Determinants of Banks Liquidity: Empirical Evidence on Turkish Banks

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ABSTRACT

The significance of holding an optimal level of liquidity has become prominent following the eruption of the global financial crisis. Hence, the main objective of this study is to identify the determinants of conventional banks' liquidity in Turkey. This study used the financial data of 21 Turkish banks over the period of 2006-2013, and employed two liquidity ratios i.e. the ratio of liquid assets to customer deposits and short term funding (first ratio), and the ratio of liquid assets to total deposits (second ratio). Bank specific, macroeconomic variables, and the realisation of the global financial crisis were analysed by performing panel random effect regression. The results of the study suggested that only bank capitalisation has positive and statistically significant impact on both liquidity ratios, while loan loss reserve ratio has positive and statistically significant impact on the first ratio, and bank size has negative and statistically significant impact on the same ratio. On the other hand, bank profitability has negative and statistically significant impact on the second liquidity ratio. The results of both regression tests revealed that macroeconomic indicators and the crisis dummy variable have non-significant relations with both liquidity ratios.

Keywords: liquidity determinants, Turkish conventional banks, panel random effect, bank specific variables, macroeconomic variables, financial crisis.

ÖZ

Küresel finans krizinin patlak vermesi sonrasında bankalarda likiditenin optimal seviyede tutulmasının önemi daha belirgin bir hale gelmiştir. Bu nedenle, bu çalışmanın temel amacı, Türkiye'de geleneksel bankaların likidite belirleyicilerini tespit etmektir. Bu çalışmada 2006-2013 dönemi için 21 Türk bankalasının finansal verileri kullanılmış ve iki likidite oranı hesaplanmıştır. Bunlardan birinci oran, likit aktiflerin müşteri mevduatı ve kısa vadeli fonlamaya oranı, ikinci oran ise likit aktiflerin toplam mevduata oranı olarak hesaplanmıştır. Regresyon analizi ile bankaların kendi karakteristik özellikleri, makroekonomik değişkenler ve küresel finans krizinin banka likiditesini nasıl etkilediği test edilmiştir. Araştırma bulguları bankaların kendi sermayelerinindeki artışın, ve kredi zararı için ayrıdıkları karşılık oranının banka likidite oranına pozitif bir etkisi olduğunu göstermistir. Öte yandan bankaların ölçek büyüklüklüğü ve karlılığı likiditelerini olumsuz etkilediği tesbit edilmiştir. Her iki regresyon testlerinin sonuçları makroekonomik göstergeler ve kriz kukla değişkeni likidite oranları ile anlamlı olmayan ilişkiler ortaya koymuştur.

Anahtar Kelimeler: Likidite belirleyicileri, geleneksel bankalar, panel data, Türkiye, makroekonomik eğişkenler, finansal kriz.

DEDICATION

This humble work is dedicated to:

The souls of my Father and Mother

My loving sisters (Amina, Douna, Fahima, Madina, and Amal)

Whose prayers, love, and encouragement have been always the catalyst for every single achievement I made in my life.

My Fiancée (Reem al-Khateeb)

Who lit up my stressful nights and inspired me throughout.

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LIST OF ABBREVIATIONS

OLS	Ordinary Least Squares
BCBS	Basel Committee on Banking Supervision
GDP	Gross Domestic Product
RWL	Risk weight loss
IMF	International Monetary Fund
CBRT	Central Bank of the Republic of Turkey
LLC	Levin, Lin, and Chu test
DW	Durbin Watson
AC	Autocorrelation
FIs	Financial institutions
LCR	Liquidity Coverage Ratio
NSF	Net Stable Funding Ratio
BRSA	Banking Regulation and Supervision Agency of Turkey

Chapter 1

INTRODUCTION

The core function of banks in the economy is to transform money from its surplus units to its deficit units. In other words, to transform the short term deposits into long term loans. In the meantime, this classic transformation has extended, as banks create liquidity on both sides of their balance sheets, which has enabled banks to lend or promise liquid monetary items to both borrowers and depositors based on holding illiquid items (Tseganesh, 2012). This maturity transformation as well as offering insurances regarding depositors' potential liquidity needs are the main reasons behind the fragility of these financial institutions (Diamond and Dybvig 1983). In this sense, banks are highly exposed to the maturity mismatch between loans and deposits. This creates the liquidity risk that may cause huge losses for banks, and in extreme cases it may even cause banks to become insolvent.

Given the fragility of banks, the duty of their managers is to ensure holding sufficient level of liquidity has become fundamental. However, the task is not about maximizing the liquid financial instruments in banks' balance sheets, as these instruments do not yield returns, rather it is about optimizing the amount of liquid financial assets. For this reasons, questions related to the level of liquidity and factors affecting the liquidity of banks become important to investigate. In this

respect, both bank-specific factors and macroeconomic factors that affect banks behaviors have to be taken into account.

Following the eruption of the global financial crisis in 2007-08, the importance of the subject of bank's liquidity has been amplified, as the consequences of this crisis have showed the significance of adequate liquidity risk management. This is mainly due to the failure of many banks during the crisis to maintain sufficient amount of liquidity, while unprecedented levels of liquidity were ordered from Central Banks in order to sustain the financial system (Teply, 2011). As a response, new regulations and principles including minimum liquidity buffers have been issued by the Basel Committee on Banking Supervision (BCBS) in order to enhance the quality of liquidity risk management and maintain a resilient banking system (BCBS, 2011). All committee member states including Turkey are committed to the full implementation of these new regulations by 31 March 2019 (Moroglu and Aydin, 2016). Thus, these regulation will constitute the first influential factor on banks' liquidity.

Regarding to the situation of the Turkish financial system during the crisis, it is evident that this system was not examined substantially, as the magnitude and the duration of the financial shocks that the Turkish financial system was exposed to in this crisis were much smaller than the financial shocks that have been witnessed in Turkey during the local crisis of 1994 and 2001 (Cömert and Colak, 2014). Further, many of the new regulations suggested by BASEL committee to enhance banks' liquidity management were already implemented in Turkey as a part of the proactive

precautions strategy. Therefore, the Turkish economy and its banking system were ready to fund the liquidity demands and maintain stability at the time of the crisis (Cangürel et al., 2010 cited in Çölgezen, 2013). The significance of this paper is therefore stems from its empirical methods in approving the previous argument, while its question goes beyond the impact of the financial crisis to be on twofold: First, at that time, what was the influence of internal bank factors and macroeconomic indicators on Turkish banks' liquidity size? Second, what was the impact of the global financial crisis on this size?

1.1 Objective of the Study

The main objective of this study is to explore the factors that are significantly influence the liquidity buffers of Turkish banks over the period of 2006-2013. Through employing two different liquidity ratios namely: The ratio of liquid assets to customer deposits and short term funding, and the ratio of liquid assets to total assets, this study will examine whether banks' profitability, bank capitalization, and bank size are among the common factors that significantly influence banks' liquidity size in Turkey. Also, this study will determine if the asset quality or the quality of loans represented by the ratio of loan loss reserve has a significant impact on the two suggested liquidity ratios. Moreover, this study aims at investigating the influence of the macroeconomic indicators on banks' liquidity by including gross domestic product and inflation into its empirical test. Finally, this study will seek an empirical evidence on the impact of the global financial crisis on Turkish banks' liquidity.

1.2 Scope of the Study

The scope of this study will be limited to investigate the impact of six factors namely: Return on equity, bank capitalization, asset quality, bank size, GDP, and

inflation on banks liquidity in Turkey, in addition to the impact of the global financial crisis. This empirical study will be based on the annual data of 21 conventional Turkish banks over the period of 2006-2013. Indeed, the scope of this study is adequate to meet the requirement of the utilized research methodology, and it is broad enough to capture the realization of the global financial crisis, thereby it is sufficient to achieve the core objectives of this study.

1.3 Structure of the Thesis

This work will be structured as follows:

Chapter one or the introduction part: It consists of the significance of the subject of banks' liquidity and how it has been amplified following the global financial crisis, in addition to the objective, scope, and the structure of the thesis.

Chapter two or the literature review part: It includes a brief background on liquidity risk, the banking regulations, and the position of Turkish banks, in addition to the past studies on the determinants of banks liquidity.

Chapter three: this chapter starts by acknowledging the sources of the data employed, then introducing the two statistical models accompanied with a comprehensive description of the variables utilized in these models. Finally, it will illustrate the methodology of this research.

Chapter four: this part consists of the empirical analysis and the results of the methodological tests suggested in chapter three.

Chapter five: a conclusion summarizing the outcome of this work.

Chapter 2

LITERATURE REVIEW

2.1 Liquidity and Liquidity Risk

The best starting for this research requires looking at the best definition of liquidity and its concepts before moving to address its associated problems and regulations. Basel Committee (2008) defines liquidity as the capacity of depository institution to fund increases in assets and meets its commitments when they mature. Indeed, the importance of liquidity in banks and other depository institutions is derived from its main role in transforming short-term deposits into long term loans. This thing that creates banks' exposure to the so called liquidity risk.

Studies distinguish between two types of liquidity: funding liquidity and market liquidity. Funding liquidity refers to bank's ability to raise money for funding its expected and unexpected commitments at reasonable cost. In other words, it refers to bank's ability to attract sufficient funds without incurring losses or disrupting bank's daily operations, while market liquidity refers to the capacity of bank to raise funds by liquidating its assets instead of borrowing. If this liquidity is low, then liquidating the assets will be done at lower price than expected (Bonner et al., 2015). Hence, Kyle (1985) points out that market liquidity takes three forms 1) bid-ask prices gap 2) market depth, or the amount that can be sold before causing the price to change, and 3) market resiliency, or the time needed for depressed prices to restore its

original value. However, the afore-mentioned concepts of liquidity will become clearer after considering the risk associated with it.

As indicated above, the fundamental role of depository institutions is to transform short term deposits into long term loans. Hence, banks are facing commitments on both balance sheet sides, and these commitments require sufficient amounts of cash to be met without incurring losses. In this context, Liquidity risk refers to the failure of depository institution to meet the suggested commitments at reasonable cost. In other words, it refers to the possibility that the financial institution will fund illiquid (Bonner et al., 2015).

Given its fundamental role and the nature of its operations, banks face many problems that can threaten its solvency. These problems are in the form of interest rate risk, market risk, technology risk, off-balance sheet risk, sovereignty risk, credit risk and foreign exchange risk, but unlike these types of risk, liquidity risk tends to be a normal side of the everyday management of banks, as banks are required to control its liquidity and ensure its sufficiency on daily basis, and this is to pay back immediately the promised deposits for its holders or to meet all expected loan commitments. Nonetheless, Liquidity risk may still threaten bank's solvency if bank completely fails to generate the liquidity required to pay back the promised deposits (Saunders et al., 2006). However, this happens in extreme circumstances or at the time of sudden crisis as we shall explain later.

The reason why the causes, repercussions and the treatment of liquidity risk are explained in this chapter is to provide a better understanding of why banks must have an optimal liquidity buffers. However, a simple and clear answer to this question will be provided following the next explanation of liquidity risk which is mostly derived from the book of Saunders et al. (2006).

In line with the definition of liquidity risk mentioned above, Saunders et al. (2006) explain the causes of liquidity risk, and how they develop in extreme cases resulting in insolvent financial institution. They articulate that liquidity risk is attributed to two reasons: an asset side reason and a liability side reason. Liquidity risk arises in the asset side when financial institution practice its off-balance sheet commitment such as the contracts of loan commitment. This type of contracts allows customer to borrow an agreed amount of loan over a commitment period, and the bank is obligated to offer the loan immediately on demand, which creates a need for liquidity. Regarding to the liability side liquidity risk, it occurs when deposits holders withdraw their deposits immediately which creates a pressure on banks to offer the required cash. However, in both causes of liquidity risk, financial institutions meet the required liquidity first by using its cash reserve, but this reserve is rarely sufficient since FIs tend to avoid liquid assets which yields no interests, instead it is preferable to invest on less liquid and more risky assets to yield higher returns. In here, it is crucial for FIs management to balance between its self-insurance against liquidity shortage and the profits generated from illiquid assets (Baltensperger, 1980). Therefore, FIs have to respond to the liquidity demands either by liquidating

its stored assets or by borrowing additional funds, but none of these methods are free of cost (Saunders et al., 2006).

Indeed, FI manager must observe the liquidity position of his institution and tries accurately to predict the potential distribution of net deposits drains in the FI's balance sheet, which refers to the gap between deposits withdrawals and deposits additions. In the case of net deposits drains and the lack of liquidity, banks overcome this shortage by entering the money market to borrow additional funds, which is called purchased liquidity management and this can be done by seeking loans from the federal funds, repurchase agreements, sell bonds and notes, or by issuing fixed-maturity wholesale certificates of deposit. However, this is also not free of cost since banks must pay an interest (market rate) on these loans. The other method available to FIs is called stored liquidity management. Instead of seeking loans from the wholesale money market, banks could overcome the liquidity shortage by utilizing its stored liquidity, an excess liquidity to the required cash reserves determined by Central Banks or banking regulations. However, if this excess was not sufficient to overcome the deposit drain, it is still available for bank to liquidate some assets by selling them immediately in the market, but it can be noted that this would make banks vulnerable to the cost of fire sale price, which means that assets' prices would be depressed and less than the original prices when the same assets would be sold in normal market conditions.

An additional mechanism concerns the liability side of bank's balance sheet to overcome the liquidity shortage or to hedge against the potential financial crisis is

using the last resort option provided by the central bank, which is an emergency liquidity assistance provided to particular illiquid financial institutions in specific circumstances (Vodova, 2012).

However, all the suggested solutions can alternate each other and can be used together to face liquidity problems, and they are all efficient solutions in normal conditions and expected deposit drains, but liquidity crisis arises when these methods become inefficient, and this is when banks face sudden deposits drain and unexpected liquidity shocks as we shall explain (Saunders et al., 2006).

As a response to some concerns related to the solvency of depository institutions or as a result to a sudden switch in investor preferences to nonbank financial assets, large and unexpected increase in deposit withdrawals will be faced and bank run situation will be triggered which can enforce banks into insolvency. Indeed, once the bank run situation erupted, bank initially and as indicated above, will seek to overcome this demand by using its cash reserves, then by liquidating all marketable assets such as treasury bonds and treasury bills. And finally by entering the money market to borrow short, but as the bank struggling to fund its commitments, more deposit holders will call their deposits back which results in inefficient and expensive procedures to meet the required cash and frames the first sign of liquidity crisis. This crisis may not be limited to the insolvent financial institution, as the contagious effect of bank run may produce a situation of bank panic and call all deposit holders to lose their trust in the whole banking system and seek withdrawing their deposits

indiscriminately from all FIs, the thing that drive the whole system into a financial crisis (Saunders et al., 2006).

After considering the afore-mentioned explanation, it seems to be obvious that banks must maintain an optimal amount of liquidity to meet expected and unexpected cash demands, and must recognize all bank specific and macroeconomic factors that influence this liquidity, and this is mainly due to the cost accompanied with the available methods to generate cash and the probability that these methods will become inefficient and cause banks to be on the brink of collapse. However, banks also must take into account the trade-off between the hedges against liquidity shortages which requires holding liquid assets and the highly yielding illiquid assets, in addition to the international standards of banking regulations that are issued by the Basel Committee on Banking Supervision (BCBS) to keep strong and resilient banking systems as explained in the following section.

Prior to the eruption of the global financial crisis in 2007, new standards for banks were introduced in the form of Basel II accord. In fact, this accord established a group of procedures to monitor operational, market and credit risk, and it was assumed that these procedure were adequate to stabilize banks and build strong and resilient banking system. But at the time of the financial crisis, only banks with sufficient liquidity could resist the liquidity shakes of the crisis and meet their obligations, while banks with low liquidity ratios could not. This is what alerted the Basel Committee on Banking Supervision (BCBS) about the necessity of assessing the liquidity risk. Hence, they established new banking regulations accord called

Basel III. This accord paid considerable attention to capital and equity as well as liquidity management, and was introduced as a global regulatory framework for more resilient banks and banking system (Gideon et al., 2012). In the matter of applying Basel III requirements, it is expected that all the committee member states including Turkey will comply their domestic requirements with the international requirements by 31 March 2019 (Moroglu and Aydin, 2016).

2.2 New Liquidity Regulations

As an initial response in 2008, BCBS developed some principles in the form of detailed guidance to enhance the quality of liquidity risk management and supervision. However, only the full implementation of this guidance can guarantee better management in this area, so the Committee also has assigned group of supervisors to follow up banks' performance and ensure that banks are implementing these fundamental principles completely. Later on, the Committee has supplemented the suggested principles by developing two minimum standards for funding liquidity as an extra element of liquidity framework. The first liquidity standard is the Liquidity Coverage Ratio {LCR} which aims at achieving short-term banks' stability and this is by holding sufficient high quality of liquidity sources that are adequate to absorb short-term liquidity stress lasts less than one month. Regarding to the achievement of resilient and stable banks over long time period, the Net Stable Funding Ratio {NSF} that has a time horizon of one year has been developed (BCBS, 2011).

2.3 The Position of Turkish Banks

In Turkey, the mission of transforming the banking system towards the international standardized principles and regulations has been assigned to an independent banking

entity called the Banking Regulation and Supervision Agency BRSA, which was established in 2000 to provide stability to financial markets, secure the rights of depositors and stakeholders, and supervise the activities of the banking sector (BDDK, 2007). Investigating the position of Turkish banks following the eruption of the financial crisis reveals that Turkey was one of the very few countries that could survive and resist the impact of the global crisis, and this is mainly due to the implementation of flexible monetary policies and capital inflow that have highly contributed to the protection of the banking sector in Turkey (Çölgezen, 2013).

In regards to the main feature of the global crisis which is liquidity shortage, it is approved that the establishment of Turkish lira reserves as foreign exchange and gold has benefited the banking sector in Turkey in terms of liquidity need and its cost which resulted in the reduction of the Turkish lira borrowing from the Central Bank. Although the ratio of liquid assets to the total assets declined, it can be noted that liquidity coverage ratio {LCR} remained above the minimum rate suggested by Basel III which is 100% (Çölgezen, 2013). Many of the suggested standards that have been brought up by Basel III accord were already implemented by Turkish banks as a part of the proactive precautions taken by BRSA before the eruption of the financial crisis. This made the Turkish banks relatively ready to fund the liquidity demand and continue functioning without facing serious liquidity problems at the time of the crisis. In fact, the Turkish Central Bank (CBRT) responded to previous crisis by promoting well supervised banking sector and effective liquidity management.

A series of precautions were also followed regarding to the banking system foreign exchange liquidity and monetary policies (Cangürel et al., 2010 cited in Çölgezen, 2013).

In the meantime, the Central Bank of Turkey (CBRT) and the Banking Regulation and Supervision Agency (BRSA) sequently issue new guidelines and amendments to the domestic banking regulation to comply with and exceeds the requirements of Basel III. For example, in line with the definition of liquidity coverage ratio {LCR} which is the ratio of high quality liquid assets to the net cash outflows over a one month stress period. BRSA, on 21 March 2014 identified the level of this ratio for the Turkish banks to ensure that they have sufficient high liquid assets in the short run. BRSA classified high liquid assets into three categories (Level 1, 2A and 2B assets) based on their degree of liquidity and determined that the {LCR} is 80% for foreign exchange liquidity and 100% for Turkish lira liquidity (Matthews and Keskin, 2015). Further updates regarding the regulatory environment and the rules of calculating {LCR} to align Turkish regulation with the standardized approach of Basel committee have been issued by BRSA on August 2015 and February 2016 respectively (Moroglu and Aydin, 2016; Matthews and Keskin, 2015).

2.4 Past Studies on the Determinants of Liquidity

Taking into account the serious liquidity problems at the time of the global financial turmoil and the attention that has been paid to the necessity of maintaining an optimal liquidity buffers in banks' balance sheets, the literature on the determinants of liquidity risk still relatively scarce. Nonetheless, the current studies are able to reflect the importance of considering the variables that impact bank's liquidity other

than the regulatory impact of banking authorities. Indeed, reviewing the current literature reveals diverse sample scopes and different liquidity measures, more exactly some studies as this paper utilize balance sheet liquidity ratios to represent liquidity risk exposure, while other studies employ the two liquidity indicators recommended by the Basel committee; Liquidity Coverage Ratio and Net Stable Funding Ratio {LCR, NSFR}. Furthermore, the current research on the determinants of liquidity risk examine some bank specific and macroeconomic variables that exceed the variables chosen for this paper as we shall review in the following section.

A significant research by Cucinelli (2013) employed the liquidity coverage ratio and the net stable funding ratio as liquidity measures. This study was conducted on a sample of 1080 Eurozone banks and investigated the interconnection between some bank specific variables (asset quality, capitalization and size) and liquidity risk. The results suggested a significant impact on at least one of the two indicators. Regarding to the sign of their relations, Cucinelli highlights that bank size negatively impacts bank's liquidity, this is in line with the theory of "too big to fail" which suggests that bigger banks are less motivated to hold liquid assets since they rely on the Central Bank and government intervention at the time of the crisis, while capitalization has a positive impact only on NSFR which represents the long term liquidity. With regard to the asset quality, its impact was only on the short term liquidity (LCR).

Another study by Angora and Roulet (2011) employed the two liquidity indicators of Basel III. They used a sample comprised of US and European publicly traded

commercial banks over the period of 2000-2008. Similar to this paper, authors classified their explanatory variables into two categories: internal i.e. balance sheet variables (the natural logarithm of total assets, ROE, loans to deposits ratio…etc.) and external i.e. macro-economic indicators such as GDP growth rate, central bank rate and internal bank rate. They underline that GDP growth rate and central bank rate have significant and positive relationships with liquidity indicators, while most internal variables show negative relationships with liquidity ratios.

By using a sample composed of European and North American banks over the period of 2002-2009 and employing three different measures of liquidity risk, Bonfim and Kim (2011) attempt to understand whether banks have similar liquidity strategies in stress period, and also to identify the determinants of liquidity risk. Regarding the first interest of their study, they emphasize that prior to a crisis period, banks in general and big banks in particular collectively witness a global deterioration in their liquidity figures. With regard to the determinants of liquidity risk, they highlight that bank size positively impacts bank liquidity which can be attributed to the higher profits generated by bigger banks, while the impacts of other variables such as bank performance and the ratio of loans to deposits seem to be ambiguous as they depend on the liquidity ratio utilized.

Deléchat et al. (2012) investigate the determinants of banks' liquidity buffers in Central America by using a sample consisting of about 100 commercial banks with a time scale of five years (2006-2010). They underline that bank size, capitalization and bank performance negatively related to liquidity buffers. Additionally, they

suggest that less liquidity is held by foreign banks as well as banks with riskier loans. Another study by Moore (2010) addresses the determinants of bank liquidity with a sample of banks from Latin America and the Caribbean. In his study Moore (2010) concluded that bank liquidity has negative relations with interest rate, cash to deposits ratio, and business cycle. Also, he underlined that liquidity at the time of the crisis declined on average by approximately seven percentage points, but it increased on average by seventeen percentage points in the eighteen month period in the wake of the crisis.

Bunda and Desquilbet (2008) utilize a sample comprised of 1107 commercial banks from 36 emerging economies. They found that the financial crisis of 2000 has a significant and negative impact on liquidity ratios. In other words, banks are more vulnerable to liquidity risk during the financial crisis, while liquidity ratios is positively related to capitalization which is calculated as the ratio between equity and total assets. The last panel data by Nguyen et al. (2012) examined the relationship between liquidity risk and bank market power by employing a sample taken from 113 developed and developing countries. Authors underline that liquidity has a negative relations with bank size and positive relation with capitalization. They conclude also that liquidity tends to be higher in listed banks than non-listed banks.

Moving to address the past studies that focused on bank liquidity in one specific country requires considering firstly the work by Vodova (2013) who is deemed one of the main contributors in this area of literature in Europe. In his panel data regression analysis on Hungarian commercial banks over the period of 2001-2010,

Vodova (2013) employed three different liquidity measures and found that banks liquidity has positive relationship with banks' profitability, capital adequacy and interest rate on loans, while it has negative relationship with bank size, interest rate on interbank transactions, interest margin, and monetary policy interest rate. He addresses that the impact of GDP growth on liquidity is ambiguous. Earlier ,Vodova (2012) attempted to identify the determinants of liquidity in Polish commercial banks over the same period of 2001-2010 by using four liquidity measures and similar regression method, and he came out with different conclusions as he found that liquidity in Poland decreased as a result of the financial crisis and it is also negatively related to bank size, interest rate margin, and bank profitability, but it is positively related to interest rates on loans, interbank transactions, inflation, capital adequacy, and the share of non-performing loans.

The same author Vodova (2011) use the same variables and research methods to examine the determinants of liquidity in the Czech Republic, his results suggest that liquidity has negative relationships with financial crisis, inflation and business cycle, and it has positive relationships with interest rate on interbank transaction, interest rate on loans, share of nonperforming loans, and capital adequacy, while the relation with bank size is ambiguous.

Another study written within the context of liquidity in Czech Republic is Horvath et al. (2014) who was motivated by the impact of capital requirements such as the requirements suggested by Basel III on liquidity creation. Authors examined the relations between liquidity creation and capital by performing granger causality tests

on a data set of small Czech banks. Indeed, their studies show that capital negatively granger cause liquidity creation and liquidity granger cause the reduction in capital. However, these results are in line with the assumption that Basel III requirements can reduce liquidity creation while greater liquidity creation may threaten bank's solvency, the thing that generates the trade-off between self-insurance or financial stability represented by sufficient capital requirements and the benefits of higher returns or liquidity creation.

Mehmet (2014) uses multiple regression analysis to test the statistical significance and the explanatory variables of selected bank specific and macroeconomic variables in an attempt to identify the determinants of banks' exposure to liquidity risk in Bosnia and Herzegovina. He employed a sample composed of 17 out of 28 commercial banks within a time scale from 2002 to 2012, and used two different models of liquidity. His empirical results showed that only the reserve ratio and the ratio of loan to deposits are significant in both models, with a notice that the former is positively significant while the latter is negatively significant in one model and positively significant in the other. Regarding the other variables, he finds in his most robust model that liquidity has positive significant relations with bank size and loan loss reserve ratio, and negative significant relations with the share of nonperforming loans on total loans and bank performance represented by the ratio of return on equity, while no significant relations with GDP growth rate.

Aspachs et al. (2005) provides a comprehensive analysis of the determinants of UK banks liquidity by investigating the relationships between liquidity and a set of

internal and macroeconomics variables through the period from Q1 1985 to Q4 2003. In this study two liquidity ratios are used to conclude that liquidity in the UK is determined by a group of variables, such as: loan growth, short term interest rate, last resort support, interest margin, bank size, profitability, and GDP. The last reviewed study related to the determinants of liquidity in a European country is Giannotti et al. (2011), who underline based on their study on a sample of Italian banks that bigger banks tend to have lower liquidity exposure since big banks are characterized by good reputation and they are, therefore, less vulnerable to liquidity shocks.

Arif and Anees (2012) examine banks liquidity risk in Pakistan and assess its impact on banks' profitability. This study uses a sample consisting of 22 Pakistani banks through the period of 2004-2009, and examined whether the liquidity risk impacts bank profitability significantly. The presence of liquidity gap and nonperforming loans as factors that worsen the liquidity risk and they are negatively related to banks' profitability.

Two studies by Gilbert (2013) and Audo (2014) are related to banks' liquidity in African banks. In his study on analyzing the financial risk management in South African banks, Gilbert (2013) uses a sample of 12 banks over the period of 2006-2011 to examine the factors influencing liquidity risk management. He performs a regression model by regressing five bank specific factors (ROA, ROE, bank size, capital adequacy, and net working capital) to liquidity ratio and came out with the conclusion that bank size and net working capital are positively related to liquidity risk management, while capital adequacy has negative association with it. Audo

(2014) examines the relationships between the inflation rate and the liquidity of Kenyan commercial banks by employing a sample consisting of 43 commercial banks over the period of 2008-2013. His empirical findings suggest no significant relations and the inflation rate is not a macroeconomic factor that impacts the liquidity ratio of commercial banks in Kenya. Furthermore, he observes in his study that small banks in Kenya tend to have higher liquidity compared to medium and big banks.

Chapter 3

DATA AND METHODOLOGY

3.1 Data Collection

This research uses panel data from 21 conventional banks in Turkey over the period of 2006-2013 to conduct a regression analysis that estimates the determinants of liquidity risk in Turkey. In line with the previous literature we statistically examine the type and degree of relationships between two different liquidity ratios as dependent variables, and four bank specific factors and two macro-economic indicators as explanatory variables. The data of Turkish banks employed in this study is collected from the Bankscope database, whereas the macro-economic indicators is taken from the International Monetary Fund website.

The Islamic banks are excluded from this study because the nature of Islamic Banks' operations and their regulations are different from conventional banks. Theoretically speaking, the profit sharing nature of these banks makes them more stable and less vulnerable to liquidity shocks (Ali, 2013). Therefore, the liquidity risk of these banks must be studied in isolation.

The period between 2006 and 2013 is sufficient to meet the requirements of panel regression and broad enough to capture the impact of the global financial crisis. Hence, one dummy variable is utilized in this study to represent the realization of the

crisis and identify its impact on the two liquidity ratios. Also the year 2006 is when BCBS issued the final version of Basel II accord which intended to boost the quality of capital and risk management of banks.

3.2 Model Specification and Variable Description

3.2.1 Model Specification

OLS panel data regression analyses is used to identify the determinants of liquidity risk in Turkey by estimating the two following equations:

$$LIQD=\alpha_1+\beta_1(ROE)_{it}+\beta_2(TETA)_{it}+\beta_3(LLR)_{it}+\beta4(LTA)_{it}+\beta5(GDP)_{it}+\beta6(INF)_{it} +\beta7(FIC)_{it}+\varepsilon \quad (1)$$

$$LATA=\alpha_1+\beta1(ROE)_{it}+\beta_2(TETA)_{it}+\beta_3(LLR)it+\beta_4(LTA)_{it}+\beta_5(GDP)_{it}+\beta_6(INF)_{it} +\beta_7(FIC)_{it}+\varepsilon \quad (2)$$

Where:

LIQD: Liquid Assets/ Customer deposits and short-term funding

LATA: Liquid Assets/ Total Assets

ROE: Return on Equity (Net income/Total assets)

TETA: Total equity / Total Assets (Bank capitalization)

LLR: Loan Losses Reserve/ Total Loan (Loan Losses Reserve Ratio)

LTA: Logarithm of Total Assets (Bank Size)

GDP: Gross Domestic Product (growth rate %)

INF: Inflation (Consumer price index)

FIC: Financial Crisis Dummy Variable (Takes the value of 1 in 2009-2010)

α_1: Intercept for each model

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$: The coefficients of the two regression models

ε: Error term

All the variables employed in this study have already been examined in previous literature with different sample scales and different financial markets, thereby they all proved to have relationships with liquidity ratios. However, the next section provides a brief description of theses variables and a hint of its existence in literature.

1.3.2 Variables Description

- **LIQD (Liquid Assets/ Customer deposits and short term funding)**

  One of the method to measure Bank's liquidity is using different balance sheet ratios that reflect the liquidity trends and bank's ability to meet its commitments. Higher liquidity ratios means that bank has less exposure to liquidity risk. LIQD as the ratio of liquid assets to customer deposits and short term funding is one of these ratios that represents Banks's sensitivity to multiple types of funding. If this ratio is 100% or more this means that Bank's funding is sufficient enough to serve its obligation. Otherwise, bank would be more sensitive to deposits withdrawal (Vodova, 2011). This liquidity ratio are commonly employed in literature such as Mehmed (2014), Vodova (2011), Vodova (2013) and Munteanu (2012).

- **LATA (Liquid Assets/ Total Assets)**

  The other liquidity ratio used in this study is the ratio of liquid assets over total assets. This ratio is an informative tool reflects directly the ability of banks to absorb any potential liquidity shock. It represents the amount of cash, government securities, balances with other banks, reverse repo and other liquid assets hold within a bank. The higher value of this ratio reflects higher capacity of banks to absorb liquidity problems, but it should be taken

into account the negative relationships between liquid assets and income generation. High value of this ratio, therefore, is interpreted as insufficient balance sheet bears high opportunity cost for the bank and calls for considering the liquidity relation with bank's profitability (Vodova, 2011). Among the previous studies that employed this ratio as a measurement of liquidity are Vodova (2011), Barth et al. (2003), Vodova (2013) and Mehmed (2014).

- **ROE**

  Return on equity ratio is calculated by dividing the net profits to the total equity. It indicates how bank employs shareholders' money in order to maximize their profits. In other words, it measures the profits generated from shareholders' investment on equity. It is an indicator of Bank's performance. Therefore, high ROE reflects good performance and vice versa. However, equal ROE does not mean equal performance as an extra borrowings may result in a decrease in equity, thereby ROE is influenced by the structure of debt and equity. ROE has proved to have significant relations with bank's liquidity ratios. As indicated before high liquidity yields low income, so bank's profitability is examined in this study to reveal whether it is one of the determinants of liquidity ratios of Turkish banks or not. ROE as an explanatory variable in liquidity models are frequently used in literature such as Arif and Anees (2012), Mehmed (2014), and Gilbert (2013).

- **TETA (Bank Capitalization)**

The share of total equity on total assets. It also known as the capital adequacy ratio which has been a crucial theme to be controlled in all Basel accords. In fact, this ratio represent the likelihood of insolvency in banks. In other words, sufficient capital ratio maintains a stable financial system and hedges bank from operation risk, market risk, liquidity risk, and other types of risks related to its assets, thereby this ratio determines the sufficient capital and risk weight loss (RWL) required to serve that goals. According to Basel I and Basel II accords banks must maintain a capital adequacy ratio of 8% or more as well as managing its liquidity to keep banks safe and reassured depositors. This ratio elaborates the relations between risk and funding sources and banks must retain sufficient capital to achieve investors' goals starting from their confidence (Greenspan, 1998). The relations between liquidity risk and bank's capital and reserve always questionable within the literature as many authors following the financial crisis have focused their studies on this area. Sohaimi (2013), for instance, in his attempt to approach a full understanding of the liquidity risk in Malaysia concluded that liquidity risk impacts bank's capital and reserve significantly.

- **LLR: Loan Losses Reserve Ratio**

  The ratio of loan loss reserve account to total loans is used as a proxy of asset quality and negatively associated with credit risk as high value of this ratio requires lower capital to meet expected losses, but it reflects also more problematic loans called for a higher reserve account. The main business of banks is investing depositors' money on securities and loans. Indeed, the

majority of invested securities are issued by government and are less risky, whereas loans hold unexpected losses since banks cannot asses precisely the amount of unrepaid loans and this is why loan loss reserve account is required. Another reason to set up this reserve account is the need to have an accurate evaluation of bank's balance sheet. In other words, considering the amount of loans on the balance sheets as it is without adjustments is misleading to the board of directors and all bank's stakeholders, so uncertain loans must be viewed and a reserve account is needed to meet the expected losses (Walter, 1991). It is evident that bank capitalization has negative relations with risks. In other words, high value of this ratio reflects high value of liquidity and stability in the face of financial troubles. Mehmed (2014) investigates the determinants of liquidity risk in Bosnia and Herzegovina and finds that LLR has a significant positive impact on liquidity ratios.

- **LTA (Bank Size)**

  In accordance with previous studies such as Laeven (2015) and Gilbert (2013) the natural logarithm of total assets is used as a proxy to represent the size of the bank. Size as a determinant of liquidity is frequently examined in previous studies and it is expected that bigger banks tend to hold high liquidity, but in a comprehensive research conducted on a sample of 1080 banks within the Eurozone, Cucinelli (2013) came out with the conclusion that bank size is negatively related to bank's liquidity ratios and bigger banks witness higher exposure to liquidity risk. He attributed this to "too big to fall"

theory as big banks have less tendency to hold liquid assets because of its reliance on government interventions in case of liquidity shocks.

- **GDP**

  This study and in line with previous literature will be extended beyond the bank specific factors and covers two macroeconomic indicators (GDP and Inflation). GDP or Gross Domestic Product is a measure of the overall economic activities within a country. It is the mirror of the economic growth of a country and it is assumed that investments and economic developments within a country are highly influenced by the liquidity functions of its banking system. Gaytan and Ranciere (2001) argue that financial instability and liquidity troubles evolve with different levels of economic growth. They find that middle income economies are more vulnerable to face banking crisis while high and low income economies tend to develop more covered banking system. Taken into account that scholars suggests different results based on different liquidity measures in their studies, GDP has proved to be an explanatory variable in great bulk of liquidity models. Consider Vodova (2011) who finds that GDP is negatively related to bank's liquidity ratios in Czech, whereas the same scholar finds GDP's relation with liquidity is ambiguous in Hungary (2013).

- **INF**

  Inflation or consumer price index is a measure of the general level of prices within a country. It is negatively associated with the purchasing power of a

national currency, so governments and central banks and in order to keep the economy running smoothly should maintain low levels of inflation. According to a study conducted by Bunda and Desquilbet (2008) on a sample of commercial banks in emerging countries, inflation has a significant relationship with different liquidity measures, whereas Audo (2014) found no significant relationships between inflation and liquidity measures of Kenyan banks.

- **FIC (Financial Crisis)**

  Liquidity and credit shortage was prominent in all economic entities following the financial crisis in 2008 since the main feature of this period was the increased demand on money. However, there were some factors contributed to the success of Turkey to be less effected than other countries by this crisis. Turkey had an experience in dealing with crisis after 2001, thereby The Central Bank of the Republic of Turkey (CBRT) has made some regulations in the monetary policies to prevent the devastating impact of the global crisis on its financial system. Additionally, Turkey did not sign any agreement with the International Monetary Fund (IMF) which gave it an advantage in limiting the effects of this crisis with the contribution of the concrete infrastructure of its banking system (Eroglu and Eroglu 2011). According to past studies the impact of financial crisis on liquidity risk depends on the liquidity measure used in these studies. Vodova (2011) found a significant impact only on one of the four ratios employed in his study on Czech, whereas Cucinelli (2013) underlines in his study on the determinants

of liquidity risk within the Euro area that the financial crisis of 2008 has a significant impact only on the short term liquidity and this is mainly due to banks' tendency to manage the liquidity on a short horizon during this period. In this study and in order to investigate the impact of the financial crisis on the liquidity within Turkish banks, this crisis is represented by FIC dummy variable. This variable takes the value of (1) in the years 2009, 2010, and the value of (0) for the rest of the period. A summary of the variables used in this study is shown in table 3.1.

Table 3.1: Summary of the variables used in the regression models

Variable	**Notation**	**Proxy**	**Literature**
Liquidity Ratio 1	LIQD	Liquid Assets/ Customer deposits and short term funding	Mehmed (2014); Vodova (2011); Vodova (2013); Munteanu (2012)
Liquidity Ratio 2	LATA	Liquid Assets /Total Assets	Vodova (2011); Barth et al. (2003); Vodova (2013); Mehmed (2014)
Return on Equity	ROE	Net income/Total assets	Arif and Anees (2012); Mehmed (2014);
Bank Capitalization	TETA	Total equity / Total Assets	Sohaimi (2013); Mehmed (2014)
Loan Loss Reserve Ratio	LLR	Loan Losses Reserve/ Total Loan	Mehmed (2014)
Bank Size	LTA	Logarithm of Total Assets	Cucinelli (2013); Gilbert (2013)
Gross Domestic Product $	GDP	Growth rate of GDP	Vodova (2011); Mehmed (2014)
Inflation	INF	Consumer Price Index	Bunda and Desquilbet (2008); Audo (2014)
Financial Crisis	FIC	FIC=1 in 2009, 2010 and FIC=0 in other years	Vodova (2011); Cucinelli (2013)

3.3 Methodology

Using E-Views 9 software, the aforementioned models will be analyzed by running OLS (Ordinary Least Square) regression based on panel data. For accurate and robust results, some preliminary tests for the data and the model are required. The following section of this chapter provides brief explanations of the sequential tests that will be done for our analysis.

3.3.1 Unit Root Test

This test aims at addressing the issue of stationarity for all variables. According to Gujarati (2009) stationarity of all variables is one of the prerequisites for developing econometric techniques. A variable is stationarity if its mean and variance do not change systematically over time. In other words, the trend of the data must show a degree of variability. In order to ensure that all variables are stationary, Levin, Lin and Chu (LLC) test will be considered and applied initially in level based on the following hypothesis:

H_0: variable is not stationary- Panel data has a unit root.

H_1: variable is stationary- panel data has no unit root.

Estimating Levin, Lin and Chu (LLC) test on a level of significance 95% calls that p-value of this test for every single variable must be less than 5% to be stationary. Otherwise, non-stationarity problem is detected and requires to be resolved. The first application on variables in this case will be by estimating the first difference of variables instead of the level estimation (Gujarati, 2009).

3.3.2 Correlation Analysis

The development of the correlation matrix exposes the dependency or the association among explanatory variables. Hence, this stage aims at addressing the multicollinearity problem. Multicollinearity occurs when there is high correlation among the independent variables which makes it impossible to measure the role of the each single explanatory variable in explaining the variations in the dependent variable. Therefore, the regression coefficients will not be estimated precisely. Kennedy (2008) states that Multicollinearity is a serious problem and requires a modification when the association among the independent variables is above 80%. Hence, the goal of this step is to ensure that there is no correlation exceeds the aforementioned limit to assume the absence of Multicollinearity problem. However, the response to any high degree of correlation will be by conducting a vector Auto regression model at lag 1 or lag 2 which increases the number of observations and heals the problem.

3.3.3 Hausman Test (Random or Fixed) Effect Model

The question at this stage is to identify the model that is more appropriate to analysis our results. Indeed, the perfection of the fixed effect model springs from the assumption that the constant term and error term of banks are not correlated and the time invariant characteristics of each bank are not correlated with the others. A different situation refers to the imperfection of the fixed effect model and calls for estimating the random effect model. However, an accurate response to the previous question requires performing a test called Hausman test based on the following hypothesis:

H_0: Random effect model is the most appropriate

H_1: fixed effect model is the most appropriate

Considering the random effect model as a null hypothesis means that this model is more desirable if the probability value generated from the Hausman test is more than 5% (Greene, 2003).

3.3.4 The Durbin-Watson (DW) Test for Autocorrelation

It is important before performing The Ordinary Least Squares (OLS) regression to ensure that our model fits to the data, and search for the violations of the OLS assumptions. One of the OLS assumptions as suggested by Gujarati (2009) is the absence of serial correlation or autocorrelation. That is, the residuals among the observations are randomly distributed. In other words, the error term at one observation is not correlated with the others. Keele and Kelly (2006) states that this problem is a technical violation of OLS assumptions that should not be ignored. Otherwise, an incorrect estimation of coefficients' standard errors will be generated. Therefore, serial correlation problem must be detected and fixed before accepting the estimated results to be analyzed. Durbin Watson test is one of the methods to detect this problem. It measures the linear association between residuals and detects the first order serial correlation. The Value of DW is almost between 0 and 4, and using this value to address the problem of autocorrelation will be done based on the following generally accepted rule:

DW is approximately (2): There is no autocorrelation

DW is somewhere between 0 and 2: There is positive autocorrelation

DW is somewhere between 2 and 4: There is negative autocorrelation

Both models in this study will be tested in terms of DW values, and one of the suggested solutions for eliminating the existence of autocorrelation is the utilization of the lagged dependent variable (Keele and Kelly, 2006).

After ensuring that all variables in both models are stationary, there is no multicollinearity among the explanatory variables, deciding on the best fitted model to be analyzed, and mitigating any detected serial correlation problem, both models will be ready to be analyzed based on OLS panel regression.

Chapter 4

EMPIRICAL ANALYSIS AND RESULTS

Following the methodological tests mentioned in the previous chapter, this chapter will address the results of these tests accompanied with a comprehensive analysis. In order to ensure that the assumptions of OLS panel regressions are not violated in the two regression models of this study, this chapter starts by considering the results of unit root test to ensure that all variables in both models are stationary, then the correlation analysis will be considered to detect the collinearity among the explanatory variables. Finally, the results of the regression tests will be analyzed after considering the modification suggested by the outcomes of Durban- Watson test and Hausman test.

4.1 Unit Root Test

Given that the null hypothesis for Levin, Lin and Chu (LLC) stationarity test suggests that variables have unit roots and they are non-stationary, the results indicate that we can reject this null hypothesis at the empirical significance level of 5% for all variables except LATA variable which is used as a dependent variable for the second model. Therefore, all the variables in the first model which has LIQD as a dependent variable are stationary. In other words, the change in their mean and variance varies over time, thereby these variables avoid the problem of spurious regression.

One of the suggested methods to deal with non-stationary variable like (LATA) as indicated in the previous chapter is to eliminate this problem by differencing. Considering Levin, Lin and Chu (LLC) test at first difference reveals that the null hypothesis at a level of significance 5% can be rejected for LATA and all other variables. As a result, the second liquidity model which has LATA as a dependent variable will be tested at first difference, whereas the first liquidity model which has LIQD as a depended variable will be tested at level. Results of Unit Root Test at level and first difference are shown in appendixes section.

4.2 Correlation Analysis

This analysis aims at detecting the multicollinearity among the explanatory variables. Hence, one correlation matrix was developed as the explanatory variables for both models are the same. The coefficients of this matrix are shown in table 2.4.

Table 4.2: Correlations among the Independent Variables

	ROE	TETA	LLR	LTA	GDP	INF	FIC
ROE	1.00000						
TETA	-0.1577	1.00000					
LLR	0.05367	-0.5007	1.00000				
LTA	0.343400	-0.18904	-0.21990	1.000000			
GDP	-0.06887	-0.21652	0.106474	-0.00641	1.000000		
INF	-0.13800	0.320610	-0.42566	0.134411	0.023768	1.000000	
FIC	0.010669	0.228643	-0.17196	0.011761	-0.23806	0.013781	1.000000

In general, the correlation among the explanatory variables is low or moderate, while the most important conclusion of this analysis is the absence of multicollinearity among the independent variables since this problem is existential when there is a correlation of 80% or above between the independent variables as suggested by Kennedy (2008).

In essence, the results show that loan loss reserve ratio LLR has negative moderate correlations with inflation INF and bank capitalization TETA, while the values of these correlations are 42% and 50% respectively. The same variable LLR has low negative correlation with the financial crisis FIC and bank size LTA, and positive low correlation with the gross domestic product GDP and return on equity ROE. Other coefficients indicate that return on equity ROE has negative correlations with bank capitalization TETA, gross domestic product GDP and with inflation INF, while it has positive correlations with banks size LTA and the financial crisis FIC. Moreover, results show that bank capitalization is negatively correlated with bank size and gross domestic product, while it is positively correlated with inflation and the financial crisis. Further, low positive relations have been found to determine the financial crisis' correlations with bank size and inflation.

4.3 Hausman Test

In line with the research methodology mentioned in the previous chapter, the panel data for both models are examined through Hausman test in order to determine whether the fixed effect model or the random effect model is the most appropriate. Given that the null hypothesis for this test indicates that the random model is the most appropriate, the panel regression will be done based on this method, as the

results of this test produced a probability value higher than 5%, thereby the null hypothesis cannot be rejected and the random effect model is preferred. In that sense, our models will not allow for heterogeneity among the banks by considering a constant value for each bank, rather banks will have a common mean value for that constant.

4.4 Durban Watson or Autocorrelation Test

Achieving correct estimations of the coefficients' standard errors requires the absence of autocorrelation between the residuals in each model. As mentioned above, the value of Durban Watson is one of the indicators to detect this problem. Thus, initial regression test has been run for both models in order to examine this value and deal with any problem detected.

The initial value of Durban Watson for the first model which has LIQD (Liquid assets to customer deposits and short term funding ratio) as a dependent variable is 0.849149 which refers according to the autocorrelation rule of thumb to a problem of positive autocorrelation. However, the inclusion of the lagged dependent variable into this model has changed the value of Durban Watson to be 1.993434. Therefore, the issue of autocorrelation in this model has been solved.

The value of Durban Watson for the second model which has LATA (The ratio of liquid assets to total assets) as a dependent variable is 2.263186. The rule of DW suggests that if DW is approximately two, there is no autocorrelation. Although the value of DW in this model is slightly higher than the suggested value for the absence of autocorrelation, it refers to an accepted model as the rule does not require an exact

value to accept the outcome. Therefore, there is no autocorrelation in the second model.

4.5 Regression Analysis

After the consideration of stationarity, multicollinearity, and autocorrelations as preconditions for OLS panel regression, this test was applied for both models by using the method of random effect as suggested by Hausman test, and has generated the following outcomes:

The regression results for model 1 and model 2 have generated the values of R squared of 71% and 15% respectively. However, the better measurement of the explanatory power in an econometric model is the adjusted R squared, as this value is adjusted for the number of explanatory variables, and prevents the random increase in R squared. The value of adjusted R squared for the first model is 69%, which indicates that 69% of the variance in the dependent variable (LIQD) is explained by the variability in the examined independent variables. On the other hand, the value of adjusted R squared for the second model which has been tested at first difference to avoid the problem of spurious regression is 11%, which means that only 11 percent of the variance in the dependent variable (LATA) is attributed to the variability of the independent variables. Obviously, the first model is more robust than the second one, while the explanatory power of the second model is substantially very low.

In regards to the overall significance of both regression models, this can be measured by F-test which compares the model at hands with the model of an intercept-only. The null hypothesis of this test indicates the equality of fitness between the model being studied and the model of an intercept-only model, while the alternate

hypothesis suggests that the fit of the model at hand is better compared to an intercept-only model. The statistic formula of this hypothesis is as follows:

The null hypothesis $\beta 1 = \beta 2 = \beta p\text{-}1 = 0$

The alternate hypothesis $\beta k \neq 0$, for at least one value of k

According to this test, the regression analysis reveals that both models are statistically significant at the empirical significance level of 5% each, as the results suggested the following probability values of F-test: Prob (F-statistic) of 0.000000 < 5% for model (1), and Prob (F-statistic) of 0.001294 < 5% for model (2).

Given that the empirical significance level of this study is 5%, the OLS regression test revealed that the following variables: TETA (bank capitalization), LLR (loan loss reserve ratio) and LTA (bank size) from the first model, in addition to TETA (bank capitalization) and ROE (return on equity) from the second model were found to be statistically significant. Summary of the regression results for model (1) and model (2) are shown in tables 3.4 and 4.4 respectively.

Table 4.3: Regression results for the determinants of liquidity measured by LIQD

Variable	**Coefficients / Values**	**Prob. Values**
ROE	0.054641	0.7356
TETA	1.577371	0.0000
LLR	0.167005	0.0229
LTA	-0.032818	0.0005
GDP	0.001989	0.5022
INF	-0.143331	0.1334
FIC	-0.023489	0.4210
R squared	0.716274	-
Adjusted R squared	0.699826	-
Durban Watson	1.993434	-

The regression results reveals that the explanatory variable TETA (bank capitalization) has a significant positive relation with LIQD (The first liquidity ratio), with the coefficient value of 1.577371. This indicates that one unit of increase in TETA (bank capitalization) or the ratio of total equity to total assets increases the ratio of liquid assets to customer deposits and short term findings by 1.577371 units. This outcome is consistent with Bunda and Desquilbet (2008) and Nguyen et al. (2012). Also, the same relation was found by Cucinelli (2013) who conducted his study by using liquidity coverage ratio and net stable funding ratio as a measurement of liquidity. He found this positive relation of bank capitalization only with net stable

funding ratio NSFR which refers that bank capitalization positively impacts the long term liquidity only.

Another positive significant determinant of the liquidity measure LIQD in Turkey is the ratio of loan loss reserve to total loan LLR which refers to the quality of bank loans. This ratio has a positive coefficient of 0.167005, which indicates that an increase of one unit in this ratio will cause the liquidity ratio LIQD (The ratio of liquid assets to customer deposits and short term funding) to be increased by 0.167005 units. Since a higher value of this ratio reflects a more problematic loans, this means that a better liquidity situation is crucial for banks to avoid the insolvency. The same conclusion was found by Mehmet (2014) who attempted to identify the determinants of liquidity risk in in Bosnia and Herzegovina by utilizing two liquidity measures, and likewise this study he has approved the positive impact of loan loss reserve ratio LLR on only one of the two liquidity measurements.

As it can be seen from the table, bank size LTA represented by the logarithm of total assets is the only variable that has a negative significant relation with LIQD (The ratio of liquid assets to customer deposits and short term funding), with the coefficient value of -0.032818. This slight impact indicates that an increase of one unit in bank size LTA decreases the LIQD ratio by -0.032818 units. However, many scholars have concluded the same results by using different samples from different countries like Deléchat et al. (2012) in Central America, Giannotti et al. (2011) in Italy, Vodova (2012) in Poland, and Vodova (2013) in Hungary. Indeed, the negative relationship between bank size and liquidity ratio is usually attributed to the theory of

"too big to fail". In that sense, bigger banks in Turkey are less motivated to hold liquid assets since they predict that the Central Bank and the government will intervene to rescue these banks in the case of liquidity shortage.

Table 4.4: Regression results for the determinants of liquidity measured by LATA

Variables	**Coefficients / Values**	**Prob. Values**
D(ROE)	-0.169469	0.0118
D(TETA)	0.215032	0.0455
D(LLR)	0.017496	0.5784
D(LTA)	0.013939	0.4280
D(GDP)	0.001153	0.1761
D(INF)	0.169014	0.7076
D(FIC)	-0.016506	0.0974
R squared	0.154174	-
Adjusted R squared	0.111579	-
Durban Watson	2.263186	-

The test for the second model was implemented at the first difference for all variables, and as it can be seen from the table, this analysis shows that the independent variable ROE (return on equity) which measures banks' performance has a negative significant relations with the dependent variable LATA (the ratio of liquid assets to total assets) in line with Mehmet (2014) and Deléchat et al. (2012). The value of its coefficient suggests that one unit of increase in ROE (return on

equity) decreases the ratio of LATA by -0.169469 units. In other words, banks with higher profitability tend to hold low levels of liquidity. However, this relation can be explained by the trade-off between the stability resulted from holding liquid assets and the higher returns generated from holding illiquid assets.

Consistently with the first regression model, banks with a better capitalization have a better liquidity position, as the results of the second model show a positive significant relation between bank capitalizations TETA and the liquidity measurement LATA (the ratio of liquid assets to total assets), more exactly an increase of one unit in the former will cause the latter to be increased by 0.215032 units. In line with Bunda and Desquilbet (2008) and Cucinelli (2013) as indicated above.

With regard to the two macroeconomic indicators tested in this study, the results of both regression models show that gross domestic product GDP as well as inflation INF have non- significant relationship with both liquidity measurements LIQD (The ratio of liquid assets to customer deposits and short term funding) and LATA (the ratio of liquid assets to total assets). However, this non-significant relation can be attributed to the effective liquidity management and the flexible monetary policies that were implemented in Turkey during the time scale covered in this study.

Likewise, the dummy variable FIC representing the realization of the global financial crisis has proved to have non-significant relations with both liquidity ratios LIQD (The ratio of liquid assets to customer deposits and short term funding) and LATA

(the ratio of liquid assets to total assets); this means that the liquidity situation of Turkish banks did not change following the eruption of the financial crisis. In line with the argument that the financial markets in Turkey did not experience a serious liquidity problems during the crisis. However, this can be deemed a natural outcome to the proactive precautions taken by BRSA prior to the eruption of the global crisis, as these precautions have allowed Turkish banks to meet their liquidity demands and continue functioning without facing notable changes in their liquidity ratios. Further, the financial shocks hit Turkey in the global financial crisis were finer in its volume and shorter in its duration compared to the financial shocks of its previous local financial crisis.

In sum, only bank capitalization TETA has proved to have positive significant relations with both liquidity ratios LIQD (The ratio of liquid assets to customer deposits and short term funding) and LATA (the ratio of liquid assets to total assets), while loan loss reserve ratio LLR and bank size LTA have proved to have significant relations with the first liquidity ratio LIQD, with a positive sign for the former and negative sign for the latter. On the other hand, return on equity ROE has a negative significant relation with the second liquidity ratio LATA. With regard to the macroeconomic indicators and the crisis dummy variable included in both models, the results of both regression tests have shown that these variables have non-significant relations with both liquidity ratios.

Chapter 5

CONCLUSION

Before performing the empirical test to identify the determinants of liquidity, this study started by highlighting the importance of holding an optimal level of liquid assets in banks, and how the significance of liquidity risk management has been amplified following the eruption of the financial crisis. This has justified the selection of this topic and the inclusion of the financial crisis dummy variables in both models. The new banks liquidity regulation were introduced to refer to it as an influential factor on liquidity size other than the internal and external factors examined in this study. Later, a theoretical argument regarding the position of Turkish banks at the time of the crisis was developed. It showed that the Turkish financial system was not tested during the crisis due to the flexible policies and the precautions implemented by the Turkish Central Bank before the eruption of the crisis. However, this theoretical argument has backed the results of our empirical analysis.

In order to identify the factors that influence the liquidity size in Turkish banks, the main question of this study was on twofold: First, what is the influence of some internal bank factors and macroeconomic indicators on Turkish banks' liquidity ratios and secondly what was the impact of the global financial crisis on these ratios? To answer these questions, OLS panel regression analysis was conducted on two

liquidity ratios. The first liquidity ratio (first model) was the ratio of liquid assets to customer deposits and short term funding, while the second liquidity ratio (second model) is the ratio of liquid assets to total deposits.

This study used the financial data of 21 conventional Turkish banks over the period of 2006-2013, and it has employed four bank specific factors i.e. return on equity (bank profitability), bank capitalization, loan loss reserve ratio (loan quality), and bank size, and two macroeconomic indicators i.e. inflation and GDP growth rate, in addition to the dummy variable of the global financial crisis.

Before performing the panel regression, the issues of stationarity, multicollinearity, and autocorrelations were tested to ensure that all variable and both models fulfill the assumptions of OLS regression. There was a problem of positive autocorrelation in the first model, and the second liquidity ratio was found non-stationary. However, the first problem was solved by the inclusion of the lagged depended variable, while the issue of non-stationarity was solved by performing the regression on the second model at first difference.

The random effect model was performed as suggested by Hausman test. The regression results suggested that the explanatory power of the first model is substantially higher than the explanatory power of the second model which is very low, as the values of adjusted R squared for model (1) and model (2) were 69% and 11% respectively. In regards to the overall significance of both models, the results of F-test revealed that they are statistically significant at the empirical significance level

of 5% each. The results suggested that Only the influence of bank capitalization was found statistically significant on both liquidity ratios, while the influences of loan loss reserve ratio and bank size were found statistically significant on the first liquidity ratio, and the influence of return on equity was found statistically significant on the second liquidity ratio.

Regarding to the signs of the significant relations approved in this study, bank capitalization and loan loss reserve were found to have positive significant relations with the first liquidity ratio, while bank size was found to have negative significant relations with this ratio. This can be explained by the theory of "too big to fail" which suggests that large banks tend to hold less amount of liquidity as they rely on the government intervention at the time of liquidity shocks. On the other hand, bank capitalization was found to have positive significant relation with the second liquidity ratio, while banks profitability represented by the ratio of return on equity was found to have a negative significant relation with this ratio. This can be attributed to the trade-off between hedging against liquidity shortage by holding liquid assets and seeking higher profits by holding illiquid assets.

We found also that the two macroeconomic indicators; gross domestic product and inflation have non- significant relationship with both liquidity measurements, which reflects the quality of the liquidity management and the flexible monetary policies implemented in Turkey at the time of the crisis. Also, this study found no significant relations between the financial crisis dummy variable and the liquidity size in

Turkish banks, which mirrors the important role of the proactive precautions taken by BRSA prior to the eruption of the global crisis.

However, this empirical study was limited to six factors among many possible explanatory variables that have proved to have significant influence on banks liquidity in the previous literature. Therefore, further researches are recommended to consider other explanatory variables such as the share of non-performing loans on total loans, the ratio of loans to deposits, and interest rate margin interest rate. Also, this study employed two liquidity ratios to represent the liquidity size, while there is other ratios can be utilized like the ratio of liquid assets to deposits or the two liquidity ratios suggested by BASEL committee i.e. liquidity coverage ratio {LCR} and new stable funding ratio {NSF}.

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APPENDIX

Appendix A: The Results of Stationarity Test

The results of Levin, Lin & Chu stationarity test at level

Variables	**LIQD**	**LATA**	**ROE**	**TETA**	**LLR**	**LTA**	**GDP**	**INF**
Levin, Lin & Chu t*	-6.42304	-0.94954	-22.6526	-32.5023	-963.915	-21.5296	-11.9201	-7.81317
P-value	0.0000	0.1712	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

The results of Levin, Lin & Chu stationarity test at first difference

Variables	**LATA**	**ROE**	**TETA**	**LLR**	**LTA**	**GDP**	**INF**
Levin, Lin & Chu t*	-25.6133	-23.7002	-11.2567	-497.419	-29.2702	-12.6249	-21.5365
P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000