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**ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
DEPARTMENT OF ACCOUNTING AND FINANCE**

**DETERMINANTS OF LIQUIDITY RISK: EVIDENCE FROM
ETHIOPIAN PRIVATE COMMERCIAL BANKS**

A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Accounting and Finance.

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Addis Ababa, Ethiopia

Statement of Declaration

I declare that the thesis entitled: Determinants of liquidity risk: Evidence from Ethiopian private commercial banks, hereby submitted by me in partial fulfillment of the requirements for the Degree of Master of Science in Accounting and Finance at Addis Ababa University, is my original work and has not been presented for the award any degree in any other University or institution. I have undertaken it independently with the advice of my advisor, Habtamu Birhanu (PhD). In performing the thesis I have used different sources and material which have been properly acknowledged.

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Statement of Certification

This is to certify that the thesis prepared by **Kinfe Tuga**, entitled: “**Determinants of Liquidity Risk: Evidence from Ethiopian Private Commercial Banks**” and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Accounting and Finance complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ABBREVIATIONS AND ACRONYMS

AbB	Abay Bank
AB	Awash Bank
BrIB	Birhan International Bank
BIS	Bank for International Settlement
BOA	Bank of Abyssinia
BuIB	Bunna International Bank
CBE	Commercial Bank of Ethiopia
CBO	Cooperative Bank of Oromia
CLRM	Classical Liner Regression Model
DB	Dashen Bank
GDP	Gross Domestic Product
LEV	Leverage
LG	Loan Growth
LIR	Lending Interest Rate
LM	Lagrange Multiplier
lnTA	Natural Logarithm of Total Asset
LR	Liquidity Risk
LIB	Lion International Bank
M2	Money Supply
NBE	National Bank of Ethiopia
NIB	Nib International Bank
OIB	Oromia International Bank
OLS	Ordinary Least Square

OPIN	Operational Inefficiency
OWN	Ownership
RGDP	Real Gross Domestic Product Growth
ROA	Return on Assets
TNG	Tangibility
UB	United Bank
VIF	Variable Inflation Factor
WB	Wegagen Bank
ZB	Zemen Bank

Abstract

Risk is part and parcel of banking business. This study examines to find out the determinants of liquidity risk in Ethiopian private commercial banks. The study identifies some of bank specific and macroeconomic determinants that influence liquidity risk of private commercial banks in Ethiopia based on empirical literature review. The study used a sample of thirteen private commercial banks covering the period from 2000 to 2017 year financial statements with unbalanced panel data. Financing gap to total asset ratio was used as proxy for liquidity risk. The random effect regression technique and correlation analysis was used to analyze the data using the econometric package STATA version 13 software. The random effect regression revealed that from bank specific explanatory variables loan growth, return on asset, leverage and operational inefficiency have significant influence on private commercial banks liquidity risk. Lending interest rate and money supply growth also have significant impact on liquidity risk of Ethiopian private commercial banks from macroeconomic variable. However, according to the study size of the bank, tangibility and real GDP growth rate are not power full variable to influence liquidity risks of Ethiopian private commercial banks. Finally, each commercial bank should consider the fluctuation of loan growth, return on asset, leverage, operational inefficiency, lending interest rate and growth in money supply in their respective liquidity risk policy as a framework to control liquidity risk.

Keywords: *Bank Specific, Ethiopian Private Commercial Banks, Liquidity Risk and Macroeconomic.*

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The health of financial sector is a cornerstone for the overall economic development of a country. Banks' health reflects to a large extent the health of their borrowers, which in turn reflects the health of the economy as a whole (Das & Ghosh, 2007). A strong financial system promotes investment by financing productive business opportunities, mobilizing savings, efficiently allocating resources and makes easy the trade of goods and services.

The banking sector is the driving engine of the economic growth for the emerging market economies. Financial stability and security are the important and crucial components of the banking sector. Banking in modern economies is all about risk management because the economic repercussions of a bank failure could be catastrophic on the entire financial system. Unsound risk management practices governing bank lending played a critical role in recent episodes of financial turmoil (Thiagarajan, et al., 2014).

In 21st century business environment is added multifaceted and intricate than ever. The majority of businesses have to treat with uncertainties and qualms in every dimension of their operations. Without a doubt, in the present-day's unpredictable and explosive atmosphere all banks are in front of a hefty risks like: credit risk, liquidity risk, operational risk, market risk, foreign exchange risk, and interest rate risk, along with others risks, which may possibly intimidate the survival and success of the bank's (Ali, et al., 2011).

Commercial banks play a fundamental role in the economy by undertaking intermediation functions. Banking business involves receiving funds from the public by accepting demand, time and saving deposits or borrowing from the public or other banks, and using such funds in whole or in part for granting loans, advances and credit facilities and for investing funds by other means (Asteway, 2017). Banking industry in Ethiopia was dominated until very recently by the public owned commercial banks namely Commercial Bank of Ethiopia and Development Bank of Ethiopia. The sector was opened for private investors since the 90s. Since then some 18 banks have been established and have been a significant engine for the growing economy (Tilahun & Dugassa, 2014).

Although there is no universal agreed risk classification, according to Ali, et al., (2011) there are two major categories of business risks, namely: financial risk that refers to losses arising from financial variables and non-financial risks concerning losses arising from variables that have impact on the operations of a business.

Liquidity represents the ability of banks to provide liquid funds for payment of due and withdrawn deposits in order to fund asset growth and business operations, as well as to settle other foreseen and unforeseen financial obligations (Milic & Solesa, 2017). Belaid, et al., (2016) defined liquidity risk as the likelihood that the demand for cash by the customers of banks exceeds the bank's ready supply of cash. According to Bank in Settlement (2008), liquidity is the ability of bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses.

Liquidity creation is the main concerns of commercial banks because it is crucial for its existence. It is known that the banking sector plays an important role in the economic growth of a country. This is made through matching surplus economic units with deficit economic units. However, this fundamental role of banks in the 'maturity transformation' of short term deposits into long term loans make banks inherently vulnerable to liquidity risk, both of an institution specific nature and that which affects markets as a whole (Liza, 2018).

This paper focused on determinants of liquidity risk in Ethiopian private commercial banks. The existing empirical literature shows that two classes of banks' financial risk determinant. One strand of literature identifies internal variable as a determinant of banks liquidity risk which are unsystematic. Whereas, the other is external variable which affect all banks systematically like macroeconomic variables and regulation.

1.2 Statement of the Problem

The banking sector plays a vital role in an economy by engaging as an intermediary between surplus and deficit units, respectively, other than playing a pivotal role in the execution of different valuable activities on both sides of the balance sheet. The statement of financial position supplies very important information to interested stakeholders. For instance, the assets side, besides other current and fixed assets, includes loans of the banks while the liabilities side show deposits made by the customers, among other things (Shah, et al., 2018).

Global financial crises since 2007 which began from United State damage the world economy. At that time financial institution written off losses of worth billions of dollars which forced them to decrease their employees and the government also incurred a loss in subsidizing these financial institutions. As liquidity problems of some banks during this global financial crisis showed, liquidity is very important for functioning of financial market and the banking sector (Vodova, 2013).

Unless the banking sector in Ethiopia should have strong financial risk detection and handling mechanism, it is a matter of time the collapse of the banking sector will leads to the collapse of the whole economy as it has seen in Europe and America (Tewodros, 2013). Therefore, studding liquidity risk in banks is not only important for banking industry but also for the economy as a whole. The main reason behind this attention is that a liquidity shortage at one so called “too big to fail” banking institution can lead to systemic contagion and financial instability. Also, a bank with an appropriate liquidity level will be able to meet its obligations, even in difficult times as bank runs. From this perspective, a “comfortable” liquidity level decreases the risks of failure which may reduce the funding costs and improve the profitability (Belaid, et al., 2016).

In order to safely and successfully run the business operations and to build healthy relations with the stakeholders, the banks as intermediaries, should manage the supply and demand of the liquidity. If the firm fails to manage liquidity then it may leads to certain irregular exposures i.e. the risk to maintain the high bank reserve, high interest rate risk and the risk to decrease the reputation of banks (Ismal, 2010). The liquidity problem might arise in the banks either due to mismanagement of funds or volatile withdrawals of funds by the depositor at the time of unfavorable economic conditions in the society. The global financial crunch (2007-2008) also arises when the banks are failed to provide the liquidity to the depositor and third parties. Therefore, to manage the liquidity positions in the banks are extremely difficult and challenging in the current unusual external influencing environment along with the competitive economic conditions (Ahmed, et al., 2011).

As stated by Tilahun & Dugassa (2014) and Emawayeh (2017), the NBE conducted a survey in 2009 aimed to identify status of risk management practice to address weaknesses. Questionnaires were distributed for a sample of fifteen Ethiopian commercial banks. The report revealed that credit, liquidity and operational risks were key bank risks over the past years and would continue

to be so over the next five years. But, the study did not list the factors that affect financial risk of Ethiopian banks and recommend the banks to identify their financial risk determinants. Therefore, identifying the factors that determine liquidity risk of Ethiopian banks is open for empirical analysis.

Various scholars such as Akhtar, et al., (2011); Belaid, et al., (2016); Cucinelli, (2013) and Yaacob, et al., (2016) have studied about determinants of liquidity risk but in Ethiopia few studies (Zagwe, 2018; Samuel, 2015; Tseganesh, 2012 and Mulualem 2018) were made. Most of them overlooked studying on the determinants of banks liquidity risk directly since the approach was to study points like the relationship between liquidity and performance of banks. Studies like Tirualem (2009) and Tsion (2015) study the liquidity risk management practice using primary data (questionnaires and interview) and the studies disregard the determinants of liquidity risk. A study by Emawayeh (2017) on by the determinants of financial risk on private Ethiopian commercial banks, Belete (2015) on factors affecting liquidity of selected commercial banks and another study by Liza (2018) on determinants of liquidity risk of commercial banks of Ethiopia hence, proxies used by those researchers were only liquidity ratios. And all the studies made on sample commercial banks operate more than ten years which ignore commercial banks with less than ten years' experience.

Since the financial sector variables are affected by lots of internal and external variables, this study investigates major liquidity risk determinants directly from a wide range of variables in an objective manner. These variables categorized into bank specific variables and macroeconomic variables. These enable to see the picture surrounding liquidity risks of private commercial banks in Ethiopia since this study includes thirteen private commercial banks and to have a clear cut liquidity risk determinants in Ethiopian private commercial banks.

1.3 Objective of the Study

General Objective

The general objective of the study is to identify determinants of liquidity risk in Ethiopian private commercial banks.

Specific Objectives

Specifically, this study addresses the following objectives:-

- To examine the impact of bank size on liquidity risk of Ethiopian private commercial banks
- To examine the effect of return on asset on liquidity risk of Ethiopian private commercial banks
- To examine the impact of tangibility on liquidity risk of Ethiopian private commercial banks
- To examine the impact of loan growth on liquidity risk of Ethiopian private commercial banks
- To examine the impact of leverage on liquidity risk of Ethiopian private commercial banks
- To examine the impact of operational inefficiency on liquidity risk of Ethiopian private commercial banks
- To examine the impact of real GDP growth rate on liquidity risk of Ethiopian private commercial banks
- To examine the impact of lending interest rate on liquidity risk of Ethiopian private commercial banks
- To examine the impact of money supply growth on liquidity risk of Ethiopian private commercial banks

1.4 Significance of the Study

The study beyond serving the academic purpose it will have the following contributions:-

- It helps the private banks to identify major factors that determine liquidity risk and, give attention for factors which higher liquidity risk and enables them to take corrective actions.
- It provides valuable information for the regulatory body (NBE) in their policy framing regarding with liquidity position of commercial banks.
- It serve as a reference material for anyone who will undertake a further study on the same or related topic

1.5 Research Hypothesis

The following research hypotheses were developed in order to address the research objectives. Therefore to examine the determinants of liquidity risk of Ethiopian private commercial banks, the following research hypotheses were tested.

Hp1: Bank size has a significant positive influence on liquidity risk

Hp2: Loan growth has a significant positive influence on liquidity risk

Hp3: Return on asset has a significant positive influence on liquidity risk

Hp4: Tangibility has a significant positive influence on credit risk

Hp5: Leverage has a significant positive influence on liquidity risk

Hp6: Operational inefficiency has a significant positive influence on liquidity risk

Hp7: Real GDP growth has a significant positive influence on liquidity risk

Hp8: Lending interest rate has a significant negative influence on liquidity risk

Hp9: Money supply growth has a significant negative influence on liquidity risk

1.6 Scope of the Study

The scope of the study is restricted to the assessment of the bank specific and macro-economic factors affecting banks liquidity risk of private commercial banks registered by NBE. The scopes of the study also include thirteen private commercial banks. In this study the researcher consider eighteen fiscal years i.e. from 2000 to 2017 for six banks those start operation before 2004 namely Awash Bank, Bank of Abyssinia, Dashen Bank, Wegagen bank, United bank and Nib International bank; and for the rest of seven banks starting from their beginning operation year to 2017 were considered in this study with unbalanced panel data. The study didn't include government owned bank. In addition, since it is not possible to incorporate all factors that affect liquidity risk in one study, only six bank-specific and three macroeconomic determinants are included in this study.

1.7 Organization of the Study

The research is organized under five chapters. The first chapter includes background of the study, statement of the problem, research objectives, significance of the study, scope and limitation of the study, and organization of the research report. The second chapter is the review of theoretical and empirical literature, and conceptual framework. The third chapter deals with methodology of the study. The fourth chapter deals with result and discussion. The last chapter includes conclusion and recommendation.

CHAPTER TWO: LITRATURE REVIEW

2.1 Introduction

A risk can be defined as an unplanned event with financial consequences resulting in loss or reduced earnings. An activity which may give profits or result in loss may be called a risky proposition due to uncertainty or unpredictability of the activity of trade in future. In other words, it can be defined as the uncertainty of the outcome (Shodhganga, 1997).

As cited by Sahlemichael (2009) Basle committee on banking supervision states that risk is a fact of life in every business and if not managed properly, would adversely affect the very existence of any businesses. However, the damage could be more severe in the case of banks as banking business is not only a stake of the owners but also that of depositors (public), other banks and hence, the economy as a whole. The main risks facing banks are credit risk, market risk, liquidity risk and operational risk.

Commercial banks are profit-making organizations acting as intermediaries between borrowers and lenders attracting temporarily available resources from business and individual customers as well as granting loans for those in need of financial support. From this point of view, banks deal with money belonging to persons and other firms assuming a number of risks by performing their activities. Thus, risk is the possibility that a loss will occur and for any businesses it is a part of every decision. In fact, the essence of business decision making is comparing the gains and potential risks involved (Driga, 2012).

2.2 Liquidity Risk

According to Bank in Settlement (2008), liquidity is the ability of bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses. Liquidity risk is sometimes also referred to as a sub-category of market risk related to bank ability to fulfill their obligations in meeting demands from depositors for withdrawal of their deposits (Yaacob, et al., 2016). A risk that represents about an investment that has less marketability or that cannot be sold early in order to protect from potential loss is named s liquidity risk. The point and time when certain liquidity featured investment pinches to face subordinate composition against these investments are elaborated as investment under liquidity risk. Liquidity risk forces entire entity

to execute alternative decision rather than investment conversion into cash. Liquidity risk parameters are widely investigated scientifically (Iqbal, et al., 2015).

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 liquidity risk: funding liquidity risk and market liquidity risk. Funding liquidity risk is the risk that the bank will not be 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 (Vodova, 2013).

Liquidity of an asset is its ease of convertibility into cash or a cash equivalent asset. Liquidity risk arises from the difficulty of selling an asset quickly without incurring large losses. For a banking and financial firm “liquidity risk includes both the risk of being unable to fund [its] portfolio of assets at appropriate maturities and rates and the risk of being unable to liquidate a position in a timely manner at reasonable prices.” Sometimes it is defined in terms of maturity mismatch between assets and liabilities while at others it is defined in terms of asynchronous timing of cash inflows and cash outflows from the business (Ali, 2004, p. 2).

Provision for adequate liquidity in a bank is crucial because a liquidity shortfall in meeting commitments to other banks and financial institutions can have serious repercussions on the bank’s reputation and bank’s bond prices in the money market. Liquidity risk can sometimes lead to a bank run, where depositors rush to pull out their money from bank, which aggravates the situation (Perez, 2014). Assuring a better bank liquidity risk management has been a focus of regulatory and supervision institutions and international financial stability institutions. One recent regulatory reform have been provided by the Basel III framework which addresses the vulnerabilities that caused the financial crisis by strengthening bank capital and liquidity standards with the aim of having a more resilient banking sector (Belaid, 2016). The Committee highlighted the importance of good liquidity risk management and defined two new ratios to measure liquidity risk: the liquidity coverage ratio as a measure of short-term liquidity risk and the net stable funding ratio to measure long-term liquidity risk. In literature there are a lot of contributions on liquidity risk management that apply very different measures of liquidity risk (Cucinelli, 2013).

There are many factors that affect banks own liquidity and in turn affect the amount of liquidity they can create. These factors have a varying degree of influence on the balance between liquidity risk and liquidity creation, or a bank's liquidity management. A bank's assets and liabilities play a central role in their balancing of liquidity risk and liquidity creation. A bank's liabilities include all the banks sources of funds. Banks have three main sources of funds: deposit accounts, borrowed funds, and long-term funds. The amounts and sources of funds clearly affect how much liquidity risk a bank has 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. Liquidity is necessary for banks to compensate for expected and unexpected balance sheet fluctuations and to provide funds for growth (Tsiou, 2015).

2.3 Theories of Liquidity and Liquidity Management

Theories of liquidity management are based either on the management of assets or liabilities. There are three theories based on the management of asset as commercial loan theory, the shift ability theory, the anticipated income theory and one theory based on the liabilities is called liability management theory (Shodhganga, 1997).

Commercial Loan Theory

This theory maintains that a commercial bank's liquidity would be assured as long as assets were held in short term loans that would be liquidated in the normal course of business. Banks are expected to finance the movement of goods through the successive stages of production to consumption or what would be called today as inventory or working capital loans. Also, the theory assumes that repayment from the self-liquidating assets of the bank would be sufficient to provide for liquidity. This ignores the fact that seasonal deposit withdrawals and meeting credit request could affect the liquidity position adversely. Moreover, the theory fails to reflect in the normal stability of demand deposits in the liquidity consideration. This obvious view may eventually impact on the liquidity position of the bank. (Zagwe, 2018).

The Shift ability Theory of Liquidity

The shift ability theory is based on the proposition that the assets the banks hold are either to be sold to other lenders or investors or shifted to central bank which stands ready to purchase assets offered for sale. A commercial bank would be able to meet the liquidity needs if it has assets to

sell (Mugenyah, 2015). The shift ability theory held that banks could most effectively protect themselves against massive deposit withdrawals by holding, as a form of liquidity reserve, credit instruments for which there existed a ready secondary market. Included in this liquidity reserve were commercial paper, prime bankers' acceptances and, most importantly as it turned out, Treasury bills. Under normal conditions all these instruments met the tests of marketability and, because of their short terms to maturity, capital certainty. The shift ability theory was enhanced during the 1930's and 1940's by the rapid growth in volume of short-term U. S. Government obligations (Diamond, 1984).

The Anticipated Income Theory

The Anticipated Income theory holds that liquidity can be ensured if scheduled loan payments are made on future income of the borrower. This theory relates loan repayment to income than rely on collateral. This theory also holds that a banks liability can be influenced by the maturity pattern of loans and investment portfolios. The theory recognized that certain types of loans have more liquidity than others (Ibe, 1991). This theory holds that a bank's liquidity can be managed through the proper phasing and structuring of the loan commitments made by a bank to the customers. Here the liquidity can be planned if the scheduled loan payments by a customer are based on the future of the borrower. According to Nzotta (1997) the theory emphasizes the earning potential and the credit worthiness of a borrower as the ultimate guarantee for ensuring adequate liquidity. Ibe (1991) posits that the theory points to the movement towards self-liquidating commitments by banks. This theory has encouraged many commercial banks to adopt a ladder effects in investment portfolio.

The Liability Management Theory

The liability management theory holds that banks can meet their liquidity requirement by bidding in the market for additional funds to meet loan demand and deposit withdrawal. The large money markets started the practice which later spread throughout U.S. The roots of the theory can be traced to the rejuvenation of federal funds markets in the 1980's and development of negotiable time deposits as a major money market instrument. Banks in U.S rely for liquidity on federal funds market, Euro dollar market or sale of loan participation certificates. Such borrowing came to be called to be known as liability management (Mugenyah, 2015).

2.4 Determinants of Liquidity Risk: Empirical Evidence

The risks that are faced by businesses can be categorized into financial and non-financial risks. Both of these types of risks are very vital in order to safely run any business (Ali, et al., 2011). Commercial banks are profit-making organizations acting as intermediaries between borrowers and lenders attracting temporarily available resources from business and individual customers as well as granting loans for those in need of financial support. From this point of view, banks deal with money belonging to persons and other firms assuming a number of risks by performing their activities. Thus, risk is the possibility that a loss will occur and for any businesses it is a part of every decision. In fact, the essence of business decision making is comparing the gains and potential risks involved (Driga, 2012).

In broad meaning, the financial risk is defined as any fluctuation in the cash flows, financial results and the company's value due to the influence of different types of factors; mainly market ones, such as: interest rates, exchange rates, and commodity and stock prices. So, according to this definition financial risk is responsible for any changes in the financial condition of the company (Blach, 2010).

The liquidity risks in banking sector are determined by a number of factors. As indicated by a number of literatures like Abdulganiyy (2017), Vodova (2013) and Waemustafa & Sukri (2015) it can be classified as bank specific (unsystematic risk) and macroeconomic (systematic risk) determinant of liquidity risk. Bank specific determinants of liquidity risk are unique to individual banks such as return on asset, size of the bank in terms of asset, liquid asset, capital, leverage, tangibility, age of bank, operational inefficiency and others. Moreover, liquidity risk of firms also highly influenced by macroeconomic conditions like unemployment rate, inflation rate, real GDP as a measure of economic growth, public expenditure, broad money supply, exchange rate, lending interest rate and financial stability (financial crises in 2009 & 2010).

In addition, according to Woods and Dowd (2008) there are two main categories of risks that affect a company's cash flows and/or cost of capital:

1. Firm-specific risk: also known as diversifiable or unsystematic risk. These risks are specific to the particular activities of the company such as fire, lawsuits and fraud. The

company can manage many sources of these risks with adequate internal controls and other risk management techniques.

2. Market-wide or systematic risk: risk that cannot be diversified away and is measured by beta. It is about macroeconomic conditions which affect each companies and it is our said the control of each company, including changes in interest rates, GDP, exchange rates and commodity prices. These risks can be managed using derivative contracts and other financial risk management tools.

2.4.2 Bank Specific Determinants of Liquidity Risk in Banking Sector

Bank Size

Including financial risk determinants research in a number of studies bank size is represented by natural logarithm of total asset. Size of the bank is important that will help to understand risks that are unstable when a firm grows. Size of the bank can be a momentous determinant of bank's position for the fact that it affects both the ease of access to liquidity and costs (Ali, et al., 2011). According to Estrada (2011) as size grows it will help them to overwhelm the risk which is similar to economies of scale but also is should be noted that as a firm grow it may leads to failures. This is argued as most of the time a growing business is supported by debt which rise risk and finally it threatens both the creditor and lender. Size growth combined with rising debt can lead to colossal failures. In addition when the size is based on the consistency of the networks (networks) (as large supply chains), risks in the chain may contribute to higher costs maintenance of industrial and financial organizations. Therefore grow in size can also exposed to increasing risks.

Bank size is taken as bank specific variable in a number of studies done on liquidity risk and these studies try to relate size of the bank with the above respective risk. Gilbert (2013), Belaid, et al., (2016), Akhtar, et al., (2011), Abdulganiyy, et al., (2017) and Cucinelli (2013), Ahmed, et al., (2011), Iqbal, et al., (2015), Shaikh (2015) and Vodova (2013) take bank size as natural logarithm of total asset (lnTA) as one determining variable of liquidity risk and try to relate one way or another liquidity risk with bank size. The next paragraphs below try to show the results of the studies in drawing relationship between liquidity risk and banks asset size.

In studying liquidity risk determinants, Ahmed, et al., (2011) an empirical study on liquidity risk and Islamic banks in Pakistan was carried out. The study takes six banks of Pakistan providing services as pure Islamic banks and investigates the determinants of liquidity risk over the period of 4 years from 2006 to 2009. The study found that size of the bank has insignificant negative relation with liquidity risk. Similarly, Mugenyah (2015) study made on determinants of liquidity risk in commercial banks of Kenya reveals that size of the bank had insignificant negative impact on liquidity risk.

A study by Shen, et al., (2009) on bank liquidity risk and performance in twelve advanced economies (Australia, Canada, France, Germany, Italy, Japan, Luxembourg, Netherlands, Switzerland, Taiwan, United Kingdom and United States); revealed that the relationship between size and liquidity risk is significantly positive, while the square of size and liquidity risk is significantly negative. Having this result researchers argue that large banks believe too big to fail. Thus they have incentive to increase risk-taking and hold more loans and consequently have larger financing gap ratio. However, over limit point the effect of size becomes negative. Thus, the effect of size on liquidity risk is non-linear which is similar to economies of scale.

Another study by Iqbal, et al., (2015) on impact of liquidity risk on firm specific factors in a case of Islamic banks of Pakistan. The study includes four Islamic banks that covers thirteen years from 2001 to 2013 and analyze multivariate regression analysis. And finally the study found that bank size had significant negative relation with liquidity risk.

Loan Growth

Loan growth and bank liquidity the loans & advances portfolio is the largest asset and the predominate source of revenue of banks. According to Muranaga, and Ohsawa, (2002), lending is the principal business activity for banks. Since loans are illiquid assets, increase in the amount of loans means increase in illiquid assets in the asset portfolio of a bank. The amount of liquidity held by banks is heavily influenced by loan demand and it is the base for loan growth (Basel, 2011). If demand for loans is weak, then the bank tends to hold more liquid assets whereas, if demand for loans is high they tend to hold less liquid assets since long term loans are generally more profitable (Liza, 2018).

Generally loans are considered as illiquid assets and generate higher revenue to banks. Therefore, the increase in loan means increase in illiquid assets and decrease in short term/liquid assets. A research by Vodova (2013) on liquidity of Hungary and Slovakia commercial banks and its determinants result shows that there negative relationship with liquidity within 1% level of significance. This implies loan growth has positive relationship with liquidity risk.

Capital Adequacy

According to Ayele (2012) as cited by Mugenyah (2015), capital adequacy is a measure of a bank's financial strength, in terms of its ability to withstand operational costs and fund liquidity. The study suggest that the regulatory requirement on the minimum capital required to be maintained by banks, the ratio of core capital to customer deposits as measure of capital adequacy to be a significant determinant of liquidity risk. Capital adequacy also indicates the ability of bank to undertake additional business. The size of capital provides financial flexibility for bank and financial institution. Capital adequacy is selected as bank specific determinants of liquidity risk in different studies like Abdulganiyy, et al., (2017), Cucinelli (2013), Mugenyah (2015) and Vodova (2013).

Vodova (2013) a research carried out on determinants of commercial banks liquidity in Hungary which covers the period from 2001 to 2010 include both bank specific and macroeconomic variables. The study found the result that reveals capital adequacy had significant positive effect on liquidity. Bank liquidity increases with the higher capital adequacy of banks as we have expected, solvent banks are liquid as well.

A study by Abdulganiyy, et al., (2017), on determinants of liquidity risk in dual and fully Islamic banking sector evidence from Malaysia and Sudan. Three banks in each of the countries from 2004 and 2015 were used for the study. Using Ordinary Least Regression Analysis (OLS) and panel data analysis techniques, the authors conclude that the different environment the Islamic banks operate determines the significance of liquidity risk determinants. Finally the study reveals that capital adequacy have significant negative impact on liquidity risk in Malaysian Islamic banks but insignificant positive impact in Sudanese Islamic banks.

Mugenyah (2015) a study on determinants of liquidity risk of commercial banks in Kenya. The study includes all 43 commercial banks licensed in Kenya between 2010 to 2014. Multiple

regression analysis was used to evaluate the determinants of liquidity risk. The coefficient of determination R^2 for the regression model was found to be 0.185, indicating that the model had a moderate explanatory power. This study found that capital adequacy had a positive effect on liquidity risk, suggesting that banks with a high ratio of core capital to customers deposit would experience higher liquidity risk. The effect of capital adequacy on liquidity risk was found to be statistically significant at 5% level since the significance probability (p-value) of 0.008 is less than 0.05.

Another study by Cucinelli (2013), on determinants of bank liquidity risk within the context of Euro area composed a sample of 1080 listed and non-listed Eurozone banks and the methodology applied in the analysis is OLS regression based on panel data. He found liquidity risk has positive and insignificant relationship with capital adequacy. Whereas, a study by Ali, et al., (2011), on liquidity risk management: a comparative study between Conventional and Islamic Banks of Pakistan found that capital adequacy ratio in conventional banks significant positive relation with liquidity risk at 10% level of significant where as positive and insignificant in Islamic banks.

In general capital is a means of offsetting risk because it can cover losses. In the measurement of risk and capital adequacy, most attention has been paid to measurement of possible losses in income. Yet the measurement of current and projected net worth should play a role as or even more significant than that of possible losses. Furthermore, the difficulties of measuring net worth are as great, or even greater. A key factor in total risk is the real or economic value of a bank's capital and those non income forces which will cause it to differ at the next evaluation. Because many gains or losses in the value of assets and liabilities are taken into the books only over time rather than when they occur, and because many intangibles are never recorded, the economic value of capital often varies greatly from that shown on a bank's books (Tewodros, 2013).

Return on Asset

According to Iqbal, et al., (2011) a study on impact of liquidity risk on firm specific factors in the case of Islamic banks in Pakistan to develop a model and to test the relationship among liquidity risk and firm performance through its facets. Form the result return on asset had positive and significant impact on liquidity risk with 1% level of significance.

A study by Ahmed et al. (2011), on liquidity risk in Pakistan Islamic banks found explanatory variable profitability, measured in terms of return on asset; beta is 0.203 with the positive coefficient sign. However, profitability is not statistically significant with p-values of 0.195. However, a comparative study between conventional and Islamic banks of Pakistan on liquidity risk management by Akhtar et al. (2011) covering the same period with above study 2006 up to 2009 liquidity risk has significant positive associated with return on assets in Islamic banks with approximately 90% confidence level but insignificant in conventional banks.

Loan Loss Provision

In making loans, banks face the risk that borrowers will default and the full amount of the loan may not be recovered. When a loan loss becomes likely, a bank will make a charge to the profit and loss statement (“provision”) to create a loan loss reserve that is shown on the balance sheet. When the full amount of principal and interest on the loan becomes uncollectible, the loan balance is reduced through a charge to the loan loss reserve (Angklomkiew, et al., 2009).

Cucinelli (2013) studied the determinants of bank liquidity risk within the context of Euro area to analyze the type of relationship that exists between liquidity risk, measured with the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR), and some specific bank structure variables. The sample is composed of 1080 listed and non-listed Eurozone banks and the methodology applied in the analysis is OLS regression based on panel data. The OLS regression result shows that loan loss provision has positive significant influence on liquidity risk measured with the LCR but negative and insignificant influence on liquidity risk measured with the NSFR.

Another study by Thong (2013) on factors affecting liquidity risk in the system of Vietnamese commercial banks was done. The research covers from 2002-2011 annual reports of 27 Vietnamese commercial banks. The study used financing gap to measure liquidity risk. Finally the regression result reveals that loan loss provision ratio has positive and insignificant relationship with liquidity risk.

Operational Inefficiency

This ratio indicates how successfully banks manage internally their assets and liabilities in hedging against their risk dimensions (Gilbert, 2013). This variable will explain how well a bank workout its assets and liabilities internally in order to successfully manage their risk dimensions.

A study by Shakih (2015) on panel data estimation of liquidity risk determinants in Islamic banks in the case of Pakistan was carried on. This study covers 7 years data from 2007 to 2013 for 5 Islamic banks in Pakistan and the study used ratio of total cash to total asset for measuring liquidity risk. The fixed effects regression result reveals that operational inefficiency has significant effect on liquidity risk with the p-value of 0.058 within 10% level of significance.

Another study by Moussa (2015) on determinants of bank liquidity in the case of Tunisia done on eighteen banks from 2000 to 2010 period through static panel and method of panel dynamic. The study regression result presents that operational inefficiency (measured by the ratio of operating expense to total asset) has negative significant impact on liquidity of Tunisian banks. Which indicates direct relationship with liquidity risk.

Tangibility

Tangibility is defined as the ratio of fixed asset to total asset. The study by Ahmed (2011) on liquidity risk and Islamic banks evidence from Pakistan reveals that tangibility has negative and insignificant relationship with liquidity risk but if there is massive increase in the proportion of fixed asset to total asset, it may affect the liquidity position of the bank. When fixed asset higher it will results higher liquidity risk.

Leverage

Leverage results from using borrowed capital as a funding source when investing to expand the firm's asset base and generate returns on risk. Leverage is an investment strategy of using borrowed money specifically, the use of various financial instruments or borrowed capital to increase the potential return of an investment. Leverage can also refer to the amount of debt a firm uses to finance asset (Investopedia definition).

Ahmed et al. (2011) study seeking to investigate the firm's level determinants of liquidity risk of listed Islamic banks of Pakistan. For this purpose, liquidity risk is used as dependent variable

while, leverage is used as independent variable. The result reveals, among other things, leverage is important determinant to define liquidity risk of Islamic banks of Pakistan at 5% level of significance and positive relation with liquidity risk. According to Iqbal, et al., (2011) a study on impact of liquidity risk on firm specific factors in the case of Islamic banks in Pakistan to develop a model and to test the relationship among liquidity risk and firm performance through its facets. The study has found that leverage has positive and insignificant effect on liquidity risk. Both studies define leverage as the ratio of debt to total asset.

Another study by Mugenyah (2015) on determinants of liquidity risk of commercial banks in Kenya. . The study targeting all 43 commercial banks licensed in Kenya between 2010 to 2014. The research measures leverage as the ratio of total shareholders fund to total asset. And finally the research reveals that leverage and liquidity risk has significant and negative relationship. And the study concludes that highly levered commercial banks would experience lower liquidity. This happens because of opposite proxy used for leverage when we compare with the above two studies.

Age of the Bank

According Ahmed, et al., (2011) define age of the bank as the difference between establishment year and observation year. A research by Ahmed, et al., (2011) seeks to investigate the firm's level determinants of liquidity risk of listed Islamic banks of Pakistan. For this purpose, liquidity risk is used as dependent variable while size, tangibility of assets, leverage, profitability and age are employed as independent variables. The results show that leverage, tangibility and age are the important determinants of liquidity risk of Islamic banks of Pakistan. Surprisingly, the results predict that explanatory variables size and profitability are not powerful explanatory variables to define the liquidity risk of Islamic banks of Pakistan. Age of the bank has positive and significant relationship with liquidity risk within 5% level of significance. Another study by Emwayeh (2017) a research on determinants of financial risk of private commercial banks of Ethiopia, has found age to be significant and negative relationship with liquidity risk at 1% level of significance.

2.4.3 Macroeconomic Determinants of Liquidity Risk in Banking Sector

Macroeconomic imbalances and sector wide shocks are another avenues giving rise to liquidity risk. These factors are particularly important in developing countries. Excessive government borrowing from domestic markets and banks increases cost of funding for the banks. In many restrictive environments it gives rise to financial repression where banks are required to finance government expenditures at less than the market price. (Ali, 2004, p. 6)

As explained earlier macroeconomic factors are important determinants of liquidity risk. Cucinelli (2013); Yaacob, et al. (2016);. Vodová (2013); Milic & Solesa (2017); Sheefeni & Nyambe (2016) and Abdulganiyy, et al., (2017) indicated that macroeconomic variables should be included into liquidity risk analysis of banks since they have considerable influence on the changes of liquidity risk of banks. Macroeconomic factors include the inflation rate, the employment rate, growth in gross domestic product, stock index, monetary policy, lending rate, exchange rate movements, and conjuncture fluctuations in the economy.

Gross Domestic Product (GDP)

Gross domestic product (GDP) is the monetary value of all the finished goods and services produced within a country's borders in a specific time period. GDP includes all private and public consumption, government outlays, investment, private inventories, paid-in contraction costs and the foreign balance of trade. GDP is commonly used as an indicator of the economic health of a country, as well as a gauge of a country's standard of living.

While in studying liquidity risk determinants, Abdulganiyy, et al., (2017), a study to compare the determinants of liquidity risk of Islamic banks in the two environments of full Islamic banking scheme and dual banking system. The researchers used samples of Islamic banks in Sudan and Malaysia to represent the two banking environment. Data sourced from Islamic Banks Information System provided by Islamic Research and Training Institute for three banks in each of the countries from 2004 and 2015 was used for the study. Using Ordinary Least Regression Analysis (OLS) and panel data analysis techniques, the authors conclude that the different environment the Islamic banks operate determines the significance of liquidity risk determinants. Finally the study reveals GDP has insignificant positive relationship with liquidity risk in Malaysia and insignificant negative relation in Sudan.

Another study by Cucinelli (2013) on determinants of bank liquidity risk within the context Euro area results have found that GDP has positive and significant impact on liquidity risk within 5% level of significance. Similarly, Vodova (2013) a study on determinants of commercial banks liquidity in Hungary which covers the period from 2001 to 2010 using panel data regression analysis shows that GDP has positive and significant relationship with bank liquidity. Moussa (2015) also found similar result.

Lending Interest Rate

Lending interest rate is the bank rate that usually meets the short and medium term financing needs of the private sector. This rate is normally differentiated according to creditworthiness of borrowers and objectives of financing. The terms and conditions attached to these rates differ by country, however, limiting their comparability. According to Vodova (2013) a study determinants of commercial banks in Hungary reveals that lending interest rate has significant positive relationship with liquidity within 5% level of significance. This factors lead to higher lending activity of banks and thus reduce bank liquidity with higher correlation coefficient. The interest rate on interbank transaction has a negative impact on bank liquidity, too; however, the researcher came to the conclusion that the level of the interest rate is not the main factor which influences the incentives of banks to hold liquidity in the form of interbank deposits.

Money Supply

Regarding money supply (M2) should keep pace with economic growth; thus, an excessive supply will be the root of inflation. Abdulganiyy (2017) found a negative relationship between liquidity risk and money supply using correlation analysis. As the OLS regression reveals that money supply has positive and significant influence on liquidity risk in Sudan where as insignificant negative influence in Malaysia.

According Thong (2013), change in money supply through various instruments employed by the central bank can influence the liquidity of commercial banks, or in other words, a loose monetary policy may increase liquidity. On his study of factors affecting liquidity risk in the system of Vietnamese commercial banks, the regression result reveals that money supply have negative and insignificant relationship between money supply and liquidity risk.

2.5 Conclusion and Knowledge Gap

In line with the above theoretical as well as empirical review, liquidity risk is important for banking industry. It also revealed that liquidity risk of banks can be determined by different factors such as bank specific and macroeconomic. While this study focus on some of the bank specific and macro-economic factors. Hence, the selection of variables for this study is on the basis of previous studies that reviewed in the literature and the idea of the researcher and, so it focus on bank specific and macro-economic variables that determine the liquidity risk of private commercial banks in Ethiopia.

As per the review of the literature most of the empirical evidence (Belaid, et al., 2016; Akhtar, et al., 2011; Cucinelli, 2013; Abdulganiyy, et al., 2017 and Vodova 2013) on the determinant variables have been conducted with the aim of identifying factors affecting bank liquidity risk belongs to European Union, some Asian and African countries like Pakistan, Philippines, Malaysia, Sudan and Tunisia. Moreover, the literature review also reveals the existence of controversial conclusions that results from different studies made so far. Furthermore, so far as the review of the literature discloses, scanty work has been done with the objective of identifying the determinants of liquidity risk of banks in Sub Sahara African countries.

It is possible to say few or finger counted studies in Ethiopia concerning to liquidity risk but most of them disregard studying determinants of liquidity risk directly, rather studying on points like the relationship between liquidity risk and performance of banks in Ethiopia such as financial risk and profitability (Samuel, 2015 and Sori, 2014) and risk management practices (Tirualem, 2009).

Emawayeh (2017) studied the determinants of financial risk on private Ethiopian commercial banks and Belete (2015) on factors affecting liquidity of Ethiopian commercial bank, the measurement used by the researchers for liquidity risk was only liquidity ratios like loan to deposit ratio and liquid asset to total asset ratio. As Shen, et al., (2009) stated there are another ways can be used to assess bank liquidity risk besides traditional liquidity ratios and measuring liquidity risk based on the traditional liquidity ratios only was not enough. Liza (2018) on determinants of liquidity risk of commercial banks of Ethiopia made on only four banks taking 5 years data (2012 to 2016) using traditional liquidity ratios. Nigist (2015) study on determinants of liquidity of Ethiopian measuring liquidity using financing gap ratio but as stated by Shen, et

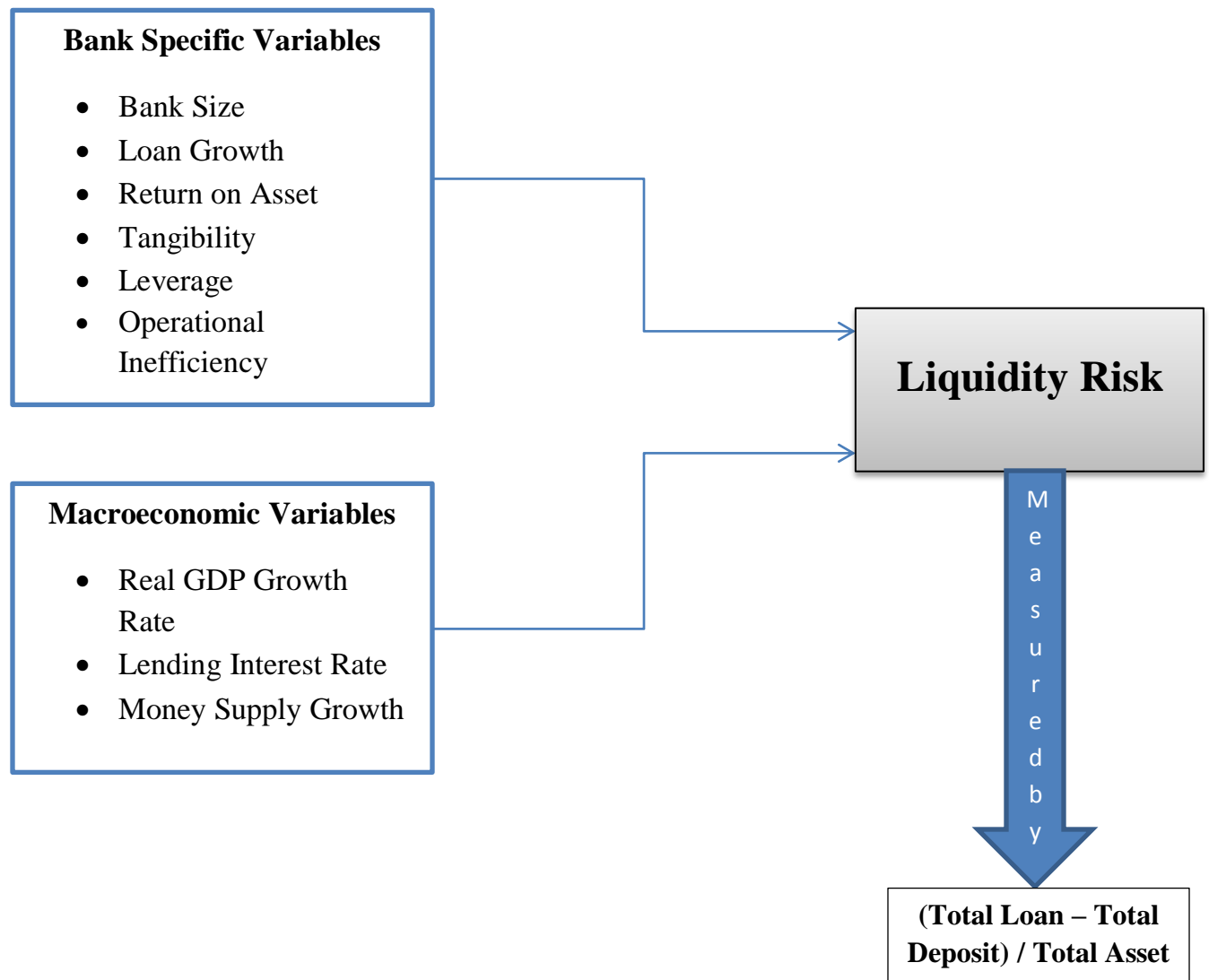
al., (2009) banks with higher financing gap ratio, the more liquidity risk the banks will suffer. However, Nigist use this ratio with the revers meaning and also the study fails to disclose the impact of some important variables on Ethiopian banks liquidity risk. Both bank specific and macroeconomic variables were analyzed by employing the balanced panel fixed effect regression model and the result of the study revealed that capital adequacy, profitability, and real GDP growth rate have negative and statistically significant impacts on liquidity of Ethiopian commercial banks while bank size has positive and statistically significant impact on liquidity. Whereas nonperforming loan, loan growth, inflation rate, and interest rate margin were found to be statistically insignificant/ has no any impact on liquidity of Ethiopian commercial banks for the tested period. And all the above researches was done by considering sample commercial banks with above ten years working experience which ignore banks with less experience.

In Ethiopia the banking industry is on the growth stage, it is important to notify the important determinants of liquidity risk by making empirical investigation on established private commercial banks. Therefore, the objective of this study is to examine the factors that affect liquidity risk of private commercial banks in Ethiopia by including 13 private commercial banks using financing gap to total asset ratio for measurements of liquidity risk as recommended by Basel Committee on Banking Supervision by including and testing new variables that are not tested by prior Ethiopian researchers.

2.6 Conceptual Frame Work

This conceptual framework describes the relationship of independent (bank specific & macroeconomic) variables and liquidity risk. Originally these are not the only variable selected based on empirical review. From the model some explanatory variables were drooped due to serious multicollinearity problem above a tolerable limit.

Figure 1: Conceptual Framework



Source: Researchers' own design

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Research Design

As a general guideline this study is based on the philosophy of positivism that strongly argues on objectivism, measurability, scientific methods and value free; and ignores belief, emotion and perception. Quantitative research is a systematic and scientific investigation of quantitative properties, phenomena's and their relationships by developing and employ mathematical models, theories and hypotheses pertaining to natural and/or social phenomena (Abiy et al., 2009). This quantitative study, beyond mathematical and statistical models application, used econometrics application. Therefore quantitative research method is used in this research which enables to see the relationship between bank specific & macroeconomic variables with liquidity risk of private commercial banks in Ethiopia.

According to Loose (1993) as cited by Nigist (2015), a deductive research approach entails the development of a conceptual and theoretical structure prior to it's testing through empirical observation. If the problem is identifying factors that influence an outcome, the utility of an intervention or understanding the best predictors of outcomes` then a deductive (quantitative) approach is best. It is also the best approach to test a theory or explanation. A mathematical multiple regression models are developed which is based on one dependent variable and two or more independent variables. Then, this mathematical model is converting to econometrics model by adding error term (ε) in the model. Finally, the collected data is inserted in to econometrics model in order to estimate econometrics model or parameters and based on these estimates the developed hypothesis are tested.

Since the study objective is to examine the effect of independent (bank specific and macroeconomic) variables on the dependent variable liquidity risk of private commercial banks of Ethiopia, it is explanatory type of research.

3.2 Data Type and Source

The study used a panel secondary data only. Since, sufficient data is obtained from secondary sources which help to achieve the study objective. The panel secondary data is quantitative in nature and encompass financial statement reports. The secondary data include audited report of

banks' balance sheet & income statement. The data obtained from banks financial statement used to determine bank specific variables that determine liquidity risk. In order to increase the credibility and reliability of the research the study used audited financial statements (balance sheet and income statement) of each banks sourced from private banks and National Bank of Ethiopia (NBE). In addition, annual economic reports also included for macroeconomic variables obtain from NBE (sourced from MoFED).

3.3 Population, Sampling Method and Sampling Frame

Population of the study: The study population/participants are all private commercial banks that existed in the fiscal year 2017/18. According to NBE (2017/18), there are sixteen private commercial banks in the year 2017/18. These are; Awash Bank S.C (AB), Dashen Bank S.C (DB), Bank of Abyssinia S.C (BOA), Wogagen Bank S.C (WB), United Bank S.C (UB), Nib International Bank S.C (NIB), Cooperative Bank of Oromia S.C (CBO), Lion International Bank S.C (LIB), Oromia International Bank S.C (OIB), Zemen Bank S.C (ZB), Buna International Bank S.C (BuIB), Birehan International Bank S.C (BrIB), Abay Bank S.C (AbB), Addis International Bank S.C (AdIB), Dehub Global Bank S.C (DGB), and Enat Bank S.C (EB).

Sampling method: This study employed purposive sampling. In this type of sampling items for the samples are selected deliberately; the researcher choice concerning the items remains supreme. Under purposive or judgmental sampling the organizers of the inquiry purposively choose the particular units of the universe for constituting a sample on the basis that the small mass that they so select out of a huge one will be typical or representative of the whole (Kothar, 2004). Particularly, the researcher used purposive sampling in which the banks service year is set as criteria and all private commercial banks that meet this criterion are selected as a sample. Hence, for this study a sample of below listed thirteen private commercial banks that has been in operation before 2011 is selected. The reason for not including the rest three banks is because of having few observations which is not reasonable to conclude results with little information.

Table 3.1: List of Sampled Private commercial Banks

No.	Name of Banks	Year of Establishment
1	Awash Bank	1994
2	Dashen Bank	1995
3	Bank of Abyssinia	1996
4	Wegagen Bank	1997
5	United Bank	1998
6	Nib International Bank	1999
7	Cooperative Bank of Oromia	2004
8	Lion International Bank	2006
9	Zemen Bank	2008
10	Oromia International Bank	2008
11	Buna International Bank	2009
12	Berhan International Bank	2009
13	Abay Bank	2010

Source: National Bank of Ethiopia

Sampling Frame: In Ethiopia a total of sixteen private commercial banks are licensed and in operation up to December 2018 according to National Bank of Ethiopia official web site. Thus, the study takes a sample of thirteen private commercial banks licensed and operated before 2011. The reason for excluding the rest three banks is because of availability of only few years (less than 5 years) data. Sample commercial banks account 81.25% of the total population. All of them that included in this study are operated equal or above seven years and operated in a wide range of geographical areas of a country which enables a fair representation of bank industry in Ethiopia. For the first six banks listed in Table 3.1 this research includes eighteen fiscal years from 2000 to 2017 and for the rest seven banks from their beginning operation year which is one year after their establishment year is considered in this study. Therefore, it is possible to draw a relationship among variables using 173 observations with unbalanced panel data.

3.4 Method of Data Analysis and Tools

After the data is collected the next step is to analyze the collected data to achieve the stated general and specific objectives. In this study two types of analysis is used. The first is descriptive statistics and followed by multiple regression analysis. The descriptive analysis part deals with a simple description of variables. It includes mean, maximum, minimum and standard deviation of each variable. On the other hand, multiple regression analysis, the most important part of the analysis, helps to identify the determining variables of liquidity risk and draw relationship between dependent and independent variables. According to Gujarati (2004) regression analysis is concerned with the study of the dependence of one variable, the dependent variable, on one or more other variables, the explanatory variables, with a view to estimating and/or predicting the (population) mean or average value of the former in terms of the known or fixed (in repeated sampling) values of the latter. STATA version 13 employed for the above analysis.

3.5 Description of Variables and Hypothesis Development

This study attempts to see the relationship between the dependent and independent variables through testing the hypotheses regarding to the relationships between liquidity risk and bank specific and macroeconomic factors affecting it in the private commercial banks of Ethiopia. Bank specific variables include bank size, loan growth, return on asset, tangibility, leverage and operational inefficiency. Whereas, macroeconomic variables include real GDP growth rate, lending interest rate and money supply growth. Hence, to attain the objective of the study the

following hypotheses were developed with the detail descriptions of the variables under the study.

3.5.1 Dependent Variable

Liquidity Risk (LR)

According Woods & Dowd (2008) liquidity risk refers to uncertainty regarding the ability of a firm to unwind a position at little or no cost, and also relates to the availability of sufficient funds to meet financial commitments when they fall due. Liquidity risk arises in banks when long term assets are funded by short term liabilities thereby resulting to refinancing risk.

According to the definition of the Basel Committee on Banking Supervision (1997), liquidity risk arises from the inability of a bank to accommodate decreases in liabilities which are deposit and/or to fund increases in assets which is loan. In this study liquidity risk is measured by using ratio of bank's financing gap to total asset which is recommended by Basel Committee on Banking Supervision as cited by Shen, et al., (2009). Thus, financing gap is defined as the difference between a bank's loans and customer deposits in this study. Besides, financing gap is divided by total assets to standardize, finally get the ratio of financing gap to total assets. Banks with higher financing gap ratio must use its cash, selling liquid assets and much external funding to fund this gap, and face larger liquidity risk (Shen, et al., 2009 and Thong, 2013).

3.5.2 Independent Variables

3.5.2.1 Bank specific variables

The existing literature provides evidence that suggests a strong association between liquidity risk and several bank specific variables. Hence, the following part of this subsection presents the bank-specific variables will be in use for this study.

Bank Size (LnTA)

Bank size is one of bank specific variable that determines liquidity risk. It shows the asset size of a bank and used as a measure the effect of bank asset size on liquidity risk. The proxy used to measure bank size is natural logarithm of total asset (LnTA) (Ahmed, et al., 2011; Iqbal, et al., 2011).

There are two opposing arguments both theoretically as well as empirically regarding to the relationship between bank liquidity and size. The effect of size could therefore be nonlinear; meaning that liquidity risk is likely to increase up to a certain level by achieving economies of scale and decline from a certain level.

Hp1: Bank size has a significant positive influence on liquidity risk

Loan Growth (LG)

It is defined as growth in loan portfolio of banks in the lag periods. It is used to show the effect of rapid loan portfolio growth on liquidity risk. The proxy used to measure loan growth is percentage change in loan portfolio. According Vodova (2013) on liquidity of Hungary and Slovakia commercial banks and its determinants result shows that loan growth lower banks liquidity so liquidity risk increase with loan growth. Liza (2018) found that positive and significant relation with liquidity position of sample Ethiopian commercial banks.

Hp2: Loan growth has a significant positive influence on liquidity risk

Return on Asset (ROA)

Return on asset show earning potentials of an asset that is profitability. The proxy used to measure return on asset is net income divided by total asset. Iqbal, et al., (2011) a study on impact of liquidity risk on firm specific factors in the case of Islamic banks in Pakistan to develop a model and to test the relationship among liquidity risk and firm performance through its facets. Finally the study reveals that return on asset has positive and significant impact on liquidity risk. Another study by Ahmed, et al., (2011) has found that profitability has positive but insignificant impact on liquidity risk. Nigist (2016) a study on liquidity determinants has found negative association between profitability and liquidity position of commercial banks in Ethiopia.

Hp3: Return on asset has a significant positive influence on liquidity risk

Tangibility (TNG)

Tangibility shows the proportion of fixed asset from the total asset of banks. The proxy used to measure tangibility is the ratio of fixed asset to total asset. The study by Ahmed, et al., (2011) regression result reveals that tangibility has negative and significant impact on liquidity risk. But

increase in fixed asset as proportion to total asset will decrease the liquidity position of a banks because total asset is the summation of both current and fixed assets, as the higher fixed asset lower liquidity ratio which results increase in liquidity risk.

Hp4: Tangibility has a significant positive influence on liquidity risk

Leverage (LEV)

Leverage is refers to the amount of debt a firm uses to finance its asset. The proxy used to measure leverage is the ratio of total debt to total asset. Ahmed, et al., (2011) study on liquidity risk and Islamic banks of Pakistan have found a positive relationship between leverage and liquidity risk. It is reasonable since risk and leverage goes side by side according to financial leverage theory.

Hp5: Leverage has a significant positive influence on liquidity risk

Operational Inefficiency (OPIN)

Operating efficiency indicates how successfully banks manage internally their assets and liabilities in hedging against their risk dimensions. A study by Shakih (2015) on panel data estimation of liquidity risk determinants in Islamic banks in the case of Pakistan was carried on. The fixed effects regression result reveals that operational inefficiency has significant positive effect on liquidity risk with the p-value of 0.058 within 10% level of significance. This result is also supported by Moussa (2015). In this research the proxy used to measure operational inefficiency is the ratio of operating (non-interest) expense to total asset.

Hp6: Operational inefficiency has a significant positive influence on liquidity risk

3.5.2.2 Macroeconomic Variables

Real GDP Growth (RGDP)

It shows the total amount of goods and services produced in a country. It is as a proxy for economic cyclical. The proxy used to measure Real GDP growth rate is annual real GDP growth rate. Studies like Vodová (2011) and Shen et al. (2009) argue that the demand for loan increase with economic expansion which grind down the liquidity buffer of banks thereby increase liquidity risk. In addition, during economic expansion bank deposit is less attractive than investment which also increase financing gap. According to Vodová (2011) during

economic downturn, lending opportunities are not so good so banks hold higher share of liquid assets. Both arguments are very convincing. Farther more, the result of both studies proves this argument. According to Nigist (2016), real GDP growth rate has significant negative relationship with liquidity which implies positive relation with liquidity risk.

Hp7: Real GDP growth has a significant positive influence on liquidity risk

Lending Interest Rate (LIR)

It shows average interest rate charged on loan by banks. Vodová (2013) while in identifies determinants of commercial banks liquidity in different countries, he highlight the fact that higher lending rates do not encourage banks to lend more which results higher liquidity or lower liquidity risk. Belete (2015) on his study of factors affecting liquidity position found lending interest rate has positive and significant relationship with liquidity with high coefficient. The proxy used to measure lending interest rate is annual average interest rate charged on loan by banks.

Hp8: Lending interest rate has a significant negative influence on liquidity risk

Money Supply (M2) Growth

Money supply shows the total value of monetary assets available in an economy at specific time. This includes cash, checking deposits, saving deposits, money market securities, mutual funds and other time deposits. The proxy used to measure M2 growth is current year broad money less broad money previous year divided by previous year broad money. Abdulganiyy (2017) found a negative relationship between liquidity risk and money supply using correlation analysis. As the OLS regression reveals that money supply has positive and significant influence on liquidity risk in Sudan where as insignificant negative influence in Malaysia.

Hp9: Money supply growth has a significant negative influence on liquidity risk

3.6 Model Specification

To achieve the research objective econometric model developed for liquidity risk. This dependent variable is regressed with its respective bank specific and macroeconomic independent variables in order to identify liquidity risk determinate in Ethiopian private commercial banks using Ordinary Least Square (OLS) estimation. OLS is a statistical technique that uses sample data to estimate the true population relationship between two variables, namely

dependent and independent variables. OLS is a method to estimate and find the best fitting line which minimizes the sum of squared residuals (SSR).

In this study, multiple regression is used to determine the most significant explanatory variables affecting the liquidity risk of Ethiopian private commercial banks. The general model for this study presented as;

$$Y_{i,t} = \beta_0 + \beta_1 X_{i,t} + \epsilon_{i,t}$$

The subscript **i** representing the cross-sectional dimension and **t** denote the time-series dimension. The left hand side equation, represent the dependent variable in the model, which is the liquidity risk. In the right side, represent the set of independent variables in the estimated model and ϵ is error term.

Model : Liquidity risk (LR)

$$LR_{it} = \beta_0 + \beta_1(\ln TA_{it}) + \beta_2(LG_{it}) + \beta_3(ROA_{it}) + \beta_4(TNG_{it}) + \beta_5(LEV_{it}) + \beta_6(OPIN_{it}) + \beta_7(RGDP_{it}) + \beta_8(LIR_{it}) + \beta_9(M2_{it}) + \epsilon_{it}$$

Where, LR is liquidity risk with the proxy of financing gap (total loan minus total deposit) to total asset ratio, β_0 is constant, β_i is coefficient, ϵ is error term, i =bank and t =time

3.7 Chapter Conclusion

Chapter three included the methodology used to analyze data analysis in the next Chapter. This research includes quantitative and secondary data in nature. And to test the relationship between bank specific and macroeconomic determinants with liquidity risk in private commercial banks of Ethiopia using ordinary least square method.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Descriptive Statistics

This section is going to discover about descriptive statistics of dependent and independent variables which helps to have the overall look at variables being studied. The descriptive statistics include mean, standard deviation, minimum and maximum. Mean value shows the average value of all samples in each variable; whereas the maximum and minimum values of each variable from all samples are shown in the minimum and maximum statistics. Sample variation from the mean is shown in standard deviation which is square root of variance.

Table 4.1 present data from thirteen private commercial banks in Ethiopia covering eighteen years span from 2000 up to 2017 which have 173 observations with unbalanced panel data because from thirteen private commercial banks seven private banks starts operation after the year 2004. Sample private banks are Awash Bank, Abay Bank, Bank of Abyssinia, Berhan International Bank, Bunna International Bank, Cooperative Bank of Oromia, Dashen Bank, Lion International Bank, Nib International Bank, Oromia International Bank, United Bank, Wegagen Bank, and Zemen Bank. There are 10 variables in the table of which liquidity risk (LR) is dependent variable whereas the remaining are independent variables which include bank size (lnTA), loan growth (LG), return on asset (ROA), tangibility (TNG), leverage (LEV) and operational inefficiency (OPIN) from bank specific variable and real GDP growth rate (RGDP), lending interest rate (LIR) and money supply growth (M2) from macroeconomic variables. Detailed description of summary statistics for the model based on Table 4.1 is as follow:-

Table 4.1 Summary of descriptive statistics for variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Lr	173	-0.2427482	0.1129054	-0.4712952	0.1294643
Inta#	173	8.1284620	1.2806910	4.8598120	10.6448300
Lg	173	0.4537160	0.3977990	-0.0998807	2.5593220
Roa	173	0.0228448	0.0122667	-0.0197646	0.0525045
Tng	173	0.0217010	0.0148710	0.0030971	0.1405376
Lev	173	0.8446774	0.0856971	0.1317829	0.9357490
Opin	173	0.0342051	0.0094183	0.0106202	0.0760228
Rgdp	173	0.0951225	0.0335264	-0.0209852	0.1353407
Lir	173	0.1178113	0.0073002	0.1050000	0.1275000
m2	173	0.2301234	0.0753018	0.0724361	0.3920676

not measured in percentage

Source: STATA13 summary result for sample private commercial banks

Liquidity risk (LR) is in terms of financing gap between bank's loan and customer deposit and in order to standardize financing gap to total asset ratio is used. The higher the financing gap ratio the higher the liquidity risk since liquidity risk is the result when banks cannot accommodate decrease in liability which is deposit or increase in asset which is loan. According to Table 4.1 the mean financing gap to total asset ratio is -24.27%. Its value range from -47.13% in the year 2011 for CBO up to 12.94% for same bank in the year 2006 with a standard deviation statistics of 11.29%. The negative sign indicates the excess of deposit over loan. And the reverse is true for the positive sign.

Natural logarithm of total asset (lnTA) is a proxy for bank size of banks having a mean value of 8.128. The standard variation from the mean is 128.07% which shows a very high variation from the mean. Since, natural logarithm reduced the variation of minimum and maximum, values are 4.859 and 10.644 respectively. The minimum value belongs to CBO during the first operation year and the highest one is for AB which is more than 100% far from the minimum value of CBO.

Loan Growth (LG) as indicated in Table 4.1 the mean value of loan growth is 45.37% for 2000 to 2017 which reveals that on average each bank increased its loan with a rate of 45.37% each year for the observation period. But, each year change in loan growth between banks has a higher variation with standard deviation of 39.78%. The maximum growth rate in loan is 255.93% belongs to NIB in 2001 whereas it also decreases at a rate of up to -9.988% in 2009 for WB.

Return on Asset (ROA) proxy for profitability, ratio of net income after tax to total asset, is used. The average return on asset of selected banks over a period between 2000 up to 2017 is 2.28%. This implies sample Ethiopian private commercial banks that were included in this study earned an average of 2.28 cents of net income for a single birr investment in their asset years from 2000 up to 2017. The least profitable observation is -1.976% which is very low even below zero cents (loss) per one birr invested whereas the most profitable observation is 5.25% where a bank generates 5.25 cent returns per one birr investment in banks. The standard variation statistics implies the variation in profitability among selected banks is 1.22%.

Tangibility shows the proportion of fixed asset from the total asset of banks. The ratio of fixed asset to total asset has a mean value of 2.17% means sample private banks estimate that between periods 2000 up to 2017 from their total asset on average 2.17% is covered by fixed asset. Whereas, its value in the observation ranges from 0.3% up to 14.05% and with a low variation of 1.48%.

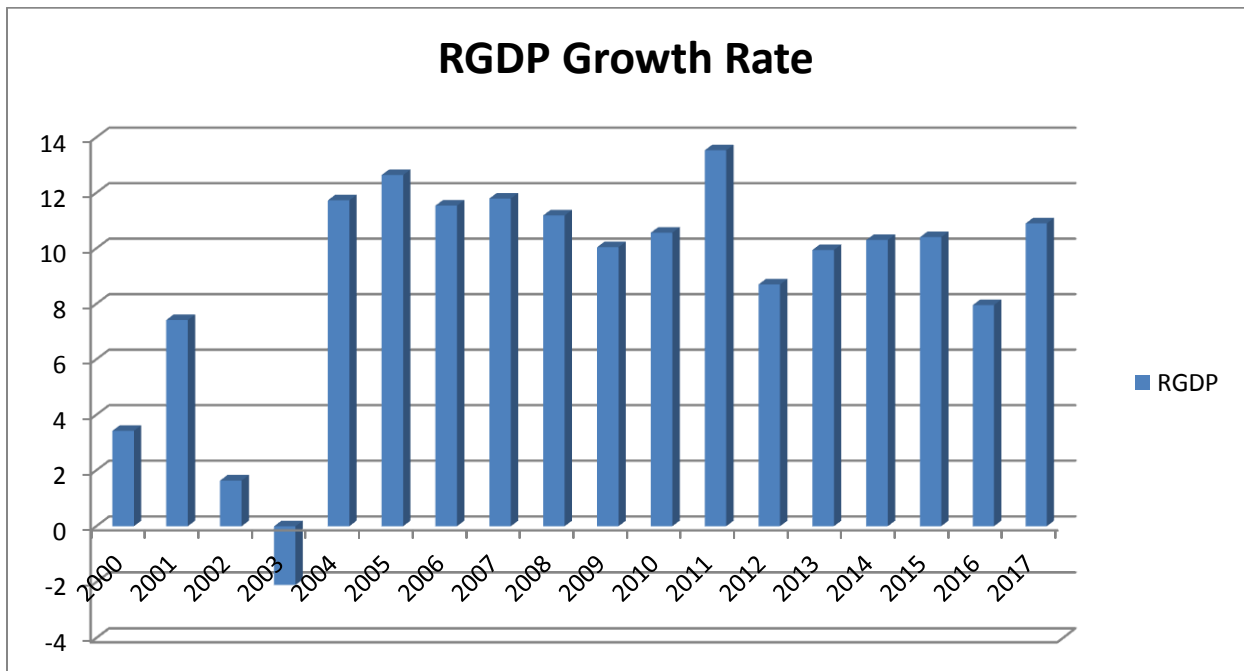
Leverage is the ratio of total debt to total asset. According to Table 4.1, leverage has a mean value of 84.46% i.e. from the period between 2000 to 2017 the selected sample private commercial banks, debt (liability) cover 84.46% of the total asset. Therefore the highest part of total asset of private commercial bank in Ethiopia is covered by liability. The minimum and maximum value ranges from 13.17% to 93.57% respectively. The standard deviation for leverage is 8.57% from the mean.

Operational Inefficiency (OPIN) operational efficiency indicates how successfully banks manage internally their assets and liabilities in hedging against their risk dimensions. The proxy for measurement of operation inefficiency in this study is the ratio of total operating expense to total asset. The mean value of operational inefficiency for year from 2007 to 2017 of selected private banks is 3.42% with the standard deviation of 0.94%. The value ranges from 1.06% to 7.6%. Operational inefficiency has the lowest standard deviation as compared to other bank specific variables.

Real GDP Growth Rate (RGDP) The rest variables are macroeconomic variables like real GDP growth rate (RGDP), lending interest rate and money supply growth. These variables are the same for all sample banks at a given period. RGDP growth rate shows a mean record of 9.51%

between 2000 up to 2017 which shows economic growth for the given year since GDP is commonly used as an indicator of the economic growth of a country. The maximum and minimum values are 13.53% in the year 2011 and -2.09% respectively. The minimum (negative) value belongs to the year 2003. Obviously it has a standard deviation of 3.35% which implies the economic growth is sustainable and stable between a period 2000 and 2017 except the year 2003 which have negative growth rate.

Figure 2: Real GDP growth rate from 2000 to 2017



Lending Interest Rate (LIR) It shows average interest rate charged on loan by banks. Lending interest rate exhibit a maximum value of 12.75% over the study period whereas, the lowest observation is 10.5% interest rate. In general it shows a lowest variation 0.73% with a mean interest rate of 11.78% between periods 2000 up to 2017.

Money Supply (M2) Broad money supply is the composition of time deposit, saving deposit, demand deposit (net) and currency outside banks. The mean degree of money supply growth is 23.01%. The highest record in the observation is 39.20% and the minimum record 7.24%. The standard deviation from the mean is 7.53%.

4.2 Correlation Analysis

Before the regression result, it is important to check the correlation between variables that are used in the regression. Correlation analysis is the statistical tool used to study the closeness of the relationship between variables. This section of the study deals with the correlation analysis of the studied variables. The purpose of undertaking correlation analysis is to check whether there is multicollinearity problem in the model and to indicate whether the variables move together or not in the same direction and the correlation coefficient indicates the strength of a linear relationship between two variables. The correlation coefficient ranges between +1 and -1. +1 indicates the strongest positive correlation possible, and -1 indicates the strongest negative correlation possible. Therefore the closer the coefficient to either of these numbers the stronger the correlation of the data it represents. On this scale 0 indicates no correlation, hence values closer to zero highlight weaker/poorer correlation than those closer to +1/-1.

Table 4.2: Correlation matrix of dependent and independent variables

```
. corr lr lnta lg roa tng lev opin rgdp lir m2
(obs=173)
```

	lr	lnta	lg	roa	tng	lev	opin	rgdp	lir	m2
lr	1.0000									
lnta	-0.5201	1.0000								
lg	0.2811	-0.4949	1.0000							
roa	-0.2562	0.5289	-0.2889	1.0000						
tng	-0.1395	0.1748	0.0543	-0.1277	1.0000					
lev	-0.3065	0.5070	-0.4278	0.4431	-0.0335	1.0000				
opin	0.0326	0.0641	0.1470	-0.2094	0.2068	0.0612	1.0000			
rgdp	-0.2883	0.2809	-0.0190	0.2601	-0.0123	-0.0962	-0.1702	1.0000		
lir	-0.3905	0.4089	0.0264	0.1308	0.2553	0.1064	0.3424	0.0629	1.0000	
m2	-0.6044	0.4237	-0.0125	0.3257	0.0471	-0.0219	-0.0570	0.6426	0.3517	1.0000

Source: STATA13 result for correlation matrix

The above correlation matrix table 4.2 shows the relationship between dependent and independent variables, and independent variables each other used in this study. The correlation matrix presents correlation analysis of liquidity risk (LR) with independent variables. Based on the correlation matrix liquidity risk (LR) have a positive correlation with LG and OPIN which indicates when those variables increases liquidity risk also increase with different correlation

coefficient. In addition LnTA, ROA, TNG, LEV, RGDP, LIR and M2 are negatively correlated with liquidity risk (LR). The negative correlation figures implies if the those independent variables increase liquidity risk is decreased.

4.3 Testing Assumptions of Classical Linear Regression Model (CLRM)

In order to answer the research questions, it is to be recalled that the paper constructed econometric model in the previous chapter. The researcher also knows theoretically, an econometric model should pass pre and post estimation tests or diagnostic tests. In the way to make sure the model is valid, consistent and reliable the researcher applied the following tests.

4.3.1 Test for weather average value of the error term is zero

The first assumption required is that the average value of the errors is zero. In fact, if a constant term is included in the regression equation, this assumption will never be violated (Brooks, 2014). Therefore, since the constant term (i.e. β_0) was included in the regression equation, the average value of the error term in this study is expected to be zero.

4.3.2 Normality Test

Before applying statistical methods that assume normality such as least square regression, it is necessary to perform a test on residuals for normality. The researcher hypothesize that the data follows a normal distribution of the residuals, and only reject this hypothesis if its have strong evidence to the reverse i.e. if the test is significant, the distribution is non-normal. In order to test the normality of the residuals Bera-Jarque test is used in this research. According to Bera-Jarque normal data test the data is not normal if the p value is less than 0.05. If p value is greater than 0.05 the null hypothesis will be accepted, the error term of the model is normally distributed.

Table 4.3: Normality Test

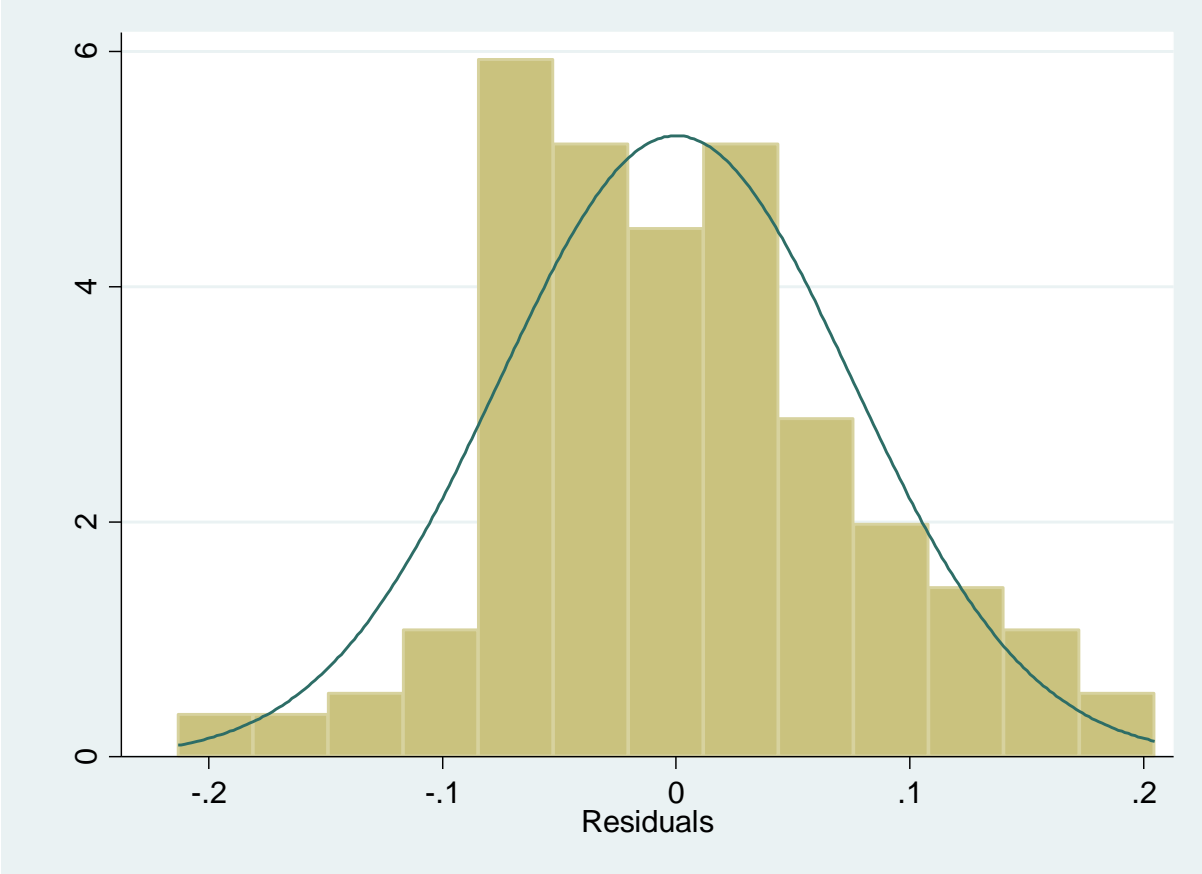
```
. sktest uhat
```

Skewness/Kurtosis tests for Normality						
Variable	Obs	Pr (Skewness)	Pr (Kurtosis)	adj chi2 (2)	joint	Prob>chi2
uhat	173	0.1229	0.4723	2.94		0.2304

Source: STATA13 result for Skewness/Kurtosis test

According to Bera-Jarque Skewness/Kurtosis test for normal data the error term is normally distributed since p value is 0.2304 which is above 0.05. And both the probability of skewness and kurtosis is above 5%. In this case we have enough evidence to say error term of the model is normally distributed. And values of skewness and kurtosis shown in the Appendix II part.

Figure 3: Histogram for Residual



Source: STATA13 result for Histogram of Residual

In addition to Bera-Jarque statistical test there are also other tests of normality such as Shapiro-Wilk, density plot, histogram, pp plot and Quantile-Quantile plot (QQ plot). The most common density test is kernel density estimate which is used to show the normal density of the residual term. The result of the kernel density estimate shown in the Appendix III which is normal for the model since more or less the graph is estimated kernel density and the normal density overlies each other.

4.3.3 Heteroskedasticity Test

According to Gujarati (2004) one of the important assumptions of the classical linear regression model is that the variance of each disturbance term, conditional on the chosen values of the explanatory variables, is some constant number. This is the assumption of homoskedasticity, when this assumption is violated it is called heteroskedasticity. Persisting in using the usual testing procedure along with heteroskedasticity will result the conclusion misleading. The study proceeds with white's test in order to detect heteroskedasticity.

Table 4.4: Heteroskedasticity Test

```
. imtest, white

White's test for Ho: homoskedasticity
    against Ha: unrestricted heteroskedasticity

    chi2(54)    =    66.86
    Prob > chi2 =    0.1124

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	66.86	54	0.1124
Skewness	16.33	9	0.0603
Kurtosis	0.44	1	0.5061
Total	83.63	64	0.0503

Source: STATA13 result for white's test

Moreover, white's test confirm that the absence of heteroskedasticity in the model. The p value in white's test of heteroskedasticity is 0.1124 since the p -value is considerably in excess of 0.05 we couldn't reject the null hypothesis of homoskedasticity.

4.3.4 Multicollinearity Test

Multicollinearity indicates a situation when there is linear relationship among some or all explanatory variables of a regression model (Gujarati, 2004). In order to detect the degree of

multicollinearity variable inflation factor (VIF) or tolerance value is used. Variable inflation factor (VIF) or tolerance value is used interchangeably. According to Ahmad and Ariff (2007) and Gujarati, (2004) if the variable inflation factor (VIF) is more than 10 and tolerance level less than 0.10 it indicates a serious multicollinearity problem. The tolerance value is between zero and one if it approaches zero it indicates collinearity problem and when it approaches 1 no multicollinearity problem. According to Table 4.5 variable inflation factor (VIF) is less than 10 for both the model (mean VIF) and each independent variable. This test confirms the presence of lower degree of collinearity among explanatory variables.

Table 4.5: Multicollinearity Test

. vif

Variable	VIF	1/VIF
lnta	2.90	0.345298
m2	2.25	0.445114
rgdp	1.89	0.530151
roa	1.77	0.565693
lev	1.76	0.569215
lg	1.62	0.618694
lir	1.61	0.619476
opin	1.33	0.753337
tng	1.18	0.848931
Mean VIF	1.81	

Source: STATA13 result for Variable inflation factor test

Originally these are not the only variable selected based on empirical review. From the model some explanatory variables were dropped due to serious multicollinearity problem above a tolerable limit. According to Gujarati (2004) dropping a variable from a model may commit specification bias or error whereas multicollinearity problem results bias estimation of parameters. In order to solve these contrasting ideas the model result is checked with and without collinear variables. Finally, the collinear variables found to be statistically insignificant. The only change in the inclusion of collinear variables is that change in estimation of parameters or

coefficients which is basis estimation if there is multicollinearity problem. Therefore, the study proceeds by dropping statistically insignificant collinear variables in order to have truthful estimation of the rest parameters.

4.3.5 Model Specification Test

The other assumption of CLRM is assumption the regression model is correctly specified or no specification bias or error. The inclusion of irrelevant variable or exclusion of relevant variable; wrong functional form such as log linearly; and error in measurement of proxy will violate this assumption which will result under fitting or over fitting the model. To detect this problem link test is used in this study.

Link test is based on a null hypostasis of the regression model is correctly specified. To tests this STATA generate two variables which are predictive value (`_hat`) and square prediction (`_hatsq`) from the original regression model. After regression these two variables with the model if a predictive value (`_hat`) is statistically significant at five percent level of significance and square prediction (`_hatsq`) is insignificant at five percent level of significant the model is good.

Table 4.6: Model Specification Test

lr	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
<code>_hat</code>	1.364427	.2472653	5.52	0.000	.8763213	1.852533
<code>_hatsq</code>	.8112377	.5289046	1.53	0.127	-.2328288	1.855304
<code>_cons</code>	.0349737	.0287931	1.21	0.226	-.0218643	.0918118

Source: STATA13 result for link test

The link test in the above table clearly shows for the model predictive value (`_hat`) is significant with a p value of 0.000. While, square prediction (`_hatsq`) is insignificant at five percent level of significance with a p value of 0.127. Therefore, link test confirms there is no evidence of model specification error.

4.4 Selection of Model (Fixed Effect versus Random Effect Models)

The selection of a computational model should be based on our expectation about whether or not the studies share a common effect size and on our goals in performing the analysis. It makes sense to use the fixed-effect model if two conditions are met. First, if all the studies included in the analysis are functionally identical. Second, if the goal is to compute the common effect size for the identified population, and not to generalize to other populations. By contrast, when the researcher is accumulating data from a series of studies that had been performed by researchers operating independently, it would be unlikely that all the studies were functionally equivalent. Typically, the subjects or interventions in these studies would have differed in ways that would have impacted on the results, and therefore we should not assume a common effect size. Therefore, in these cases the random-effects model is more easily justified than the fixed-effect model.

The econometrics model used to identify the effect of bank specific and macroeconomic factors on liquidity risk of private commercial banks in Ethiopia is a unbalanced panel data regression model which should be either fixed effects or random effect model. In order to analyze this panel data the study employ either fixed or random effect model based on Hausman test. Hausman test is based on the null hypothesis in favor of random effect model estimator. If p value is higher than 0.05 (insignificant) random effects is preferable and if p value is lower than 0.05 (significant) use fixed effect is preferable.

H0: Random effects model is appropriate.

H1: Fixed effects model is appropriate.

$$\alpha = 0.05$$

Decision Rule: Reject H0 if P value is less than significant level 0.05. Otherwise, do not reject H0.

Table 4.7: Hausman test for fixed versus random effect

```
. hausman fe re
```

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
lnta	-.0193663	-.013365	-.0060013	.
lg	.0664383	.056291	.0101473	.
roa	1.387007	1.343735	.0432723	.
tng	-.680862	-.5502937	-.1305684	.
lev	-.3527291	-.3280373	-.0246918	.
opin	3.736995	2.540388	1.196607	.2909794
rgdp	.4500726	.4027717	.047301	.
lir	-1.791829	-2.149871	.3580424	.
m2	-.6495259	-.7836759	.13415	.0061503

```

      b = consistent under Ho and Ha; obtained from xtreg
      B = inconsistent under Ha, efficient under Ho; obtained from xtreg

```

```
Test: Ho: difference in coefficients not systematic
```

```

      chi2(9) = (b-B)' [(V_b-V_B)^(-1)] (b-B)
              =          1.29
      Prob>chi2 =          0.9984
      (V_b-V_B is not positive definite)

```

Source: STATA13 result for Hausman test

According to Hausman test shown in Table 4.7, the model is better off if random effect model is used since the p value for the model is 0.9984 which is much greater than 0.05.

Following random effect model estimation the next step is to test the estimates using Breusch and Pagan Lagrange multiplier (LM) test which allow making a choice between random effect and pooled OLS model. Breusch and Pagan Lagrange multiplier (LM) test is test of individual specific effect based on the null hypothesis variances across entities is zero ($\text{var}(u) = 0$). If p value is lower than 0.05 the null hypothesis is rejected and use random effect model. If p value is higher than 0.05 the null hypothesis is accepted and use the pooled OLS model. Pooled OLS estimation is a simple regression result of panel data which pooled both cross sectional and time serious data. Finally, according to Breusch and Pagan Lagrange multiplier (LM) test for the

model random effect model is appropriate. Breusch and Pagan LM test shown in Table 4.8 the p value of the model is 0.000 lower than 0.05 so, random effect model is still preferable.

Table 4.8: Breusch and Pagan Lagrangian multiplier test for random effects

```
. xttest0
```

Breusch and Pagan Lagrangian multiplier test for random effects

$$lr[A,t] = Xb + u[A] + e[A,t]$$

Estimated results:

	Var	sd = sqrt(Var)
lr	.0127476	.1129054
e	.0043402	.0658805
u	.000913	.0302154

Test: Var(u) = 0

chibar2(01) = 27.47
 Prob > chibar2 = 0.0000

Source: STATA13 result for Breusch and Pagan Lagrangian multiplier test

4.5 Panel Data Regression Result and Discussion

The study uses unbalanced panel data to identify determinants of liquidity risk in Ethiopian private commercial banks. The unbalanced panel data is with a total observation of 173 encompass both time serious ranges from seven years to eighteen years based on their establishment year and cross sectional (thirteen banks) data from private commercial banks. In order to analysis these data the model was developed for liquidity risk.

In this section, the relationship between the dependent variable and independent variables will be discussed on the basis of the findings on this empirical study of random effect model. The dependent variable, liquidity risk of Ethiopian private commercial banks, was measured by ratio of bank's financing gap to total asset. Thus, financing gap is defined as the difference between a bank's loans and customer deposits in this study.

Model: Liquidity risk (LR)

$$LR_{it} = \beta_0 + \beta_1(\ln TA_{it}) + \beta_2(LG_{it}) + \beta_3(ROA_{it}) + \beta_4(TNG_{it}) + \beta_5(LEV_{it}) + \beta_6(OPIN_{it}) + \beta_7(RGDP_{it}) + \beta_8(LIR_{it}) + \beta_9(M2_{it}) + \varepsilon_{it}$$

The output of the econometrics model by random effect regression shows that explanatory power of the model based on the result of R^2 . The R^2 measures the success of the regression in predicting the values of the dependent variable in the sample. In standard settings, may be interpreted as the fraction of the variance of the dependent variable explained by the independent variables. The statistic will equal one if the regression fits perfectly, and zero if it fits no better than the simple mean of the dependent variable. As it said before, R^2 values indicate the explanatory power of the model and adjusted R^2 value which takes into account the loss of degrees of freedom associated with adding extra variables were inferred to see the explanatory powers of the models.

Table 4.9: Random Effect Estimation for Liquidity risk

```
. xtreg lr lnta lg roa tng lev opin rgdp lir m2, re

Random-effects GLS regression              Number of obs   =       173
Group variable: A                          Number of groups =        13

R-sq:  within = 0.6113                      Obs per group:  min =         7
        between = 0.1939                      avg =       13.3
        overall = 0.5284                      max =        18

Wald chi2(9) =       228.04
corr(u_i, X) = 0 (assumed)                  Prob > chi2     =       0.0000
```

lr	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lnta	-.013365	.0074469	-1.79	0.073	-.0279607	.0012306
lg	.056291	.0175429	3.21	0.001	.0219076	.0906744
roa	1.343735	.6218577	2.16	0.031	.1249164	2.562554
tng	-.5502937	.4087048	-1.35	0.178	-1.35134	.2507529
lev	-.3280373	.085826	-3.82	0.000	-.4962531	-.1598215
opin	2.540388	.7645554	3.32	0.001	1.041887	4.038889
rgdp	.4027717	.2167947	1.86	0.063	-.0221382	.8276815
lir	-2.149871	.9302862	-2.31	0.021	-3.973199	-.3265439
m2	-.7836759	.1102707	-7.11	0.000	-.9998024	-.5675493
_cons	.3984824	.1130233	3.53	0.000	.1769609	.6200039
sigma_u	.03021535					
sigma_e	.06588047					
rho	.17379248	(fraction of variance due to u_i)				

Source: STATA13 result for random effect regression

$$LR_{it} = 0.3984 - 0.0133(\ln TA_{it}) + 0.05629(LG_{it}) + 1.343(ROA_{it}) - 0.55(TNG_{it}) - 0.328(LEV_{it}) + 2.54(OPIN_{it}) + 0.4027(RGDP_{it}) - 2.149(LIR_{it}) - 0.7836(M2_{it}) + \varepsilon_{it}$$

Table 4.9 shows random effect estimation on 173 observations taken from thirteen groups over a seven to eighteen years span with unbalanced panel data. The R^2 , goodness of fit of the model for the model is 52.84% which is fairly good. This means variation of liquidity risk in Ethiopian private commercial banks is 52.84% explained by bank size (lnTA), loan growth (LG), return on asset (ROA), tangibility (TNG), leverage (LEV), operational inefficiency (OPIN), real GDP growth rate (RGDP), lending interest rate (LIR) and money supply growth (M2). The rest 38.87 variation of liquidity risk in Ethiopian private commercial banks is not explained by either bank specific or macroeconomic variables used in this model. In addition over all test of significant

Prob> chi2 is 0.0000 shows jointly statistical significant of coefficients and linearity in parameters. So this implies the overall model is statistically significant since p-value 0.000 which is below 5%.

According to random effect estimation of the model out of nine explanatory variables six of them are statistically significant at five percent level of significance. From bank specific variables loan growth, return on asset, leverage and operational inefficiency have significant effect on liquidity risk of private commercial banks at 5% level of significance. On the other hand, from the three macroeconomic variables lending interest rate and money supply growth have significant impact on liquidity risk of private commercial banks in Ethiopia.

In assessing coefficients of correlation loan growth, return on asset, operational inefficiency and real GDP growth rate have a positive or direct relationship with liquidity risk of private commercial banks which suggest increase in these independent variables will result in increasing in liquidity risk and decrease in these explanatory variables will result decrease in liquidity risk of Ethiopian private commercial banks. While the rest; bank size, tangibility, leverage, lending interest rate and money supply growth have a negative coefficient, mean these explanatory variables have an inverse relation with liquidity risk of private commercial banks.

4.6 Discussion for Liquidity Risk Determinants

Bank Size

The proxy used for bank size is natural logarithm of total asset to show the impact of bank size on liquidity risk of private commercial banks in Ethiopia which helps to know liquidity risk that are unstable when firm grows. According to random effect model regression result bank size has found to be statistically insignificant impact on liquidity risk of Ethiopian private commercial banks with the p-value of 0.073. And negative coefficient (-0.013365) approved a negative relationship between bank size and liquidity risk of private commercial banks in Ethiopia.

According to Estrada (2011) as size grows it will help them to overwhelm the risk which is similar to economies of scale but also is should be noted that as a firm grow it may leads to failures. In this study bank size is not a powerful independent variable to define liquidity risk of private commercial banks of Ethiopia. The result of this research is different from Shen, et al., (2009) & Iqbal, et al., (2011) bank size has significant effect on liquidity risk. And Liza (2018)

and (2015) also found significant impact on liquidity position of Ethiopian commercial banks. While others, Ahmed, et al., (2011) and Mugenyah (2015) result shows bank size found to be statistically insignificant on liquidity risk.

Loan Growth

The proxy used to measure loan growth is percentage change in loan portfolio. The random effect estimation model result reveals that loan growth is statistically significant variable at 5% level of significance that determine liquidity risk in Ethiopian private commercial banks with the p-value of 0.001. Hence, loan growth of private commercial banks is one of the important pre conditions that determine level of liquidity risk of private commercial banks in Ethiopia. In addition a positive coefficient of 0.05629 proves the argument that banks with a high loan growth tend to take a higher liquidity risk. It is interpreted as one percent increase in loan growth results 5.62% increase liquidity risk holding other variables constant. In general on the issue of loan growth, an increase in the loan growth of private commercial bank in Ethiopia causes liquidity risk across them to increase since there is 45% an average increase in total loan of private banks.

The result of this study is supported by Vodova (2013) on his study of determinants commercial bank's liquidity in Hungary and Slovakia. As he states, where higher loan growth signals increase in illiquid assets because loan granted by banks is taken from customers deposit. Therefore, increase in loan growth results higher illiquid assets and decrease in short-term assets which finally imply higher liquidity risk.

Return on Asset

Return on asset measure profitability and the regression result shows return on asset found to be statistically significant with the p-value of 0.031. And the positive coefficient 1.343 interpreted as 1% increase in return on asset result 134.37% increase in liquidity risk holding the rest variables constant. As per random effect regression result return on asset has significant effect on liquidity risk of private commercial banks in Ethiopia. This result is in line with Iqbal, et al., (2011) on liquidity risk of Pakistan Islamic banks and Akhtar, at al., (2011) on liquidity risk management study on Pakistan Islamic banks have found that return on asset is positive and statistically significant effect on liquidity risk. This result is also supported by another study by

Mazur & Szajit (2015) on determinants of liquidity risk in commercial banks in the European Union as they found ROA has positive and significant relationship with liquidity risk.

The positive coefficient (direct relationship) is supported by financial theory which is higher profit is the return of higher risk. Therefore, the private banks with higher return on asset face higher liquidity risk as reveals by the regression result. Highly profitable private banks accept higher liquidity risk because of high credit grants as credit increase results lower liquid asset of banks. This increases in loan; which in turn increase profitability from interest income. Since, interest income is the major source of profit for banks.

Tangibility

Tangibility, ratio of fixed asset to total asset, found to be insignificant variable with a p value of 0.178. These finding shows an increase in demand for loan and/or decrease in deposit are not considerably affected by fixed asset ratio of banks. However, a negative coefficient of correlation reveals holding other variables constant an increase in the amount of fixed asset proportion to total asset is followed by decrease in liquidity risk. These finding is in contrast to Ahmed et al. (2011) as they found an inverse and significant relationship between liquidity risk and tangibility. The insignificant relation is a faithful result since the fixed asset ratio of Ethiopian private commercial banks to total asset are very low whereby tangibility cannot affect neither on loan nor on deposit. As shown in the descriptive statistics part the mean value of tangibility ratio of sample private commercial banks is 2.17% fixed asset out of total asset.

Leverage

Leverage refers to debt financing. As the result of random effect regression on Table 4.9 reveals that leverage is significant variable to determine liquidity risk of private commercial banks with the p-value of 0.000. As shown in Table 4.9 a negative coefficient of correlation 0.328 indicates an inverse relation between leverage and liquidity risk of private commercial banks. And the coefficient interpreted as holding other variables constant a one percent increase in leverage will result 32.8% decrease in liquidity risk and vice versa. Therefore leverage is powerful variable to define liquidity risk of Ethiopian commercial private banks.

The study result is different from Ahmed, et al., (2011) and Iqbal, et al., (2011) who's found positive relationship between leverage and liquidity risk which are similar with financial theory,

risk increase with leverage. But in banking business a large part of leverage is deposit. So increase in deposit will raise not only leverage but also liquidity position of banks which lowers liquidity risk since deposit create liquid asset (cash). And a rapid increase in deposit results banks' to rise up private commercial banks liquidity and lowers liquidity risk.

Operational Inefficiency

This variable how well bank workout its assets and liabilities internally in order to successfully manage their risk dimension. The ratio of total operating expense to total asset is used as proxy to measure operating inefficiency. Table 4.9 random effect regression result proves that operational inefficiency is a significant variable at 5% level of significance with the p-value of 0.001 and operational inefficiency has positive relationship with liquidity risk with positive correlation coefficient of 2.54. This means with the assumption of *ceteris paribus* a one percent increase in operational inefficiency results a 254% increase in liquidity risk of private commercial banks in Ethiopia. Therefore operational inefficiency is a powerful variable to determine liquidity risk in Ethiopian private commercial banks. This result supported by previous studies like Shakh (2015) and Moussa (2015) as they found significant direct relationship between the two variables. Shakh (2015) states that improvement in operational efficiency also reduces liquidity risk by freeing tied up resources therefore, the reverse is true for operational inefficiency. And Tilahun & Dugassa states that bad management of the banking firms will result in banks inefficiency and affects the liquidity position of banks. To sum up, bank's inefficiencies leads to higher liquidity risk.

Real GDP Growth Rate

Based on the Table 4.9 regression result real GDP growth rate has a positive and insignificant correlation with liquidity risk as p-value is 0.063. The result reveals that positive coefficient of -0.4027. This result suggest that ,even if, the demand for loan increases from year to year as GDP grow a high resource mobilization helps banks' to control liquidity risk. This finding is in contrast with the findings of Vodova (2013) and Cucilleni (2013) as they found significant positive relationship between GDP and liquidity risk in commercial banks of Hungary and Euro area respectively. In the contrary, this research result is similar with Abdulganiyy, et al., (2017) on his study of liquidity risk determinants on Malaysia and Sudan Islamic banking system. Liza (2018) also found similar result with this study.

Lending Interest Rate

Lending interest rate shows average interest rate charged on loan by commercial banks and it is found to be significant with 5% level of significance with the p-value of 0.021 and also high negative coefficient of 2.1498. The negative coefficient is interpreted as one percent increase in lending interest rate results 214.98% of decrease in liquidity risk of private commercial banks in Ethiopia holding other variables constant. This result supports the fact that higher lending interest rates do not encourage banks to lend more which results higher liquidity position which is lower liquidity risk. This result is in line with Vodova (2013) findings as regression result reveals positive significant relationship between lending interest rate and liquidity which is the reverse is true for liquidity risk. In addition, a high coefficient of 2.1498 is surprisingly low as compared to the above mentioned study. This result different from the findings of Nigisit (2015) and Liza (2018) whose gets insignificant relationship between average lending interest rate and liquidity position of commercial banks of Ethiopia.

Money Supply

It shows the total value of monetary assets available in an economy at specific time. This includes cash, checking deposits, saving deposits, money market securities, mutual funds and other time deposits. Table 4.9 reveals that growth in money supply has significant effect at 5% level of significance on liquidity risk of Ethiopian private commercial banks with a negative coefficient of 0.7836. This means one percent increase in money supply growth holding other variables constant results 78.36% decrease in the level of liquidity risk of private commercial banks and vice versa. The result support that change in money supply through various instruments employed by the central bank (NBE) can influence the liquidity position of private commercial banks, or in other words, a higher money supply growth may increase liquidity position and then decrease liquidity risk of private commercial banks. As broad money supply includes checking and saving deposit in banks therefore, when money supply increase it also increase saving and checking deposit of banks which higher liquidity position of private commercial banks. This finding contradict with Thong (2013) found negative and insignificant relationship with liquidity risk.

4.7 Hypothesis Test

This section deals with testing previously formulated alternative hypothesis based on the findings of random effect regression model estimation for liquidity risk.

Hp1: Bank size has a significant positive/negative influence on liquidity risk

According to random effect regression result bank size in terms of natural logarithm of total asset has an insignificant impact on liquidity risk of Ethiopian private commercial banks. Hypothesis Hp1 is rejected.

Hp2: Loan growth has a significant positive influence on liquidity risk

Loan growth is found to be statistically significant variable in order to explain liquidity risk in Ethiopian private commercial banks with 5% level of significance. The study also reveals the direct relationship between loan growth and liquidity risk in private commercial banks of Ethiopia which similar with expectation. Thus, hypothesis Hp2 is accepted.

Hp3: Return on asset has a significant positive influence on liquidity risk

Hypothesis Hp3 is accepted since it is similar with general hypothesis. Random effect regression shows return on asset of Ethiopian private commercial banks has statistically significant relationship with their liquidity risk.

Hp4: Tangibility has a significant positive influence on credit risk

Tangibility refers the proportion of fixed asset from the total asset is not powerful determinant of liquidity risk in private commercial banks since it is not statistically significant. Therefore, hypothesis Hp4 is rejected.

Hp5: Leverage has a significant positive influence on liquidity risk

Leverage is among one of important variables that determines liquidity risk in Ethiopian private banks at 5% level of significances but negatively correlated. But the negative coefficient is different from expectation. Thus, hypothesis Hp5 is rejected.

Hp6: Operational inefficiency has a significant positive influence on liquidity risk

The finding of liquidity risk model using random effect estimation reveals that operational inefficiency is one of the determining variables for commercial banks liquidity risk with positive correlation and 5% level of significance. Thus, hypothesis Hp5 is accepted.

Hp7: Real GDP growth has a significant positive influence on liquidity risk

According to random effect regression result of liquidity risk of Ethiopian private commercial banks is not significantly affected by real GDP growth rate. Therefore, hypothesis Hp7 is

rejected due to its statistical insignificant relationship between liquidity risk and real GDP growth rate of private commercial banks in Ethiopia.

Hp8: Lending interest rate has a significant negative influence on liquidity risk

Lending interest rate found to be statistically significant variable with 5% level of significance. As expected the coefficient of correlation between lending rates and liquidity risk is negative. Thus, hypothesis Hp8 is accepted.

Hp9: Money supply growth has a significant negative influence on liquidity risk

Random effect regression shows that money supply growth rate is one of important variables that determine liquidity risk in commercial banks at 5% level of significances and negative correlation as expected. So, hypothesis Hp9 is accepted.

Table 4.10: Summary of Variables, Hypothesis Test and Decisions

Explanatory Variables	Expected Signs	Actual Sign	Decision
Bank Size	Positive/negative and Significant	Negative and insignificant	Rejected
Loan Growth	Positive and Significant	Positive and Significant	Accepted at 5%
Return on Asset	Positive and Significant	Positive and Insignificant	Accepted at 5%
Tangibility	Positive and Significant	Negative and insignificant	Rejected
Leverage	Positive and Significant	Negative and Significant	Rejected
Operational Inefficiency	Positive and Significant	Positive and Significant	Accepted at 5%
Real GDP Growth Rate	Positive and Significant	Positive and insignificant	Rejected
Lending Interest Rate	Negative and Significant	Negative and Significant	Accepted at 5%
Money Supply Growth	Negative and Significant	Negative and Significant	Accepted at 5%

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

The previous chapter presented the analysis of the findings and discussions of the study. The purpose of this chapter is to discuss the conclusions and recommendations. Accordingly, the chapter is organized in three sections; the first section presents the conclusions of the study, the second section presents the recommendations provided based on the findings of the study and finally further research area is presented.

5.1 Conclusion

The main objective of this research was to examine firm specific and macroeconomic determinants of liquidity risk of Ethiopian private commercial banks for the period 2000 to 2017. The unbalanced panel data of thirteen private commercial banks with 173 observations have been used for analysis. The sample data of private commercial banks analyzed using descriptive statistics and random effect panel regression model. The dependent variable used to estimate liquidity risk is the ratio of financing gap to total asset, financing gap represents the difference between total loan and total deposit. The dependent variable regressed with independent variables which are bank size, loan growth, return on asset, tangibility, leverage and operational inefficiency from bank specific explanatory variables, and real GDP growth rate, lending interest rate and money supply growth from macroeconomic explanatory variables.

The finding of the study confirmed that from bank specific variables leverage has significant and negative effect on liquidity risk of private commercial banks. This indicates that banks leverage has inverse relationship with private commercial banks liquidity risk. Since leverage indicates debt financing, major portion of private banks debt is deposit. Therefore, rapid increase in deposit results banks' to rise up private commercial banks liquidity and lowers liquidity risk. In the contrary operational inefficiency, loan growth and return on asset have significant positive impact on liquidity risk at 5% level of significance respectively. This implies that as those explanatory variables increases, the liquidity risk of private commercial banks also increases. The positive association between operational inefficiency and liquidity risk, which was in favor of improvement in efficiency reduces liquidity risk by freeing tied up resources. Loan growth, the other bank specific variable has positive relationship with liquidity risk indicates higher loan growth results higher illiquid assets and decrease in short-term assets which results higher liquidity risk. As financial theories proves firms with higher profitability faces high risk, return

on asset of private commercial banks have positive association with their respective liquidity risk.

Second, with respect to macroeconomic variables lending interest rate and money supply growth have negative and significant effect on liquidity risk. Lending interest rate and liquidity risk have negative association with high correlation coefficient supports the fact that higher lending rates do not encourage banks to lend more which results higher liquidity position or lower liquidity risk. The other macroeconomic variable, money supply growth also has negative relationship with liquidity risk indicates higher money supply increase bank's liquidity as money supply is sum of cash, checking deposits, saving deposits, money market securities, mutual funds and other time deposits.

The rest variables bank size, tangibility, and real GDP growth are not powerful variables to influence liquidity risk of Ethiopian private commercial banks.

Finally, based on the finding previously formulated hypothesis was tested one by one. When it viewed from the general hypothesis, since four of bank specific variables and two of macroeconomic variables have significant influence on liquidity risk of Ethiopian private commercial banks both general hypothesis are accepted which guesses that bank specific and macroeconomic variables have significant influence on liquidity risk of commercial banks of Ethiopia.

5.2 Recommendations

The findings of the study showed that loan growth, return on asset, leverage, operational inefficiency, lending interest rate and money supply growth were the significant drivers of liquidity risk in Ethiopian private commercial banks during 2000 to 2017. Hence, focusing and taking the necessary action on these indicators could reduce the probability of liquidity risk in Ethiopian private commercial banks. Based on the findings of the study the following possible recommendations are forwarded:

- ❖ Loan growth is powerful bank specific driver of liquidity risk of private commercial banks in Ethiopia. Therefore private commercial banks should revise their credit policy in accordance with the liquidity position of the bank since high loan growth fall liquid asset of banks which results liquidity risk.

- ❖ Return on asset is powerful bank specific driver of liquidity risk of private commercial banks in Ethiopia. Therefore private banks should consider on liquidity risk that emerge with activities that create profitability.
- ❖ Since operational inefficiency and leverage have significant impact on liquidity risk of private banks, focusing and reengineering the banks in accordance with those factors could enhance the efficient management of liquidity position and minimize the liquidity risk of Ethiopian private commercial banks.
- ❖ From macro-economic variables included in this research private commercial banks in Ethiopia is advisable to pay attention for lending interest rate and money supply since those drivers are significant effect on liquidity risk. So, private commercial banks in Ethiopia should not only be concentrated on firm specific determinants, but also macroeconomic factors must be incorporated in developing strategies to effectively manage liquidity position of private banks.
- ❖ There is need for the government to reduce the strains to the general economy in order not only to facilitate economic growth but also to support the reduction of liquidity risk. The government must take into account that liquidity risk can contribute to the collapse of the banking sector and to the entire economy.

5.3 Farther Research Consideration

In this study private commercial banks are studied liquidity risk from financing gap angle by including some bank specific and macroeconomic factors. For farther study, it will be interesting if farther studies make a comparative study between private and public commercial banks liquidity risk and consider government regulation and industry market variables and other risks like operational risks and market risk. Farther more, it is recommended that to assess liquidity policies and practices of banks in their liquidity risk study.

Reference

- Abiy, Z., Alemayehu, W., Daniel, T., Melese, G., & Yilma, S., 2009. Introduction to research methods: Preparatory module for Addis Ababa University graduate programs. *Graduate Studies and Research Office. Addis Ababa University*
- AbdulGainyy, A., Zainol Z., & Ahmed N.H., 2017. Determinants of liquidity risk in dual and fully Islamic banking system: Evidence from Malaysia and Sudan. *Islamic Business School* ISSN: 2321-8819
- Ahmed ,K., Ahmed,Z.,& Naqvi,I.H. 2011. Liquidity Risk and Islamic Banks: Evidence from Pakistan. *Interdisciplinary Journal of Research in Business, 1(9)*, pp.99- 102.
- Akhtar,M.F., Ali,K., & Sadaqat,S. 2011. Liquidity risk management: A comparative study between conventional and Islamic banks of Pakistan. *Interdisciplinary Journal of Research in Business, 1(1)*, pp.35-44.
- Ali, S.S., 2004. Islamic mode of finance and associated liquidity risks.
- Ali, K., Akhtar, M.F., & Sadaqat, S., 2011. Financial and non-financial business risk perspectives: Empirical evidence from commercial banks. *Middle Eastern Finance and Economics ISSN: 1450-2889 1(1)* Retrieved from www.eurojournals.com
- Angklomkiew,S., George,J., & Packer,F. 2009. Issues and developments in loan loss provisioning: The case of Asia. *BIS Quarterly Review*. Retrieve from www.bis.org
- Asteway, F., 2018. The effect of income diversification on bank performance: Evidence from Ethiopian commercial banks. MSc thesis in Accounting and Finance, Addis Ababa University.
- Basel International Settlement 2008. *Principles for sound liquidity risk management and supervision*. Bank for International Settlements. Basel, Switzerland.
- Belaid, F., Bellouma, M., & Omir, A., 2016. Determinants of liquidity risk: Evidence from Tunisian bank. *International Journal of Emerging Research in Management and Technology* ISSN: 2278-9359, 5(9), pp. 95-104.

- Błach, J., 2010. Financial risk identification based on the balance sheet information. Retrieved from www.ekf.vsb.cz
- Brooks, C., 2014. Introductory econometrics for finance. 3rd ed., The ICMA Center, University of Reading, Cambridge University press.
- Castro, V., 2012. Macroeconomic determinants of the credit risk in the banking system: The case of GIPSI. Available at <http://www.eeg.uminho.pt/economia/nipe>
- Cucilleni, D., 2013. Determinants of bank liquidity risk within the context of Euro area. *Interdisciplinary Journal of Research in Business* ISSN: 2046-7141, 2(10), pp. 51-64
- Das, A., & Ghosh, S. 2007. Determinants of credit risk in Indian state owned banks: An empirical investigation. *Economic Issue*, 12(2). Retrieved from www.mpra.ub.uni-muenchen.de
- Diamond, D. W., 1984, Financial intermediation and delegated monitoring, *Review of Economic Studies*, 5(1), pp.393-414
- Diamond, D. W., 1983. Bank runs, deposit insurance, and liquidity. *The Journal of Political Economy*, 91(3), pp. 401-419.
- Drigă, I. 2004. Means of reducing credit risk. *Annals of the University of Petroșani, Economics*, IV, pp. 69-74.
- Drigă, I., 2012. Financial risks analysis for a commercial bank in the Romanian banking system. *Annales Universitatis Apulensis Series Oeconomica*, 14(1).
- Estrada, F., 2011. *Theory of financial risk*. Retrieved from <http://mpira.ub.uni-muenchen.de>
- Garr, D.K., 2013. Determinants of credit risk in the banking industry of Ghana. *Developing Country Studies*. ISSN 2225-0565, 3(11).
- Gilbert, A.T., 2013. Analyzing financial risk management in banks: Evidence of liquidity risk, credit risk and capital risk in South Africa. Msc thesis in Banking and Business, Eastern Mediterranean University.
- Gujarati, D.N., 2004. Basic Econometrics, 4th edn, McGraw Hill, Boston

- Harvey, C., (1996). Banking reform in Ethiopia. Retrieved from www.ids.ac.uk
- Holton,G.A., 2004. Defining risk. *Financial Analysts Journal Volume 60*
- Horcher, K.A., 2005. Essentials of financial risk management. *Hoboken, New Jersey.*
- Ibe, S. O. 2013. The impact of liquidity management on the profitability of banks in Nigeria. *Journal of Finance and Bank Management* 1(1), pp. 37-48.
- Iqbal, S., Chaudry, S.N., Iqbal, N., Din, M.Z., 2015. Impact of liquidity risk on firm specific factors: A case of Islamic banks of Pakistan. *Journal of Business and Management Research* ISSN: 2356-5764 pp. 256-260.
- Ismal, R., 2010. Assessment of liquidity management in Islamic banking industry. *International Journal of Islamic and Middle Eastern Finance and Management*, 3(2) pp. 147-167.
- Kelliher, P.O.J., Wilmot, D., VI.J, & Klumpes, P.J.M., 2011. A common risk classification system for the actuarial profession. *Risk classification working party*. Retrieved from www.actuaries.org.uk
- Kothari, C.R. (2004). Research methodology: methods and techniques (2nded.). *New age international (p) limited, New Delhi.*
- Liza, B., (2018). Determinants of bank liquidity risk of commercial banks of Ethiopia. MSc thesis in Accounting and Finance, Addis Ababa University.
- Mazur, A, W., & Szajt, M., 2015. Determinants of liquidity risk in commercial banks in the European Union. *Argumenta oeconomica* 2(35) ISSN 1233-5835.
- Milic D., & Solesa, D., 2017. The analysis of macroeconomic determinants of the banking sector liquidity with role in financing agricultural sector. *Economics of Agriculture.*
- Moussa, M. A. B., 2015. The determinants of bank liquidity: Case of Tunisia. *International Journal of Economics and Financial Issues* 5(1) pp. 249-259.
- Mugenyah, L.O., 2015. Determinants of liquidity risk of commercial banks in Kenya. MBA thesis, University of Nairobi.

- Muranaga, J., & Ohsawa, M., 1997. Measurement of liquidity risk in the context of market risk calculation. *Institute for Monetary and Economic Study*. Bank of Japan.
- Nigist, M., 2015. Determinants of Banks Liquidity: Empirical evidence on Ethiopian commercial banks. MSc thesis in Accounting and Finance, Addis Ababa University.
- Nzzotta, S. M. (2004.) *Money, Bankung and Finance: Theory and Practice*.
- Pestova, A., & Mamonov, M., 2014. Macroeconomic and bank specific determinants of credit risk: Evidence from Russia.
- Sahlemichal, M., 2009. Credit risk management system of Ethiopian commercial banks. MSc thesis in Accounting and Finance, Addis Ababa University.
- Samuel, A., 2015. Determinants of commercial banks profitability: The case Ethiopian commercial banks. MSc thesis in Accounting and Finance, Addis Ababa University.
- Saurina, J. (n.d). Loan Loss Provisions In Spain ; A working macro prudential tool. Banco de Saunders, A. (1997). *Financial institutions management: A modern perspective* (2nd ed). New York: Irwin.España. Retrieved from www.bde.es.
- Shaikh, A.S., 2015. Panel data estimation of liquidity risk determinants in Islamic banks: A case study of Pakistan. Online at <https://mpa.ub.uni-muenchen.de>
- Shah, S. Q. A., Khan, I., Shah, S. S. A., & Tahir, M., 2018. Factors affecting liquidity of banks: Empirical evidence from the banking sector of Pakistan. *Colombo Business Journal*. 9(1) pp.1-18.
- Sheefeni, P.S., & Nyambe, N.J., 2016. Macroeconomic determinants of commercial bank's liquidity risk in Namibia. *European Journal of Business, Economics & Accountancy*. ISSN 2056-6018, 4(5)
- Shen, C.H., Chen, Y.K., Kao, L.F., & Yeh, C.Y., 2009. Bank liquidity risk and performance. Retrieved from www.finance.nsysu.edu.tw
- Singh, A., & Sharma, A. K., 2016. An empirical analysis of macroeconomic and bank-specific factors affecting liquidity of Indian banks. *Future Business Journal* 2(1) pp. 40-53.

- Sori, T., 2014. Factors affecting banks profitability: An empirical study on Ethiopian private commercial banks. MSc thesis in Accounting and Finance, Addis Ababa University.
- Tewodros, M., 2013. Determinants of financial risk: Empirical evidence on private commercial banks of Ethiopia. MSc thesis in Finance and Investment, Mekele University.
- Thiagarajan, S., Ayyappan, S. & Ramachandran A., 2011. Credit risk determinants of public and private sector banks in India. *European Journal of Economics, Finance and Administrative Sciences* ISSN 1450-2275 Issue 34. Retrieved from www.eurojournals.com
- Thong, T. Q., 2013. Factors affecting liquidity risk in the system of Vietnamese commercial banks. Economics Article University of Economics HCMC.
- Tirualem, M., 2009. Assessment of liquidity risk management of commercial banks of Ethiopia. MSc thesis in Accounting and Finance, Addis Ababa University.
- Tsion, F., 2015. Risk management practice of Ethiopian commercial banks. MSc thesis in Accounting and Finance, Addis Ababa University.
- Vodova, P., 2013. Determinants of commercial bank's liquidity in Hungary. *Financial Internet Quarterly*, ISSN 1734-039X, 9(3), pp. 64-71. Available at <http://hdl.handle.net/10419/147078>
- Vodova, P., 2013. Determinants of commercial bank's liquidity in Slovakia.
- Vodová,P.(2010) .Determinants of commercial banks' liquidity in Poland. *Proceedings of 30th International Conference Mathematical Methods in Economics*. Retrieve from www.mme2012.opf.slu.cz/proceedings
- Vodová,P.(2011). Liquidity of Czech commercial banks and its determinants. *International Journal Of Mathematical Models And Methods In Applied Sciences*,5(6)
- Waemustafa, W., & Sukri, S., 2015. Macroeconomic and bank specific dynamic determinants credit risk in Islamic banks and conventional banks. *International Journal of Economics and Financial Issues*, 5(2), pp. 476-481. Available at <http://www.econjournals.com>
- Wooldridge, J. M., 2009. *Introductory Econometrics: A modern approach* (4ed). Michigan State University.

Woods, M., & Dowd, K., 2008. Financial risk management for management accountants. *The society of management accountants of Canada, the American Institute of Certified Public Accountants and The Chartered Institute of Management Accountants*.

Yaacob, F.S., Rahman, A.A., & Karim, Z.A., 2016. The determinants of liquidity risk: A panel study of Islamic banks in Malaysia. *Journal of Contemporary Issues and Thought*.

Zelalem, T., 2013. Determinants of non-performing loans: Evidence study on Ethiopian commercial banks. MSc thesis in Accounting and Finance, Addis Ababa University.

Zribi, N., & Boujelbène, Y. (2011). The factors influencing bank credit risk: The case of Tunisia. *Journal of Accounting and Taxation*, 3(4), pp. 70-78. Available online at <http://www.academicjournals.org/JAT>

Appendixes

Appendix I

	Variables	Proxy used	Reference
Dependent variable	Liquidity risk	The ratio of financing gap to total assets. Financing gap defined as the difference between a bank's loans and customer deposit.	Shen et al.(2009) and Thong (2013)
Bank specific independent variables	Size of bank	Natural logarithm of total asset	Ahmed et al(2011); Mugenyah (2015); Shen, et al., (2009) and Iqbal, et al., (2015)
	Loan Growth	Current year loan minus previous year loan divided by previous year loan	Vodova (2013)
	Return on asset	Ratio of net profit to total asset	Iqbal, et al., (2011) and Akhtar, et al., (2011)
	Tangibility	Ratio of fixed asset to total asset	Ahmed, et al., (2011)
	Leverage	Total debt divided by total asset	Ahmed, et al., (2011) and Iqbal, et al., (2011)
	Operational inefficiency	Operating expense divided by total asset	Shakih (2015); Moussa (2015) and Tilahun & Dugassa (2014)
Macroeconomic Independent Variables	Real GDP growth rate	Annual real GDP growth rate	AbdulGaniyy (2017); Cucinelli (2013); Moussa (2015) and Vodova (2013)
	Lending interest rate	Average Lending interest rate	Vodová (2011 & 2013)
	Money supply growth	Ratio of change in broad money supply to previous year broad money supply	AbdulGaniyy (2017) and Thong (2013)

Appendix II

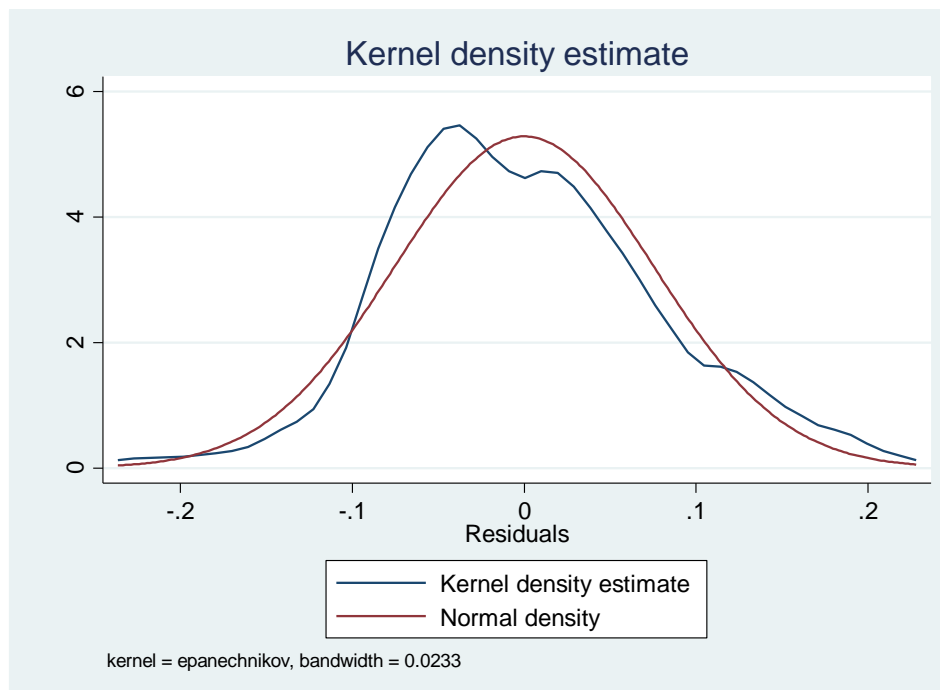
Bera-Jarque Normality Test

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. sum uhat, detail
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Residuals				
	Percentiles	Smallest		
1%	-.2070027	-.2131269		
5%	-.1122836	-.2070027		
10%	-.0771571	-.1507477	Obs	173
25%	-.0530882	-.1490178	Sum of Wgt.	173
50%	-.0070657		Mean	-1.18e-10
		Largest	Std. Dev.	.0754782
75%	.0447857	.1721752		
90%	.1061426	.1795507	Variance	.005697
95%	.1470382	.1939068	Skewness	.2810873
99%	.1939068	.2046099	Kurtosis	3.176746

Appendix III

Kdensity estimates



Appendix IV

Pooled OLS regression result

```
. reg lr lnta roa tng lg lev opin rgdp lir m2
```

Source	SS	df	MS	Number of obs =	173
Model	1.21271816	9	.134746462	F(9, 163) =	22.41
Residual	.979875752	163	.006011508	Prob > F =	0.0000
				R-squared =	0.5531
				Adj R-squared =	0.5284
Total	2.19259391	172	.012747639	Root MSE =	.07753

lr	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
lnta	-.0080615	.0078557	-1.03	0.306	-.0235736	.0074506
roa	1.539027	.6407817	2.40	0.017	.2737239	2.804331
tng	-.5496632	.4314701	-1.27	0.205	-1.401655	.3023283
lg	.0443438	.0188941	2.35	0.020	.0070351	.0816525
lev	-.3476865	.0914373	-3.80	0.000	-.5282407	-.1671322
opin	1.418173	.7232013	1.96	0.052	-.0098784	2.846224
rgdp	.337948	.2421811	1.40	0.165	-.1402689	.8161648
lir	-2.484843	1.028915	-2.42	0.017	-4.516563	-.453122
m2	-.9322775	.1176756	-7.92	0.000	-1.164643	-.6999124
_cons	.4997382	.1229244	4.07	0.000	.2570087	.7424677

Appendix V

Data for Liquidity Risk Model

bank	year	lr	lnta	Lg	roa	tng	lev	opin	rgdp	lir	m2
AB	2000	-0.18972	6.632	0.18254	0.0198	0.030303	0.8762	0.0277	0.034	0.120	0.1432
AB	2001	-0.20948	6.8101	0.25503	0.0121	0.031974	0.8853	0.0309	0.074	0.127	0.1054
AB	2002	-0.26349	7.0139	0.13547	0.0108	0.034173	0.8822	0.0297	0.016	0.108	0.0724
AB	2003	-0.25981	7.2449	0.25589	0.01	0.040685	0.9022	0.0407	-0.021	0.108	0.1053
AB	2004	-0.30904	7.4787	0.1825	0.0147	0.041808	0.9124	0.0333	0.117	0.108	0.1571
AB	2005	-0.292	7.708	0.36364	0.0171	0.033693	0.8976	0.027	0.126	0.105	0.1959
AB	2006	-0.23527	7.9909	0.45116	0.0264	0.030467	0.8971	0.0234	0.115	0.105	0.1533
AB	2007	-0.15666	8.2506	0.34188	0.0373	0.02611	0.8868	0.0201	0.118	0.105	0.2215
AB	2008	-0.23477	8.4806	0.08992	0.0296	0.027219	0.8761	0.0234	0.112	0.115	0.2035
AB	2009	-0.35024	8.7676	-0.0091	0.0223	0.022913	0.8832	0.0241	0.100	0.123	0.2101
AB	2010	-0.3726	8.9803	0.15949	0.0312	0.028587	0.8816	0.0228	0.106	0.123	0.2657
AB	2011	-0.37143	9.2219	0.26728	0.0357	0.025448	0.8707	0.0211	0.135	0.119	0.3921
AB	2012	-0.30995	9.3874	0.38083	0.033	0.0274	0.8651	0.0247	0.087	0.119	0.3028
AB	2013	-0.32541	9.6063	0.40064	0.0342	0.032053	0.8646	0.0319	0.099	0.119	0.2424
AB	2014	-0.29275	9.9049	0.19019	0.0309	0.031784	0.8739	0.0308	0.103	0.119	0.2653
AB	2015	-0.25297	10.08	0.36024	0.027	0.037974	0.8705	0.0336	0.104	0.119	0.2471
AB	2016	-0.24929	10.296	0.23784	0.0251	0.039291	0.8711	0.0357	0.080	0.127	0.1991
AB	2017	-0.19094	10.645	0.46118	0.0239	0.028458	0.8889	0.0357	0.109	0.127	0.2877
AbB	2011	-0.23066	6.1244	1	-0.0083	0.024658	0.6551	0.0329	0.135	0.119	0.3921
AbB	2012	-0.26396	7.1212	1.8617	0.0195	0.029386	0.7865	0.0402	0.087	0.119	0.3028
AbB	2013	-0.32436	7.5761	0.86462	0.0197	0.023176	0.8268	0.0463	0.099	0.119	0.2424
AbB	2014	-0.32639	8.0699	0.74933	0.018	0.020313	0.8586	0.0483	0.103	0.119	0.2653
AbB	2015	-0.28643	8.4299	0.56719	0.0274	0.022943	0.8437	0.0485	0.104	0.119	0.2471
AbB	2016	-0.2843	8.7302	0.32983	0.0238	0.023894	0.8447	0.0474	0.080	0.127	0.1991
AbB	2017	-0.29946	9.0623	0.36955	0.0288	0.018068	0.846	0.0441	0.109	0.127	0.2877
BOA	2000	0.05571	6.5765	1.03906	0.0167	0.008357	0.8287	0.032	0.034	0.120	0.1432
BOA	2001	0.04018	6.7979	0.31609	0.0212	0.013393	0.8359	0.0301	0.074	0.127	0.1054
BOA	2002	-0.21016	7.0405	-0.0262	-0.0018	0.011384	0.8765	0.0333	0.016	0.108	0.0724
BOA	2003	-0.2003	7.1952	0.20927	0.0045	0.009752	0.8882	0.0345	-0.021	0.108	0.1053
BOA	2004	-0.19748	7.3683	0.18912	0.024	0.011987	0.8782	0.0252	0.117	0.108	0.1571
BOA	2005	-0.19105	7.629	0.28274	0.0297	0.017015	0.8765	0.018	0.126	0.105	0.1959
BOA	2006	-0.07551	7.9494	0.59076	0.03	0.013409	0.8582	0.0201	0.115	0.105	0.1533
BOA	2007	-0.1225	8.1304	0.17422	0.0197	0.012073	0.8813	0.033	0.118	0.105	0.2215
BOA	2008	-0.15471	8.3594	0.22219	0.0034	0.01545	0.9017	0.0544	0.112	0.115	0.2035
BOA	2009	-0.32597	8.6082	-0.0384	0.0183	0.014176	0.9052	0.0269	0.100	0.123	0.2101
BOA	2010	-0.3162	8.7451	0.164	0.0224	0.012199	0.9068	0.0231	0.106	0.123	0.2657
BOA	2011	-0.37917	8.8926	0.05152	0.0249	0.011892	0.9092	0.0269	0.135	0.119	0.3921
BOA	2012	-0.34881	9.0167	0.17544	0.0263	0.011597	0.89	0.0274	0.087	0.119	0.3028
BOA	2013	-0.37456	9.2232	0.20646	0.0214	0.026105	0.8907	0.0223	0.099	0.119	0.2424
BOA	2014	-0.34973	9.3304	0.0959	0.0397	0.043201	0.8644	0.0306	0.103	0.119	0.2653
BOA	2015	-0.3748	9.5228	0.16351	0.0213	0.063971	0.8675	0.0338	0.104	0.119	0.2471
BOA	2016	-0.32764	9.7308	0.35457	0.0214	0.064181	0.8738	0.0424	0.080	0.127	0.1991
BOA	2017	-0.26043	10.14	0.73682	0.0213	0.048988	0.8853	0.0425	0.109	0.127	0.2877

BrIB	2010	-0.22348	5.9389	1	-0.0158	0.021973	0.7303	0.0328	0.106	0.123	0.2657
BrIB	2011	-0.39663	6.8176	1.166	0.0232	0.014625	0.8359	0.0257	0.135	0.119	0.3921
BrIB	2012	-0.33631	7.1585	0.5055	0.0262	0.011534	0.8162	0.0269	0.087	0.119	0.3028
BrIB	2013	-0.27954	7.695	0.95956	0.0241	0.008612	0.8264	0.0228	0.099	0.119	0.2424
BrIB	2014	-0.29398	7.9422	0.21023	0.016	0.010172	0.8029	0.0413	0.103	0.119	0.2653
BrIB	2015	-0.28582	8.3361	0.5831	0.0249	0.013094	0.8258	0.0388	0.104	0.119	0.2471
BrIB	2016	-0.22162	8.8813	0.9737	0.0369	0.008944	0.8527	0.0415	0.080	0.127	0.1991
BrIB	2017	-0.22292	9.2581	0.41943	0.0449	0.01521	0.8203	0.0444	0.109	0.127	0.2877
BulB	2010	-0.09998	6.174	1	0.0001	0.02202	0.6478	0.0375	0.106	0.123	0.2657
BulB	2011	-0.16012	6.6606	0.90506	0.0249	0.019597	0.7024	0.043	0.135	0.119	0.3921
BulB	2012	-0.18415	7.2189	0.77999	0.0204	0.012626	0.7897	0.0349	0.087	0.119	0.3028
BulB	2013	-0.28104	7.6631	0.45631	0.0217	0.010481	0.8241	0.0303	0.099	0.119	0.2424
BulB	2014	-0.26836	8.0103	0.41485	0.0265	0.020628	0.8284	0.0442	0.103	0.119	0.2653
BulB	2015	-0.24071	8.4118	0.8	0.0299	0.019558	0.8494	0.0467	0.104	0.119	0.2471
BulB	2016	-0.25697	8.8278	0.50204	0.0275	0.016542	0.8591	0.0454	0.080	0.127	0.1991
BulB	2017	-0.23197	9.1922	0.43224	0.0205	0.019218	0.8622	0.0413	0.109	0.127	0.2877
CBO	2005	-0.09302	4.8598	1	-0.0085	0.007752	0.1318	0.0106	0.126	0.105	0.1959
CBO	2006	0.12946	5.4116	1.33333	-0.0187	0.022321	0.4554	0.0402	0.115	0.105	0.1533
CBO	2007	-0.08962	6.0497	0.88189	0.0057	0.018868	0.6934	0.0377	0.118	0.105	0.2215
CBO	2008	-0.24715	6.5194	0.34847	0.0173	0.018509	0.7813	0.0341	0.112	0.115	0.2035
CBO	2009	-0.18838	6.9304	0.84928	0.0023	0.028912	0.8472	0.0398	0.100	0.123	0.2101
CBO	2010	-0.3676	7.4778	0.21104	0.0142	0.019793	0.8931	0.0368	0.106	0.123	0.2657
CBO	2011	-0.4713	7.8243	0.11101	0.0189	0.025313	0.9017	0.0324	0.135	0.119	0.3921
CBO	2012	-0.38522	8.2081	0.7253	0.0278	0.023604	0.8863	0.0286	0.087	0.119	0.3028
CBO	2013	-0.35924	8.7855	0.52948	0.0313	0.037299	0.8936	0.029	0.099	0.119	0.2424
CBO	2014	-0.23637	8.9026	0.75443	0.0467	0.017933	0.8517	0.0416	0.103	0.119	0.2653
CBO	2015	-0.05493	9.3468	0.81505	0.0273	0.017195	0.8769	0.053	0.104	0.119	0.2471
CBO	2016	-0.20931	9.2711	-0.0833	0.0033	0.02322	0.8851	0.076	0.080	0.127	0.1991
CBO	2017	-0.24121	9.7827	0.61906	0.0145	0.021849	0.9144	0.0483	0.109	0.127	0.2877
DB	2000	-0.08324	6.7627	0.77076	0.0127	0.019653	0.911	0.0335	0.034	0.120	0.1432
DB	2001	-0.15636	7.0031	0.33959	0.0191	0.016364	0.9155	0.0364	0.074	0.127	0.1054
DB	2002	-0.21467	7.3038	0.22129	0.0162	0.014805	0.9179	0.0269	0.016	0.108	0.0724
DB	2003	-0.1778	7.5964	0.45298	0.0136	0.013059	0.9352	0.0337	-0.021	0.108	0.1053
DB	2004	-0.18229	7.8925	0.33386	0.0209	0.014569	0.9357	0.0273	0.117	0.108	0.1571
DB	2005	-0.17573	8.1374	0.32071	0.0208	0.01345	0.9289	0.0249	0.126	0.105	0.1959
DB	2006	-0.11615	8.422	0.41756	0.0293	0.013198	0.9151	0.0253	0.115	0.105	0.1533
DB	2007	-0.14451	8.7063	0.26043	0.031	0.016057	0.9099	0.0222	0.118	0.105	0.2215
DB	2008	-0.22603	8.9655	0.0988	0.0305	0.011988	0.9067	0.0224	0.112	0.115	0.2035
DB	2009	-0.35691	9.1832	0.01586	0.0257	0.011276	0.9066	0.0209	0.100	0.123	0.2101
DB	2010	-0.4125	9.4217	0.13419	0.0262	0.013347	0.9091	0.0209	0.106	0.123	0.2657
DB	2011	-0.38361	9.5929	0.23148	0.0307	0.013242	0.9047	0.0223	0.135	0.119	0.3921
DB	2012	-0.33914	9.7711	0.3066	0.0372	0.014958	0.8957	0.0241	0.087	0.119	0.3028
DB	2013	-0.35392	9.8908	0.09091	0.0307	0.016149	0.8964	0.026	0.099	0.119	0.2424
DB	2014	-0.37572	9.9971	0.06401	0.0324	0.027272	0.8817	0.028	0.103	0.119	0.2653
DB	2015	-0.33465	10.117	0.22242	0.0294	0.027562	0.8819	0.0357	0.104	0.119	0.2471
DB	2016	-0.35216	10.26	0.10134	0.0254	0.027977	0.8825	0.0365	0.080	0.127	0.1991
DB	2017	-0.28014	10.452	0.4244	0.0218	0.024041	0.8847	0.0437	0.109	0.127	0.2877
LIB	2007	-0.17669	5.5835	1	-0.0188	0.045113	0.4925	0.0331	0.118	0.105	0.2215

LIB	2008	-0.33574	6.3529	1.43292	-0.0014	0.027072	0.7021	0.041	0.112	0.115	0.2035
LIB	2009	-0.24511	6.8591	1.57655	0.0028	0.018404	0.7987	0.0356	0.100	0.123	0.2101
LIB	2010	-0.31797	7.2179	0.24217	0.0293	0.014426	0.8227	0.0302	0.106	0.123	0.2657
LIB	2011	-0.34347	7.5	0.15812	0.0242	0.011103	0.8048	0.0288	0.135	0.119	0.3921
LIB	2012	-0.311	7.8091	0.43519	0.0306	0.009106	0.8207	0.0304	0.087	0.119	0.3028
LIB	2013	-0.26774	7.987	0.3579	0.0379	0.009863	0.8158	0.0308	0.099	0.119	0.2424
LIB	2014	-0.31895	8.1866	0.16926	0.0269	0.013497	0.831	0.0392	0.103	0.119	0.2653
LIB	2015	-0.27993	8.6676	0.83664	0.0259	0.011255	0.8668	0.0528	0.104	0.119	0.2471
LIB	2016	-0.25273	8.9913	0.52033	0.0244	0.01144	0.8776	0.0549	0.080	0.127	0.1991
LIB	2017	-0.30278	9.2931	0.27474	0.0247	0.010274	0.877	0.0415	0.109	0.127	0.2877
NIB	2000	-0.12025	5.0626	1	0.0063	0.018987	0.7468	0.019	0.034	0.120	0.1432
NIB	2001	0.00595	5.8171	2.55932	0.0357	0.008929	0.8155	0.0268	0.074	0.127	0.1054
NIB	2002	-0.03933	6.2804	0.54286	0.0243	0.009363	0.8146	0.0243	0.016	0.108	0.0724
NIB	2003	-0.04294	6.7856	0.69753	0.0147	0.00678	0.8588	0.0407	-0.021	0.108	0.1053
NIB	2004	-0.03689	7.1285	0.42909	0.0281	0.005613	0.8613	0.0233	0.117	0.108	0.1571
NIB	2005	-0.05196	7.457	0.44148	0.0266	0.005774	0.8707	0.026	0.126	0.105	0.1959
NIB	2006	0.01135	7.6143	0.30185	0.0286	0.015294	0.8594	0.0232	0.115	0.105	0.1533
NIB	2007	-0.02378	7.866	0.23186	0.0292	0.01611	0.837	0.023	0.118	0.105	0.2215
NIB	2008	-0.09756	8.2025	0.16335	0.031	0.011746	0.8361	0.0262	0.112	0.115	0.2035
NIB	2009	-0.22388	8.4777	0.05037	0.032	0.011699	0.8484	0.0274	0.100	0.123	0.2101
NIB	2010	-0.26481	8.6946	0.14676	0.0336	0.012102	0.8465	0.0304	0.106	0.123	0.2657
NIB	2011	-0.3362	8.8695	0.08656	0.0347	0.010557	0.8354	0.0272	0.135	0.119	0.3921
NIB	2012	-0.25729	9.0211	0.34064	0.0346	0.011542	0.8154	0.0263	0.087	0.119	0.3028
NIB	2013	-0.23098	9.1209	0.22489	0.0327	0.013561	0.8178	0.03	0.099	0.119	0.2424
NIB	2014	-0.23661	9.2716	0.19035	0.028	0.020598	0.8152	0.0259	0.103	0.119	0.2653
NIB	2015	-0.219	9.4843	0.27485	0.0256	0.023209	0.8344	0.0355	0.104	0.119	0.2471
NIB	2016	-0.3129	9.6611	0.08963	0.0248	0.025073	0.8396	0.0348	0.080	0.127	0.1991
NIB	2017	-0.27142	9.9532	0.4259	0.0325	0.140538	0.8595	0.035	0.109	0.127	0.2877
OIB	2009	-0.22118	5.7714	1	-0.0097	0.040498	0.6636	0.0171	0.100	0.123	0.2101
OIB	2010	-0.40404	7.0198	2.26536	0.0172	0.032699	0.8105	0.0389	0.106	0.123	0.2657
OIB	2011	-0.44067	7.5817	0.79341	0.0227	0.024934	0.8491	0.0326	0.135	0.119	0.3921
OIB	2012	-0.39381	7.9329	0.54077	0.0178	0.028829	0.843	0.039	0.087	0.119	0.3028
OIB	2013	-0.36541	8.2716	0.59007	0.0171	0.026533	0.86	0.0456	0.099	0.119	0.2424
OIB	2014	-0.40191	8.7245	0.56154	0.025	0.018485	0.8783	0.0388	0.103	0.119	0.2653
OIB	2015	-0.27098	9.1627	0.85912	0.0226	0.019173	0.8967	0.0411	0.104	0.119	0.2471
OIB	2016	-0.37072	9.3309	0.09756	0.0197	0.044878	0.8832	0.0513	0.080	0.127	0.1991
OIB	2017	-0.3829	9.6985	0.38906	0.0177	0.032203	0.8978	0.0483	0.109	0.127	0.2877
UB	2000	0.08392	4.9628	1.37838	0.021	0.041958	0.7203	0.049	0.034	0.120	0.1432
UB	2001	0.02336	5.366	0.52273	0.0234	0.03271	0.7056	0.0467	0.074	0.127	0.1054
UB	2002	-0.0828	5.7494	0.21642	0.0127	0.025478	0.7197	0.035	0.016	0.108	0.0724
UB	2003	0.0064	6.1506	0.77914	0.0107	0.01919	0.806	0.0384	-0.021	0.108	0.1053
UB	2004	-0.21958	6.5132	0.32414	0.0104	0.013353	0.8576	0.0371	0.117	0.108	0.1571
UB	2005	-0.25349	6.9782	0.54427	0.0289	0.010252	0.8835	0.0289	0.126	0.105	0.1959
UB	2006	-0.13508	7.3771	0.69309	0.0275	0.008755	0.8806	0.0231	0.115	0.105	0.1533
UB	2007	-0.06002	7.6882	0.40438	0.0293	0.014662	0.8351	0.0298	0.118	0.105	0.2215
UB	2008	-0.1796	8.0864	0.31891	0.028	0.010417	0.8561	0.028	0.112	0.115	0.2035
UB	2009	-0.31462	8.445	0.15733	0.0201	0.009083	0.8882	0.0266	0.100	0.123	0.2101
UB	2010	-0.35807	8.6821	0.21437	0.0296	0.007236	0.8919	0.0269	0.106	0.123	0.2657

UB	2011	-0.36099	8.9523	0.25381	0.03	0.007586	0.8833	0.0211	0.135	0.119	0.3921
UB	2012	-0.30411	9.081	0.2467	0.0339	0.011157	0.8746	0.0258	0.087	0.119	0.3028
UB	2013	-0.33602	9.2081	0.15308	0.0214	0.013418	0.8796	0.0354	0.099	0.119	0.2424
UB	2014	-0.32294	9.3823	0.07618	0.0167	0.01901	0.8674	0.0337	0.103	0.119	0.2653
UB	2015	-0.34429	9.5723	0.35317	0.0196	0.024999	0.8826	0.0411	0.104	0.119	0.2471
UB	2016	-0.26076	9.7567	0.24406	0.0196	0.028279	0.88	0.0416	0.080	0.127	0.1991
UB	2017	-0.20586	9.9944	0.40565	0.0174	0.03337	0.8851	0.0405	0.109	0.127	0.2877
WB	2000	-0.21595	6.2422	0.33673	0.0058	0.01751	0.9027	0.0467	0.034	0.120	0.1432
WB	2001	-0.1801	6.3682	0.31298	0.0103	0.015437	0.9005	0.0497	0.074	0.127	0.1054
WB	2002	-0.16873	6.4708	0.18023	0.0093	0.021672	0.9009	0.0464	0.016	0.108	0.0724
WB	2003	-0.14961	6.7901	0.4064	0.0124	0.016873	0.8954	0.0394	-0.021	0.108	0.1053
WB	2004	-0.12105	7.0388	0.29247	0.0281	0.014035	0.8868	0.0412	0.117	0.108	0.1571
WB	2005	-0.17698	7.3877	0.35772	0.0297	0.012995	0.8886	0.0402	0.126	0.105	0.1959
WB	2006	-0.08189	7.7227	0.58982	0.0314	0.011067	0.8871	0.0403	0.115	0.105	0.1533
WB	2007	-0.16336	8.1548	0.35279	0.0322	0.009483	0.8842	0.0322	0.118	0.105	0.2215
WB	2008	-0.1502	8.3248	0.08899	0.0337	0.009832	0.8532	0.0365	0.112	0.115	0.2035
WB	2009	-0.31573	8.5406	-0.0999	0.0353	0.011261	0.8366	0.0259	0.100	0.123	0.2101
WB	2010	-0.25234	8.6556	0.17113	0.0389	0.014415	0.8168	0.03	0.106	0.123	0.2657
WB	2011	-0.37804	8.9948	0.17631	0.0401	0.014385	0.8341	0.0318	0.135	0.119	0.3921
WB	2012	-0.26267	9.0297	0.2253	0.0403	0.03703	0.8078	0.0302	0.087	0.119	0.3028
WB	2013	-0.27521	9.249	0.31536	0.033	0.034702	0.8239	0.0313	0.099	0.119	0.2424
WB	2014	-0.33623	9.3275	-0.0183	0.0271	0.003097	0.8093	0.039	0.103	0.119	0.2653
WB	2015	-0.26996	9.526	0.33991	0.0257	0.046751	0.8239	0.0425	0.104	0.119	0.2471
WB	2016	-0.213	9.6921	0.23678	0.0232	0.045738	0.8267	0.044	0.080	0.127	0.1991
WB	2017	-0.1738	9.9499	0.36	0.0254	0.045408	0.8398	0.0462	0.109	0.127	0.2877
ZB	2009	-0.19264	6.1368	1	-0.0198	0.066276	0.8043	0.0524	0.100	0.123	0.2101
ZB	2010	-0.28809	6.9619	1.03418	0.0483	0.031889	0.8498	0.0398	0.106	0.123	0.2657
ZB	2011	-0.32064	7.3861	0.68065	0.0525	0.014151	0.8508	0.0344	0.135	0.119	0.3921
ZB	2012	-0.32586	7.7808	0.56951	0.0361	0.019608	0.8828	0.0322	0.087	0.119	0.3028
ZB	2013	-0.34966	8.0859	0.35249	0.029	0.018491	0.8481	0.0556	0.099	0.119	0.2424
ZB	2014	-0.4079	8.2751	0.04403	0.0469	0.019007	0.8327	0.0307	0.103	0.119	0.2653
ZB	2015	-0.34191	8.4917	0.50822	0.0314	0.014093	0.8432	0.0338	0.104	0.119	0.2471
ZB	2016	-0.30282	8.9057	0.50877	0.0275	0.010478	0.8641	0.0307	0.080	0.127	0.1991
ZB	2017	-0.34674	9.1767	0.22025	0.0368	0.052144	0.864	0.0326	0.109	0.127	0.2877