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THE EFFECT OF THE BANKING PROFITABILITY AND EFFICIENCY ON LIQUIDITY: A DYNAMIC PANEL ANALYSIS IN TURKISH BANKING SECTOR

(PhD THESIS)

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Tezi Hazırlayan: Mohamed Mohamud MAKARAN
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ÖZET

2008 küresel finansal krizinin ardından bankacılık sektöründe likidite yönetimi çok daha önemli bir konu haline gelmiştir. Ekonomik sistemin omurgası bankacılık sistemidir ve likidite risk faktörleri de dahil olmak üzere bir dizi değişken, sistemin işleyişi üzerinde önemli etkiye sahiptir. Likidite oranları, sermaye oranları, etkinlik oranları ve karlılık oranları bu değişkenlere örnek olarak verilebilir. Likidite riski, bankaların borçlarını zamanında ödemek için yeterli likit varlığa sahip olmama ihtimalini gösterir. Bankalar, piyasanın ve müşterilerin güvenini korumak için, vade uyumsuzluğunun getirdiği likidite riskine karşı yeterli likit varlığa sahip olmalıdır. Optimum likidite seviyesinin belirlenmesi, piyasanın ve tüketicinin güvenini sağlamanın yanı sıra maliyet ve karlılığı da etkilediği için çok önemlidir. Özellikle bankalarda likidite düzeyi ile etkinlik ve karlılık değişkenleri arasında ciddi bir etkileşim bulunmaktadır.

Bu çalışmanın temel amacı, Türkiye bankacılık sektöründe karlılık ve etkinlik değişkenlerinin banka likiditesi üzerindeki etkisini araştırmaktır. Türkiye Bankalar Birliği veri tabanından 2003-2021 yılları arasındaki 19 yıllık bir zaman diliminde 21 ticari bankaya ait veriler toplanmış ve analiz edilmiştir. 2003 yılından 2021 yılına kadar Türkiye'de 21 ticari banka üzerinde hipotez testi yapmak için ikincil veriler kullanılmıştır. Bu çalışmada Sistem Genelleştirilmiş Momentler Yöntemi (SGMM) tahmin teknikleri kullanılmaktadır. Bulgular, Türk mevduat bankalarında etkinlik ve karlılık oranlarının likidite düzeyi ile önemli ölçüde ilişkili olduğunu, ancak kullanılan likidite değişkenine bağlı olarak bu ilişkinin derecesinin farklılık gösterebildiğini ortaya koymaktadır.

İki ayrı model üzerinde gerçekleştirilen Sistem GMM analiz sonuçları, Türk bankacılığında karlılığın (ROE) ve likiditenin (LATA ve LASL) pozitif korelasyon gösterdiğini ortaya koymaktadır. Ulaşılan bulgular, ROE'deki 1 birimlik artışın LATA'yı 0,0355 arttırdığını, bir diğer likidite ölçütü olan LASL'yi ise 0,1098 birim arttırdığını göstermektedir. Analizde kullanılan her iki modelde de faaliyet giderleri ile likidite (LATA ve LASL) değişkenleri arasında pozitif korelasyon bulunmuştur.

Anahtar Kelimeler: Likidite, Kârlılık, Etkinlik, Türk Bankacılık Sektörü, GMM.

ABSTRACT

Following the 2008 global financial crisis, liquidity management in banking sector has become a much more important issue. Furthermore, the backbone of economic system is the banking system and a number of variables, including liquidity risk factors, have a significant impact on how well it functions. Liquidity ratios, capital ratios, efficiency ratios and profitability ratios are some examples of the variables. Risk of liquidity indicates that banks won't have adequate liquid assets to pay their bills on time. In order to maintain the confidence of the market and clients, banks must hold enough liquid assets to defend against the risk of liquidity brought on by a maturity mismatch. Determining the optimal level of liquidity is crucial since it affect cost and profitability as well as maintaining the market's and consumer's confidence. Particularly in banks, there is a significant interaction between profitability, efficiency and liquidity.

Therefore, the main purpose of this study is to investigate the effect of profitability and efficiency variables on bank liquidity in Turkish banking sector. Quarterly data for 21 commercial banks were gathered over a 19-year period from the Turkey Banks Association database from 2003 to 2021. A quantitative approach was used to examine the research hypotheses by performing a panel data analysis for the designated time frame. This study utilizes System Generalized Method of Moments (SGMM) estimation techniques.

The results of the System GMM analysis performed on two different models reveal that profitability (ROE) and liquidity (LATA and LASL) in Turkish banking show a positive correlation at a significance level of 1%. The coefficient of ROE is 0.0355, indicating that the influence of ROE on liquidity in banks is significant at the 1% level, as one unit increase in ROE will also increase liquidity by 0.0355. Besides, the results show that at a 1% significant level, profitability (ROE) has significant and positive effects on liquidity (LASL), with one unit increase in ROE, increase also liquidity by 0.110. Also, positive and significant correlation has been found between operational expenses (OETA) and liquidity (LATA and LASL). This finding indicates that bank's liquidity needs increase when the level of efficiency decreases or operating expenses increase.

Keywords: Liquidity, Profitability, Efficiency, Turkish Banking Sector, GMM.

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LIST OF ABBREVIATIONS

BCBS : Basel Committee on Banking Supervision

BDDK : Bankacılık Düzenleme ve Denetleme Kurumu

BIS : Bank for International Settlements

BRSA : Board of Bank Regulation and Supervision Agency

CAR : Capital Adequacy ratio

CIR : Cost Income Ratio

EPS : Earnings Per Share

FC : Foreign Currency

FDIC : Federal Deposit Insurance Corporation

FED : Federal Reserve System

FEM : Fixed Effect Model

GDP : Gross Domestic Product

GMM : Generalized Method of Moments

GPM : Gross Profit Margin

LATA : Liquid Assets to Total Assets

LASL : Liquid assets to Short-term Liabilities

LCR : Liquidity Coverage Ratio

LTD : Loan-to-Deposit

NIM : Net Interest Margin

NIITA : Net Interest Income to Total Assets

NPL : Non-performing loan

NPM : Net Profit Margin

NSFR : Net Stable Funding Ratio

OCC : Office of the Comptroller of the Currency

OEOI : Operating Expense to Operating Income

OETA : Operating Expense to Total Assets

OOETA : Other Operating Expenses to Total Assets

OPM : Operating Profit Margin

REM : Random Effect Model

ROA : Return on Assets

ROE : Return on Equity

SDIF : Savings Deposit Insurance Fund

SGMM : System Generalized Method of Moments

TBB : Türkiye Bankalar Birliği

TL : Turkish Lira

VaR : Value at Risk

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INTRODUCTION

The major reason for the recent international financial crisis has been cited as liquidity risk and it caused an adverse impact on banks. The failure of numerous banks all over the world was majorly caused by liquidity risk according to many academicians, policymakers, and professionals thus leading to the recent financial confusion between 2008-2009. To respond to the last financial crisis, the Basel Committee on Banking Supervision (BCBS) has devised new rules regarding the level of liquidity of banks. Financial institutions have become extremely significant in globalization as well as worldwide financial integration. BCBS regulations require financial institutions to increase their proportion of liquid assets to protect them from a bank run. As result, economies, as well as financial institutions, have to bear a heavy cost in terms of lower profitability and slower economic activities. Liquidity risks clarify the connection between the bank's demand for liquidity to meet the withdrawals of depositors and seize opportunities to give funding to customers.

A bank has sufficient liquidity is it has ability to generate funds by increasing the liabilities or by converting assets promptly and at a reasonable cost. The ability of the bank to meet the liquidity requirements of liquidity efficiently and economically without incurring inappropriate at costs any point in time is defined as liquidity management. Liquidity management may also be referred to as the process of funds generation at all times at a reasonable price to meet relational or contractual obligations on new loan demands, deposit withdrawals, existing loan commitments etc. When they fund the long-term assets with short-term liabilities, their liquidity risk arises which results in making the liability subject to roll over or refinancing risk. The profitability of the bank is greatly affected by the liquidity risk that exists in any bank. The distance between the best practice banks' cost and the cost of a specific bank is referred to as cost efficiency given the assumption that they produce the same output under the same environmental condition. This efficiency ideally focuses on how to control cost. Since the sustenance of banks is very important to the economic stability of the country, they must have efficiency in their activities. There are many variables form the efficiency of banks, among them is technology improvement, data processing, management skills, and more productive communication that can lead to minimize operating costs and maximize proper utilization of resources.

The broader objective of the study is to determine the effect of the liquidity risk on banking profitability and efficiency using dynamic panel analysis. The specific objectives are:

1. Identifying the impact of profitability on liquidity of the Turkish banking sector
2. Identifying the effect of efficiency on liquidity of the Turkish banks.
3. Recognizing the influence of equity level on liquidity of the Turkish banks.

The main purpose of this study is to examine the connection between liquidity, profitability and efficiency variables. Therefore, the link between liquidity risk, efficiency, and profitability of commercial banks in Turkey is examined by the utilized system GMM. The total size of the study is 21 deposit banks. Furthermore, the study considers only 19 years of data from 2003 to 2021. Data used in the study is mainly secondary data and it also panel data which consisted of cross-sections and time series. The data on the banks were taken from the Turkish Banks Association website database. In addition, the Central Bank of the Republic of Turkey websites and the Banking Regulation and Supervision Agency were used. STATA 14 was used for statistical analyzes and tests.

In summary, the study consists of four parts in total. In the first part of the thesis, the definitions and the origins of risks are explained in detail. Then the risks that banks are exposed to in the banking sector are determined in accordance with the literature. Liquidity concept and liquidity risk definitions are discussed in detail, and types and main sources of liquidity risk are emphasized. After that, the theoretical and empirical literature on liquidity risk is explained in detail. Liquidity risk management is clarified. Regulations and supervisions of banks for liquidity risk are discussed. Then, the approaches used in measuring the liquidity level are mentioned.

In the second part, profit definitions and profitability concepts are talked. Then, the types of profit are discussed. The balance between liquidity and profitability is clarified. The ratios used to measure the profitability of banks are mentioned. In this section, also concepts and definitions of efficiency are discussed and efficiency measurements in the banking sector are studied.

In the third part, the current situation in Turkish banking sector, liquidity ratios, efficiency indicators, and profitability variables, the role of Turkish banking sector in 1994 and 2000/2001 financial crises, regulation on measurement and management of liquidity risk is argued in detail. In the fourth part, panel data analysis, which is the technique to be applied before starting the analysis, is explained in detail. Variables were tested with panel data analysis and system GMM. In the conclusion part of the thesis, the results of the study were discussed and the interpretations of the findings were given.

PART I

1. LIQUIDITY RISK: CONCEPT AND MANAGEMENT

1.1. ORIGIN OF RISK AND RISKS IN BANKING SECTOR

Risk comes from the Latin word “riscum” or Arabic word “risq”. In Latin, riscum was initially used to mean a challenge to a sailor which could result into an unfavorable event. In Arabic, risq means anything God-given from which you can draw profit, in other words, it refers to a favorable outcome. Used in the twelfth century, the Greek derivative of the Arabic word risq appeals in general to a chance of outcomes with neither positive nor negative implications. The modern French word “risqué” has mainly negative with occasional positive connotations, as for example in “qui de risqué rienn’ arien” or ‘nothing ventured nothing gained’ (Merna and Al-Thani, 2008: 9). In English, risk is used to mean a negative outcome or exposure to danger. It also means the likelihood of the occurrence of negative consequences of an event. Others have also used risk to mean the probability and severity of unwanted effects.

Also, risk is commonly used by traders, managers, and the public in newspapers and magazines to mean unfavorable markets. In these articles, readers are always cautioned from investing “too much” in “risky assets” (Crouhy et al., 2001: 22). For any financial institution management’s major objective is to raise the bank’s profits for its owners at the cost of raised risk**.** For banks, risks can be classified as systematic, credit, counterparty, operational, legal and liquidity risk (Santomero, 1997: 88; Saunders and Cornett, 2008: 181). Related terms to risk include perils and hazards. A peril is used to mean exposure to risk while hazard is used to the acts that increase likelihood of risk.

Systematic risk which is known as “general market risk,” defines to vary in market value resulting from market fluctuation (Crouhy et al., 2001: 65). Systematic risk is the risk of securities value movements related to systematic factor. To finance and business, the most prevalent risk is credit risk and credit risk arises from nonperformance by a borrower. In general terms, an organization faces credit risk if it is owed money or relies on another for payment or on its behalf. This happens whenever the contractual agreement's performance or payment by another organization is expected.

The counterparty's failure becomes a less concern when money on net basis is not owed to an organization. This depends level of legal environment and whether funds are owed on a net or aggregate basis on individual contracts. Securities issuer which is an example of the deterioration of credit quality can also be a source of risk through the decreased asset market value that a firm might own (Horcher, 2005: 39). Similar to credit risk, counterparty risk is general terms can be viewed as risk that is not related to standard creditor default risk but rather to trading. Furthermore, the failure of counterparty is to settle a trade can arise from other factor beyond a credit crisis (Santomero, 1997: 89).

The potential losses resulting from inadequate systems, management failure, faulty control fraud, and human error are collectively referred to as operational risk (Crouhy, 2006: 30-31). Presently, there is no universally agreed-upon definition of operational risk. For numerous banks, operational risk is called any risk that is not categorized as credit or market risk while for others, it is the risk of loss arising from different types of human or technical error. Operational risk is concerned with settlement or payments risk and business interruption, administrative and legal risks by a number of respondent banks. As seen by many banks, there are various types of events that are not necessarily classified as operational risk yet there are many elements in them coming from more than one risk (Basel Committee on Banking Supervision, 1998: 3).

An organization is regarded a legal risk if it has no legal permission to transact especially in the derivatives of the transactions. The risk includes decision markers being able to transact or authorize entering into transactions on behalf of the counterparties (Horcher, 2005: 42).

Another important risk factor that banking sector in all financial markets are heavily exposed to is systemic risk. It is the risk that a default by one bank will create a “ripple effect” that result to the failure of another bank, threatening the stability of the financial system (Hull, 2018: 349).

As can be seen in figure 1.1 different classifications can be made for banking risks. However, today, the risk classification on Basel Committee is taken as a basis in the management of banking risks. As will be discussed in the following sections, risks are classified as credit risk, market risk and operational risk according to the Basel accords, which is a more comprehensive approach in the management of banking risks.

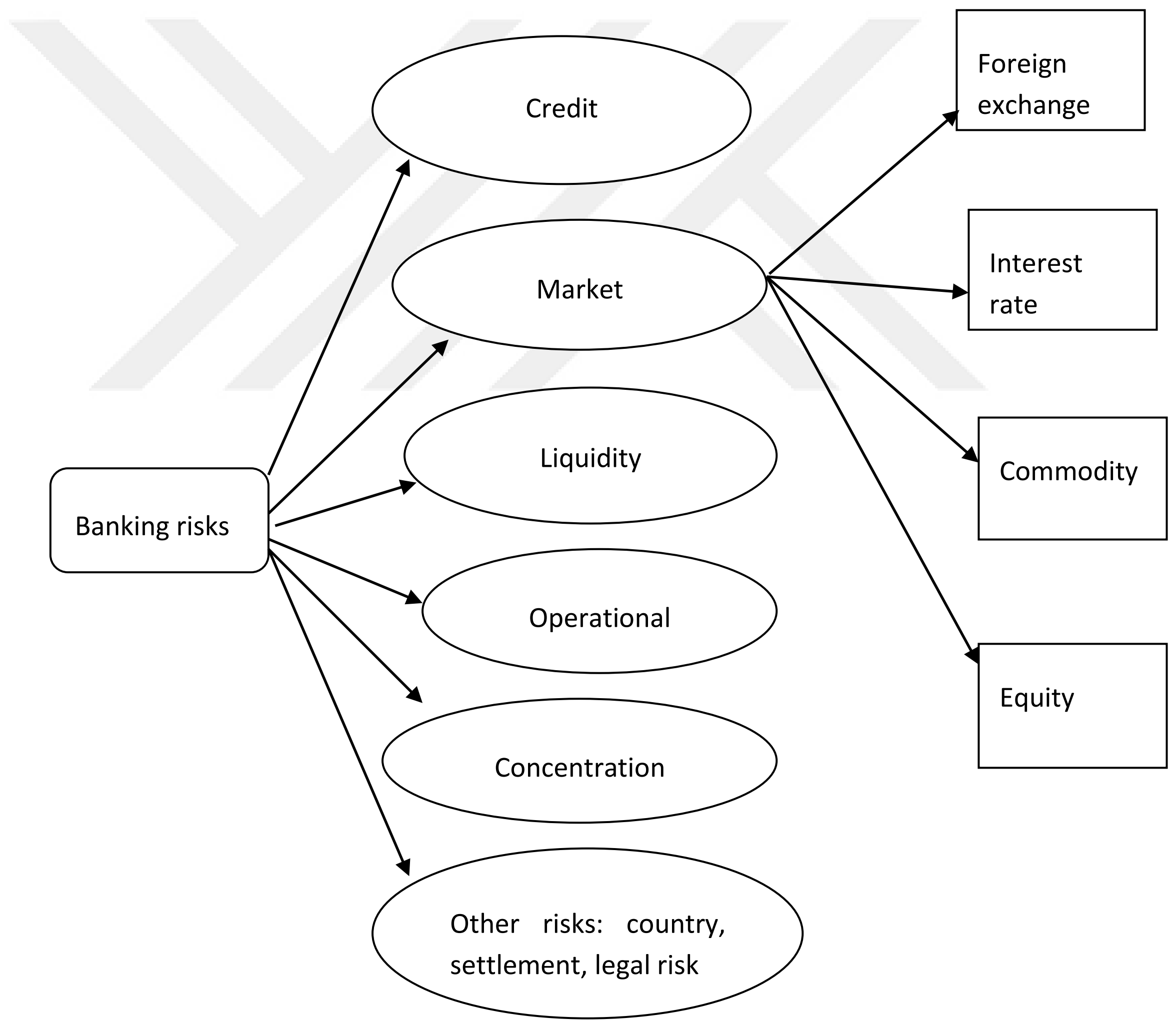

Figure 1.1: Risks in Banking Sector (Jasiene et al., 2012: 188)

1.2. LIQUIDITY AND LIQUIDITY RISK

In this part, we discuss liquidity, liquidity risk, and liquidity and solvency. Liquidity is the company's ability to paying short-term obligations. Also, it can refer to a firm's ability to raise cash rapidly by selling its assets at market prices. Conversely to liquidity is liquidity risk which is termed as a bank's inability to fulfill obligations. A firm's capacity to meet its long-term financial commitments is its solvency. According to Alshatti (2015: 62), the liquidity in the deposit bank is when the contractor has the capacity to fund its obligations at the maturity date, such as investment commitments and lending, withdrawals, deposits and accrued liabilities. Bank's liquidity risk is when the bank faces unavailability of funds when requested by depositors to meet the demand for clients or the bank's inability to lend money by borrower who has a commitment by the bank to lend (Tripe, 1999: 2). Cash payment when they fall due is known as liquidity related to solvency. For this, we can understand that solvency is a condition for liquidity that is provided as well as reasonably assured (Duttweiler, 2009: 11).

1.2.1. Liquidity and Importance of Liquidity

The concept of liquidity is well known in business and financial institution world, in other words, the ability to sell assets in the short term with minimal loss of value (Gup and Kolari, 2004: 312). Liquidity can be defined as capacity to fund in assets while meeting obligations. This meaning assumes that at a reasonable cost, obligations can be met (Basel Committee on Banking Supervision, 2008: 2). For a bank, liquidity can be defined as the bank's potential to cash anticipated and contingent cash needs. These wishes stand up from a variety of sources which include loan disbursals, withdrawal of deposits as well as liability maturities. To meet the requirement for cash, it means increasing the deposits and borrowings, investment maturities, loan repayments and the sale of assets. The capacity to fulfill each commitment while due and to adopt new transactions while desirable is considered a minimum criterion of liquidity (Machiraju, 2008: 187).

Solvency is a condition of having enough capital to cover losses. In an arrower sense solvency can be expression in term of capital adequacy while in wider sense solvency can be seen as having money ready to fulfill payments. Being solvent means having liquidity. A firm with no capital means it has no ready money to pay the bills. The behavior of the customer base as well as firm counterparts in common largely determines the liquidity of a firm. Customers' and business counterparts' relationship with the bank is directly influenced by the status of the bank's solvency. Being liquid means a bank has a positive status of solvency. However, since liquidity is cash related, there is great possibility of being solvent and illiquidity at the same time (Duttweiler, 2009: 10-11).

The capacity to meet expected as well as unexpected demands for cash is also regarded as liquidity. Specially, it is ability of a company to meet the cash demands of its policy as well as contract holders without loss. A company's liquidity profile is a function of both its assets as well as its liabilities. Inherent the financial services sector is liquidity risk. Therefore, understanding, measuring, managing as well as monitoring this risk is an inevitable requirement for every manager (American Academy of Actuaries, 2000: 4). Also, liquidity is defined as the ability to fulfill all payment obligations at maturity date as well as in the currency required as it relates to cash flows only since it is done in cash, while illiquidity is condition of not being able to perform (Duttweiler, 2009: 2). Banks' ability to meet withdrawals at any time and meet the financing commitments is liquidity. When banks meet financial obligations at maturity dates, we can say that banks have liquidity. Commercial bank's liquidity is their capacity of financing their contractual obligations including investment, lending as well as deposit's withdrawal and liabilities maturity in the course of bank actions (Alshatti, 2015: 63).

For any company, the most important indicator for any company's liquidity is its ability to meet its short-term liability. If the company's more liquidity in its assets, it means that company is less likely to experience challenges in meeting the short term obligation (Teker et al, 2016: 604). On the other hand, for an enterprise to work at full capacity, liquidity is so significant in increasing the credit value, expanding the firm volume as well as avoiding the complexities that can occur in connection with financing. To meet deposit withdrawals as well as client loan demand, banks require liquidity. Bank experience liquidity issues due to volatile liabilities and unexpected changes in the flows of loan (Sinkey, 1998: 236).

One source of liquidity is known as market liquidity. This is a market where participants can execute large number transactions quickly with a little effect on price according to Basel Committee on Banking Supervision (2000: 5).

Solvency crises are partially caused by liquidity problems. These crises affect the whole banking system stability. Before the bank liquidity crisis occurred during global financial crisis, regulators were convinced that liquidity risk was only a consequence of solvency risk. That was the basis of Basel I and Basel II, in which rules were established for bank capital rather than liquidity because BCBS thought that the proper balancing of capital and risk resulted in bank stability. After the global financial crisis, it become evident to regulators that liquidity risk has impact on solvency and stability of the bank much as it may not necessarily be a result of solvency problem in a bank. Therefore, it was now clear that was strongly interdependent between solvency and liquidity and thus there was need for rules to be introduced to contain liquidity problems in future as well (Chiaramonte, 2018: 47).

1.2.2. Liquidity Risk

Liquidity risk is capacity of financial institutions to meet their obligations to depositors and the needs of borrowers by converting assets into cash rapidly as well as with minimal loss, borrowing funds as needed as well as having funds for conducting highly profitable securities trading activities (Gup and Kolari, 2004: 12-13). Liquidity risk is a bank's failure to fulfill its payment obligations. As a risk factor, this can make the whole financial system become unstable through various sources (Dahir et al., 2018: 232). Liquidity risk can also be defined as a rapid increase in the withdrawals of debt that may leave a financial institution in a position that may lead it to liquidate its assets at great prices and right away **(**Saunders and Cornett, 2011: 194). According to Iskandar et al. (2019: 32); Selcuk and Tunay (2014: 89), financial institutions cannot convert financial securities (Bank assets) into cash without loss is called liquidity risk.

Arif and Anees (2012: 184) defined liquidity risk as a risk that a bank cannot meet its obligations when it expires without incurring unacceptable losses. While Bessis (2002: 16) stated the multiple components that make up liquidity risk include failure to raise funds, assets and market liquidity risk. Commercial risk leads to liquidity risk. The portfolio or project cannot generate enough resources to meet its debt puts that project or portfolio into liquidity risk. When an entity cannot meet payments on due date / at maturity, the potential risk arising out of this is liquidity risk (Merna and Al-Thani, 2008: 128).

In their attempts to measure or predict liquidity risk, organizations seek to decrease highly customized or unusual transactions. This is sometimes referred to as liquidity risk if the company does not have sufficient liquidity to maintain its day-to-day operations. No matter whether revenues as well as sales are enough for long-term growth, when short-term cash is not enough, detrimental decisions that may affect long-term growth may be required to address liquidity issues (Horcher, 2005: 44).

When a bank cannot totally or partially meet its depositors' request for certain period of time its liquidity is at risk. In other words, the inability of banks to meet short term financial demands is liquidity risk. Also, poor performance and loss of reputation are among the impact of liquidity risk on bank. This undermines the trust of depositors, thus causing an additional cost (Hakimi and Zaghdoudi, 2017: 47). Besides liquidity risk may arise when liabilities of the institution mismatches with its assets, this is to say when the maturity of liability has shortened than assets. When borrowers' demand is beyond the expected level, it leads to shortages of cash and liquid marketable assets which in turn causes to insolvency and bank runs. One of the mainly vital aspects of liquidity risk minimization is to put precaution measures to maturity mismatch on the balance sheet of the banks (Ariffin, 2012: 78). It can be defined economic loss suffered while trying to secure significant cash to continuing business operations. Detailed definitions of liquidity risk have been developed in regard to asset, funding, as well as joint liquidity. Combining asset and funding liquidity produces an incremental degree of risk.

There are some other definitions of liquidity risk in the finance literature. Liquidity risk may either arise when the firm does no longer have enough financial resources to pay its obligations while they are due, or when the firm is not able to raise funds at reasonable cost. Liquidity risk is the fundamental risks that most of the businesses come across during their operation (Financial Service Authority, 2003: 3). According to Tripe (1999), Bank's liquidity risk is when it does not have available financial resources to meet demands from the bank's depositors or to meet the funding demands from its borrowers who have commitment by the bank to lend. While Office of the Comptroller of the Currency (2001: 1) is defined liquidity risk for banks as the risk to income and capital of the banks resulted from its incapacity to pay its obligations on time without incurring substantial cost and losses.

A liquidity risk is associated with the firm's financial position in terms of mismatch between maturity as well as size of what the firm owns and what is owes. This risk may arise when the bank has insufficient liquid assets as well as at the same time unable to meet its financial obligations without impairment of financial or goodwill capital (Casu, et al., 2006: 264-265). Santomero (1997: 89) argues that liquidity risk is the result of funding crisis where the firm encounters an unexpected event for example incurring large, loss of confidence and a crisis in the proportion of countries including the currency crisis.

According to Koch and MacDonald (2000: 124), liquidity risk can be described as both potential and current risk to firm's income as well as the stockholders' equity market value when the banks are not capable to meet their obligations and demands of its depositors as they come due in a quickly as well as cheaply. Christofferesen (2003: 5) believes that the risk from conducting transactions in markets with large bid–ask spreads and with low liquidity as a result of low trading volume is called as liquidity risk. In this circumstance all attempts to sell assets lead to lower prices thus leading to selling assets at prices below their price or in a longer time frame than expected. Also, liquidity risk is the risk of loss associated with mismatch between cash inflows and outflows and may result in failing to sell an asset at its real value according to Banks and Dunn (2003: 21).

Liquidity and interest rate risk look the same at first sight, especially when it comes to gaps. Though, under certain conditions, there is a systemic link between gaps the interest rate gap as well as the liquidity gap. Short-term transactions with interest rate adjusted during the contract period and subsequent long-term commitments as well as some of the interest rates positions from derivative contract are used to clearly distinguish between liquidity and the impact on interest rate sensitivity reports (Duttweliler, 2009: 11-12).

Over the years, financial institutions have been concerned with liquidity and have attached great importance to it. The adoption of fractional reserve banking by goldsmiths and other early banks reflected a discovery that it was not always necessary to have liquid assets to fully cover customer liabilities, but it is not easy for banks to decide how much of liquidity needed to meet the needs of depositor. In event the institution runs out run of deposits, the proprietors of the institution in question could be placed under pressure. Furthermore, once pressure was applied to the failing institution, more widespread deposit runs could be triggered. This would potentially lead to widespread financial institutions' failure. The initial solutions to this conundrum was the adoption of the real bills doctrine, in which banks would only lend by way of self-liquidating transactions for relatively short period (Tripe, 1999: 3).

Intraday liquidity risk is a major challenge faced by large banks that are involved deeply in settlement and payment systems. Intraday liquidity is named as "funds which can be assessed during the business day, usually to enable financial institutions to make payments in real-time" (Castagna and Fede, 2013: 69)**.** Intraday liquidity risk is more evident which under normal and stressed conditions banks are not able to meet their liquidity positions for meeting settlement and payments obligations timely. Relevant as it is, intraday liquidity profiles are different for diverse banks depending on how their access to payment and settlement system directly or indirectly. It can also depend on the weather corresponding banking services and intraday credit facilities to other banks are provided (Castagna and Fede, 2013: 69).

Adalsteinsson (2014: 57) indicates that intraday risk is the latest type of liquidity risk hitting the spotlight. The most important parameter is not only the amount but rather the timing of day that the payment has to happen. Furthermore, intraday risk relates more to gross liquidity outflows that can create a temporary net funding shortfall at different times of the day. It is not about the net total amount that goes through each day. It might not necessarily be large amounts, when compared to the bank’s overall size of liabilities but a failure of honoring settlements by another bank that can cause an effect on other banks. This therefore can stop the settlement and payment system to function very well. As a result, regulators cannot ignore intraday risk concerns.

Soprano (2015: 67-68) explains that the management of intraday liquidity of payment is based on a sound process that involves function at the front and back office. It has a close structure for monitoring expected payment. This structure involves contracts with counterparties that are direct for settling disputes and misalignments. Rapid and effective management of problems that hamper payments and settlements are ensured by mechanisms in place. Management of settlement systems can be done by application of net or gross netting. However, for liquidity risk of utmost importance is that intraday payment obligations be met while matching the expected flows.

Back office processes and mechanisms should therefore be put in place to allow immediate intervention for problems that may emerge during the day. There should also be in place alert indicators that for allowing forward-looking and preventive intervention. Intraday payment statistics are extremely useful and worth analyzing. The analyses might include; averages, volumes and volatility by individual or groups, transaction type, posted collateral, and liquidity line intraday utilization. When these are combined with market information and indicators on counterparties from internal credit departments, they become very useful, an overall analysis of exposure and breakdown on the short-term, long-term issuer, pre-settlement, and settlement risks. Therefore, a process to manage intraday liquidity should include the following (Soprano, 2015: 67-68):

- The monitoring and control mechanism for intraday liquidity positions, timing forecasts of payment, and inflows.
- Funding source that is adequate to meet the intraday needs.
- In case of unexpected operational problems, emergency or contingency procedures should be in place.

1.3. MAIN SOURCES OF THE LIQUIDITY RISK

There are two traditional sources of liquidity. Cash or cash-like liquidity buffers can be held by institutions to cover asset price liquidity problem. Depending on the capability to have debt access on reasonable terms, numerous institutions are able to switch to liability-based liquidity. Thus, liquidity of credit-based is fanciful. The blend of leverage with no liquidity is dangerous in any case of the quality of a company's assets (Fraser and Simkins, 2010: 312). However, the source of liquidity is the main balance sheet structure which is the matching cash inflow to cash outflows. On the assets side, good liquidity is to sell, or pledge assets in short notice at the lowest cost while on the debt or liabilities side is the capacity to increase new funds in the short term. All those abilities of the liquidity rely on the perception market of the bank's financial strength (Machiraju, 2008: 188).

Saunders and Cornett (2011: 515-516; 2008: 493-494) assert that two factors lead to liquidity risk, i.e. a liability-side as well as asset-side factors:

a. Liability-side factor: Immediate cash claims by a bank's liabilities holders, for example, insurance policyholders or depositors, is one of the liability-side reasons. The cash demands by liability holders to withdraw deposits from the bank means that the bank borrows more funds or disposes off assets by selling them to meet withdrawal. The mainly liquid asset is cash hence banks utilize it for paying claim holders seeking funds withdrawal. In contrast to having cash, as a way of minimizing cash, banks generate assets as cash reserve since there is no interest payable on interest. As a result, banks invest in less and/or longer maturity assets to generate interest revenues. Whereas mainly assets can be turned into cash ultimately, for some of them this can be costly when the asset must be liquidated without delay.

b. Asset-side Reason: The capacity to fund the exercise of off-balance-sheet debt commitments is an example of asset-side liquidity risk. A customer is allowed to borrow money from a bank on-demand on a loan commitment. This means that the banks must immediately raise funds for their loan on the balance sheet; thus, creating a demand for liquidity. As with liability withdrawals, a bank must meet such a liquidity demand by running down its cash assets, selling off other liquid assets, or borrowing additional funds.

According to Jorion (2009: 608), liquidity risk is a composition of asset and funding liquidity risk. According to the Committee of European Banking Supervisors, asset liquidity risk is defined as market or product liquidity risk. Hence, to significantly influence the market price, this risk cannot be unwound or offset at short notice without inadequate market depth or market disruption. Funding liquidity risk on the other hand is defined as prospective risk that may arise from the inability of an institution to meet its obligations as well as liabilities which come due with no incurring unacceptable losses. Liquidity risk is a composition of market and funding liquidity risks. Banks may not be capable to meet their obligations immediately for a time frame is caused by funding liquidity risk.

As stated by IMF (2008), the incapacity of financial institutions to meet their liabilities when they reach their deadline can be captured as funding liquidity risk. In other definitions, time horizon has been named to be in funding liquidity risk, i.e. the probability of becoming non-liquid can be usually measured for certain period of time. Not being able to trade immediately at a fair price is defined as market liquidity risk. It is the non-diversifiable (systematic) part of liquidity risk (Nikolaou, 2009: 17-18).

Essentially, if the banks are incapable to meet their payment obligations, it results in funding liquidity risk. Alternatively, if transactions cannot be conducted at quoted prices due to of the size of the needed trade compared to regular trading lots; it besides results in asset liquidity risk or market liquidity risks (Jorion, 2007: 259). Similarly, Crouhy et al. (2001: 36) declare that liquidity risk arises from two parts, i.e. trade –related liquidity risk as well as funding liquidity risk. Funding liquidity risk is related to the bank's capacity to increase the required cash to meet its debt, to meet the counterparty margin, cash as well as collateral needs as well as to fulfill capital withdrawals. On the other side, trading-related liquidity risk involves the risk that a bank will not be able to execute a transaction at the current market price in light of the fact that there is briefly; no desire for the contract the "opposite side" of the market.

According to Iqbal (2012: 55); in principally, liquidity risk in finance lays in market liquidity risk as well as the funding liquidity risk. The initial associated with the financial instruments in the capital market. This can be due to inadequate market depth, market trouble or the incapacity of banks to right of entry the market. The final liquidity risk is associated with solvency; it is the possibility that banks are unable to meet funding needs to fund their assets. It incorporates the commitment of banks to make payments to outsiders.

Indeed, funding liquidity risk is concerned with the risk that funding providers, for example, investors, will withdraw or not over their particular funding whereas market liquidity risk relates to liquidity drying up in asset markets. Consequently, assets that were once liquid and effectively tradeable become illiquid (De Weert, 2011: 91).

There are two categories of liquidity risk according to Banks and Dunn (2003: 25-26). First, the risk of loss as result of an inability to realize an expected value on a position when required is regarded as asset liquidity risk. An organization may need to sell assets to meet payments, make an alternative investment in plant and equipment or financial instruments and repay maturing debt. At the point when it cannot after that sell an asset at its carrying value, it faces the risk of loss. Second, the failure to payments, fund assets, as well as additional obligations when required result in the risk of loss. An organization firm normally utilizes some types of debt-payables, repurchase agreements, deposits, short-term debts, commercial paper, long-term bonds, convertible securities, bank loans as business funds thus any interruption in the financing program can lead to funding risk losses.

1.4. MANAGEMENT OF LIQUIDITY RISK

Liquidity risk management targets ensuring a bank against liquidity risk i.e., to keep away from a situation of negative net liquid assets (Casu et al., 2006: 297). According to Arif and Anees (2012: 185), liquidity risk management is concerning all companies as well as it is generally a fundamental risk management framework component for financial system. For a well-managed bank essentially should be a properly defined mechanism that identifies, measures, and monitors and mitigates the liquidity risk.

According to Jorion (2007: 259); asset liquidity management can be achieved through diversification or when limits are set on specific markets or products. On the other hand, management of funding liquidity risk can be achieved by setting limits on cash flow, appropriate cash-flow needs planning as well as having in place a vigorous plan to raise fresh funds in case need arises. Also, requirements assessment for funds and meeting these requirements is a component of liquidity management. This requirement heavily depends on loan commitments and deposit inflows and outflows. Therefore, the potential requirement for funds can be met by asset liquidity and liability liquidity. Asset liquidity relies upon close cash assets including funds lent to other banks, money market securities, interbank deposits, and securitization of loans (Machiraju, 2008: 192). If banks have understood the requirements for cash flow, then they are able to effectively liquidity risk management. External factors greatly influence the required steps. Thus managing liquidity risk in a greatly influence the required steps. Thus managing liquidity risk in a financial institution is important as managing liquidity short fall to avoid a multiplier outcome on the economy in general.

Furthermore, Jorion (2009: 618) declares that managing liquidity risk begins with managing operational liquidity including daily payment queue, cash inflows and outflows forecasts. The second step in managing liquidity risk is tactical management. In this step, an assessment of access to sources of unsecured funding as well as asset inventory liquidity characteristics. Included is the asset liquidity risk assessment. The last step is integration of this information into the strategic perspective beginning with liabilities and short-term assets as well as off-balance sheet items. Using this information, a funding matrix detailing the funding requirements for different maturities is built. Selling assets or the through borrowing covers any identified funding gaps.

1.4.1. Liquidity Risk Management Strategy

An agreed strategy for the day-to-day management of liquidity is a necessity for every bank and communicating this strategy should be communicated throughout the organization should be done. As the case is in most organizations, the strategies are formulated by senior managers and directors as well as results are submitted to the Board for formal approval. The major requirement for strategy to manage liquidity risk is the establishment of risk limits. The general approach taken by banks to manage liquidity risk is setting a liquidity risk strategy. This should include various quantitative and qualitative targets. Ensuring consistent limits with the firm's expressed risk tolerance should be among the reasonable steps the board should take. To coordinate the strategic planning as well as risk management, the board and senior management should consider the bank's liquidity risk management by establishing a liquidity risk management strategy (Matz and Neu. 2007: 67-68).

1.4.2. Controlling Liquidity Risk

Liquidity risk can be controlled by using different methods include reliance on more stable sources of funding and diversification cross sources of funds, geographical location, and debt maturities. In a similar way, controlling asset liquidity risk can be done through diversification and when limits are set on certain in markets and products. Over various horizons, funding gaps should be subjected to limits. Some regulators require setting limits on maturity mismatches, liquid assets minimum levels, or limiting the reliance on particular funding sources. Another tool to control liquidity risk is penalizing business units or instruments that can generate claims on liquidity (Jorion, 2009: 619-620).

Diversifying source of funding over time, keep away from unexpected vital market funding and maintaining few liquidity short-term assets, salable without incurring capital gains and losses is a means of controlling liquidity risk (Bessis, 2002: 137). As a first step, the liquidity committee should develop as well as implement procedures and policies aimed at controlling risk of the liquidity that are consistent with the firm's mandate. Policies of the liquidity convey strategies that deal with exposures as well methodologies a company uses to manage liquidity risk; therefore, they should be considered according a high level of expression. Liquidity policies commonly used include; diversification of assets and funding, control and monitoring, setting limits and approval, stress testing, setting up asset-liability committee as well as contingency funding plans

The liquidity committee should put in place procedures as well as given the firm's mandate to control consistent manner. A company's liquidity risk mandate conveys a practical expression in form of a liquidity policy with strategies dealing with exposures. In contrast, a detailed execution the liquidity policy is provided in liquidity procedures. Creating a balance of controls is a must for the liquidity committee to cover the true sources of risk, at the same time not being too many that resulting matrixes becomes difficult to manage. As an illustration of the process, joint liquidity, asset liquidity, funding liquidity controls, off-balance sheet liquidity controls as well as other safeguards are considered as regarded as general types of controls under liquidity procedures (Banks, 2005: 162-163).

1.4.3. Liquidity Risk Monitoring Function

A dedicated function in that independent of business functions and is responsible for funding liquidity risk control should be put in place. In many companies, this function is part of the risk control area which is in charge of different risk types including credit, market, operational, and counterpart (Soprano, 2015: 153).

To ensure that controlled legal entities are present there is need for an articulated liquidity risk oversight function that is relevant in liquidity management yet providing for group-wide oversight as well as coordination. For regulatory and managerial purposes, there is need for coordination and oversight to ensure that there is limit compliance and rebalancing within the similar group of companies. A set-up like this requires support from well articulated monitoring and governance rules. To strengthen such coordination, limit sets, common reporting and information technology systems are needed (Soprano, 2015: 153).

1.4.4. Asset and Liability Management

Liquidity management composes of two interrelated sections. The first section deal with managing estimate of funds needed based on the deposit inflows and outflows and various levels of loan commitments. The effect on deposit flows are a result of interest rates movements in relation to other financial instruments and the competitive rates from banks in their respective geographic markets. For instance, there was a 50-year low interest rate in the late 1990s to the early 2000s. This affected banks and could not attract transaction on deposits. At the same time banks were on pressure to supply credit even when deposits as sources of funds were shrinking. A credit problem for large banks comes from both financial and non-financial firms competing for loan. Large banks further suffer liquidity demands from loan commitments, letters of credit and off-balance-sheet activities. For this reason, accurately estimating liquidity needs has been a challenge for banks in the recent past. Meeting liquidity needs is the second section of liquidity management. To fulfill this section requires appropriate asset and liability management. Asset management is when liquidity needs are met using near-cash assets such as net funds that are sellable to other banks and money market securities. A growing source of asset liquidity is asset-backed securities that are derived from securitizing loans in the banking sector (Gup and Kolari, 2004: 312). Usually large numbers of unexpected loan defaults can cause a financial institution to experience liquidity problems on the asset side of the balance sheet. However, Banks have been seen to grant credit lines to borrowers yet themselves expect little or nothing to the drawn from these credit lines (Heffernan, 2005: 124).

In this case, banks met the cash demand through asset liquidity. The money market instruments comprised of interbank lending, treasury bills and repos which can be realized with minimum loss of capital. Hence, large deposit withdrawals and loan demand were met by liquidating near money instruments and this approach was defined as asset management. In addition, Asset liquidity is not just an alternative source of funds for the bank yet a reserve depending on the relative costs of funds to forestall problems of solvency. Instrument of money market help in avoiding transaction costs and also price risk whereas maximizing interest income. Furthermore, a secondary reserve of money market instruments that may be immediately converted to cash with small capital loss to meet cash needs does not influence the bank’s capital position (Machiraju, 2008: 193).

Here, reserve asset management supposes that the bank has a pool of reserve assets management that can be sold in cash (Tripe, 1999). When a bank faces liquidity issues, it can use the necessary reserves and surplus cash or sell other liquid asset to meet the demand.

On the balance sheet, liquidity risk relates to the liabilities side if depositors unexpectedly withdraw their financial claims. On the assumption that there is a constant liquidity preference of bank customers, the problems will arise if there is a run of depositors to withdraw their money. On the other hand, when there is an unusually high withdrawal rate experienced by bank, there will be money shortage and the bank faces liquidation long-term investment. There is a possibility of prices going down if other investment houses and other banks are also selling (Heffernan, 2005: 124).

Liabilities management on the other hand is when liquidity needs are meet using outside sources generated from discretionary funds. A second financial condition is however needed to access these sources of liquidity. In other words, a financially sound state of a bank should be maintained. In contrast to larger banks who emphasize liability management, smaller banks put to emphasis on asset management to meet their liquidity needs (Gup and Kolari, 2004: 312-313).

In the same way, liability management depends on the purchase of funds necessary to meet deposit withdrawals and loan demands. This way the bank's funds from low-earning short-term money market instruments are shifted to high-earning loans and longer-term securities. In dealing with liquidity needs, financial flexibility of a bank is greatly increased by liabilities liquidity. Hence, liability management by increasing debt interest obligations as a percentage of total assets however increases the interest rate risk and also the financial risk (Machiraju, 2008: 193).

Therefore, it is important that bank management develops policy to guide a liquidity plan or strategy in order to balances risks and returns. An excess of assets liquidity can reduce bank's profits even though it may offer safety. This is because liquid assets are regarded shorter term and lower risk than other assets meaning that there is a lower rate of return than that could be earned on investment securities and loans. Alternatively, aggressive liability management can improve the profits of bank by shifting funds from shorter-term to longer-term and lower-earning assets to higher-earning assets. This strategy however can lead to bank being exposed to unexpected risks that could lead to abrupt withdrawals of deposits that interest-sensitive and non-deposit funds (Gup and Kolari, 2004: 313).

According to Tripe (1999), liability management depends on a bank being able to increase funds to respond liquidity pressures. At the point, when there is need for unexpected withdrawal of deposits from the banks, as an alternative, the bank borrows from the market to meet this liquidity need.

There is significant relationship between liquidity management and prudential regulation of the banking industry on the assumption that depositors perceive future loan losses on loan will be in exceed available capital on a bank's balance sheet. Even though it is impossible to predict with confidence when a bank would become insolvency, the more possibility of a bank failure could cause depositors fear and a full-blown bank run. Asset-liability management's goal is to develop strategies and implement that shape a bank's balance sheet in way that contributes to its desired objectives (Gup and Kolari, 2004: 313-473).

1.4.5. Contingency Plan

According to Matz (2011: 44) the contingence plan defines the governance in a stress situation, provides indication of the priority of management options, and ensures the availability of a mix of contingent funding sources when market start to dry up. The contingency plan, which is aligned with the bank's overall crisis plans, must deliver clear and swift guidance in terms of responsibilities and potential actions to be pursued. As a minimum, the plan should specify the following topics, which proved to be relevant for the successful management of the crisis Matz (2011: 44):

- Members and lead of the liquidity crisis team with ex ante definition of tasks, responsibilities, meeting rhythm and venues, as well as interfaces to other crisis task forces.
- Escalation levels and related quantitative and qualitative triggers (e.g., liquidity survival period). Additionally, any designated member of the disaster or crisis team should have at any time the authority to call a meeting.
- Overview of contingent funding sources such as additional unsecured and secured funding based on unencumbered collateral, get entry to central bank reserves, reduction, or sale of unencumbered assets. This contingent liquidity generation plan must reach well beyond the thirty-day horizon usually applied for short-term liquidity risk measurement.

- Communication channels and contacts; maintaining communication with the counterparties, the central bank(s), and the regulator is essential in a liquidity crisis.

In preparation for a crisis, there should be a contingency plan that balances the need to have pre-existing procedures and flexibility. At the group this contingency plan is formulated and local ones supplemented it. For appropriate crisis management, dedicated policies and procedures should be put in place, particularly the existing stress tests, robust liquidity buffers and effective funding for contingency plans (Soprano, 2015: 33).

A contingency funding plan is a set of internal procedures used in emergency situations to manage cash flow shortfalls. It is based on assumptions about assets' and buffers' liquidity values, liabilities' behavior, clients and regulators. Policies, procedures and action plans designed to manage liquidity stress events are included in a contingency plan. Contingency funding plan's objectives include well articulated instructions to respond to crises due to liquidity, identifying alternative sources of liquidity accessible by company during events leading to liquidity stress, and a description of steps to take to ensure that the sources of liquidity for covered company are sufficient to fund the costs of operation as well as meeting commitments at minimal costs and disruption. Contingency plans though more recent regulatory requirements, many a number of large banking groups rely on several years of experience to establish one (Soprano, 2015: 164-165).

1.4.6. Liquidity Reserve

The liquidity reserve also referred to as the liquidity buffer, assumes the role of a first line of defense in a liquidity crisis and provides breathing space within the defined survival horizon for triggering further contingency measures if needed. It consists of a stock of highly liquid assets that are not correlated with the financial industry. The reserve also includes high-grade collateral received under reverse repo transactions and collateral pledged to the central bank(s) for emergency situations. Apart from this dedicated stock of liquid assets that are "managed with the clear and sole intent for use as a source of contingent funds," as Basel III puts it, banks normally carry a large bulk of other liquid assets on their balance sheet, in particular in the trading book (Matz, 2011: 48).

Liquidity reserves, secondary liquidity reserves, liquidity warehouses or storehouses are readily and reliably sellable assets. The focus of these is being short-term and readily marketable. Even long-term assets can be liquid if they are readily sellable in an active secondary market. A major obstacle in realizing the cash from selling an asset is unattractive price. Exposure to price volatility is less for a shorter term fixed asset as compared to longer-term assets. Thus we restrict the definition of a liquid asset which is short-term assets and readily marketable (Matz and Neu, 2007: 103).

Cash reserves held in the form of assets that can be quickly and reliably exchanged for cash-in other words liquidity buffers-are the indispensable and preeminent liquidity risk management tool. Not surprisingly, the size of a bank's buffer has long been considered to be very definition of its liquidity (Matz, 2011). The liquidity buffer has no precise definition and banks use different notions for it. A liquidity buffer is the liquidity that is available to cover any extra liquidity need arising under stress conditions over a defined short period of time (Castagna and Fede, 2013: 144).

A liquidity buffer is the amount based on risk tolerance that is sufficient for a bank to survive for a given period of time without disruptions in business model. Thus liquidity buffer is a representation readily available asset for given time period without disruption operations or utilizing additional funding sources within that period. In periods of stress, liquidity buffer is maximum value when accessibility of traditional funding channels are no longer available or cannot provide enough liquidity to the bank when there is urgently need to increase short term liquidity. Liquidity buffer is a short-term component of counterbalancing capacity. Counterbalancing capacity is the bank's ability through its own actions of countering trends which negatively impact on the treasury and liquidity equilibrium. This is done through intervention which urgent liquidity gaps covering in the short-term and strategic management policies and guidelines leading to additional source of liquidity or integrations and changes of activities that improve impacts on financial flows as well as the company's financial structure (Chiaramonte, 2018: 111).

In the risk appetite statement, an alternative to set limits on risk is by adequately covering the need for liquidity to bring the size and composition of the liquidity buffer into play is called high-quality liquid assets. The size and composition of the liquidity buffer can be a science in itself. The liquidity reserve is liquidity available to cover additional funding needs for a defined period of time under stressed conditions (Adalsteinsson, 2014: 76). So the liquidity needs first and foremost to be available when needed, which is dealt with under the composition of the liquidity buffer. There are two major aspects of the liquidity buffer or reserves: its size and its composition. To determine the appropriate size, it should be reviewed the reasons for the liquidity buffer (Adalsteinsson, 2014: 76).

1.4.7. Liquidity Management Policies

A bank's liquidity management policies should include a decision-making structure, a funding approach and liquidity operations, liquidity risk exposure limits set and procedures for planning for liquidity under different scenarios inclusive of crisis situations. The importance that management places on liquidity is reflected in decision-making structures. For banks that institutionalize liquidity risk management structure in Asset-Liability Committee, normally stress the importance of liquidity. Ultimate responsibility is assigned by setting policies and reviewing liquidity decisions to the highest management level of the bank. The funding strategy and liquidity operations of the bank upon approval by the board set specific policies on aspects of risk management. These include the structure of target liabilities, use of financial instruments or deposit pricing. Determination of liquidity needs through construction of a maturity ladder over a series of specified time bands comprise cash inflow and outflows. A starting point to measure a bank's future liquidity excess or shortfall at any given time provides the difference between the outflows and inflows in each period (Greuning and Bratanovic, 2009: 195-196).

1.5. MEASUREMENT OF LIQUIDITY RISK

According to Chen et al (2018: 6-7), commonly liquidity ratio is used to measure liquidity risk. Literature defines liquidity risk ratio in two different ways. The first definition considers adjustment of size to measure liquidity ratio that includes the liquid assets to total assets ratio, liquid assets to deposit ratio, and liquid assets to customer and short-term funding. In the second definition a consideration of adjustment of loans by size, for example the net loan to customer and short-term funding ratio as well as loans to total assets ratios. The dynamic and unpredictable nature of the underlying variables that drive exposures makes measuring liquidity risk a challenge. While some aspects of funding and asset liquidity risk can be easily identified and quantified, other numbers are not.

In the literature we find a number of approaches to liquidity risk measurement. A bank's sources of liquidity are cash or assets that can be sold for cash and funds able to be borrowed in wholesale financial markets. The bank's uses of liquidity are primarily funds that have already been borrowed in wholesale markets. Therefore, it reasonably difficult to measure a bank's liquidity sources unless it obtains committed standby lines from other financial institutions. But even then, these supposedly committed lines may be terminated if the source of liquidity becomes sufficiently concerned about the solvency would be user of the liquidity (Tripe, 1999: 6).

Comparing balance sheet features and ratios of a bank with those of banks of an equal size and geographic location is second way to liquidity risk measurement. These features include ratios of loans to deposits, borrowed funds to total assets, commitments to lend to assets (Saunders and Cornett, 2011: 523).

Liquidity index is another liquidity risk measurement. Liquidity index measures a financial institution's potential loss from rapid disposal of assets in comparison to a fair market value under normal sale conditions. This approach is appropriate in market such as the United States where asset security history as well as loan sales is extensive enough (Tripe, 1999: 7).

Another measure of liquidity risk is to determine a financing gap. A financing gap is an alternative measure of liquidity risk. This gap is defined as the difference between the average deposits as well as loans of a bank. In generally, it is a financial requirement for core deposits' and loans' level as well as the amount of liquid assets will determines how borrowing or purchased fund needs of a bank. A bank's deposit base that is the relative stable and focuses on the changes its financing requirement and financing gap is another approach to liquidity risk measurement (Saunders and Cornett, 2011: 524).

Banks and Dunn (2003: 68-69), analytic formulas and scenarios can also used to measure liquidity risk. In this approach, on balance sheet and off-balance sheet items in need of funding or disposal are the focus of liquidity risk measurement.

Furthermore, Machiraju (2008: 194) declares that the ratio of loans to non-deposit liabilities, loans to deposits, unencumbered liquid assets divide non-deposit liabilities, as well as near cash assets divide large denomination liabilities are used to evaluate bank liquidity. A high loan divide deposits ratio gives a bank either large loan portfolio or utilizing non-deposit or purchased funds to finance assets. Similarly, high loans-non deposit liabilities ratios give a bank heavy reliance on non-deposit funds. In addition, a high unencumbered liquid asset non-deposit ratio gives a bank considerable secondary reserve. Near cash asset/ large denomination liabilities ratio measures the bank's capacity to use liquid assets to cover wholesale funds.

Here, liquidity measurement helps to meet obligations for expenses on operations and other current or short-term liability. Within one year, current liabilities should be paid out of current assets and thus current assets and current liabilities are used to calculate liquidity measures. Capital ratio, current ratio, cash ratio, investment ratio and quick ratio are the most significant measures of liquidity (Alshatti, 2015: 64).

1.5.1. Bank Liquidity Ratios

The fundamental asset-liability gap ratio is a bank's liquidity ratio (Choudry, 2011: 245). From the perspective of bank analyst, call report condition can be used to estimate bank liquidity. There are four typical ratios used to measure bank liquidity (Gup and Kolari, 2005: 327):

Loans / deposits

Loan / non-deposit liabilities

Unencumbered liquid assets / non-deposit liabilities

Near-cash assets / large-denomination liabilities

A picture of an institution's liquidity position can be conveyed by its liquidity ratio as measure things from the corporate income statement, cash flows statement as well as balance sheet to determine the adequacy of resources. Various liquidity ratios are used by financial institution to calibrate to their operations. Common ratios used by banks are considered below according to Banks (2005: 134). Volatile funds divided by liquid assets, total deposits divided by borrowed funds, and subtraction of current assets from volatile funds divided by total assets minus current assets are indictors of borrowing ratios. These ratios measure a financial institution's need to support business by using volatile borrowings. They also measure the degree of use of cash and equivalents to repay money on a very short notice. The bank's degree to support core lending through deposits is measured using loan to deposit ratio or total loans divided by total deposits. Cash liquidity ratios are cash divided by total assets and quick assets divided by total assets, higher the ratios, the more liquid the asset portfolio (Banks 2005: 134).

Here, the degree to which a bank's leveraged position is correctly matched or completely unwound is indicated by a measure of the matched book ratio divided by reverse repurchase agreements within the securities firm sector. A greater liability mismatch is reflected by higher ratio as well as more difficulty to unwinding the operation that prove necessary (Banks 2005: 134). In order for banks as well as securities firms to rate sensitive of their assets for liquidity risk and risk of interest rate, they use the difference of measurement between their rate sensitive liabilities and assets.

i. Liquid Assets to Total Assets Ratio (LATA)

Assets that may be easily and rapidly converted for cash on the market at a reasonable cost are known as liquid assets (Soprano, 2015: 6). Cash and balances with central banks, amount due from other financial institutions and securities available for sales are the majority of liquid assets (Adalsteinsson, 2014: 114). Asset liquidity is the simplicity which an asset can be converted into cash with the minimum of loss. Measures of liquidity are represented as a percentage of total assets. The majority of small banks maintain substantial investments in highly liquid assets due to the offer liquidity under pressure. As a general measure of liquidity, loan-to-deposit ratios are monitored or closely watched by many banks. Illiquidity is indicated by a high ratio. A low ratio indicates that a bank has more liquid assets. The ease with which a bank can issue new debt in order to obtain clearing balances at reasonable costs is known as liability liquidity (MacDonald and Koch, 2006: 298-299).

According to IMF (2019: 6), ratios like liquid assets to total assets, liquid assets to short-term liabilities, liquidity coverage ratio, and net stable funding ratio are examples of liquidity ratio. The most well-known one is the liquid assets to total assets ratio (LATA). This ratio is computed with liquid assets to total assets, which is regularly utilized in financial literature and it is termed as the obligation of deposit banks to maintain a predetermined percentage of other liabilities and deposits in the form of liquid assets. The formula is as follows:

Liquid Assets to Total Assets = Liquid Asset / Total Assets

The ratio of assets to liabilities is known as the liquidity ratio. The ratio of assets to liabilities is short-term ratio that is determined typically only for the money market term and it is up to one year. From the perspective of ROE, a ratio that is much below 1 is inefficient (Choudry, 2011: 156). The percentage of liquid assets in total assets serves as a stand-in for the liquidity indicator (Tariq Islam, 2020: 41).

ii. Loan-to Deposit Ratio

Loan-to-deposit ratios were the attention of banks and regulators. Due to the loans are generally illiquid, the higher the loan-to-deposit ratio of a bank, the lower its liquidity (MacDonald and Koch, 2006: 298). The most crucial indicator to assess the bank’s liquidity is the loan-to-deposit ratio. For conventional banks, a loan is an advance. When compared banks with high loan-deposit ratios, those with low loan-deposit ratios are considered to have excessive liquidity, potentially lower profitability, and therefore low risk (Pradhan and Shrestha, 2016: 5). The formula is as follows:

Loan-to-Deposit Ratio= Loan / Deposit

A common indicator of bank liquidity is the loan-deposit ratio, which shows how frequently deposits are utilized to fund loan requests. The ratio of loans and leases to core deposits is a variation on this theme. All other factors being equal, the smaller this percentage, the more stored liquidity a bank has (Sinkey, 1998: 257).

iii. Liquid Assets to Deposit + Short-term Borrowing Ratio

The concepts of liquid assets are also used in this ratio. On the other hand, this ratio focuses more on the bank's sensitivity to particular funding sources. The higher is the ability to absorb liquidity shock, the higher the ratio's value (Vodova, 2013: 65).

Liquid Assets to Deposit + Short-term Borrowing Ratio = Liquid Assets / Deposit + Short-term Borrowing

iv. Temporary Investment to Assets Ratio

The ratio short-term investment to assets used to measure a bank's most liquid assets as a percentage of total assets. The sum of three things can be used to define temporary investment (Sinkey, 1998: 257). The formula is as follows:

Temporary Investment to Assets Ratio= Temporary Investment / Assets

v. Liquid Assets to Deposit Ratio

The Liquid Assets to Deposit Ratio and the ratio of Liquid Assets to Deposit + Short-term Borrowing are extremely comparable**.** On the other hand, it only includes deposits made to businesses and households. This ratio assesses a bank's liquidity under the assumption that it cannot borrow from other banks in the event of liquid need. Lower value signifies that a bank is more sensitivity to withdrawal of deposits (Vodova, 2013: 65).

Liquid Assets to Deposit Ratio = Liquid Assets / Deposit

vi. Liquid Assets to Short-term Liabilities

This ratio is computed utilizing short-term liabilities as the denominator and the liquid assets as the numerator. Liquid Assets include Cash and Balance CBRT plus Financial Assets where fair value change is reflected to income statements (net) plus Money Market placement plus Banks and other Financial Institutions plus Securities Available for Sale (net) plus Reserves. Short-term Liabilities include "Demand" and "One Month maturity" columns of the "Liquidity Risk" table from "Financial Position" section of the Communiqué-Financial statements and related explanation and footnotes of the banks that is disclosed to the public (BRSA, https://www.bddk.org.tr//BultenAylik/en). The formula is as follows (Şimşek, 2019):

LASL = Liquid Assets / Short-term Liabilities

1.5.2. Cash Flow Gap and Financing Gap

To determine possible surpluses or deficits over various time horizons cash flow gaps are used. Basic discrete time buckets are used in measuring cash flow gaps. Alternatively, more advanced measures for example duration analysis are used. Except a firm's operations are mainly straight forward, simple maturity gaps are given due consideration as being a bluntly ineffective capture of cash flow nuances. Basically, liquidity risk is supplying liquidity below the requirement of net funding for a particular period of time (Banks, 2005: 136-137).

According to Saunders and Cornett (2008: 503), financing gap is named as the difference between depository institution's average loans as well as average (core) deposits and is calculated by the following equation as;

Financing Gap = Average loan – Average deposits

On the other hand, financing requirement is named as the financing gap plus a depository institution's liquid assets.

Financing Requirement = Financing Gap + Liquid Assets

1.5.3. Stress Testing

Stress tests encompass various practices (scenarios, sensitivity analysis) that aim to evaluate the consequences of infrequent. By definition, a stress test is a stress test scenario or test of sensitivity according to BIS. Stress test scenario can also be defined as a test that is multi-variant based on an historical scenario or a hypothetical scenario a significant event (Matz and Neu 2006: 41-42). Stress testing is an element of great importance in management and measurement of liquidity risk, risk evaluation as well as contingency planning (Matz and Neu 2006: 41-42).

Banks being unable to avoid holding enough liquidity under normal condition so as to survive hypothetical worst-case problems is dealt with using stress testing.

Thus, liquid assets are held to buy time at the inception of non-normal conditions. In this context, banks utilize stress testing to enable them to assess liquidity assets and implement alternative actions in a remedial perspective as well as large amounts to survive. Forecasting also uses stress testing to refine forecasts when potential assumptions errors as well as misunderstandings of correlations amongst risk factors are identified (Matz and Neu 2006: 42).

Matz (2011: 171) indicates that the most important element of risk management is stress testing. Despite its importance, inappropriate methods are often used to measure stress testing and hence the results are often misunderstood. In the end, the entire process of stress testing is often dismissed as mere regulatory compliance. This confusion begins with the very definition of stress testing as difference between deterministic and probabilistic approaches. While some risk professionals use the term “scenario analysis” for identifying deterministic tests, others use “stress tests” to refers to probabilistic test. Another discrepancy comes from single variable and multiple variable stress testing. In case, some risk professionals describe “stress tests” as univariate testing, and “scenario analysis” as multivariate testing. It becomes even more confusing when “sensitivity analysis” is sometimes used to mean univariate testing, and “stress tests” to mean multivariate testing.

1.5.4. Value at Risk (VaR)

To deal with diverse types of risks, VaR as well as liquidity risk measures have been applied to a great extent. However, a great number of researchers have advocated for liquidity-adjusted VaR measure which combine both with VAR and liquidity risk. One such definition of liquidity-adjusted VaR is a sum of regular VaR and the cost of unwinding positions in normal market (Hull, 2018: 543).

In another study, Vento and Ganga (2009: 98), the measure of liquidity value at risk, sometimes called ‘cash flow at risk’ describes as the maximum loss that comes from ‘unwanted liquidity situation but not exceeding a given probability for known period of time. This probability is known as the confidence level. The cause of this is unpredictable options of counterparties as well as market variables’ changes. In the liquidity adjusted value at risk framework, the expected liquidity profile of the bank is adjusted for proper management of potential of expected cash flows changes.

1.6. REGULATIONS AND SUPERVISIONS OF BANKS FOR LIQUIDITY

Ordinarily, financial institutions including banks are obligated to comply with a variety of controls, and regulation. The primary regulatory control in this regard is capital level held by a bank. It is a requirement that this level be sufficient to sustain bank's activities. This regulation may be applicable locally or even across borders. Among cross borders regulation is the European Union's capital adequacy directive.

In this regard, the bank for international settlement (BIS) proposal by the committee of central banks in 1988 has been universally adopted as the capital requirements scheme. This scheme is referred to as the Basel capital ratios or BIS regulatory requirements. The Basel capital ratios require that off-balance sheet instruments and all cash in the bank's portfolio to be assigned a risk weighting. The weighting is based on the perceived credit risk as determines of the minimum level of capital that must be set against them (Choudhry, 2011: 282).

The Basel Committee on Banking Supervision (BCBS) was established by the central bank Governors of the group of 10 countries at the end of 1974. The Board of Governors of the Federal Reserve System (FED), the Office of the Comptroller of the Currency (OCC), and the Federal Deposit Insurance Corporation (FDIC) regulate commercial banks in the United States. Unlike in the United States, the United Kingdom adopts a more logical regulatory framework. In this framework, only one regulator is responsible for banks, securities markets, and insurance firms. This framework is called the Financial Services Authority. In July 2000, Japan established the Financial Services Agency with the primary of the supervision of financial markets, banking, securities business, and insurance. Banks in all part nations in the EU are required to meet minimum standards. A new Capital Adequacy Directive implements Basel II was adopted in June 2006 as well as applies to all banks in the EU (Jorion, 2007: 637).

Globally, the Basel Committee regulates and supervises banks; Basel has since its inception issued three guidelines. In 1988, the Basel I Accord was initialized. This sets the requirement to calculate the amount of capital that must be set aside to absorb potential losses across all banks throughout. Amendments Basel I was made in 1996 to incorporate market risk. Basel II was issued in 2004. This regulation includes international convergence of capital measurement and capital standard. The purpose of Basel II is to make requirements for capital more risk sensitive. As a response to Financial Crisis; in 2010 Basel III Accord was issued. This extended include liquidity ratios as well as leverage ratio (Abdulganiyy, 2018: 66).

1.6.1. The Basel-I Accord and the 1996 Amendment

The major goal of the 1988 Basel Accord was to provide requirements for minimum capital for commercial banks. Promoting a safe and sound global financial system and creating a level-playing field for international active banks was its objective. There is greater penalty for riskier assets created by risk-based capital charges. The initial 1988 Basel Accord covered only credit risk expressing the minimum level of capital expressed as a ratio of the total risk-weighted assets. A balance sheet and off-balance sheet items are included. However, there should be at least 8% coverage of risk-weighted assets for capital held in banks (Jorion, 2007: 643-644).

The Capital Accord was introduced in July 1988 by the Basel Committee on Banking Supervision. By the end of 1992, it was assumed that world's leading central banks should apply the Basel Accord, which is new known as 'Basel I'. The original 1988 Capital Accord established an international standard around a capital ratio of 8 percent. Lending and other types of risk of associated risk were the major point to be focused on. Accordingly, the Basel defines Bank total capital as a sum of core capital (Tier 1) and supplement capital (Tier 2) elements (Casu et al., 2006: 181).

The 1996 amendment of the capital accord incorporated market risks. Capital charge for market risk was also included in this amendment and came into force at the end of 1997. Basing on bank's own risk management system, a standardized model or an internal model approach use was bank' asset being separated into trading and banking categories. In the 1996 amendment, capital charge trading books' market risk is added and banking, and banking book commodity and the currency risk. Equity securities and debt in the trading book and positions in commodities are exchange excluded from the specific risk charge (Jorion, 2007: 644).

In April 1995 consultative proposal to amend the Accord which became known as the "1996 Amendment" or, after it implemented "BIS 98" was issued by the Basel Committee". The U.S. regulatory agencies adopted this proposal in July 1995. This became mandatory for all U.S. financial institutions with significant trading activities as of January 1, 1998 (Crouhy et al., 2001: 62). To cover exposure coming from equity and debt positions in trading books, and commodity positions and foreign exchange in trading banking and trading books, financial institutions are required to measure and hold capital (Crouhy et al., 2001: 62).

1.6.2. The Basel-II Accord

To respond to the criticisms of the original Accord, on 3 June 1999, Basel II was formally launched by the Basel Committee on Banking Supervision. This proposed the new capital adequacy framework. Strong criticism of the first accord from bankers and academics of the first version was the major factor that led to proposals for changes in the original framework. To this effect, in April 2003 a consultative document was published. In May 2004, an agreement on the new Accord was attained. The new Accord aimed at introducing treatment for sensitive risk in banking that was comprehensive to ensure closer regulatory relationship between capital and credit risk bearers. Basel II was founded on three Pillars. The first was that banks should quantify new capital charges that rely heavily on the bank's internal risk. The second Pillar defined the supervisory review process and the third focused on discipline in the market and imposition of great disclosure standards on banks for increased transparency (Casu et al., 2006: 185).

Market risk measures were refined in the 1996 amendment to allow internal models that were still in force. Although mandatory and the regulatory bodies rely on periodical enhanced reports to impose corrective actions, interest rate risk is not affected by capital requirement. In early 2001, the final stage of the new Basel Accord process was published with focus on defining capital requirement to incorporate credit risk measures enhancement, introduction of operation risk, disclosure, market discipline and supervisory review process (Bessis, 2002: 26).

Basel II is founded on three "pillars". In the first, calculation of the minimum capital requirement for credit risk in financial institution specially the banking book is done to reflect the credit ratings of counterparties. The 1996 Amendment does not change the capital requirement for market risk but there is a new capital charge for operational risk. The Second focuses on the supervisory review process, allows some discretion in how regulators in different countries can apply rules without losing overall consistency in the application of the rules. The final pillar asserts that for the sake of market discipline, banks require to disclose more information about the way they allocate capital and the risk they take (Hull, 2018: 360).

Basel-II implementation is largely based on three different pillars (Abdul karim, 2012: 51-55):

i) Pillar One - Minimum Capital Requirement: The first pillar focus on maintenance of regulatory minimum capital which is calculated based on the principle of risk profile attached to the investment; they are credit risk, operational risk and market risk. Among banks, the measurement of minimum capital requirement differs as the risk evaluation disperses depending on the risk situation. Therefore, the international level of minimum capital requirement regulated under Basel II is at 8% of total capital.

ii) Pillar Two - Supervisory Review Process: The second pillar emphasized the needs of banking supervision. It is an integral part of the new capital accord alongside with the minimum capital requirement to ensure an adequate amount of capital for the banks. It also encourages banks to manage its capital that is commensurate with the risk profile, operations and the business strategy.

iii) Pillar Three - Market Discipline: In the third pillar of Basel II, market discipline is added as a complement the first and second pillar. Those two pillars are to be reinforced through a transparency requirement or disclosure requirement. In particular, the purpose of pillar 3 is to improve market discipline through an effective disclosure that will be timely, reliable and transparent. It is therefore essential for market participants to assess the relevant risk in the investment so as to achieve adequate assessment of the capital as a cushion against any unexpected losses.

1.6.3. The Basel-III Accord

According to Choudhry (2011: 282), details of the new banking regulatory capital rules was released by a consortium of 27 central bankers and regulators (the Basel Committee for Banking Supervision) in September 2010. This came to be known as Basel III regime. In these rules, holding a higher amount of core capital was a requirement for banks as opposed to Basel I and II regimes. Under Basel III, core capital was required to be minimum level of 4.5% of risk-weighted assets compared to 2 % in Basel II. To act for protection in periods of economic and financial stress, capital conservation buffer of 2.5% was required. There was also a 3% for Tier 1 leverage ratio.

According to Banks (2014: 243-244), Basel III is the newest version of the framework as well as focusing on minimum requirements needed to stress test, bank capital adequacy standards basing on higher quality capital instruments and supplemental of capital buffers, prescriptive definition of limiting maximum leverage, and prudent treatment of market liquidity risk. Basel III themes majorly relate to weaknesses that were uncovered in the last financial crisis. In Basel III, there is an introduction of liquidity coverage and the net stable funding ratio. These ratios ensure that sufficient amount of liquidity that is stable is maintained. These measures are instituted by banking institutions that are regulated.

Basel III classifies Tier 1 capital as what is compulsory to absorb losses whereas Tier 2 is a 'going concern' reserve to shield creditors in case of insolvency. Tier 3 is completely abolished in Basel III. Common equity and retained earnings are expressly incorporated as Tier 1. The expectation to promote potential resilience to liquidity interruption over 30 days is called Liquidity Coverage Ratio. This in turn helps to ensure that worldwide banks can offset net cash outflows in an acute short-term stress scenario because they have adequate unencumbered, high-quality liquid assets (Basel Committee on Banking Supervision, 2010: 3). It is calculated by the following equation as;

Liquidity Coverage Ratio = Stock of High-Quality Liquid Asset / Total Net Cash Outflow over the Next 30 Calendar Days.

Merwe (2015: 157) mentions that the 30-day survival ability of a bank because liquidity disruptions is measured by the liquidity coverage ratio (LCR). This ratio based on the assumption that interbank deposits and short-term financial instruments are completely drawn in less than one-month maturity. Acute stress ratio is considered in this 30-day period calculation. The Basel III regulatory requirements state that this ratio should be greater than 100 percent for the bank's liquid assets to be sufficient for survival under these pressures.

As acknowledged by acute stress ratio, there are different securities for market liquidity and credit characteristics. Liquidity assets that are of high-quality liquid assets are mostly government bonds as well as cash. At the maximum the percentage of corporate bonds as well as mortgages certain lower quality.

For sources of funding to be stable, there should be a minimum amount the bank relative to the liquidity profiles of the assets as required by the net stable funding ratio. Basel Committee on Banking Supervision is in line with the potential contingent liquidity that results over a one –year horizon from off-balance sheet commitments according to Basel Committee on Banking Supervision (2010: 67). Castagna and Fede (2013: 55-56) define LCR as the ratio of stock of high quality current assets held by bank / net cash outflows measurement over a 30-day. Thus, the Basel III standard requires that the ratio not fall below 100%.

More medium as well as long-term asset funding and bank activities inclusive of off-balance sheet exposures and activities of capital market for reduction of the extent of bank's maturity mismatch are the aims of NSFR. In theory of NSFR is given an expectation lowering the bank's liquidity runs probability and the associated default. If it is subject to firm-specific funding stress, its intent is to support the institution for at least a one year going concern (Merwe, 2015: 158). The formula to compute this ratio is as the below:

Net Stable Funding Ratio (NSFR) = Available Amount of Stable Funding / Required Amount of Stable Funding

The numerator is product of funding categories and available stable funding factor (ASF) that reflects its stability. The funding categories include wholesale deposits, capital, and retail deposits. Assets and items required of off-balance sheet funding are used to calculate the denominator. To reflect the permanence of the required funding, each category is multiplied by a required stable funding factor.

As reported by Abdulganiyy (2018: 40), these days most of investors’ time is spent not on how to manage interest rate and credit risk but on worrying about liquidity risk. The authors argue that at a time of financial crisis, liquidity dries up because of inability of subprime borrowers to pay their mortgages to the banks. Chiaramonte (2018: 1) states that the global financial crisis which originated from United States (US) in 2007 was result of subprime mortgage loans. When regulators got attention of it, they started putting controls in place to manage bank liquidity issue and their efficient management to ensure bank stability. Before this, there was underestimation of liquidity risk by prudential regulation. This was because there was belief that there were no problems to bank stability caused by illiquidity problems that could consequently jeopardize the whole financial system.

1.6.4. The Basel-IV Accord

Reforms in Basel III Accord were announced in December 2017 by the Basel Committee Banking Supervision (BCBS). These reforms have been generally referred to as Basel IV. Sometimes it has been referred to as Basel 3.1 and its implementation is scheduled to begin on Jan.1, 2023 (Daugherty, 2022). Basel IV standard is modifying in the bank’s global capital requirements, which was agreed in 2017 and mandated from 2022. Basel Accord refers to the amends made to the standards. Basel III reforms, an international regulatory framework for banks created by BCBS in response to financial crisis of 2007-2008, are now complete (Rajendran and Shilpa, 2022: 1730).

The focus of the finalized Basel IV or reforms Basel III is to enhance reliability and credibility of calculating risk-weighted assets utilizing various methods. The revised standards and approaches include methods for calculating credit, operational and market risks, risk-sensitive capital floor, use of internal models constraints and leverage ratio that limits the leverage importance of global banks in a systematic manner (Basel Committee on Banking Supervision, 2017: 1).

A firm commitment to full, timely, and consistent has been expressed by Basel Committee Banking Supervision (BCBS) member to implement Basel IV. However, it is not known if the rules would be transposed into the national law because there is no sufficient public information from the respective national regulators on efforts to implement it, thus how they will progress with Basel IV remains uncertain. Basel IV reforms were initially planned to be implemented starting from January 2022 onwards. However, the outbreak of corona virus disease 2019 (COVID-19) and its impact on the global banking system, in April 2020 BCBS postponed the Basel IV standards implementation timeline for another year to 1 January 2023 (BCBS, 2020 a, b).

It is highly unlikely that the final form of Basel IV will amended, but this time until the implementation is widely used by global regulators and supervisors (Parchimowicz and Spence, 2020: 24). Because Basel IV concentrates on the assessment of market, operational and credit risk exposures, the main areas impacted by Basel IV regulation are portfolio composition, product structure, capital management, and operational adjustments (Bakare, 2018: 383).

As expected, once Basel IV has been implemented, there will be serious implications for banks. In the first, banks will be required to apply for supervisory approval to use the internal modeling approaches. Moreso for banks to respond to changes in risk weights they will need approval to adjust their business models, strategies and asset portfolios. Secondly, it will be requirement for banks to consider regulatory capital ratios needed to issue new capital, retained earnings or a reduction in risk weighted assets. This poses a challenge especially at this time when interest rates are historically at their lowest levels global and return on equity is expected to stay low as result of the COVID-19 pandemic (Feridun and Ozun, 2020: 9).

The four main novelties introduce in Basel IV include; i) enhanced and robust standardized approaches for risk sensitivity for credit risk and operational risk; ii) constrained approaches for using internal models, under internal ratings basing on credit risk approach and removal of the use of the internal model approaches for operational risk, limitation have been put on certain inputs used to calculate capital requirements; iii) introduction of a leverage ratio buffer that further limit the leverage of important banks that are global systemic; and iv) introduction of a revised Basel III standardized approaches to replace the existing Basel II output floor with a more robust risk-sensitive floor based on the BCBS’s (Bodellini, 2019: 90; Parchimowicz and Spence, 2020: 22).

PART II

2. PROFITABILITY AND EFFICIENCY: CONCEPT AND MEASUREMENT

Just like any other businesses, banks also aim at achieving profit. This is done by successfully managing the assets and liabilities. The decisions made by management on how much liquidity is available in the bank greatly impacts on the profit maximization efforts of banks. The financial crises have demonstrated that liquidity plays an important role in bank's operations and hence on the profitability of banks. Therefore, there is exposure to risk if banks don't have the sufficient liquid assets required to meet the random demands of depositors. Furthermore, the bank's liabilities mature in shorter times as compared to assets and thus banks should have permanent funding control of the structure of the balance sheet in respect to the maturity transformation. As a consequence, again and again re-financing circle that's part of banking commercial enterprise inevitably exposes banks to liquidity risk.

The different of a bank's liquidity ratios impacts on bank's profitability that depends on a bank's specific and macroeconomic indicators. Not forgetting that bank's profitability is related to both external and internal dynamics, it makes meaning to analyze profitability in comparison to sector averages. Interest rates, economic growth rates, inflation, supervising institutions and regulations also contribute to the profitability of banks. A case in point is interest rates on subsidized loans from public banks play an important role in Turkish commercial banks and periodically caused a decrease in profitability.

The expense-to-income ratio used to measure efficiency greatly drives the profitability of banks. Furthermore, management of expense is a major and consistent contributor to improve profitability. The presence of a big difference in wages and salaries makes efficiency use of labour key in determining relative profitability. Staff expenses are expected to relate inversely to profitability as costs reduce the bank's total operations. When the level of staff expenses is high, a negative impact on the bank's ROA is experienced. There might be a relationship that is positive between total profit and labour costs. Consequently, the received higher profit seen in regulated companies is a form of appropriation on expenditures on the payroll.

2.1. PROFITABILITY CONCEPT AND BANK PROFITABILITY

2.1.1. Profit and Profitability Concepts

Earning profit is the most important focus of every economic movement or company functionality. Many times, profitability and profit are closely related and considered to be the same though they are having a crucial dissimilarity. Profit is an absolute amount while profitability is a relative amount. Profit obtained is a difference between a company's revenue and expenses generated by the business, profitability on the other hand is measure efficiency in relation to a company's success or failure. Furthermore, profit can be defined as the excess expressed in monetary terms of output over the input factors. It is hence the surplus of revenue over costs. According to Professor Robbins, "profits are the motivating force for economic movement". Measuring profit gives business an understanding of efficiency it is (Madura, 2007: 4; Paramasivan and Subramanian, 2008: 5; Toshniwal, 2016: 174).

On a firm's income statement, profit is calculated as the difference between total revenue minus total expenses. A firm's success or failure efficiency is measured according to its profitability. According to Madura (2007: 583) the performance of a firm's operation in given period is measured by its profitability. A firm's level of assets, sales, or capital is indicative of the dollar amount of profit generated.

Profitability is also used to show the capacity of a firm to cover all costs and provides some returns relative to sales or investment. A higher the profitability means a company has a lower probability of failure (Teker et al, 2016: 604). Gross operating income is used to measure profitability. Deloof (2003: 576) defines operating income as gross revenue less costs of goods sold, as well as it is divided by total assets minus financial securities. When profitability falls, the firm will respond by investing less (Brealey et al, 2011: 85). Profitability can also be described as the ability to gain benefit from the whole enterprise activities. It shows how efficient management of a firm in generating earnings by utilizing the resources at its disposal. Analysis of profitability is the evaluating return on investment of firm while focusing on its sources and levels of profits to identify as well as measure the effect of a variety of drivers of profitability (Subramanyam and Wild, 2009: 13).

A number of policies and decisions can lead into profitability. The combined effects of asset management, liquidity and debt on operating outcomes are indicative of profitability ratio (Brigham and Ehrhardt, 2011: 98). In other words, the term 'profitability' is created 'profit' and 'ability'. 'Profit' is defined as deducting total costs from income while 'ability' means a firm's capacity to make profit. Ability can also mean earning capacity or operating performance of the concerned investment. The capacity of a given investment to produce a return from its utilization is its profitability (Toshniwal, 2016: 177).

Paramasivan and Subramanian (2008: 5) assert that profit is the financial benefit accrued from revenue generated when a business activity exceeds the expenses, costs, and taxes involved. Profit maximization is an approach which purpose at maximizing the profit and it is also called as cashing per share maximization. This leads to maximize the business operation. Every firm's ultimate aim is to make profit; therefore, it will consider all the available to raise the profitability. Profit is the parameter of measuring the efficiency of the business concern. Hence it is an indicator of the financial position of a firm.

Profitability of a bank is importance at both the micro as well as macro levels of the economy. At the micro level, a competitive banking institution must meet essential profit prerequisite with the cheapest source of fund. Without profits, like any other firm, bank can not attract outside capital (Gitman, 2009). Therefore, profits greatly persuade depositors to provide their source on advantageous terms (Aburime, 2008: 2). This makes the bank's management basic aim of conducting any business being to achieve profits. At the macro level, a sound and profitable banking sector should be able contributing to the stability of the financial system despite the negative shocks. The profitability potential of banking sector greatly contributes to encouragement, economic motion strength and global orientation increment of the sector (Aburime, 2008: 2; Acaravci and Calim, 2013: 28).

2.1.2. The Balance between Liquidity and Profitability

Maintaining a balance between liquidity and profitability by a firm in its day-to-day operations is a requirement. Liquidity is a precondition for ensuring that firms meet their obligations in the short-term so that there is guaranteed continue flow from a profitable venture. Given its importance inside the firm, it should not be surprise that cash is important as a sign of ongoing financial health. This necessitates effective and profitable corporate operations. A firm's profitability may increase in the short-term because of an asset-liability mismatch; this may lead to risk of its insolvency. Similarly, when focus is too much on liquidity, it can be the expense of profitability (Padachi, 2006: 45).

Liquidity management is important in good times but should be more importance in troubled times. In a broader sense, efficient management of the measure of liquidity and working capital is important just as the narrower measure of cash for a company's profitability and well being. Planning and controlling current assets and current liabilities efficiently to eliminate risk of not meeting short-term obligations is a major task for liquidity management practitioners. On the other hand, efficiently planning and controlling liquidity is measure that greatly affects profits and shareholders' value (Eljelly, 2004: 48). As examined by Nazir and Afza (2009) and Deloof (2003), effective working capital management, in particular effective liquidity management, has direct affects on the market value and business's profitability.

Accordingly, Abdillah et al (2016: 142) suggest the bank's profitability can influence on the profit sharing that depositors will take. Other than profitability, liquidity is also a valuable factor used in the banking industry to increase public trust. Liquidity defines the ability of banks to handle withdrawal of deposits and other liabilities efficiently way as well as cover the increase in loan funds and investment portfolio. Banks having an adequate level of liquidity can immediately obtain the necessary funds at a reasonable cost. To a bank, both profitability and liquidity mean a lot. A bank's viability in the short term depends on the liquidity, while the bank's viability in the long term and continuity depends on profitability. A successful bank is one with the appropriate level of liquidity enabling it to get the maximum profitability. Factors that affect a bank’s profitability and liquidity include; bank size, capital, non-performing financing, efficiency, etc.

Liquidity and profitability can be seen as two points at the end a straight line. Moving towards one takes you further from the other, thus there will always be a trade-off between liquidity and profitability. Therefore, it is important to maintain a balance between profitability and liquidity under tough competitions, growth and performance for both survival and continuity of enterprises (Saluja and Kumar, 2012: 78).

The short-term trade-off between profitability and liquidity exists. All other things being equal, a bank’s return on equity and return on assets will be lower the more liquid a bank is. Liquidity of both assets and liabilities affects this connection. Composition and maturity of funds have an impact on asset liquidity. More cash holdings obviously decrease profits due to the opportunity loss of interest income (MacDonald and Koch, 2006: 296). Bank must maintain some un-earning assets in the form of cash or cash equivalents in order to meet their daily liquidity needs. These assets, by their very nature, decrease a profitability of the banks (Sinkey, 1998: 246).

2.1.3. Types of Profit

Profit is described by different people in different ways. Some associate profit with additional income revenue, and reward. In any case, description of profit depends on the field which the word profit is described. However, profit is one of the most widely watched financial metrics in whenever evaluating a company’s financial health; its profit is the mostly considered financial metric. In addition, there are two different types of profit discussed by researchers, i.e. economic profit and accounting profit. The major difference between the two is that economic profit includes opportunity costs.

i) Economic Profit: This is difference between revenues and costs. The costs include both the explicit and the implicit costs. Necessary payments made to secure resources that needed are implicit costs, i.e. the cost of capital (Fabozzi and Peterson, 2003: 14). Similarly, Mckinsey & Company defines economic profit as a capital invested multiplied by the spread between return on investment as well as cost of capital. This can be used to measure residual income (Brealey et al., 2011: 300). Generally, economists argue that accounting profit is not true profit; due to arriving at true or pure or economic profit, you must deduct opportunity costs from accounting profit (Murad, 1953: 4). The economic profit is calculated as:

Economic profit = Total Revenue – (Explicit Costs + Implicit Costs)

ii) Accounting Profit: the difference between revenues and costs documented in accordance with accounting rules is accounting profit. The costs in this case are mostly the actual costs of running a business. Opportunity cost and normal profits are the implicit costs in this situation. Only the timing and uncertainty of future cash flows, which are not taken into account in accounting profit, are reflected by them (Fabozzi and Peterson, 2003: 14). Accounting Profit is a firm's net income as reported on its income statement (Brigham and Houston, 2003: 48). Hence, accounting profit may mean as the residual of income after meeting all the 'explicit' items of expenditure. The formula to calculate this ratio is as the following:

Accounting Profit = Sales Revenues – Total Costs

Profit can also be defined as the excess of revenue earned from the supply of goods or services supplied that exceed the cost of supplying them and promoting their sale. These costs include wages, interest and rent payable, and depreciation and obsolescence charge. Accounting profit is usually calculated by the accountant (Murad, 1953: 4).

2.1.4. Determinants of Bank Profitability

Profitability is affected by a number of factor such as; liquidity risk and default risk of the underlying assets; expected changes in the exchange rate; and a 'currency risk premium' (Minh and Tripe, 2002: 353). In this section, firm-specific, sector-specific and macroeconomic factors, which are the drivers of profitability, will be examined in detail.

i) Bank-specific Determinants

The following bank-specifics concepts are used as determinants of bank profitability:

Credit Risk: The risk that the money from a bank loan or an investment will not be repaid or will be delayed (Merna and Al-Thani, 2008: 129). This is the main source of bank-specific risk. This poses high risks to banks and it is resulted of poorly enforced creditor rights, weak legal environment, and information insufficient on borrowers that is inadequate. A macroeconomic level will weak economic growth adds to risk and promotes credit quality deterioration as probability of loan defaults increase. Credit risk is measured as a ratio of loan to deposits. However short-term funding can be used as a measure since it gives a provision of a forward-looking measure that exposes a bank to default and deterioration of asset quality. Credit risk can be modeled as a predetermined variable if the portfolio of outstanding is non-tradable. A positive association between profits and bank risk is expected based on standard asset pricing arguments (Flamini et al., 2009: 7).

Capital: A bank's capital adequacy is the ratio of equity to risky assets. It is complex to anticipate the net impact of changes in this ratio. For example, it is relative to consider banks with higher capital-to-asset ratios to be safer and less risky compared to other institutions that have lower capital ratio. As expected, banks that have lower capital ratios should have returns in comparison to other financial institutions that are better-capitalized. In contract, banks that have high capital i.e. highly capitalized banks, are safer and will always be profitable in times of economic difficulty. In addition, a bank's creditworthiness is increased by a lower risk thus reduces its funding cost. More so, those banks having higher equity-to-assets ratios will normally have their need for external funding greatly reduced, which gives them a positive effect on their profitability. From this perspective, there is positive effect on profitability if there is a higher capital ratio (Dietrich and Wanzenried, 2011: 311).

Cost Management: Efficient management of operating expenses is yet another important determinant of profitability. If banks do not transfer their costs to the lenders, operating expenses will have a negative effect on their profitability (Ramadan et al., 2011: 182). Overheads or costs of running the banks are measured as cost to income as percentage of income. These overheads include staff salaries and benefits, occupancy expenses, office supplies, etc. This is normally used as an indicator of management's ability to control costs. Because lower profit is due to of higher expenses and vice versa, a bank's profits and margins will be negatively affected by cost (Kosmidou et al., 2008: 9-10).

Size: Determining the size that optimizes a bank's profitability is an important question for bank policy makers. Generally, growth in size has a positive effect on a profitability of the bank. However, growing extremely large in size, become bureaucratic which coupled with other reasons may cause a negative effect. Therefore, non-linearity of the size-profitability relationship may be expected. This non-linear relationship can be expressed as the logarithm of the bank's real assets and their square (Athanasoglou et al. 2008: 128).

Off-balance sheet items to total assets: This is a non-traditional activity and affects a bank's profitability as well. Thus, among the determinants of profitability is the ratio of off-balance sheet items to total assets. This is ratio helps banks to raise their sources of income without changing structure (Rahman et al, 2015: 140).

Liquidity: Liquidity is the ratio of liquid assets to total assets. The more liquid a bank gets is a result of higher liquidity. Banks mainly fail because there is insufficient liquidity. Even though holding liquid assets will have an opportunity cost of higher returns. Therefore, liquidity causes a positive impact on bank's profitability (Alper and Anbar, 2011: 144).

Deposits: Another liquidity indicator is deposits and falls on the liability side of a balance sheet. This is the ratio of total deposits to total assets. Because deposits are the main source of bank funding, it has a significant impact on the profitability of banks (Abugamea, 2018: 59).

Productivity: Globalization of the industry and lowering of barriers to entry have been the causes of severe competition and thus have forced banks to reorganize. This has forced banks to keep steady labor forces to get high levels of productivity growth and increased output (Athanasoglou et al. 2008: 128).

ii) Industry-specific Determinants

Bank ownership: Banks are either owned by state or private individual/ corporations. A bank is owned by the state when the public sector owns greater than fifty percent of the bank. Theoretically, a bank's performance with respect to ownership is indeterminate. Empirical studies have even show disagreement on this proposition. While several studies discover insignificant relationship between the performance and bank ownership, others have found that a bank's profitability is significantly affected by ownership (Dietrich and Wanzenried, 2011: 312).

Market concentration: A great number of results between profitability and concentration the literature is normally conflicting, and have relied on the structure-conduct-performance hypothesis and the efficient structure hypothesis. Much as structure-conduct-performance examines the relationship between markets are highly concentrated and the profitability, efficient structure on the other hand investigate the efficiency of larger banks on their profitability. Some studies find that in concentrates markets, there is an increasing ability for banks to charge higher rates on loans and lower rates on the deposit, which results in a greater profit irrespective of banks efficiency (Ramadan et al., 2011: 182). In their study Dietrich and Wanzenries (2011: 315) conclude that there is statistically significant positive relation between concentration and bank profitability.

iii) Macro-economic Determinants

Inflation: Inflation is commonly used as determinants of bank's profitability. Whether anticipated or unanticipated inflation, will define the relationship between inflation and banks profitability. In timely anticipated for inflation, banks adjust interest rates, this makes revenues increase faster than costs, which positively impact on profitability. When inflation is not anticipated, there is a slow adjustment of bank interest rates; this makes bank's costs increase faster than banks revenues, consequently causing a negative impact on bank profitability (Kosmidou and Pasiouras, 2007: 228).

Effective tax rate: This is the ratio of taxes paid divided by before-tax profits. It reflects the explicit taxes paid by the bank. This ratio provides the banks an opportunity to evaluate the how differences in effective tax rates affect the profitability. To protect from the full impact of tax burden, when tax rates are high, proportionate fraction of banks' tax burden is shifted to their depositors, borrowers, and purchasers of fee-generating service though it does not entirely eliminate the effect (Dietrich and Wanzenried, 2011: 313). Therefore, a higher effective tax rate has a negative impact on bank profitability.

Gross Domestic Product: This is a common macroeconomic indicator used to measure of total economic activity within an economy. According to available literature, in general terms, there is a positive impact caused by the real GDP growth on bank's performance (Kosmidou and Pasiouras, 2007: 228).

Real interest rate: Real interest rate causes a positive relationship to banks performance. Increase in real interest rates raise bank profits (Alper and Anbar, 2011: 145).

2.1.5. Banking Profitability Indicators

A number profitability measures have been proposed in the literature. These measures help in the assessment of the profit of firm relative to sales and asset level or owner's investment. In absent profits, it is impossible for a firm to attract outside capital. Therefore, boosting profits should be a focus of owners, creditors, and management because of the great importance the market places on earnings (Gitman, 2009: 65).

As defined by Brigham and Houston (2003: 99), profitability ratios are the set of ratios that represent the effects of liquidity, asset management, and debt on operating results combined. The ability of the firm to generate profits from its operations is evaluated by comparing profitability ratios with the expenses and other costs within a given period of time. Profitability ratios are also a great vital tool assess management efficiency in the using resources in their possession. An indicator of firm's growth in sales and profits is a high profitability ratio value when compared to previous periods.

Profitability ratios are also indicators of managers' success (Watson and Head, 2007: 46). Observed profitability ratios provide useful insights in the evaluation of the effectiveness of a firm's operations. Van Horne and Wachowicz (2008: 148) suggest two of type profitability ratios, i.e. profitability ratios that relate to sales and profitability ratios that relate to investment. The first type is the profitability ratios that show profitability in relation to sales. The second type is profitability ratio in relation to investment. Put together, these two can be used as indicators of the firm's overall operation effectiveness. Besides measuring how a firm's management is effectively generating profits on sales, and total assets, they are also used to measure profits on stockholders' investment. Thus, profitability ratio is an important parameter for those whose economic interests are tied to the long-run survival of a firm (Moyer et al, 2006: 78).

Financial ratio analysts use profitability ratios to determine of a company's income and profit generate in a given period of time. More so, profitability ratios are used to determine the overall efficiency and performance of a firm (Weygandt et al. 2009: 658). A business' ability to acquire financing (both debt and equity) largely depends on its profitability therefore creditors and investors are always interested in evaluating an organization's profitability in addition to its liquidity position and ability to grow. To turn sales into profits as well as earning profits on assets, companies use profitability ratios. Profitability ratios allow some insight into the overall effectiveness of the management team. Hatten (2012: 199) defines net profit margin, Return on Assets, and Return on Equity ratios. Other types of profitability ratios found in literature include the net profit margin ratio, the gross profit margin ratio, Return on Stockholders' Equity ratio and the Return on Investment ratio.

2.1.5.1. Gross Profit Margin (GPM)

The gross profit margin is a ratio used to assess the control of production cost rather than costs of distribution and administration (Watson and Head, 2007: 47). In other words, it gives a firm's profitability from its sales after costs have been deducted. This reveals the effectiveness of firm's decisions making regarding prices and control of production costs (Moyer et al, 2006: 79). Gross profit margin is one of the most important ratios for the measurement of a firm's profitability. To calculate of gross profit margin, subtract of sales cost from net sales. Gross profit margin is the difference between total sales and cost of sales. This ratio is indicator available margin to absorb the costs of sales, administration costs, and other expenses and losses to reach a net profit. According to Gitman (2009: 67), gross profit margin is a percentage of dollar sales that remains after the goods have been paid by the firm. When gross profit margin is high, the bank is in position to make a reasonable profit on sales. The gross profit margin can also be used the gross profit per dollar of sales before any other expenses are deducted (Brigham and Ehrhardt, 2011: 98). The gross profit margin is calculated as follows:

Gross Profit Margin = (Sales – Cost of Goods Sold) / Sales

= Gross Profits / Sales

Gross profit margin tries to capture profit found in sales. However, this meaning is misleading. For example, if company is using financing, the profit portion from the sales should be paid as interest to the firm's lenders. This does not mean that this firm is less profitability than its rivals because it employs debt finance and pays out part of its profits as interest. Thus, it is useful when computations for profit margin are made; always add back the debt interest to net income. When this is done, we get what is called the operating profit margin (Brealey et al, 2011: 714-715).

2.1.5.2. Operating Profit Margin (OPM)

The operating profit margin is percentage sales that remain after deducting all costs and expenses with exception interest, taxes, and preferred stock dividends. This gives true representation of the "pure profits" that has been earned on each sales dollar. Because operating profits ignore interests, taxes and preferred stock dividend, they are called "pure profit". A high operating profit margin is usually preferred (Gitman, 2009: 67).

OPM ratio can be as well defined as EBIT / Sales. It measures a firm's profitability with no consideration of financing decisions effects. According to Brigham and Ehrhardt (2011: 98) OPM represents a firm's performance in relation to its operations before of interest expenses are considered. Operating profit margin is more suitable to compare the profit performance of firms because it is computed before considered interest charges (Moyer et al, 2006: 79). For example, the operating profit margin is defined as:

Operating Profit Margin = EBIT / Sales

2.1.5.3. Net Profit Margin (NPM)

The net profit margin is measure of the percentage of dollar sales remains as profit after all expenses, including taxes, have been paid. This ratio is widely to evaluate management efficiency. Despite the great variation of net profit margin by industry, low ratios indicate high expenses in relation to sales (Hatten, 2012: 199). It measures profitability of a company's sales after deducting all expenses, including taxes and interest (Moyer et al., 2006: 79). Net profit margin is an association between sales and net profit. Calculating net profit margin can be adjusted to include the demand for an analysis such as substituting the revenue net profit before the costs of interest or revenue after taxes and interest. Examining the net profit margin can give an insight into the proportion of revenue that is turned into profit (Brealey et al, 2001: 143). This is generally defined as

Net Profit Margin = Net income / Sales

The higher net profit margin, the more positive the company's position is. This means that a company's investment, production, pricing and financing policies are appropriate. To increase the company's net profit margin, the company should keep their costs as low as possible and sales as high as possible.

2.1.5.4. Return on Assets (ROA)

The ability of management to use the real and financial resources of the bank to generate returns is measured by the rate of return on asset. It is frequently employed to evaluate bank management (Gup and Kolari, 2005: 65). According to Brigham and Ehrhardt (2011: 99) Return on Assets is the ratio of the net income to total assets after interests and taxes. This ratio is also called the Return on Assets (ROA) and according to Nazir and Afza (2009: 23). ROA can be calculated as follows (Gup and Kolari, 2005: 25):

Rate of Return on Assets (%) = (Net Income / Total Assets) *x* 100

This ratio measures the overall efficiency of a firm's ability to make an interest through assets and investments. The higher this ratio, the bigger the firm's profitability. This ratio is also an indication of the profitability of the firm's total capital granted by equity and debt capital.

Return on Assets is net income to total assets. Returns on assets have been used frequently to measure the profitability of the banks. For banks, the Return on Assets measures the profit earned per dollar of assets. It is an indicator of how well bank management uses the banks' real investment resources to generate profit (Gul et al, 2011: 70). Also known as return on investment, Return on Assets indicates the firm's effectiveness in generating profits from its available assets. A high Return on Assets indicates effective management and good chances for future growth (Hatten, 2012: 199).

2.1.5.5. Return on Equity (ROE)

Return on Equity is the ratio of net income to common equity. This ratio measures of common stockholder's rate of return on investment (Brigham and Houston, 2003: 101). According to Brealey et al (2001: 144), Return on Equity is a valuable measure for other things besides just profitability. The following is the Return on Equity (ROE) equation:

Return on Equity = Net income / Average Equity

Generally, if this return is high, it is good for the owners (Gitman, 2009: 69). Higher values of this ratio indicate effective and efficient use of source of capital. Conversely, the lower values of this ratio indicate existence of idle equity or inefficient use of available equity. It measures the rate of return that the firm earns on stockholders' equity. This ratio is influenced by the amount of company's debt it is uses to finance assets (Moyer et al, 2006: 79).

2.1.5.6. Net Interest Margin (NIM)

Net interest margin is a representation as a percentage of net interest income earned on assets and in recent studies has been as the proxy for traditional banking activities. The higher net interest margin means higher earnings for the bank (Nguyen, 2012: 2430). NIM is obtained by subtracting bank's income generated from the interest income generated from amount of interest paid out to their lenders (for example, deposits), relative to the amount interest earned on assets (Puspitasari et al., 2021: 729). By maintaining close control over the bank's earning assets and actively seeking out the cheapest sources of funding, management was able to generate gap betweem interest revenues and interest costs, which is measured by the net interest margin (Rose, 1991: 129-130).

Abugamea (2018: 58) and Rose (1991: 129-130) defined net interest margin as the net interest income divided by total assets. It represents the profit banks earn on interest activities. It is calculated by the following equation as;

Net Interest Margin = Net Interest Income / Total Assets

Net Interest Margin = Interest Income from Loans and Security Investments - Interest Expense on Debt issued / Total Assets

2.1.5.7. Earnings per Share (EPS)

The term earnings per share is considered as the most significant variable in defines share price. It is useful for measuring the ratio of price to earnings valuation. It forms part of income that firm allocates to each outstanding share of common stock, serving as an indicator of the profitability of the firm (Saeed and Tahir, 2015: 4). Present or prospective stockholders are very much interested in a firm's earning per share. EPS is a representation of earned dollars in a given period on behalf of each outstanding share of common stock (Gitman, 2009: 68). Earnings per share is calculated as follows:

Earnings per Share = Earnings Available for Common Stockholder / Number of Shares

2.1.5.8. The Du Pont System

The Du Pont system describes useful ways to relate profitability or efficiency measures. The Return on Assets (ROA) is one of these relationships. It relates theturnover ratio of a firm to its profit margin (Brealey et al, 2001: 145):

(Asset Turnover) x (Return on Sales) = Return on Assets

(Sales / Assets) x (Net Income + Interest Expense / Sales) = Net Income / Assets

Competition is the major limitation firms face firm trying to earn a higher return on their assets. If the expected Return on Assets is fixed by competition, firms face a trade-off between the turnover ratio and the profit margin (Brealey et al, 2001: 145).

2.1.6. Profitability Measures in Prior Studies

There are some studies that used ROA as profitability measure (see for example Nazir and Afza (2009), Şen and Oruç (2009), Padachi (2006)). Some other studies applied both Return on Asset (ROA) and Return on Equity (ROE) as profitability measures. Baser et al. (2016) used liquidity-profitability tradeoff existence in Turkey. In their study, the dependent variable is ROA. It is measurement of profitability of listed and traded companies on the Istanbul Stock Exchange in Turkey.

However, other studies use another measurement for profitability. Shafana (2013) examine how liquidity is related to profitability. The authors use a sample of financial institutions in Sri Lanka by applying Return on Asset as a profitability measure in an equation Return on Assets = Net Profits / Total Asset. Khan and Ali (2016) use net profit margin and gross profit margin as a dependent variable and a proxy of profitability on banking sector in Pakistan.

Chen et al. (2018) used ROA, ROE and net interest margin as profitability measures to study how liquidity relates to performance for a sample of deposit banks in 12 advanced economies. Pradhan and Shrestha (2016) observed how bank profitability impacts liquidity utilizing data from 16 Nepalese commercial banks. In their study, the dependent variables are Return on Assets (ROA) and Return on Equity (ROE). Abdul Rahman and Saeed (2015) utilized ROA and ROE to investigate the relative significance of liquidity risk measured as loan to deposit ratio, liquidity asset to total asset ratio, capital to asset ratio, to the profitability of Malaysia banks for the period 2005-2013.

Duan and Niu (2020) looked into liquidity creation and how it influenced the profitability of US banks for 16 years (2001-2016) by applying both return on asset (ROA) and return on equity (ROE) as a profitability measure. Ndoka et al (2017) also studied how liquidity risk management impacted performance of Albanian commercial banks during the period 2005-2015 using profit before tax as dependent variable. Alshatti (2015) used return on assets and return on equity as proxies for profitability to investigate liquidity management effects on profitability of Jordanian commercial banks for the period 2005-2012. Muthumon and Raj (2017) utilized return on assets as a measure of profitability to examine the influence of the liquidity risk on the profitability of bank during the period 2006-2015.

Muriithi and Waweru (2017) examined how liquidity risks relate to financial performance of forty-three registered Kenyan commercial banks for the period 2005-2014. ROE was used to measure financial performance while LCR and NSFR were used to measure liquidity risk. Zaineldeen (2018) applied ROA and ROE in his study to investigate the liquidity in Palestinian banking sector and evaluate its effect on profitability of banks for the period 2010-2016. To investigate the factors affected profitability of banks in Pakistan for the period 2005-2009, Gul et al (2011) used the pooled Ordinary Least Square method taking return on asset (ROA), return on equity (ROE), return on capital employed and net interest margin (NIM) as proxies for profitability. Ismail (2016) utilized ROA as proxy for firm's profitability to analyze how profitability is impacted by liquidity management for Pakistani firms listed Karachi Stock Exchange from 2006 to 2011.

As in the previous studies by Chen et al. (2018), Nazir and Afza (2009), Baser et al. (2016), Muthumon and Raj (2017) and Alshatti (2015), this study also uses ROA as a measurement of profitability.

2.1.7. Liquidity Risk and Bank Profitability

Available literature is inconclusive on how liquidity risk affects on bank profitability. Whereas some studies (Muriithi and Waweru, 2017; Demirgüneş, 2016) report positive effects, others have confirmed that liquidity negatively effects on bank profitability especially if resources are misallocated. Similarly, Hakimi and Zaghdoudi (2017) applied panel data method to study how liquidity risk affects bank performance in Tunisian banks for the period 1990-2013. Their results indicate liquidity risk significantly decreases bank performance. Inflation and international financial crisis and also significantly affect bank performance.

Using financial data for companies listed on the London stock Exchange for the period 1993 to 1997, Lyroudi et al. (1999) studied how liquidity and profitability relate to each other. Liquidity indicators used were CR and QR, and profitability indicators were used are ROE, ROA and NPM. Results show a significantly negative relationship exists between liquidity and profitability variables.

Owolabi et al. (2011) using correlation and regression analyses, investigated the connection between liquidity and profitability for a sample of corporations listed on the stock exchange in the Nigeria. The results of the study suggest that for corporations in processing and manufacturing sectors, there is a positive relationship between liquidity and profitability while it is negative for corporations working in banking sector.

Shafana (2013) also utilized correlation and regression model to study how liquidity and profitability relate to each other for a sample of sixteen Sri Lanka financial institutions listed on the Colombo Stock Exchange from 2009-2013. Her results show that financial institutions in Sri Lanka, liquidity a significant negative impact on profitability. By taking return on assets as measure of profitability and temporary investment ratio to indicate of liquidity as the independent variable for banks traded on the Ghana Stock Exchange, Lartey et al. (2013) used ratio analysis, times series analysis and correlation and regression analysis to investigate how liquidity relates to profitability for period of 2005-2010. Their study revealed that for those banks listed on the Ghana Stock Exchange, there was a positive relationship between liquidity and profitability.

Sohaimi (2013) utilized multiple regressions to observe Malaysia's banking system liquidity risk and performance connection for the period 1997-2012. His findings prove that there is a significantly reverse connection between liquidity risk and banks capital with non-performing loan. This greatly exacerbates the liquidity risk causing a negative relationship with deposit, cash and liquidity gap. In their work on how liquidity affected financial performance between 1998 and 2015, Demirgüneş (2016) took sample of listed Turkish retail industries on Istanbul Stock Exchange (BIST). The results indicated a positive association existed between financial performance and liquidity.

Ayaydin and Karaaslan (2014) utilized Generalized Method of Moments technique (GMM) to study the liquidity risk management in Turkish banking sector using data for twenty-three commercial banks working in Turkey during 2003-2011. Liquidity indicators were used as dependent variables, while ROA, ROE, NIM were used as independent variables. The results showed that liquidity risk and profitability were a negatively related.

Using time series and cross-sectional test for the period 1997 to 2009, Foran and O'Sullivan (2014) studied how liquidity risk and UK mutual fund performance relate to each other. Their findings recommend stock liquidity level and systematic liquidity risks have a significant impact in models used to assess the performance of investment funds.

Baser et al (2016) used structural equation modeling to observe liquidity and profitability connection in Turkey. Their findings verify that i) current ratio or its variants as independent variables are insufficient to clarify the relationship between liquidity and profitability and ii) leverage appears to be the most significant indicator as taken into consideration when making decisions about working capital management. Prudent working capital management is used by Turkish businesses to overcome conceivable liquidity shocks.

Chen et al. (2018) used unbalanced panel dataset from 1994-2006 of twelve advanced economies' commercial banks to investigate how liquidity risk relates to bank performance. Their results showed that in a market-based financial system, liquidity risk have reverse impacts on bank performance. Khan and Ali (2016) on the other hand used correlation and regression model to examine how liquidity impacts profitability of commercial banks in Pakistan during 2008-2014 periods. Their results showed a positive relationship between liquidity with profitability of the banks.

Christopoulos et al. (2018) utilized dynamic panel model to study of financial distress with a dynamic logit based on the linkage between liquidity and profitability for a sample of NYSE listed firms during 2010-2014. In spite of the fact that certain ratios were significant in all three models; their findings suggest that there are times when ratios were weak predictors of failure in the liquidity and profitability models, found to be significant variables within the combined model and vice versa.

Golubeva et al. (2019) utilized Ordinary Least Squires techniques by Weighted Least Squares regressions analysis to study how liquidity risk and bank profitability relate to each other for a sample of 45 European banks with 180 observations from 2014 to 2017. Their findings indicated that only some profitability proxies are significantly and positive impacted by liquidity risk measures, while others are just insignificant effected. Further research is needed because the Basel III liquidity measure, LCR, contributed insignificantly to all return proxies. The findings show that profitability proxies are also decreased by growing bank size and net loan loss provisions.

Prasad et al. (2019) used correlation and regression analysis to observe liquidity and profitability connection in Nepalese commercial bank. Their findings confirm that banks' liquidity ratios are below the required level. The Cash Reserve Ratio is also significantly higher than what the monetary policy for 2016-17 calls for. The correlation between the Cash Reserve Ratio and Investment of Government Securities in Current Assets and ROA are positive, whereas the correlation between the Cash Reserve Ratio and Cash and Bank Balance to Interest Sensitive Deposit Ratio are negative. CR is inversely connected to ROE in the case of the liquidity-ROE relation. However, all other ratios are positively correlated with ROE. Additionally, it has been noted that, with the exception of and Investment of Government Securities in Current Assets and ROA, there is a considerable correlation between profitability and liquidity ratios.

Duan and Niu (2020) utilized a panel of U.S. banks to observe liquidity creation and bank profitability connection for period from 2001: Q1 to 2016: Q4. Their findings confirm that for banks of various sizes, both in ordinary times and during the recent financial crisis. Liability-side and off-balance sheet liquidity creation are favorably correlated with profitability when we break down liquidity creation into its components parts, whereas asset-side liquidity creation is adversely correlated with profitability.

Abbas et al. (2020) using linear regression panel-corrected standard error approach, investigated the connection between bank liquidity and risk in determining bank capital for a sample of Asian Banking Industry for the period 2010 to 2017. The study's findings recommend that a positive correlation between bank liquidity and bank capital ratio, however there is a negative correlation between major commercial bank's liquidity and bank capital ratio. In the case of smaller banks, the effect of banks risk on bank capital ratio is positive but negligible. In the case of smaller and medium-sized banks, the effect of bank risk on bank capital ratio is negative, however the association is found to be positive in the case of bigger and overall banks data results in the short run, other factors remain the same.

Öndeş and Osman (2020) used panel data collected from the website of the Association of Banks of Turkey to study how liquidity and bank profitability relate to each other for a sample of 10 biggest banks from 2008-2017. Their findings appeared that ROE and ROA are significant negative impacted by the loan deposit ratio and the liquid asset to total asset ratio. Although it has a little impact on ROE, the deposit asset ratio has a considerable negative impact on ROA. Additionally, the ratio of liquid assets to deposits and non-deposit resources has a statistically significant but positive impact on ROA while being statistically significant but negative influence on ROE.

Using the GMM estimation and panel data estimation technique of 26 Vietnamese commercial banks from 2003 to 2018, Doan and Bui (2021) studied how liquidity and bank profitability relate to each other. The findings prove that profitability (ROA) was positively connected with loan-to-deposit ratio and negatively correlated with Liquid asset to total asset ratio. Additionally, macroeconomic control variables like economic growth (EG) and Inflation (INF) had an impact on bank profitability.

Adusei (2021) utilized LSDV estimation technique to study how liquidity risk and financial performance relate to each other for a sample of 532 microfinance institutions in 73 countries from 2010-2018. His finding appeared that the financial performsnce of MFIs is strongly negatively and statistically significantly impacted by liquidity risk. In any case, this adverse effect changes into a favorable effect in the presence of credit risk.

Utilizing U.S. commercial bank data for the period 1996 to 2013, Chen et al. (2021) studied how liquidity risk and bank performance relate to each other during financial crises. According to their findings, liquidity risk raised a bank's loan loss provision costs while decreasing its chances of survival, return on assets, and net interest margin. For banks with weaker capital ratios and higher credit risk, this unfavorable effect was more severe (extreme). Liquidity risk, on the other hand, does not appear to negatively impact bank performance during market crises.

Adelopo et al. (2021) used multiple regression models to analyze how capital, liquidity and profitability in European banks relate to each other for a sample of 28 countries from 2010 to 2018. The findings revealed a strong positive and significant correlation between bank performance and liquidity level. Economic growth and inflation have insignificant impact on bank performance, while asset quality has a negative and statistically significant impact on bank performance.

Using GMM estimation and panel data estimation techniques, including fixed and random effect model for the period 2006-2019, Javid et al. (2022) studied how liquidity creation and bank profitability and stability relate to each other. This study indicates a negative relation of liquidity creation with profitability but a positive association with bank stability. Furthermore, the empirical findings of this study prove a negative connection of political instability with liquidity creation, profitability and stability of overall banks of Pakistan.

2.2. EFFICIENCY: CONCEPT AND MEASUREMENT

2.2.1. The Concept of Efficiency and Cost Efficiency

Efficiency is when resources are utilized in the best way to obtain a given level of output. Efficiency can be approached in two ways. First is technical also known as operational efficiency. This is used to measures the cost efficiency of financial intermediation. The second is allocational efficiency. This is utilized to measures the extent of input choices' failure to equate input price ratios with marginal products (Caner, 2004: 360). Efficiency of a firm is commonly used to mean successful production of as much as possible an output from a given set of input (Farrell, 1957: 254). Efficiency can also be defined as the ability of a firm to use minimum resources of effort to produce an output. It measures the closeness of a production unit to its possibility frontier. It comprises of optimal combinations of sets inputs in order to produce a unit of output (Banya and Biekpe, 2018: 70). Banking system performance and efficiency can be evaluated using three main methods, i.e. non-parametric techniques, parametric techniques and ratio analysis, though there are merits as well as demerits of each of these techniques. Farrell (1957) divides the concept of efficiency measurement into technical efficiency and allocative efficiency (Mokhtar et al, 2006: 3).

Cost efficiency is a difference between a bank's cost and best practice bank's cost in producing the same output under the same environment conditions (Isik and Hassan: 2002: 261). It is an indicator of the industry's cost minimizing. A high-cost efficiency is an indication of better costs control and risk of vulnerability reduction or exposure to failure (Oredegbe, 2020: 86). Cost efficiency can be defined as an economic unit's ability and willingness to minimize costs with a given level of output and input prices (Kalluru and Bhat K, 2009: 34). A bank is considered to be cost effective if it can produce desired outputs at a minimum cost of a combination of inputs.

A technically efficient of the bank is one that cannot reduce the level of inputs to produce a desire level of output. In other words, existence of technical inefficiency means that reduction some inputs will not affect the level of output. For example, if a bank has a cost efficiency score of 0.75, it means that the bank can use

75% of its costs to achieve the same level of output, so the 25% is regarded as waste in relation to the best-practice bank (Hassan and Jreisat, 2016: 863-864).

When cost efficiency is taken as a combination of technical efficiency and allocative efficiency, we get measure of closeness of a bank's actual cost to produce an equivalent level output under the same conditions. Allocative efficiency measures the ability of a firm to produce a mix of optimal outputs using the optimal amount of inputs (Ab-Rahim et al, 2012: 359; Kasman and Yildirim, 2006: 1081).

2.2.2. Efficiency Measurements

The level of output from a given input for example cost per unit is measured as efficiency. A higher the value of efficiency unit means a higher level of output from the similar amount of input or even using a lower level input. For separating production units between those which perform well and those which do not perform well in the financial sector such as banks, efficiency analyses can be used (Ozkan-Gunay and Tektas, 2006: 421).

Efficiency measurements are representations of an advancement of productivity analysis. In simple terms, the concept of efficiency is based on the computation of various input and output factors. The sum of all best-practice cases represents the position and functional form of the efficiency line is usually not known therefore estimation is always necessary (Burger and Moormann, 2008: 86).

Banya and Biekpe (2018: 73) define efficiency as the ability of firm to maximize output for a number of given inputs. This usage is based on the premise that all inputs and outputs were correctly measured. This usage conforms to the definition of measure of technical efficiency. For example, a firm that employs two factors to produce a single product, under conditions of constant returns to scale. Here, suppose the efficient production function is known; that is, the output that a perfectly efficient firm could obtain from any given combination of inputs (Farrell, 1957: 254). The standard of absolute efficiency is used as a comparison factor for the observed firm's performance. When theoretical production functions are specified, the standard of absolute efficiency can be used.

The technical efficiency measure of a decision making unit is an implication that the frontier for which it is defined as derived from the locus of efficient production plans, while the combination for a specific decision making unit and frontier is implied by distance between the observed input(s) – output(s). The Scale efficiency is subsequently investigated by some analysis of the shape of the frontier (Favero and Papi, 1995: 386). To analyze of the efficiency of the banks, Stochastic Frontier Analysis methods were used. The translog specification was applied for cost-efficiency function (Andrieş and Căpraru, 2012: 48).

Non-parametric or parametric approaches can be used to calculate efficiency. Linear mathematical programming is a nonparametric (non-stochastic) approach and is used to calculate Data Envelopment Analysis efficiency, while a cost or profit function that takes costs or profits as variables that are determined by prices of inputs, random error, quantities of variables outputs and inefficiency is used to calculate Parametric (stochastic) efficiency (Aysan et al, 2011: 635).

Nonparametric programming and parametric stochastic frontier are two techniques of measuring efficiency that have been presented in the literature. Whereas, parametric frontier (production, cost or profit frontier) assumes that maximizing behaviour exists and measures allocative efficiencies, non-parametric ones measure technical efficiencies. Data Envelopment Analysis is the mainly utilized nonparametric technique and Stochastic Frontier Analysis is generally utilized parametric technique (Deelchand and Padgett, 2009: 8).

2.2.3. The Components of Efficiency

Efficiency analysis has been widely studied in literature. In this section we shall review the existing efficiency concepts. These include cost Efficiency, x-efficiency, technical efficiency, allocative efficiency (price efficiency), scale efficiency, profit efficiency (standard efficiency and alternative profit efficiency) and productive efficiency.

i) Cost Efficiency

Cost efficiency as defined by Maudos and Pastor (2003: 2) is the ratio the minimum cost of obtaining a given vector of output as determined by the frontier to the actual cost incurred. Cost efficiency of a firm is minimization of its cost by bringing it closer to the cost the best-practice company needed to produce similar amount of outputs to be sold at certain prices in relation to the specified prices of inputs (Ariff and Can, 2008: 263). On the other hand, Berger and Mester (1997: 3), Mertens and Urga (2001: 294), defined a bank's cost efficiency as an estimate of the cost a bank need to produce its output vector given that the bank's efficient is equivalent to that of the best-practice bank in the sample. Cost efficiency also measures a bank's actual cost closeness to that of a best-practice institution's cost for producing a similar output under comparable condition (Vennet, 2002: 263). Accordingly, Yildirim and Philippatos (2007: 127-128) assert that performance of a bank relative to the best-practice banks can be measured using cost efficiency scores required to produce similar output under similar exogenous condition.

ii) X-Efficiency

Saunders and Cornett (2008: 677) define x-efficiency as saving's cost that arise due to the exceptional managerial efficiency of the acquiring bank. Also, x-efficiency is defined as the ratio of the predicted minimum costs to the predicted actual costs. The predicted minimum costs are applicable to the bank whose efficiency is close to the best-practice bank in the sample facing the similar exogenous variables with adjustments for random error (Fu and Heffernan, 2007: 39).

X-efficiency determines how efficient a bank is operating with a mixture of efficient input. Studies in the recent past have greatly focused on this. It represents management's ability to control costs while producing output with available resources (Chen et al, 2005: 232). The X-efficiency is a mixture of both technical and allocative efficiencies. Technical efficiency represents a proportionate reduction in levels of inputs for a given level of output needed to efficiently use those inputs. Allocative efficiency on the other hand measures firm's ability to optimize inputs proportionately according to their prices. The product of technical and allocative efficiencies gives what is called total economic efficiency or overall efficiency, i.e., OE=TE x AE (Akhtar, 2010: 15).

The technical component in economic efficiency avoids waste either by using technology as input/output or by using technology to minimize input required for output production. Therefore, when analyzing technical efficiency, we consider either an output-augmenting orientation or an input-conserving orientation. The allocative component focuses on how inputs and/or outputs can be combined in optimal proportions with respect to prevailing prices. These optimal proportions should satisfy the optimization problem's first-order conditions for production unit (Fried et al 2008: 20).

iii) Technical Efficiency

Using relevant input, technical efficiency is utilized to evaluate firm's capacity to achieve maximum output. The ability of the firm to produce maximum output from a sets of given inputs is its technical efficiency (Deelchand and Padgett, 2009: 10-11). Wezel (2010) defined technical efficiency as the capacity of a bank to minimize input for given a target output. The composition of pure technical efficiency and scale efficiency gives technical efficiency measure (Ab-Rahim et al, 2012: 359). The production of outputs from a specified set of inputs is technical efficiency. For a production plan to be technically efficiency there should be no other way to produce more outputs with the similar inputs or use less input to produce the same outputs (Favero and Papi, 1995: 386).

Within the bank's technology, efficient use of inputs is associated with technical efficiency. So, if the overall efficiency is largely due to technical efficiency, then we can deduce that there was under-utilization or waste of inputs. If it is funds utilization, then it is the ability of more efficient banks to use lower interest expenses to produce more output (Staub et al, 2009: 208).

iv) Allocative Efficiency (Price Efficiency)

Price or allocative efficiency is how the company is able to employ proportions inputs optimally with respect to their prices and technology (Deelchand and Padgett, 2009: 11). Also, Allocative efficiency is referred to as price efficiency and it implies that a firm can use its inputs optimally to produce fixed level of output. Allocative efficiency is when optimal decisions for the right mix of inputs with respect to prices are made. Employing more labor when it's very low priced as well as fewer capitals because of its high price in the short run is an allocatively efficient decision (Isik and Hassan, 2002: 755).

Allocative efficiency, denotes the ability for optimal utilize of inputs in the right proportions in respect to their respective prices and the underlying production technology (Wezel, 2010: 7). Allocative efficiency relates to how the production process is affected by the mix of inputs. If the allocative efficiency of a bank is small, then increasing output could result from changing the mix of its input's usage (Staub et al, 2009: 208).

v) Scale Efficiency

Another performance measure, besides technical efficiency is how distant the most productive scale is. This concept is scale efficiency (Hatunoğlu, 2012: 14). By definition, scale efficiency is the locus of the technically efficient production plans (Favero and Papi, 1995: 386). Therefore, measuring scale efficiency means measuring productivity, and thus we must find a method to identifying the most productive scale size (Coelli et al, 2005: 272). Maghyereh (2008: 77) defines scale efficiency measure as of waste avoidance ability by operating towards the most productive scale. However, the scale efficiency measure is not indicative of a bank's increasing returns to scale or decreasing returns to scale (Paul and Kourouche, 2008: 262). Scale efficiency only indicates of loss in output resulting from a firm's operation at the minimum point on the short-run average cost curve but not at the minimum point of the long-run average cost curve, with prevailing constant return to scale (Elyasiani and Mehdian, 1990: 540).

Scale efficiency is an indicator of the total output level with significant contribution to minimize the cost. It is important in increasing efficiency for any decision making unit (Hatunoğlu, 2012: 14). Scale efficiency measures the part of the technical efficiency score as well as is related to ability of the bank to operate at its optimal size of a firm (Wezel, 2010: 7).

vi) Profit Efficiency

It is much broader than cost efficiency since profit efficiency accounts for the effects on both costs and on revenues of vector of production (Maudos and Pastor, 2001: 384; Kasman and Yildirim: 2006: 1082). Profit efficiency measures the profit of a firm that has fallen below the best-practice firm's profit. Not like cost efficiency, it relates the profits generated utilizing a specific production vector to the maximum possible profit connected with that vector as determined by the frontier (Maudos and Pastor 2003: 2).

Profit efficiency is a measurement of how a bank generates the maximum profit from a given amount of inputs and outputs in respect to level of their prices. The standard profit efficiency and the alternative profit efficiency are distinguished by taking into account market power of output prices. The standard profit efficiency assumes that competition in input and output factors is perfect, and therefore firms are price-takers, i.e., no market power of output prices (Ariff and Can, 2008: 263). As signified by Berger and Mester (1997), every time perfect competition in prices is questioned, alternative profit efficiency comes closer to reality, or when differences in production quality among the banks in the sample become evident (Maudos et al, 2002: 39). There are two difference profit efficiency types:

a) **Standard Profit Efficiency:** As expressed by Maudos and Pastor (2003: 3), standard profit frontier is based on the assumption that perfect competition exists in both the input and output markets, therefore give prices are taken by firms. For a given output prices vector and input prices vector, the banking firm will adjust the amounts of the output quantity vector and input quantity vector to maximize profits. Similar to cost efficiency, standard profit efficiency is a quotient of observed profit and maximum profit that is attainable. This maximum profit is determined according to standard profit frontier of inputs and outputs prices.

b) **Alternative Profit Efficiency:** Alternative profit efficiency is named as a bank's closeness to earn maximum profit from its output levels rather its output prices as indicated in standard profit efficiency (Isik and Hassan, 2002: 746). It is observable that given an outputs vector and input prices vector, at an alternative profit frontier firms can adjust output prices vector and input vector to maximize profit. Similar to standard efficiency, alternative profit efficiency measures a quotient observed profit and the maximum profit based on alternative profit frontier (Maudos and Pastor, 2003: 3). The alternative profit efficiency is measured by a firm's score obtained from examining its distance from the maximum level of profit obtained from output levels as an alternative of output prices. Alternative profit efficiency and standard profit efficiency utilizes the similar dependent variable.

vii) Productive Efficiency

The term productive efficiency reveals the degree of success as allocating the inputs and producing outputs to reach certain objectives. To measure productive efficiency, production objectives first set and subsequently the degree to which these objectives can be successfully attained is certified (Hatunoğlu, 2012: 11). Productive efficiency optimizes behavior with respect to outputs and inputs. Optimizing behavior outputs requires that the level of production and combinations of outputs must correspond to the lowest per unit production cost. An optimal output level will exist if at different levels of output, there is existence of economies and diseconomies (Evanoff and Israilevich, 1991: 12).

2.2.4. Efficiency and Productivity

A producer's productivity is the ratio of his output to his input. A producer's productivity ratio is easy to calculate if a producer uses a single input to produce a single output. However, economic aggregation of both numerator and denominator is needed in a sensible fashion for producer who uses several inputs to produce several outputs, to keep productivity as a ratio of two scalars (Fried et al., 2008: 7). A producer's efficiency is a comparison between observed and optimal values of its output and input. This comparison involves observed output to be compared to maximum potential output obtainable from a given input. Alternatively, it can involve a comparison of observed input to potential minimum input needed for the production of the output, or both input and output combined. In either case, the definition of optimum is in term of possibilities of production and technical efficiency (Fried et al., 2008: 7). The behavioral goal of the producer can also be used to define the optimum. In this event, efficiency is a comparison of the observed as well as optimum cost, revenue, profit, or any assumed goal the producer wishes to pursue, subject to constraints that are appropriate on quantities and prices (Fried et al., 2008: 7-8).

Three fundamental reasons are presented for our interest to measure productivity as well as efficiency. First, when productivity as well as efficiency are measured separately from their effects on operating environment, the playing field is leveled. Exploration of hypotheses concern the sources of efficiency or productivity can be done in a differentiated manner. Indentifying and separation of sources that control or do not control variation of performance is vital to both public policies as well as private institutions' practices aiming at improving performance. Secondly, micro performance is dependent on micro performance; similar reasoning can be made for the study of national growth. Third and last is that efficiency and productivity measures besides being indicators of success, they are performance metrics that are used to evaluate producers (Fried et al., 2008: 11; Lovell, 1993: 5).

Productivity and efficiency management involves both revenue maximization and costs minimization with respect to the volume of business that is generated and managed. Giving the right incentives to staff for productive and efficient performance and holding them accountable in time with useful information. We can achieve productive management. Managing and reducing costs where possible is the focus of efficiency management (Ledgerwood, 1999: 248).

2.2.5. Bank Efficiency Ratios

According to Akçaoğlu (1998: 52), the term "operational efficiency", "cost efficiency" and "productive efficiency" all imply the similar thing. Operational efficiency, often known as cost efficiency, originally referred to how well firms used their resources to produce goods and services at given prices for their resources. Macro-efficiency relates to efficiency of the financial system as a whole, whereas micro-efficiency relates to the efficiency of a single institution.

Ledgerwood (1999: 212-215) proves that banks can get information on rates needed to cover their expenses to generate revenue from efficiency and productivity ratios. When productivity and efficiency ratios are calculating and comparing over time, banks can be able to determine if there is maximum utilization of their resources. Productivity is the volume of generated company output from a given resource/asset or input, while efficiency is the cost per unit of output. Efficiency ratios are measurements of the cost needed to provide services (loans) for revenue generation. Thus, these are the operating costs and neither do they include financing costs nor loss on loan provisions. Table-2.1 summarizes key financial institution efficiency ratios.

Table 2.1: Bank Efficiency Ratios

Efficiency Variable	**Efficiency Ratio**
Operating costs	Operating costs to portfolio outstanding average
Salaries of average portfolio outstanding expressed as a percentage	Salaries and benefits to portfolio outstanding average
Unit cost of currency lent	Operating costs to disbursed total amount
Cost per loan made	Operating costs to total number of loans made

Source: Ledgerwood (1999: 212-215)

The efficiency of bank has increased since the past. The efficiency ratio calculates the proportion of net operating revenues obsorbed by overhead costs. It is computed by dividing non-interest expense minus amortization by total revenues. Greater efficiency is indicted by a lower value. Thus, the ratio's drop or go down indicates that banks reduced their personnel costs by employing less workers (Gup and Kolari, 2005: 25).

According to Choudry (2011: 18- 19), human resources expenses are frequently included in banking operating cost together with other operating expenses including rent or infrastructure costs, goodwill charges, and depreciation. Cost is typically measured as a proportion of income. Analysts use a number of expenses-to-revenue ratios.

Operating Efficiency is measured by the cost-to-income ratio or operating expenses divided by operating revenue, and it refers to managerial efficiency in banks (Teixeira et al., 2021: 9). Efficiency is represented by the cost to income. Operational expenses are divided by operating revenue to calculate cost to income ratio. A larger ratio indicates that a bank will incur greater expenses to produce the similar output or with similar output it will generate less revenue (Yuanita, 2019: 9).

i) Operating Expenses to Revenue Ratio

This ratio offers information about the relationship between operational costs and revenues; specially the management of the fixed costs on the net profit margin. This ratio gives information on the firm's efficiency in the managing operating expenses relevant to the level of sales (Christopoulos et al., 2018). The formula to compute this ratio is as the following:

Operating Expenses to Operating Revenue Ratio = Operating Expenses / Operating Revenue

ii) Operating Expenses to Total Asset Ratio

Operating costs to Total Assets is ratio used to determine operating efficiency (Kaur and Sharma, 2022: 46). The operating expenses to total assets formula is the following:

Operating Expenses to Total Assets Ratio = Operating Expenses / Total Assets

2.2.6. Relationship between Liquidity and Bank Efficiency

The growing interest from both scholars as well as regulators to understand how liquidity risk, capital, profitability and bank efficiency affect of financial institutions has result to numerous studies to be conducted to examine the connection between liquidity and bank efficiency. Despite these numerous studies, there is still limited knowledge about liquidity risk, profitability, and efficiency of banks.

Duan et al. (2021) used regression model and robustness test from 2000-2014 of one hundred and twelve countries to investigate how liquidity creation relates to bank efficiency. Their results suggest that banks may be able better fulfill their role in liquidity creation for the general public by reducing their cost burden or increasing their degree of profit efficiency. Furthermore, after controlling the characteristics at the bank and country level, the results also indicate that low-efficiency banks create less liquidity for the public.

Trang et al. (2021) used pooled multi-variable regression method to observe liquidity risk and bank operational efficiency connection in Vietnam for sample of 32 banks for period from 2010 to 2020. Their findings confirm that increasing income from interest raises risk of liquidity.

Sakouvogui and Shaik (2020) used the Stochastic Frontier Analysis and Data Envelopment Analysis estimators to investigate how financial liquidity, solvency relates to cost efficiency of US banking system for period of 2005-2017. Their research showed that the cost efficiency of US commercial and domestic banks is significantly impacted by financial liquidity and solvency. Overall, compared to the tranquil period, USA domestic and commercial banks were less efficiency during the financial crisis. Additionally, the findings show that increasing cost efficiency depends on the total asset value.

Yameen and Pervez (2016) have used multiple linear regression analysis of Steel Authority of India Limited over the period 2005-2014 to investigate the impact of liquidity, solvency and efficiency on profitability. Steel Authority of India Limited's financial performance decreased during the study period, according to their findings.

Sekar and Gowri (2015) studied the relationship between bank efficiency, liquidity and profitability. They utilized a sample of 27 public sector banks and 21 private sector banks in India from 2011 to 2015. These three important variables are influenced by a variety of banking operations, including bank's treasury operations, and loans and advances granted to its customers, deposits received, borrowings, reserves maintained by the bank, innovative banking products made available to various customer, fixed financial costs of banks, interest income, and so on. Debt and bank equity determine the magnitude of the impact of these factors.

PART III

3. FINANCIAL STRUCTURE OF THE TURKISH BANKING SECTOR

Turkish Banks are classified as commercial banks, development and investment banks, and participation banks or Islamic banks. Akçaoğlu (1998: 79) indicates Turkish banks can be classified as foreign banks, state banks, and finally privately-owned banks. Out of 67 banks, 44 are domestic banks controlled by private or public capital, and the 23 banks are foreign banks or branches of foreign banks in Turkey. According to Özeltürkay and Mucan (2014: 123), Turkish banks have been executing programs, application and systems to offer higher-quality services and innovative products like multi-channel banking services for their customers. There are four different categories of Turkish banks. These include deposits banks, development and investment banks, banks transferred to savings deposits insurance fund, and foreign owned banks.

3.1. AN OVERVIEW OF THE FINANCIAL PERFORMANCE OF TURKISH BANKING SECTOR

Banking is a most vital sector that affects the entire economy. It is also the most vital component of the Turkey's financial system (Menteşoğlu, 2020: 1). In the past decade, Turkey has experienced three banking crises. It is estimated that the 2000-2001 crisis alone cost up to fifty billion dollars. Twenty banks comprising of 25% of the sector were taken over by the regulatory agency. Between 1997 and 2001, the Saving Deposit Insurance Fund (SDIF), and the takeover of banks by the regulatory agency become a major issue of concern for the bank restructuring program (Ozkan-Gunay and Tektas, 2006: 418).

Currently, the Turkish Banking Sector has fifty-four operational banks. In 2020, the banking sector asset size steadily increased and exceeded the GDP. Asset growth is greatly supported by loan while deposit is the most important source of funding. At the end of March 2021, the number of banks functioning as commercial banks were 34 development and investment banks were 14 and 6 were participation banks. Of the commercial banks, 3 are state banks, 21 are foreign banks, and 8 are private banks, and two of them still operate within the Saving Deposit Insurance Fund.

A deposit bank is also named “commercial bank”. This is a financial institution that can accept deposits, offer checking account services and various loans, as well as offering numerous basic financial products to individuals and small businesses. According to Acaravci and Calim (2013: 27), commercial banks are great importance with in financial system as well as the economy. Their profit is a result of intermediating between deposits or savers and borrowers or investors. Banks are able to differentiate between different various levels of liquidity, maturity and risk preferences, if they have a good management team. Furthermore, to stay in profit, commercial banks should be in position to evaluate the creditworthiness of a borrower in addition to monitoring performance.

Table 3.1: Bank Classification according to the Ownership Structure

Bank Classification	**Number of Bank**
State-owned Banks	**11**
Development and Investment	3
Deposit	3
Participation	3
Savings Deposit Insurance Funds (SIDIF)	2
Foreign-owned Banks	**28**
Development and Investment	4
Deposit	21
Participation	3
Privately-owned Banks	**15**
Development and Investment	7
Deposit	8
Total	**54**

Source: TBB (2021), Statisctical Reports, https://www.tbb.org.tr/tr/bankacilik/banka-ve-sektor-bilgileri/istatistiki-raporlar/59 (Date 30.03.2021).

For over half a century, participation banking has been in financial arena. Much as they are called banks, the principles on which participation banks are built very different. These principles are based on religious ethics and jurisprudence (Orhan, 2018: 291). Islamic banking is the provision of financial services that are in accordance with the Islamic legal rules (Aysan et al., 2011: 187). At present in the Turkish banking there are six participation banks. These banks are distinguished from others by not paying or charging interest on the funds that are kept in the bank's financial statements.

The Development Banking was created in the 1950s through World Bank incentives in developing countries. These banks provide investors with funds by giving them loans or though partnership. Investment banks are financial intermediaries that act as intermediaries between natural/legal persons by investing their savings in securities and institutions with an aim to provide long-term funds through floating securities. In Turkey banks that work in both fields within development banking are termed as investment banks (Karapinar and Senel, 2011: 197-199). At present, there are 14 banks in Turkey that operate as both development and investment banks. Of these, 3 are state-owned, 7 are private and 4 are foreign owned banks according to The Banks Association of Turkey (2020).

3.1.1. Balance Sheet Items of the Turkish Banking Sector

A commercial bank' balance sheet is a list of its assets and liabilities. What other people owes the bank are its assets, while what the bank owes other people or constitutes are its liabilities. The bank is reflected in its balance sheet as well as its financial position as well. At the end of every financial year of the bank, the balance sheet is issued. The assets side and the liabilities side make up the balance sheet of the bank. Liabilities are typically listed on the left side and assets on the right side (Somashekar, 2009: 12).

According to accounting principles, the balance sheet is a statement of a bank's assets and liabilities. Because it is a snapshot of a specific point in time, it is it is already outdated when it is created (Choudry, 2011: 13). The board and senior management team of the bank have a duty under corporate governance to accurately document and account for all the bank's transactions. Loans, investments, and other assets as well as deposits of the banks are included transactions. These documents serve as the basis for the bank's financial statements including balance sheet, income statement, statement of cash flows, and related notes or statements. A bank can inform to its stakeholders and regulators its financial position. The balance sheet and income statement are the main topic of this section. The balance sheet displays all of the bank's assets, liabilities and equity at specific time, like at the end of a year. It provides picture of assets and liabilities, as well as, the bank's equity (Apostolik et al, 2009: 29).

Income statement and balance sheet of a bank are related. Net interest income is based on the composition of assets and liabilities and the relationships between different interest rates. The mix of deposit between consumer and commercial customers influences the select of assets and consequently, the magnitude of noninterest expense. The ownership of nonbank subsidiaries raises fee income but frequently increase noninterest costs (Koch, 1995: 104).

The Turkish Banking Sector's asset size has continued to grow in the previous decade. As of December 2020, this size of had reached 6,261 billion Turkish Lira (TL). This is a 35.0% growth compared to the end of the prior fiscal year. In the last 9 years, loans have progressively increased. This has been a significant variable in supporting the active growth of the industries and sector. In December 2020, the banking sector's assets composed of 57% loans, 16% securities, 9% cash and cash equivalents, 5% required reserves, 2% non-performing loans as well as other assets 10%. Over the similar period, the loans' share of total assets has gradually risen from 57 to 63%. On the contrary, the share of securities has declined from 19% to 16% in the last decade. Table-3.3 shows the asset structure of the Turkish Banking Sector from 2012 to 2021.

As shown in the above Table-3.2, non-performing loan was 2%. It is stable rate from 2012 to 2021. In 2020, 4.25 % non-performing loan to total loans ratio in banking system was realized. A non-performing loan (NPL) is one where the borrower defaults because he is unable to make the scheduled payments for a specified period (Menteşoğlu, 2020: 14). Until 2018, in the Turkish Banking Sector this ratio was maintained of 3.88 %. Despite this, the USD/TL reached its historical highest level causing Turkey Lira to experience an exchange rate crisis in August 2018, which negatively affected the banking sector. Since then, this ratio started to increase and by December 2020, the ratio of non-performing loans to total loan in the banking had reached 4.08%. As of December 2021, there were 4,901 billion TL in total loans. Of this amount, 2,832 billion TL was made up of TL loans and 2,068 billion TL was comprised of FX loans. The gross amount of NPL as of December 2021 is 160 billion TL. When compared to the prior quarter, total securities grew and were realized at 1,477 billion TL.

Table 3.2: Asset Structure of Turkish Banking Sector (2012 – 2021)

Billion TL	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Assets										
Cash and Cash Equivalents	93	111	124	151	222	262	412	450	576	1,229
Required Reserves	100	156	172	206	184	227	159	193	321	702
Loans	795	1047	1241	1485	1734	2098	2,395	2656	3,577	4,901
Non-Performing Loans (Gross)	23	30	36	48	58	64	97	151	152	160
Securities	270	287	302	330	352	402	478	661	1,023	1,477
Other Assets	113	131	156	186	239	270	424	530	612	746
Total Assets	**1,394**	**1,762**	**2,031**	**2,406**	**2,789**	**3,323**	**3,965**	**4,641**	**6,261**	**9,215**
Share of Assets										
Cash and Cash Equivalents	7%	6%	6%	6%	8%	8%	10%	10%	9%	13%
Required Reserves	7%	9%	8%	9%	7%	7%	4%	4%	5%	8%
Loans	57%	59%	61%	62%	62%	63%	60%	57%	57%	53%
Non-Performing Loans (Gross)	2%	2%	2%	2%	2%	2%	2%	3%	2%	2%
Securities	19%	16%	15%	14%	13%	12%	12%	14%	16%	16%
Other Assets	8%	7%	8%	8%	9%	8%	11%	11%	10%	8%

Source: BRSA, https://www.bddk.org.tr//BultenAylik/en

Turkish banking sectors' other significant asset is securities. These amounted to 1,023 billion TL by December 2020 (BRSA, 2021). As of December 2020, deposit banks, participation banks, and development and investment banks' total assets share of the banking system stood at 87%, 7%, and 6% respectively. According to the ownership group; the whole banking system assets share of the public, domestic private and foreign banks were 45%, 30% and 25% respectively (BRSA, 2020).

As shown in Table-3.3, 57% of the sector's liabilities consisted of deposits while 11% of due to banks, 4 % of fund from repo transactions, 4% of issued securities, 10% of equities, and 15% of other liabilities in 2020. The total deposits of banking sector have increased from 772 billion TL in 2012 to 3.5 trillion TL in December 2020. There has been a progressive increase in the last 9 years and this is the mainly significant funding source of the banking system. In the similar period, a gradual decrease in total liabilities' share of deposits from 56 % to 53% has been registered. However, the decline in deposits is balanced with an increment in the share of securities issued in previous decade. As of December 2020, the funds provision through repo by banks reached 255 billion TL. In the last decade, the securities issued by banks have also increased. Being an alternative source of funding for the banking system, issued securities contributed up to 4% to total liabilities. A total of 224 billion TL issued in Turkish banks was realized as of December 2020 (BRSA, 2020). In the last decade, the shareholder's equity in the sector has also increased from 182 billion TL to 601 billion TL. This increase in equity has been mainly the increase in profitability.

Table 3.3: Liabilities Structure of Turkish Banking Sector (2012 – 2021)

Billion TL	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Liabilities										
Deposits	772	946	1053	1245	1454	1711	2,036	2567	3,455	5,303
Payables to Banks	173	254	293	361	418	475	563	533	658	1,048
Funds from Repo Transactions	80	119	137	157	138	99	97	154	255	587
Securities Issue	38	61	89	98	116	145	174	194	224	310
Equities	182	194	232	262	300	359	421	492	601	714
Other Liabilities	125	159	190	234	305	468	577	552	915	1,253
Total Liabilities	**1,370**	**1,733**	**1,994**	**2,357**	**2,731**	**3,257**	**3,868**	**4,492**	**6,108**	**9,215**
Share of Liabilities										
Deposit	56%	55%	53%	53%	53%	53%	53%	57%	57%	58%
Due To Banks	13%	15%	15%	15%	15%	15%	15%	12%	11%	11%
Funds From Repo	6%	7%	7%	7%	5%	3%	3%	3%	4%	6%
Securities	3%	4%	4%	4%	4%	4%	4%	4%	4%	3%
Equity	13%	11%	12%	11%	11%	11%	11%	11%	10%	8%
Other Liabilities	9%	9%	10%	10%	11%	14%	15%	12%	15%	14%

Source: BRSA**,** https://www.bddk.org.tr//BultenAylik/en

Total payable to banks are worth 1,048 billion TL. In December 2021, funds from repo transactions totaled 587 billion TL a rise from previous quarter. By December 2021, equity would total 714 billion TL.

3.1.2. Income Statement Items of the Turkish Banking Sector

An organization's revenues and expenses within an accounting period such as a year or a quarter are shown the income statement represents. Rather than being reported on a cash basis, the statement is an accrual basis (Gup and Kolari, 2005: 225). The bank's income statement lists all the revenue and expenses that the bank has encountered for a given time period, such as one month, one quarter, or whole year (Apostolik et al. 2009: 29).

The P&L report serves as the bank's income statement, which records all gain and losses over a given period of time. Revenues that can be accounted for as net interest income, fees and commissions, and trading income are displayed on a bank's income statement. Thus, the precise mix of these sources will depend on the type of banking institution and the sector it serves. Operating expenses, loan loss provisions, trading losses and tax expense reduce revenue (Choudry, 2011: 14).

The Turkish Banking sector's income statement confirms that the interest income was 423 billion TL as well as interest expense was 209 billion TL. The Turkish Banking sector's net income stood at 59 billion TL by December 2020. This is an increase from 20 billion in the 2012-2020 periods. This increase is mainly attributed to the increase in net interest incomes after provisions.

In comparison to the net income of December 2019, there was an increase for public as well as domestic private banks while this decreased for foreign banks for 2020. Similarly, the public, domestic private banks realized a higher ROE while in comparison it was on the lower side for foreign banks for the similar period. The Turkish banking sector's return on asset in December 2020 was lesser than the previous years for the same period (BRSA, 2020).

Interest income was realized as 642 billion TL and interest expense was recognized as 376 billion TL in the Turkish banking sector's income statement. The Turkish banking sector's net income as of December 2021 is 92 billion TL.

Table 3.4: Income Statement of Turkish Banking Sector (2012 – 2021)

Billion TL	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Interest Income	110	111	139	164	195	247	368	421	423	642
Interest Expenses	58	53	73	87	103	134	222	258	209	376
Net interest income	52	57	66	77	91	113	146	162	215	265
NII after provisions	44	47	52	62	70	94	111	106	173	218
Non Interest Income	27	33	37	42	47	56	77	106	102	160
Non Interest Expenses	43	50	55	64	68	78	110	129	181	239
Profit before tax	30	31	31	33	47	61	66	61	76	118
Provision for Taxes	7	6	7	3	10	12	12	12	17	25
Net income	24	25	25	26	38	49	54	49	59	92

Source: BRSA**,** https://www.bddk.org.tr//BultenAylik/en

3.2. THE ROLE OF TURKISH BANKING SECTOR IN 1994 AND 2000/2001 FINANCIAL CRISES

The 1994 crisis was one of the biggest financial crises in the history of the Turkish Republic, and the banking sector was severely damaged by this crisis. The 1994 crisis is also extremely important in term of revealing the importance of risk management (especially liquidity risk management) in the banking sector.

The Turkish lira underwent over 50 percent devaluation against the US Dollar in the first quarter of 1994. This lead to the loss of almost half of the central bank's reserves, interest rates skyrocketing, and inflation reaching three-digit levels. On 5th April 1994, a stabilization program was launched. This was later supported by an IMF stand-by program. Unfortunately, there was no success realized by these measures (Celasun, 1998: 2). This led to a fierce financial crisis in 1994, which is believed to be the precursor of the subsequent chain of crises experienced elsewhere in the world, such as 1995 Mexico crisis, 1997 in the Far East in 1997, 1998 in Russia, and 1999 in Brazil. The 1994 crisis which began in the financial sector later spread to other sectors. Much as the effects were not so bad in the industrial sector, the "flu" of the financial sectors specially the distress in the banking sector stressed the strong link between the two sectors (Isik and Hassan, 2002: 292; Demirguc-Kunt and Detragiache, 1997).

The 1994 financial crisis compounded with deficit in current accounts was worsened by the Government's intention to lower interest rates despite the damaged inflationary expectations and accelerated foreign currency demands. There was rapid depreciation of the TL, increased wholesale average inflation, soared interest rates and contracted demand. By depreciation against the USD was at 170 percent, interest rates of government securities were 190 percent, a decline by 26 in USD terms of GNP. There was surplus in current account with a capital outflow amount reaching USD 4 billion (The Banks Association of Turkey, 2000).

With an output loss of 6.1% in 1994, there was a rapid output recovery. A 7.5% and 8% growth in the economy was realized in 1995 and 1996 respectively. The IMF, upon observing that no structural reform was undertaken, withdrew in the summer of 1995, and the last trench of the Stand-by was never disbursed. With early elections entered the political agenda in mid-1995 and correction process in the non-interest component of the public budget started to weaken. The elections in a coalition government at the conclusion of the general elections but this government changed twice in 1996 and public expenditures rose again. At the beginning of 1996, Turkey's trade balance started to deteriorate again despite Turkey being accepted to participate in the EU Customs union (Celasun, 1998: 17). The Turkish crisis can be described as a perfect fit of the Krugman model. This is because the deteriorated fiscal fundaments that leads to the huge domestic credit expansion of the public sector that substantially led to the depreciation of the currency many times in the first four months of 1994 and loss of central bank's foreign assets. Evidence shows that even in absence of an official pegged rate, sufficient deterioration of macro balances leads to crush adjustments in the value of the currency (Celasun, 1998: 17-21).

The financial crisis, the first symptoms of which emerged in November 2000 and deeply affected the Turkish economy in February 2001, is considered the most severe financial crisis in the history of the republic to date. Since the banking sector is at the center of the crisis, the 2001 February crisis is also of great importance in terms of risk management in banking.

The fragility of the financial sector was greatly influenced by the crises at the end of 2000 and the beginning of 2001. Banks which constitute the biggest portion of the financial sector experienced major deterioration in their structures. In respect of this, a restructuring program for banks was a major priority and had to be set up in May of 2001 (CBRT, 2001a: 16). The February 2001 crisis came at the end in May 2001 after three months of volatility.

This unsettled period opened with news the previous November crises or problems in the banking system resulting from gambling for survival by banks under growing competitive pressure (Eichengreen, 2001: 6). The increase in rapid imports of crude oil with a depreciated Turkish Lira against the Euro were effects of much needed recovery in domestic demand and increase in energy prices, however this further led to more deterioration of current account. The persistently increasing deficit in current account led to privatization and structural reforms delay in the second half of the year and this increased uncertainty in both domestic and external markets. With these developments, there was an increase in short-term interest rates, which affected both capital inflows and liquidity adversely. Because of the delayed structural reforms and reluctance in taking on additional financial measures, the IMF postponed the October awaited third tranche of the IMF credit. This adversely affected the prospects of international markets (CBRT, 2001b: 1-2).

Banks that held large amounts of Treasury Bills to fund over the short term were affected by the rise in interest rates and this deteriorated their financial positions. This increased distrust in financial markets in the second half of November. There was loss of confidence in these banks, as a result of rapid increase in their liquidity requirements and this there was a maturity mismatch realization at high levels. This further caused short-term interest rates to rise above 100 percent in the November 17-22, 2000 period (CBRT, 2001b: 1-2). These two (November 2000 and February 2001) financial crises Turkey experienced led to a redesign of its stabilization programme to focus on stronger adjustments in fiscal in measurement, transparency and governances with a greater need for an extensive banking sector restructuring (Binay, 2003: 246).

The sudden and sharp crisis of February 2001 had a profound effect on the Turkish economy. When Turkish lira’s crawling peg proved unsustainable, the currency fell by more than 40% against the dollar and the euro (BIS, 2001: 95). Interest rates in both the primary and secondary markets were high despite favorable developments in the Central Bank balance sheet; this was due to sharp increase in risk premium. There was observed recovery in capital inflows, but the damage the damage on the banking sector caused by the November crisis especially on state owned banks, caused great increase in the fragility of the system. Both domestic and foreign funds maturity shortened during this period. Relative depreciation rate kept interest rates high raising serious doubts on the sustainability of current exchange rate regime. The unfavorable political developments that followed the Treasury Action put markets that were in a relentless mood started panicking towards the end of February. There was a complete shake in the markets confidence and the Turkish lira faced a serious attack on February 19, 2001 (CBRT, 2001b: 1-2).

The currency and banking crises that were experienced in November 2000 and February 2001 in Turkey caused a significant deterioration in the banking and financial structure. In comparison to earlier years, the banking sector's total assets which included banks under SDIF administration, declined by 20 percent in USD terms. As of November 2001, there was a decline to 14.4 billion dollars in the total assets of the sector against 142.3billion dollars in November 2000. As the share of public and foreign banks was declining, that of private and SDIF banks was increasing. Mergers, acquisitions and cancellation of banking licenses saw a significant decline in the number of banks, from 79 to 61. The number of branches went down from 7,837 to 6,893 as the number of employees also declined from 170,401 to 137,342 (Altug, 2002: 35).

3.3. LIQUIDITY AND LIQUIDITY RISK MANAGEMENT IN TURKISH BANKING SECTOR

3.3.1. Liquidity Regulations on Turkish Banking Sector

Lack of liquidity is among the most fundamental and devastating risk that the banking sector may face. Especially in times of crisis, this can spread rapidly to the entire sector and caused devastating consequences for the country's economy. While a relatively limited attention was given to liquidity risk within the scope of Basel Accords before, liquidity risk management in banking has become much more vital after the 2008 mortgage crisis. As a result of the studies started after global mortgage crisis, with the "liquidity coverage ratio" and net stable funding ratio" regulations published by BIS in 2013 and 2014, a greater importance has been given to the liquidity risk in banking.

In Turkey as a result of the studies initiated after the 2001 financial crisis, liquidity risk management was included in Article 46 of the Law No.5411 dated 19.10.2005. According to the relevant article, banks have to calculate, perpetuate and report the minimum liquidity level. In line with this law, a regulation titled "Regulation on Measurement and Evaluation of Liquidity Adequacy of Banks" on liquidity risk measurement and management was prepared by the BRSA and put into effect in 2006. Within the scope of the regulation, bank assets and liabilities are divided into two slices of term and minimum liquidity adequacy ratios are determined separately for each term slices, according to article 13 of the regulation (Official Gazette, 1.11.2006, Nr.26333).

The total liquidity adequacy ratio for the second slice of the terms based on the weekly simple arithmetical average of the total liquidity adequacy ratios related to the first slice of terms cannot be fewer than one hundred percent; the foreign currency adequacy ratio for the second slice of the terms based on weekly simple arithmetical average of the foreign currency liquidity adequacy ratio related to the first slice of terms cannot not ne fewer eighty percent. In article 4 of the regulations, the slices of terms to be ten as a basis in calculation of the total liquidity adequacy ratios and total foreign currency liquidity adequacy ratios are indicated in the table below.

Slice of term	Period before term
First Slice of the term	0 to 7 days
Second Slice of term	0 to 31 days

Another comprehensive regulation on this subject is the regulation title "Regulation on Calculation of Liquidity Coverage Ratio of Banks" published in the Official Gazette dated 21.03.2014 and number 28948. According to article 2 of this regulation, "The purpose of this regulation is to set down the procedures and principles regarding banks' having high quality liquid assets stock at a sufficient level to cover their net cash outflows in order to designate minimum liquidity level, both at consolidated level and on individual basis". The liquidity qualities of the assets are defined in detail in Articles 5-8 of the regulation, and the liquidity levels regarding the asset classes that must be provided by the banks are included in the Article 9 (Official Gazette, 21.03.2014, Nr.28948).

According to the regulation, liquidity level of banks is measured by calculating liquidity coverage ratio on consolidated and individual level in Turkish Lira and FX total and consolidated and individual level in FX. Liquidity coverage ratio is calculated by dividing high quality liquid assets stock to net cash outflows (Official, 21.03.2014, Nr 28948).

Another important regulation regarding liquidity risk management in the banking sector is the document titled “Guideline for Liquidity Risk Management” published by BRSA on 31.03.2016. With this document, it is aimed to ensure the efficiency and adequacy of liquidity risk management, and basically the following topics are regulated (BRSA, 2016):

a) Liquidity risk management framework
b) Organizational structure in liquidity risk management
c) Strategy, policy and procedures of liquidity risk
d) Liquidity risk management process
e) Contingency plan and business continuity plan

In this document, which serves as a detailed roadmap and business plan for a detailed liquidity risk management, liquidity risk management is built on 12 basic principles, which are given under the following headings (BRSA, 2016):

- Established Liquidity Risk Management Structure
- Liquidity Risk Management
- Responsibilities of the Board of Directors
- Responsibilities of Senior Management
- Measuring and Managing Liquidity Risk
- Funding Diversification and Market Access
- Stress Tests
- Liquidity Cushions
- Intragroup Liquidity Risk Management
- Intraday Liquidity Risk Management
- Collateral Management
- Contingency Funding Plan

In addition to the basic regulations described so far, some secondary regulations have been made to contribute to the effective management of liquidity risk in the Turkish banking sector in line with emerging needs and compliance with the Basel Accords and the process continues in line with the principles of continuous improvement. Components of liquidity coverage ratio (LCR) consists of 3 parts such as high quality liquid assets, cash outflows and cash inflows. Liquidity coverage ratio is computed by dividing high quality liquid asset stock into net cash outflows. Table-3.6 shows that level 1 asset have of weight of 100%. Level 2 assets measured as weight of between 50 to 85 %. Unsecured funding has weight of 5% to 100%. Secured funding has weight of 0% to 100%. Secured and unsecured lending and other cash inflows have weight of 0% to 100%.

Table 3.5: Components of Liquidity Coverage Ratio

Components of Liquidity Coverage Ratio	**Weights**
A. High Quality Liquid Assets	
• Level 1 Liquid Assets	100%
○ Marketable securities representing claims on or guaranteed institutions assigned a 0% risk weight	100%
○ Coins, banknotes and foreign currency cash	100%
• Level 2 Liquid Assets	50 - 85%
○ 2A Level Liquid Assets	85%
○ 2B Level Liquid Assets	75-50%
B. Cash Outflows	
▪ Unsecured Funding	5 - 100%
▪ Secured Funding	0 -100%
▪ Structure Financial Liabilities	100%
▪ Off Balance Sheet Liabilities.	0 - 100%
C. Cash inflows	
▪ Secured Lending	0-100%
▪ Unsecured Lending	0 - 100%
▪ Other Cash Inflows	0 - 100%

Source: Menteşoğlu (2020: 37)

3.3.2. Liquidity Risk Ratios of the Turkish Banking Sector

According to BRSA, Banking Sector Evaluation Report (2004), the economic stability obtained after 2002 saw reduce in liquidity risk of the banking sector in Turkey. The investment in high-yield assets instead of low-yield liquid assets by banks was a result of a low interest rate environment. Thus, there was reducing in liquid assets to total assets ratio at the end-2014, from 46% to 20% in 2003. Since 2002, the loan to deposit ratio has been in upward trend. To access the bank's liquidity for the same period, the loan-to-deposit ratio is utilized to compare the total loans of a bank to its total deposit. The deposits to loans were converted at a ratio of 1.04 in December 2020. Total loans are exclusive of development and investment banks (BRSA, 2020).

Since weak value of these below mention ratios suggests that the company may have trouble covering its short-term financial liabilities, liquidity ratios indicate the entity's capacity to satisfy its short-term liabilities (Durrah, 2016: 435). The ratios that are used to measure liquidity risk of Turkish banking sector are Liquid Assets to Short-term Liabilities, Liquid Assets to Total Assets, Liquid Assets to (Deposits + Non-Deposit Funds), TC Liquid Assets to Total Assets, and FC Liquid Assets to FC Liabilities for the period between 2010 and 2020. The commercial banks are divided into three groups in the tables as state-owned, private-owned and Foreign-owned banks. Liquid assets to total assets ratios, where the liquid assets are characterized as cash and cash equivalents and deposits with other banks (Ali, 2013: 71). Hence, the results of liquid assets to total assets ratio of Turkish banking sector are shown in Table-3.6. The higher the ratio, the better the company's liquid position.

Table 3.6: Liquid Assets / Total Assets Ratio (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	32.9	31.0	31.4	28.8	27.9	26.6	25.5	24.8	14.0	13.8	13.5	20.0
State-owned Banks	30.2	27.8	30.3	30.2	28.3	26.3	24.7	23.9	9.9	9.0	10.9	15.9
Private Banks	34.1	31.5	31.7	27.5	27.1	27.4	26.2	26.0	14.6	15.7	14.6	21.3
Foreign Banks	33.9	35.6	32.3	30.5	29.7	25.8	25.5	24.2	18.7	18.5	17.1	25.3

Source: Source: TBB, Statistical Reports: Selected Ratios.

Table-3.6 shows liquid assets to total assets ratio of state, private, foreign, and deposit banks between 2010-2020. The rate of private –owned bank is in the top 2010 while the rate of foreign banks second highest in the same period of time. Rate of private-owned banks continued to be on top since 2010 and as well rate foreign banks stayed to be second top one in 2010. In 2011 rate of private-owned banks faced a little decline and foreign banks leads the commercial banks by having the highest rate in that year. The decrease in rate exists and affects all banks in different ways. The analytical information in the Table-3.6 shows that the rate of foreign banks have the most elevated average worth contrasted with other banks in the study during 2010-2020. Furthermore, rate of private-owned banks have been the second –most noteworthy average banks in this period. Rate of state-owned banks have had the lowest value of liquid assets to total assets ratio.

This series is calculated by using the core measure of liquid assets as numerator and short-term liabilities as the denominator and the results of Turkish banking sector are shown in Table-3.6. As can be seen from the Table-3.6 the state-owned commercial banks had less liquid assets to total deposit ratios than their private-owned. Deposit banks show a decrease from 2019 to 2020. There is a general increase for state-owned banks in 2020. Privately owned banks show reduces from 2019 to 2020. Similar trend is observed for the foreign owned banks. In addition, state-owned banks show an increase during 2020-2021. A similar trend can be seen in private banks. Also, foreign banks indicate a raise from 2020 to 2021. Deposit banks appear an increase to 13.5 in 2020 and 20 in 2021.

Table 3.7: Liquid Assets / Short-term Liabilities (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	53.5	52.2	55.3	53.2	51.8	49.5	46.1	43.9	25.9	23.8	22.2	31.5
State-owned Banks	45.1	41.3	50.4	51.8	48.8	45.9	42.0	40.5	17.1	15.3	16.9	24.0
Private Banks	56.9	54.9	57.1	52.9	52.7	51.8	48.1	46.8	28.1	27.5	24.6	34.3
Foreign Banks	61.7	71.4	59.2	56.5	54.3	50.4	48.2	44.2	36.2	31.9	29.8	41.6

Source: Source: TBB, Statistical Reports: Selected Ratios.

From Table-3.7, the average of state owned deceases to 41.3 in 2011 but again shows an increase in 2012 and 2013. From 2014 onwards there is a steady decrease from 48.8 in 2014 to 15.3 in 2019. The average for private owned banks shows a steady decrease from 2010 to 2020, registering a high of 56.7 in 2009 and a low of 27.5 in 2019. The trend for the foreign banks begins with an increase from 59.1 in 2010 to 2011. From 2011 onwards, the trend steadily decreases from 71.4 in 2011 to 31.9 in 2019. For all commercial banks the average is shown to be stable from 2010 up to 2015 where the decrease starts to be very clear from 49.5 to 23.8 in 2019.

TC liquid assets to total assets ratio is calculated by dividing a bank's TC liquid assets to its Total assets. The ratio decreased year by year for all banks groups (state, private and foreign-owned banks) from 2013 to 2019. "TC liquid assets to total assets ratio" was in the highest level all banks groups in 2010 and its lowest level was in 2018-2019. There is a general decrease for deposit banks from 2.4 in 2019 to 2.3 in 2020. State-owned and privately-owned banks show reduce in 2020. In addition, foreign-owned banks indicate also increase from 5.4 (2019) to 3.9 (2020). In addition, the liquid assets / short-term liabilities ratio increased for all bank groups during 2020-2021.

Table 3.8: TC Liquid Assets / Total Assets (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	24.2	19.8	17.7	13.7	13.5	11.0	11.0	10.8	2.4	2.4	2.3	2.9
State-owned Banks	23.1	18.5	16.6	14.5	13.7	11.1	10.8	10.8	1.2	0.6	1.4	2.3
Private Banks	24.2	19.3	17.4	12.4	12.5	10.9	11.3	11.6	2.8	2.2	2.4	2.7
Foreign Banks	26.6	24.4	21.1	16.4	16.3	10.9	10.8	9.5	3.5	5.4	3.9	4.0

Source: Source: TBB, Statistical Reports: Selected Ratios.

In order to calculate this ratio, liquid asset are divided to deposit + non-deposit funds of the banks and the results are shown below table. This ratio had a tendency to increase in privately-owned, state-owned, and foreign owned banks by the the end of 2011.

Table 3.9: Liquid Assets / (Deposits + Non-Deposit Funds) (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	40.1	37.4	39.2	35.2	34.2	32.5	31.2	30.5	17.6	17.4	16.7	24.3
State-owned Banks	34.6	31.8	36.0	35.1	33.4	30.9	29.0	28.3	11.8	10.8	12.6	18.1
Private Banks	42.6	38.7	40.5	34.2	33.7	33.8	32.4	32.5	19.0	20.4	18.9	27.3
Foreign Banks	43.6	45.0	41.4	38.4	37.3	32.4	32.2	30.5	24.6	24.4	22.3	32.0

Source: Source: TBB, Statistical Reports: Selected Ratios.

Table 3.9 summarizes Liquid Assets / (Deposits + Non-Deposit Funds): Like other tables in the study, four different banks will be compared. These banks are; State-Owned, privately-owned, foreign and commercial banks. In 2010 Foreign-owned banks were at the highest level compared to other banks in the analysis of the table. And the private banks were coming after the foreign banks whereas state-owned banks were at the lowest level in that year. Only there was little decline faced by privately owned banks. Tangible changes were recorded during 2011 for all banks in the study. The ratio was very high compared to previous years. In a general view of the changes that occurred in the banks were straightforward increases from the beginning year of the study to the end the year.

According to the data, some banks increased threefold, while some other banks in the study increased by more than fifty percent. For example, commercial banks increase more than 50% while state–owned banks recorded an increase more than threefold. Deposit banks show a decrease liquid assets / deposit and non deposit funds from 17.4 (2019) to 16.7 (2020). The average of state-owned banks increases from 10.8 in 2019 to 12.6 in 2020. Privately-owned banks and foreign banks indicate decrease liquid assets / deposit and non-deposit funds in 2020. The ratio increased for all commercial banks (state, private and foreign banks) during 2020-2021.

Table 3.10 shows foreign currency liquid assets to foreign currency liabilities of state, private, foreign, and deposit banks between 2010-2021. According to the data in the table 3.10 average of private-owned was the highest in 2010, followed by average foreign banks which became the second-highest in that year. In 2010 some decline happed overall commercial bank and average foreign banks became the highest one than others. The foreign currency liquid assets to foreign currency liabilities are something that fluctuates which makes the estimation to be more difficult since each bank faces some change each year. However, we can see that rate of state banks increasing from 2010 up to 2016. From 2017 to 2019 some upward and downward experienced in the rate of state-owned banks. It is good remember that the average of all commercials is generally increasing from 2010-2021.

Table 3.10: Foreign Currency Liquid Assets / FC Liabilities (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	28.3	31.3	39.3	37.3	35.0	35.2	32.8	30.9	24.2	23.9	23.1	30.7
State-owned Banks	33.0	36.7	48.7	47.2	43.3	42.0	38.8	36.2	21.8	20.5	23.0	27.2
Private Banks	28.8	29.8	37.2	34.1	32.8	35.0	31.6	29.1	22.8	26.2	23.1	32.0
Foreign Banks	20.2	29.5	31.7	33.0	30.0	29.8	29.4	28.8	28.8	24.8	23.5	33.8

Source: Source: TBB, Statistical Reports: Selected Ratios.

It is calculated by dividing a bank's foreign currency liquid assets to its foreign currency liabilities. Foreign currency liquid assets to foreign currency liabilities ratio increased for all banks groups (state, private and foreign-owned banks) in 2010-2016. In 2017, the rate of entire bank groups has decreased as compared to the previous year. The ratio increased in foreign, state, and private banks in 2019. Deposit banks show a decrease foreign currency liquid asset/ foreign currency liabilities ratio from 2019 to 2020. State-owned banks show a relative raise from 2019 to 2020 that fluctuates between 20.5 and 23. Privately-owned banks show a relatively down trend recording low of 23.1 in 2020. Foreign banks show a decrease to 23.5 in 2020. In addition, state-owned banks prove a raise from 2020 to 2021. A similar trend can be seen in private banks. Foreign banks appear an increase between 2020 and 2021. Deposit banks appear a raise to 23.5 in 2020 and 30.7 in 2021.

3.4. PROFITABILITY AND EFFICIENCY OF THE TURKISH BANKING SECTOR

This study focus the effect of liquidity risk on profitability and efficiency of the Turkish banking sector. Due to emerging economies as well as unique circumstance in transition, liquidity risk, efficiency and profitability of banks are vital. Therefore, this section, profitability ratio, efficiency ratio and liquidity risk ratio of the deposit banks in Turkey are discussed.

3.4.1. Profitability Ratios

Profitability ratios measure the income or operating success of a company for a given period of time (Weygandt et al. 2009: 658). Profitability ratios assist managers and investors in determining if they are receiving an adequate return on their bank investment (Ledgerwood, 1999: 220). In this case, Turkey is a great example that can be analyzed becuase of the availability of data as this study tries to analyse banking data for Return on Assets, Return on Shareholder’s Equity, Income Before Taxes / Total Assets, Net Profit / Paid-in Capital.

Table 3.11: The Rate of Return on Assets (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	2.4	1.8	1.8	1.6	1.4	1.2	1.5	1.6	1.5	1.1	1.1	1.2
State-owned Banks	2.5	1.7	1.9	1.8	1.5	1.5	1.6	1.7	1.3	0.8	0.8	0.4
Private Banks	2.6	1.9	1.9	1.7	1.4	1.0	1.5	1.6	1.6	1.2	1.3	1.8
Foreign Banks	1.6	1.6	1.5	0.7	0.8	1.2	1.4	1.7	1.7	1.5	1.2	1.7

Source: TBB, Statistical Reports: Selected Ratios.

As shown in the above Table-3.11, deposit banks and the private banks’ return on Assets were moving the same trend through out the period of study. In 2010, the return of assets on deposit bank was at its highest level and starts to decline until 2015. In 2016, the ROA on deposit bank recovered while declined in 2018 until 2019. In 2010, the ROA on private banks were also at its highest level and starts to decline until 2015. On the other hand, the ROA on state banks were its peak in 2010 but hit in 2011 and moderately stabled from 2012 to 2017 where it started to decline in 2018 through out 2019. ROA on foreign banks were moving the same direction on deposit banks and private banks during the period of study. This shows that all banks were facing the same circumentances in Turkey.

In 2018, the deposit bank’s Return on Asset decreased to 1.5 percent from 1.6 percent. As of December 2019, the banking sector’s Return on Assets decreased to 1.1 percent from 1.5 percent. ROA of Turkish banking sector as of December 2019 realized lower as to the same period of the previous year. The trend for deposit banks is a relatively stable in 2020. Also, the trend for state-owned banks is stable in 2020. There is a rise for privately-owned banks in 2020. Foreign banks show a decrease from 2019 to 2020. State-owned banks show a decline from 2020 to 2021. In contrast to state banks, it was seen that the situation was the opposite and prvate banks show increase in the same period. Foreign banks indicate also an increase from 2020 to 2021.

Table 3.12: The Rate of Return on Equity (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	19.7	15.3	15.4	13.9	12.5	11.1	14.0	15.3	14.0	10.3	10.3	13.7
State-owned Banks	26.0	17.7	18.5	17.7	15.3	14.7	16.1	17.6	13.9	8.6	9.7	6.4
Private Banks	19.4	15.0	14.9	14.2	12.4	9.0	13.5	14.0	13.5	10.1	10.9	17.5
Foreign Banks	11.4	12.4	12.0	6.3	8.0	11.0	12.3	14.7	14.8	12.6	10.3	17.1

Source: Source: TBB, Statistical Reports: Selected Ratios.

As can be seen in Table 3.12, state banks positioned at the most significant level in 2010 contrasted with private, foreign and deposit banks. Foreign bank's ROE was at its most highest level. Also, the table shows that deposit banks were the most elevated after state banks in a similar period. In 2012, the ROE of the state was 18.5 percent which shows an increase contrasted with 2011. On other hand, foreign banks were the most lowest level of the that period. There were decline state banks in 2018 and 2019. It showed that it has the most reduced ROE contrasted with private, foreign and deposit banks. All banks faced a decline, although the impact of the decline in the overall assessment differed from bank to bank, but all showed the decline in the selected date range.

As of December 2018, deposit bank's return on equity decreased to 14 percent from 15.3 percent. Return on Equity of banking system in Turkey also decreased to 13.8 percent from 14.9 percent. ROE of Turkish banking sector realized lower when compared to the same period of the previous year. The trend for deposit banks shows a relatively stable trend in 2020. State-owned banks showed an increase from 2019 of 8.6% to 9.7% in 2020. Privately-owned banks indicate also rise from 2019 to 2020. Finally, the trend for foreign banks indicates a decrease in 2020. Between 2020 and 2021, state-owned banks show a downturn. Private banks have an upward trend, which is a separate pattern. Foreign banks predict a rise between 2020 and 2021.

Table 3.13: The Income Before Taxes / Total Assets (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	2.7	2.0	2.2	1.7	1.6	1.4	1.8	1.9	1.7	1.3	1.2	1.3
State-owned Banks	2.8	2.1	2.3	2.0	1.8	1.8	1.9	1.9	1.4	0.9	0.9	0.5
Private Banks	2.9	2.1	2.3	1.9	1.7	1.3	1.7	1.8	1.8	1.4	1.5	1.8
Foreign Banks	1.8	1.6	1.9	0.8	1.0	1.1	1.6	2.0	2.0	1.8	1.4	1.8

Source: Source: TBB, Statistical Reports: Selected Ratios.

As seen in the Table 3.13, the ratio of the income before tax to total assets was shown in 2010 with the highest level. Both Private and deposit were of the same level at that time. Whereas, the foreign banks were the lowest during that period. State banks were moving the same direction from 2010 up to 2019 by encountering different decline in each period. But it is good to remember that state banks faced the lowest in 2019. On the other hand, private banks experienced a decline from 2010 to 2019. It shows that 2019 is the lowest peroid compared to other date range. Likewise, foreign banks and deposit banks faced the same downward changes as the other aforementioned banks. As ROE analysis, all banks confronted a decrease during the study period, albeit the effect of the decrease in the general appraisal varied from one bank to another, all showed the decrease in the state banks were the lowest level in 2019 according to whole date range.

In 2019, Turkish banks showed their worst perormance in terms of Income before taxes to total assets. Also Income before taxes to total assets for all banks groups decreased in 2011 and 2013. It also increased for all banks groups in 2016-2017. In 2018, deposit banks' income before taxes to total assets ratio declined to 1.7 percent from 1.9 percent. As of December 2019, deposit bank's income before taxes to total assets ratio decreased to 1.3 percent from 1.7 percent. There is a decrease for deposit banks in 2020. The trend for state banks shows that stability for the years 2020. Privately-owned banks show a rise from 2019 of 1.4 to 1.5 in 2020. The trend for foreign banks indicates that increase in 2020. State-owned banks decline in 2020-2021. However, private banks are on the rise. A similar trend can be seen in foreign banks. Finally, deposit banks have increased in generally from 2020 (1.2%) to 2021 (1.3%).

Table 3.14: The Net Profit / Paid in Capital (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	58.2	49.8	56.4	56.1	53.9	50.4	66.5	83.7	81.0	67.5	65.7	103.3
State Banks	110.1	86.0	107.3	122.7	128.2	107.5	133.8	164.6	148.6	108.7	79.2	61.5
Private Banks	57.3	48.1	54.9	60.0	57.2	51.1	75.1	91.5	85.0	69.2	83.7	160.6
Foreign Banks	23.9	28.8	27.6	13.5	16.3	26.2	36.4	49.0	53.8	51.9	43.8	86.1

Source: Source: TBB, Statistical Reports: Selected Ratios.

As shown in Table 3.14, the rate of net profit to paid-in capital increased in 2010. However, it showed a decrease in 2011 which was the lowest period compared to other years of the study. The net profit to paid–in capital is also faced some decline in private banks but appears to have progressed smoothly except in 2011 which hit its lowest level. In foreign banks, on the other hand, there has been a regression of changes in most of the working years.

The net profit to pay in capital ratio for all the banks groups except foreign banks decreased in 2015 and 2018. Conversely, the rate of net profit to paid-in capital increased for all banks groups in 2016 and 2017. In 2018, deposit bank's net profit to paid-in capital dropped to 81 percent from 83.7 percent. In 2019, also net profit to paid-in capital ratio declined to 67.5 percent from 81 percent. We note that deposit banks exhibit a decrease from 2019 to 2020. Similarly, a state-owned bank shows declines to 79.2 in 2019 from 108.7 in 2020. Other deposit banks (privately and foreign-owned banks) show also reduce from 2019 to 2020. All banks indicate a decline in 2020. Between 2020 and 2021, state-owned banks indicate a downturn. However, there were increases in foreign and private banks.

3.4.2 Efficiency Indicators

Efficency indicators measure a bank's operational costs relative to its assets. The operating cost ratio provides an indication of the efficiency of the lending operations (sometimes referred to as the efficiency indicators). This ratio is affected by increasing or decreasing operational costs relative to the average portfolio. Efficiency ratios are also most useful for internal financial management (Ledgerwood, 1999: 252).

The following ratios describe income-expense structure of Turkish banking sector; net interest income after specific provisions to total operating income, non-interest income (net) to other operating expenses, other operating expenses to total operating income, provision for loan or other receivables losses to total assets, interest income to interest expense, total income to total expense, interest income to total assets, interest expense to total assets, interest expense to total expenses, net interest income after specific provisions to total assets, non-interest income (net) to total assets and interest income to total expenses.

Table 3.15: Net Interest Income After Specific Provisions / Total Assets(2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	3.5	3.1	3.4	2.9	2.8	2.8	2.7	3.0	2.4	2.1	1.9	1.5
State-owned Banks	3.4	3.2	3.6	3.1	2.8	2.8	2.8	2.9	2.3	1.9	1.8	1.4
Private Banks	3.2	2.8	3.1	2.8	2.7	2.6	2.5	2.8	2.4	2.1	2.1	1.8
Foreign Banks	4.8	4.1	4.4	3.1	3.1	3.0	2.9	3.6	2.7	2.2	1.8	1.5

Source: Source: TBB, Statistical Reports: Selected Ratios.

Table 3.15 shows the net interest income after special provisions to total assets ratio of state, private, foreign, and deposit banks between 2010-2021. According to the data in the table, foreign banks had the highest level in 2010, while state-owned banks were the second-highest bank in the same period. Looking at the year 2010, foreign banks are again one of the other banks with the highest value, followed by deposit banks, which was the second-highest bank in 2010. The data generally showed that foreign banks have the highest average value compared to other banks in the context. In addition, state banks have been the second-highest average bank in this period. The ratio in privately-owned banks decreased since 2018. The lowest net income after specific provision to total assets rate were realized in privately-owned Banks. This ratio has decreased in state-owned banks in 2018 and 2019. To get the ratio, divide the net interest income after specific provisions by total assets. The highest net interest income after specific provision within total assets were seen in foreign-owned banks. The trend for the deposit banks decrease from 2.1% in 2019 to 1.9% in 2020. The trend for foreign banks and state-owned banks are the same as for the deposit banks. Privetly-owned banks shows that stability for the years 2019 to 2020. Therefore, all banks show a noticeable decline this year (2020) except privet banks. Finally, table above demonstrates the fall of state-owned banks from 2020 to 2021. In private banks, a comparable pattern can be observed. From 2020 to 2021, there is a drop in foreign banks. A decreased to 1.9 in 2020 and 1.5 in 2021 is indicated for deposit banks.

As shown in the Table 3.16, the ratio of net interest income after specific provision to total operating income was shown in 2010 with the highest level. State-owned banks were highest in 2010 while privately-Owned banks were lowest, whereas foreign banks and deposit banks were 58.1% and 56% respectively. State-owned banks were highest in 2010 and faced the lowest in 2019, foreign banks were highest in 2010 and lowest in 2019. In general 2019 was lowest for all banks group.

To get the ratio, divided the net interest income after specific provisions by total operating income. When compared to privately and state-owned of deposit banks, foreign-owned bank's rate of net interest income after specific provisions within total operating income was the highest. efficiency ratio of state-owned banks, foreign and the private banks decreased in 2018 and 2019. Foreign banks showed their best performnace in terms of net interest income after specific provisions / total operating income in 2017.

Table 3.16: Net Int. Inc. After Specific Provisions / Total Operating Income (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	58.5	60.9	61.0	58.5	59.5	61.9	57.1	66.7	57.6	42.7	41.7	39.1
State-owned Banks	65.7	68.8	67.7	64.6	63.5	66.4	62.6	67.8	66.5	53.5	50.7	50.1
Private Banks	51.5	54.7	56.9	55.0	57.1	57.8	53.2	61.9	55.0	40.9	41.8	40.8
Foreign Banks	70.2	68.5	62.7	58.8	60.4	62.8	56.4	71.8	52.3	34.9	31.2	27.5

Source: Source: TBB, Statistical Reports: Selected Ratios.

Table 3.16 shows Net Interest Income after Special Provisions relative to Total Operating Income. The data in the table consists of four different banks, namely state-owned, private-capital, foreign and deposit banks. If the analysis were started from The first period in the study it is seen that state-owned banks showed the highest value in 2011 compared to the other three banks, private banks had the lowest value with 40.8% in 2021. Foreign banks and deposit banks show that their rates are close to each other, respectively.In the next year, which is 2010, foreign banks showed the highest value of Net Interest Income after Special Provisions by Total Operating Income with a value of 70.2 %, while in the same year, private banks were the lowest with a ratio of 51.5%. Public banks and deposit banks show 65.7% and 58.5% respectively, which makes them mid-range relative to the other two banks. It exhibits a very close ratio to State Banks and Foreign Banks in 2011 which makes these banks top notch. On the other hand, other remaining banks show lower value compared to State Banks and Foreign Banks. The changes in the range of working values seem to be close to each other, only some soft fluctuations are experienced in the banks, but it is clearly seen that 2019 showed a tangible change compared to 2011. All banks show a noticeable decline this year. There is reduce for deposit banks, state and foreign owned banks from 2019 to 2020. But the trend for privetly-owned banks indicate that an increase form 2019 to 2020. Trend for entire deposit banks show that a decrease in table below such as private, foreign and state banks between 2020 and 2021.

Table 3.17 shows the interest income to interest expense ratio of state, private, foreign, and deposit banks between 2010-2020. As seen in the Table 3.17, foreign banks had the most significant level in the whole years in the study, while deposit banks were the second-most noteworthy bank in the all time frame. The information for the most part show that foreign banks have the highest average of interest income to interst expense contrasted with different banks during 2010-2020. What’s more, deposit banks have been the second-most noteworthy normal bank in this period. State-owned banks have had the lowest level of interest income to interest expense rate. Interest income to interest expenses ratio was in the highest level in 2013 and in 2019 was at the lowest level. State-owned banks had the interest income to interest expenses’ rate in the lowest ratio level from 2010 to 2020. As for foreign banks, it is seen that their interest income to interest expense’rate was in the the highest level. Interest income to interest expenses ratio for all the bank groups has decreased in 2011. All deposit banks increase interest income / interest expense ratio from 2019 to 2020.On the other hand, state, private and foreign banks show decline between 2020 and 2021.

Table 3.17: Interest Income / Interest Expense (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	201.6	181.4	191.7	209.7	190.4	189.2	188.7	184.7	165.7	163.7	203.0	170.2
State Banks	184.5	173.1	190.4	212.4	181.2	178.2	184.6	171.4	149.3	146.4	175.3	147.3
Private Banks	200.3	179.3	185.0	203.1	192.6	187.9	183.2	183.7	172.2	177.2	225.1	186.1
Foreign Banks	252.5	209.4	219.0	225.7	201.2	204.9	202.7	205.9	182.9	177.9	243.9	209.4

Source: Source: TBB, Statistical Reports: Selected Ratios.

Table 3.18 shows the total income to total expense of state, private, foreign, and deposit banks between 2010-2020. Privately-owned remained at the top in 2010 and deposit banks also indicated at the top in 2010. Besides from 2010 up to 2011 still, privately-owned banks lead by turning into the most noteworthy banks. Yet, from 2012-2019 privately-owned banksface a decrease and state-owned banks lead the commercial banking. The analytical information in the Table 3.18 shows that privately-owned banks have the most elevated average worth contrasted with different banks from 2010 to 2020. Furhermore, deposit banks have been the second-most noteworthy average bank in this period. Foreign banks have had the lowest value of the total income to total expenses ratio.

This series is calculated by using the core measure of total income as the numerator and total expense as the denominator. With respect to Turkey, the highest total income to total expeses ratio were seen in foreign-owned banks. While the lowest ratio was realized in stated-owned banks. There was a decreased in this ratio for all bank groups in 2011 and 2015. All bank groups rise total income to total expense ratio from 2019 to 2020. In addition, state, private and foreign banks appear decrease between 2020 and 2021.

Table 3.18: Total Income / Total Expense (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	152.3	141.9	147.0	149.2	141.1	137.1	145.9	143.5	154.2	152.1	177.4	160.8
State Banks	153.3	142.4	152.7	158.5	143.9	140.4	150.1	143.6	140.3	135.1	155.5	134.7
Private Banks	157.2	145.0	146.3	149.9	143.5	137.8	144.6	142.6	159.9	161.0	190.4	174.2
Foreign Banks	135.4	130.6	139.2	132.9	130.1	132.8	143.0	144.6	167.0	169.4	207.8	204.0

Source: Source: TBB, Statistical Reports: Selected Ratios.

As seen in Table 3.19, state owned banks show a decrease from 2010 up to 2011, and then increase in 2012, from where it starts to increase again up to 2019. Similar trend is observable for privately owned banks. Foreign banks show a decrease from 2009 to 2011, there are a rise in 2012 and then a decreasing trend from 2013 to 2016. From 2017 onwards, the trend in interest income/total assets starts to increase again. All banks groups reduce interest income to total assets ratio from 2019 to 2020. In addition, state banks indicate a raise while private and foreign banks appear decline between 2020 and 2021.

Table 3.19: Interest Income / Total Assets (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	8.0	7.5	8.4	6.7	7.3	7.3	7.5	7.9	10.1	10.0	7.3	7.4
State-owned Banks	8.3	8.1	8.7	6.8	7.3	7.3	7.6	7.9	9.9	10.1	7.3	8.0
Private Banks	7.5	7.0	7.9	6.5	7.0	7.1	7.3	7.6	10.0	9.7	7.4	7.0
Foreign Banks	9.1	8.6	9.8	7.2	8.1	7.4	7.6	8.4	10.5	10.1	7.2	7.0

Source: Source: TBB, Statistical Reports: Selected Ratios.

As shown in Table 3.20, similar trends as observed for Loan or Other Receivables Losses Provision / Total Assets and Interest Income / Total Assets for state owed banks are observed. That is a decrease from 2009 up to 2016 and then starts to increase in 2017 onwards. Privately owned banks show a decrease from 2009 of 5.0 to 3.8 in 2010. There is an increase in 2011 and 2012, then a decrease to 3.2 in 2013. There is an observed steady increase from 2013 onwards. The trend for foreign and deposit banks is the same as for privately owned banks, though with different figures. There is decrease for deposit banks from 2019 to 2020. Also, state-owned banks indicate reduce from 2019-2020. Foreign and privately-owned banks show decrease in 2020. All banks groups raise interest expense to total assets ratio between 2020 and 2021.

Table 3.20: Interest Expense / Total Assets (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	4.0	4.2	4.4	3.2	3.8	3.8	4.0	4.3	6.1	6.1	3.6	4.4
State-owned Banks	4.5	4.7	4.6	3.2	4.0	4.1	4.1	4.6	6.6	6.9	4.2	5.4
Private Banks	3.8	3.9	4.3	3.2	3.6	3.8	4.0	4.2	5.8	5.5	3.3	3.8
Foreign Banks	3.6	4.1	4.5	3.2	4.0	3.6	3.8	4.1	5.7	5.7	3.0	3.3

Source: Source: TBB, Statistical Reports: Selected Ratios.

From Table 3.21, we note that state owned banks exhibit a decrease from in 2010, then an increase from 2010 to 2012, a decline in 2012, from 2012 onwards, the trend is on the increase. Privately owned banks show a relatively stable trend from 2010 to 2014 that fluctuates between 75.3 and 82.7. From 2014 onwards, the trend steadily increases. Foreign banks show a relatively stable trend recording a low of 85.0 in 2012 and a high of 92.2 in 2017. Deposit banks show an increase to 81.8 in 2010 from 80.2 in 2010. From 2010 onwards there is an increasing steady trend up to 2019. There is a general increase for state-owned banks and foreign banks from 2019 to 2020. Similar trend is observed for the privately owned banks. The trend for deposit banks shows a decrease from 2019 to 2020. Besides state banks show an increase whereas private and foreign banks appear decrease during 2020-2021.

Table 3.21: Interest Income / Total Expenses (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	80.2	81.8	83.6	81.8	84.8	87.3	85.8	89.7	91.2	91.2	89.7	89.3
State-owned Banks	85.5	87.1	87.8	84.9	86.8	87.9	88.2	89.6	93.3	96.1	95.4	98.3
Private Banks	75.3	77.8	80.9	79.1	82.7	85.8	83.7	88.1	90.7	90.5	88.1	85.5
Foreign Banks	86.8	85.3	85.0	85.4	87.8	88.7	85.9	92.2	89.3	85.2	82.5	79.9

Source: Source: TBB, Statistical Reports: Selected Ratios.

In Table 3.22, state owned banks show a decreasing interest expense/total expenses from 2010 to 2013 with a low of 2013, from 2013 onwards the trend increases steadily up to 88.7 in 2019. Private owned banks show a stable trend fluctuating for the years 2010 up to 2013 with a low of 58.4 in 2013. From 2013 onwards the trend steadily increases. The trend for foreign banks is not different from that of privately owned banks. Deposit banks show an increase from 60.6 in 2010 to 63.9 in 2011. From 2010 onwards the trend steadily increases with a drop to 58.2 in 2013 from 64.1 in 2012, but then a resurrection to 62.9 in 2014. From 2014 onwards the trend is increasing. There is decrease for state-owned banks from 2019 to 2020. Also, privately-owned banks show reduces from 2019 to 2020. Deposit banks and foreign banks indicate decrease from 2019 to 2020. State-owned banks show an increase. A similar trend can be seen in private banks. Also, foreign banks indicate a raise during 2020-2021. Deposit banks show an increase to 78.4 in 2020 and 84.4 in 2021.

Table 3.22: Interest Expense / Total Expenses (2010-2021, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposit Banks	60.6	63.9	64.1	58.2	62.9	63.3	66.3	69.7	84.9	84.7	78.4	84.4
State-owned Banks	71.1	71.6	70.4	63.3	68.9	69.2	71.7	75.1	87.7	88.7	84.6	89.8
Private Banks	59.1	62.9	63.9	58.4	61.6	62.9	66.1	68.4	84.2	82.2	74.5	80.1
Foreign Banks	46.6	53.2	54.0	50.3	56.8	57.5	60.6	64.7	81.5	81.1	70.3	77.8

Source: Source: TBB, Statistical Reports: Selected Ratios.

PART IV

4. AN APPLICATION ON THE RELATIONSHIP BETWEEN PROFITABILITY EFFICIENCY AND LIQUIDITY IN THE TURKISH BANKING SECTOR

This study utilized dynamic panel data estimation methods (GMM) to examine the connection between liquidity, profitability and efficiency in the Turkish banking sector. The study's purpose and importance of the study are discussed in this section, along with the literature review, data and variables, methodology and research design are explained. Then, GMM estimation method's framework is introduced. Finally, the study's models and hypotheses are described.

4.1. PURPOSE AND IMPORTANCE OF THE STUDY

There are many studies on risk management in Turkey, however, there are limited studies examining effect of efficieny and profitability on banking liquidity. There is generally scarcity of literature on factors affecting bank liquidity levels. Therefore, this study is important to fill the gap and lay the foundation extended research on risk management in general and liquidity risk in particular for deposit banks.

This study provides a better understanding to liquidity and profitability and efficiency of the Turkish commercial banks and how profitability and efficiency variables affect bank liquidity. This study provides some policy implications that will be derived from the findings to banks managements and banking regulatory authorities. The findings may also contribute to the existing knowledge of liquidity risk and profitability and cost efficiency especially by providing empirical evidence in the context of Turkish commercial banks.

4.2. LITERATURE REVIEW

A great deal of literature has documented that liquidity risk is associated with profitability and efficiency of banking sector. Arif and Anees (2012) investigate the liquidity risk and performance of banking system of listed 22 banks in Pakistani for the period 2004-2009. The findings indicate that liquidity risk impacts profitability of the bank significantly, with liquidity gap and non-performing as the two factors exacerbating the liquidity risk and they have a negative relationship with profitability.

Zolkifli et al. (2015) looked into impact liquidity risk on bank performance in Malaysian Banks for 7 years (2008-2014) by using panel data analysis. The findings indicated that the most significant factor is the capitalization and it has s strong relationship with performance. According to results, problem of liquidity risk associated with regulatory requirement will decrease and this will give banks to increase their profitability as well as get better their financial performance.

Ndoka et al (2017) used data of 16 deposit banks working in Albania for 11 years (2005-2015) to examine the impact of management of liquidity risk on the performance by using multiple regression analysis. The results show that the link between profit before tax and cash is statistically significant. Also, the findings indicate that there exists a negative correlation between deposits and profit before tax and liquidity GAP and profit before tax as well as these correlations are significant.

Altan (2017) used GMM and panel data analysis to observe factors determining liquidity risk of 28 commercial banks working Turkish banking sector for a sample of 2009-2014. The study's findings imply that variables including lagged liquidity, deposit level, credits received, asset profitability, and liquidity risk variable have positive and significant connections. Additionally, it is discovered that there is a strong and negative correlation between bank size and liquidity risk.

For a sample of UK commercial banks from 2005 to 2015, Ciftci (2016) used the GMM estimator technique to explore the factors that affect bank liquidity risk and performance. According to research result, capitalization has a negative impact on bank liquidity, whereas bank size, the unemployment rate, and the interbank rate have positive effects on bank liquidity. The findings show that gross domestic product has a positive impact on UK commercial banks' performance, while bank size, and the cost to income ratio, inflation, and the effective tax rate have a negative impact. However, according to study findings, liquidity has no influence on the performance of the bank.

Karakaş (2022) utilized Driscoll-Kraay method and Beck-Katz methods to study the effect of liquidity on profitability for a sample of 20 Commercial Banks from 2002 to 2020. The results show that LDR (Loans to Deposit Ratio) has a negative association with all three profitability ratios, whereas LAR (Liquid Assets Ratio) and CR (Current Ratio) have a positive relationship with ROA and a negative relationship with ROE and NIM (Net Interest Margin) Similarly, ATR (Acid-Test Ratio) has a negative relationship with ROA while having a good relationship with ROE and NIM. Research findings generally indicate a negative correlation between liquidity and profitability.

Abdulganiyy (2018) examined determining liquidity risk, profitability and cost efficiency of banks in selected Organization of Islamic Cooperation countries for a period of 2005-2016 by using system generalized moments method model (SGMM). The results indicate that capital adequacy ratio, cost efficiency and profitability ratio, and profit and loss sharing are significant associated with liquidity risk. Furthermore, inflation, money supply and gross domestic product have significant impact on liquidity risk.

Tu et al. (2019) studied the determinants of liquidity risk of commercial banks in Vietnam, for a sample of 35 banks from 2010 to 2015. They discovered that the interbank market aids or helps deposit banks in increasing their liquidity, the liquidity risk increases with loan size, good credit risk management has a positive influence on liquidity risk management, and long-term interest rates have a negative correlation with deposit bank liquidity.

Huong et al (2021) examined the impact of liquidity risk on bank performance in Southeast Asian countries using system generalized moments method (SGMM) for a period of time between 2004 and 2016. The findings show that liquidity risk has a positive effect on the performance of banks. The impact of liquidity risk on bank performance is negative during financial crisis. In a study conducted by Adusei (2021), the connection between the liquidity risks and performance was analyzed. Researchers investigate 532 microfinance institutions in 73 countries for the period between 2010 and 2018. The results show that liquidity risk exhibits a robust negative and statistically significant impact on the financial performance of MFIs.

Turgutlu (2014) studied dynamics of profitability in the Turkish banking sector using system generalized moments method model (SGMM) for the period of from 2006-2016. The findings show that the capital ratio has an impact on bank profitability and that this impact may continue during the Basel III timeframe. The results also indicate positive impact of bank’s increased financial soundness on profitability.

Şimşek (2019) investigated the identification internal liquidity risk varibles for commercial banks in Turkey, examining the impact of Basel III on a sample of 23 deposit banks during 2002 to 2017. There were correlations between the ratios of non-performing loans to total loans, loans obtained to total assets, total loans to total deposits and capital adequacy ratio. Findings show that capital adequacy ratio (CAR) and total loan to total deposits ratio are prevalent in both time periods and act as the primary determinants during the study’s main period. After Basel III, other significant explanatory variables included the ratio of fixed asset to total asset, the ratio of interest income to total asset, the ratio of foreign currency assets to foreign currency liabilities and the ratio of equity to total assets

Gulhan (2018) investigated the relationship between liquidity risk and liquidity regulation in Turkish banking sector for a sample of banking sector in turkey using system generalized moments method model (SGMM) for the period of from 2003 to 2016. Based on the study results, it has been determined that the Turkish banking sector can not realize the net stable funding rate under stress conditions within the legal limits. Additionally, the findings indicate that from banking factors; profitability, capital adequacy, asset size and non-performing loans, from macroeconomic variables, crisis, GDP and inflation are determinants of liquidity buffers in Turkish banking sector.

4.3. DATA AND VARIABLES

4.3.1. Target Population and Sample

The population is the total number or group of observable units. Therefore, a population can compose of any particular types of objects, organizations, person or even events. Population or universe means, the whole of the observations, that are the parent group from which the sample is formed (Singh, 2006: 82; Walliman, 2011:

94). The population of this thesis consists of deposit banks in Turkey. The target population of the thesis will be 34 commercial banks for the periods from 2003: Q1 to 2021: Q4. A sample of 21 will be helpfully chosen out of the listed commercial banks since there is restriction data of commercial banks for the period between 2003 and 2021. Thus the choice of the sample study is considered their accessibility of data within the period range.

Table 4.1: The Selected Deposit Banks in Turkish Banking Sector

	Bank Name
1	Türkiye Cumhuriyeti Ziraat Bankası A.Ş.
2	Türkiye Halk Bankası A.Ş.
3	Türkiye Vakıflar Bankası T.A.O.
4	Akbank T.A.Ş.
5	Anadolubank A.Ş.
6	Şekerbank T.A.Ş.
7	Turkish Bank A.Ş.
8	Türk Ekonomi Bankası A.Ş.
9	Türkiye İş Bankası A.Ş.
10	Yapı ve Kredi Bankası A.Ş.
11	Alternatifbank A.Ş.
12	Denizbank A.Ş.
13	HSBC Bank A.Ş.
14	ING Bank A.Ş.
15	Türkiye Garanti Bankası A.Ş.
16	Turkland Bank A.Ş.
17	Citibank A.Ş.
18	Arap Türk Bankası A.Ş.
19	QNB Finansbank A.Ş.
20	ICBC Turkey Bank A.Ş.
21	Burgan Bank A.Ş.

A sample design is a definitive plan for getting samples from a particular population. This refers to the technique or the procedures the researcher use when selecting items to sample (Kothari, 2004: 56). The sample includes quarterly observations from 21 planned deposit banks, consisting of 3 state-Owned Banks, 7 private-owned banks and 11 foreign banks of Turkish over the period from 2003: Q1 to 2021 Q4. The selected deposit banks of this study are shown in the Table 4.1.

4.3.2. Determining the Variables and Collecting Data

In this study, the data of the selected banks used in the application were obtained from the TBB (https://www.tbb.org.tr/tr/bankacilik/banka-ve-sektor-bilgileri/istatistiki-raporlar/59) from the periods of 2003: Q1 to 2021: Q4. A total of 21 deposit banks were used in the study, as shown in the table below.

Table 4.2: Sources of Data

Acronyms	**Explanation**	**Source**
LATA	Liquid Assets to Total Assets Ratio	www.tbb.org.tr
LASL	Liquid Assets to Short-term Liabilities Ratios	www.tbb.org.tr
ROE	Return on Equity	www.tbb.org.tr
OETA	Operating Expense to Total Assets	www.tbb.org.tr
ETA	Equity to Total Assets	www.tbb.org.tr

In this study, the effects of profitability, efficiency and equity variables on liquidity levels in commercial banks are investigated. In the analysis, the liquidity indicators LATA and LASL will be used as dependent variables, and the profitability (ROE), Efficiency (OETA) and equity (ETA) ratios will be used as independent variables. Framework is based on the studies investigating the relationship between the dependent variables and independent variables, the following framework was conceptualized**.**

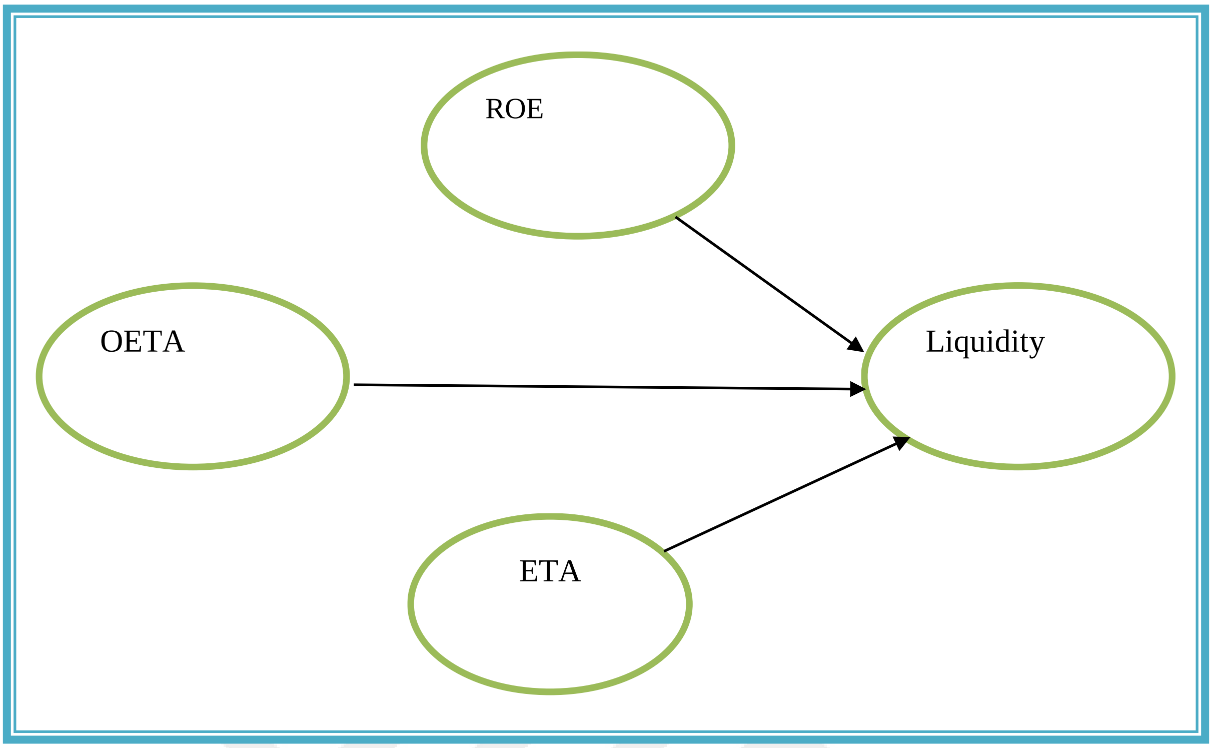

Figure 4.1: Conceptual framework of the Analysis

In this study, the effects of profitability and efficiency on liquidity in the Turkish banking sector are investigated. Due to its close relationship with liquidity, equity ratio is also used as an independent variable in the analysis. The following variables are used within the scope of the application.

A. Liquidity Ratios

In this study, the dependent variable is the liquidity which has been measured differently in various research papers. Akhter (2018) used liquid assets to customer and short-term funding as a proxy for liquidity risk. Athanasoglou et al. (2006) used loans to total assets as a proxy for liquidity risk. Şimşek (2019) used liquid assets to total assets ratio. Some authors Zolkifli et al. (2015) used loan to deposit ratio. Chen et al. (2018) used financing gap (financing gap is defined the difference between a bank's loans and customer deposit) to total assets. This study focuses on liquidity ratio (LATA and LASL) in Turkish commercial banking.

Liquid Assets = Cash and Cash Equivalents (Cash and cash balances at Central Bank + Banks + Receivables from Money Markets) - Allowances for expected credit losses (-)

LATA = Liquid Assets / Total Assets

Short-term Liabilities: "Demand" and "Up to 1 Month" columns of the "Liquidity Risk" table from "Financial Position" section of the Communique-Financial statements and related explanation and footnotes of the banks that is disclosed to the public (-)

LASL = Liquid Assets / Short-term Liabilities

B. Efficiency Ratio

Efficiency ratio (it is also called cost-income ratio (CIR) or expense-income ratio), examines its usefulness as a measure of bank's performance. It is defined as the ratio total expenses to income (Tripe, 1998: 1). The cost-income ratio was used to represents efficiency and productivity of banks. To represent the efficiency of banking operations, study uses the ratio of total non-interest costs to total non-interest revenues of the bank. Higher ratio means less efficiency (De Haan and Poghosyan, 2012: 3010). In this study, the ratio of operating expenses to total assets will also be used in the measurement of bank efficiency. Additionally, this study focuses on OETA to represents efficiency.

C. Return on Equity (ROE)

Return on Equity is a financial indicator of how much a company has made profit compared to the total amount of shares reported on its investment or balance sheet. It is what the shareholder wants in return for their investment (Moslemany et al. 2021: 407). It is calculated as follows: Return on Equity = Net income / Total Equity.

D. Equity to Total Assets Ratio (ETA)

Bank capitalization as measured by the book value of equity to total asset. So, a positive sign of this factor is expected for liquidity risk (Zolkifli et al, 2015). It is a measure of a bank's financial strength and its capital adequacy and provides information on the degree of financial stability of the bank (Alshatti, 2015). Khan et al. (2016) suggest that there is a positive relationship between Capital adequacy and liquidity risk.

Table 4.3: Variables and Definitions Used in the Application

Variables	Definition	Measurement
Dependent Variable		
Liquidity ratio (LATA and LASL)	LATA ratio is computed with liquid assets to total assets. LASL ratio is computed utilizing short-term liabilities as the denominator and the liquid assets as the numerator.	LATA= Liquid Asset / Total Assets (Şimşek, 2019). LASL= liquid Assets / Short-term liabilities (Şimşek, 2019).
Independent Variables		
Return On Equity (ROE)	It is a measure of financial performance calculated by divided net income by shareholders'equity.	ROE = Net Income / Total Equity (Acaravci, 2013).
Operating Expenses on Total Assets (OETA)	It is defined as operating expenses on Total assets	Operating Expenses / Total Assets (Kaur and Sharma, 2022: 46).
Equity to Total Assets Ratio (ETA)	The total shareholder's equity is divided by bank's total assets at the shareholder equity ratio, which is given as a percentage	ETA = Equity / Total Assets (Chen et al., 2018)

4.4. RESEARCH HYPOTHESES AND MODEL

A total of six (6) hypotheses were made in this study to investigate the impact liquidity risk on profitability and cost efficiency hence these hypotheses are shown below.

Model 1: Dependent Variable: LATA

H_0: There is no relation between return on equity (ROE) and liquidity level (LATA) in Turkish deposit banks

H_1: There is a relation between return on equity (ROE) and liquidity level (LATA) in Turkish deposit banks

H_0: There is no relation between Operating Expenses on Total Assets (OETA) and liquidity (LATA) in Turkish deposit banks

H_1: There is a relation between Operating Expenses on Total Assets (OETA) and liquidity in (LATA) Turkish deposit banks

H_1: There is a relation between Equity to Total Assets Ratio (ETA) ratio and liquidity (LATA) in Turkish deposit banks

H_0: There is no relation between Equity to Total Assets Ratio (ETA) and liquidity (LATA) in Turkish deposit banks

Model 2: Dependent Variable: LASL

H_0: There is no relation between return on equity (ROE) and liquidity level (LASL) in Turkish deposit banks

H_1: There is a relation between return on equity (ROE) and liquidity level (LASL) in Turkish deposit banks

H_0: There is no relation between Operating Expenses on Total Assets (OETA) and liquidity (LASL) in Turkish deposit banks

H_1: There is a relation between Operating Expenses on Total Assets (OETA) and liquidity in (LASL) Turkish deposit banks

H_1: There is a relation between Equity to Total Assets Ratio (ETA) ratio and liquidity (LASL) in Turkish deposit banks

H_0: There is no relation between Equity to Total Assets Ratio (ETA) and liquidity (LASL) in Turkish deposit banks

Research model can be written as follows:

Model 1 and Model 2:

$$LATA_{it} = \beta_0 + \beta_1 ETA_{it} + \beta_2 ROE_{it} + \beta_3 OETA_{it} + \varepsilon_{it} \quad \text{Equation 1} \ldots\ldots\ldots\ldots\ldots\ldots 4.1$$

$$LASL_{it} = \beta_0 + \beta_1 ETA_{it} + \beta_2 ROE_{it} + \beta_3 OETA_{it} + \varepsilon_{it} \quad \text{Equation 2} \quad \ldots\ldots\ldots\ldots\ldots 4.2$$

Where:

$LATA_{it}$ = Liquidity for bank i, year t

$LASL_{it}$ = Liquidity for bank i, year t

ROE_{it} = Profitability for bank i, year t

$OETA_{it}$ = Efficiency for bank i, year t

ETA_{it} = Equity level for bank i, year t

β_0 =Intercepts

β_1-β_3 Coefficients of parameters

ε_{it} =Error term of bank i

This research utilizes system generalized method of moment (SGMM) model to test the dynamic impact liquidity risk on profitability and efficiency in Turkish commercial banks. The quarterly reports from the selected banks will be processed and analyzed using STATA 14.0. The dependent and independent variables are analyzed by using correlation, linear regression and System GMM model. GMM model will be used to analyze the effect liquidity risk on profitability and efficiency of Turkish commercial banks.

According to Dahir et al. (2018: 237), the system GMM's merits over other panel models include the following:

1) System GMM method eliminates dynamic panel bias in addition to dealing with endogeneity issues and fixed effects.

2) System GMM estimation, which employs a system that combines level regression as well as first differences, is more efficient than difference GMM estimation.

3) The system GMM estimator is more effective for short periods of time, indicating that dependent variable is persistent as well as has a significant association with the autoregressive term.

4) System GMM estimation can still produce accurate and reliable estimates when explanatory variables are not exogenous, and there is individual heteroscedasticity and autocorrealation.

5) The Pooled Ordinary Least-square Regression Model (POLS), the Fixed Effect Model (FEM) and Random Effect Model (REM), which are models for panel analysis, are biased and inconsistent in their parameter estimates as either a lagged dependent variable exists or explanatory variables may have an endogeneity issue. Therefore, the system GMM estimator provided by Arellano and Bover (1995) and Blundell and Bond (1998) can eliminate the bias caused by panel analysis standard models.

4.5. METHODOLOGY AND RESEARCH DESIGN

A research design is a planned approach to a study topic (Greener, 2008: 38). It is a planned approach to collect, measure, and analyze data, focused on the study's research equations (Sekaran and Bougie, 2013). Research design guides research to come up with solution to the study problem. With a research design, there is guarantee that accuracy, general and applicable of the research result will be obtained (Bhatti and Sundram, 2015). Through research design, the purpose of the study, method of investigation, techniques for analysis and time needed for the study can be identified. Kothari (2004: 31) defines research design as "a conceptual structure for conducting research and as a blueprint for the collecting, measuring, analyzing of data."

Hypothesis testing approach was adopted for this study. Hypothesis testing, a researcher aims to explains the relationship between variables using various statistical tests. Also, this research uses quantitative method and also employs secondary data of some selected listed commercial banks in Turkey for a period from 2002 to 2020 in which liquidity risk is considered as independent variable, while profitability and cost efficiency are dependent variable.

4.5.1. Panel Data

In this study we refer to panel data as data observed over several periods for a cross-section of countries, firms, households, etc. This data obtained by taking multiple surveys over time (Baltagi, 2005: 1). An efficiency analytical method for handing econometric data is panel data estimation.

As a popular data analysis method among social scientists, panel data analysis allows the inclusion data for N cross-sectional data at T time periods, for example yearly, quarterly data for countries or firms (Asterious and Hall, 2007: 344). Panel data is also referred pooled data, combined cross-section time services data, longitudinal data, micro panel data, cohort or event history analysis data (Gujarati, 2004: 636).

To estimate dynamic econometric models, panel data is nowadays commonly utilized. Unlike cross-section data, panel data enables estimation from observation at single point in time. It is rare for single cross-section surveys to provide information that is sufficient to enable investigation of dynamic relationships about earlier time periods. When compared to aggregate time series data, panel data enables obscuring aggregation biases in the underlying microeconomic dynamics. Furthermore, with panel data, there is a wider scope for investigating heterogeneity dynamic adjustment between different types of firms, household and individuals. At the same time, the shared advantages by cohort or repeated cross-section data, allows the use of variation in the micro data to construct parameter estimates while permitting relative use of simple econometric techniques (Bond, 2002: 141-142).

Panel datasets also offer meaningful ways of testing particular parameters if interest as to whether or not they differ over time as controlling for individual specific effects. For researcher, panel data allows them to test hypotheses on a range of firms with a small number of observations for which time-series analysis is not a viable option for the individual (O’Connell, 2007: 373).

Accordingly, Law (2018: 3) asserts that cross-sectional data and time series data combined forms panel data. In model specifications, these are denoted by i and t subscripts. Same unit observations (e.g. companies, markets, people, cities, states, countries) over various time periods (monthly, quarterly, annually, etc.), allows formation of panel data by stack the datasets.

Baltagi (2005: 1) explained panel data as a collection of observations over several time periods on a cross-section of households, countries, firms, etc. According to him, panel data helps in control individual heterogeneity. Data that is more informative, efficient and variable has less collinearity between the variables, having more degrees of freedom enables to study the dynamics of adjustment much better. With panel data there is ability of identifying and measuring simply effects that may not be hard to detect in pure cross-section or time-series data. Panel data models allow the construction and testing of behavioral models that are complex than purely cross-section or time series data. Measuring micro data on firms, households or individuals is more accurate with panel data than similar variables measured at the macro level. On the other hand, macro panel has a longer time series compared to problem of nonstandard distributions typical of unit roots test in time-series analysis. As listed by Law (2018: 8) and Baltagi (2005), the limitations of panel data include:

- There are design and data collection problem
- Distortions of measurement errors
- Can cause selectivity problems
- Short time series dimensions
- There is dependence on cross-section

In a balanced panel data, each cross-sectional unit has the same number of time series observations, as compared to unbalanced panel data in which some cross-sectional elements have fewer observations at different times than others (Brooks, 2014: 529). In other words, in balanced data, each i has T observations while for unbalanced panel data, each i has a varying number of observations (Law, 2018: 6). In balanced panel data, each sample consists of same number T of cross-sectional units, or in other words when we get a full nest of data both across time and countries. Otherwise it is unbalanced panel data if there are missing observations for some time periods of some of the cross-sectional units (Asterous and Hall, 2007: 345).

Asterious and Hall (2007: 345) propose three models for estimating linear panel data models, i.e., with a common constant, allowing for fixed effects and allowing for random effects. The fixed effect and also the random effect model are common estimates of panel data models. These estimation techniques have been greatly utilized for research relating to banks operation as in the studies by Isik and Ince (2016), Akbas et al. (2012), Sarigul, H. (2013), and Yaldiz and Bazzana (2010).

i) Fixed Effect

The fixed effect model treats quantities as non-random to represent the observed quantities in terms of explanatory variables. Using this model, partial regression coefficients that are taken to common across-sectional units, while intercepts of each regression model are distinct for individual banks. This model assumes that the independent variables are associated with the individual specific effect. The intercept and coefficients of slope are assumed to be constant across time and space while the error term represents the difference over individuals and time (Gujarati, 2004: 640).

Fixed effect model (FEM) is specified as follows:

$$Yit = \beta 1 + \beta 2X2it + \beta 3X3it + uit \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.3$$

Where Y_{it} is an observation on some series for individual i in period t, Xit is an independent variable, β_1 is the coefficient of Xit, uit is an error term.

ii) Random Effect Model

The random effect model is an alternative to fixed effects model. Hence it is also called the error components model (Brooks, 2008: 498). The model is known as random effect model if λi is assumed to be a random variable with mean zero, variance and more importantly, uncorrelated with the regressor, i.e., Cor (λi, Xit) = 0. Individual effects are described as being random (Law, 2018: 26).

Random Effect Model (REM) is specified as follows:

$$Yit = \beta 1 + \beta 2X2it + \beta 3X3it + \varepsilon it + uit \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. 4.4$$

Where *uit* is between entity errors while εit is within entity error

Therefore, it is assumed the selection among the fixed effect and random effect is based on the correlation between the individual, or cross-section specific, error component εit as well as the X regressors. RE may be appropriate, when εit is assumed to be uncorrelated to the X's, otherwise FE is appropriate when εit and the X's are correlated.

Comparative to the fixed effect model, the random effects model suggests diverse intercept term for each entity as well as once more these intercepts are constant over time, with the connections between the explained variable and explanatory factors accepted to be the same both temporally as well as cross-sectionally (Brooks, 2008: 500). The difference is that under the random effect model, the intercepts for each cross-sectional unit are expected to emerge from a common intercept, additionally random factors that differs cross-sectionally however is constant over time (Brooks, 2008: 500).

Besides to panel data, the study also explored the consistency of the result with Generalized Method of Moments (GMM).

4.5.2. Dynamic Panel Data (Generalized Methods of Moments - GMM)

The dynamic nature of economic and finance topics uses the panel data analysis to recognize adjustment. If we let the underlying process to be dynamic, it becomes important to recover consistent estimates of other parameter (Law, 2018: 134). Regressions on panel data are characterized by autocorrelation because the presence of a lagged dependent variable between the regressors and individual effects characterizing the heterogeneity among the individuals (Daher et al. 2015: 40).

Both Arellano and Bond (1991) and Holtz-Eakin et al. (1988) demonstrated how to build estimators based on moment equations built from extra lagged levels of y_{it} as well as the first –differenced errors

- Building moment conditions utilizing first differences of the errors εit and lagged levels of the dependent variable (Y)
- Moment conditions are likewise produced by using the first differences of strictly exogenous covariates (X)

Generalized Method of Moments (GMM) was first introduced into the econometrics literature by Hansen in 1982. As its introduction, it has found wide application in analyzing economic and financial data. To address the endogeneity issue, as well as using instruments, the GMM model is widely used (Drukker, 2010). In addition, use of GMM for panel data of bank is necessary because of endogeneity problems in banks data.

Dynamic Model is specified as follows:

$$y_{it} = \rho y_{i,t-1} + \beta X_{it} + (v_i + \mu_{it}) \quad \ldots\ldots 4.5$$

Where:

y_{it} = An observation on some series for individual i in period t,

$y_{i,t-1}$ = The observation on the same series for the same individual in the previous period (as independent variable). It captures the dynamic nature of the dependent variable.

X_{it} = An independent variable (or vector of explanatory variables),

v_i = An unobserved individual –specific time –invariant effect which allows for heterogeneity in the mean of the y_{it} series across individuals,

μ_{it} = A disturbance (error) term.

The dynamic panel data regression is categorized by two sources of persistence over time (Law, 2018: 134):

- Autocorrelation due to the presence of a lagged dependent variable among the regressors
- Individual effect characterizing the heterogeneity among the individuals (unobserved specific effects).

Advantages of GMM (Nagayev, 2021):

- Addresses the unobserved panel heterogeneity (individual effects)

- Reduces omitted variable bias as well as the effect of measurement errors
- GMM controls for endogeneity issue of lagged dependent variable using instrumental variables: internal and external instruments

Disadvantages of GMM (Nagayev, 2021):

- Depends on the assumption that N is large. Not for long T Panels Use N > 20.
- More complicated compared to other panel models
- Does not account for cross-sectional dependent (contemporaneous correlation). So, include time dummy into the model.
- Possibility for manipulation

GMM is designed for situations with (Roodman, 2009: 86):

1) A linear functional relationship;
2) "Small T, large N" panels (micro panel), meaning few time periods and many individuals;
3) Fixed individual effects;
4) One left-hand-side (Dependent) variable that is dynamic, depending on its own past realizations;
5) Heteroscedasticity and autocorrelation within individuals but not across them;
6) Independent variables that are not strictly exogenous, meaning they are correlated with past and possibly current realizations of the error.

Difference GMM and System GMM are two types of GMM. The past study used xtabond2 and xtdpdsys which implements each system and difference GMM (Baum, 2013). Xtdpsys also reports the Arellano-Bond for autocorrelation. However, the current study uses xtabond2 which implements both difference and system GMM. Sargan test will also be used in the application to testing for over-identifying restrictions in model and it was recommended by Sargan (1958).

There are two popular GMM estimators:

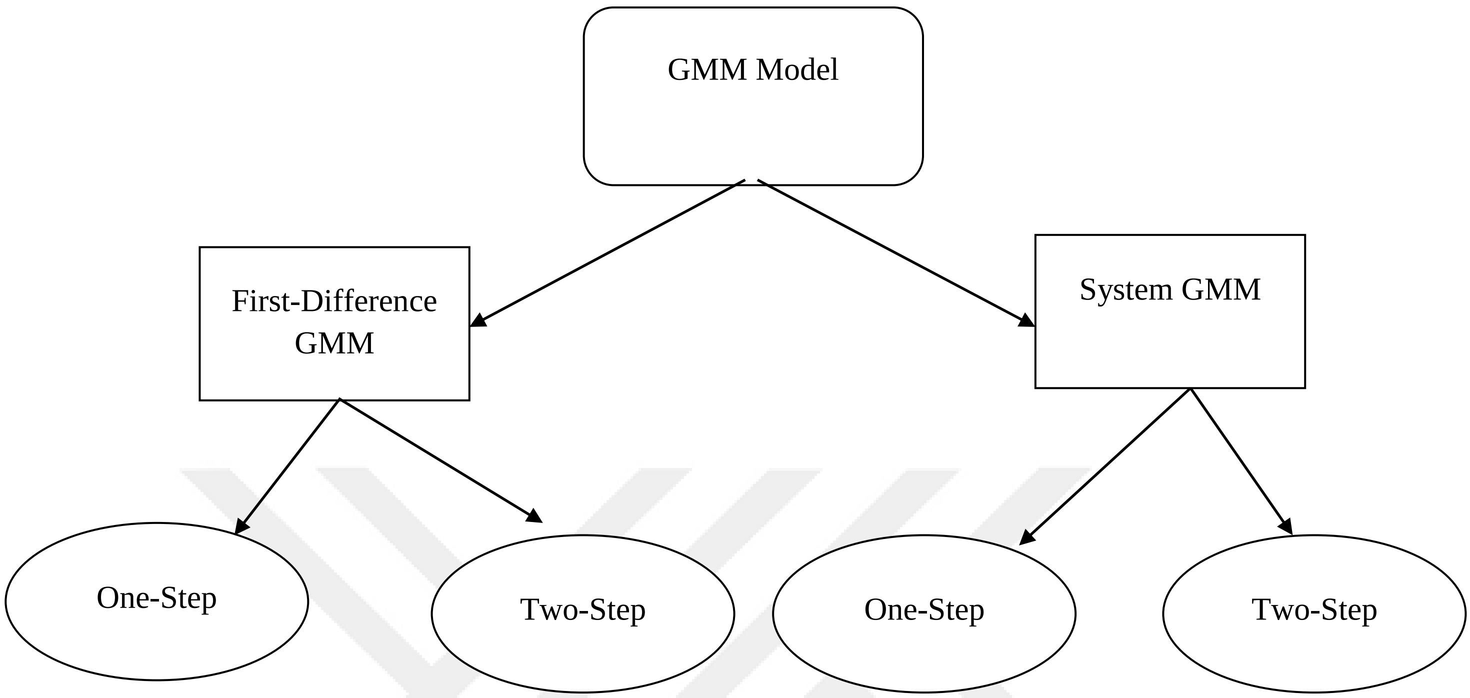

Figure 4.2: Types of GMM Models (Nagayev, 2021)

According to Alandejani and Asutay (2017: 839), GMM models such as the GMM difference model, created by Holtz et al. (1998) and Arellano and Bond (1991), and the GMM system model, created by Arellano and Bover (1995), are used to estimate the variables that may determine NPL over time.

In order to correct this short panel bias, econometric techniques have been developed. A generalized method of moment framework is used by Arellano and Bond (1991) to create reliable instruments (Flannery and Hankins, 2013: 4).

Arellano and Bond (1991) suggested employing the difference GMM estimation in the presence of lagged dependent variables. By changing the data, the difference GMM estimator eliminates fixed effects and addresses the endogeneity problem by employing lagged values as instrument (Jha, 2019: 72; Mittal and Garg, 2021: 215).

To address the problem with auto-regressive models, Arellano and Bond (1991) developed the difference GMM technique of dynamic panel estimation (Arı and Özcan 2011: 109). For the dynamic panel model, Arellano and Bond (1991) suggested a new GMM estimator (Difference GMM). Their suggestion used the difference transformation, as the name implies, and was to add more instruments to the dynamic panel model (Hasanovic and Latic, 2017: 9).

Law (2018: 152) reported that the two-step GMM estimators' estimates standard error was found to be;

A) Downward biased (particularly the sample is not big). The Wald test for parameter limitations are enlarged as a result.

B) Too many instruments (proliferation of instruments) as the number of strictly exogenous variables and time series data rise, so do the number of moment conditions.

The number of instruments increases quadratically in T and the GMM become inconsistent as the number of instruments diverges.

4.6. ANALYSIS OF DATA AND RESULTS

4.6.1. Correlation Analysis

The study uses correlation analysis to measure the strength of relationship between two variables and calculate their relationship. Correlation values are between -1.0 and 1.0. Table-4.4 below shows the correlations that exist between the study variables. The maximum positive correlation of 0.3197 is between liquidity and ETA. The highest negative correlation of -0.0512 is between liquidity and OETA. The results show that ROE has positive and strong relations with liquidity level. In addition, there are a positive correlation between liquidity and ETA while there are negative correlations between OETA and liquidity level. Since there are significant relationships between the dependent variables, it is necessary to estimate multiple linear relationships between the dependent variables to build a regression model.

Table 4.4: Correlation of Variables for Commercial Banks

	LATA	LASL	ROE	OETA	ETA
LATA	1				
LASL	0.7700	1			
ROE	0.0613	0.0562	1		
OETA	-0.0512	-0.0638	-0.0296	1	
ETA	0.3197	0.3152	-0.0300	-0.0048	1

The correlation between each pair of variables in table 4.4 was examined, and it was discovered that the correlation between each pair of variables is not very high. The since the maximum value is 0.3197 and is below 0.8, thus we declare that there are no significant multicollinearity problems.

The cross-sectional dependency indicates whether all series would be equally affected by a shock to the study's cross-sectional units. Therefore, Breusch-Pagan (1980) LM or Pesaran (2004) CD test can be used to assess whether there is a cross-sectional dependency among the series.

Based on Swamy's (1970) study, suggested asymptotically normal distribution standardized distribution statistics for panel data models where unit size N and T are large. If N > T, a regression equation that appears unrelated cannot be applied so the recommendation is to utilize the created Swamy's heterogeneity test.

According to Baltagi (2005: 199), through the use of Monte Carlo simulations, Driscoll and Kraay (1998) show that the presence of even modest spatial dependence can introduce large bias into OLS standard errors when N is big or large. On the other hand, they draw the conclusion that the issue of consistent nonparametric covariance matrix estimation is much less solvable if T is small.

The Lagrange multiplier (LM) test is suggested by Breusch and Pagan (1980) to identify cross-sectional dependence. The following panel data model must be estimated in order to compute the LM test.

$$y_{it} = \alpha i_{it} + \beta X_{it} + \varepsilon_{it} \quad \text{...4.6}$$

for i = 1,. . ., N; t = 1,. . ., T

Where y_{it} is economic growth (EG), i is the cross-sectional dimension, t is the time dimension, X_{it} is the vector of explanatory variables, α_i is the individual intercept, and β_i is slope coefficients. In the LM test, the null hypothesis of no cross-sectional dependence, i.e. H_0: Cov (ε_{it} , ε_{jt}) = 0 for all t and i ≠ j. Breusch and Pagan (1980)'s LM test statistic for cross-sectional dependence of is provided by:

$$CD_{BP} = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^{2}$$

Where ρ^ij is the sample estimate of pair-wise correlation of the residual from OLS estimation of Equation 1 for each i. The test is valid if T sufficiently large as well as N moderately small.

Table 4.5: Cross-Section Dependence Test Result

Variable Name	Breusch ve Pagan LM adj* test Statistics	Swammy's S test Statistic	Panel Unit Root Test
LATA	139.8***	150.05***	Pesaran's CADF Test
LASL	53.03***	162.76***	Pesaran's CADF Test
OETA	2744.00***	201.96***	Pesaran's CADF Test
ETA	320.60***	96.29***	Pesaran's CADF Test
ROE	207.8***	220.42***	Pesaran's CADF Test

According the test findings, the null hypothesis was rejected and an alternative hypothesis was accepted. Therefore, there was a cross sectional dependency and correlation between the units. Furthermore, table above indicates that the p-value is lower than 5%, we have to reject the null hypothesis. Slope coefficients are heterogeneous.

Table 4.6: Panel Unit Root Test Results

Variables	t Statistic	p-value
LATA	-2.595***	0.0000
LASL	-3.132***	0.0000
OETA	-3.310***	0.0000
ETA	-2.431***	0.0000
ROE	-3.121***	0.0000

This study employed the panel unit root test proposed by Levin et al. (2002). Acceptance of the null hypothesis suggests that a common unit root exists. The unit root does not exist, on the other hand, if the alternative hypothesis is accepted. The fact that the alternative hypothesis was accepted shows that the panels are stationary.

Pesaran (2003) was used as the unit root test in this study. He provided a simple and new method to evaluate unit roots in dynamic panels with serial dependence on correlated errors as well as have cross-section dependence.

Based on the finding above table, the null hypothesis was rejected for all variables since p-values are lower than 5% and lastly conclude that the series utilized for the analysis is stationary.

4.6.2. GMM Results

This study's main objective is to examine the effects of profitability and efficiency on liquidity and liquidity risk, utilizing a sample of 21 Turkish commercial banks over the between 2003: Q1 and 2021: Q4. The study describes model estimation that links liquidity as dependent variable with profitability and efficiency as explanatory variables. As mentioned before, the equity ratio (ETA) is also used as an independent variable in the analysis due to its close relationship with liquidity.

Model 1: SGMM Estimation Results

Model 1 explores the association between liquidity, profitability and efficiency in the study is as the following formula:

$$LATA_{it} = \beta_0 + \beta_1 ETA_{it} + \beta_2 ROE_{it} + \beta_3 OETA_{it} + \varepsilon_{it} \qquad \text{(Equation 1)….4.7}$$

Table 4.7: GMM Result Dependent Variable: LATA (2003-2021)

VARIABLES	LATA	P-value
L.LATA	0.904596	(0.000)
ETA	-0.0114668	(0.736)
ROE	0.0355357	(0.002)
OETA	0.17744	(0.000)
Sargan test	1308.184	
P-value of Saragan	0.9815	
Observations	1,575	1,575
Number of id	21	21

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The system GMM test is used to determine whether the model is an autocorrelation problem, and the Sargan test is used to determine whether the instrumental variables are valid (reliable). A Sargan test with a p-value higher than 5% (0.9815) fails to reject the null hypothesis. The overidentifying restriction appears to be valid in this way. The system GMM test is used to determine whether the model is an autocorrelation problem, and the Sargan test is used to determine whether the instrumental variables are valid (reliable). A Sargan test with a p-value higher than 5% (0.0568) fails to reject the null hypothesis. The overidentifying restriction appears to be valid in this way.

The table above displays the system GMM model 1 result. These findings shows that ROE has positive impact on liquidity level in Turkish banking sector. ROE and LATA have a statistically significant at a significance level of 1%. This finding shows that as bank's profitability ratio (ROE) rises, its liquidity also raises; conversely, bank's ROE reduces also declines it's LATA. Thus, it has been found that profitability has a positive effect on liquidity in Turkish banking. LATA and ROE have a positive association in model 1, meaning that when ROE rises by 1%, LATA increase by 0.0355. Additionally, LATA represents liquidity level. High liquidity level results in low liquidity risk and vice verse. If banks raise their return on equity, their liquid reserves also raise; consequently, they greater the probability to meet a liquidity risk. Profitability growth improves the bank's ability to manage liquidity risk, which has a positive impact on liquidity. As a result, it is possible to say that higher profitability positively affects the liquidity levels of the bank and therefore the liquidity risk management.

The increase in profitability is expected to have a positive impact on the level of liquidity as long as the bank does not distribute the majority of its profits as dividends or do not transfer them to long-term investments with low liquidity and using them in relatively more liquid assets. Additionally, even if the cash dividends are not paid, the rise in liquidity might still encourage investment to the same extent as unpaid dividends, which will increase bank's ability to lend money and create value.

Dezfouli et al. (2014), Moussa (2015), Vodova (2013) and Zaineldeen (2018) confirm our results with positive findings. Singh and Sharma (2016) declare a positive link between profitability of the bank and liquidity. Also, Kosmidou et al. (2005) report a positive connection between profitability and liquidity.

Other research, however, indicate that profitability has negative effect on liquidity such as Kosmidou et al. (2005), Zaineldeen (2018), and Avdalović1 and Kalaš (2016). Additionally, Kosmidou et al. (2005) discovered that liquidity risk and profitability are positively connected. According to Teixeira et al. (2021), liquidity risk and bank profitability are positively correlated.

Positive and significant (at the 1% level) correlation between OETA and LATA has been found. The findings show that the bank's liquidity level is positively impacted by the rise in operational expenses. This indicates that low efficiency in banks increases the need for liquidity. In other words, this circumstance can be understood as "low-efficiency banks having to deal with higher liquidity." Therefore, this shows that if OETA rises by one unit, liquidity will likely rise by 0.177 units. Hence, higher LATA causes in lower liquidity risk. A bank's operating efficiency is higher if it consistently achieves a lower operating cost to assets ratio. The increase in operating expenses also increases the liquidity need of banks and results in higher liquidity.

Avdalović1 and Kalaš (2016) identify a negative relationship between efficiency measurement and liquidity. Kaur and Sharma (2022) conducted similar research that describes a positive correlation between bank liquidity risk and operating expenses to total assets ratio.

According to the analysis results, there is a negative correlation between ETA and LATA in model 1. Negative correlations exist between the ETA and LATA variables; this means that as bank’s ETA increases, their LATA drops. However, this result is not statistically significant.

The results of the analysis also reveal that a 1-unit increase in the previous value (LATA t-1) of liquidity increases the current value of liquidity (LATA) by 0.904 units at the 1% significance level.

Model 2: SGMM Estimation Results

Model 2 examines the link between liquidity, profitability and efficiency variables. Its formula is as follows:

$$LASL_{it} = \beta_0 + \beta_1 ETA_{it} + \beta_2 ROE_{it} + \beta_3 OETA_{it} + \varepsilon_{it}$$ (Equation 2)…..4.8

Table 4.8: GMM Result Dependent Variable: LASL (2003-2021)

VARIABLES	LASL	P-value
L.LASL	0.6349671	0.000
ETA	0.6124351	0.000
ROE	0.1098644	0.007
OETA	0.490601	0.000
Sargan test	1502.208	
P-value of Saragan	0.0568	
Observations	1,575	1,575
Number of id	21	21

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The table above displays the system GMM model 2 results. Although it is expected that profitability will have a negative coefficient on liquidity variables, this study looks into how profitability and efficiency affects on liquidity. According to Table-4.8, ROE and LASL and have a positive connection. Furthermore, it is noted that ROE and LASL have a statistically significant at a significance level of 1%. Meaning that if ROE increases by one unit, LASL will also increases by 0.110. This finding shows that as bank's profitability ratio (ROE) rises, its liquidity also raises; conversely, bank's ROE reduces also declines it's LASL. Thus, higher LASL results in lower liquidity risk. High liquidity ratio has a reducing effect on banks' liquidity risk.

Also model 2 findings disclose that ETA and liquidity (LASL) show significant and positive correlation at 5% level. The coefficient of ETA is 0.612, indicating that a 1-unit raise in ETA will also raise liquidity by 0.612. Considering the liquidity risk-reducing effect of high liquidity ratios, it can be concluded that the increase in the level of equity in banks makes a significant contribution to liquidity risk management.

The finding was same with the research done by Sheefeni (2016) which indicated the positive effects of capital adequacy ratio on bank liquidity. Furthermore, the findings were comparable with Kaur and Sharma (2022), Vodova (2013) which proved a positive effect of CAR on bank liquidity. According to this result, if the capital adequacy ratio increases, their liquidity level also increases. Zengin and Yüksel (2016), Şimşek (2019), Singh and Sharma (2016), Avdalović1 and Kalaš (2016) and Iqbal (2012) identify a positive relationship between CAR and liquidity. Furthermore, according to Ayaydın and Karaaslan (2014), the ratio of bank equity to total assets is significant, and in the same direction influences bank liquidity.

As in model 1, model 2 also shows that there is a positive and significant (at the 1% level) correlation between OETA and LASL. Findings show that one unit rise in OETA ratio will result in a 0.491 rise in the liquidity (LASL) over the sample quarterly data of 2003: Q1 -2021: Q4. Therefore, higher LASL results in lower liquidity risk. Also, a bank's operating efficiency is higher if it consistently achieves a lower operating cost to assets ratio. Increased operating expenses also result in banks needing more money, which raises liquidity level. The findings show that the bank's liquidity level is positively impacted by the rise in operational expenses. This suggests that banks with low efficiency must employ larger liquidity levels.

The results of the model 2 also reveal that one unit increase in the previous value of liquidity (LASL t-1) increases the current value of liquidity (LASL) by 0.635 units at the 1% significance level.

CONCLUSION

The failure of numerous banks around the world was majorly caused by liquidity risk according to many academicians, policy makers and professionals thus leading to the recent financial confusion between 2007-2009. Besides, a bank’s earnings could be negatively impacted by liquidity problems. Thus, this thesis study observes the effects of profitability and efficiency on liquidity and liquidity risk using the two-step system GMM estimation technique and a sample of 21 deposit banks in Turkey over the quarterly data from 2003: Q1 to 2021: Q4. Regression of instrumental variables from panel data is an approach used for model estimation.

The first objective of the study is to examine the effect of return on assets (ROE) on liquidity. System GMM results reveal that liquidity and profitability (ROE) show positive correlation. So, these findings showed that ROE has positive impact on liquidity situation in Turkish banking. Furthermore, it is noted that ROE and LATA have a statistically significant at a significance level of 1%. This finding shows that as bank’s profitability ratio (ROE) rises, its liquidity (LATA) also raises; in the same way, bank’s ROE reduces also declines its LATA. Thus, it has been found that profitability has a positive effect on liquidity in Turkish banking. LATA and ROE have a positive association in model 1, meaning that when ROE rises by one unit, LATA increase by 0.0355. Since the LATA represents the liquidity level, it is possible to say that high profitability positively affects the liquidity risk management of banks.

ROE and LASL also have a positive connection in model 2. Furthermore, it is noted that ROE and LASL have a statistically significant at a level of 1%. Meaning that if ROE increases by one unit, LASL will also increases by 0.11. This finding shows that as bank’s profitability ratio (ROE) rises, its liquidity also raises; in the same way, bank’s ROE reduces also declines it’s LASL.

The second purpose of this study is to examine the impact of efficiency (Operating Expenses to Total Assets-OETA) on liquidity. Positive and significant (at the 1% level) correlation between OETA and LATA has been found. The findings show that the bank's liquidity level is positively affected by the rise in operational expenses. According to the results, if OETA rises by one unit, liquidity will likely rise by 0.177 units. In model 2, also a positive and significant (at the 1% level) correlation between OETA and LASL has been found. Findings show that one unit rise in OETA ratio will result in a 0.491 rise in the liquidity (LASL) over the sample quarterly data of 2003: Q1 -2021: Q4. This results indicate that banks operating with low efficiency (with high operational expenses) need higher liquidity.

The third purpose of this research is to investigate the effect of on equity to total assets (ETA) on liquidity. There is a negative correlation between ETA and LATA in model 1. Negative correlations exist between the ETA and LATA variables; this means that as bank's ETA increases, their LATA drops. However, this result is not statistically significant. On the other hand, model 2 findings disclose that ETA and liquidity (LASL) show significant and positive correlation at the level of 1%. Analysis results indicate that one unit raise in ETA will also raise liquidity by 0.612. Based on finding, it is possible to say that high equity level is effective in increasing the liquidity level and reducing the liquidity risk.

Therefore, this study found that:

- ROE, which is used as a profitability measure in the analysis, has a significant (at the level of 1%) and positive effect on liquidity factors (LATA and LASL) in both model-1 and model-2.
- Operating Expense to Total Assets (OETA) which was as represent for efficiency has significant at the 1% level and positive impact on liquidity ratios (LATA and LASL) of the commercial banks in model 1 and model 2.
- Equity to total assets ratio (ETA) significantly and positive impact on commercial banks' liquidity (LASL) at the 1% level in model 2.

Government, banks and policy makers should aware of liquidity level and liquidity risk as it has a significant impact on a bank's performance. Banks are required to manage this liquidity risk appropriately by strengthening their own resources as depositors can withdraw capital at any time to invest in new activities with higher returns for unforeseen reason. Efficient asset and liability management is important to reduce risk and attain a good balance between profitability, efficiency and liquidity. For successful banking, assets must be match liabilities in terms of maturity and risk. This study was carry out on banking sector in Turkey. It is recommended that subsequent studies have to include companies operating in different sector in different counties.

The findings of this study give a contribution to the existing literature, first in matter of the methodologies utilized. This study used system GMM model as opposed to panel data in most prior studies. Also, this study's sample period is 19 years, and significantly longer than the national literature's sample periods, which are in the range of 4-13 years. This study also used quarterly data, as compared to yearly data used in other studies.

The limitations of this study can be listed as follows:

- The scope of this study is limited to commercial banks.
- While interpreting the analysis results, liquidity ratios are also considered as a measure of liquidity risk.
- At the first stages of the analysis process, macroeconomic variables such as GDP, inflation and interest rates were also used, but these variables were excluded because no significant result could be reached.
- Bank specific variables such as Liquid Assets to Deposits (LAD), Capital Adequacy Ratio (CAR), and Net Interest Income to Total Assets (NIITA) were also used in the analysis process, but these variables were excluded from the analysis because no significant results could be obtained.

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APPENDICES

APPENDIX I: GMM Results

i) System GMM Results for 2003-2021

```
. xtdpdsys lata eta roe oeta, lag(1)noconstant

System dynamic panel-data estimation           Number of obs     =      1,575
Group variable: id                              Number of groups  =         21
Time variable: number
                                                Obs per group:
                                                              min =         75
                                                              avg =         75
                                                              max =         75

Number of instruments =   1.4e+03              Wald chi2(4)      =   11475.78
                                                Prob > chi2       =     0.0000
One-step results
------------------------------------------------------------------------------
        lata |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        lata |
         L1. |    .904596    .011003    82.21   0.000     .8830305    .9261615
             |
         eta |  -.0114668   .0339549    -0.34   0.736    -.0780172    .0550837
         roe |   .0355357   .0113439     3.13   0.002     .0133021    .0577693
        oeta |     .17744   .0331653     5.35   0.000     .1124372    .2424428
------------------------------------------------------------------------------
Instruments for differenced equation
        GMM-type: L(2/.).lata
        Standard: D.eta D.roe D.oeta
Instruments for level equation
        GMM-type: LD.lata
```

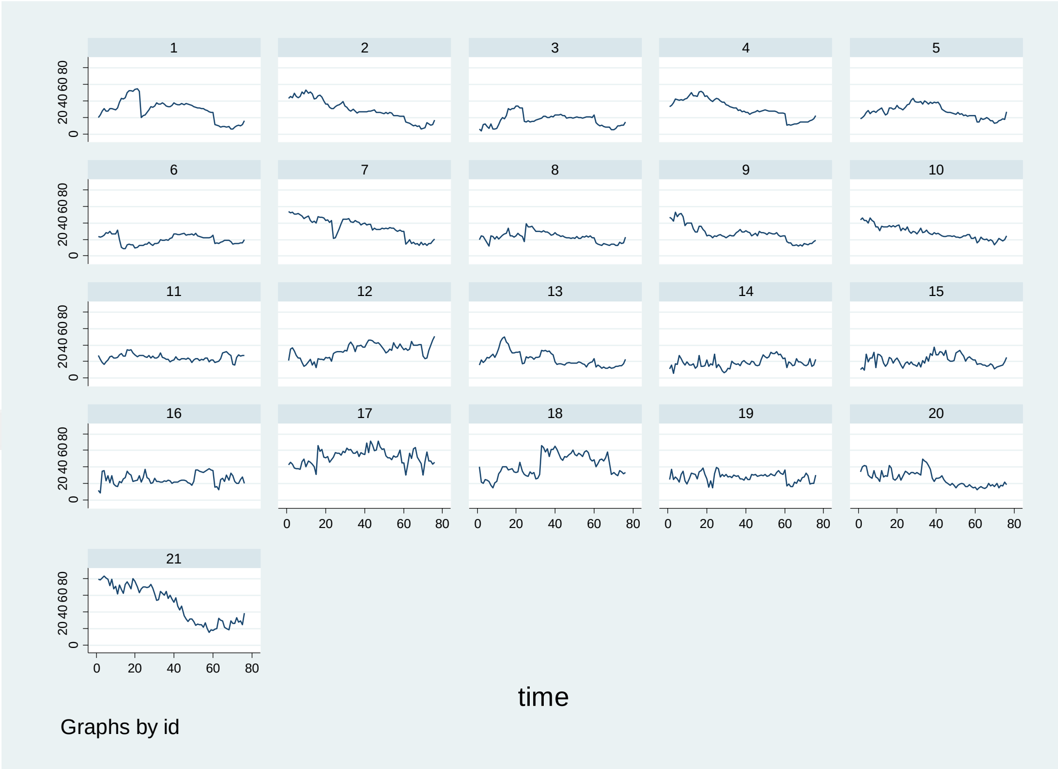
```
. estat sargan
Sargan test of overidentifying restrictions
        H0: overidentifying restrictions are valid

        chi2(1417)    =  1308.184
        Prob > chi2   =    0.9815
```

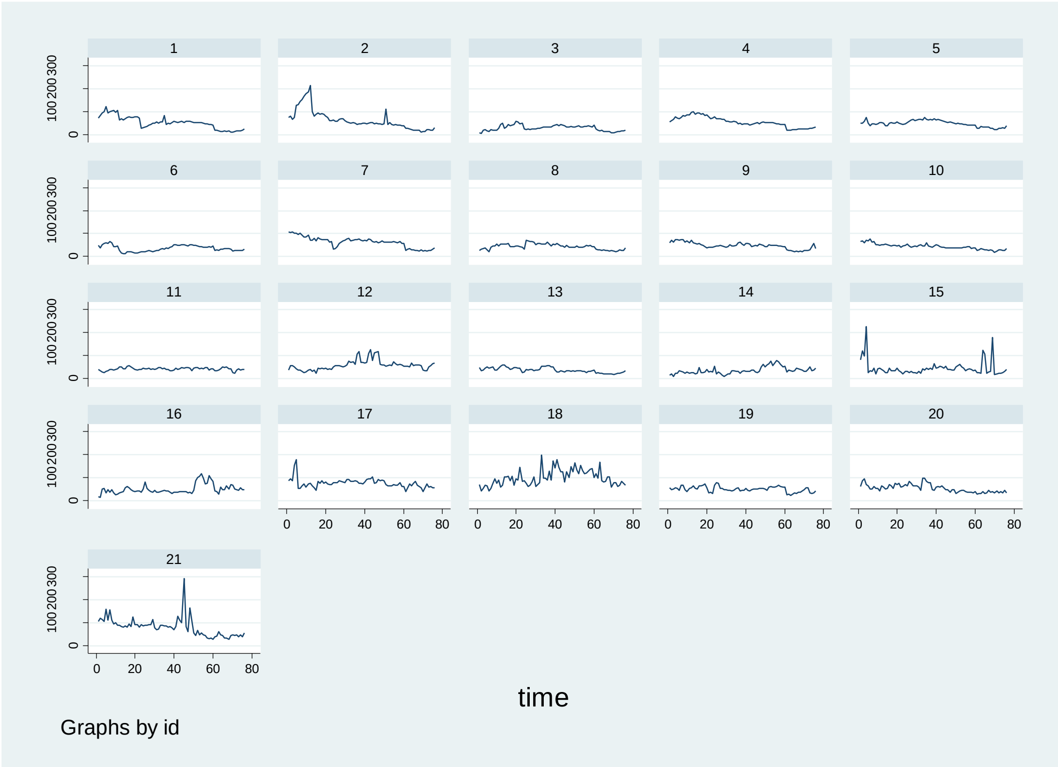
```
. xtdpdsys lasl eta roe oeta, lag(1)noconstant

System dynamic panel-data estimation           Number of obs     =      1,575
Group variable: id                             Number of groups  =         21
Time variable: number
                                               Obs per group:
                                                             min =         75
                                                             avg =         75
                                                             max =         75

Number of instruments =   1.4e+03              Wald chi2(4)      =    2713.46
                                               Prob > chi2       =     0.0000
One-step results
```

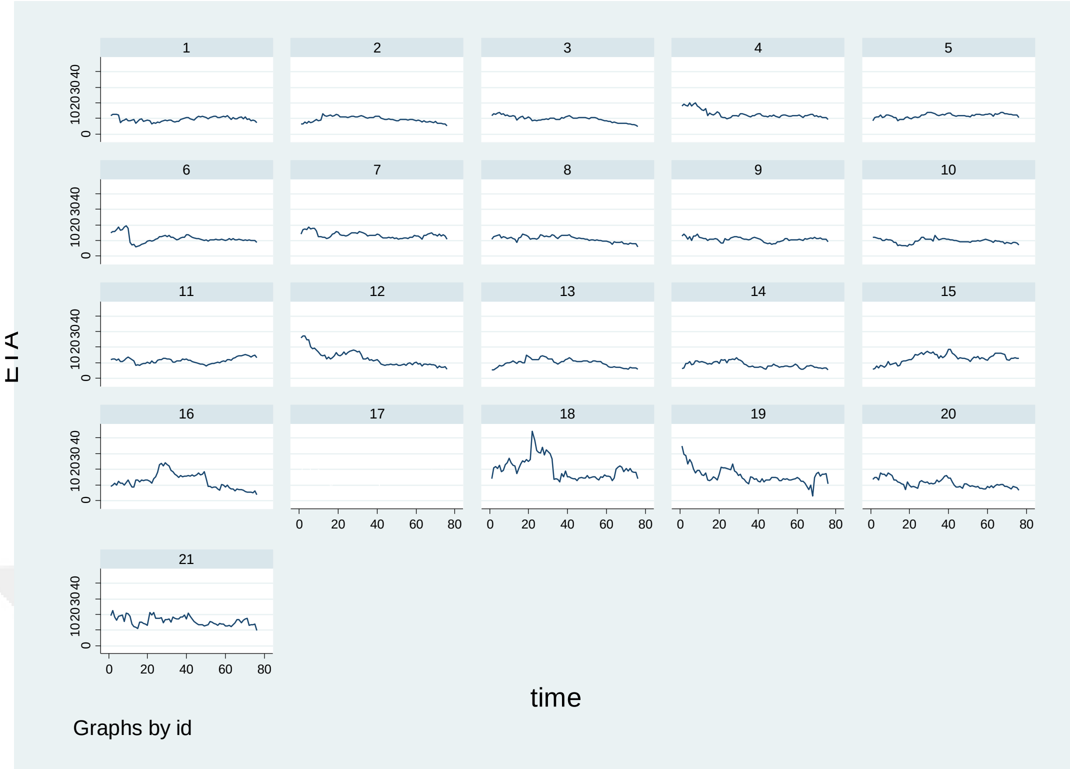
lasl	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lasl						
L1.	.6349671	.0161142	39.40	0.000	.6033838	.6665504
eta	.6124351	.1159476	5.28	0.000	.385182	.8396881
roe	.1098644	.0407556	2.70	0.007	.029985	.1897438
oeta	.490601	.1173173	4.18	0.000	.2606633	.7205387

```
Instruments for differenced equation
        GMM-type: L(2/.).lasl
        Standard: D.eta D.roe D.oeta
Instruments for level equation
        GMM-type: LD.lasl

. estat sargan
Sargan test of overidentifying restrictions
        H0: overidentifying restrictions are valid

        chi2(1417)    =  1502.208
        Prob > chi2   =    0.0568

.
```

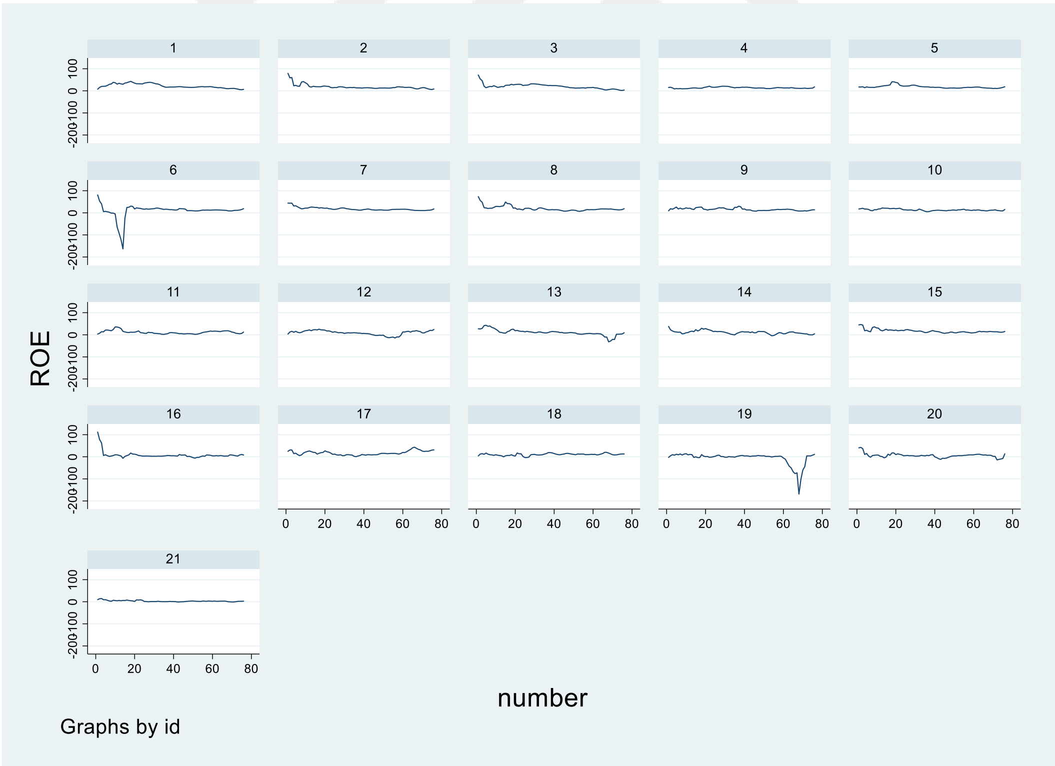
APPENDIX II: Variables Trend by Commercial Banks



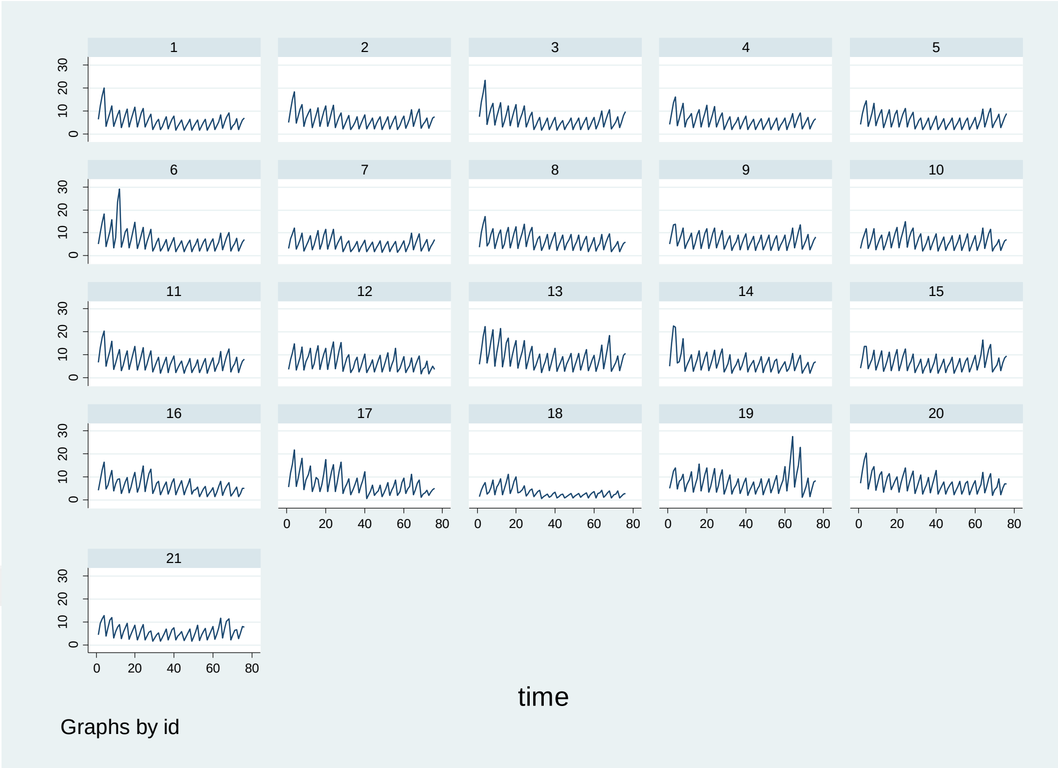




ETA
time
Graphs by id



ROE
number
Graphs by id


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
0 10 20 30
0 20 40 60 80
time
Graphs by id

Variable Name	Information Criteria		
	AIC		AIC
lata (constant)	0.29	0.24	0.29
lasl (constant)	0.38	0.24	0.33
lad (constant)	0.24	0.14	0.24
lqdty (constant)	0.29	0.19	0.19
niita (constant)	0.76	0.33	0.48
roa (constant)	0.52	0.43	0.43
oeoi (constant)	0.24	0.10	0.10
oeta (constant)	0.81	0.29	0.57
weight (constant)	0.33	0.19	0.29
car (constant)	0.19	0.14	0.19
lngdp (constant + trend)	0.00	0.00	0.00
lncpi (constant + trend)	0.00	0.00	0.00
comlir (constant)	1.00	1.00	1.00
eta (constant)	0.33	0.05	0.19
Roe (constant)	0.52	0.38	0.48

Variable Name	Breusch ve Pagan LM adj* t Statistics	Swammy's t Statistic	Panel Unit Root Test
lata (constant)	139.8***	150.05***	Pesaran's CADF Test
lasl (constant)	53.03***	162.76***	Pesaran's CADF Test
lad (constant)	125.00***	98.48***	Pesaran's CADF Test
lqdty (constant)	76.30***	141.48***	Pesaran's CADF Test
niita (constant)	1763.00***	622.76***	Pesaran's CADF Test
roa (constant)	236.20***	210.36***	Pesaran's CADF Test
oeoi (constant)	154.70***	140.09***	Pesaran's CADF Test
oeta (constant)	2744.00***	201.96***	Pesaran's CADF Test
weight (constant)	56.91***	122.97***	Pesaran's CADF Test
car (constant)	217.20***	86.19**	Pesaran's CADF Test
lngdp (constant + trend)	3640.00***	0.00	Robust Breitung
lncpi (constant + trend)	3640.00***	0.00	Robust Breitung
comlir (constant)	3565.00***	0.00	Robust Breitung
eta (constant)	320.60***	96.29***	Pesaran's CADF Test
roe (constant)	207.8***	220.42***	Pesaran's CADF Test