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# **LIQUIDITY AND BANK PERFORMANCE OF ETHIOPIAN BANKING INDUSTRY**

**By: Desalegn Tekle**

**A thesis submitted to the Department of Accounting and Finance of Addis Ababa University in partial fulfillment of the requirements for the award of the Degree of Masters of Science in Accounting and Finance**

**March 2020**

# **Liquidity and Bank Performance of Ethiopian Banking Industry**

**By: Desalegn Tekle**

**ID. No. –GSE/0573/06**

**Advisor: Habtamu Berhanu (PhD)**

**A thesis submitted to the Department of Accounting and Finance of Addis Ababa  
University in partial fulfillment of the requirements for the award of the Degree of  
Masters of Science in Accounting and Finance**

### Declaration

I, the undersigned declare that this thesis entitled "Liquidity and Bank Performance of Ethiopian Banking Industry" is my original work. All sources of materials used for the thesis had been duly acknowledged and referenced. Besides, the study as a whole or any part of it has not been submitted to a university or College for the Award of a Diploma.

Name: Desalegn Tekle Berhe

Signature: Desalegn

Date: 01 July 2020

Place: Addis Ababa University

### Certification

This is to certify that Desalegn Tekle Berhe has done a study on the topic "Liquidity and Bank Performance of Ethiopian Banking Industry". This study is of his original work and all the sources of materials used for the thesis had been duly acknowledged

Advisor's Name: Dr. Habtamu Berhanu

Signature: Jusub

Date: 01-07-20

Place: Addis Ababa University

Addis Ababa University  
College of Business and Economics  
Department of Accounting & Finance

Liquidity and Bank Performance of Ethiopian Banking Industry

By: Desalegn Tekle

Approved by Board of Examiners

Habtamu B.

Adviser

JTB

Signature

01-07-20

Date

Abisaw Rame

Internal Examiner

[Signature]

Signature

30-09-2020

Date

Lemessa Bayissa (PhD)

External Examiner

[Signature]

Signature

30-09-20

Date

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### List of acronyms

<b>ARDL</b>	Autoregressive Distributed Lag
<b>BCBS</b>	Basel Committee on Banking Supervision
<b>CUMSUM</b>	Cumulative Sum of Recursive Residuals
<b>CUMSUMQ</b>	Cumulative Sum of Squares of Recursive Residuals
<b>FLR</b>	Funding Liquidity Risk
<b>IMF</b>	International Monetary Fund
<b>MLR</b>	Market Liquidity Risk
<b>NBE</b>	National Bank of Ethiopia
<b>NIM</b>	Net Interest Margin
<b>OLS</b>	Ordinary Least Square
<b>RR</b>	Reserve Ratio

### **Abstract**

*Healthy and profitable banks can contribute immensely to the development of financial sector in particular and the country's development in general. The study employed autoregressive distributed lag (ARDL) to examine the relationship and behavior of liquidity and profitability of the commercial banking industry in Ethiopia. Quarterly consolidated financial statements that cover the period 1998 Q3- 2017 Q4 were used for this study. Augmented Dickey Fuller (ADF) was used to test for unit root. In attempt to draw valid conclusion, diagnostic tests were carried out for serial correlation, heteroscedasticity, and normality. In order to check the stability of long-run coefficients that form the error-correction term in combination with short-run dynamics, cumulative sum of recursive residuals test (CUSUM) and the cumulative sum of squares of recursive residuals test (CUSUMQ) is applied to the residuals of the models. The estimation result of the error correction model shows that the speed of adjustment of liquidity and profitability to long run equilibrium is faster in the commercial banking industry of Ethiopia. The results of ARDL estimation shows that Funding Liquidity Risk, over all Liquidity Position (i.e. Ratio of Liquid Assets to Total Deposit), Bank size measured as a Natural logarithm of total asset are key determinants of the Net Interest Margin both in the short and long term.*

**Keywords:** *ARDL, Liquidity, NIM, Profitability. Granger causality, Error correction model, Commercial banking industry*

## CHAPTER ONE

### INTRODUCTION

This thesis empirically examines the impact of liquidity risks (Market Liquidity Risk, Funding Liquidity risk, Overall Liquidity position, Reserve ratio, and Bank Size) on the Performance measured by the Net interest margin of commercial banking industry in Ethiopia both in the short and long run. The causalities between the liquidity proxies and the Net Interest Margin are also analyzed. This chapter is organized in eight sections. Background information on the thesis and statement of the problem are dealt with in the first and second section. Objective of the study and Research questions and hypothesis are presented in the third and fourth sections respectively. Benefit of the study is described in the fifth section. Scope and limitations of the study are discussed in the sixth and seventh sections. Organization of the Thesis is presented.

#### 1.1 Background of the Study

Over the past six decades, since Markowitz's influential paper on portfolio selection, most financial theories and models assumed markets were frictionless (Godfray Marozva, 2015). Thus in traditional asset pricing models, liquidity plays no roll at all because it is assumed away. The moment these conventions are relaxed, the world changes, though not in an expected way.

The vast literature on liquidity and asset pricing argues that liquidity is indeed priced and contains both theoretical models and empirical findings detailed how an asset's liquidity affects expected returns (Adler 2012).

During the 2008 global financial crisis several banks experienced liquidity problems because they failed to manage liquidity in a prudent manner. Thus, this financial crisis gave lesson to financial institutions to give more stress for the importance of liquidity to the proper functioning of financial markets and the banking sector (Luc Laeven 2012; Godfray Marozva, 2015).

Before the financial crisis, financial intermediaries were stable as funding was readily available and at low cost. According to him, the rapid reversal in market conditions illustrated how quickly liquidity can evaporate, and that illiquidity can reserve already earned profits as financial

institutions are either forced to sell assets well below their market value or borrow at interest rates charges above their weighted return on assets (Godfray Marozva, 2015).

The term liquidity risk includes two types of risk: funding liquidity risk and market liquidity risk. Funding liquidity risk is the risk that the bank will not be able to meet efficiently both expected and unexpected current and future cash flow and collateral needs without affecting either daily operations or the financial condition of the firm. Market liquidity risk is the risk that a bank cannot easily offset or eliminate a position at the market price because of inadequate market depth or market disruption (Vodová, P., 2011).

According to Vodová (2011), there are strong interactions between funding liquidity risk and market liquidity risk, especially in periods of crisis. He pointed to the fact that shock to funding liquidity can lead to asset sales and may lead to decrease of asset prices. Lower market liquidity leads to higher margin which increase funding liquidity risk. He adds and explains that the same fact with two liquidity spirals which work together: loss spiral and margin spiral.

According to Godfray Marozva (2015), though insufficient liquidity is one of the major reasons for bank failures, holding liquid assets has an opportunity cost of higher returns. To the opposite, Bourke (1989) finds a positive significant link between bank liquidity and profitability. However, in times of instability banks may choose to increase their cash holding to mitigate risk. Unlike Bourke (1989), Molyneux and Thornton (1992) came to a conclusion that there is a negative correlation between liquidity and profitability levels.

There is a lot of literature that leads to the point that liquidity crunch was the main cause of the 2009/10 global financial crisis yet very little is known about the nexus between bank performance and liquidity. Of the few studies that have looked at the bank liquidity and bank performance nexus most of them took a theoretical approach and the few studies that attempted to empirically test this phenomenon used net interest margin as the indicator for bank profitability (Marozva, 2015) and the linkage between net interest margin and liquidity is unsettled.

## 1.2 Statement of the problem

Banks, as the most important financial institutions, have a determinant role in circulating currency and wealth of the society and enjoy a special position in financial system. Therefore, the desired and effective performance of banks can create important effects on the development of different economic sectors and increase in the quantitative levels of the output.

Empirical studies have been made on the determinants of liquidity and profitability of commercial banks in Ethiopia (Abebaw and Deepack, 2011; Tseganesh, 2012; Berhanu, 2012; Birhanu, 2012; Habtamu, 2012; Tesfaye, 2014; Sori, 2014; Belete, 2015; Daniel, 2015; Samuel, 2015; Belay, 2016). The methodology and the type of data used in these studies have similarities and differences. A Multiple regression was the methodology employed on the annual panel data in these studies. The variables used and findings of these studies are not all the same. These studies did not split the short and long term relationship between determinants of liquidity and profitability.

Moreover, for a Study of Ethiopian banking, liquidity is taken as one variable of the profitability measured as return on Asset and Return on Equity along with the bank specific determinant factors (i.e. Capital adequacy, Bank Size, Operating Expense Management, Ratio of Non-performing loans, inflation, Interest rate, Loan growth, Real GDP, operating expense management (Operating expense/Total Assets) etc.).

In the Banking Industry, Interest rate margin also interacts with the other significant source of bank profitability - fee income. Lepetit et al. (2008) find that higher income share from commissions and fees is associated with lower margins and loan spreads. The higher the commission and fee income share, moreover, the weaker the link between interest spreads and loan risk.

As liquidity problems of some banks during global financial crisis re-emphasized, liquidity is very important for functioning of financial markets and the banking sector. While it is generally agreed that there is a negative relationship between liquidity and bank profitability there is counter evidence which shows the need to consider the tradeoff between resilience to liquidity shocks and cost of holding less profitable liquid assets as the latter is assumed to impact on the

bank's ability to take advantage of opportunities arising in the market which may result in increase in revenue, capital or ability to extend capital credit (Bordeleau and Graham, 2010).

This study focused on one of the most important fundamental indicators for the analysis of bank operations - the net interest margin (NIM), that is the ratio of net interest income to the average earning assets (interest earning assets) or net interest profitability. This indicator is less frequently encountered in reports and statistics compared to returns on assets (ROA) or returns on equity (ROE). However, it does succinctly summarize the effectiveness of banks' interest bearing assets. The larger the net interest margin, the more successfully does the bank manage its' interest bearing assets.

Ethiopian banks are short of liquid assets; So, are Ethiopian banks obtaining the appropriate net interest margin for the liquidity risks they are in is another additional point to review. It also helps to understand the direction of causality between liquidity variables and the net interest margin. It also appears that the issue of what determines the liquidity and profitability of commercial banks in Ethiopia is yet to be settled. Using quarterly data has advantages in terms of showing for intra-year dynamics and providing larger sample size (IMF, 2013).

In this study, therefore, the researcher is interested to explicitly and empirically examine, whether the major measures of liquidity (such as Market Liquidity Risk, Funding Liquidity Risk, over all Liquidity Position), the Reserve ratio and Bank Size has significant impact on NIM. Along with the liquidity measures the Bank size factor is used as control variables. It also shows that net interest margin is an important analytical indicator, which complements returns on assets as a useful signal of vulnerability.

### **1.3 Objectives of the study**

#### **1.3.1 General objective of the study**

The main objective of this study was to empirically examine bank specific determinants of liquidity and profitability in the long run and as well as understanding the causalities between liquidity and performance in the commercial banking industry of Ethiopia.

### **1.3.2 Specific objective of the study**

The specific objectives of this study are as follows:

- a) To investigate the effects of Market liquidity on bank performance of Ethiopian Banks.
- b) To investigate the effects of funding liquidity on bank performance of Ethiopian Banks.
- c) To assess the effects of overall liquidity position on the performance Ethiopian Banks.
- d) To assess the effects of the Reserve held with National Bank of Ethiopia on the performance of Ethiopian Banks.
- e) To assess the effects of the Bank Size on the performance of Banks in Ethiopia.
- f) To examine the causalities between liquidity and profitability in the commercial banking industry of Ethiopia

### **1.4 Research Question and Hypothesis of the study**

Research Question:

The study attempted to provide empirical answers to the following research question:

1. Does the Banks liquidity position affect the Net Interest Margin of Ethiopian Banks?
2. Does the Central Bank reserve requirement affect the Net Interest Margin of Ethiopian Banks?
3. Does the Banks' Size affect the Net Interest Margin of Ethiopian Banks?

#### **1.4.1 Research Hypothesis:**

Most of the empirical evidences on the relationship between the liquidity and profitability on one hand, and, and between the solvency and profitability on the other hand come from studies of the determinants of corporate liquidity ratio (to measure liquidity) and debt ratios (to measure solvency) and profitability ratios (to measure profitability).

Study of (Bordeleau and Graham, 2010) analyzed the impact of liquid assets holding on bank profitability for a sample of large U.S. and Canadian banks, the result suggested that profitability is improved for banks that hold some liquid assets, whereas the study (Lamberg and Valming, 2009) evaluated and compared the use and extent of the liquid practices and measured if the changing of liquidity strategy is related to the profitability.

These, study developed the following hypothesis to address the research questions

*H1:* Marketliquidity risk of Ethiopian Banksnegatively affects their performance both in the short and long term and it is significant.

*H2:* Funding Liquidity Risk of Ethiopian Banks positively and significantly affects their performanceboth in the short and long term.

*H3:* Overall liquidity position of the Ethiopian Banks affects their performance significantlyboth in the short and long term andthe sign of the relationship is negative.

*H4:* Reserve held by the National Bank of Ethiopia significantlyaffects the performance of Ethiopian Banksboth in the short and long term andwith a negative sign of relationship.

*H5:* Size of the Banks affects the performance of Ethiopian banking industry significantly and positively both in the short and long term.

*H6:* Liquiditygranger causesprofitabilityin thecommercial bankingindustryofEthiopia andvice versa.

### **1.5 Significance of the Study**

Both liquidity and performance are critical for commercial banks to survive and thrive in the finance industry. The research is aimed at examining the long run relationship of liquidity and performance in the commercial banking industry of Ethiopia. The beneficiaries of this study will most likely be banks in Ethiopia, policy makers, regulators like NBE, institutional investors and others.

Ethiopian Banks will benefit from the study by determining and practicing how the effects of each liquidity measures impact their profitability. The study will help those banks to know whether the

banks' interest bearing assets are used optimally. Beside monetary tools, such as reserve requirement, Policy makers and regulators like NBE will most likely know the effects of the reserve requirement. Moreover, institutional and other investors like individual shareholders can identify whether their investment in bank is bringing the appropriate level of earnings based on the risks taken by their agents.

### **1.6 Scope of the study**

The scope of this study is limited to the long run relationship of liquidity and Bank performance. For this study, Liquidity is measured via four variables (Funding Liquidity, Market Liquidity, Overall liquidity position, and Reserve requirement to Deposit ratio) and the Bank Size is used as a controlling variable of the commercial Banking sector of Ethiopia, it covers the period starting from third quarter of 1998 up to fourth quarter of 2017 due to availability of data. Using quarterly data has advantages in terms of showing for intra-year dynamics and providing larger sample size (IMF, 2013).

### **1.7 Limitations of the study**

In this study, Industry specific, monetary policy measures and other economic factors that may affect the liquidity of Banks were not included. For the purpose to be served, secondary data and relative ratio measures are used. No Interviews to Ethiopian Bank officials were made. The quarterly financial reports, which are provided to the National bank of Ethiopia, are not audited, while audited annually at end of financial year, June 30. In order to validate the findings of the study, I checked whether the sum of the quarterly data gives the annual data which is audited.

### **1.8 Organization of the thesis**

The organization of the rest of the thesis contains five chapters. Chapter two reviews literature on liquidity and profitability of banks. Methodology and design of the research is presented in Chapter three. Chapter four presents Data presentation, analysis and discussion of results. Finally, Summary of major findings, conclusion and recommendation is presented in Chapter five.

## CHAPTER TWO

### THEORETICAL REVIEW OF LITERATURE

The literature covers conceptual framework and brief assessment of what other authors have documented on the subject of research. In addition, arguments are built on the theoretical literature of bank liquidity and profitability. Moreover, empirical studies relevant to the objectives of the study are incorporated

#### 2.1. Concepts and Definitions

##### 2.1.1 Liquidity

Liquidity is the ability of bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses (BIS, 2008). Liquidity risk arises from the fundamental role of banks in the maturity transformation of short term deposits into long term loans. It includes two types of risk: funding liquidity risk and market liquidity risk. Funding liquidity risk is the risk that the bank will not be able to meet efficiently both expected and unexpected current and future cash flow and collateral needs without affecting either daily operations or the financial condition of the firm Pavla Vodová (2013).

##### 2.1.2 Bank Liquidity management

A bank's assets and liabilities play a central role in their harmonizing of liquidity risk and creation. A bank's liabilities include all the banks sources of funds within a given period of time. Deposit accounts, borrowed funds, and long term funds are Banks' three main sources of funds. The amounts and sources of funds clearly affect how much liquidity risk a bank can entertain and how much liquidity it can create. The easier a bank can access funds the less risk it has and the higher amount of funds it holds the more liquidity it can create, if willing to do so. Deposit accounts are made up of transaction deposits, also known as demand deposits, savings deposits, time deposits, and moneymarket deposit accounts. The longer term sources of funds for banks are bonds that banks issue and bank capital (Madura, 2013).

There are many factors that affect banks own liquidity and in turn affect the amount liquidity they can create. These factors have a varying in degree of influence on the balance between liquidity risk and liquidity creation, or a bank's liquidity management (Brendan, 2010).

The balancing act for banks between liquidity risk and creation can also be a strategic decision instead of one solely to meet demands and prevent the bank from failing (Acharya et al., 2009).

Therefore, in crisis periods banks holding more liquidity will be able to both grow in new business and take over business of other banks by buying their assets at low prices. By purchasing assets at fair sale prices banks that are the purchaser stand to make a great deal of profit (Acharya et al., 2009). An example of this can be found in the book *Citibank, 1812- 1970*. The authors explain how National City Bank used this high liquidity strategy prior to both the crises of 1893 and 1907. This strategy led to significantly higher growth in new loans and in deposits (Cleveland & Huertas, 1985). This means that the bank was able to increase its role as a liquidity provider and keep its liquidity risk constant.

Liquidity Management relies on the daily assessment of the liquidity conditions in the banking system, so as to determine its liquidity needs and thus the volume of liquidity to allot or withdraw from the market. The liquidity needs of the banking system are usually defined by the sum of reserve requirements imposed on banks by a monetary authority (CBN, 2012).

### **2.1.3 The need for liquidity**

Liquidity was an instrumental factor during the recent financial crisis. As uncertainty led funding sources to evaporate, many banks quickly found themselves short on cash to cover their obligations as they came due. In extreme cases, banks in some countries failed or were forced into mergers. As a result, in the interest of broader financial stability, substantial amounts of liquidity were provided by authorities in many countries, including Canada and the United States (Longworth 2010; Bernanke 2008).

In the aftermath of the crisis, there is a general sense that banks had not fully appreciated the importance of liquidity risk managerial sense that banks have not fully appreciated the importance of liquidity risk management and the implications of such risk for the bank itself, as wider financial system. As such, policymakers have suggested that banks should hold more liquid

assets than in the past, to help self-insure against potential liquidity or funding difficulties. This has led to an international desire for common measures and standards for liquidity risk, culminating in ongoing work by the Basel Committee on Banking Supervision (BCBS, 2010)

According to Anyanwu (1993), liquidity simply means the ability to convert an asset to cash with minimum delay and minimum loss/cost. Banks largely operate with the funds borrowed from depositors in form of demand and time deposits; as such liquidity assets play a vital role. These liquidity assets are the essential balance sheet items which have the capacity to maintain the confidence of depositors which is the most valuable intangible asset of the commercial banking business (Spindt, 1980).

In banking industry, liquidity risk has an opposite effect on profitability. Some studies such as Molyneux & Thornton (1992) and Chatterji (2015) supported the positive effect of risk on the profitability; wholesome studies such as Bourke (1989) and Kosmidou et al. (2007) believed in its negative effect. Liquidity risk is usually measured as liquidity ratio which is practically calculated in two different forms. In first type, liquidity is adjusted by size which includes the ratio of cash asset to total asset Bonfinet et al. (2012) and Horvath et al. (2012), the ratio of cash asset to deposits (savings) Curak et al. (2012). Second type includes the adjusted loan by the size which includes the ratio of total asset and/or the ratio of net loan to total asset (Kosmidou et al., 2008).

## **2.2 Types of Liquidity**

Funding liquidity risk, market liquidity risk and central bank liquidity risk are three types of liquidity risk. Funding liquidity risk refers to the possibility that the bank will not be able to discharge its current and future obligations as and when required due to lack of access to funding. Market liquidity risk refers to failure to buy or sell assets without change in price. Central bank liquidity risk refers to failure of the central bank to provide liquidity required for the financial system (Nikolaou, 2009).

Distinction between funding liquidity risk and market liquidity is getting blurred owing to a holistic approach followed by the financial institutions to manage the two sides of the balance sheet according to Crockett (2008).

## **2.3 Theories of Liquidity Management**

There are different theories of liquidity management; these include Anticipated Income Theory, Shiftability theory, Liability Management theory, and Commercial Loan Theory (Emanuel, 1997; Ali 2015).

### **2.3.1 Anticipated Income Theory**

Anticipated income theory of liquidity management holds that the bank plans repayment of loans from projected income of the borrower. In this theory the basis for loan granting is Collateral and expected income of the borrower (Alshatti S., 2014, P 63). For the purpose, the anticipated income theory is preferred.

## **2.4 Review of Empirical Studies and Conceptual Framework**

Gaps, anomalies, disagreements, and contradictions are identified in the methodologies; and empirical findings are identified in this chapter. This chapter also discusses as to how the theoretical determinants and the variables chosen are linked in this study and the measures of the identified variables are also defined. The reasons why the explanatory variables are chosen as well as the major empirical findings of previous studies are also discussed. Conceptual framework of the study is also presented in here.

After summarizing the preceding studies, Market liquidity risk, Funding liquidity risk and Overall Bank liquidity position were selected and included as bank specific major liquidity explanatory variables of the commercial Banks Liquidity position. In the foregoing Ethiopian Banking studies, often the Return on Asset and rarely the Return in Equity is used as a measure of Profit. However, Interest rate margin also interacts with the other significant source of bank profitability - fee income. For this reason reserve balance of banks held with the Ethiopian National Bank of Ethiopia and Bank size (as a control variable) are included to reduce spurious results due to minimum number variables.

Lepetit et al. (2008) find that higher income share from commissions and fees is associated with lower margins and loan spreads. The higher the commission and fee income share, moreover, the weaker the link between interests spreads and loan risk and vice versa. Therefore, The Net Interest Margin is selected as a measure of major Banking profitability.

#### **2.4.1 Review of Empirical Studies and Conceptual Framework**

Bank profitability is the ability of a bank to generate revenue in excess of cost, in relation to the bank's capital base. A sound and profitable banking sector is better able to withstand negative shocks and contribute to the stability of the financial system Athanasoglou et al. (2005).

The majority of studies on bank profitability, such as Vodová, P. (2011), Bourke (1989), Molyneux and Thornton (1992), Horvath et al. (2012) and Goddard et al. (2004), used linear models to estimate the impact of various factors that may be important in explaining profits. Bank profitability is usually expressed as a function of internal and external factors. The internal determinants of bank profitability are also known as micro or bank-specific determinants. These can be broadly classified into two-financial statement variables and non-financial statements variables. The financial statement variables which determine bank profitability are: expense management, loan composition and bank credit, composition of bank deposits, market interest rates, bank earning and operating efficiency, changes in capital and liquidity management. The non-financial statement variables which determine bank profitability include number of bank branches, bank size and bank location. The external determinants are variables that are not related to bank management but reflect the economic and legal environment that affect the operation and performance of financial institutions (Athanasoglou et al., 2005). These factors include: financial regulation, concentration, competitive condition, market share, market growth and ownership type.

There have been many researches on the determinants of bank profitability and almost all find liquidity to be one of the determinants of bank profitability. Examples include Bourke, (1989), Bunda et al. (2008), Saunders and Schumacher (2000), Perera (2013), Loutschina (2011), Adler (2012), Naceur (2003), Maudos and Guevara (2004), Williams (2016), and Fabozzi et al. (2014)

Meanwhile, there have been varying reports on the relationship between bank liquidity and profitability. Some argue, per their research findings, that banks holding more liquid assets benefit from a superior perception in funding markets, reducing their financing costs and increasing profitability. For example, Bourke (1989), finds some evidence of a positive relationship between liquid assets and bank profitability for 90 banks in Europe, North America and Australia from 1972-1981. On the other hand, other researchers argue that, holding liquid assets imposes an

opportunity cost on the bank given their low return relative to other assets, there by having a negative effect on profitability. For example, Molyneux and Thornton (1992) and Goddard et al. (2004) find evidence of a negative relationship between the two variables for European banks in the late 1980s and mid-1990s, respectively. According to Loutskina (2011), the fewer the funds tied up in liquid investments, the higher we might expect profitability to be. In effect, various authors have found varying relationships between the liquidity and profitability of banks in various countries.

Sufian (2011) examined the determinants of profitability of Korean banking sector, in which bank- specific and macroeconomic determinants were evaluated. By employing unbalanced bank level panel data, the period considered was 1992-2003. The empirical results revealed that liquidity level, significantly affect banks' profitability, similar results were noted for diversification, credit risk, business cycle, and industry concentration variables. These results concurred with Eljelli (2012) who concluded that adequate level of liquidity is positively related with bank profitability and contradicted a study by Ongors and Kusa (2013) which reported insignificant relationship between liquidity and bank profitability.

Al Nimer et al. (2013) explained the relationship between liquidity and quick ratio; and profitability and return on Assets. The result suggested that with liquidity firms are able to make more profits. However, the associated opportunity with the maintenance of liquidity might affect the overall profitability of the firm.

Munther et al. (2013), while conducting a study on trade-off between liquidity and profitability using correlation analysis and descriptive statistics. The study covers 31 manufacturing firm out of 39 listed in the Colombo stock exchange (CSE). They find that, there is no significant relationship between liquidity and profitability and concluded that manufacturing firms should concentrate on maximizing profit while preserving liquidity. Therefore, in their framework manufacturing firms should maintain some degree of liquidity so that profit would be maximized.

Agbada and Osuji (2013), while conducting a study on the efficacy on liquidity management and banking performance which is evident of the fact that, there is significant relationship between efficient liquidity management and banking performance and that efficient liquidity enhance the soundness of banks. The method of data employed that survey design accomplished through the

administration of structured questionnaires. Data obtained were first presented in table of percentages and pie charts and were empirically analyzed by Pearson product moment correlations coefficient( $r$ ). The targeted population senior, middle and lower executive categories of 20 randomly selected banks. They concluded the needs for efficient liquidity management in the banking industry cannot be overemphasized particularly for reasons of maximizing profits level and concurrently remaining liquid. However, gaining more of one ordinarily concedes some of the other.

Lartey et al. (2013) sought to find out the relationship between the liquidity and the profitability of banks listed on the Ghana Stock Exchange. The study sought to describe the relationship between the liquidity and the profitability of banks listed on the Ghana Stock Exchange using a target population of 9 commercial banks listed on the Ghana Stock Exchange and a sample of 7 banks. Purposive sampling technique was used. In conclusion, both the liquidity and the profitability levels of the listed banks were decreasing with in the period 2005-2010. There was a very weak positive relationship between the liquidity and the profitability of the listed banks. These findings support Munther et al. (2013) in the case of Jordanian banks.

Ibe (2013) studies the impact of liquidity management on the profitability of banks in Nigeria over the period 1995-2010. The results show that liquidity management indeed a crucial problem in the banking industry. Competence and qualified personnel should be engaged to ensure optimum level of liquidity and still maximize profit.

Bordeleau and Graham (2010) determine the impact of liquid assets holding on bank profitability for a panel of Canadian and U.S Banks over the period of 13 years 1997-2009. Econometric framework is presented in the study. Result suggested that profitability is improved for banks that hold some liquid assets; however, there is a point at which holding further liquid assets diminishes bank's profitability all else equal. More over empirical evidence also suggest that this relationship varies depending on a bank's business model and the state of the economy. Therefore, firms should maintain a balance between liquidity and profitability in its day to day operation.

Berger (1995) analyses the statistical relationships between bank earnings and capital for U.S banks over the period of 1983-1989 and finds that, contrary to what one might expect in situations

of perfect capital markets with symmetric information, according to Modigliani and Miller (1958), there is a positive relationship between capital and return on equity. This result, according to the author, is consistent with the “expected bankruptcy cost hypotheses.” More specifically, Berger’s results suggest that banks with higher levels of capital see their funding costs decrease to such an extent that it more than offsets the cost of issuing additional capital while Berger (1995) applies the concept of the “expected bankruptcy cost hypothesis” in the realm of capital, it is also conceptually applicable to the impact of liquid assets on profitability, whereby banks holding more liquid assets benefit from a superior perception in funding markets, reducing their financing costs and increasing profitability.

A paper by Morris and Shin (2010) develops a model where the total credit risk of a bank is decomposed into “insolvency risk” “the conditional probability of default due to deterioration of asset quality if there is no run by short term creditors” and “illiquidity risk” the probability of a default due to a run when the institution would otherwise have been solvent” The model provides a formula for “illiquidity risk” and the authors show that an increase in the liquidity ratio of a bank decreases the probability of an “illiquid” default.

Maaka et al. (2013), in their research to establish the relationship between liquidity risk and financial performance of commercial banks in Kenya. The study adopted correlation research design where data was retrieved from the balance sheets, income statements and notes of thirty-three (33) Kenyan banks during 2008-2012. Multiple regressions were employed to assess the impact of liquidity risk on banks’ profitability and the findings were that profitability of the commercial bank in Kenya is negatively affected due to increase in the liquidity gap and leverage. With a significant liquidity gap, the banks may have to borrow from the market even at a higher rate thereby push in up the cost of banks. The level of customer deposit was also found to positively affect the bank’s profitability and it will therefore be encouraged for banks to open more branches in the country.

Agbada and Osuji (2012) in the study of the efficacy of Liquidity management and Banking performance in Nigeria found that there is significant relationship between efficient liquidity management and banking performance and that efficient liquidity management enhances the soundness of bank.

In the study of the determinants of liquidity and their impact on financial performance in Nepalese commercial banks by Sushil and Bivab (2013), the results of regression analysis showed that capital adequacy, bank size, share of non-performing loans in the total volume of loans and liquidity premium paid by borrowers had negative and statistically significant impact on banks' liquidity. Growth rate of gross domestic product on the price level, short term interest rate and inflation rate had negative and statistically insignificant impact on banks' liquidity. And, loan growth rate had positive and statistically insignificant impact on banks' liquidity. Among the statistically significant factors affecting banks' liquidity capital adequacy, bank size and growth rate of gross domestic product on the price level had negative impact on financial performance whereas, liquidity premium paid by borrowers had positive impact on financial performance.

Therefore, the impact of bank liquidity on financial performance was non-linear. Results suggest that profitability is improved for banks that hold some liquid assets; however, there is a point at which holding further liquid assets shrinks banks' profitability, *ceteris paribus*.

Moreover, as per the above literature, empirical evidences also suggest that this relationship varies depending on a bank's business model and the state of the economy. These results are particularly relevant as policymakers devise new standards establishing an appropriate level of liquidity and management for banks. While it is generally agreed upon that banks undervalued liquidity prior to the 2008 financial crisis, one must also consider the trade-off between resilience to liquidity shocks and holding cost of lower-yielding liquid assets as the latter may impact banks' ability to generate revenues, increase capital and extend credit.

#### **2.4.2 Earlier studies on Ethiopian banking liquidity**

Worku (2006) argued that liquidity has an impact on the performance of commercial banks in Ethiopia and there was an inverse relation between deposit/net loan and ROE. And the coefficient of liquid asset to total asset was positive and directly related with ROE.

Semu (2010) conducted study using the Quantitative method particularly survey design approach with individuals working in both private and state owned banks in Ethiopia using self-administered questionnaire that was conducted to examine the possible factors that compel

the banks to reduce or restrict lending and it's the impact of reducing or restricting loan disbursement on the performance of banks in Ethiopia. The findings of the study showed that deposit and capital have statistically significant relationship with banks' performance measured in terms of return on equity (ROE). New loan and liquidity have relationship with banks' performance measured in terms of both return on asset (ROA) and ROE. However, the relationship was found to be statistically insignificant. Deposit and capital have no statistically significant relationship with banks' performance in terms of ROA. The study suggested that when banks face lending constraints, they have to use their funds like by purchasing treasury bills and bonds. Moreover, banks must develop noninterest generating services. Excess cash maintained by banks should be used by diversifying credit options and to avoid inefficiencies.

Amdemikael (2012) studied Factors Affecting Profitability on Ethiopian Banking Industry. This study examined the bank-specific, industry-specific and macro-economic factors affecting bank profitability for a total of eight commercial banks in Ethiopia, covering the period of 2000- 2011 using a mixed methods research approach by combining documentary analysis and in-depth interviews. The result of the interview revealed that the liquidity of banks was one of the major determinants of Ethiopian banks profitability. But, the output of the regression analysis and the interview were in agreement in relation to the direction of the effect of liquidity as far as both of them proved the existence of negative or inverse relationship between liquidity and profitability of Ethiopian banks. The study concluded that the impact of Ethiopian banks' liquidity on their performance remains ambiguous and further research is required.

The study conducted by Tseganesh (2012), to identify determinants of commercial banks liquidity in Ethiopia and then to see the impact of banks liquidity up on financial performance through the significant variables explaining liquidity for the data of eight commercial banks in the sample covered for the period 2000 to 2011, The impact of bank liquidity on financial performance was non-linear/positive and negative.

The study conducted by Belay (2016), empirically examined the impact of bank specific factors (capital adequacy, credit risk, management quality, profitability, loan growth, bank size, demand deposit growth, saving deposit growth and fixed deposit growth) on the liquidity as well as the impact of bank specific factors (capital adequacy, bank size, credit risk, non-interest income,

liquidity, and operating expenses management) on ROA. The impact of other bank specific variables such as liquidity, credit risk, capital adequacy, and bank size are not statistically significant to explain profitability.

#### **2.4.3 Summary and Knowledge gap**

With the growing of the banking institutions and the recent surge of Ethiopian banks liquidity failure it is justified that bank liquidity and profitability investigation shall be started from both scholars and industry specialists. While a very limited number of studies emerge to include more than one liquidity measures as an explanatory variable for bank profitability. Moreover, there is not much study of such kind of variables directly related to the current liquidity issues on Ethiopian Banks. To our knowledge, there is no existing empirical work directly focusing on the specific question considered in the current paper. However, we are able to draw on relevant concepts in some related literature dealing with relationship between liquidity and profitability of different sectors.

In line with the above theoretical as well as empirical review, banks profit can be affected by different factors such as bank specific, macroeconomic and regulatory factors; this study focused on the impact of bank liquidity on financial performance.

Unlike Empirical studies, Theory on bank liquidity is well documented. According to the review, most of the empirical studies done on the area of bank liquidity management and its shock on financial performance were done following the U.S. subprime mortgage crisis of the year 2008. Although liquidity tribulations of some banks during global financial crisis re-emphasized the fact that liquidity is very important for carrying out of financial markets and the banking sector, an important gap still exists in the empirical literature about optimum liquidity. Currently, only few studies designed to identify the impact of liquid assets on the financial performance. Studies cited above suggest that commercial banks performance factors (such as size of the bank, profitability, capital adequacy and factors describing risk position of the bank), macroeconomic factors (such as different types of interest rates and indicators of economic environment) as well as the central bank decisions (Marozva, 2015).

There are also very limited number of studies appears to include the overall and major liquidity measures as an explanatory variable for bank profitability. Rather they included only one measure of liquidity along with other factors. Although the researches made by Worku (2006), Semu (2010), Tseganesh (2012) and others focused on one variable of liquidity for ROA and ROE.

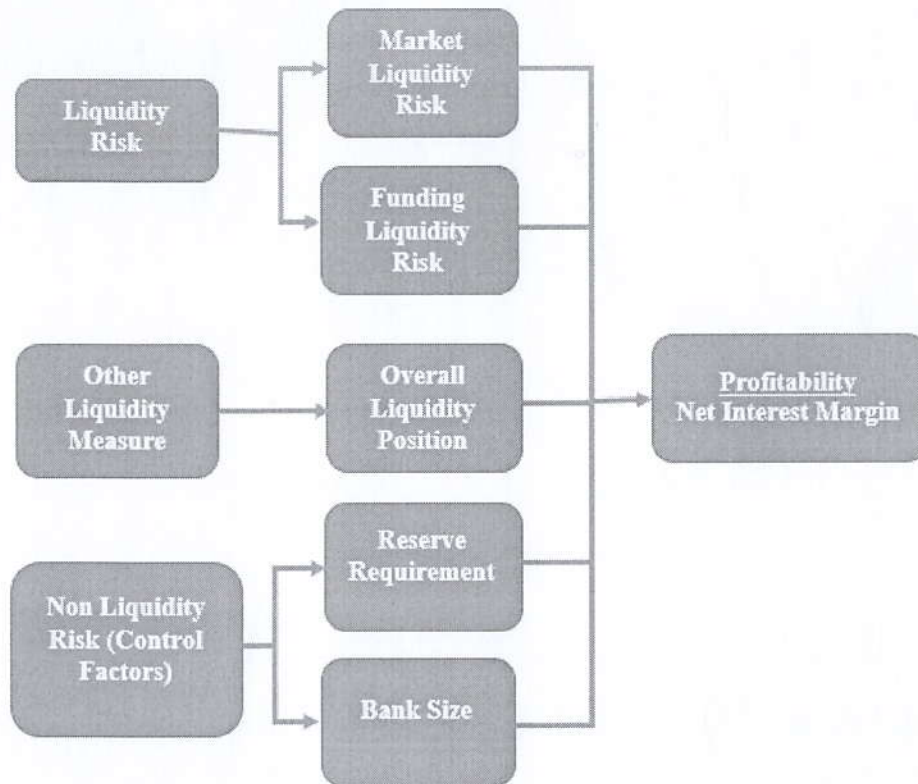
However, in this study the researcher used the three liquidity measures namely Market Liquidity risk, Funding Liquidity Risk, and the overall liquidity risk and the balance of the reserve recruitment and Bank Size (as a controlling variable)Vs Net Interest Margin (NIM). Using the NIM as a measure, benefits to analyze the contribution of these assets to the Interest Income.

To the Ethiopian banks, liquid asset position is a challenge, especially currently liquid assets and forex reserve shortage is among the challenges and this serious problem can greatly hamper the value maximization process of the banks.

#### **2.4.4 Conceptual framework**

The conceptual model below is developed based on previous research undertaken in order to show the effects liquidity and its determinants on profitability. Along with liquidity measures, The Balance of Reserve requirement by National Bank of Ethiopia and Bank size are used a control independent variables.

Figure 2.1 Conceptual framework



## CHAPTER THREE

### METHODOLOGY AND DESIGN

The underlying principles of the research methodology and design are presented in this chapter in order to choose the appropriate research methods for the study.

#### 3.1 Research design and approach

The main objective of this study was to empirically examine the relationships of bank liquidity measures and the net Interest margin both in the short run and long run and as well as understanding the causalities between these variables in the commercial banking industry of Ethiopia. The research design employed in this study is explanatory. Zikmund (2009) asserts explanatory studies look for explanations of the nature of certain relationships and helps to test hypothesis in order to provide an understanding of the relationship that exist between variables and draw inferences about the relationship and causality among variables. According to Crockett (2008), causes for phenomenon are explained in explanatory studies. Explanatory studies are not limited to observing and describing the circumstance as in the case of descriptive studies.

This study implemented a quantitative approach in order to comprehend the objective of the study and test the hypothesis using time series data.

#### 3.2 Data type and data source

This study uses secondary data that are quarterly consolidated financial statements for the banking industry. The data was obtained from National Bank of Ethiopia (NBE) for the period of third quarter of 1998 to fourth quarter of 2017. The stated time period is a bit longer and selected due to the availability of consolidated data and to make the inference of the long run relationship as reasonable as possible.

#### 3.3 Data analysis techniques

As mentioned earlier, this study uses autoregressive distributed lag (ARDL) approach in order to examine the relationship and behavior of liquidity proxies and performance as measured by net

interest margin in the commercial banking industry of Ethiopia. Eviews9 software tools are used for the statistical analysis.

### **3.4 Autoregressive distributed lag modeling approach**

The autoregressive distributed lag model (ADL) is the major workhorse in dynamic single-equation regressions. One particularly attractive parameterization is the error-correction model (EC). Its popularity in applied time series econometrics has even increased; since it turned out for nonstationary variables that cointegration is equivalent to an error-correction mechanism (Engle and Granger, 1987). According to Engle and Granger (1987), by differencing and forming a linear combination of the nonstationary data, all variables are transformed equivalently into an EC model with stationary series only.

Working on feedback control mechanisms for stabilization policy, Phillips (1954) introduced EC models to economics. Sargan (1964) used them to estimate structural equations with autocorrelated residuals, and Hendry popularized their use in econometrics in a series of papers.

According to Monteanu (2012), the error correction formulation provides an excellent framework within which it is possible to apply both the data information and the information available from economic theory". A survey on specification, estimation and testing of EC models is given by Alogoskoufis and Smith (1991). The present paper contributes to this literature in that it treats some aspects of testing cointegration and asymptotic normal inference of the cointegrating vector estimated from an EC format.

Fabozzi et al. (2014) affirm that variables that are specified in the level or non-stationary form are likely to give spurious results, in order to deal with this problem stationary or differenced variables are required. Test for the existence of long-run relationships is required as in the process of using differenced variables. Eagle-Granger (1987) test, Johnson maximum likelihood test (1988, 1991) test are some of the methods used to test for the existence of co-integration or long run relationship. According to Kremers et al. (1992) these tests are not reliable for small sample size.

The ARDL framework is endorsed by Pesaran and Shin (1999), Pesaran et al. (2001). The ARDL approach has a number of advantages over the other co-integration techniques. Firstly, Unlike Johansen-Juselius test of co-integration, ARDL model can be used in modeling irrespective of whether the order of integration of variables is at level ( $I(0)$ ), first difference ( $I(1)$ ) or mutually co-integrated. Thus, the ARDL approach lets us to express co-integrated behavior of variables with different order of integration (Pesaran et al., 2001). Secondly, ARDL is suitable for small sample size. But Johansen's test of co-integration is valid for large sample size (Pesaran et al., 2001). Thirdly, as ARDL can distinguish between dependent and independent variables, it does not have problem of endogeneity as in the case of other co-integration methods (Jalil and Ma 2008). Fourth, ARDL can handle small samples better than Johansen and Juselius method of co-integration (Pesaran and Shin, 1999). Finally, the error correction model (ECM) can also be derived from ARDL (Banerjee et al., 1993). ECM integrates short run adjustments without losing long run information.

### **3.5 Unit root test**

In order to know whether the time series variables are stationary Dickey-Fuller test, Augmented Dickey-Fuller test and/or Phillips-Perron test can be used. The null hypothesis for these tests is the variables have a unit root while the alternative hypothesis is the variables do not have unit root. If a null hypothesis is rejected and identified that the variable is nonstationary, then depending on the data, the differenced variable can be stationary in any order. Dickey-Fuller test (statistics) and Augmented Dickey-Fuller tests (statistics) are believed to be more reliable than Phillips-Perron test (Fabozzi et al., 2014).

### **3.6 Cointegration Test**

Once unit root test is carried out and it declares us that the series is only of integration order of  $I(0)$ ,  $I(1)$  or both, the next step is to carry out bounds test to check if long run relationship exists. The F statistics for the joint significance of all lagged levels of variables and lower and upper critical bounds is obtainable by the bounds test. If the F statistics is higher than both the lower and upper bounds, then there is strong evidence that long-run relationship among variables exists (Jalil and Ma, 2008).

### 3.7 Granger causality test

Granger-causality analysis helps to test whether past values of liquidity help explain current values of performance, Net Interest Margin, and vice versa. It is tested that whether the lags of the lagged values of liquidity ratio variables are equal to zero. If the null hypothesis, liquidity does not Granger cause net interest margin, is rejected, then it is said that liquidity granger causes Net Interest margin. If the null hypothesis, Net Interest Margin does not Granger cause liquidity is rejected, then it is said that Net Interest Margin causes liquidity. All variables should be at I (1) level of integration in order to test Granger causality (Narayan & Smyth, 2005).

### 3.8 Model Specification

This study reviewed the previous findings in empirical literature and adapted the model in the context of the commercial banking industry of Ethiopia. The econometric model of this study is developed as follows:

**Model:** Liquidity and independent variables

$$NIM_{it} = f(MLR, FLR, OLP, RR, BS) \dots\dots\dots 4.1$$

In order to use the above equation for the purpose of estimation it is presented in following form as:

$$NIM = \alpha + \alpha_1 (MLR) + \alpha_2 (FLR) + \alpha_3 (OLP) + \alpha_4 (RR) + \alpha_5 (BS) + \varepsilon \dots\dots\dots 4.2$$

**Where,**

- NIM* = Net Interest Margin
- MLR* = Market Liquidity Risk
- FLR* = Funding Liquidity Risk
- OLP* = Overall Liquidity position
- RR* = Reserve Requirement of NBE
- BS* = Bank Size

The models were tested for residual Breusch-Godfrey serial correlation LM test, heteroscedasticity, normality, and stability.

### 3.9 Definition of Variables used

*Net Interest Margin:* A bank's net interest rate margin (NIM) is the difference between the interest it receives on its assets and the interest it pays on its liabilities, divided by the amount of its interest-bearing assets (BIS 2020).

*Market Liquidity Risk (MLR):* It is the Ratio of Liquid Assets to current liabilities, proxying the market liquidity risk faced by banks. It is the ability of a market participant to execute a trade or liquidate a position with little or no cost, risk or inconvenience (BIS, 2008).

*Funding liquidity Risk (FLR):* FLR is represented by loan-to-deposit ratio. It may also be defined as the ability of banks to settle obligations with immediacy Köhler, M. (2012). The Basel Committee on Banking Supervision defines funding liquidity as the ability of banks to meet their liabilities, unwind or settle their positions as they come due.

*Overall Liquidity position:* In this study the overall liquidity position is considered as the ratio of Liquid assets to Total Assets of the Banks.

*Reserve Requirement(RR):* NBE reserve requirement is a proportional %age balance on all Birr and foreign currency deposit liabilities held in the form of demand (current) deposits, saving deposits and time deposits (NBE, 2013). It is central Banks (NBE) obligatory reserve requirement.

*Bank Size (BS):* Following Luc Laeven et al. (2014), the size of the Banks is proxied by natural logarithm of the Banks total assets brought from the Balance sheet.

Table 3.1: Measure Description and expected effects of explanatory variables

	<i>Variable</i>	<i>Measure/Description</i>	<i>Theoretical ExpectedEffect</i>
<i>Dependent variable</i>	<i>Net Interest Margin</i>	$\frac{\text{Interest Income} - \text{Interest Expense}}{\text{Total Assets}}$	
<i>Independent Variable</i>	<i>Market Liquidity Risk</i>	<i>The Ratio of Liquid Assets to current liabilities</i>	-
	<i>Funding Liquidity Risk</i>	<i>% age of Loan to Deposit Ratio</i>	+
	<i>Overall Liquidity Risk</i>	<i>The ratio of Liquid assets to Total Assets</i>	-
	<i>Central Banks Reserve</i>	<i>The Ratio of Balance with The National Bank of Ethiopia to the Total Loans and Advances</i>	-
	<i>Bank Size</i>	<i>The Natural Logarithm of the Total Asset</i>	-

(Marozva et al., 2015)

## CHAPTER FOUR

### DATA PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS

Data analysis result is presented in this chapter. It contains seven sections. Section 4.1 presents result of unit root test; optimal lag selection is presented in section 4.2; model stability and diagnostic tests are in section 4.3; results of ARDL bounds test for the models is presented in section 4.4; results of ARDL estimation result for the models is presented in Sections 4.5.; section 4.6 presents Granger causality test result. The last section discusses the result of ARDL estimation and Granger causality test in detail against each of the hypothesis of the study.

#### 4.1 Unit root test

Results obtained by using non-stationary time series may be spurious in that they may indicate a relationship between two variables where one does not exist.

Many economic and financial time series exhibit trending behavior or non-stationarity in the mean. Leading examples are asset prices, exchange rates and the levels of macroeconomic aggregates like real GDP. An important econometric task is determining the most appropriate form of the trend in the data. If the data are trending, then some form of trend removal is required. Two common trend removal or de-trending procedures are first differencing and time-trend regression. First differencing is appropriate for  $I(1)$  time series and time-trend regression is appropriate for trend stationary  $I(0)$  time series. Unit root tests can be used to determine if trending data should be first differenced or regressed on deterministic functions of time to render the data stationary. Moreover, economic and finance theory often suggests the existence of long-run equilibrium relationships among nonstationary time series variables. If these variables are  $I(1)$ , then cointegration techniques can be used to model these long-run relations. Hence, pre-testing for unit roots is often a first step in the cointegration modeling

A stationary (time) series is one whose statistical properties such as the mean, variance and autocorrelation are all constant over time. Non-stationary data should be first converted into stationary data (for example by trend removal), so that further statistical analysis can be done on the de-trended stationary data.

Table 4.1: Unit root test at level

Variable	Intercept			Trend and Intercept			No Intercept, No Trend			Order of integration
	ADF Test statistic	Critical Value at 5% level of significance	P-Value	ADF Test statistic	Critical Value at 5% level of significance	P-Value	ADF Test statistic	Critical Value at 5% level of significance	P-Value	
MLR	-1.579951	-2.898145	0.4881	-2.046292	-3.466966	0.5671	-0.604844	-1.944915	0.4524	At Level
FLR	-2.933803	-2.899619	0.0461	-3.981580	-3.469235	0.0481	-2.986846	-1.945199	0.0497	At Level
OLP	-1.285588	-2.899619	0.6326	-1.938392	-3.469235	0.6248	-0.631901	-1.945081	0.4404	At Level
RR	-2.614405	-2.899619	0.0945	-2.684677	-3.469235	0.2458	-1.097616	-1.645081	0.2448	At Level
BS	3.128721	-2.899619	1.0000	-1.629661	-3.469235	0.7721	10.89465	-1.945081	1.0000	At Level
NIM	1.930557	2.897678	0.9998	-2.662762	-3.464865	0.2547	2.050749	-1.944862	0.9900	At Level

Source: Author's computation of EViews 9 results

Table 4.2: Unit root test at first difference

Variable	Intercept			Trend and Intercept			No Intercept, No Trend			Order of integration
	ADF Test statistic	Critical Value at 5% level of significance	P-Value	ADF Test statistic	Critical Value at 5% level of significance	P-Value	ADF Test statistic	Critical Value at 5% level of significance	P-Value	
MLR	-12.52051	-2.898145	0.0001	-12.68060	-3.466966	0.0001	-12.60048	-1.944915	0.0000	At I(1)
FLR	-29.63742	-2.895109	0.0001	-28.80857	-3.462292	0.0001	-29.96259	-1.944574	0.0000	At I(1)
OLP	-8.986458	-2.900137	0.0000	-9.165739	-3.470032	0.0000	-9.042183	-1.94519	0.0000	At I(1)
RR	-10.23765	-2.900137	0.0001	-10.19829	-3.470032	0.0000	-10.30758	-1.945139	0.0000	At I(1)
BS	-2.669023	-2.901779	0.0345	-8.22115	-3.470851	0.0000	-0.481443	-1.945324	0.0339	At I(1)
NIM	-5.271790	2.897678	0.0000	-5.823760	-3.466248	0.0000	-5.051199	-1.944862	0.0000	At I(1)

Source: Author's computation of EViews 9 results

The results of unit root test for Market liquidity risk (MLR), Funding Liquidity Risk (FLR), Overall Liquidity Position (OLP), Reserve Requirement by central Bank (RR), Bank Size (BS) and (NIM) are reported in Table 4.1 and Table 4.2. The result of the unit root test shows that none of the variables are of integration of order I (2) and Except Funding Liquidity, all are integration of order I (1). With this test result one can proceed to ARDL test.

## **4.2 Optimal lag selection**

There are several criteria for choosing the optimal lag length in a time series: AIC: Akaike information criterion; BIC: Schwartz information criterion; HQ: Hannan-Quinn criterion; MAE: Mean Absolute Error; BP: Bias proportion; RMSE: Root Mean Square Error; LIK: Log-Likelihood.

The information criterion for optimal lag length is contingent on the number of observations (Liew, V, K-S., 2004). The AIC and Final Prediction Error (FPE) are more appropriate when observations are less than 60, the Hannan-Quinn (HQ) is more competent when observations are above 120.

Moreover, it remains the decision of the researcher to select the maximum lags which the adopted criterion for choosing optimal lags will use.

One immediate econometric implication of this study is that as most economic sample data can seldom be considered "large" in size, AIC and FPE are recommended for the estimation the autoregressive lag length. The lag length is calculated using AIC and FPE, Accordingly the lag length using a maximum of 4 lags, it delivers robust results, and the lag length is also supported by HQ and SC.

## **4.3 Model stability and diagnostic tests**

The Breusch-Godfrey serial correlation LM test for residual autocorrelation, heteroscedasticity test to check if the variance of the error term is constant or the same, and normality test based on skewness and kurtosis of the residuals are carried out.

Stability test has been done for the specified models. In order to check the stability of long-run coefficients that form the error-correction term in combination with short-run dynamics, cumulative sum of recursive residuals test (CUSUM test) and the cumulative sum of squares of recursive residuals test (CUSUMQ test) is applied to the residuals of the models. CUMSUM and CUSUMSQ statistics shall stay within 5% critical bound in order to infer that the stability of short run dynamics and long run parameters of the model (Brown et al., 1975).

#### 4.3.1 Test for absence of residual autocorrelation ( $Cov(u_i, u_j) = 0$ for $i \neq j$ )

One of the assumed properties of error term is that no statistically significant correlation between adjacent residuals exists and it is also assumed that the independent variables are not correlated with the residuals. In the context of time series data analysis two adjacent time periods should not have significant correlation. The occurrence of auto correlation in time series makes hypothesis testing of regression coefficients doubtful by way of significantly miscalculating variances. The following table shows the result of autocorrelation test.

Table 4.3: Breusch-Godfrey serial correlation LM test result

*Breusch-Godfrey Serial Correlation LM Test:*

<i>F-statistic</i>	<i>1.654980</i>	<i>Prob. F(4,51)</i>	<i>0.1749</i>
<i>Obs*R-squared</i>	<i>8.501820</i>	<i>Prob. Chi-Square(4)</i>	<i>0.0748</i>

*Source: Author's Computation of EViews 9 results*

Breusch-Godfrey Serial Correlation LM Test is reported in the above table. The null hypothesis in this test is that there is no auto correlation. The test result at 5% level of significance reveals evidence that the null hypothesis cannot be rejected.

#### 4.3.2 Test for residual homoscedasticity ( $Var(u_t) = \sigma^2$ )/heteroscedasticity

It has been assumed thus far that the variance of the errors is constant. This is known as the assumption of homoscedasticity. If the errors do not have a constant variance, they are said to be heteroscedastic.

The null hypothesis in ARCH test is that the variance of the error is constant or homoscedastic, the alternative hypothesis being the variance of the error term is heteroscedastic. Heteroscedasticity test for the model of this study is reported in Table 4.4 the model.

Table 4.4: Heteroscedasticity test

*Heteroscedasticity Test: White*

<i>F-statistic</i>	1.466693	<i>Prob. F(15,62)</i>	0.1463
<i>Obs*R-squared</i>	20.42884	<i>Prob. Chi-Square(15)</i>	0.1561
<i>Scaled explained SS</i>	9.324651	<i>Prob. Chi-Square(15)</i>	0.8599

*Heteroscedasticity Test: Breusch-Pagan-Godfrey*

<i>F-statistic</i>	1.842166	<i>Prob. F(5,72)</i>	0.1154
<i>Obs*R-squared</i>	8.846663	<i>Prob. Chi-Square(5)</i>	0.1153
<i>Scaled explained SS</i>	4.038018	<i>Prob. Chi-Square(5)</i>	0.5440

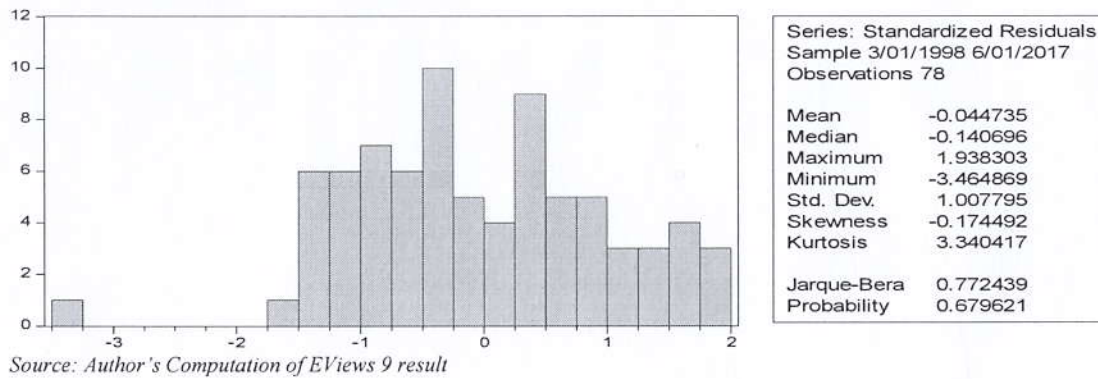
*Source: Author's computation of EViews9 results*

The test statistics gives the information needed to determine whether the assumption of homoscedasticity is valid or not, to conclude whether we have to reject the null hypothesis or not, using the resulting F Statistic is enough. Seeing the actual auxiliary regression in the above table can provide useful additional information on the source of the heteroscedasticity if any is found. In this case, both the F-and X2 versions of the test statistic give the same conclusion that there is no evidence for the presence of heteroscedasticity, since the P-values are considerably in excess of 0.05

### 4.3.3 Normality Test

Normally distributed data has a coefficient of kurtosis 3 i.e., it is not skewed. Jarque-Bera formalizes this by testing the residuals for normality and testing whether the coefficient of skewness and kurtosis are zero and three respectively the Jarque-Bera probability statistics/P-value is also expected not to be significant even at 10% significant level Brooks (2008). The normality test for the model is presented in figure 4.1 below.

Figure 4.1: Normality Test

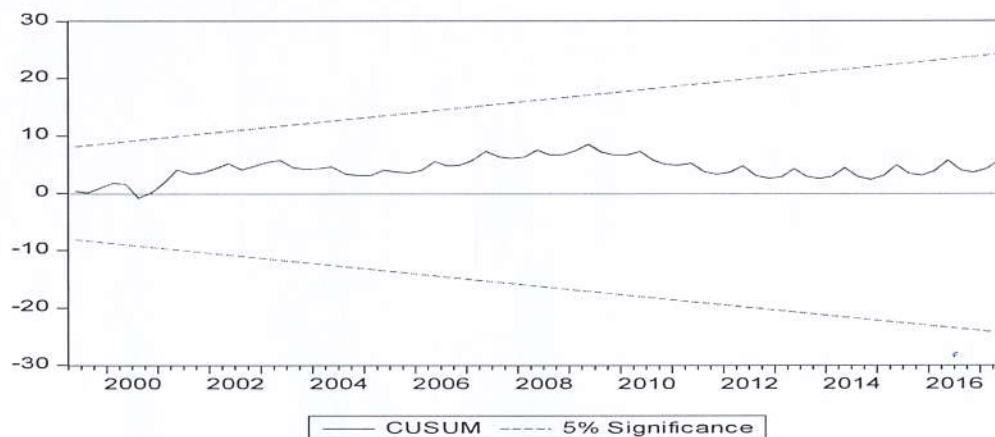


The result shows that the error terms are normally distributed, as the null hypothesis cannot be rejected due the probability value that is greater than 5%. The P- Value is not significant even at 10%.

#### 4.3.4 Model stability test

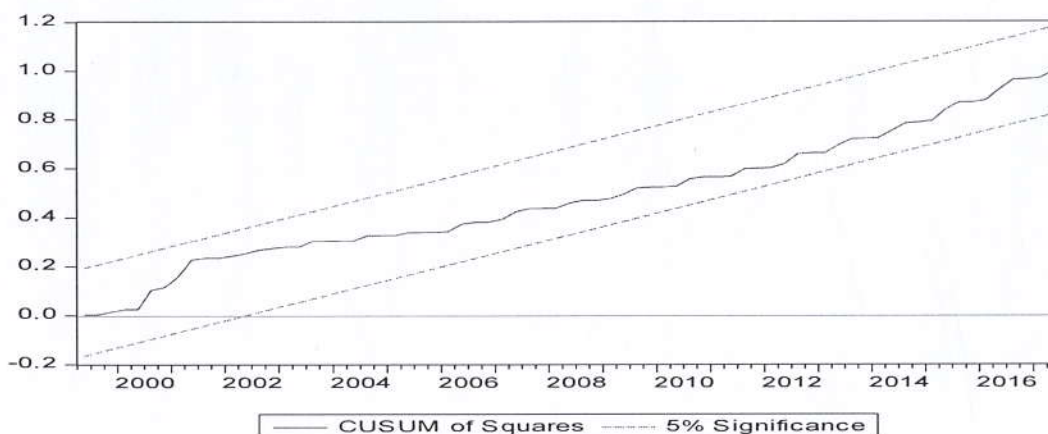
The CUSUM test Brown, Durbin, and Evans, (1975) is based on the cumulative sum of the recursive residuals. This option plots the cumulative sum together with the 5% critical lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. The stability test result is presented in figure 4.2. The CUMSUM tests show that the model is stable in relative terms. Figure 4.3 shows the CUSUMQ test.

Figure 4.2: Plot of CUSUM



Source: Author's computation of EViews 9 results

Figure 4.3: Plot of CUSUMQ



Source: Author's computation of EViews 9 results

#### 4.4 Result of ARDL bounds Test

ARDL bounds test result for the existence of long run relationships is presented in Table 4.5 below the model. As can be seen in the table the F-statistics (2.60) is less than the critical bounds at 5% level of significance both at I (0) bound and I (1) bound. This shows that the null hypothesis of no long run relationship exists cannot be rejected. As a result, it can be concluded that there is no sign if long run relationship existence between the variables. Thus, there is no evidence that there is a long run relationship between the selected Bank Liquidity measures and Net Interest Margin.

**Table 4.5: ARDL bounds test result**

*ARDL Bounds Test*

*Date: 03/17/20 Time: 12:11*

*Sample: 3/01/1999 6/01/2017*

*Included observations: 74*

*Null Hypothesis: No long-run relationships exist*

<i>Test Statistic</i>	<i>Value</i>	<i>k</i>
<i>F-statistic</i>	2.602395	5

<i>Critical Value Bounds</i>		
<i>Significance</i>	<i>10 Bound</i>	<i>11 Bound</i>
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

*Source: Author's computation of EViews 9 results*

#### **4.5 Result of autoregressive distributed lag (ARDL) estimation**

The ARDL estimation results for the determinants of liquidity are reported in Table 4.6 below. Of the taken liquidity ratio parameters, and the size as a control variable, the long run statistics reveals that the Market Liquidity risk (MLR), Funding Liquidity risk (FLR), Reserve requirement (RR), the banks size (BS) and ratio of liquid asset to total asset (OLP) has insignificant relationship with the Net Interest Margin in the long run.

The short run dynamics of the model is also reported in Table 4.6. The coefficients of Funding Liquidity Risk (FLR) and Overall liquidity position (OLP) and Bank Size (BS), are statistically significant determinants of Net Interest Margin in the short term at 5% level. While the Market Liquidity Risk (MLR) and the reserve Balance with NBE is insignificant in the short term.

The coefficient of  $VECM_{t-1}$  statistically significant (P-value =0.0005) and negative. This confirms that there is a cointegration among the series.

**Table 4.6: ARDL estimation results for liquidity and independent variables**

*ARDL Cointegrating And Long Run Form*

*Dependent Variable: NIM*

*Selected Model: ARDL(4, 0, 4, 3, 0, 2)*

*Date: 03/17/20 Time: 12:14*

*Sample: 3/01/1998 6/01/2017*

*Included observations: 74*

<i>Cointegrating Form</i>				
<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
<i>D(NIM(-1))</i>	-0.076574	0.210414	-0.363921	0.7173
<i>D(NIM(-2))</i>	-0.325416	0.144864	-2.246354	0.0287
<i>D(NIM(-3))</i>	-0.606605	0.083094	-7.300206	0.0000
<i>D(MLR)</i>	0.181683	0.169487	1.071958	0.2884
<i>D(FLR)</i>	0.005852	0.019394	0.301712	0.7640
<i>D(FLR(-1))</i>	0.018583	0.023232	0.799885	0.4272
<i>D(FLR(-2))</i>	0.042575	0.021767	1.955971	0.0556
<i>D(FLR(-3))</i>	-0.059504	0.020754	-2.867113	0.0059
<i>D(OLP)</i>	-0.050429	0.018982	-2.656714	0.0103
<i>D(OLP(-1))</i>	-0.002910	0.021936	-0.132644	0.8950
<i>D(OLP(-2))</i>	-0.035379	0.015037	-2.352822	0.0222
<i>D(RR)</i>	-0.682201	0.588028	-1.160151	0.2510
<i>D(BS)</i>	1.179159	1.541376	0.765004	0.4475
<i>D(BS(-1))</i>	-3.347486	1.480882	-2.260468	0.0278
<i>CointEq(-1)</i>	-1.028221	0.279011	-3.685236	0.0005

$$\text{Cointeq} = \text{NIM} - (0.1767 * \text{MLR} + 0.0132 * \text{FLR} - 0.0107 * \text{OLP} - 0.6635 * \text{RR} + 0.3945 * \text{BS} - 3.2877)$$

<i>Long Run Coefficients</i>				
<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
<i>MLR</i>	0.176697	0.169435	1.042858	0.3016
<i>FLR</i>	0.013244	0.026334	0.502921	0.6170
<i>OLP</i>	-0.010672	0.015883	-0.671941	0.5044
<i>RR</i>	-0.663477	0.571894	-1.160140	0.2510
<i>BS</i>	0.394464	0.206123	1.913733	0.0609
<i>C</i>	-3.287679	4.454273	-0.738096	0.4636

*Source: Author's computation of EViews 9 results*

#### 4.6 Granger causality test

The pair wise granger causality test for variables is presented in Table 4.7 below. As per the computation, of the series of variables taken for the study, Market liquidity risk does granger causes both the Funding Liquidity Risk (FLR) and Size of the Bank (BS). Balance of Reserve

with the National Bank does granger causes both the Bank size and the overall liquidity position.

However, and in general, the null hypothesis that liquidity granger cause the net interest margin is rejected. But of all the independent variable, the NIM dos granger causes the reserve ratio and overall liquidity position.

**Table 4.7 Pair wise Granger causality test for Liquidity and Profitability**

*Pairwise Granger Causality Tests*

*Date: 03/17/20 Time: 12:22*

*Sample: 3/01/1998 6/01/2017*

*Lags: 4*

<i>Null Hypothesis:</i>	<i>Obs</i>	<i>F-Statistic</i>	<i>Prob.</i>
<i>BS does not Granger Cause FLR</i>	74	1.78919	0.1417
<i>FLR does not Granger Cause BS</i>		1.31562	0.2735
<i>MLR does not Granger Cause FLR</i>	74	3.58115	0.0106
<i>FLR does not Granger Cause MLR</i>		0.78041	0.5420
<i>NIM does not Granger Cause FLR</i>	74	2.05178	0.0974
<i>FLR does not Granger Cause NIM</i>		1.61893	0.1801
<i>OLP does not Granger Cause FLR</i>	74	0.61041	0.6566
<i>FLR does not Granger Cause OLP</i>		10.9523	8.E-07
<i>RR does not Granger Cause FLR</i>	74	1.34499	0.2629
<i>FLR does not Granger Cause RR</i>		2.24922	0.0733
<i>MLR does not Granger Cause BS</i>	74	2.78925	0.0335
<i>BS does not Granger Cause MLR</i>		1.79031	0.1415
<i>NIM does not Granger Cause BS</i>	74	1.55200	0.1977
<i>BS does not Granger Cause NIM</i>		1.71678	0.1570
<i>OLP does not Granger Cause BS</i>	74	1.68287	0.1646
<i>BS does not Granger Cause OLP</i>		1.31547	0.2736
<i>RR does not Granger Cause BS</i>	74	3.08257	0.0219
<i>BS does not Granger Cause RR</i>		0.93198	0.4510
<i>NIM does not Granger Cause MLR</i>	74	1.28722	0.2842
<i>MLR does not Granger Cause NIM</i>		1.93950	0.1144
<i>OLP does not Granger Cause MLR</i>	74	0.70032	0.5945
<i>MLR does not Granger Cause OLP</i>		20.3683	7.E-11

<i>Null Hypothesis:</i>	<i>Obs</i>	<i>F-Statistic</i>	<i>Prob.</i>
<i>RR does not Granger Cause MLR</i>	74	0.62008	0.6498
<i>MLR does not Granger Cause RR</i>		2.72590	0.0367
<i>OLP does not Granger Cause NIM</i>	74	2.54366	0.0478
<i>NIM does not Granger Cause OLP</i>		3.70591	0.0089
<i>RR does not Granger Cause NIM</i>	74	0.49360	0.7404
<i>NIM does not Granger Cause RR</i>		4.40038	0.0033
<i>RR does not Granger Cause OLP</i>	74	4.74718	0.0020
<i>OLP does not Granger Cause RR</i>		3.39784	0.0138

Source: Author's computation of EViews 9 results

#### 4.7 Discussion of results

The result of the study is presented in the previous sections. In this section, analysis of each independent variable, proxies to liquidity, is made in light of its level of significance in determining the Net Interest Margin.

Up on these above findings of the study the research hypothesis outlined in chapter one may either be accepted or rejected. Findings of this study are analyzed against other related empirical studies.

#### Error correction term for liquidity

Table 4.6 shows that the coefficient of the error correction term (VECMt-1) for Net Interest Margin is statistically significant (P-value =0.0005) and negative. The coefficient of error correction term is -1.028221. The adjustment process back to the long run equilibrium after a shock is 27.9% per quarter. The result also shows that though Net Interest Margin may temporarily deviate from its long run equilibrium, it will converge back to its equilibrium hence, the full adjustment requires more than three quarter.

#### Market Liquidity Risk and Profitability

*H1: Market liquidity risk of Ethiopian Banks negatively affects their performance and it is significant both in the short and long term.*

The estimation result of ARDL estimation in table 4.6 shows that the Market Liquidity Risk has an insignificant effect both in the long run and the short run (p-value=0.2884). The coefficient sign is not as expected (negative); hence the result could have not confirmed the hypothesized level of significance at 5% level of confidence. The null hypothesis can be rejected and the alternative hypothesis that claims “*Market liquidity risk of Ethiopian Banks does not negatively affect their performance and it is significant both in the short and long term*” can be rejected. Because it does not fulfill the sign, it has insignificant but positive relationship.

Therefore, it is possible to conclude that the Net Interest Margin of the banks do not depend on the volatility of the ratio of their current asset to their current liability. The findings here are also consistent with the findings of Maudos and Solis (2009) who found an insignificant relationship between net interest margin and market liquidity. Inconsistencies with the researcher’s findings are findings by Maudos and Guevara (2004), and Saunders and Schunacher (2000) who found a significant but positive relationship between market liquidity risk and net interest income.

#### **Funding Liquidity Risk and Profitability**

*H2: Funding Liquidity Risk of Ethiopian Banks positively and significantly affects their performance both in the short and long term.*

The ARDL estimation result in table 4.6 shows that the relationship between the Funding Liquidity Risk and The Net Interest Margin has a positive coefficient but insignificant (p-value=0.6170) at 5% level of confidence interval in the long run. The sign of the coefficient is as expected. It has a positive sign but insignificant. However, in the short-term (p-value=0.0059) a significant effect at a 5% level is observed. In the long run, an increase in Loan to Deposit ratio is a relative high growth rate of a loan in relation to growth in banks deposit. Accordingly, an increase in this ratio brings a lower Net Interest for the Banks.

For a long run, the null hypothesis cannot be rejected because of its sign but not significant; and the alternative hypothesis, claiming that “*Funding Liquidity Risk of Ethiopian Banks does not positively and significantly affect their performance both in the short and long term*” can be rejected at 5% significant level. It is not significant for at least a short term.

The result indicates, other explanatory variables remaining constant, a unit increase in funding liquidity risk results a 1.3% increase in Net Interest Margin of Ethiopian Banks in the long run period. To conclude, there was an evidence revealed (Negative i.e. Contradicting for the short run) and a positive effect but insignificant in the long run. However, it doesn't contradict to the theoretical hypothesis for the long run. These findings support an empirical study made by Munther et al. (2013) in the case of Jordanian banks.

### **Overall Liquidity Position and Profitability**

*H3: Overall liquidity position of the Ethiopian Banks affects their performance significantly both in the short and long term and the sign of the relationship is negative.*

The ARDL estimation result in table 4.6 shows that overall liquidity position has insignificant effect in the long term at a 95% level of confidence. A significant effect is observed in a short term (p-value=0.0222) with a negative sign for both short and long term. For the short run the Null hypothesis cannot be rejected. The result indicates that other explanatory variables remaining constant, a unit decrease in the overall liquidity position results an increase of a 3.54% and 1.07% net interest margin in the short and long run respectively. As per the finance theory, an increase in liquidity risk, higher risk (Such as using short term finance for fixed assets) results in an increase in return. Hence, long term loans bring a higher interest resulting in an increase in net interest margin. To conclude, it conforms the financial theory of high risk high return.

### **Reserve Held with National Bank of Ethiopia and Profitability**

*H4: Reserve held by the National Bank of Ethiopia significantly affects the performance of Ethiopian Banks both in the short and long term and with a negative sign of relationship.*

The Reserve held by the National Bank to the Total deposit of Banks liquidity ratio effect is not significant both in the long run (p=0.2510) and the short run (p=0.2510). The result of P Value is same for both short and long run. The reason that the reserve amount is not volatile resulted an insignificant result. Although, it has a negative sign as expected, the null hypothesis is

rejected for its insignificance contribution to the bank's Net Interest Margin. The researchers result confirms to the Foreign Joint venture Banks in Nepal Arhan(2012).

### **The Banks' size and Profitability**

*H<sub>5</sub>: Size of the Banks affects the performance of Ethiopian banking industry significantly and positively both in the short and long term.*

The Size of the Banks positively affects the Bank's Net Interest Margin significantly both in the short and the long run as well. Hence, the Null hypothesis "*Size of the Banks affects the performance of Ethiopian banking industry significantly and positively both in the short and long term*" cannot be rejected. The long run impact is significant at least at 10% level of significance. The sign of the coefficient is positive and as expected. A unit increase in the size of the banks brings a 0.39 Net interest Margin. Belay (2016) in his study found that Bank size measure by Branch expansion has a positive association but insignificant and figured out that increase in size may entail branch expansion that is accompanied by additional costs. In this study the size parameterized by the natural log of the total assets and the result revealed that different parameterization of same variables results in different result.

The Positive association ship of the Bank size and the profitability is similar with empirical findings of Athanasoglou, Delis and Stairkouras (2006), a study made of Greece and South East European countries, Sufian (2011), a study made for Korean banks; Anbar and Alper (2012), a study made for Turkish Banks; and Karimzadeh et al. (2013), a study made for Indian Banks.

### **Granger Causality**

*H<sub>6</sub>: Liquidity granger causes profitability in the commercial banking industry of Ethiopia and vice versa.*

The test of causality showed that all independent variables does not granger cause the Dependent Variable. However, causality is observed among some of the series. Hence Market liquidity risk does granger causes both the Funding Liquidity Risk (FLR) and Size of the Bank (BS). This implies as liquid assets increases over the current liability, Ethiopian Banks will

have more funds to lend. Balance of Reserve with the National Bank does granger causes both the Bank size and the overall liquidity position.

## CHAPTER FIVE

### SUMMARY OF MAJOR FINDINGS, CONCLUSION AND RECOMMENDATION

This chapter summarizes the first four chapters of the paper briefly. The first part summarizes the major conclusions of the study. The second part dwells forward recommendations and areas of depending for further research.

#### 5.1 Summary of Major Findings

In this study, an empirical framework was specified to investigate whether liquidity proxies specifically Market Liquidity Risk, Funding Liquidity Risk, The Overall Liquidity position of Banks, the ratio of Reserve requirement by NBE to total Deposit and Size of the banks of commercial Banks in Ethiopia have both short term and long term effects with a varied level of significance with that of the Net Interest Margin. The causality between these proxies and the Net Interest Margin is also examined.

In a short term, Funding Liquidity Risk significantly affects the Net Interest Margin of the Banks (P Value of 0.0059). An increase in Loan to Deposit ratio is a relative high growth rate of a loan in relation to growth in banks deposit. Accordingly, an increase in this ratio brought a higher Net Interest for the Banks. However, in a long run, The Net Interest Margin has a positive coefficient but weaker/insignificant effect at 5% level of confidence interval.

The result showed the overall liquidity position of Ethiopian Banks has a significant impact (p-value=0.0222) on their Net Interest Margin with a negative sign of coefficient value. For the short run the Null hypothesis cannot be rejected.

The other ratio of Banks liquidity measure is a ratio of a Reserve requirement held by the National Bank to the Total deposit of Banks. This liquidity measure is not significant both in the long run and the short run with exactly equal P Values of 0.2510. This same P value for a short and long run is a result of relatively less dynamism in the balance held by the NBE.

## 5.2 Conclusion

For the period under study, Market liquidity risk does granger causes both the Funding Liquidity Risk (FLR) and Size of the Bank (BS) in the Ethiopian Banking Industry. Balance of Reserve with the National Bank does granger cause both the Bank size and the overall liquidity position of the Ethiopian Banks.

The Size of the Banks positively affects the Bank's Net Interest Margin significantly both in the short and the long run, but at a decreasing level of significance in the long run.

Empirical findings indicate that the Market Liquidity Risk has an insignificant effect both in the long run and the short run ( $p\text{-value}=0.2884$ ). The coefficient sign is not as expected (negative), Hence the result could have not confirmed the hypothesized level of significance at 5% level of confidence. Therefore, it is possible to conclude that the Net Interest Margin of the Ethiopian banks do not depend on the volatility of the ratio of their current asset to their current liability.

## 5.2 Recommendation

Based on the major outcomes of the study, the researcher recommends the following:

- The analysis indicated that not all liquidity proxies significantly affect the Net Interest Margin in the commercial banking industry of Ethiopia. Therefore, commercial banks should give greater emphasis to these significant variables in managing the liquidity.
- Except for Market liquidity risk, the study showed that increased loan to deposit ratio (Funding liquidity) brings increased Net Interest Margin. Overall liquidity risk is significantly and negatively (Small Coefficient) related to the net interest margin.
- Thus, in the short run, Ethiopian Banks, should find and keep optimal funding liquidity as it has a strong effect to the Net Interest margin only in the short run while weak effect in the long run. Theoretically, as risk and return goes together, Ethiopian Banks should have comparable added value to the owners that can comparably compensate the risks taken.

### **5.3 Direction for future research**

Considering the importance of each liquidity measures and profitability in the banking Industry Various liquidity measures and proxies might have various effects with that of various profitability measures, these, the study contemplates that it is appropriate to investigate the long and short run effect of these various liquidity proxies with that of each performance measures i.e. beyond financial performance indicators, Thus, I consider suitable to study how each of liquidity accounts and their measures, Liquidity related bank regulation, and other liquidity relate facts versus various performance measures.

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## Appendix

### 1. Breusch-Godfrey serial correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.654980	Prob. F(4,51)	0.1749
Obs*R-squared	8.501820	Prob. Chi-Square(4)	0.0748

Test Equation:

Dependent Variable: RESID

Method: ARDL

Date: 03/17/20 Time: 10:13

Sample: 3/01/1999 6/01/2017

Included observations: 74

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NIM(-1)	0.061076	0.147066	0.415297	0.6797
NIM(-2)	0.114322	0.131047	0.872378	0.3871
NIM(-3)	0.105722	0.124191	0.851286	0.3986
NIM(-4)	0.111577	0.119522	0.933531	0.3549
MLR	0.014345	0.166680	0.086066	0.9318
FLR	0.006600	0.020071	0.328815	0.7436
FLR(-1)	0.004088	0.018824	0.217140	0.8290
FLR(-2)	-0.005607	0.023045	-0.243320	0.8087
FLR(-3)	-0.003693	0.021530	-0.171515	0.8645
FLR(-4)	-0.000369	0.021645	-0.017049	0.9865
OLP	-0.006948	0.019380	-0.358500	0.7214
OLP(-1)	0.004629	0.023720	0.195138	0.8461
OLP(-2)	0.007512	0.022310	0.336694	0.7377
OLP(-3)	0.000911	0.014989	0.060749	0.9518
RR	-0.189846	0.596023	-0.318521	0.7514
BS	-0.164523	1.560951	-0.105399	0.9165
BS(-1)	-0.392284	1.986898	-0.197436	0.8443
BS(-2)	0.441014	1.503018	0.293419	0.7704
C	0.470083	4.359565	0.107828	0.9146
RESID(-1)	0.042780	0.206648	0.207021	0.8368
RESID(-2)	-0.213853	0.193325	-1.106180	0.2738
RESID(-3)	-0.282003	0.175910	-1.603108	0.1151
RESID(-4)	-0.222026	0.184632	-1.202534	0.2347
R-squared	0.114889	Mean dependent var		5.67E-15
Adjusted R-squared	-0.266923	S.D. dependent var		0.347826
S.E. of regression	0.391505	Akaike info criterion		1.211744
Sum squared resid	7.817077	Schwarz criterion		1.927873
Log likelihood	-21.83454	Hannan-Quinn criter.		1.497417
F-statistic	0.300906	Durbin-Watson stat		1.993904
Prob(F-statistic)	0.998441			

Source: Author's EViews 9 Computation

## 2. Heteroscedasticity Test

### *Heteroscedasticity Test: White*

F-statistic	1.466693	Prob. F(15,62)	0.1463
Obs*R-squared	20.42884	Prob. Chi-Square(15)	0.1561
Scaled explained SS	9.324651	Prob. Chi-Square(15)	0.8599

Test Equation:

Dependent Variable: RESID<sup>2</sup>

Method: Least Squares

Date: 03/17/20 Time: 10:25

Sample: 3/01/1998 6/01/2017

Included observations: 78

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.931000	2.983901	1.652535	0.1035
MLR <sup>2</sup>	-0.468372	0.334754	-1.399153	0.1668
MLR*FLR	-0.034336	0.035463	-0.968238	0.3367
MLR*OLP	0.047616	0.047461	1.003272	0.3196
MLR*RR	0.226980	3.320100	0.068366	0.9457
MLR*BS	0.203919	0.300010	0.679709	0.4992
FLR <sup>2</sup>	0.001329	0.001169	1.137506	0.2597
FLR*OLP	0.004045	0.002113	1.914215	0.0602
FLR*RR	0.078899	0.130199	0.605992	0.5467
FLR*BS	-0.026150	0.016230	-1.611222	0.1122
OLP <sup>2</sup>	-0.001299	0.002346	-0.553825	0.5817
OLP*RR	0.049824	0.139455	0.357275	0.7221
OLP*BS	-0.027073	0.012148	-2.228665	0.0295
RR <sup>2</sup>	-6.326111	7.844867	-0.806401	0.4231
RR*BS	-0.175053	0.929893	-0.188251	0.8513
BS <sup>2</sup>	0.074614	0.045735	1.631464	0.1079
R-squared	0.261908	Mean dependent var		0.724611
Adjusted R-squared	0.083338	S.D. dependent var		0.744540
S.E. of regression	0.712841	Akaike info criterion		2.341565
Sum squared resid	31.50482	Schwarz criterion		2.824993
Log likelihood	-75.32105	Hannan-Quinn criter.		2.535090
F-statistic	1.466693	Durbin-Watson stat		1.916776
Prob(F-statistic)	0.146295			

Source: Author's EViews 9 Computation

**Heteroscedasticity Test: Breusch-Pagan-Godfrey**

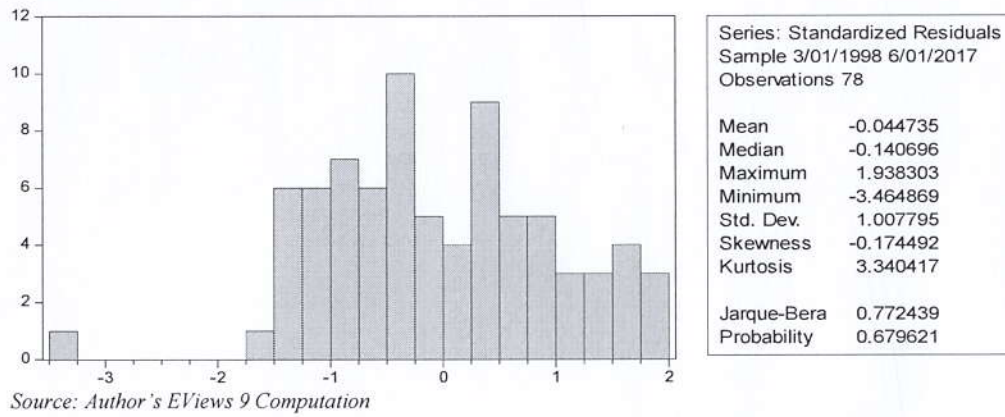
F-statistic	1.842166	Prob. F(5,72)	0.1154
Obs*R-squared	8.846663	Prob. Chi-Square(5)	0.1153
Scaled explained SS	4.038018	Prob. Chi-Square(5)	0.5440

Test Equation:  
 Dependent Variable: RESID^2  
 Method: Least Squares  
 Date: 03/17/20 Time: 10:49  
 Sample: 3/01/1998 6/01/2017  
 Included observations: 78

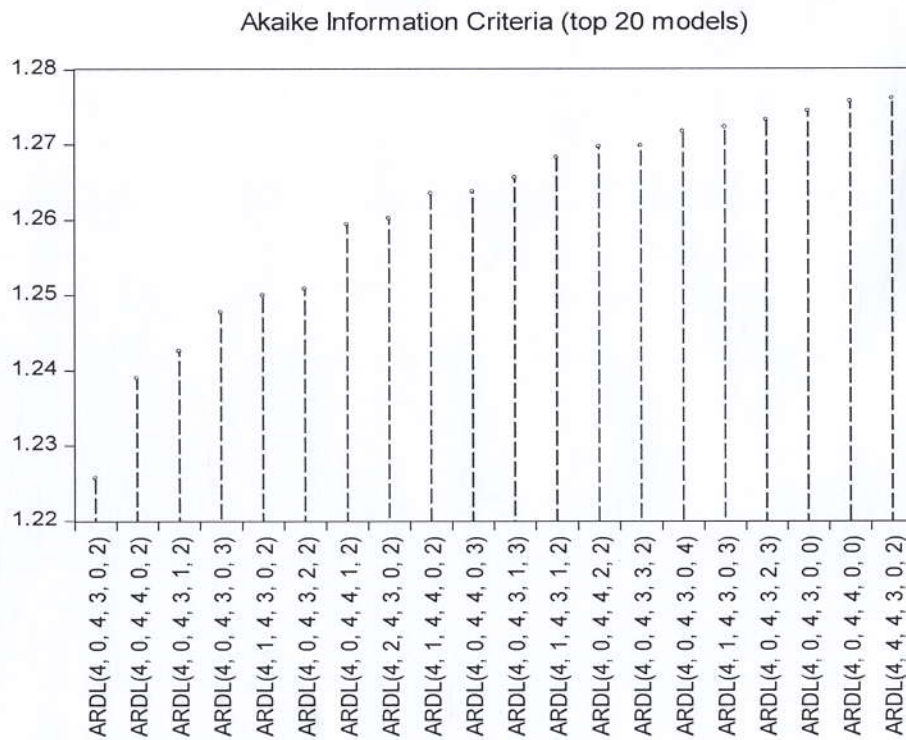
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.735845	4.075391	0.425933	0.6714
MLR	-0.176834	0.274490	-0.644228	0.5215
FLR	-0.002845	0.025878	-0.109920	0.9128
OLP	-0.014051	0.014004	-1.003323	0.3191
RR	0.270394	0.810767	0.333504	0.7397
BS	-0.016073	0.188175	-0.085417	0.9322
R-squared	0.113419	Mean dependent var		0.724611
Adjusted R-squared	0.051851	S.D. dependent var		0.744540
S.E. of regression	0.724981	Akaike info criterion		2.268460
Sum squared resid	37.84297	Schwarz criterion		2.449745
Log likelihood	-82.46993	Hannan-Quinn criter.		2.341032
F-statistic	1.842166	Durbin-Watson stat		1.813745
Prob(F-statistic)	0.115414			

Source: Author's EViews 9 Computation

### 3. Normality Test



### 4. Model selection Summary



## 5. ARDL Cointegrating and Long run form

ARDL Cointegrating And Long Run Form

Dependent Variable: NIM

Selected Model: ARDL(4, 0, 4, 3, 0, 2)

Date: 03/17/20 Time: 12:14

Sample: 3/01/1998 6/01/2017

Included observations: 74

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NIM(-1))	-0.076574	0.210414	-0.363921	0.7173
D(NIM(-2))	-0.325416	0.144864	-2.246354	0.0287
D(NIM(-3))	-0.606605	0.083094	-7.300206	0.0000
D(MLR)	0.181683	0.169487	1.071958	0.2884
D(FLR)	0.005852	0.019394	0.301712	0.7640
D(FLR(-1))	0.018583	0.023232	0.799885	0.4272
D(FLR(-2))	0.042575	0.021767	1.955971	0.0556
D(FLR(-3))	-0.059504	0.020754	-2.867113	0.0059
D(OLP)	-0.050429	0.018982	-2.656714	0.0103
D(OLP(-1))	-0.002910	0.021936	-0.132644	0.8950
D(OLP(-2))	-0.035379	0.015037	-2.352822	0.0222
D(RR)	-0.682201	0.588028	-1.160151	0.2510
D(BS)	1.179159	1.541376	0.765004	0.4475
D(BS(-1))	-3.347486	1.480882	-2.260468	0.0278
CointEq(-1)	-1.028221	0.279011	-3.685236	0.0005

Cointeq = NIM - (0.1767\*MLR + 0.0132\*FLR -0.0107\*OLP -0.6635\*RR + 0.3945\*BS -3.2877 )

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
MLR	0.176697	0.169435	1.042858	0.3016
FLR	0.013244	0.026334	0.502921	0.6170
OLP	-0.010672	0.015883	-0.671941	0.5044
RR	-0.663477	0.571894	-1.160140	0.2510
BS	0.394464	0.206123	1.913733	0.0609
C	-3.287679	4.454273	-0.738096	0.4636

Source: Author's EViews 9 Computation

## 6. ARDL Bounds Test

ARDL Bounds Test

Date: 03/17/20 Time: 12:11

Sample: 3/01/1999 6/01/2017

Included observations: 74

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	2.602395	5

### Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Test Equation:

Dependent Variable: D(NIM)

Method: Least Squares

Date: 03/17/20 Time: 12:11

Sample: 3/01/1999 6/01/2017

Included observations: 74

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NIM(-1))	-0.084522	0.215025	-0.393079	0.6958
D(NIM(-2))	-0.329768	0.148511	-2.220503	0.0305
D(NIM(-3))	-0.594039	0.087281	-6.806017	0.0000
D(FLR)	0.000105	0.016293	0.006436	0.9949
D(FLR(-1))	0.013566	0.024962	0.543472	0.5890
D(FLR(-2))	-0.013494	0.022676	-0.595074	0.5542
D(FLR(-3))	-0.052150	0.020227	-2.578283	0.0126
D(OLP)	-0.056244	0.020559	-2.735795	0.0084
D(OLP(-1))	-0.030069	0.017603	-1.708164	0.0932
D(OLP(-2))	-0.030201	0.015021	-2.010529	0.0493
D(BS)	0.451612	1.579896	0.285849	0.7761
D(BS(-1))	-3.504865	1.501879	-2.333653	0.0233
C	-2.160161	3.883977	-0.556172	0.5803
MLR(-1)	0.181969	0.187151	0.972309	0.3352
FLR(-1)	0.006785	0.023132	0.293314	0.7704
OLP(-1)	-0.021418	0.017928	-1.194671	0.2373
RR(-1)	-0.180386	0.538337	-0.335080	0.7388
BS(-1)	0.355448	0.185599	1.915136	0.0607
NIM(-1)	-1.033137	0.286068	-3.611512	0.0007

R-squared	0.925454	Mean dependent var	0.032393
Adjusted R-squared	0.901057	S.D. dependent var	1.286784
S.E. of regression	0.404760	Akaike info criterion	1.245736
Sum squared resid	9.010684	Schwarz criterion	1.837321
Log likelihood	-27.09225	Hannan-Quinn criter.	1.481727
F-statistic	37.93336	Durbin-Watson stat	1.670079
Prob(F-statistic)	0.000000		

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*Source: Author's EViews 9 Computation*