is to support local banking sector to extend deposit tenor since there is a serious mismatch between liability and asset tenors in banks' balance sheets. It was tried to loosen reserve cost on longer term deposits and make it more attractive for depositors. Turkish banks have longer assets tenors than liabilities and that structure expose banks to significant interest rate and liquidity risks. This puts local financial markets in a fragile environment.

Another main change CBT made on reserve requirement application is to remove interest payment for reserve balances. In order to support banks' intermediation role to manage more effectively and more productively, CBT started to pay interest for Turkish Lira reserve balances starting from 2001, and for foreign currency denominated reserve balances starting from 2002. But to support de-dollarisation process and to encourage local currency deposit and loans, in December 2008, CBT removed it for foreign currency reserves. In September 2010, this time to counterbalance financial risk and bank loans rapid growth, CBT removed interest

payment for Turkish Lira reserves. We can argue that that action was in line with banks' profit maximization function which was showed in equation 13 above.

In addition to these amendments, by the new monetary policy framework, CBT implemented new interest rate policy and reserve option mechanism. The idea behind Reserve Options Mechanism was to absorb the massive inflows triggered by the quantitative easing policies of advanced economies and accumulate foreign exchange reserves without excessive sterilisation costs. This new mechanism introduced at the end of 2011 allows banks to voluntarily hold a certain portion of their TL reserve requirements in foreign exchange and/or gold (Alper, Kara and Yörükoğlu, 2013). The amount of foreign exchange or gold that can be held per unit of TL is called the reserve option coefficient (ROC). For example, if the ROC is 2, banks must hold 2 TL worth of foreign currency or gold per 1 TL reserve requirement if they wish to utilize the ROM facility. The CBT adjusted the ROC to change the relative cost of using the reserve option mechanism. All these measures led to substantial variations in the reserve holdings of the banking system, both across banks and through time.⁷ All these measures led to material fluctuations in reserve balances of the system, both across banks and through the period, which is not general practice in central banking (Alper et al, 2012). As Kara indicated, "these unconventional tools aim to ease the policy trade-offs associated with the volatility in capital flows by dampening the amplifying role of capital flows" (Kara, 2016, p.87).

CBT's initial intention was to soften the capital inflow volatility; later on it tried to contain capital inflow effecting local economical balances. CBT used reserve requirement and a wide interest rate corridor as cyclical tools to control credit growth and capital flow volatility.

⁷ See Alper, Kara, and Yörükoğlu (2013) for a detailed exposition of the reserve option mechanism.

Capital flow towards high yield countries due to the liquidity abundance in low interest rates developed countries brought about some unsustainable financial positions in Turkey like rising import goods and current account deficit. While Turkey current account deficit ratio to gross domestic product (GDP) was around 3% before the second half of the 2010, it recorded a quick increase and ended the year just below 6%. The following year the trend continued and 2011 recorded 9% deficit to GDP. The Central Bank of Turkey which is following and announcing the current account balance periodically took action to curb banks' credit growth which was helping private consumption to increase. Total banking sector loans increased around by 43% in 2010 according to CBT monthly domestic loans data in TL.⁸ These developments were accompanied by an overheating economy and a sharp widening in the current account deficit. Perhaps more importantly, the quality of external finance deteriorated sharply. By the end of 2010, almost all the current account deficit was financed by short-term or portfolio flows, leaving the economy susceptible to sudden reversals in global sentiment (Kara, 2016).

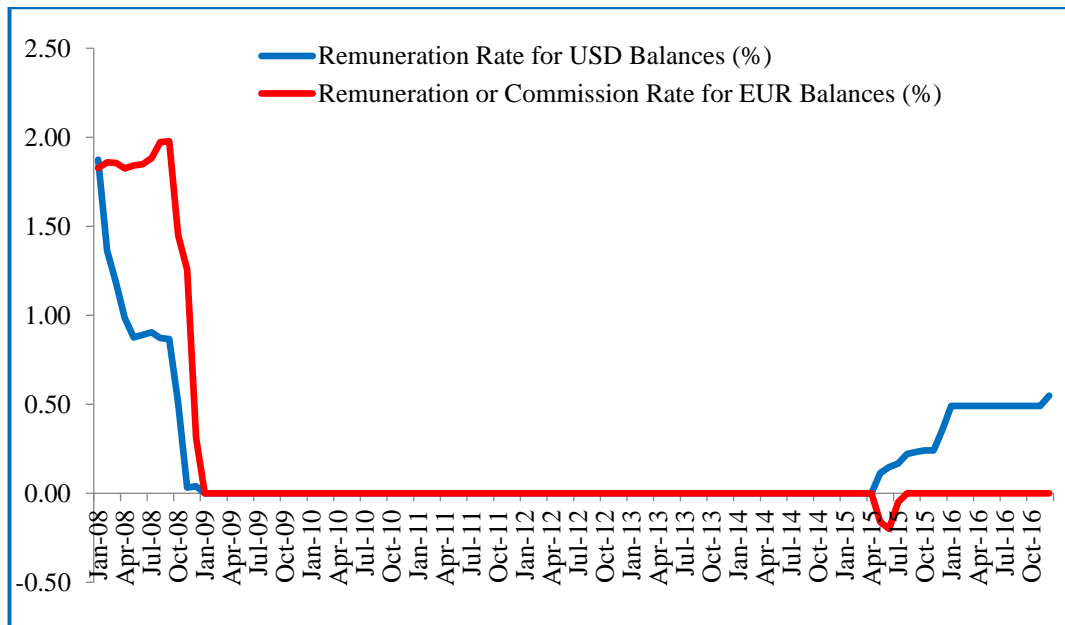
CBT didn't make interest payment for the banks' foreign currency and TL balances held with it until end of 2015 and 2014 respectively. The CBT started to remunerate required reserves of banks and financing companies maintained in Turkish Lira as of November 2014 and gradually raised remuneration rates in 2015 to spur balanced growth and domestic savings. As also stated in the Monetary and Exchange Rate Policy in 2015, the CBT's regulation to remunerate Turkish lira required reserves in a way to encourage core liabilities was put into effect in January 2015. Accordingly, financial institutions whose ratio of deposits and equity to loans are higher than the sector average are remunerated at a higher rate unless they worsen their own situation.

On May 2015, CBT announced that given the changing global and local financial market conditions, USD required reserves, reserve options and free reserves held at

⁸ Central Bank of Turkey announces banking sector total loans balance on monthly basis on its electronic data delivery system (EVDS) which is open to public.

the CBT were started to be remunerated. The remuneration rate is held close to the upper end of the FED funds target rate range. Due to ECB negative interest rate policy, Euro denominated required reserve balances held with CBT became subject to a commission rate between May 2015 and August 2015 as presented in the below Chart 2-1. Moreover, through the arrangements introduced on 30 May 2015, the coverage of liabilities subject to reserve requirements of foreign branches of banks incorporated in Turkey has been broadened. Thus, foreign branches of banks have also been encouraged to borrow longer term.

Chart 2-1: Interest rates paid to FX required and free accounts and commission rates charged on accounts.



Source: Central Bank of Turkey

Overall, we can argue that CBT mainly used the reserve requirements for countercyclical purposes in the past few years both for the Lira and foreign currencies. CBT used reserve requirements in three ways essentially: (i) changing ratios and coverage, (ii) changing remuneration rate paid for reserve held by banks, (iii) implementation of reserve option mechanism. Due to liability maturity differentiation from bank to bank and to implementation of this new mechanism, reserve requirement application became a variable specific to each bank. Given the

dominant role of banks in Turkey in sense of financial intermediation, from a macro point of view, CBT seems as the stabiliser authority and it uses RR with both its cost and liquidity channels.

CHAPTER III

3. TURKISH BANKING SECTOR STRUCTURE AND BANKING LOANS

The banking sector dominates financial intermediation in Turkey. The system had a very crucial crisis in 2001 and afterwards it had a rapid credit growth lasting fifteen years on the back of improved economic fundamentals and easy global liquidity conditions. Since Turkey is still classified as an emerging country, given the challenges facing the industry and the broader economy, Turkish banking sector is operating in a considerably more challenging environment and thus its structure has some fragile aspects which face the sector and its players with sustainability problem. In line with macro economy, the banking sector evolved significantly since the local banking crisis. In this section, we will provide a broad review of banking system together with the bank loans development between 2008 and 2016.

We can review Turkish banks in two periods chronologically following the crisis in 2001 which reshaped the whole system: between 2002 and 2012 and after 2012. Turkey underwent a drastic transformation during 2002–12. The inflation has been brought down to single-digit levels, GDP per capita has increased and fiscal balance has significantly been improved. Accommodative global backdrop also supported Turkey's transformation process. According to Ernst and Young Global Banking and Financial Policy Review 2016, annual FDI inflows averaged around \$10b during the decade, while Turkish banks became popular acquisition targets.⁹

⁹ Ernst and Young Global 2(016), Turkish Banking Sector Overview - Global Banking & Financial Policy Review. on <http://www.ey.com/tr/en/industries/financial-services/turksh-banking-sector-overview-article-page>, accessed May 9th, 2017.

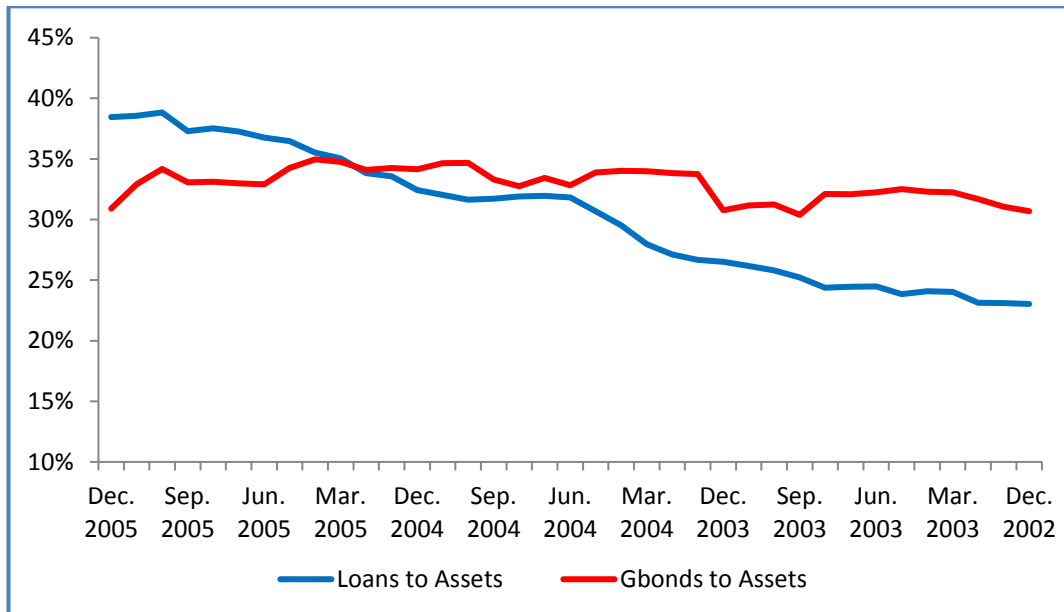
Back in 2002, Turkish banks were operating in a financial environment where crowding out effect of Turkish government bonds dominated financial decisions. Banks were significantly involved in investing their funds into high yielding government bonds because the real return was quite high around 15%. This environment left no real appetite for a proper banking sector. Of the overall assets, according to BRSA data, more than 40% were invested into government bonds and the share of the loans was just 23% at 2002 year end.¹⁰ As it is shown in the Chart 3-1, while loans share in total assets increased since 2002, investment in government bonds stayed almost flat on monthly basis.

Starting in 2003, Turkish banking sector was rebuilt under the close supervision of the BRSA. It was a period when Turkish banks were enjoying return on equity of above 20% and nominal loan growth of above 35% every year¹¹ by 2006, the Turkish banking sector had become an attractive investment opportunity for global players. Many local banks' ownerships changed and global players had an important share in the sector.

¹⁰ BRSA Turkish Banking Sector Interactive Monthly Bulletin published on <http://ebulten.bddk.org.tr/finturk> , accessed on 10/June/2017.

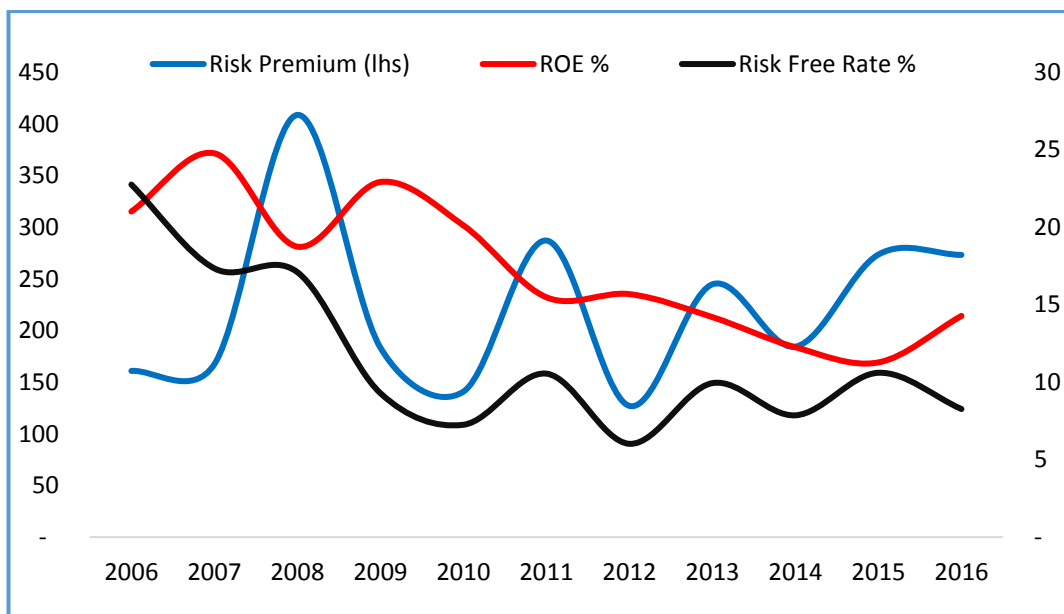
¹¹ Author calculation based on monthly BRSA Data.

Chart 3-1 : Banking Sector Investment Shares Between 2002 and 2005.



Source: Author Calculations Based On BRSA Monthly Statistical Bulletin

Chart 3-2: Turkish Banking Sector Return on Equity vs Cost of Capital

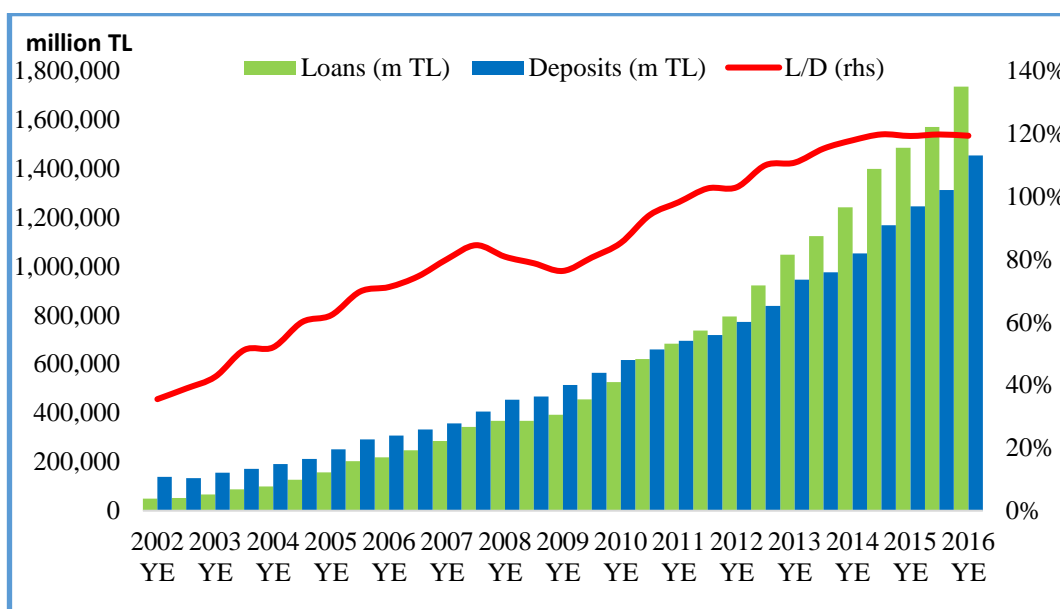


Source: BRSA Reports (RoE Calculation), Bloomberg (5Y CDS and Turkey 2Y Benchmark)

The sector balance sheet's main feature was strong credit growth and mismatch between assets and liabilities regarding tenors. Since the main funding source was deposits, due to macro-economic environment, maturity gap, which is calculated as the difference between liabilities maturity and assets maturity, is negative. Having a negative maturity gap, in that sense, means that liabilities have more repricing cycle than assets. In Turkey, while average deposit tenor is around 41 days¹², average tenor for loans is above 1 year. That position puts banks in a repricing risk which is indirectly pushes loan prices higher. Since there is not enough deposit basis, any increase in reserve requirement has also a negative impact on credit balance growth because of liquidity short fall and higher prices.

During that time, liabilities' structure followed different ways. Turkish banks benefited from quantitative easing policies of big central banks and thus external borrowings increased significantly. When we arrived at 2012, loans to deposits ratio in the sector exceeded the 100% as illustrated in chart 3-3.

Chart 3-3: Turkish Banking Sector Loan, Deposit and Loan to Deposit Ratio



Source: BRSA Turkish Banking Sector Interactive Monthly Bulletins

¹² See Annex 4.s

Increasing loans to deposits ratio is crucial for reserve requirement position as well since it is all about the liquidity and its cost. Rising loans and lower saving levels trigger a hard competition for deposits. As was shown in above Figure 2-2, as long as interest margin on loans are enough to be profitable, banks can compete to get more deposits but in case of sticky loan prices this situation will end up with less profit or slow down credit growth.

Meanwhile, strong growth story in abundant global liquidity environment had some side effects. While the growth number realized as 9%¹³ year on year in 2010 and in 2011, due to consumption driven economy and lack of saving, according to CBT data, current account deficit to gross domestic production ratio reached 8,93% at the last quarter of 2011.¹⁴ According to CBT's own calculations, at that time, each 5% loan growth brings about 2.1% on top of current account deficits (Yılmaz, Durmuş. 2010, p.5).

Since banks have the dominance in local financial markets, prudential measures are generally applied to the banking system (Kara, 2016). Banking sector loans, especially retail loans and credit card business, were put on regulators' target to counterbalance macro-economic outlook. In the presence of overheating economy, CBT took action at the end of 2010 and announced that except interbank repo transaction and repo with central bank, all other repo transactions were included to reserve requirement coverage. Thus, in order to slow bank loans, CBT decided to cut available liquidity in the sector. According to CBT communique dated on 17/12/2010 (Number 2010-68), that step decreased market liquidity by TRY 7.6 billion and USD 200 million.

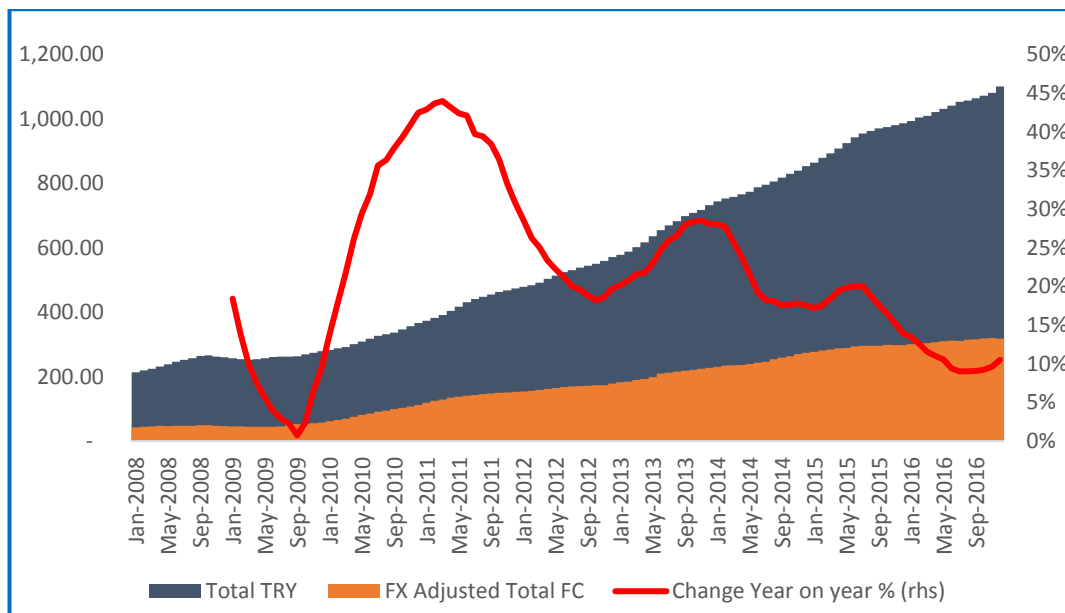
¹³ Turk stat changed the calculation methodology for GDP figures in accordance with the guidelines of the National Accounts System (SNA-2008) and the European Accounting System (ESA-2010). Therefore, growth figures which had previously been expressed at constant prices now started to be calculated according to the chain-linked volume index (2009=100). Growth by 9% in 2011 is with the new chain linked data.

¹⁴ <http://www.tcmb.gov.tr/wps/wcm/connect/TCMB+EN/TCMB+EN/Main+Menu/MONETARY+POLICY/Interactive+Charts/Current+Account+Balance> accessed 26 June 2017.

The Chart 3-4 presents loan balances' development as monthly averages and year on year changes starting from 2009. Due to high capital inflow, banking credit balances had growth number up to 45% in 2010 and 2011. But afterwards, CBT's measures to control the sector via liquidity and cost channels brought about lower credit growth trend.

We can argue that regulators, including CBT and BRSA, used reserve requirement application very actively to control and orient the financial intermediation to counterbalance the macro economic outlook. The CBT has introduced the interest rate corridor, the reserve requirement and the reserve option mechanism so as to loosen credit growth and credit volatility (Başçı and Kara 2011). Although banks adapted to these changes, each reserve application change had an echo on banks' balance sheets in the form of return and liquidity constraints.

Chart 3-4: Banking Sector Loan Balances (Non-Financial Sector Loans / Monthly In TL)



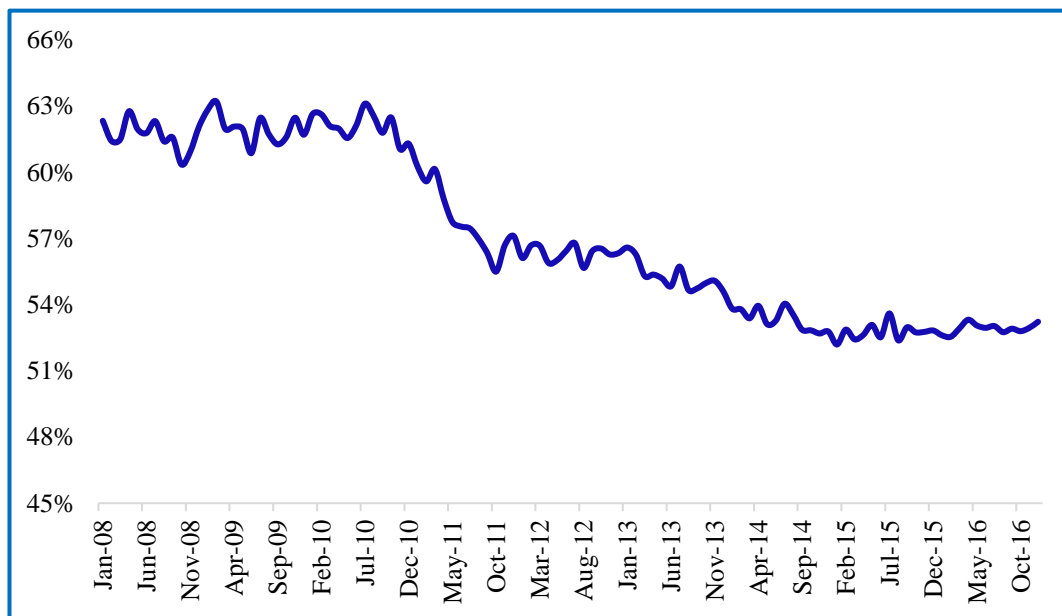
Source: CBT, Author Calculation.

As illustrated in chart 3-5, deposits are the core liability for the sector which refers a sustainable source for assets. Other sources for assets' funding are, payables to

banks, funds from repo transactions, securities issued, payables to the central bank and payables to the money market.

The chart 3.5 shows also that increase in deposits is not as much as in balance sheet growth. Due to lower deposit increases, banking sector has been pushed to have a diversified funding structure which put itself in a more volatile and costly environment. As it is shown in the above chart 3-3, Turkish banking sector loan to deposit ratio has a significantly increasing trend just after the global crisis impact in 2008. That picture presents that the main source of the credit growth in Turkey depended on non-core liabilities such as security issues or interbank borrowings. In the context of RR, banking sector feels RR's power in sense of liquidity constraint also its cost and react accordingly.

Chart 3-5: Deposits Share In Total Liabilities Between 2008 And 2016.



Source: Author's Calculation based on BRSA monthly Data.

CHAPTER IV

4. DATA AND MODEL

In this section, the response of loan balances is investigated in face of changes in reserve requirement changes, in policy rates and in industrial production index which is considered as a good indicator for economic activity. In the first sub section, these variables are studied in time series and the second sub section consists of event analysis and vector auto regression (VAR) model in order to analyze the interactions between these variables.

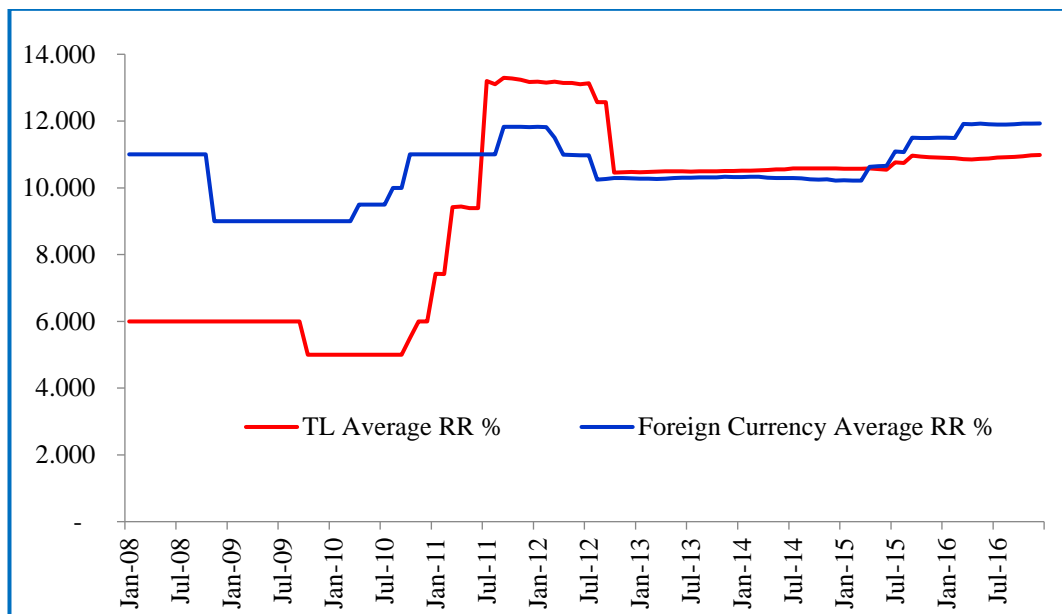
4.1: Reserve Requirements Series

In this research, reserve requirements data are taken into consideration in different formats. First, the impact of the reserve requirement ratios on bank loans is analyzed based on average ratios announced by CBT on weekly basis. Weekly data has been transformed to monthly basis by averaging four week data. As shown below chart 4-1, after the first reaction to the global financial crisis, both Turkish Lira and foreign currency average reserve ratios were increased significantly. Although foreign currency reserve ratios were higher than Turkish Lira, due to reserve option mechanism, its average stayed between 9% and 12%. The reserve option mechanism effect was explained shortly in previous section. Besides, marginal RR ratios will be included as a variable in VAR model in order to investigate if it is significant for banks to have RR changes marginally or not. During event analysis, only marginal reserve

requirement ratios will be utilised since the aim was to monitor if there is an immediate reaction or not.

Secondly, in order to have a consistent reserve requirement data set and to take policy changes in consideration, cost effective reserve requirement ratios have been calculated by slightly developing the model used by Alper et al. (2014) in their study. This will help to reflect the real impact of reserve ratio changes since there are several changes in ratios and remuneration rates for the analysis period. As Alper et al. (2014) indicated in their article, to indicate all these change into one consistent variable; it is needed to use one single metric.

Chart 4-1: Average Reserve Requirement Ratios



Source: Based on data of Central Bank of Turkey

The model used in the article mentioned above is based on conversion of reserve requirement to a cost based reserve requirement ratio. It is about the cost of funding for required reserve which depends on how its cost is constructed. According to this model developed by Alper et al. (2014), if there isn't a remuneration rate for the amount paid by central bank held for reserve then its funding cost is assumed to be equal to market rate which is assumed to

be proxied by the deposit rate (i_d). If central bank pays interest (i_{rr}) then the cost of funding is assumed to be proportional to $i_d - i_{rr}$. Therefore, the cost-effective reserve requirement (RR^C) can be calculated approximately by scaling RR as shown in equation (14).

$$RR^C = RR \times (i_d - i_{rr})/i_d \quad (14)$$

In this study, we tried to fine tune this model by including the tenor into the equations. Because, we argue that without the tenor impact the calculation cannot be adequate since cost of funds differs significantly in different tenors.

First, we have calculated funding cost amount and remuneration amount by applying average deposit maturity (D_{ave}) in the markets. Also, since the day count convention¹⁵ is different for deposit and central bank payments, we have applied correct day count conventions: for cost of funding proxied by deposit rates it has been used 365 and 360 for central bank interest rate. Then the equation was transformed as below:

$$(RR^C) \approx RR \frac{\left[\frac{A \times RR \times i_d \times DtM_{ave}}{365} - \frac{A \times RR \times i_{rr} \times DtM_{ave}}{360} \right]}{\left[\frac{A \times RR \times i_d \times DtM_{ave}}{365} \right]} \quad (15)$$

In equation (15), A refers to a symbolic deposit amount and RR to average reserve requirement ratio over liabilities in scope. In order to simplify the equation, central bank remuneration rate (i_{rr}) has been converted side to 365-day count with the following formulas: $i_{rr} \times 365/360$.

Firstly, Turkish banking sector average deposit tenor was calculated based on the CBT monthly money and banking statistic data set on electronic data

¹⁵ In finance, day count convention is the system to determine how interest accrues the investment period.

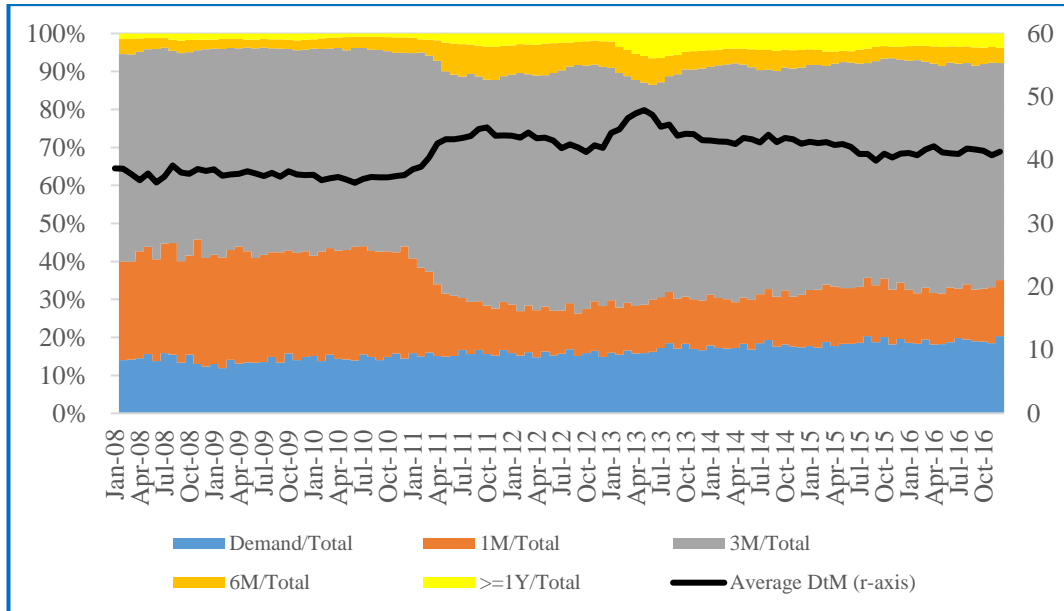
delivery system.¹⁶ Since the data set is arranged for general time bucket such as 1 month, 3 months, 6 months and 1 year and not on daily basis, to calculate average day to maturity, we have applied mid-point of each maturity breakdown as the effective tenor. As it is shown below chart 4-2, between 2008 and 2016, up to 3 month deposit balances consist averagely 58% of the total deposit balances. Starting from market practice in local market, although it seems up to 3 month time bucket, the effective maturity is up to 45 days. This is also supporting our assumption to apply mid-point of each bucket as effective days to maturity. But, again, as we know from market practice that, banks are not paying competitive interest rates for shorter than 30 days deposit, we preferred to keep demand deposit and 1 month deposit days to maturity unchanged as 1 day and 30 days respectively. Table 4-1 presents our tenor assumption and weighted average deposit tenor acceptance which is 41 days.

Table 4-1: Days to Maturity Breakdown for Deposits.

Tenor	Assumed Original DtM	Effective DtM	Balance (in b. TRY)
Demand Deposit	1	1	156
up to 1 month	30	30	118
up to 3 month	90	45	451
up to 6 month	180	90	31
1 Year and Above	365	183	32
Weighted Average DtM		41	788

¹⁶ Data were extracted from CBT Electronic Data Delivery System (EVDS) on its website.

Chart 4-2 : Banking Sector Maturity Breakdown (Monthly %) And Weighted Average Days to Maturity

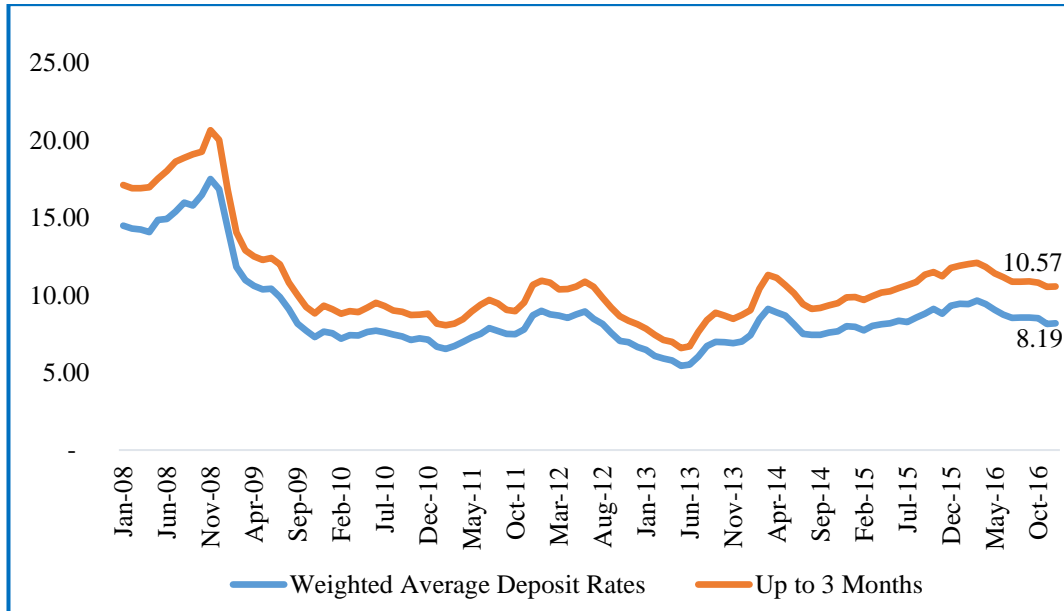


Source: CBT EVDS.

Second, in line with weighted average days to maturity calibration, average cost of marginal funding increase has been calibrated based on CBT data. Since deposit balances are heavily concentrated in up to 3 month maturity breakdown, average deposit rate up to 3 months announced by central bank has been taken into account. Different from developed markets practices, demand deposit balances are not remunerated generally in Turkish banking sector. When we integrate demand deposit balances with zero interest rate, weighted average cost of deposit decreases significantly. For example, as presented in chart 4-3, while 3 month deposit rates were at 10.57% on average at 2016 year end, weighted average rate became 8.19%.

During cost effective reserve requirement ratio calculation, we have used simple average cost for 3 month maturity breakdown since in case of a funding rise need, banks must pay in a competitive environment to attract the money. Thus, as marginal deposit cost, we have applied average 3 month deposit rate.

Chart 4-3: 3 Month Average Deposit Rates vs Weighted Average Deposit Rates (%) Between 2008 and 2016



Source: CBT and Author Calculation

For example, as of 2016 year end, reserve requirement ratio for TRY was 10.50% for the maturity tenor up to 3 month which is the breakdown where deposits concentrated, the competitive market deposit rate for a new deposit for the same period was on average 14.00% and central bank remuneration rate for reserve balances held with it was averagely 4.28% ¹⁷ for the banks which has high loans to deposit ratio and the deposits’ weighted average days to maturity was 41.3 day. Then, if we put these variable into above equation by consideration amount as 1 symbolically;

$$(RR^c) \approx 10.50 \left[\frac{1 \times 10.50\% \times 14.00\% \times 41.3}{365} - \frac{1 * 10.50\% \times 4.34\%^{18} \times 41.3}{365} \right] \quad (16)$$

$$(RR^c) \approx 7.25\%$$

¹⁷ Look Annex 3

¹⁸ CBT average remuneration rate 4.28% converted to Act/365 day count basis with the formula stated before.

The cos-effective reserve requirement ratio became 7.25% and this is well below the official reserve requirement ratio. That calculation helps to follow the impact of reserve ratio change within the cost channel.

The equation 16 helps to calculate a cost effective reserve ratio for common reserve maintenance but due to reserve option mechanism introduced by CBT since the last quarter of 2011, equation has to be modified further to take it into account following Alper et al. (2014) methodology. As explained above, banks may prefer to hold a certain part of their Turkish Lira required reserve in US Dollars and/or gold. Under ROM, bank can prefer to hold some part of its reserve in foreign currency which will be subtracted the total TL denominated reserve balance with a coefficient. CBT applies a coefficient called reserve option coefficient (ROC). It differs according to tranches presented in table 5 below and we have applied weighted average ROC for calculations. The weighted coefficients were calculated by weighting each tranche marginal increase by its coefficients.

Table 4-2: Reserve Option Mechanism And Reserve Option Coefficient

FX ROM Tranches and ROC			Gold ROM Tranches and ROC		
Tranches	Coefficient	Weighted Coefficient	Tranches	Coefficient	Weighted Coefficient
0-30	1.0	1.0	0-15	1.6	1.6
30-35	1.4	1.1	15-20	1.7	1.6
35-40	1.7	1.1	20-25	2.1	1.7
40-45	2.1	1.2	25-30	2.5	1.9
45-50	2.5	1.4			
50-55	2.9	1.5			
55-56	3.7	1.5			
56-57	3.9	1.6			
57-58	4.1	1.6			
58-59	4.3	1.7			
59-60	4.5	1.7			

Source: CBT and Author Own Calculation

We followed the methodology applied by Alper et al. (2014) to calculate ROM impact. Therefore, reserve requirement cost for TL can be expressed as a linear combination of common funding cost and foreign exchange borrowing cost (i_{fx}) and gold borrowing cost. For simplicity, we also accepted that the gold borrowing cost is equal to FX borrowing cost.

Following mentioned methodology, in this case, the cost of reserve held within ROM is be calculated as:

$$Z \times i_d + (1 - Z) \times ROC \times i_{fx}^{19} \quad (17)$$

In the equation, Z refers to the percentage held as TL and $(1-Z)$ refers to percentage held in foreign currency. Alper et al. (2014) scales cost based reserve requirement by

$$[Z \times i_d + (1 - Z) \times ROC \times i_{fx}] / i_d \quad (18)$$

to have cost effective reserve ratio under ROM period. Then, equation (16) transforms to

$$(RR^c) \quad (19)$$

$$\approx RR \times \frac{\left[\frac{A \times RR \times i_d \times DtM_{ave}}{365} - \frac{A \times RR \times i_{rr} \times DtM_{ave}}{360} \right]}{\left[\frac{A \times RR \times i_d \times DtM_{ave}}{365} \right]} \times [Z \times i_d + (1 - Z) \times ROC \times i_{dfx}] / i_d$$

¹⁹ Please look Alper et al. (2014) for details.

ROM is included thus since September 2011 in order to have cost effective reserve requirement ratio since.²⁰ For example, in September 2011 when the ROM was first implemented, average RR ratio was 13.12% for TL and central bank was not paying interest for the reserve balances. ROM utilisation ratio became for that month averagely 10.8% while the maximum facility was 10% and the coefficient was 1. According to CBT data, average deposit rate for TL was 7.5% and again average deposit tenor is assumed as 41.3 days. The average deposit rate for USD is taken as 3.74%. If we put these details in equation (17);

$$(RR^c) \tag{20}$$

$$\approx 13.12 \times \frac{\left[\frac{1 \times 13.12\% \times 7.5\% \times 41.3}{365} - \frac{1 \times 13.12\% \times 0 \times 41.3}{365} \right]}{\left[\frac{1 \times 13.12\% \times 7.5\% \times 41.3}{365} \right]}$$

$$\times [89.2\% \times 7.5\% + (1 - 89.2\%) \times 1 \times 3.74\%] / 7.5\%$$

$$(RR^c) \approx 12.41$$

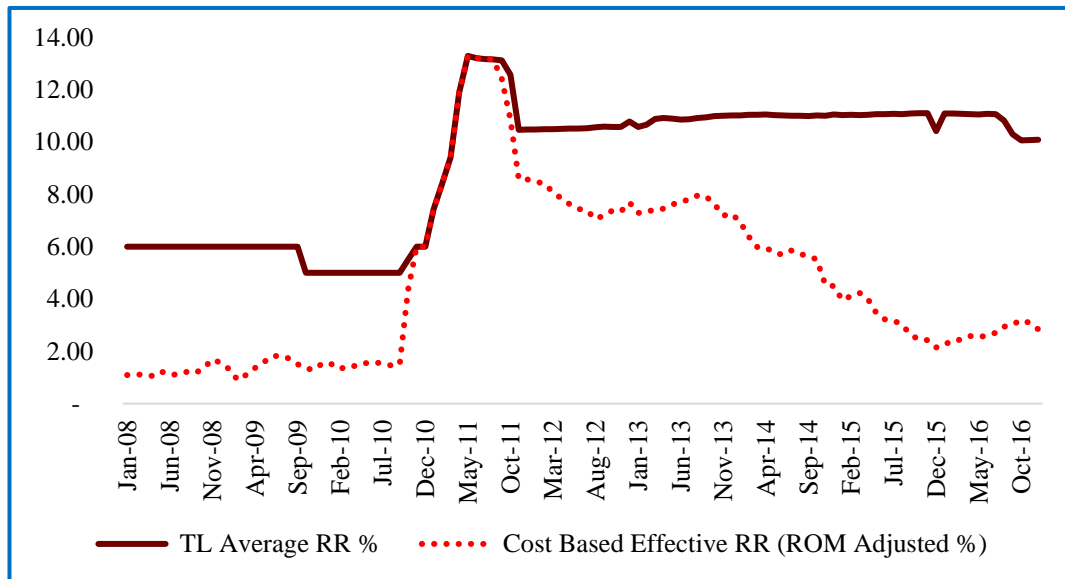
We have that cost effective reserve requirement ratio decrease to 12.41% from average 13.12%. In order to reflect the real cost of reserve requirement approximatively, we produced a monthly time series accordingly for the period January 2008 – December 2016.²¹ As shown in below chart 4-4, introducing reserve option mechanism lowered intermediation cost of reserve requirement. Central Bank of Turkey paid interest on reserves until October 2010, that's why based reserve ratio cost is lower than official average reserve ratio, but it became equal until September 2011 during the period central bank didn't pay interest. ROM brought about lower reserve requirement cost since deposit cost of foreign currency held for TL reserve was much lower than TL deposit rates. CBT's remuneration impact may be followed more significantly in foreign

²⁰ Please look Annex 1.

²¹ See Annex 1

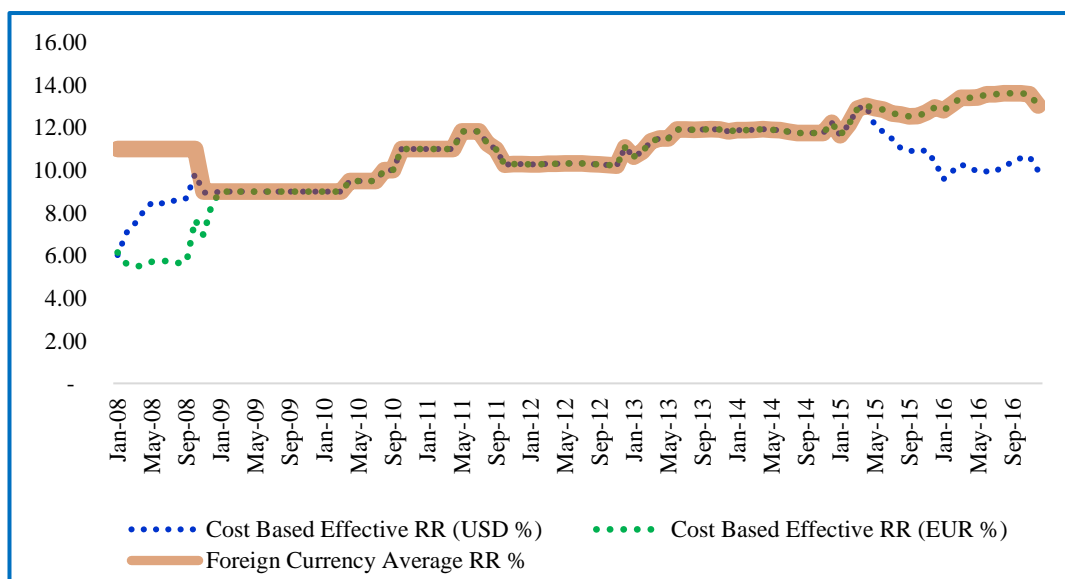
currency reserve requirement ratios presented in chart 4-5. If central bank does not pay interest for reserve balances than the cost of reserves becomes equal to official reserve ratio.

Chart 4-4: Average RR And Cost-Based Effective RR For TL Liabilities



Source: CBT And Author Calculations

Chart 4-5 : Cost Effective Foreign Currency Reserve Requirement Ratio



Source: CBT And Author Calculations

4.2: Bank Loans Data

Turkish banking sector loans are generally classified under consumer loans (including credit cards), corporate loans and small and medium size enterprise (SME) loans. According to BRSA December 2016 data, corporate loans constitute 52% of total loan balance while the rest is constituted by SME and consumer loans equally. For the same period, 65% of the total balance is in TL denominated loans.

Interest rate sensitivity is the main point to examine loans developments. To some extent, while corporate loans are less sensitive to interest rate changes, other loan items' sensitivity is higher. If interest rates increase, consumer loans slow since it is possible to delay some consumption. But corporate loans behavior shows that there is not always a linear reaction there because banks don't reflect rate hikes to corporate due to relationships or corporates can't stop their businesses suddenly. While consumer loans have longer maturity mainly due to mortgage loans, commercial loans have shorter tenor around 1 year.

Implementation of loans data in Turkish lira and in foreign currency has been done separately since reserve requirement ratio differ by currency. In order to clean the noise in the behavior of loan rates we used monthly averages which is also a general methodology in the literature. In order to adjust FX rates impact, we have divided foreign currency loan balances (which are TL equivalent) by TL FX basket rate weighted by 65% USDTRY FX rate and by 35% EURTRY FX rate which is in line with foreign currency loans distribution. Then, to convert in Turkish Lira, that balance has been multiplied by period (from Jan. 2008 to Dec. 2016) average basket rate which is 2.1284.²²

²² See Annex 5 for FX Adjusted Loan Balance Time Series

4.3: Short Term Interest Rates and Economic Activity

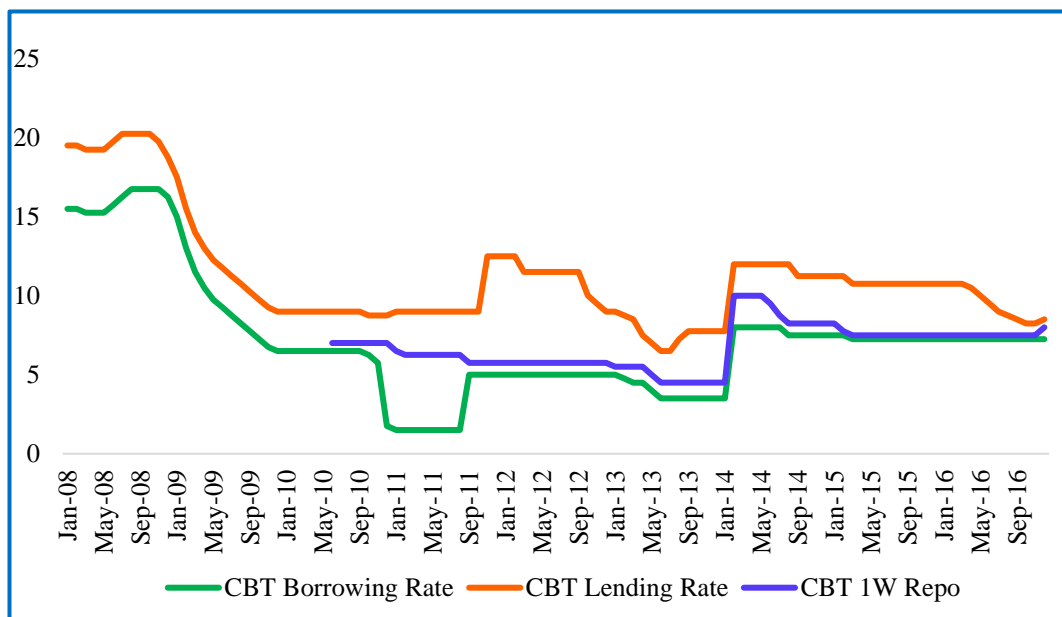
The two other variables for our analysis are interest rates and economic activity index. The interest for these variables is to understand if the loans balances' movement is due to macro-economic developments and/or interest rates level but not reserve requirement ratios.

The ultimate goal of CBT is to maintain price stability. The most influential economics tool is the control on short term interest rates by decreasing or increasing it. Central Bank rate decisions directly affect macroeconomic structures and player preferences, such as production and consumption. The central bank policy rate is also its target rate and it arranges the liquidity in the market to maintain its rate target. So, as Di Giorgio (1999) argues, short term interest rates and reserve requirements are two standard operating targets for monetary policies. Since credit market is very competitive, in case of a rate change, it may be very costly for the bank to adjust the loan rate. Following an interest rate shock, if a bank cannot adjust its loan rates then the adjustment is made through the quantity of loans in line with the market demand. For example, if interest rates are increased, then funding cost is increased via higher deposit rates which increases cost of funding for reserve requirement as well and loans rate must be adjusted accordingly. Rising loans prices limits loan demand and then loan growth will be limited.

CBT has been implementing an interest rate corridor since 2010 in order to maintain financial stability and control the volatility caused by global capital flows. Unlike conventional corridor frameworks, CBT's framework is asymmetric which means that policy rate is not always the mid-rate of the corridor. Before interest rate corridor, overnight borrowing rate was central bank official policy rate and as it is shown in chart 4-6, it became one week repo rate after 2010 which moved between lower band (borrowing rate) and upper band (lending rate) of the corridor till 2016 end. We have implemented

to model CBT's overnight borrowing rates till 2010 and weekly repo rates for following dates.²³

Chart 4-6 : Central Bank Of Turkey Borrowing And Lending Rates



Source: CBT

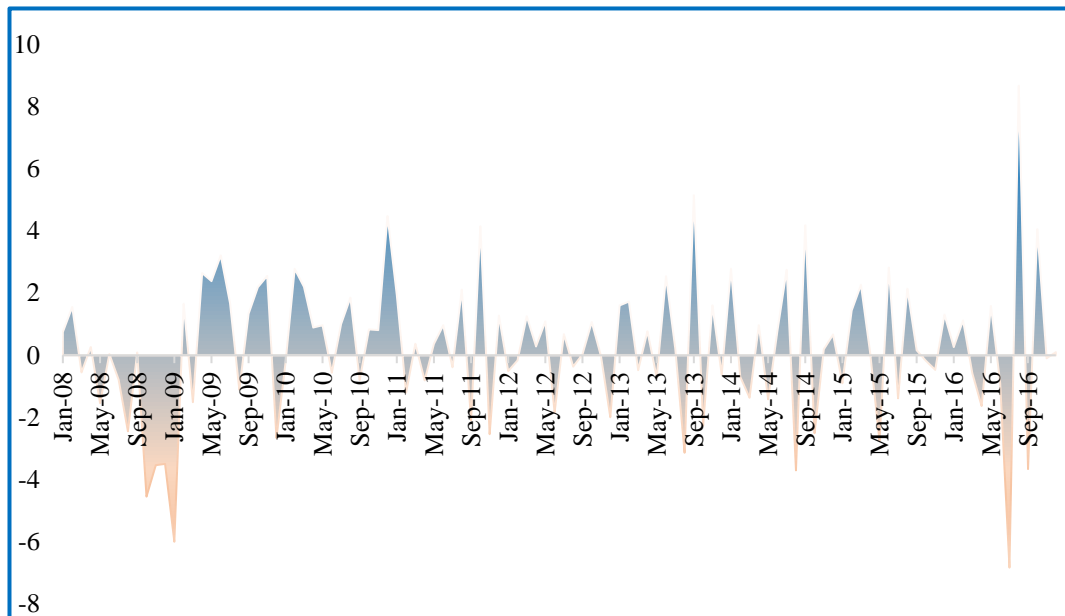
The other component of the analysis is the economic activity which will help us to understand the underlying reason of bank loans development. We will try to understand that whether developments in loan balances are in line with macro-economic environment because for example during a supportive macro economical period we expect a growth trend in bank loans.

To measure economic activity, season adjusted monthly industrial production index data published by Turkish Statistical Institute has been utilised. Industrial production measures the output of industrial establishments in the main industries like manufacturing, mining and public utilities. As it can be seen in below Chart 4-7s, industrial production data has a quite high volatility

²³ See Annex 1 for CBT Benchmark Rate

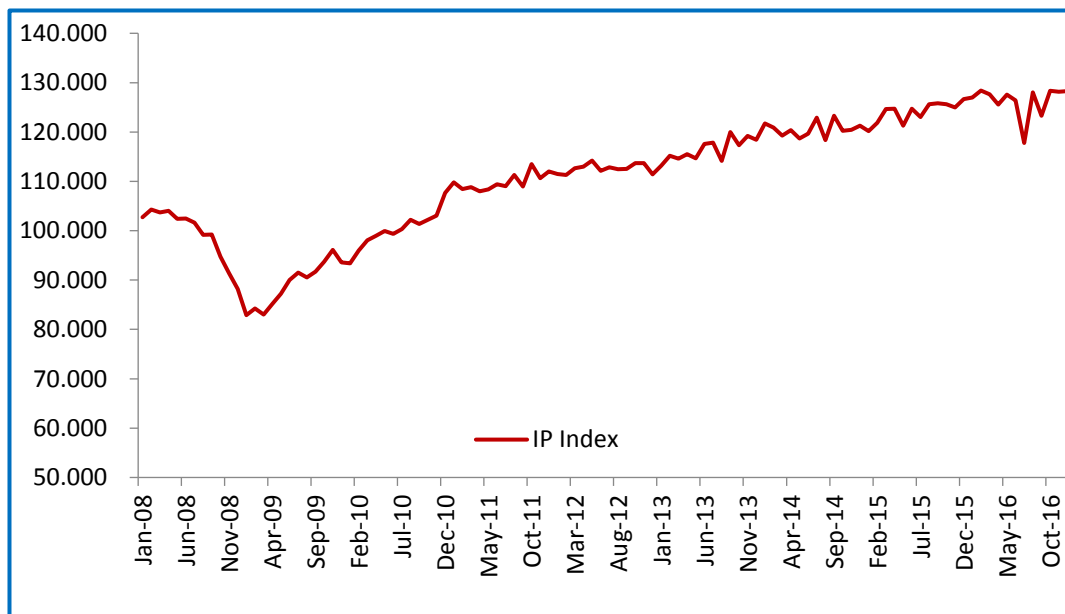
and that is why we preferred to use index data illustrated in chart 4-8 than change data.

Chart 4-7 : Turkey Industrial Production Monthly Change



Source: Bloomberg

Chart 4-8 : Turkey Industrial Production Index



Source: TÜİK

4.4: Event Analysis

In this section, we will try to display the relationship between bank loans growth and other macro variables such as reserve requirement ratio changes, interest rates change and economic activity index changes. The scope of impacts is limited with six months before and six months after the time of changes.

We have implemented marginal reserve requirement ratios to see if it changes banks' behaviors. For interest rates basis, we have considered CBT's policy rate for TL and a basket rate weighted by 1 year USD Libor and Euribor. Since the foreign currency loans composition includes 65% USD and 35% EUR and others, we have weighted monthly Libor and Euribor curves with the same percentages and then convert them in USD with the valid EURUSD FX rates.²⁴

In May 2011, TL reserve requirement ratio for 3 month tenor was increased by 400bps and 100bps for up to 3 month foreign currency deposits in September 2011. Our findings indicate that reserve requirement ratio increase has a negative impact on loan balances which is both visible for Turkish Lira denominated loans as presented in chart 4-9 and for FX loans in chart 4-10, where time 0 shows the shock date. While the downward trend in TL loans starts within next 2 months, it starts immediately in foreign currency loans.

In terms of foreign currency interest rates change results show (in Chart 4-11), when 50bps increase broke downward trend in Libor rates at the end of 2009, starting from second month following the increase, FX loan balance growth had significant decline. For TL loans, in chart 4-12, when CBT increased interest rates to contain devaluation in TL against USD in January 2014, the flat trend

²⁴ See Annex 2 for the time serie.

in TL loans growth begins to decrease about for 6 months before being stabilised again.

Chart 4-9 : Response Of Bank Loans In TRY To Reserve Requirement Change

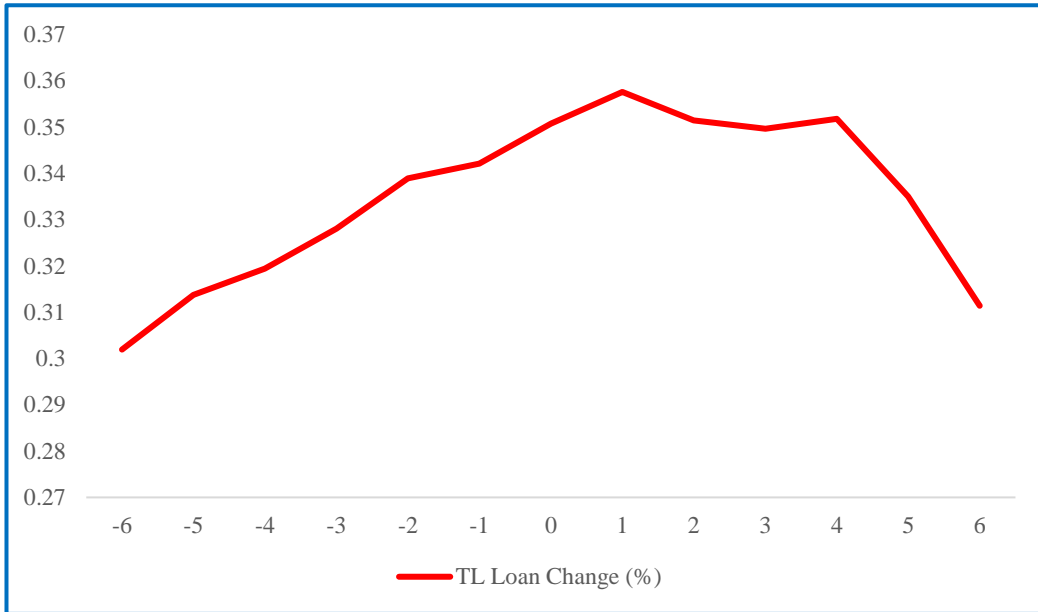


Chart 4-10 : Response Of Bank Loans In FX To Reserve Requirement Change

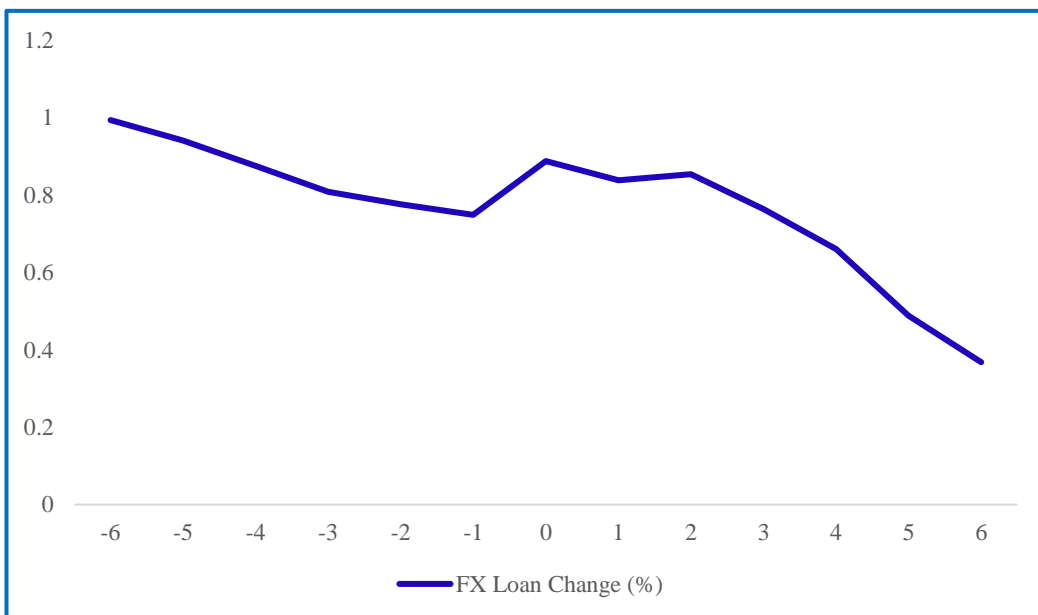


Chart 4-11 : Response Of Bank Loans In Fx To Fx Interest Rates Changes

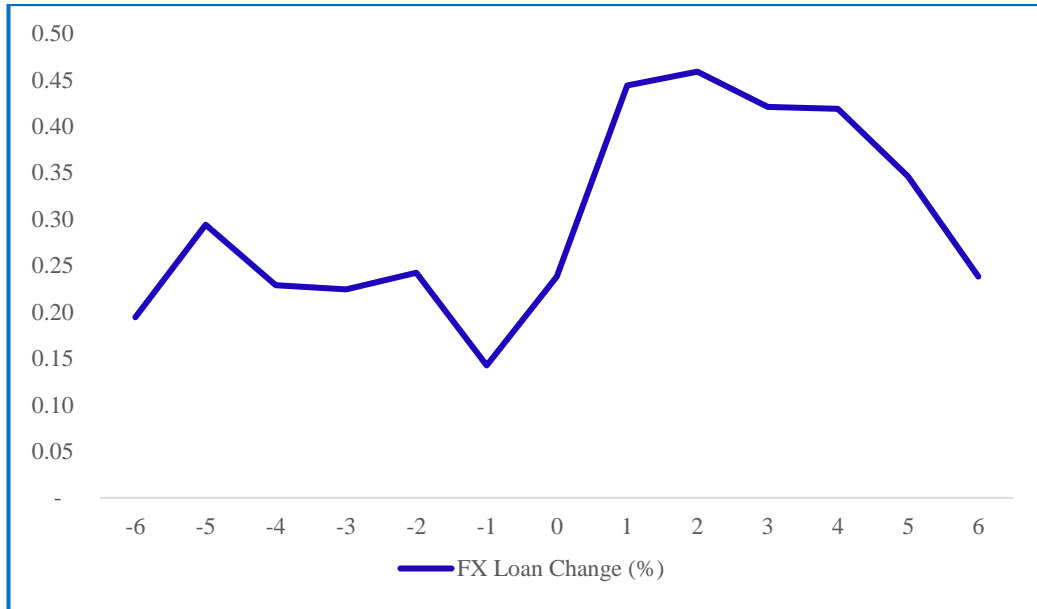


Chart 4-12 : Response Of TRY Bank Loans To TRY Rates Changes

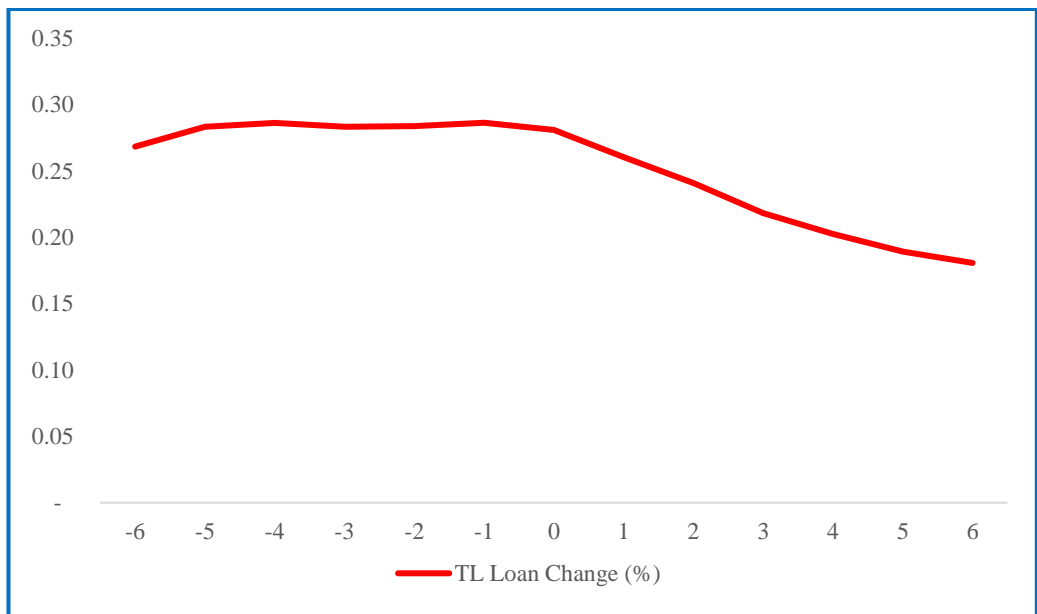
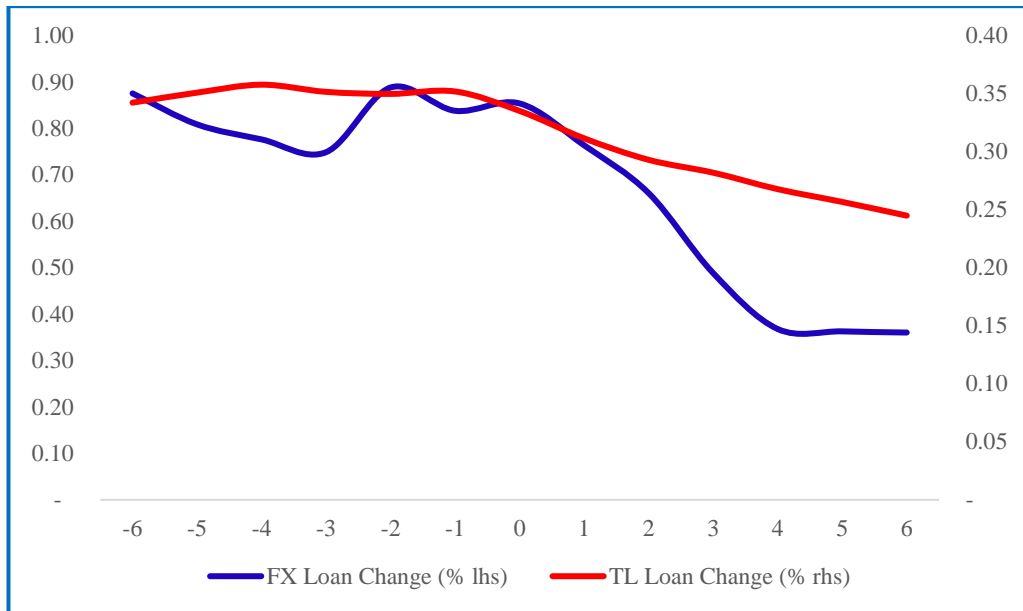


Chart 4-13 : Response Of Bank Loans To Industrial Production Change



As explained before, to measure economic activity, industrial production index monthly number was implemented into the analysis. According to event analysis example presented below chart 4-13, a strong production data as happened in October 2011 (by 7.5% mom increase) does not bring an increase in bank loans.

As result of event analysis, although example events suggest that reserve requirement increases, and interest rate base increases have significant negative impact on bank loans' growth, this can also be due to the conjuncture as well. Therefore, above analysis is not enough to indicate effect of reserve requirements application over bank loans development. It is needed to analyse these variables together, therefore, in the next section, the relationship between bank loans and reserve requirement ratios will be explored further.

4.5: Vector Auto Regression

In this section, vector auto regression (VAR) model is considered to investigate the role of reserve requirements played on bank loans growth. VAR models in economics were made popular by Sims (1980). The VAR is very strong to model multivariate time series. These models are used generally to analyse dynamic economic data structurally. According to Chris Brooks, in his book *Introductory Econometrics for Finance*, “a VAR is a systems regression model that can be considered a kind of hybrid between the univariate time series models and the simultaneous equations models.” (Brooks, 2014, p.290). In a VAR model, all variables are treated symmetrically. They are all modelled as if they influence each other equally. The utilization area of VAR is to reveal interactions between variables rather than identifying politics (Sevüktekin and Çınar, 2014).

Then, it is one where the current value of a variable, y , depends upon its values and on other variables' values that the variables took in previous periods plus an error term. The structure is that each variable is a linear function of past lags of itself and past lags of the other variables. VAR model treats all variables in the system as endogenous. According to an article in *Wikipedia*, a VAR model describes the evolution of a set of k variables (endogenous variables) over the same sample period ($t = 1, \dots, T$) as a linear function of only their past evolution. The variables are collected in a $n \times 1$ vector y_t , which has as the i th element $y_{i,t}$ the time t observation of variable y_i .²⁵ For example, if the i th variable is reserve requirement ratio, then $y_{i,t}$ is the value of reserve requirement ratio at t .

²⁵ Vector Autoregression. (n.d). In *Wikipedia*. Retrieved May 20, 2017, from https://en.wikipedia.org/wiki/Vector_autoregression

The system could also be expanded to include n variables, $y_{1t}, y_{2t}, y_{3t} \dots y_{nt}$, each of which has an equation. A basic p -lag vector autoregressive model has the form

$$y_t = c_t + \Phi_1 y_{t-1} + \Phi_2 y_{t-2} + \dots + \Phi_p y_{t-p} + e_t \quad (21)$$

$$t = 1, \dots, T$$

where c is a $(n \times 1)$ vector of constants (intercepts), Φ_i is a time-invariant $(n \times n)$ matrix of coefficients (for every $i=1 \dots p$) and e_t is a $(n \times 1)$ vector of error terms, a white noise disturbance term with $E(e_t) = 0$, $(i = 1, 2), E(e_t) = 0$.

On the assumption that the process has been initiated in the infinite past it generates stationary time series that have time-invariant means, variances, and covariance.

4.6: Applying the Model

We consider a simple extension of the model developed in Tovar et al. (2012). In order to explore the role of reserve requirement changes on bank loan balances, account CBT policy interest rate and level of economic activity will also be taken into account. Therefore, there will be four variables considered as in relations with each other: Reserve requirements, bank loans, policy interest rate and economic activity index. Policy rate, credit growth data and economic activity index which is materialised as industrial production index are considered on monthly basis. While we first consider reserve requirements as average data, then marginal reserve requirements is considered as well as cost effective reserve requirements that we have calculated in previous section. Then, in our analysis, the system $y_{t,i}$ is first a four variable vector which will be extended to six variables and it considers a second order VAR model for foreign currency loans and third order VAR model for TL denominated loans.

Since this analysis needs to use a software tool to calculate and solve, the system in equation (21) is estimated by using Eviews Student Version Lite to investigate the VAR model. Its results are analysed using impulse responses. Cholesky decomposition is also used to identify the impulse response results. The most exogenous variable seems as average reserve requirement ratios which are followed by official interest rate base, cost base reserve requirement ratio and finally economic activity index (industrial production). Nevertheless, the results do not change meaningfully under alternative orderings.

The lag order selection is done according to Eviews estimations which showed two as the best lag order level for FX loans and three for TL loans.²⁶ So, we have two similar models; one is second order and the other one is third order VAR model.

$$y_{t,i} \equiv \begin{bmatrix} \text{Reserve Requirements} \\ \text{Policy Interest Rates} \\ \text{Level of Economic Activity} \\ \text{Bank Loans Growth} \end{bmatrix}$$

We can formulate above equations for these four variables with two lag order as following;

$$\begin{aligned} y_{t,1} = c_1 + \phi_{1,1}y_{t-1,1} + \phi_{1,2}y_{t-1,2} + \phi_{1,3}y_{t-1,3} & \quad (22) \\ + \phi_{1,4}y_{t-1,4} + \phi_{1,1}y_{t-2,1} + \phi_{1,2}y_{t-2,2} & \\ + \phi_{1,3}y_{t-2,3} + \phi_{1,4}y_{t-2,4} + e_{t,1} & \end{aligned}$$

and with 3 lag order as following;

²⁶ See Annex 6.

$$\begin{aligned}
y_{t,1} = & c_1 + \Phi_{1,1}y_{t-1,1} + \Phi_{1,2}y_{t-1,2} + \Phi_{1,3}y_{t-1,3} \\
& + \Phi_{1,4}y_{t-1,4} + \Phi_{1,1}y_{t-2,1} + \Phi_{1,2}y_{t-2,2} \\
& + \Phi_{1,3}y_{t-2,3} + \Phi_{1,4}y_{t-2,4} + \Phi_{1,1}y_{t-3,1} \\
& + \Phi_{1,2}y_{t-3,2} + \Phi_{1,3}y_{t-3,3} + \Phi_{1,4}y_{t-3,4} \\
& + e_{t,1}
\end{aligned} \tag{23}$$

Where $y_{t,i}$ stands for average reserve requirements ratios,

$$\begin{aligned}
y_{t,2} = & c_2 + \Phi_{2,1}y_{t-1,1} + \Phi_{2,2}y_{t-1,2} + \Phi_{2,3}y_{t-1,3} \\
& + \Phi_{2,4}y_{t-1,4} + \Phi_{2,1}y_{t-2,1} + \Phi_{2,2}y_{t-2,2} \\
& + \Phi_{2,3}y_{t-2,3} + \Phi_{2,4}y_{t-2,4} + e_{t,2}
\end{aligned} \tag{24}$$

and with 3 lag order as following;

$$\begin{aligned}
y_{t,2} = & c_2 + \Phi_{2,1}y_{t-1,1} + \Phi_{2,2}y_{t-1,2} + \Phi_{2,3}y_{t-1,3} \\
& + \Phi_{2,4}y_{t-1,4} + \Phi_{2,1}y_{t-2,1} + \Phi_{2,2}y_{t-2,2} \\
& + \Phi_{2,3}y_{t-2,3} + \Phi_{2,4}y_{t-2,4} + \Phi_{2,1}y_{t-3,1} \\
& + \Phi_{2,2}y_{t-3,2} + \Phi_{2,3}y_{t-3,3} + \Phi_{2,4}y_{t-3,4} \\
& + e_{t,2}
\end{aligned} \tag{25}$$

Where $y_{t,2}$ stands for policy interest rates,

$$\begin{aligned}
y_{t,3} = & c_3 + \Phi_{3,1}y_{t-1,1} + \Phi_{3,2}y_{t-1,2} + \Phi_{3,3}y_{t-1,3} \\
& + \Phi_{3,4}y_{t-1,4} + \Phi_{3,1}y_{t-2,1} + \Phi_{3,2}y_{t-2,2} \\
& + \Phi_{3,3}y_{t-2,3} + \Phi_{3,4}y_{t-2,4} + e_{t,3}
\end{aligned} \tag{26}$$

and with 3 lag order as following;

$$\begin{aligned}
y_{t,3} = c_3 + \Phi_{3,1}y_{t-1,1} + \Phi_{3,2}y_{t-1,2} + \Phi_{3,3}y_{t-1,3} & \quad (27) \\
+ \Phi_{3,4}y_{t-1,4} + \Phi_{3,1}y_{t-2,1} + \Phi_{3,2}y_{t-2,2} \\
+ \Phi_{3,3}y_{t-2,3} + \Phi_{3,4}y_{t-2,4} + \Phi_{3,1}y_{t-3,1} \\
+ \Phi_{3,2}y_{t-3,2} + \Phi_{3,3}y_{t-3,3} + \Phi_{3,4}y_{t-3,4} \\
+ e_{t,3}
\end{aligned}$$

Where $y_{t,3}$ stands for level of economic activity,

$$\begin{aligned}
y_{t,4} = c_4 + \Phi_{4,1}y_{t-1,1} + \Phi_{4,2}y_{t-1,2} + \Phi_{4,3}y_{t-1,3} & \quad (28) \\
+ \Phi_{4,4}y_{t-1,4} + \Phi_{4,1}y_{t-2,1} + \Phi_{4,2}y_{t-2,2} \\
+ \Phi_{4,3}y_{t-2,3} + \Phi_{4,4}y_{t-2,4} + e_{t,4}
\end{aligned}$$

and with 3 lag order as following;

$$\begin{aligned}
y_{t,4} = c_4 + \Phi_{4,1}y_{t-1,1} + \Phi_{4,2}y_{t-1,2} + \Phi_{4,3}y_{t-1,3} & \quad (29) \\
+ \Phi_{4,4}y_{t-1,4} + \Phi_{4,1}y_{t-2,1} + \Phi_{4,2}y_{t-2,2} \\
+ \Phi_{4,3}y_{t-2,3} + \Phi_{4,4}y_{t-2,4} + \Phi_{4,1}y_{t-3,1} \\
+ \Phi_{4,2}y_{t-3,2} + \Phi_{4,3}y_{t-3,3} + \Phi_{4,4}y_{t-3,4} \\
+ e_{t,4}
\end{aligned}$$

Where $y_{t,4}$ stands for bank loans growth.

It will be also analysed as a six-variable vector as below;

$$y_{t,i} \equiv \begin{bmatrix} \textit{Average Reserve Requirements} \\ \textit{Marginal Reserve Requirements} \\ \textit{Cost Effective Reserve Requirements} \\ \textit{Policy Interest Rates} \\ \textit{Level of Economic Activity} \\ \textit{Bank Loans Growth} \end{bmatrix} \quad (30)$$

In order to have a healthy system the series must be stationary. From the figure 4-1 and 4-2 produced by Eviews below, our model seems stationary since all roots have modulus less than one and lie inside the unit circle. Table 4-3 illustrates VAR Estimation Outputs for Turkish Lira denominated loans and Table 4-4 for fx loans estimations.

Figure 4-1 : FX Loans Stationary Test

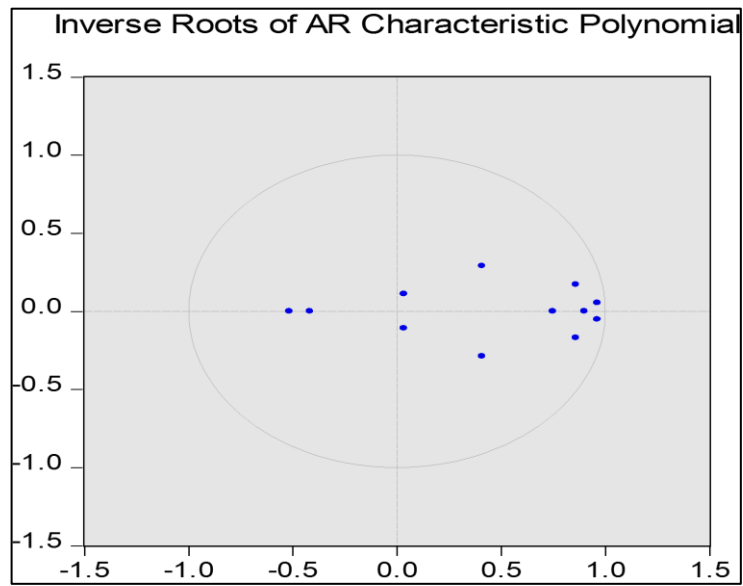


Figure 4-2 : TL Loans Stationary Test

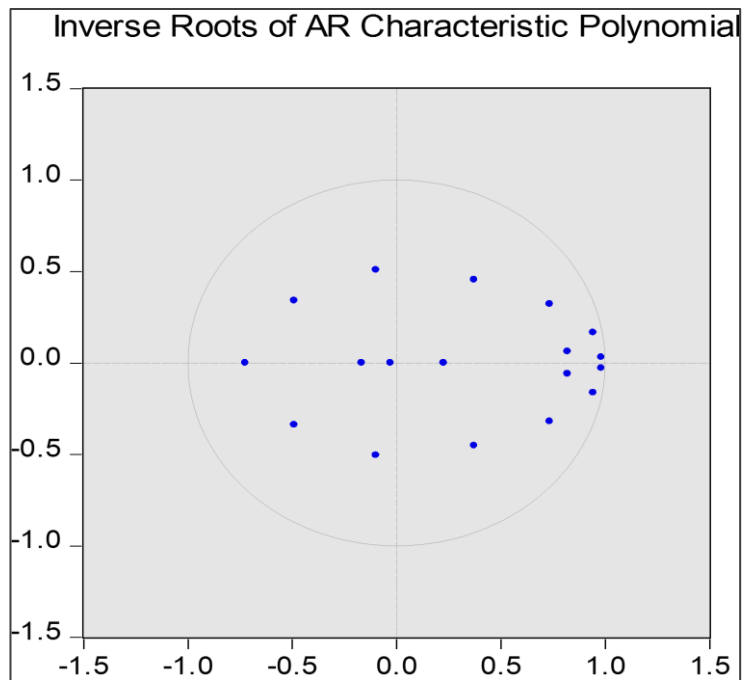


Table 4-3: VAR Estimation Results For TL Denominated Loans Produced By Eviews

Vector Autoregression Estimates							
Date: 08/16/17 Time: 15:42							
Sample (adjusted): 2008M04 2016M12							
Included observations: 105 after adjustments							
Standard errors in () & t-statistics in []							
	TLLOANCH...	AVERAGET...	MARGINALT...	COSTBASETL	TLINTERES...	IPINDEX	
TLLOANCH(-1)	1.73509901... 0.11102290... [15.6283]	0.48529916... 5.08861509... [0.09537]	4.67067565... 4.88284402... [0.95655]	-14.699446... 7.41086999... [-1.98350]	3.31995378... 8.25245452... [0.40230]	42.5880520... 29.0133966... [1.46788]	
TLLOANCH(-2)	-0.7731200... 0.20708190... [-3.73340]	-5.2661097... 9.49137562... [-0.55483]	-3.9214311... 9.10756775... [-0.43057]	26.4324758... 13.8228868... [1.91223]	2.65973111... 15.3926253... [0.17279]	-83.740585... 54.1163047... [-1.54742]	
TLLOANCH(-3)	0.01119904... 0.12059877... [0.09286]	6.81395912... 5.52751467... [1.23273]	-2.3411541... 5.30399558... [-0.44139]	-9.4597795... 8.05006703... [-1.17512]	-3.6088474... 8.96423931... [-0.40258]	39.0514701... 31.5158392... [1.23911]	
AVERAGETLRR(-1)	-0.0012540... 0.00190725... [-0.65750]	0.82103640... 0.08741679... [9.39220]	0.25469743... 0.08388187... [3.03638]	0.14585282... 0.12731057... [1.14565]	-0.0861225... 0.14176807... [-0.60749]	0.29007696... 0.49841818... [0.58200]	
AVERAGETLRR(-2)	0.00149884... 0.00232410... [0.64491]	0.21084853... 0.10652267... [1.97938]	0.19649847... 0.10221515... [1.92240]	-0.8958878... 0.15513566... [-5.77487]	-0.0697962... 0.17275299... [-0.40402]	-0.0767999... 0.60735277... [-0.12645]	
AVERAGETLRR(-3)	-0.0014939... 0.00186320... [-0.80180]	-0.1828339... 0.08539783... [-2.14097]	-0.0683793... 0.08194455... [-0.83446]	1.08889718... 0.12437023... [8.75529]	0.12524324... 0.13849381... [0.90432]	-0.3653230... 0.48690678... [-0.75029]	
MARGINALTLRR(-1)	1.61222470... 0.00231025... [0.00698]	-0.2802665... 0.10588794... [-2.64682]	0.83440921... 0.10160610... [8.21220]	-0.2788476... 0.15421127... [-1.80822]	0.03724775... 0.17172363... [0.21691]	0.04682193... 0.60373382... [0.07755]	
MARGINALTLRR(-2)	-0.0013503... 0.00305628... [-0.44184]	0.90160717... 0.14008141... [6.43631]	-0.0381166... 0.13441687... [-0.28357]	-0.0229433... 0.20400937... [-0.11246]	-0.0751636... 0.22717684... [-0.33086]	-0.2804369... 0.79869231... [-0.35112]	
MARGINALTLRR(-3)	0.00162799... 0.00207735... [0.78369]	-0.5976974... 0.09521324... [-6.27746]	-0.2835150... 0.09136305... [-3.10317]	-0.3008409... 0.13866503... [-2.16955]	0.06871215... 0.15441194... [0.44499]	0.25336616... 0.54287061... [0.46672]	
COSTBASETL(-1)	0.00199596... 0.00117656... [1.69644]	-0.0481279... 0.05392639... [-0.89247]	0.10346469... 0.05174574... [1.99948]	0.98928527... 0.07853639... [12.5965]	-0.0166175... 0.08745505... [-0.19001]	-0.3506885... 0.30746828... [-1.14057]	
COSTBASETL(-2)	-0.0015226... 0.00163222... [-0.93289]	0.10403476... 0.07481108... [1.39063]	-0.0227035... 0.07178591... [-0.31627]	0.06375996... 0.10895209... [0.58521]	-0.0087904... 0.12132478... [-0.07245]	0.48541926... 0.42654509... [1.13803]	
COSTBASETL(-3)	-0.0002454... 0.00123965... [-0.19800]	-0.0573464... 0.05681827... [-1.00930]	0.01043547... 0.05452067... [0.19140]	-0.0309920... 0.08274801... [-0.37454]	-0.0185678... 0.09214495... [-0.20151]	-0.1536563... 0.32395670... [-0.47431]	
TLINTERESTRATE(-1)	-0.0018433... 0.00145969... [-1.26281]	-0.0746427... 0.06690338... [-1.11568]	0.02618561... 0.06419797... [0.40789]	-0.1546411... 0.09743560... [-1.58711]	1.03400248... 0.10850046... [9.52994]	-0.6310171... 0.38145827... [-1.65422]	
TLINTERESTRATE(-2)	0.00156639... 0.00211157... [0.74182]	-0.0174196... 0.09678161... [-0.17999]	-0.0252286... 0.09286800... [-0.27166]	-0.0320429... 0.14094915... [-0.22734]	-0.0457369... 0.15695545... [-0.29140]	0.38183463... 0.55181290... [0.69196]	
TLINTERESTRATE(-3)	-0.0005115... 0.00143243... [-0.35709]	0.04509249... 0.06565407... [0.68682]	0.01382842... 0.06299918... [0.21950]	0.05037398... 0.09561616... [0.52684]	-0.0330784... 0.10647441... [-0.31067]	-0.1251363... 0.37433521... [-0.33429]	
IPINDEX(-1)	0.00017585... 0.00040994... [0.42897]	0.01682841... 0.01878936... [0.89564]	-0.0272162... 0.01802956... [-1.50954]	-0.0206558... 0.02736412... [-0.75485]	0.04142680... 0.03047162... [1.35952]	0.44125190... 0.10712997... [4.11885]	
IPINDEX(-2)	-0.0001813... 0.00039894... [-0.45456]	0.01797207... 0.01828498... [0.98289]	-0.0038489... 0.01754558... [-0.21937]	0.01783595... 0.02662957... [0.66978]	-0.0120701... 0.02965365... [-0.40704]	0.46272868... 0.10425422... [4.43846]	
IPINDEX(-3)	6.71967941... 0.00040704... [0.16508]	-0.0159123... 0.01865669... [-0.85290]	0.03760961... 0.01790225... [2.10083]	0.02847879... 0.02717091... [1.04814]	-0.0129735... 0.03025646... [-0.42879]	0.08622127... 0.10637353... [0.81055]	
C	0.01197349... 0.01140436... [1.04990]	-0.9806792... 0.52270665... [-1.87616]	0.13541231... 0.50156968... [0.26998]	0.32342885... 0.76125055... [0.42487]	-1.7638913... 0.84769879... [-2.08080]	6.21569544... 2.98027952... [2.08561]	

R-squared	0.99289971...	0.98374060...	0.98556360...	0.98107669...	0.96650994...	0.97429435...
Adj. R-squared	0.99141361...	0.98033747...	0.98254203...	0.97711600...	0.95950040...	0.96891409...
Sum-sq. resids	0.00598722...	12.5776483...	11.5809969...	26.6771010...	33.0800779...	408.881436...
S.E. equation	0.00834379...	0.38242871...	0.36696424...	0.55695497...	0.62020324...	2.18046676...
F-statistic	668.121856...	289.069428...	326.175866...	247.703383...	137.884818...	181.087121...
Log likelihood	364.046070...	-37.581495...	-33.247319...	-77.055419...	-88.349516...	-220.36045...
Akaike AIC	-6.5723061...	1.07774277...	0.99518703...	1.82962703...	2.04475270...	4.55924670...
Schwarz SC	-6.0920656...	1.55798321...	1.47542748...	2.30986748...	2.52499314...	5.03948714...
Mean dependent	0.21350405...	9.31330270...	9.66666666...	6.18251376...	7.88333333...	111.195917...
S.D. dependent	0.09004471...	2.72728713...	2.77732635...	3.68174888...	3.08183002...	12.3670963...
Determinant resid covariance (dof adj.)	6.319711509971846e-07					
Determinant resid covariance	1.907884881450727e-07					
Log likelihood	-81.64600416179588					
Akaike information criterion	3.726590555462778					
Schwarz criterion	6.608033221348089					

Table 4-4: VAR Estimation Results For FX Denominated Loans Produced By Eviews

Vector Autoregression Estimates						
Date: 08/16/17 Time: 15:47						
Sample (adjusted): 2008M03 2016M12						
Included observations: 106 after adjustments						
Standard errors in () & t-statistics in []						
	FXLOANCH...	AVERAGE ...	MARGINALF...	COSTBASEFX	FXINTERES...	IPINDEX
FXLOANCHCHANGE(-1)	1.27142228... 0.09518742... [13.3570]	-0.0998431... 0.27999802... [-0.35659]	-1.0017450... 0.37381387... [-2.67980]	-0.4977640... 0.41621336... [-1.19593]	-0.2053478... 0.22237074... [-0.92345]	0.37143531... 2.90547847... [0.12784]
FXLOANCHCHANGE(-2)	-0.4196781... 0.09747859... [-4.30534]	0.56740627... 0.28673761... [1.97883]	0.57555190... 0.38281161... [1.50349]	0.29376943... 0.42623166... [0.68922]	0.30221427... 0.22772323... [1.32711]	-2.5949836... 2.97541366... [-0.87214]
AVERAGE_FX_RR(-1)	0.03245626... 0.02998097... [1.08256]	0.75268656... 0.08819037... [8.53479]	-0.0460021... 0.11773935... [-0.39071]	-0.3052661... 0.13109383... [-2.32861]	0.12357593... 0.07003963... [1.76437]	0.94711756... 0.91513233... [1.03495]
AVERAGE FX RR(-2)	-0.0326876... 0.02945475... [-1.10976]	0.02876917... 0.08664245... [0.33204]	0.05918171... 0.11567278... [0.51163]	0.14981522... 0.12879286... [1.16323]	-0.1509813... 0.06881029... [-2.19417]	0.27489955... 0.89906983... [0.30576]
MARGINALFXRR(-1)	-0.0323954... 0.02613586... [-1.23950]	0.35211725... 0.07687981... [4.58010]	0.87449432... 0.10263908... [8.52009]	0.06614121... 0.11428083... [0.57876]	0.00305281... 0.06105693... [0.05000]	0.25967893... 0.79776510... [0.32551]
MARGINALFXRR(-2)	0.00584461... 0.02615727... [0.22344]	-0.3391551... 0.07694277... [-4.40789]	-0.0891671... 0.10272313... [-0.86803]	-0.2664023... 0.11437441... [-2.32921]	-0.0126947... 0.06110693... [-0.20775]	-0.2460285... 0.79841838... [-0.30814]
COSTBASEFX(-1)	0.00783861... 0.02456561... [0.31909]	-0.2789488... 0.07226085... [-3.86030]	-0.0897254... 0.09647250... [-0.93006]	0.87379049... 0.10741480... [8.13473]	0.00538400... 0.05738862... [0.09382]	0.23998924... 0.74983515... [0.32006]
COSTBASEFX(-2)	0.01322596... 0.02482827... [0.53270]	0.14782985... 0.07303347... [2.02414]	0.18847256... 0.09750399... [1.93297]	0.02895009... 0.10856329... [0.26667]	-0.0643736... 0.05800222... [-1.10985]	0.11487050... 0.75785247... [0.15157]
FXINTERESTRATE(-1)	0.04837379... 0.04473798... [1.08127]	0.74950643... 0.13159876... [5.69539]	-0.0885775... 0.17569210... [-0.50416]	0.64083264... 0.19561982... [3.27591]	1.15503317... 0.10451400... [11.0515]	3.95465206... 1.36557168... [2.89597]
FXINTERESTRATE(-2)	-0.0418727... 0.04545217... [-0.92125]	-0.7697432... 0.13369958... [-5.75726]	0.13927744... 0.17849682... [0.78028]	-0.6145693... 0.19874265... [-3.09229]	-0.1923678... 0.10618244... [-1.81167]	-5.5659291... 1.38737138... [-4.01185]
IPINDEX(-1)	0.00038874... 0.00298070... [0.13042]	0.01470617... 0.00876787... [1.67728]	0.01122828... 0.01170563... [0.95922]	0.01228334... 0.01303333... [0.94246]	0.00266344... 0.00696333... [0.38250]	0.32820803... 0.09098233... [3.60738]
IPINDEX(-2)	-0.0006096... 0.00278772... [-0.21867]	0.00136428... 0.00820023... [0.16637]	-0.0015246... 0.01094779... [-0.13927]	0.00970876... 0.01218953... [0.79648]	0.00478176... 0.00651251... [0.73424]	0.47949032... 0.08509200... [5.63496]
C	0.16842340... 0.12616465... [1.33495]	1.61275230... 0.37111892... [4.34565]	0.37875847... 0.49546563... [0.76445]	2.64105432... 0.55166337... [4.78744]	0.18184754... 0.29473775... [0.61698]	8.15767874... 3.85102010... [2.11832]
R-squared	0.93811882...	0.95992838...	0.94797048...	0.94783055...	0.98072158...	0.97625198...
Adj. R-squared	0.93013415...	0.95475785...	0.94125700...	0.94109901...	0.97823404...	0.97318772...
Sum sq. resids	0.40684127...	3.52026864...	6.27446478...	7.77853677...	2.22034858...	379.054086...
S.E. equation	0.06614104...	0.19455680...	0.25974480...	0.28920612...	0.15451445...	2.01887354...
F-statistic	117.490031...	185.653752...	141.203920...	140.804386...	394.253902...	318.593052...
Log likelihood	144.419391...	30.0523102...	-0.5790865...	-11.967729...	54.4785846...	-217.94219...
Akaike AIC	-2.4796111...	-0.3217417...	0.25620917...	0.47108923...	-0.7826148...	4.35739989...
Schwarz SC	-2.1529629...	0.00490648...	0.58285737...	0.79773742...	-0.4559666...	4.68404808...
Mean dependent	0.40061113...	10.5428993...	11.6792452...	10.4906809...	1.34210459...	111.125481...
S.D. dependent	0.25022954...	0.91469193...	1.07168909...	1.19164307...	1.04732197...	12.3294094...
Determinant resid covariance (dof adj.)	6.81033581841242e-08					
Determinant resid covariance	3.106211528934802e-08					
Log likelihood	13.78076954735195					
Akaike information criterion	1.21168359344619					
Schwarz criterion	3.171572738170163					

4.7: Impulse Response Function

More generally, an impulse response refers to the reaction of any dynamic system in response to some external change. It is often of interest to know the response of one variable to an impulse in another variable in a system that involves a number of further variables as well. The impulse response function of VAR is to analyse dynamic effects of the system when the model received the impulse since VAR models are very difficult to interpret in sense of economics (Çınar, Sevüktekin, 2014). An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. In this study, results are evaluated relying on impulse responses.

Therefore, we evaluated effect of a shock in reserve requirements, in interest rates and in economic activity over bank loans balances' change. Estimation based on vector author egression with two lags (for fx loans) and three lags (for TL loans) using monthly data for the period January 2008 – December 2016. The system includes reserve requirements (including average numbers, marginal numbers and cost bases effective numbers separately), interest rates and industrial production index.

Below charts 4-(14-15-16-17-18) illustrate impulse response charts of Turkish Lira loans reactions for each of these variables. According to responses, while average and marginal reserve requirement developments have a negative impact on loan growth after third period it can be argued that it is not very significant. The cost effective reserve requirement has almost no impact even some positive impact which can be argued that thanks to ROM banks can minimise the cost of TL by lower interest rate currency such as USD. On the other hand, the more significant variable seems as interest rate hikes which cause a negative impact just after first period. It seems that industrial production is not a significant variable on loan balances.

Chart 4-14 : TL Loans Response To Average Reserve Requirement Ratio Changes

Response to Cholesky One S.D. Innovations \pm 2 S.E.

Response of TLLOANCHANGE to AVERAGETLRR

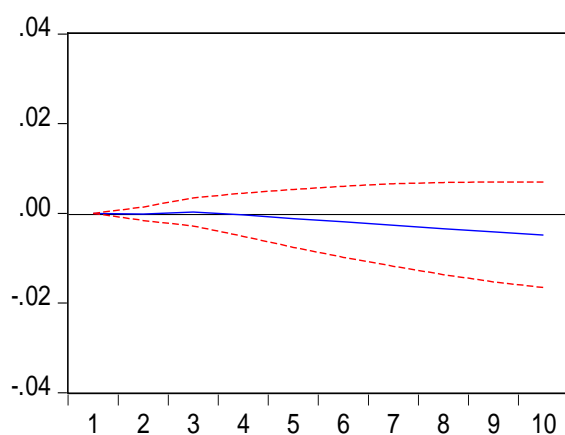


Chart 4-15: : TL Loans Response To Marginal Reserve Requirement Ratio Changes

Response to Cholesky One S.D. Innovations \pm 2 S.E.

Response of TLLOANCHANGE to MARGINALTLRR

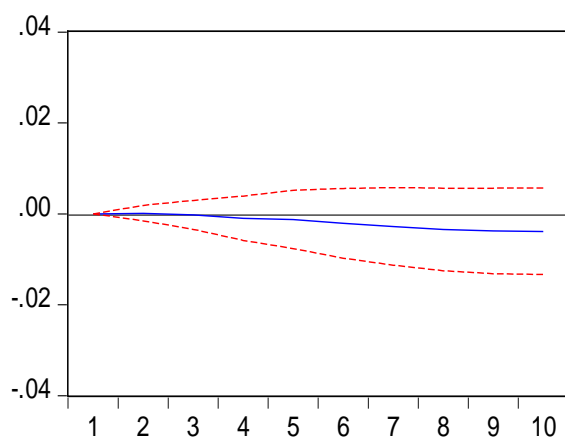


Chart 4-16 : : TL Loans Response To Cost Base Effective Reserve Requirement Ratio Changes

Response to Cholesky One S.D. Innovations \pm 2 S.E.

Response of TLLOANCHANGE to COSTBASETL

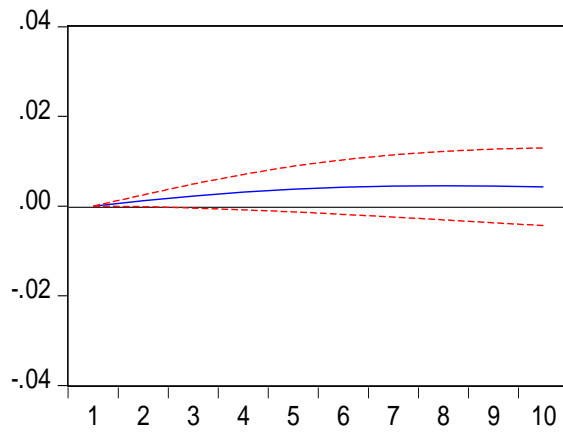


Chart 4-17: : TL Loans Response To CBT Interest Rate Changes

Response to Cholesky One S.D. Innovations \pm 2 S.E.

Response of TLLOANCHANGE to TLINTERESTRATE

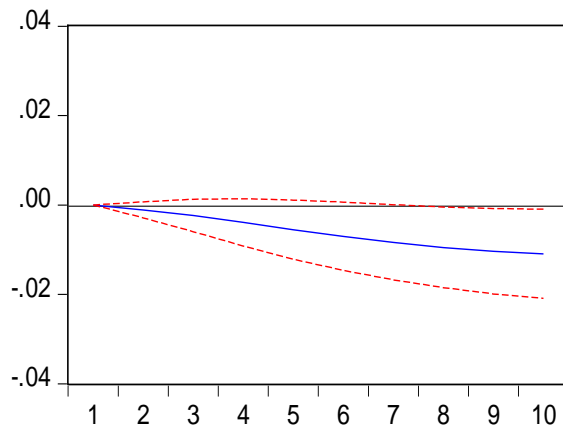
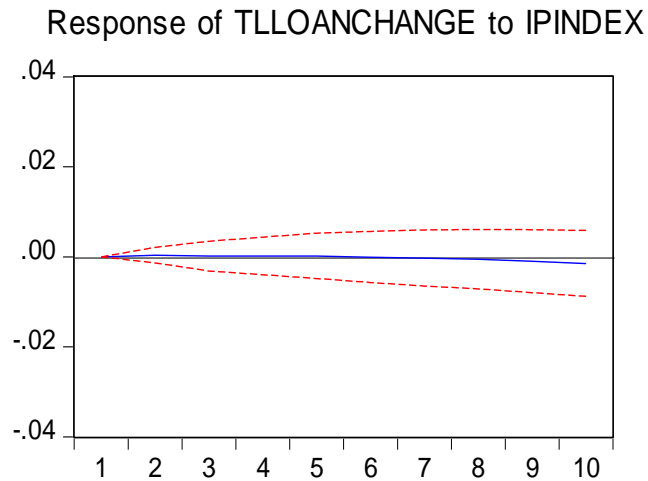


Chart 4-18: TL Loans Response to Industrial Production Index Changes

Response to Cholesky One S.D. Innovations \pm 2 S.E.



From charts 4-(14-15-16-17-18), while an increase in reserve requirements ratios (which means marginal reserve requirement ratio is higher) has an immediate negative effect on loan balances, FX loans are indifferent vis-à-vis other variables. The explanation may be the credit channel literature in line with finding of Carpenter and Demiralp (2012) study. After a monetary tightening, it is even harder to find other funding sources for real sector. We can also interpret that situation by considering FX loans structure in Turkish banking sector. According to local regulations, only corporates can utilise FX loans and as was mentioned above corporate loans' sensitivity against financial indicators is relatively lower. Because firms need hard currencies in order to continue their business since Turkey as an emerging economy needs to import items to produce value. If there is not an obstacle to reach liquidity, any increase in interest rate base helps banks to raise loan margins, then interest incomes. Therefore, as illustrated in chart 4-22, in case of an interest rate hike in foreign currencies, banks' interest for new loans is rising for following periods.

Chart 4-19: FX Loans Response To Average Reserve Requirement Ratio Changes

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

Response of FXLOANCHANGE to AVERAGE_FX_RR

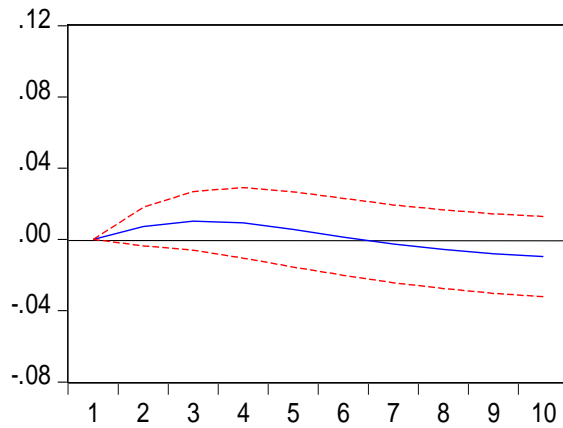


Chart 4-20: FX Loans Response To Marginal Reserve Requirement Ratio Changes

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

Response of FXLOANCHANGE to MARGINALFXRR

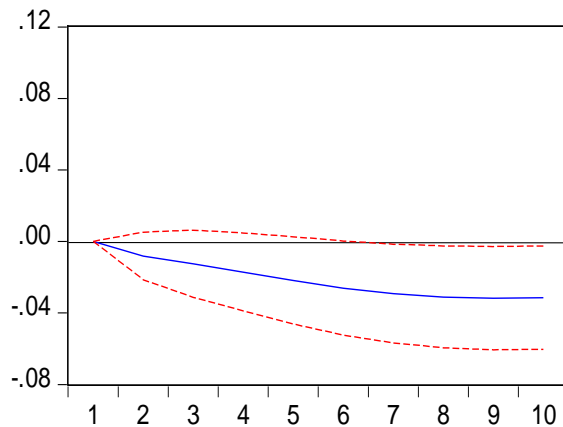


Chart 4-21 : FX Loans Response To Cost Base Effective Reserve Requirement Ratio Changes

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

Response of FXLOANCHANGE to COSTBASEFX

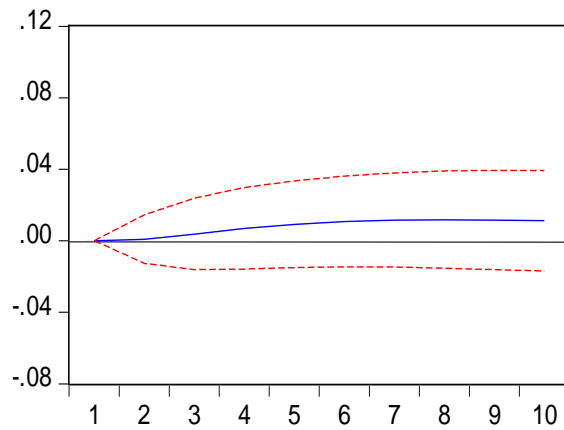


Chart 4-22: FX Loans Response To FX Interest Rate Changes

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

Response of FXLOANCHANGE to FXINTERESTRATE

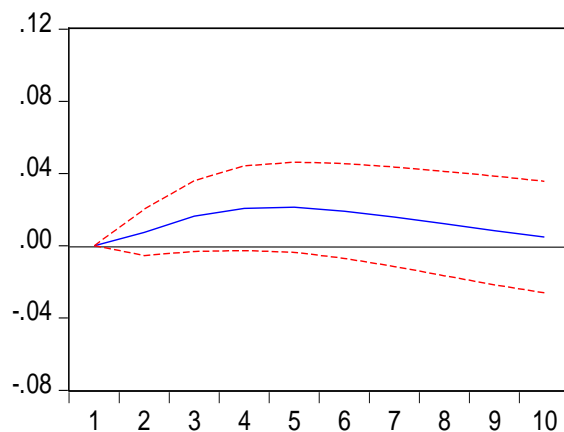
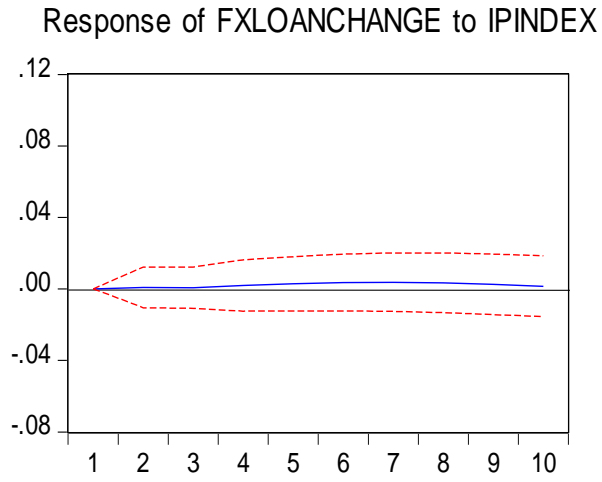


Chart 4-23 : FX Loans Response To Industrial Production Index Changes
Response to Cholesky One S.D. Innovations ± 2 S.E.



CONCLUSION

In this study, reserve requirements have been reviewed as a prudential monetary policy instrument and analysed according to their impacts on bank loans in the sense of liquidity and cost. We tried to show that CBT practice is getting more complicated due to its effort to stabilise financial markets and macro balances at the same time. While ROM application helps banks to reduce reserve requirement costs, especially for foreign currency liabilities, liquidity need is still an issue due to high reserve ratios. This study argues that from a policy perspective, next to its benefits, reserve requirements have also costs that central bank needs to follow closely in order not to distort the financial intermediation. Still, little is clear about its effectiveness. Banks' behaviours against changes in reserve requirements differ in line with their own liquidity position, policy interest rates and remuneration of reserves.

Commonly, literature examining the monetary transmission mechanism role of reserve requirements encounter the challenge of proving whether the ongoing trend in loan balances is due to supply side developments or demand side after a monetary policy action. The empirical analysis on the effectiveness of RRs focused on the interaction between loan balances and reserve requirements ratios but given the available data, vector auto regression model with four variables results suggest that the use of reserve requirements as a countercyclical tool has modest and short-lived effect on the growth of bank loans in Turkey between 2008 and 2016. Regardless, there is always an obvious link between funding environment and loans. Because, banking sector has dynamic and flexible structure and whenever local economic and global liquidity conditions are supportive we can identify this link easily as we

observed in Turkey after quantitative easing policies implemented by the central banks of developed countries. As concluded by Nora (2014), in many EM countries, reserve requirement applications serve to complement macro prudential policies since in these economies policy rates are not enough to stabilise local currencies, capital accounts and price levels. Moreover, the use of required reserve as an additional policy measure can help central banks to follow conflicting goals at the same time: increasing interest rates to control inflation and lower volatility in FX markets but adjusting reserve ratios in order not to distort loans and vice versa. In this perspective, although CBT could contain excessive bank loan growth with the support of other regulative measures, cost and constraint caused by RRs are at least partially eliminated. We can summarise that CBT use RR to resolve policy dilemmas caused by capital inflows, increase the impact of monetary policy and its transmission and to maintain financial stability and contain excessive loan growth. Although it seems for some periods RR seems effective to contain loan growth, this analysis does not deliver a conclusive proof that RR applications are effective in containing overheating economy. That said, there is a trade off in required reserve policy implementations.

The next question for further studies may be whether it works to identify different reserve ratios for different banks according to their balance sheet size or to their market size without harming competition. Thus, it may be possible to support loan market and to have a well-balanced banking sector since last global crisis proved that some banks are too big to fail which may harm the global system as whole

REFERENCES

- Alper, K., Binici, M., Demiralp, S., Kara, H., Özlü, P. (2014). Reserve Requirements, Liquidity Risk, and Credit Growth. (Central Bank of Turkey Working Paper No. 14/24). Ankara: Central Bank of Turkey
- Alper, K., Kara, H., & Yorukoglu, M. (2013). Reserve options mechanism. Central Bank of Turkey Central Bank Review, 13(1), 1-14.
- Başçı, E., & Kara, H. (2011). Financial stability and monetary policy. (Central Bank of Turkey Working Paper No. 11/08). Ankara: Central Bank of Turkey
- Bernanke, B., & Gertler, M. (1995). Inside the black box: the credit channel of monetary policy transmission. (NBER Working Paper No. 5146). Cambridge, MA: National Bureau of Economic Research.
- Brooks, C. (2014). Introductory econometrics for finance(3rd ed.). Cambridge CB. Cambridge University Press
- BRSA Turkish Banking Sector Interactive Monthly Bulletins published on <http://ebulten.bddk.org.tr/ABMVC/en>
- Carpenter, Seth, and Selva Demiralp (2012). Money, reserves, and the transmission of monetary policy: Does the money multiplier exist?. Journal of macroeconomics 34.1. 59-75.
- Carrera, C. (2013). The Evolving Role of Reserve Requirements in Monetary Policy. Journal of CENTRUM Cathedra: The Business and Economics Research Journal, 6(1), 11-25.
- Central Bank of Republic of Turkey Electronic Data Delivery System. (n.d), retrieved from http://evds.tcmb.gov.tr/index_en.html

- Cordella, T. F., Federico, P., Vegh, C., Vuletin, G. (2014). Reserve requirements in the brave new macroprudential world. (Policy Research Working Paper No. 6793). Washington DC: World Bank Publications.
- Di Giorgio, G. (1999). Financial Development and Reserve Requirements. *Journal of Banking & Finance*, 23(7), 1031-1041. doi.org/10.1016/S0378-4266(98)00130-7
- Dvořák, Pavel. Rethinking the Monti-Klein model of banking industry: new insights about the separability of loans and deposits decisions'. (Charles University Discussion Paper No. 2005. Vol. 138). Praha: Czech Republic
- Ernst and Young (2016), Turkish Banking Sector Overview - Global Banking & Financial Policy Review. Retrieved May 9th 2017 from <http://www.ey.com/tr/en/industries/financial-services/turksh-banking-sector-overview-article-page>
- Feinman, J. N. (1993). Reserve requirements: history, current practice, and potential reform. *Fed. Res. Bull.*, 79, 569.
- Glocker, C., & Towbin, P. (2012). Reserve Requirements for Price and Financial Stability-When are they effective? (Banque de France Working Paper No. 363). Paris: Banque de France
- Gray, S. (2011). Central bank balances and reserve requirements. (IMF Working Paper No.11/36). Washington DC: International Monetary Fund
- Hazar, A., Yenice, S. (2015). Zorunlu Karşılık Uygulamasının Bankaların Bilançolarına Etkisi-Türkiye Örneği. *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, 15(4).
- Hein, S. E., & Stewart, J. D. (2002). Reserve requirements: A modern perspective. *Economic Review-Federal Reserve Bank of Atlanta*, 87(4), 41.

- Hoffmann, A., & Loeffler, A. (2014). Low interest rate policy and the use of reserve requirements in emerging markets. *The Quarterly Review of Economics and Finance*, 54(3), 307-314.
- Kara, H. (2016), Turkey's experience with macroprudential policy. BIS Paper No. 86q. Available at SSRN: <https://ssrn.com/abstract=2844292>
- Mishkin, F. S. (1996). The channels of monetary transmission: lessons for monetary policy. (NBER Working Paper No. 5464). Cambridge, MA: National Bureau of Economic Research.
- Mora, Nada. (2014). Reason for reserve? Reserve requirements and credit. *Journal of Money, Credit and Banking*, 46.2-3, 469-501. doi:10.1111/jmcb.12113
- Mutlutürk, Ş. (2014). Reserve requirements as a macro prudential policy tool: Case of Turkey and its effects on the banking sector. *Bankacılar Dergisi*, 2012 (81), 102-120. Retrieved from <http://tbb.dergipark.gov.tr/bankacilar/issue/3382/46665>
- Montoro, C., & Moreno, R. (March, 2011). The use of reserve requirements as a policy instrument in Latin America. *BIS Quarterly Review*, March 2011. Retrieved from http://www.bis.org/publ/qtrpdf/r_qt1103g.pdf
- Reinhart, Carmen M., and Vincent R. Reinhart. (1999). On the use of reserve requirements in dealing with capital flow problems. *International Journal of Finance & Economics*, 4(1) 27-54.
- Robitaille, Patrice. (June, 2011). Liquidity and reserve requirements in Brazil. (FED International Finance Discussion Papers No.1021). New York:FED
- Sevüktekin, M., & Çınar, M. (2014). Ekonometrik zaman serileri analizi: Eviews uygulamalı. Bursa. Nobel Yayın Dağıtım.
- Talashlı, İsmail Anıl. (2012). Türkiye’de Bankacılık Sistemi Zorunlu Karşılık Yönetimi. (TCMB Uzmanlık Yeterlilik Tezi). Central Bank of Turkey

Tovar Mora, C. E., Garcia-Escribano, M., & Martin, M. V. (2012). Credit Growth and the Effectiveness of Reserve Requirements and Other Macroprudential Instruments in Latin America. (IMF Working Paper No.12/142). Washington DC: International Monetary Fund

Vargas, Hernando, and Pamela Cardozo. (2012). The use of reserve requirements in an optimal monetary policy framework. (Banco De La Republica Colombia Working Paper No:7161-2012.). Colombia: Banco De La Republica Colombia

Yılmaz, Durmuş (2010). CBT Governor presentation at the meeting with the general managers of the banks. (Central Bank of Turkey Governor Presentation). Ankara: Central Bank of Turkey retrieved from <http://www.tcmb.gov.tr/wps/wcm/connect/TCMB+EN/TCMB+EN/Main+Menu/Announcements/Remarks+by+Governor>

ANNEX 1:

VAR Estimation Data Set for TL						
Date	TL Loan Change (%)	TL Average RR	TL Marginal RR	Cost Based Effective RR (ROM Adjusted)	TL Benchmark Interest Rate	IP Index
Jan-08	0.32	6.00	6.00	1.09	15.50	102.72
Feb-08	0.34	6.00	6.00	1.11	15.50	104.31
Mar-08	0.35	6.00	6.00	1.12	15.25	103.73
Apr-08	0.34	6.00	6.00	1.06	15.25	104.00
May-08	0.36	6.00	6.00	1.23	15.25	102.40
Jun-08	0.36	6.00	6.00	1.10	15.75	102.44
Jul-08	0.35	6.00	6.00	1.11	16.25	101.63
Aug-08	0.35	6.00	6.00	1.22	16.75	99.15
Sep-08	0.36	6.00	6.00	1.16	16.75	99.24
Oct-08	0.34	6.00	6.00	1.36	16.75	94.73
Nov-08	0.28	6.00	6.00	1.70	16.75	91.37
Dec-08	0.24	6.00	6.00	1.56	16.25	88.19
Jan-09	0.20	6.00	6.00	1.32	15.00	82.90
Feb-09	0.16	6.00	6.00	0.90	13.00	84.26
Mar-09	0.12	6.00	6.00	1.10	11.50	82.99
Apr-09	0.10	6.00	6.00	1.36	10.50	85.17
May-09	0.08	6.00	6.00	1.58	9.75	87.21
Jun-09	0.06	6.00	6.00	1.81	9.25	90.01
Jul-09	0.04	6.00	6.00	1.83	8.75	91.52
Aug-09	0.02	6.00	6.00	1.73	8.25	90.50
Sep-09	0.00	6.00	6.00	1.51	7.75	91.71
Oct-09	0.01	5.00	6.00	1.33	7.25	93.72
Nov-09	0.05	5.00	6.00	1.30	6.75	96.11
Dec-09	0.07	5.00	6.00	1.56	6.50	93.55
Jan-10	0.10	5.00	6.00	1.51	6.50	93.38
Feb-10	0.13	5.00	6.00	1.33	6.50	95.98
Mar-10	0.16	5.00	6.00	1.45	6.50	98.09
Apr-10	0.19	5.00	6.00	1.44	6.50	98.96
May-10	0.20	5.00	6.00	1.54	6.50	99.91
Jun-10	0.22	5.00	6.00	1.59	7.00	99.35
Jul-10	0.24	5.00	6.00	1.53	7.00	100.35
Aug-10	0.27	5.00	6.00	1.47	7.00	102.21
Sep-10	0.28	5.00	6.00	1.49	7.00	101.40
Oct-10	0.29	5.50	5.00	4.34	7.00	102.24
Nov-10	0.30	6.00	5.00	6.00	7.00	103.07
Dec-10	0.31	6.00	5.50	6.00	7.00	107.69
Jan-11	0.32	7.42	5.50	7.42	6.50	109.77
Feb-11	0.33	7.42	6.00	8.42	6.25	108.45
Mar-11	0.34	9.42	7.00	9.42	6.25	108.85
Apr-11	0.34	9.44	9.00	11.90	6.25	107.97
May-11	0.35	9.40	13.00	13.29	6.25	108.37
Jun-11	0.36	9.39	13.00	13.21	6.25	109.42
Jul-11	0.35	13.20	13.00	13.16	6.25	109.00
Aug-11	0.35	13.10	13.00	13.16	6.25	111.30
Sep-11	0.35	13.30	13.00	12.41	5.75	108.98
Oct-11	0.33	13.28	13.00	10.85	5.75	113.50
Nov-11	0.31	13.24	12.50	8.58	5.75	110.62
Dec-11	0.29	13.17	12.50	8.57	5.75	112.03
Jan-12	0.28	13.17	12.50	8.48	5.75	111.46
Feb-12	0.27	13.15	12.50	8.41	5.75	111.27
Mar-12	0.26	13.18	12.50	8.07	5.75	112.66
Apr-12	0.24	13.14	12.50	7.84	5.75	112.99
May-12	0.23	13.14	12.50	7.62	5.75	114.22

Date	TL Loan Change (%)	TL Average RR	TL Marginal RR	Cost Based Effective RR (ROM Adjusted)	TL Benchmark Interest Rate	IP Index
Jun-12	0.22	13.10	12.50	7.44	5.75	112.12
Jul-12	0.20	13.13	12.50	7.37	5.75	112.88
Aug-12	0.20	12.56	12.50	7.05	5.75	112.47
Sep-12	0.20	12.57	12.50	7.19	5.75	112.51
Oct-12	0.19	10.46	12.50	7.38	5.75	113.71
Nov-12	0.20	10.46	12.50	7.34	5.75	113.68
Dec-12	0.21	10.48	12.50	7.69	5.75	111.42
Jan-13	0.21	10.47	12.50	7.28	5.50	113.21
Feb-13	0.21	10.48	11.00	7.38	5.50	115.16
Mar-13	0.22	10.49	11.25	7.37	5.50	114.61
Apr-13	0.23	10.49	11.25	7.46	5.50	115.49
May-13	0.24	10.49	11.25	7.61	5.00	114.67
Jun-13	0.25	10.49	11.25	7.73	4.50	117.58
Jul-13	0.26	10.49	11.25	7.78	4.50	117.82
Aug-13	0.27	10.49	11.25	7.96	4.50	114.14
Sep-13	0.28	10.49	11.25	7.92	4.50	120.01
Oct-13	0.29	10.49	11.25	7.61	4.50	117.30
Nov-13	0.28	10.51	11.25	7.19	4.50	119.18
Dec-13	0.28	10.51	11.25	7.26	4.50	118.44
Jan-14	0.29	10.52	11.25	6.94	4.50	121.73
Feb-14	0.28	10.52	11.25	6.39	10.00	120.89
Mar-14	0.26	10.53	11.25	5.98	10.00	119.25
Apr-14	0.24	10.53	11.25	5.96	10.00	120.40
May-14	0.22	10.55	11.25	5.76	10.00	118.70
Jun-14	0.20	10.55	11.25	5.70	9.50	119.63
Jul-14	0.19	10.58	11.25	5.86	8.75	122.92
Aug-14	0.18	10.58	11.25	5.71	8.25	118.38
Sep-14	0.17	10.58	11.25	5.65	8.25	123.32
Oct-14	0.17	10.58	11.25	5.51	8.25	120.22
Nov-14	0.17	10.58	11.25	4.53	8.25	120.45
Dec-14	0.17	10.58	11.25	4.49	8.25	121.26
Jan-15	0.16	10.58	11.25	3.95	8.25	120.17
Feb-15	0.17	10.57	11.25	4.11	7.75	121.89
Mar-15	0.18	10.57	11.25	4.24	7.50	124.65
Apr-15	0.19	10.58	11.25	3.99	7.50	124.73
May-15	0.19	10.57	11.25	3.46	7.50	121.30
Jun-15	0.20	10.55	11.25	3.22	7.50	124.72
Jul-15	0.20	10.76	11.25	3.18	7.50	123.00
Aug-15	0.19	10.74	11.25	3.03	7.50	125.63
Sep-15	0.19	10.97	11.25	2.63	7.50	125.83
Oct-15	0.17	10.94	11.25	2.45	7.50	125.60
Nov-15	0.17	10.92	11.25	2.42	7.50	125.01
Dec-15	0.16	10.90	11.25	2.14	7.50	126.64
Jan-16	0.15	10.90	11.25	2.32	7.50	126.97
Feb-16	0.14	10.88	11.25	2.32	7.50	128.40
Mar-16	0.13	10.86	11.25	2.49	7.50	127.65
Apr-16	0.12	10.85	11.25	2.59	7.50	125.58
May-16	0.12	10.87	11.25	2.54	7.50	127.56
Jun-16	0.10	10.88	11.25	2.61	7.50	126.42
Jul-16	0.10	10.90	11.25	2.71	7.50	117.79
Aug-16	0.10	10.92	11.25	2.94	7.50	128.00
Sep-16	0.10	10.92	11.50	3.02	7.50	123.32
Oct-16	0.10	10.94	10.50	3.20	7.50	128.33
Nov-16	0.10	10.97	10.50	3.08	7.50	128.19
Dec-16	0.12	10.99	10.50	2.84	8.00	128.31

ANNEX 2:

VAR Estimation Data Set for FX						
Date	FX Loan Change	Foreign Currency Average RR %	FXCostBase	Marginal RRR FX	Weighted FX Policy Rates	IP Index
Jan-08	0.00	11.00	6.09	11.00	4.10	102.72
Feb-08	0.09	11.00	7.11	11.00	4.09	104.31
Mar-08	0.19	11.00	7.54	11.00	4.23	103.73
Apr-08	0.29	11.00	8.09	11.00	4.70	104.00
May-08	0.23	11.00	8.52	11.00	4.83	102.40
Jun-08	0.22	11.00	8.49	11.00	5.12	102.44
Jul-08	0.24	11.00	8.52	11.00	5.04	101.63
Aug-08	0.14	11.00	8.67	11.00	4.82	99.15
Sep-08	0.24	11.00	8.71	11.00	5.28	99.24
Oct-08	0.44	11.00	9.86	11.00	4.23	94.73
Nov-08	0.46	9.00	8.95	11.00	3.55	91.37
Dec-08	0.42	9.00	8.93	11.00	2.79	88.19
Jan-09	0.42	9.00	9.00	11.00	2.30	82.90
Feb-09	0.35	9.00	9.00	11.00	2.28	84.26
Mar-09	0.24	9.00	9.00	11.00	2.12	82.99
Apr-09	0.09	9.00	9.00	11.00	2.02	85.17
May-09	0.13	9.00	9.00	11.00	1.85	87.21
Jun-09	0.12	9.00	9.00	11.00	1.78	90.01
Jul-09	0.14	9.00	9.00	11.00	1.65	91.52
Aug-09	0.30	9.00	9.00	11.00	1.52	90.50
Sep-09	0.26	9.00	9.00	11.00	1.45	91.71
Oct-09	0.13	9.00	9.00	11.00	1.42	93.72
Nov-09	0.15	9.00	9.00	11.00	1.31	96.11
Dec-09	0.22	9.00	9.00	11.00	1.27	93.55
Jan-10	0.27	9.00	9.00	11.00	1.14	93.38
Feb-10	0.35	9.00	9.00	11.00	1.13	95.98
Mar-10	0.41	9.00	9.00	11.00	1.17	98.09
Apr-10	0.60	9.50	9.50	11.00	1.24	98.96
May-10	0.78	9.50	9.50	9.00	1.32	99.91
Jun-10	0.87	9.50	9.50	9.00	1.32	99.35
Jul-10	0.96	9.50	9.50	9.00	1.32	100.35
Aug-10	0.83	10.00	10.00	9.00	1.18	102.21
Sep-10	0.82	10.00	10.00	9.50	1.19	101.40
Oct-10	0.82	11.00	11.00	10.00	1.25	102.24
Nov-10	0.80	11.00	11.00	10.00	1.21	103.07
Dec-10	0.92	11.00	11.00	10.00	1.21	107.69
Jan-11	1.02	11.00	11.00	10.00	1.30	109.77
Feb-11	0.99	11.00	11.00	10.00	1.37	108.45
Mar-11	0.94	11.00	11.00	10.00	1.50	108.85
Apr-11	0.88	11.00	11.00	10.00	1.60	107.97
May-11	0.81	11.00	11.83	11.00	1.55	108.37
Jun-11	0.78	11.00	11.82	11.00	1.57	109.42
Jul-11	0.75	11.00	11.82	11.00	1.59	109.00
Aug-11	0.89	11.00	11.24	12.00	1.57	111.30
Sep-11	0.84	11.83	10.98	12.00	1.54	108.98
Oct-11	0.85	11.82	10.25	11.50	1.64	113.50
Nov-11	0.76	11.82	10.29	11.50	1.65	110.62
Dec-11	0.66	11.82	10.29	11.50	1.62	112.03
Jan-12	0.49	11.82	10.27	11.50	1.51	111.46
Feb-12	0.37	11.82	10.28	11.50	1.44	111.27
Mar-12	0.36	11.50	10.30	11.50	1.34	112.66
Apr-12	0.36	10.99	10.31	11.50	1.29	112.99
May-12	0.31	10.99	10.32	11.50	1.23	114.22

Date	FX Loan Change	Foreign Currency Average RR %	FXCostBase	Marginal RRR FX	Weighted FX Policy Rates	IP Index
Jun-12	0.30	10.98	10.33	11.50	1.23	112.12
Jul-12	0.23	10.98	10.32	11.50	1.09	112.88
Aug-12	0.13	10.24	10.29	11.50	1.03	112.47
Sep-12	0.14	10.26	10.27	11.50	0.94	112.51
Oct-12	0.12	10.29	10.25	11.50	0.85	113.71
Nov-12	0.12	10.29	10.22	11.50	0.82	113.68
Dec-12	0.12	10.29	11.07	11.50	0.80	111.42
Jan-13	0.15	10.27	10.64	11.00	0.80	113.21
Feb-13	0.20	10.27	10.87	11.50	0.74	115.16
Mar-13	0.19	10.27	11.35	12.00	0.72	114.61
Apr-13	0.19	10.27	11.50	12.00	0.69	115.49
May-13	0.23	10.29	11.49	12.00	0.67	114.67
Jun-13	0.32	10.30	11.91	12.50	0.69	117.58
Jul-13	0.37	10.31	11.91	12.50	0.69	117.82
Aug-13	0.41	10.31	11.89	12.50	0.69	114.14
Sep-13	0.44	10.31	11.92	12.50	0.66	120.01
Oct-13	0.43	10.31	11.93	12.50	0.65	117.30
Nov-13	0.48	10.33	11.91	12.50	0.61	119.18
Dec-13	0.50	10.32	11.82	12.50	0.65	118.44
Jan-14	0.61	10.33	11.88	12.50	0.63	121.73
Feb-14	0.58	10.33	11.88	12.50	0.62	120.89
Mar-14	0.56	10.33	11.90	12.50	0.65	119.25
Apr-14	0.49	10.31	11.93	12.50	0.65	120.40
May-14	0.41	10.29	11.89	12.50	0.62	118.70
Jun-14	0.31	10.29	11.88	12.50	0.59	119.63
Jul-14	0.28	10.30	11.80	12.50	0.61	122.92
Aug-14	0.30	10.28	11.75	12.50	0.57	118.38
Sep-14	0.29	10.26	11.74	12.50	0.53	123.32
Oct-14	0.32	10.25	11.75	12.50	0.51	120.22
Nov-14	0.29	10.25	11.74	12.50	0.51	120.45
Dec-14	0.28	10.22	12.23	12.50	0.55	121.26
Jan-15	0.20	10.23	11.64	12.50	0.51	120.17
Feb-15	0.26	10.22	12.15	12.50	0.53	121.89
Mar-15	0.31	10.22	12.89	13.00	0.53	124.65
Apr-15	0.40	10.63	13.03	13.00	0.53	124.73
May-15	0.42	10.64	12.14	13.00	0.55	121.30
Jun-15	0.44	10.66	11.80	13.00	0.57	124.72
Jul-15	0.43	11.09	11.50	13.00	0.60	123.00
Aug-15	0.46	11.07	11.06	13.00	0.61	125.63
Sep-15	0.49	11.50	10.94	13.00	0.61	125.83
Oct-15	0.41	11.49	10.89	13.00	0.61	125.60
Nov-15	0.35	11.49	10.96	13.00	0.66	125.01
Dec-15	0.33	11.50	10.43	13.00	0.79	126.64
Jan-16	0.35	11.50	9.63	13.00	0.75	126.97
Feb-16	0.27	11.49	9.99	13.00	0.76	128.40
Mar-16	0.19	11.91	10.32	13.00	0.78	127.65
Apr-16	0.16	11.90	10.16	13.00	0.79	125.58
May-16	0.20	11.92	9.99	13.00	0.86	127.56
Jun-16	0.16	11.91	10.00	13.00	0.78	126.42
Jul-16	0.16	11.89	9.99	13.00	0.91	117.79
Aug-16	0.10	11.90	10.23	13.00	0.99	128.00
Sep-16	0.05	11.91	10.42	13.00	0.98	123.32
Oct-16	0.12	11.92	10.62	13.00	1.00	128.33
Nov-16	0.23	11.92	10.66	13.00	1.04	128.19
Dec-16	0.26	11.93	10.02	13.00	1.07	128.31

ANNEX 3:

CBT Remuneration & Commission Rates (%)

Date	TL Average	USD	EUR	EUR Commission	Date	TL Average	USD	EUR	EUR Commission
Jan-08	11.71	1.87	1.83	-	Jul-12	-	-	-	-
Feb-08	11.50	1.36	1.86	-	Aug-12	-	-	-	-
Mar-08	11.43	1.18	1.86	-	Sep-12	-	-	-	-
Apr-08	11.43	0.99	1.83	-	Oct-12	-	-	-	-
May-08	11.65	0.88	1.84	-	Nov-12	-	-	-	-
Jun-08	12.02	0.89	1.85	-	Dec-13	-	-	-	-
Jul-08	12.38	0.90	1.88	-	Jan-13	-	-	-	-
Aug-08	12.56	0.87	1.97	-	Feb-13	-	-	-	-
Sep-08	12.56	0.87	1.98	-	Mar-13	-	-	-	-
Oct-08	12.56	0.51	1.45	-	Apr-13	-	-	-	-
Nov-08	12.39	0.03	1.26	-	May-13	-	-	-	-
Dec-08	12.29	0.02	0.19	-	Jun-13	-	-	-	-
Jan-09	11.01	-	-	-	Jul-13	-	-	-	-
Feb-09	9.92	-	-	-	Aug-13	-	-	-	-
Mar-09	8.84	-	-	-	Sep-13	-	-	-	-
Apr-09	8.09	-	-	-	Oct-13	-	-	-	-
May-09	7.55	-	-	-	Nov-13	-	-	-	-
Jun-09	7.18	-	-	-	Dec-14	-	-	-	-
Jul-09	6.77	-	-	-	Jan-14	-	-	-	-
Aug-09	6.39	-	-	-	Feb-14	-	-	-	-
Sep-09	6.02	-	-	-	Mar-14	-	-	-	-
Oct-09	5.57	-	-	-	Apr-14	-	-	-	-
Nov-09	5.33	-	-	-	May-14	-	-	-	-
Dec-09	5.20	-	-	-	Jun-14	-	-	-	-
Jan-10	5.20	-	-	-	Jul-14	-	-	-	-
Feb-10	5.20	-	-	-	Aug-14	-	-	-	-
Mar-10	5.20	-	-	-	Sep-14	-	-	-	-
Apr-10	5.20	-	-	-	Oct-14	-	-	-	-
May-10	5.20	-	-	-	Nov-14	1.24	-	-	-
Jun-10	5.20	-	-	-	Dec-15	1.56	-	-	-
Jul-10	5.20	-	-	-	Jan-15	2.22	-	-	-
Aug-10	5.20	-	-	-	Feb-15	1.91	-	-	-
Sep-10	5.08	-	-	-	Mar-15	1.80	-	-	-
Oct-10	1.48	-	-	-	Apr-15	2.07	-	-	-
Nov-10	-	-	-	-	May-15	2.68	0.10	-	0.16
Dec-10	-	-	-	-	Jun-15	2.96	0.15	-	0.20
Jan-11	-	-	-	-	Jul-15	3.00	0.17	-	0.04
Feb-11	-	-	-	-	Aug-15	3.16	0.22	-	-
Mar-11	-	-	-	-	Sep-15	3.92	0.23	-	-
Apr-11	-	-	-	-	Oct-15	4.31	0.24	-	-
May-11	-	-	-	-	Nov-15	4.24	0.24	-	-
Jun-11	-	-	-	-	Dec-16	4.80	0.36	-	-
Jul-11	-	-	-	-	Jan-16	4.93	0.49	-	-
Aug-11	-	-	-	-	Feb-16	5.06	0.49	-	-
Sep-11	-	-	-	-	Mar-16	4.95	0.49	-	-
Oct-11	-	-	-	-	Apr-16	4.65	0.49	-	-
Nov-11	-	-	-	-	May-16	4.49	0.49	-	-
Dec-11	-	-	-	-	Jun-16	4.33	0.49	-	-
Jan-12	-	-	-	-	Jul-16	4.11	0.49	-	-
Feb-12	-	-	-	-	Aug-16	3.98	0.49	-	-
Mar-12	-	-	-	-	Sep-16	3.83	0.49	-	-
Apr-12	-	-	-	-	Oct-16	3.77	0.49	-	-
May-12	-	-	-	-	Nov-16	3.90	0.49	-	-
Jun-12	-	-	-	-	Dec-16	4.28	0.55	-	-

ANNEX 4:

Turkish Banking Sector Deposits Tenor Distribution

Date	Deposits Average Days To Maturity	Demand/Total	1M/Total	3M/Total	6M/Total	>=1Y/Total
Jan-08	39	14%	26%	55%	4%	1%
Feb-08	39	14%	26%	55%	4%	1%
Mar-08	38	15%	28%	52%	4%	1%
Apr-08	37	16%	28%	52%	3%	1%
May-08	38	14%	27%	55%	3%	1%
Jun-08	36	16%	29%	52%	3%	1%
Jul-08	37	15%	29%	51%	3%	2%
Aug-08	39	13%	27%	55%	3%	2%
Sep-08	38	15%	26%	54%	3%	2%
Oct-08	38	13%	33%	50%	3%	2%
Nov-08	39	12%	29%	55%	3%	2%
Dec-08	38	13%	29%	54%	2%	2%
Jan-09	39	12%	29%	55%	3%	1%
Feb-09	38	14%	29%	53%	2%	1%
Mar-09	38	13%	31%	52%	2%	1%
Apr-09	38	13%	29%	54%	2%	2%
May-09	38	13%	28%	55%	2%	2%
Jun-09	38	14%	28%	54%	2%	1%
Jul-09	37	15%	28%	54%	2%	2%
Aug-09	38	13%	29%	54%	2%	2%
Sep-09	37	16%	27%	53%	2%	2%
Oct-09	38	14%	28%	53%	3%	2%
Nov-09	38	15%	28%	53%	3%	2%
Dec-09	38	15%	26%	54%	2%	2%
Jan-10	38	14%	29%	53%	3%	1%
Feb-10	37	15%	28%	53%	3%	1%
Mar-10	37	14%	28%	53%	3%	1%
Apr-10	37	14%	29%	53%	3%	1%
May-10	37	14%	30%	52%	3%	1%
Jun-10	36	15%	29%	52%	3%	1%
Jul-10	37	15%	28%	53%	3%	1%
Aug-10	37	14%	29%	53%	3%	1%
Sep-10	37	15%	28%	53%	4%	1%
Oct-10	37	16%	27%	52%	4%	1%
Nov-10	37	14%	30%	51%	4%	1%
Dec-10	38	16%	25%	54%	4%	1%
Jan-11	39	15%	23%	57%	4%	2%
Feb-11	39	16%	21%	57%	4%	2%
Mar-11	40	15%	19%	59%	5%	2%
Apr-11	43	15%	17%	59%	8%	2%
May-11	43	15%	16%	58%	8%	3%
Jun-11	43	17%	14%	58%	9%	3%
Jul-11	43	16%	14%	60%	8%	3%
Aug-11	44	17%	13%	59%	8%	3%
Sep-11	45	16%	13%	59%	9%	4%
Oct-11	45	15%	12%	60%	9%	3%
Nov-11	44	17%	13%	59%	8%	3%
Dec-11	44	16%	13%	61%	8%	3%
Jan-12	44	15%	12%	63%	8%	3%
Feb-12	44	16%	12%	61%	8%	3%
Mar-12	44	15%	12%	62%	8%	3%
Apr-12	43	16%	12%	61%	8%	3%
May-12	44	15%	12%	63%	8%	3%
Jun-12	43	16%	11%	63%	7%	3%
Jul-12	42	17%	12%	62%	6%	2%

Date	Deposits Average Days To Maturity	Demand/Total	1M/Total	3M/Total	6M/Total	>=1Y/Total
Aug-12	42	15%	11%	65%	6%	2%
Sep-12	42	16%	12%	64%	6%	2%
Oct-12	41	16%	13%	62%	6%	2%
Nov-12	42	15%	13%	63%	7%	2%
Dec-12	42	16%	14%	61%	7%	2%
Jan-13	44	15%	12%	62%	7%	4%
Feb-13	45	17%	13%	60%	7%	4%
Mar-13	47	16%	12%	59%	7%	5%
Apr-13	47	16%	13%	59%	7%	6%
May-13	48	16%	14%	57%	7%	7%
Jun-13	47	17%	13%	56%	6%	6%
Jul-13	45	18%	14%	57%	5%	6%
Aug-13	46	17%	13%	59%	5%	6%
Sep-13	44	18%	12%	60%	5%	5%
Oct-13	44	17%	13%	61%	5%	5%
Nov-13	44	17%	13%	61%	5%	5%
Dec-13	43	18%	13%	60%	4%	4%
Jan-14	43	17%	13%	61%	4%	4%
Feb-14	43	17%	13%	62%	4%	4%
Mar-14	43	17%	12%	63%	4%	4%
Apr-14	43	18%	12%	61%	4%	4%
May-14	43	17%	13%	61%	5%	4%
Jun-14	43	18%	13%	59%	5%	4%
Jul-14	43	19%	13%	58%	5%	4%
Aug-14	44	18%	13%	59%	5%	5%
Sep-14	43	18%	14%	59%	5%	4%
Oct-14	44	18%	13%	60%	5%	4%
Nov-14	43	17%	14%	60%	5%	4%
Dec-14	43	18%	15%	59%	4%	4%
Jan-15	43	17%	15%	59%	4%	4%
Feb-15	43	19%	15%	58%	4%	5%
Mar-15	43	18%	16%	59%	3%	5%
Apr-15	42	18%	15%	60%	3%	5%
May-15	43	18%	15%	59%	3%	5%
Jun-15	42	19%	15%	59%	4%	4%
Jul-15	41	20%	15%	57%	4%	4%
Aug-15	41	19%	15%	59%	4%	3%
Sep-15	40	20%	15%	58%	3%	3%
Oct-15	41	18%	14%	61%	3%	3%
Nov-15	40	20%	15%	59%	3%	3%
Dec-15	41	19%	14%	60%	4%	3%
Jan-16	41	18%	13%	61%	4%	3%
Feb-16	41	19%	14%	59%	4%	3%
Mar-16	42	18%	14%	60%	5%	3%
Apr-16	42	18%	13%	60%	5%	4%
May-16	41	19%	14%	59%	4%	3%
Jun-16	41	20%	13%	59%	4%	3%
Jul-16	41	19%	15%	58%	4%	3%
Aug-16	42	19%	14%	59%	5%	4%
Sep-16	42	19%	14%	59%	4%	4%
Oct-16	41	19%	15%	59%	4%	4%
Nov-16	41	20%	15%	57%	4%	4%
Dec-16	41	20%	15%	57%	4%	4%

ANNEX 5:

Turkish Banking Sector Loan Balances

Monthly Average million TRY)				
Date	Total TRY	Total FC in TRY	FX Adjusted Total FC	FX Adjusted Total
Jan-08	213,322	26,723	42,398	255,720
Feb-08	218,960	28,471	44,071	263,031
Mar-08	224,491	31,590	45,782	270,273
Apr-08	230,723	33,512	46,927	277,649
May-08	238,199	31,906	46,734	284,933
Jun-08	246,191	32,043	47,200	293,391
Jul-08	251,584	31,922	47,695	299,280
Aug-08	257,417	30,406	47,758	305,175
Sep-08	263,497	32,754	49,635	313,133
Oct-08	265,902	37,574	49,055	314,957
Nov-08	261,708	38,786	47,726	309,434
Dec-08	259,871	37,577	46,737	306,608
Jan-09	257,005	37,918	45,740	302,745
Feb-09	254,283	38,323	45,112	299,396
Mar-09	252,450	39,119	44,442	296,892
Apr-09	253,973	36,375	44,315	298,288
May-09	256,583	35,930	44,204	300,787
Jun-09	260,479	35,961	44,413	304,892
Jul-09	262,154	36,457	45,707	307,861
Aug-09	261,830	39,447	50,160	311,990
Sep-09	263,297	41,417	52,132	315,429
Oct-09	269,316	42,279	53,191	322,507
Nov-09	273,813	44,617	55,371	329,184
Dec-09	278,544	46,004	57,129	335,673
Jan-10	283,153	48,088	61,381	344,535
Feb-10	287,425	51,850	65,190	352,615
Mar-10	291,950	55,343	69,278	361,228
Apr-10	301,144	58,097	75,135	376,279
May-10	308,586	63,810	80,879	389,465
Jun-10	317,287	67,149	84,890	402,177
Jul-10	326,312	71,475	91,228	417,540
Aug-10	331,581	72,274	93,802	425,383
Sep-10	336,457	75,463	98,510	434,967
Oct-10	346,412	76,941	102,737	449,149
Nov-10	356,489	80,511	107,119	463,608
Dec-10	365,947	88,293	112,281	478,228
Jan-11	373,601	97,009	118,725	492,327
Feb-11	381,727	103,368	124,933	506,659
Mar-11	390,912	107,388	129,160	520,071
Apr-11	404,177	108,953	134,554	538,731
May-11	416,831	115,406	137,696	554,526
Jun-11	430,753	119,274	140,683	571,436
Jul-11	440,988	124,988	142,242	583,230
Aug-11	447,527	136,453	145,501	593,029
Sep-11	454,812	138,687	147,279	602,091
Oct-11	462,459	142,622	150,055	612,514
Nov-11	467,507	141,976	150,367	617,874
Dec-11	473,127	146,607	152,348	625,475
Jan-12	478,889	144,376	153,983	632,872
Feb-12	483,894	141,394	155,930	639,824
Mar-12	491,228	146,351	158,945	650,173
Apr-12	503,130	148,209	161,276	664,406
May-12	513,171	151,528	164,520	677,692
Jun-12	524,728	154,768	167,757	692,485
Jul-12	530,287	154,311	169,727	700,014

Monthly Average million TRY)				
Date	Total TRY	Total FC in TRY	FX Adjusted Total FC	FX Adjusted Total
Aug-12	538,196	154,656	170,930	709,126
Sep-12	543,696	157,828	171,818	715,514
Oct-12	550,225	160,183	173,641	723,866
Nov-12	558,891	159,040	173,939	732,830
Dec-12	570,513	163,872	178,314	748,827
Jan-13	578,285	166,467	182,157	760,442
Feb-13	587,832	169,574	184,905	772,737
Mar-13	601,509	174,698	188,957	790,466
Apr-13	616,752	176,852	192,165	808,918
May-13	635,353	185,696	197,998	833,352
Jun-13	654,884	204,581	209,178	864,062
Jul-13	669,154	211,669	212,425	881,578
Aug-13	682,590	218,006	215,011	897,601
Sep-13	697,805	228,028	217,922	915,727
Oct-13	707,708	228,340	221,228	928,936
Nov-13	717,285	235,681	224,503	941,787
Dec-13	732,401	246,209	226,855	959,256
Jan-14	743,893	267,397	229,952	973,845
Feb-14	752,958	268,265	233,833	986,792
Mar-14	758,140	272,695	235,431	993,571
Apr-14	765,292	262,728	236,402	1,001,694
May-14	773,934	261,056	238,956	1,012,890
Jun-14	787,512	267,823	243,108	1,030,620
Jul-14	795,723	271,078	246,341	1,042,064
Aug-14	805,937	282,918	253,847	1,059,783
Sep-14	817,452	293,109	258,865	1,076,316
Oct-14	829,333	300,951	263,173	1,092,506
Nov-14	838,993	304,301	270,193	1,109,186
Dec-14	853,522	315,949	273,847	1,127,369
Jan-15	863,846	320,553	277,023	1,140,869
Feb-15	879,206	339,322	280,862	1,160,067
Mar-15	892,501	356,740	284,184	1,176,685
Apr-15	907,862	367,225	288,045	1,195,906
May-15	924,824	371,880	288,769	1,213,593
Jun-15	943,025	384,523	294,142	1,237,166
Jul-15	954,897	387,392	295,959	1,250,856
Aug-15	962,311	412,281	296,033	1,258,344
Sep-15	970,111	435,747	295,339	1,265,450
Oct-15	974,068	425,366	298,970	1,273,038
Nov-15	980,364	411,965	297,899	1,278,263
Dec-15	985,968	421,095	298,165	1,284,133
Jan-16	993,525	433,023	300,565	1,294,090
Feb-16	1,004,402	431,565	301,477	1,305,879
Mar-16	1,009,289	424,441	303,288	1,312,576
Apr-16	1,021,092	424,603	306,497	1,327,589
May-16	1,031,354	447,121	309,958	1,341,312
Jun-16	1,041,044	444,426	312,038	1,353,082
Jul-16	1,053,211	447,631	310,504	1,363,715
Aug-16	1,057,062	453,447	314,766	1,371,828
Sep-16	1,063,918	457,322	315,892	1,379,810
Oct-16	1,071,540	475,495	318,668	1,390,208
Nov-16	1,081,106	508,728	319,974	1,401,080
Dec-16	1,100,975	532,336	317,828	1,418,803

ANNEX 6:

VAR Lag Order Selection Criteria						
Endogenous variables: TLLOANCHANGE AVERAGETLRR MARGINALTLRR COSTBASETL TLINTE...						
Exogenous variables: C						
Date: 08/16/17 Time: 14:44						
Sample: 2008M01 2016M12						
Included observations: 100						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1031.3845...	NA	41.28223	20.74769	20.90400	20.81095
1	-217.24232...	1514.304	7.20e-06	5.184847	6.279018*	5.627677
2	-153.96693...	110.0992	4.21e-06	4.639339	6.671371	5.461739
3	-76.952578...	124.7633	1.89e-06*	3.819052*	6.788946	5.021021*
4	-47.915379...	43.55580	2.25e-06	3.958308	7.866063	5.539846
5	-20.421709...	37.94126	2.84e-06	4.128434	8.974051	6.089542
6	11.8160547...	40.61958	3.36e-06	4.203679	9.987157	6.544356
7	59.2438628...	54.06770*	3.07e-06	3.975123	10.69646	6.695370
8	92.1556459...	33.57002	3.97e-06	4.036887	11.69609	7.136703
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

VAR Lag Order Selection Criteria						
Endogenous variables: FXLOANCHANGE AVERAGE_FX_RR MARGINALFXRR COSTBASEFX IPIND...						
Exogenous variables: C						
Date: 08/16/17 Time: 14:43						
Sample: 2008M01 2016M12						
Included observations: 100						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-721.81649...	NA	0.084506	14.55633	14.71264	14.61959
1	-42.427704...	1263.663	2.18e-07	1.688554	2.782726*	2.131385
2	32.3086570...	130.0413*	1.01e-07*	0.913827*	2.945860	1.736227*
3	62.8554804...	49.48585	1.15e-07	1.022890	3.992784	2.224860
4	93.3694824...	45.77100	1.33e-07	1.132610	5.040366	2.714149
5	124.861745...	43.45932	1.55e-07	1.222765	6.068382	3.183873
6	160.901237...	45.40976	1.71e-07	1.221975	7.005453	3.562653
7	195.628323...	39.58888	2.01e-07	1.247434	7.968773	3.967680
8	226.226558...	31.21020	2.72e-07	1.355469	9.014669	4.455285
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						