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

**The Impact of Liquidity Risk on Financial Performance of  
Commercial Banks in Ethiopia**

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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**Advisor: Tekaligne Nega (PhD)**

**February, 2019**

**Addis Ababa, Ethiopia**

## **Statement of Declaration**

I declare that the thesis entitled: “The impact of liquidity risk on financial performance of commercial banks in Ethiopia”, 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, Tekaligne Nega (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 to certify that this thesis titled “The impact of liquidity risk on financial performance of commercial banks in Ethiopia” carried out by Eyob Kindu Zenebe. The work is original in nature and is suitable for the submission for the Master of Science Degree in Accounting and Finance.

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This is to certify that the thesis prepared by Eyob Kindu, entitled: The effects of Liquidity risk on financial performance of Commercial banks in Ethiopia 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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## **Abstract**

*The basic function of banks in any economy is maturity transformation from short term deposit in to long term loan. This role makes banks inherently vulnerable to liquidity risk both of an institution-specific nature and markets as a whole. The aim of this study was to examine the effect of liquidity risk on financial performance of Ethiopian commercial banks. Balanced Fixed effect panel regression was used for the data of nine commercial banks for the sampled covered period from 2007 to 2016 and secondary data were used. Eight factors affecting financial performance of Ethiopian commercial banks were selected and analyzed. The result of panel data regression analysis showed that liquidity coverage ratio, net stable funding ratio, loan to deposit ratio and liquidity ratio had negative and statistically significant impact on Ethiopian commercial banks financial performance. Cash reserve ratio, portion of nonperforming loan from the total bank loan, CPI and GDP growth rate had negative but statistically insignificant/ has no any impact on financial performance of Ethiopian commercial banks for the tested period. Therefore, liquidity risk was negatively affecting the financial performance of Ethiopian commercial banks. Finally, the study recommend that a bank's management invest the commercial banks tied up deposit/money on the market either in the form of loan or other investment and develops different new credit products like personnel loan, vehicles loan, mortgage loan, consumer loan to generate high amount of profit.*

Key words: Liquidity risk and financial performance

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## **List of Acronyms**

ABB: Abay Bank

AB: Awash Bank

BIB: Birhan International Bank

BOA: Bank of Abyssinia

BUIB: Buna International Bank

CBE: Commercial Bank of Ethiopia

CBO: Cooperative Bank of Oromia

CC: Correlation Coefficients

CI: Condition Index

CLRM: Classical Linear Regression Model

CPI: Consumer Price Index

CRR: Cash Reserve Ratio

DB: Dashen Bank

DGB: Debub Global Bank

EB: Enat Bank

FIM: Fixed Effect Model

GDP: Gross Domestic Product

IFM: International Monetary Fund

LCR: Liquidity Coverage Ratio

LIB: Lion International Bank

LR: Liquidity Ratio

LTD: Loan to Deposit

NBE: National Bank of Ethiopia

NIB: Nib International Bank

NPL: Non Performing Loan

NSFR: Net Stable Funding Ratio

OECD: Organization for Economic and Development

OIB: Oromia International Bank

OLS: Ordinary Least Square

REM: Random Effect Model

ROA: Return on Asset

ROE: Return on Equity

RTGSs: Real Time Gross Settlements

UB: United Bank

VIF: Variance Inflation Factor

WB: Wegagen Bank

ZB: Zemen Bank

# **Chapter One**

## **Introduction**

### **1.1. Background of the Study**

A bank is a financial intermediary whose core activities is collects deposit from saver to provide loans to borrower. Banks collects surplus fund from saver and allocate to those both people and companies with a deficit of funds (borrower) in doing this, they channels funds from saver to borrower, thereby increasing economic efficiency by promoting a better allocation of resource (Barbara, Claudia, & Philip, 2015). 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 (Basel, 2008). In addition to maturities transformation banks transform size and risk. The size transformation helps the bank to collect funds from saver in the form of small size denomination and repackage them in to large size loan and the risk transformation helps the bank that the saver diversifying their investment, pooling risk screening and monitoring borrower and holding capital and reserve as a buffer for unexpected losses (Barbara et al. 2015). By performing this role the bank generate profit. Sayers (1976) infers that the profit that the bank generate derived from the income attached to the asset and it is enable to hold by the public being willing to hold the bank’s deposits as money balance. To sustain the profit the bank must maintain public confidence, to maintain public confidence the bank must maintain adequate degree of liquidity asset.

Liquidity in banking is a key factor because a bank needs to ensure that it keeps enough cash or other liquid asset to meet is obligation (Tracy, 1978). Liquidity represents the closeness of asset to cash. Sayers, (1976) define liquidity as it is the word that the bank uses to describe its ability to satisfy demands for cash in exchange for deposit. Liquid asset is an asset which is convertible to cash easily. Barbara et al. (2015) define liquidity asset as an asset that can be turned in to cash quickly and without capital loss or interest penalty. National Bank of Ethiopia (NBE) also define liquid asset as an asset which include cash, deposits with the National Bank , other local and foreign banks having acceptance by the National Bank and other assets readily convertible into cash expressed and payable in Birr or foreign currency having acceptance by the National Bank.

When the bank holding insufficient liquid asset on its balance sheet and unable to meet its requirement without incurring high cost this is called liquidity risk. Liquidity risk is generated in the balance sheet by a mismatch between the size and maturity of asset and liability (Barbara et.al, 2015).

Basel committee (2008) describe liquidity as it is the ability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses. Effective liquidity risk management helps ensure a bank's ability to meet cash flow obligations, which are uncertain as they are affected by external events and other agents' behavior. Liquidity risk management is of paramount importance because a liquidity shortfall at a single institution can have system-wide repercussions. Financial market developments in the past decade have increased the complexity of liquidity risk and its management. On the other hand holding more liquid asset to minimize liquidity problem is costly. Barbara et.al (2015) argue that there is a trade-off between liquidity and profitability, as the more liquid the asset, the lower rate of return. Instead of holding liquid fund, a bank could make more profitable loan. Despite the cost, however, the holding of liquid asset is necessary as it; reassure creditor that the bank is safe and able to meet its liability, signal to the market that the bank is prudent and well managed, ensure that all lending commitment can be meet, avoid forced sale of the bank asset, avoid having to pay excessive borrowing cost in the interbank market and central bank borrowing.

The issue related to effect of liquidity risk on financial performance in the commercial banks was studied by different researcher for instance; Siaw (2013), Muriithi and Waweru (2017), Wanjiku and Assuptah (2017), Maaka (2013) and Mwangi (2014) shows that the liquidity risk affect the financial performance of the banks. However the independent variables of one study vary from other study. There are some studies which are conducted in Ethiopia such as Nathnael Hailu (2013), Sirak Yifru (2016) and Tseganesh (2012). The first two studies were prepared to examine the impact of liquidity risk on profitability of banks. However they limit the study on single commercial and development bank (Nib International bank and Development Bank of Ethiopia). The aim of the third study was two folders: first, to identify the determinants of liquidity of commercial banks. Second, to determine the impact of bank liquidity on financial performance. However many of the study variables are macroeconomic. The impact of liquidity risk on financial performance of Ethiopian commercial banks is still unexploited. Hence this study aims

examine, exploited and investigate the impact of liquidity risk on financial performance of Ethiopian commercial banks.

## **1.2. Statement of the Problem**

The basic function of banks in any economy is maturity transformation from short term depositor in to long term loan. This role makes banks inherently vulnerable to liquidity risk both of an institution-specific nature and that which affects markets as a whole (Basel, 2008). Liquidity is important in any business specially for banking business because banks need to have enough cash or other liquid asset to meet its obligation as they come due. The actual inflow and outflow of funds does not necessary reflects contractual maturities and yet banks must be able to meet certain commitment whenever they come due. Therefore this liquidity mismatch experiences the bank, making its liquidity policies and liquidity risk management is a key factor for its business strategy.

Supervisory organ now tends to concentrate a maturity structure of a bank asset and liability rather than solely on its statutory liquid asset requirement (Greuning & Bratanovic, 2009). National bank of Ethiopia directive clearly states that every bank shall transfer annually 25% of its annual net profit to its Legal Reserve Account until such account equals its capital. When the legal reserve account equals the capital of the bank, the amount to be transferred to the legal reserve account shall be 10% (ten percent) of the annual net profit. Holding liquid assets can reduce a bank's liquidity risk. However, holding further liquid assets imposes an opportunity cost on the bank given their low return relative to other assets. There is a point at which holding further liquid asset diminishes a bank profitability (Bordeleau and Graham, 2010). In Ethiopia there is no secondary capital market, due to this banks are expected to hold high amount of liquid asset. Worku (2006) and Semu (2010) indicated the presence of excess liquidity held by Ethiopian commercial banks. At some point holding much more liquid asset outweighed by the opportunity cost on the bank given low return.

The issue related to effect of liquidity risk on financial performance in the commercial banks was studied by different researcher in Ethiopia and in the rest of the world. There are some studies which are conducted in Ethiopian such as Nathnael (2013), Sirak (2016) and Tseganesh (2012). The first two studies were prepared to examine the impact of liquidity risk on profitability of

banks. However they limit the study on single commercial and development bank (Nib International bank and Development Bank of Ethiopia). Tseganesh (2012) the aim of her study was to attain two objectives: one, to identify the determinants of liquidity of commercial banks. Second to determine the impact of bank liquidity on financial performance. However many of the study variables are macroeconomic variables. The impact of liquidity risk on financial performance of Ethiopian commercial banks is still unexploited area of research. Hence this study aims to fill the stated gap by examine, exploited and investigate the impact of liquidity risk on financial performance of Ethiopian commercial banks by introduce new variables like Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR).

### **1.3. Research Objectives**

This study determines the impact of liquidity risk on financial performance of Ethiopian commercial banks through analyzing statistically significant factors affecting banks liquidity on financial performance.

### **1.4. Research Hypothesis**

The following research hypotheses were developed in order to address the research question. Therefore this study attempt to test the following hypothesis in order to address the impact of liquidity risk on financial performance of commercial banks in Ethiopia.

1. H1: Liquidity coverage ratio has negative and significant effect on financial performance of commercial banks
2. H2: Net stable funding ratio has negative and significant effect on financial performance of commercial banks
3. H3: Non performing loan has negative and significant effect on financial performance of commercial banks
4. H4: Loan to deposit ratio has negative and significant effect on financial performance of commercial banks
5. H5: Cash reserve ratio has negative and significant effect on financial performance of commercial banks
6. H6: liquidity ratio has negative and significant effect on financial performance of commercial banks

7. H7: GDP growth rate has negative and significant effect on financial performance of commercial banks.
8. H8: Consumer price index rate negative and has significant effect on financial performance of commercial banks.

### **1.5. Scope and limitation of the Study**

The scope of the study was limited to see only the impact of banks liquidity risk (liquidity coverage ratio, stable funding ratio, non-performing loan, loan to deposit ratio, cash reserve, liquidity asset ratio, CPI and GDP growth on financial performance of commercial banks in Ethiopia through analyzing the impact of liquidity risk on financial performance from 2007 to 2016 for selected nine commercial banks in Ethiopia.

### **1.6. Significance of the Study**

The study has great contribution to the existing knowledge in the area of the impact of liquidity risk on financial performance of Ethiopian commercial banks. This in turn contributes to the well-being of the financial sector of the economy and the society as a whole. The other benefit of the study is to create alertness of the bank officials in order to boost their bank's profitability. Therefore, the major beneficiaries from this study are each commercial bank, regulatory bodies, the academic staff of the country and the society as a whole in the country and for other researchers to gain knowledge about the impact of liquidity risk on financial performance of commercial banks.

### **1.7. Organization of the Study**

This study has five chapters. Chapter one contains the introduction that given an overview of the study. It explains the rationale for the study and how its objectives were achieved. Chapter two include two parts which is a review of theoretical and empirical literature on the concept of liquidity risk, measures of liquidity risk and the effect of liquidity risk on bank financial performance. The third chapter contains the topic that clearly indicates how this research was carried out. In doing so, it include the topic called research design method, sources of data, econometric specifications, justification of variables, population and sampling method, data collection, presentation and analysis method, and model specification. Chapter four contains the analysis, interpretations of the estimations and findings. Chapter five provides a summary of the content of the whole study and recommendations.



## **Chapter Two**

### **Literature Review**

#### **2.1 Review of related Literature**

Liquidity is the ability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses (Basel, 2008). European central bank also defines liquidity as the ability to settle obligations with immediacy. Consequently, a bank is illiquid if it is unable to settle obligations in time. In this case the bank defaults, and shareholders and possibly also depositors incur losses. IMF define liquidity as it is an assets that can be easily converted into cash, and now includes most financial assets as financial innovations and financial deepening have enabled them to be readily converted into money. Bank liquidity includes the impact of alternative funding source and their predictability. Macdonald and Koch (2006) describe bank liquidity as a bank capacity to acquire available funds at reasonable price as needed immediately. As per Machiraju (2003) liquidity of banks may be define as the ability of financial institution to meet anticipated and contingent cash need. The cash need may arise from withdrawal of deposit, liability maturities and loan disbursement. A bank is considered to be liquid if it has ready access to immediately spendable funds at reasonable cost at precisely the time those funds are needed (Rose, 1999). This suggested that a liquid bank either has the right amount of immediately spendable funds on hand when they required or can quickly raise liquid funds by borrowing or by selling of asset.

A liquid asset is an asset that can be readily converted to cash. Koch and Macdonald (2015) define liquidity risk as the one that can be easily and quickly covered into cash with minimum loss. They considered liquid asset to be cash and due from banks in excess of requirements, federal funds sold and reserve repurchase agreement, short term treasury and agency obligation, high quality short term corporate and municipal securities, and some government guaranteed loan that can be readily sold. NBE also considered to be liquid assets are “cash, deposits with the National Bank and other local and foreign banks having acceptance by the National Bank, other assets readily convertible into cash expressed and payable in Birr or foreign currency having acceptance by the National Bank, deposits held in Organization for Economic Cooperation and Development (OECD) member countries’ currencies and payable by banks of OECD member

countries and in such other currencies as may be approved by the National Bank as well as securities issued by OECD member countries denominated in currencies of such countries”. As per Rose (1999) liquid assets have three characteristics. The first it must have ready market so that it can be converted in to cash without delay. The second is it must have reasonable price so that no matter how quickly the asset must be sold or how large the sale is, the market is deep enough to absorb the sale without a significant price decline. The third is it must be reversible so that the seller can recover his/her original investment with little risk of loss.

The main roles of banks are maturity transformation (i.e. change short term deposit in to long term loan), facilitate payment, credit, cash management, trust, agency, utility role and etc. The fundamental role of banks in the maturity transformation of short-term deposits into long-term loans makes banks inherently vulnerable to liquidity risk, both of an institution-specific nature and that which affects markets as a whole. Virtually every financial transaction or commitment has implications for a bank’s liquidity (Basel, 2008). Liquidity risk is a risk that a financial institution face due to unable to meet short term financial demand. The financial institution has effectively met its liquidity need when it can acquire sufficient fund quickly and at reasonable cost either by issuing liability or liquidating assets. As per Koch and Macdonal (2015) they hold liquid asset to meet potential deposit outflows and withdrawal for other liabilities, to fund investment in loan and to plan for both expected and unexpected balance sheet fluctuation as well as future growth. Greuning and Bratanovic (2009) also confirm that financial institution hold liquidity to compensate for expected and unexpected balance sheet fluctuation and to provide fund for growth. Accordingly this liquidity boost the bank’s ability efficiently accommodates the redemption of deposit and other liabilities and to cover funding increase in the loan and investment portfolio. Machiraju (2003) further elaborate the need for liquidity or holding liquid asset is to replace outflows of fund giving rise to funding risk (i.e. Funding risk is the risk that the firm will not be able to meet efficiently both expected and unexpected current and future cash flow and collateral needs without affecting either daily operations or the financial condition of the firm.), to compensate for non receipt of expected inflows of funds giving rise to time risk, to find new funds when contingent liability become due and to undertake new transactions when desirable giving rise to call risk. But financial institutions are not holding enough liquid assets all the time. As per Rose (1999) lack of adequate liquid asset is often lead

the banks in serious trouble. The trouble bank usually begins to lose deposit which erode its supply of cash and force the institution to dispose of its more asset liquid asset by fewer prices. While other institution become increasingly reluctant to lead the trouble bank any funds without additional securities or high rate of interest, which further reduce the income of the problem institution. Machiraju (2003) also agree with the above idea and he describe that inadequate liquidity can lead the financial institutions to unexpected cash shortfalls that must be covered at inordinate cost which reduce profitability. Further it leads them to liquidity insolvency without being capital insolvent.

This chapter has four broad sections. Section 2.2 discusses about the theoretical aspects of banks liquidity and its impact on financial performance. Section 2.3 extensively explains important empirical studies on the impact of bank liquidity on financial performance. Then, section 2.4 asses related empirical studies in Ethiopia. Section 2.5 give summaries to the chapter and briefly discusses knowledge gap in the relevant literatures and finally section 2.6 the conceptual frame work of the study.

## **2.2 Theory of Bank Liquidity Management**

The major objective of a commercial bank is to create liquidity while remaining financially sound. However, there are a number of dimensions in the way banks concretely manage their liquidity risk. There are theories of bank liquidity management which are mainly based on management of asset and liability. For this study purposes the researcher use commercial loan theory, Shiftability theory, anticipated income theory and liability management theory. Except liability management theory all other theories are based on asset management.

### **Commercial Loan Theory**

As per Machiraju (2003) commercial loan theory maintained that commercial banks liquidity would be assured as long as asset were held in short term loan that would be liquidated in the normal course of business. As per Botoe (2011) a critical underlying assumption of this theory is that short-term commercial loans were desirable because they would be repaid with income resulting from the commercial transaction financed by the loan. This assumption would certainly not hold during a general financial crisis even if bank loan portfolios did conform to theoretical standards, for in most commercial transactions the purchaser of goods sold by the original

borrower had to depend to a significant extent on bank credit. In addition to this Machiraju (2003) also the theory failed to take in to account the credit needs of the economy and it also didn't take in to account the relative stability of deposit, especially core deposit which enables the bank to extend loans for reasonable long period without becoming illiquid.

### **Shiftability Theory**

As per Mitchell (1923) describe that, the orthodox theory of banking which assume banks should keep themselves in condition to meet the demand of depositor by disbursing short time loan for commercial transaction purpose. This theory challenged by many authors due to; first short term paper for commercial purpose doesn't liquidate at maturity. Secondly good banking policy would avoid a general forced liquidation of such paper. Thirdly reliance for the liquidity of earning asset to shift the earning asset. Fourthly banks become conduct business on small margin of business. Fifthly the liquidity of asset depends not so much up on the form and maturity of commercial paper. So, due to this and the necessity to shift the illiquid assets to strong institution in exchange for more liquid asset. This shift gives liquidity to the illiquid asset and Shiftability theory is born.

As per Machiraju (2003) also Shiftability theory is based on the proposition that the asset the bank hold either be sold to other lender or investors or shifted to the central bank which stands ready to purchase asset offer for discount. Botoe (2011) also describe that it 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 Shiftability theory survived these realizations under a modified form that included the idea of ultimate liquidity in bank loans resting with Shiftability to the Federal Reserve Banks. Under this institutional scheme, the liquidity concerns of banks were partially returned to the loan portfolio, where maintenance of quality assets that could meet the test of intrinsic soundness was paramount. A major defect in the Shiftability theory was discovered similar to the one that led to the abandonment of the commercial loan theory of credit, namely that in times of general crisis

the effectiveness of secondary reserve assets as a source of liquidity vanishes for lack of a market.

### **Anticipated Income Theory**

The anticipated income theory holds that liquidity can be ensured if scheduled loan payments are based on the future income of the borrower. The theory relates loan repayment to borrower income than rely on collateral. The theory also holds that a banks liability can be influenced by the maturity pattern of the loan and investment portfolio. The theory also recognized that certain types of loan have more liquid than the other. On the basis of theory bank management adopted the ladder effect in the investment portfolio (Machiraju, 2003). Botoe (2011) link anticipated income theory in to term loan which were of growing importance, with appropriate repayment schedules adapted to the anticipated income or cash flow of the borrower. He describe that the credit demands of business were well accommodated under this system of banking policy, and the use of loan commitments was freely pursued. Changing economic conditions, however, placed extra demands on the banking system that resulted in a new approach to balance sheet management, and businesses faced new financial challenges. Under this emerging state of affairs, bank loan commitment policies would come to play a more important part in the credit process.

Prochnow (1949) also describe that anticipated income theory become know in relation to introduction of term loan which were extend by banks. Commercial banks ordinarily liquidate term loan neither by the sale of asset of borrower which is held as collateral nor by shifting the term loan to some other lender rather by the anticipated income of the borrower. Commercial banks put pressure on the borrower to save and to retire his/her loan from earnings or to defer replacement to obtain funds for liquidating his/her borrowing.

### **Liability Management Theory**

As per Machiraju (2003) liability management theory holds that banks can meet their liquidity requirement by bidding in the market for additional fund to meet loan demand and deposit withdrawal. The root of the theory may be traced to the rejuvenation of the federal fund market in 1950s and development of negotiable time certificate/instrument of deposit as major money

market instrument. Now a day's many banks rely for liquidity on secondary market or sale of loan participation certificates.

### **2.3 Measurements of Liquidity Risk**

Before going to describe the measurement of liquidity risk, cause of liquidity and possible way of to mitigate them should clearly state. As per Tsi (2018) the major cause for liquidity risk is maturity mismatch. This happen due to when a bank borrow large amount short term deposit or reserve from individual or business or other lending institution and then turn around and make long term credit available to their liability. Machiraju (2003) also argue that the source of liquidity risk are mainly depend on the maturity structure of the balance sheet (expected outflow of funds matched by expected flows of funds) on the asset side, to sell, discount or pledge asset at short notice at minimum cost; and on the liability side ability to raise new money at short notice. Iqbal et al. (2015) also identify the cause for liquidity risk. They agree that in general liquidity risk is caused when one party (an investor or a bank) cannot sell a particular asset on the open market because of there is no other party available or willing to purchase and trade for it. It is easily to think that liquidity risk is a lack of mobility for a given investment product instead of a lack of that value. The other source of liquidity risk is sensitivity to change in interest rates raises; some depositors will withdraw their fund in search of return at elsewhere. Many creditors on contrary postpone new loan request or speed up their drawings other credit line that carry lower interest rates (Tsi, 2018).

Rochet (2008) also states four main sources of liquidity risk: on the liability side, there is a large uncertainty on the volume of withdrawals of deposits or the renewal of rolled-over inter-bank loans, especially when the bank is under suspicion of insolvency or when there is an aggregate liquidity shortage, on the asset side, there is an uncertainty on the volume of new requests for loans that a bank will receive in the future, of course the bank could refuse to grant these new loans but this would in general lead to the loss of profit opportunities. This would also be detrimental to the borrowing firm if it is credit rationed and more general to the economy as whole, off-balance sheet operations, like credit lines and other commitments, positions taken by banks on derivative markets and the final source of liquidity risk are large value inter-bank payments, for which central banks favor the use of real time gross settlements (RTGSs) over

deferred net basis, because they are less prone to systemic risk. However RGTSSs are highly liquidity intensive and can only function properly if banks hold sufficient amount of collateral to back credit lines, either from the central bank or from other participants.

According to Rose (1999) there are three broad strategies for dealing with bank liquidity problem. The first one is providing liquidity from asset (i.e. Asset liquidity management) this strategies is the oldest approaches and it calls for storing liquidity in the form of holding of liquid asset predominantly in cash and marketable securities. When liquidity is needed, selected asset are sold for cash until all the banks demand for cash are met. This strategy mainly used by small banks that find it a less risky approach to liquidity management that relying on borrowing. However storing liquid assets are opportunity cost. The second strategy is relying on borrowed liquidity to meet cash demand (i.e. Liability management). It used by largest bank in the industry, began to raise more of their liquid funds through borrowing in the money market. These borrowing funds are used to cover all anticipated demand for liquidity. Unlike storing liquid asset, this strategy borrow liquid asset only when it actually needs fund. However there is volatility of money market interest rates and the rapidity with which the availability of credit can change. The third approaches is balanced (i.e. asset and liability) liquidity management. Due to the risk inherent in relying on borrowed liquidity and the cost of storing liquidity in asset, most banks compromise in choosing their liquidity management strategy and use both asset management and liability management. Under this strategy some of expected demands for liquidity are stored in asset while other anticipated liquidity needs are backstopped by advance arrangement for line of credit from correspondence bank and other supplier of funds.

Accordingly Aspaches (2005) there are a number of mechanisms that banks can use to insure against such liquidity crises. Key among those is for banks to self-insure against liquidity shocks on the liability side of the balance sheet, by holding a buffer of liquid assets on the asset side. A large enough buffer of asset which is cash, balance with central bank and other liquid asset reduce the chance that liquidity demands threaten the viability of the bank. A second mechanism is for banks to co-insure in the interbank market. This relies on liquidity shocks being less than perfectly correlated across banks, and again requires banks to hold a certain amount of liquid assets to help each other out, in case of particular institutions shocks Of course, in the face of

informational asymmetries and free-rider problems, this type of interbank insurance mechanism may not work perfectly in all situations, which is why the central bank typically acts as a Lender of Last Resort to provide emergency liquidity assistance to particular institutions and to provide aggregate liquidity in case of a system-wide shortage. Different scholars measure liquidity risk in different ways. Some of the measurements are the below;

### **Liquidity Coverage Ratio**

LCR is the one that the Basel committee (2011) used as a standard or parameter to promote short-term resilience of a bank's liquidity risk profile by ensuring that it has sufficient high quality liquid resources to survive an acute stress scenario lasting for one month. According to Basel (2011) the LCR is intended to promote resilience to potential liquidity disruptions over a thirty day horizon. It will help ensure that global banks have sufficient unencumbered, high quality liquid assets to offset the net cash outflows it could encounter under an acute short term stress scenario. The specified scenario is built upon circumstances experienced in the global financial crisis that began in 2007 and entails both institution-specific and systemic shocks. The scenario entails a significant stress, although not a worst-case scenario, and assumes a significant downgrade of the institution's public credit rating, a partial loss of deposits, a loss of unsecured wholesale funding, a significant increase in secured funding haircuts, and increases in derivative collateral calls and substantial calls on contractual and non-contractual off-balance sheet exposures, including committed credit and liquidity facilities. High-quality liquid assets held in the stock should be unencumbered, liquid in markets during a time of stress and, ideally, be central bank eligible.

### **Net Stable Funding Ratio**

Basel (2011) banks requires to hold a minimum amount of stable sources of funding at a bank relative to the liquidity profiles of the assets, as well as the potential for contingent liquidity needs arising from off-balance sheet commitments, over a one-year horizon. The NSFR aims to limit over-reliance on short-term wholesale funding during times of buoyant market liquidity and encourage better assessment of liquidity risk across all on- and off-balance sheet items. As per Muriithi and Waweru (2017) this reduces the maturities mismatch between the asset and liability items on the balance sheet and thereby reduces funding and rollover risk. If high available stable funding which consists of capital and retail deposit is required competitive pressure will contain



bank to some extent resulting in competition for loans, deposit, and even the source of equity and debt investment. This competition lead to high costs of doing business resulting in instability.

### **Non-Performing Loan**

Non-performing loans are loan remain default in both principal and interest in contrary agreement of the contract for long period of time. Mainly profit source of financial institution is interest which is generated from loans. As a result of declining liquidity and bad condition of macroeconomics most of the firms and people are unable to pay and defaulting the loans. Rise in NPL is a warning indicator for any banking industry of the world to prevent the banking crisis. As per Azeem et al. (2017) the main causes of nonperforming loan are high interest rate, low GDP, poor credit appraisal, inflation, unemployment and improper lending disbursement to the economy. This leads NPL to have negative impact on the economy and financial institution. According to Armstrong and Caldwell (2008), liquidity risk management tries to guarantee a bank's capability to keep on performing bank main role that are involves the transformation of liquid deposit liabilities into illiquid assets such as loan. Banks are also in need to meet uncertain cash flow obligation. Bank ought to have enough cash or liquid assets out request to meet their clients require or need. A liquidity shortfall in a bank will reduce the confidence of the customers toward the bank and even can create a bank run over speculation. According to Bloem and Gorter (2001) non performing loan may affect all sectors in the economy. However the most serious impact is on financial institution such as commercial banks and mortgage financial institution which tends to own large loan portfolio. They extend further that large bad loan portfolio will affect the ability of banks to provide credit, the resulting liquidity crunch may suffocate otherwise good creditors. Depositor and foreign investors may start a run on the banks, pushing them in to liquidity problem. Therefore, the amount of non-performing loans has a negative impact on banks liquidity.

### **Loan to Deposit**

As per Choudhry (2011) LTD is the standard and commonly used metrics. It measures the relationship between lending and customer deposit and it also measure the self sustainability of the bank. However it is not predict and does not account for the tenor, concentration and volatility of fund. If loan to deposit ratio is high, the bank either has a large loan portfolio or

using non deposit or purchased funds to finance asset. When the ratio is relatively high, banks would be less inclined to lend and invest (Machiraju, 2003). A level above 100% is an early warning sign of excessive asset growth; of course a level below 70% implies excessive liquidity and implies a potential inadequate return on funds (Choudhry, 2011).

### **Legal/Cash Reserve Ratio**

The economics times define legal reserve as a percentage of deposits which commercial banks are required to keep as cash according to the directions of the central bank. As per Cacy (1976) the legal reserve are a certain percentage of various types of deposit that the commercial banks maintain either as vault cash or deposit at Federal Reserve Bank. As per Gray (2011) there are three reasons to impose legal reserve by central bank. The First is prudential which is when commercial banks' ability to take deposits and issue their own banknotes was constrained by a requirement to hold proportionate reserve balances either directly, or at central bank, which in turn held gold reserves. These reserves provided some protection against both liquidity and solvency risks. Secondly as monetary control, this takes two forms: First, if reserve money cannot easily be increased, reserve ratio may restrict commercial bank balance sheet growth. Second, the central bank could influence the spread between deposit and lending rates, in order to impact the growth of monetary aggregates and thus inflation by using reserve ratio. Thirdly as liquidity management tools a central bank immobilize surplus reserves by administrative fiat, so that the impact of a surplus on bank behavior (low interest rates, demand for foreign exchange) does not in turn lead to inflation or depreciation. Therefore legal reserve has negative impact on liquidity.

### **Liquidity Ratio**

Liquidity ratios are used to determine a company's ability to meet its short-term debt obligations. According to Harahap (2013) liquidity ratio is the ability of company in fulfilling the short term liabilities. Awais (2016) describe liquidity ratio it is plays a very important role in every business because banks usually operate with large funds which is borrowed from depositors in the form of demand and time deposits. As per Vodova (2011) liquidity ratio gives information about the general liquidity shock absorption capacity of a bank. As a general rule, the higher the share of liquid assets in total assets, the higher the capacity to absorb liquidity shock, given that market liquidity is the same for all banks in the sample. However, high value of this ratio may be also

interpreted as inefficiency, since liquid assets yield lower income liquidity bears high opportunity costs for the bank. Thus it is necessary to optimize the relation between liquidity and profitability.

### **Inflation**

Inflation is a quantitative measure of the rate at which the average price level of a basket of selected goods and services in an economy increases over a period of time. Oner, 2010 define inflation as it is the rate of increase in prices over a given period of time. Inflation is typically a broad measure, such as the overall increase in prices or the increase in the cost of living in a country. A chief measurement of inflation is the inflation rate which is the annualized percentage change in a general price index normally the consumer price index (CPI) over time (Audo, 2014). CPI is a measurement of inflation that examines the weighted average prices of a basket of goods and services which are primary consumer needs. When the general price level rises, each unit of currency buys fewer goods and services. Consequently, inflation reflects a reduction in the purchasing power per unit of money a loss of real value in the medium of exchange and unit of account within the economy.

### **GDP Growth**

As per Shen et al. (2010) GDP is one of macroeconomics variable to capture the macroeconomic factors. GDP is a measure of total economic activity within an economy. Higher economic growth encourages banks to lend more and permits them to charge higher margins, and improving the quality of their assets. Siaw (2013) also infers that GDP is Key amongst macroeconomic factors that influence the profitability of a financial institution in any economy is the annual percent change of GDP (GDPC). GDP is expected to influence numerous factors related to the supply and demand for loans and deposit and as its growth slows down particularly during recessions, credit quality deteriorates, and defaults increase, thus reducing bank returns. With GDP as a measure of total economic activity in an economy, higher economic growth encourages banks to lend more and permits them to charge higher margins, and improve the quality of their assets. On contrary Mäksel (2018) infers that GDP ratio and the profitability of the banks have a negative relationship because as GDP growth increase, although the loans are important ways to earn income for the banks, banks lend too much for this purpose. The main

reason for this is that sometimes banks are not selective when lending to the customers in order to increase their income. Because of that, there is a significant risk of giving loans to people who have low credibility. Hence, these customers may have difficulty paying back the loan amount to the banks. Thus, this has a negative influence on the profitability of the banks.

The strong increase in lending activities in relation to the volume of acquired deposit will decrease credit risk. Accordingly the high dynamics of lending activity increase is accompanied by a relatively lower increase in the reserves value, which leads to the decrease in the overall level of credit risk. This relation confirms that there is dependency between GDP growth and liquidity risk (Szaji and Mazur, 2015). As per Aspachs et al. (2005) indicates that real GDP growth does appear to affect banks' liquidity holdings. GDP growth and liquidity has negative relationship, banks appear to hold smaller (larger) amounts of liquidity, relative to both total assets and total deposits, in periods of stronger (weaker) economic growth. In other words, banks appear to build up their liquidity buffers during economic downturns and draw them down in economic upturns.

#### **2.4 The Impact of Liquidity on Financial Performance**

Profitability accounts for the impact of better financial soundness on bank risk bearing capacity and on their ability to perform liquidity transformation (Rauch et al. 2008 and Shen et al. 2010). Loans are among the highest yielding assets a bank can add to its balance sheet, and they provide the largest portion of operating revenue. In this respect, the banks are faced with liquidity risk since loans are advanced from funds deposited by customers. However, the higher the volume of loans extended the higher the interest income and hence the profit potentials for the commercial banks. At this point, it is also worth noting that banks with a high volume of loans will also be faced with higher liquidity risk. Thus, the commercial banks need to strike a balance between liquidity and profitability.

It is argued that when banks hold high liquidity, they do so at the opportunity cost of some investment, which could generate high returns (Kamau 2009). The trade-offs that generally exist between return and liquidity risk are demonstrated by observing that a shift from short term securities to long term securities or loans raises a bank's return but also increases its liquidity risks and the inverse is true. Thus a high liquidity ratio indicates a less risky and less profitable bank (Hempel et al. 1994). Thus management is faced with the dilemma of liquidity and

profitability. Myers and Rajan (1998) emphasized the adverse effect of increased liquidity for financial institutions stating that, “although more liquid assets increase the ability to raise cash on short-notice, they also reduce management’s ability to commit credibly to an investment strategy that protects investors” which, finally, can result in reduction of the “firm’s capacity to raise external finance” in some cases. Thus, this indicates the negative relationship between bank profitability and liquidity.

Liquid assets such as cash and government securities generally have a relatively low return, holding them imposes an opportunity cost on a bank (Bordeleau and Graham, 2010). In the absence of regulatory organ to hold liquid asset, it is reasonable to expect banks will hold liquid assets to the extent they help to maximize the firm’s profitability. Beyond this, policymakers have the option to require larger holdings of liquid assets, for instance, if it is seen as a benefit to the stability of the overall financial system.

Berger (1995) analyses the statistical relationships between bank earnings and capital for U.S. banks over the period of 1983-1989 and finds that, contrary to what one might expect in situations of perfect capital markets with symmetric information (see Modigliani and Miller 1958, 1963) in which there is no relationship between earning and bank capital), there is a positive relationship between capital and return on equity. This result, according to the author, is consistent with the “expected bankruptcy cost hypothesis.” More specifically, Berger’s results suggest that banks with higher levels of capital see their funding costs decrease to such an extent that it more than offsets the cost of issuing additional capital. While Berger (1995), applies the concept of the “expected bankruptcy cost hypothesis” in the realm of capital, it is also conceptually applicable to the impact of liquid assets on profitability, whereby banks holding more liquid assets benefit from a superior perception in funding markets, reducing their financing costs and increasing profitability.

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

two concepts can be drawn together in the context of the current paper. If an increase in the relative liquid assets holdings of a bank decreases its probability of default, and if the “expected bankruptcy cost hypothesis” is indeed correct, then holdings of liquid assets should exhibit a positive relationship with bank profits. At the same time, holding liquid assets imposes an opportunity cost on the bank given their low return relative to other assets, thereby having a negative effect on profitability. Thus, overall, liquid assets exhibit a non-linear relationship to bank profitability in which increasing liquid assets would improve a bank’s profitability through the “expected bankruptcy cost hypothesis”, as long as the marginal benefit of holding additional liquid assets outweighs the opportunity cost of their low relative return.

## **2.5 Review of Related Empirical Studies**

### **2.5.1 Review of Related Empirical Studies outside Ethiopia**

The study made by Siaw (2013), presented the empirical evidence on liquidity risk and banks profitability of Ghanaian banks with an unbalanced data set of 22 banks over a 10 year period spanning from 2002 up to 2011. The study applies a panel data using the two stages least squares (2SLS) regression analysis method. The study aims to explain the reasons behind the level or stage when banks find it difficult to meet their obligations by funding increases in assets or decreases in liabilities. The study also seeks to obtain the effects of circumstances on the profit maximization objectives of the banks operating in Ghana among other factors that may also influence the level of profitability. the study conclude that the bank profitability which measured by ROA and ROE are positively affected by liquidity risk that is, banks with high exposure to liquidity risk made higher profits resulting from higher net interest margins as compared with banks with low liquidity risk exposure. The researcher recommend that the bank should reduce the percentage of liquid asset held rather increase in the percentage of illiquid asset (loan disbursed) in order to maximize the profit through high interest income. This will achieve by collecting huge amount of deposit and also consider it as the major source of funding by making the saving more attractive.

The study made by Bordeleau and Graham (2010), presented empirical evidence regarding the relationship between liquid asset holdings and profitability for a panel of Canadian and U.S. banks over the period of 1997 to 2009. In short, results suggested that a nonlinear relationship

exists, whereby profitability was improved for banks that hold some liquid assets, however, there was a point beyond which holding further liquid assets diminishes a bank's profitability, all else equal. Conceptually, this result is consistent with the idea that funding markets reward a bank, to some extent, for holding liquid assets, thereby reducing its liquidity risk. However, this benefit is can eventually be outweighed by the opportunity cost of holding such comparatively low-yielding liquid assets on the balance sheet. At the same time, estimation results provide some evidence that the relationship between liquid assets and profitability depends on the bank's business model and the risk of funding market difficulties. The researchers recommended that adopting a more traditional i.e., deposit and loan-based business model allows a bank to optimize profits with a lower level of liquid assets.

Muriithi and Waweru (2017) empirically investigate the effect of liquidity risk on financial performance of commercial banks for 10 years period and 43 commercial bank register in Kenya. The study used panel data and generalization method of moment's model. The liquidity risk has negative effect on financial performance. The study recommends that banks management should pay the required attention to the liquidity management. The other study made by Shen et al. (2009). The study empirically investigates the causes of liquidity risk and the relationship between bank liquidity risk and performance. The study employs alternative liquidity risk measures besides liquidity ratio (uses other quantitative and qualitative measurement of liquidity risk) and investigates the causes of liquidity risk. It further investigates the determinants of bank performance in terms of the perspective of the bank liquidity risk (bank liquidity risk and performance model). To achieve the objective the study used unbalanced panel dataset of 12 advanced economies commercial banks over the period 1994-2006 by applying using two-stage least squares (2SLS) estimators to estimate bank liquidity risk and performance model. The funds that liquidity risk is the endogenous determinant of bank performance and also they find that liquidity risk may lower bank profitability (ROAA and ROAE). Banks with larger gap lack stable and cheap fund, and thus they have to use liquid assets or much external funding to meet the demand of fund, increase bank's cost of funding. It consequently decreases bank's profitability.

There are also other researchers investigated the relationship between bank liquidity risk and financial performance by taking liquidity as an endogenous variable. However the researcher results are mixed, some studies found out bank liquidity risk has positive effect on financial performance of commercial banks (e.g. Molyneux and Thornton 1992; Barth et al., 2003); others found out liquidity risk has negative effect on financial performance of commercial banks (e.g. Bourke 1989; Demirgüç-Kunt and Huizinga 1999; Kosmidou et al. 2005; Kosmidou 2008). Besides, previous studies found that banks with high liquidity have lower net interest margins. (e.g. Demirgüç-Kunt and Huizinga 1999; Shen et al. 2001; Demirgüç-Kunt et al. 2003; Naceur and Kandil 2009).

### **2.5.2 Review of Related Empirical Studies in Ethiopia**

Some related studies were conducted by different researchers in Ethiopia. From related studies the researcher try to review direct related studies. Tseganesh (2012) is one of them. The study has two objectives: firstly to identify determinants of commercial banks liquidity in Ethiopia and then to see the impact of banks liquidity up on financial performance through the significant variables explaining liquidity. Balanced fixed effect panel regression was used for the data of eight commercial banks in the sample covered the period from 2000 to 2011. Eight factors affecting banks liquidity were selected and analyzed. The study found that the impact of bank liquidity on financial performance was non-linear/positive and negative. Capital adequacy and bank size had positive and significant impact on financial performance, on the other side non-performing loan and short term interest rate had negative and significant impact on financial performance. The study recommends that commercial banks in Ethiopia have to adopt other ways of managing credit risk through by minimize adverse selection during the time of credit approval and strict follow up of borrowers to minimize the problem of moral hazards after the provision of credit.

The other study made by Natnael (2013) intended to assess the determinants of liquidity and their impact on profitability of development bank of Ethiopia. Like Tseganesh (2012), this study also has two aims first, to identify determinants of liquidity of Development Bank of Ethiopia and secondly to see the impact of banks liquidity on financial performance through the factors explaining liquidity. Six variables affecting banks liquidity were chosen and analyzed. The study



used panel data of 24 years of development Bank of Ethiopia from 1990 to 2013. Data was presented by using descriptive statistics. The study found that GDP growth, general inflation and loan growth affect banks performance. Additionally GDP growth rate and Loan growth had positive and significant impact on financial performance. Whereas, general inflation has negative and significant impact on financial performance of development bank of Ethiopia. Finally the study concludes that the impact of banks liquidity on financial performance was non-linear. The study recommends that the Development bank of Ethiopia should undertake prudent liquidity management policy in relation to the credit service and have to establish macroeconomic analysis section in the research department or the fund management process.

Sirak (2016) planned to assess the impact of liquidity on profitability of private commercial banks specifically Nib international bank. The study aims to achieve four main objectives: to investigate the relationship that prevails between liquidity and profitability of the bank, to find out the extent to which liquidity affects profitability of the bank, to evaluate the effect of external factors on performance of the bank and to find out the effectiveness of the Bank's liquidity measurement tools. The study use both qualitative and quantitative data and the time series data taken from during 1999-2015 and analyzed using multiple regressions. The study use liquidity ratio and loan to deposit ratio, NBE Bills purchase (NBE), deposit interest rate (IR) and the general inflation rate (INF) of the country. The dependent variable was ROA. The study found that Liquidity ratio; NBE Bills and annual inflation rate had significant positive impact on profitability and finally conclude that liquidity had significant impact on profitability of NIB. The study recommend that NIB international bank should adopt international standards in the liquidity management practice and introduce new liquidity measurement tools as per the current international practice.

Nigist and Laximikantham (2015) empirically investigate determinates of liquidity risk of Ethiopian commercial banks. The study aims to investigate the impact of bank specific factors on liquidity of Ethiopian commercial banks. The data covered the period from 2007-2013 for sample of ten commercial banks in Ethiopia and used secondary data, and regress using linear regression model. The study found that ratio of equity to total asset was positive and statistically significant that affected liquidity. The study also revealed that bank size has positive and

statistically significant influence on liquidity. Finally ROA as proxy of profitability was found to be negative and statistically significant influence on liquidity. This relationship happen due to holding liquid assets imposes an opportunity cost on the bank given their low return relative to other assets.

## **2.6 Summary and Knowledge Gap**

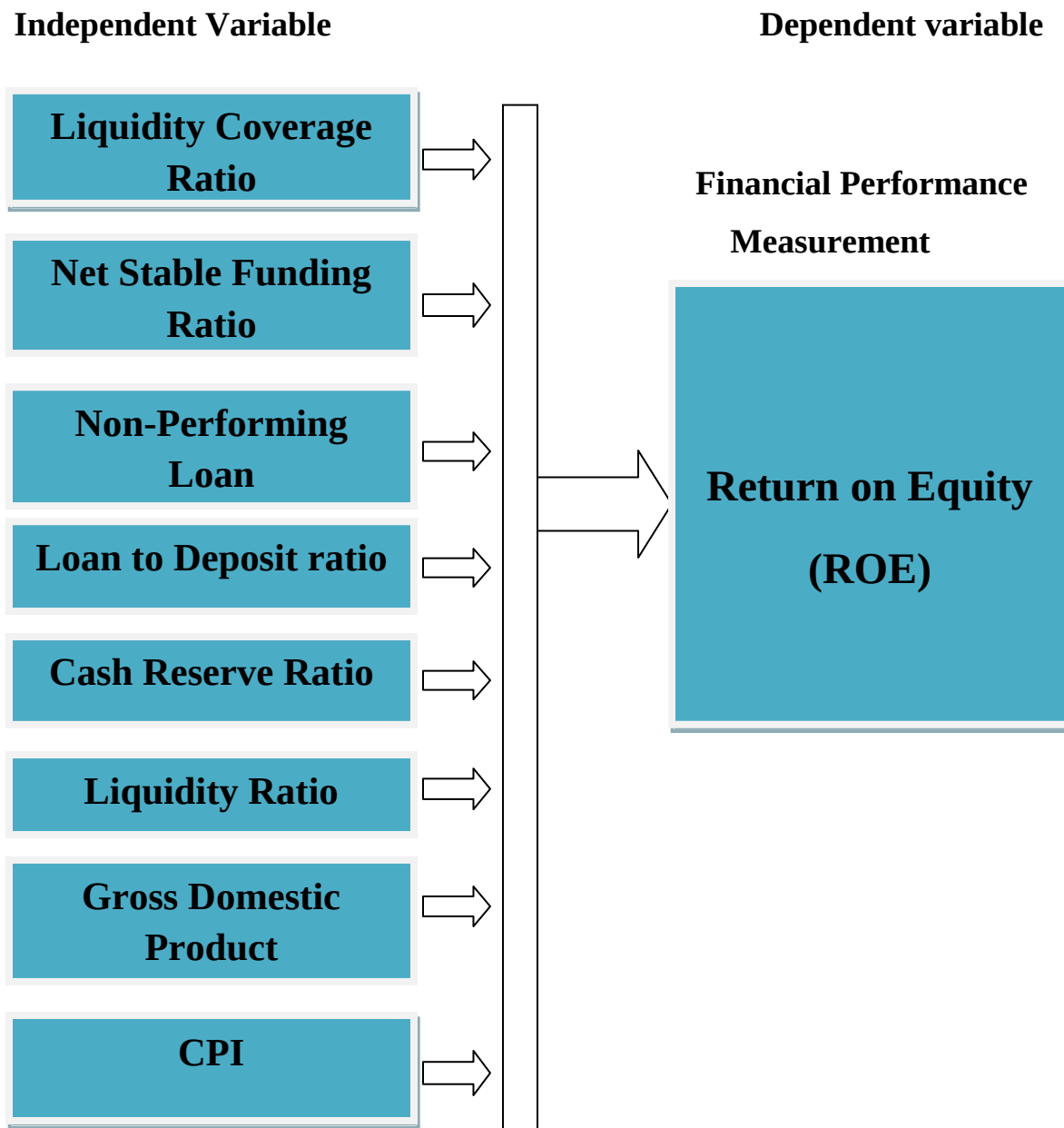
As per the above theoretical and empirical review, liquidity is important to all business specially for banking industry since their function is creation of liquidity both on the asset and liability side of their balance sheet. In general the impacts of liquidity risk on financial performance of banks are not overemphasized. However, liquidity risk management plays a major role in survival and growth or otherwise of any bank. According to the review, most of the empirical studies done on the area of bank liquidity and its impact on financial performance were done following the U.S. subprime mortgage crisis (2007-8). Although liquidity problems of some banks during global financial crisis re-emphasized the fact that liquidity is very important for functioning of financial markets and the banking sector, an important gap still exists in the empirical literature about liquidity.

There are also very limited number of studies appears to include liquidity risk as an explanatory variable for bank financial performance, this relationship is not the focus of those papers and the empirical results were mixed. The method will use in this study is through the significant factors affecting liquidity. Since the banking industry is in the growth stage with opening of new banks and the absence of active secondary stock exchange in the country, it is important to notify the impact of liquidity risk on financial performance by making empirical investigation to already established banks.

In many researches both the determinants of liquidity risk and bank profitability were both estimated; where liquidity risk was an explanatory variable (endogenous variable) in the financial performance equation, most of the studies either considered the determinants of liquidity risk and its impact on bank profitability. This study thus capitalizes on the gaps in the literature to take into consideration effects of liquidity risk on financial performance of commercial banks in Ethiopia by using ROE as a measurement of financial performance by controlling for other variables. This study also introduce liquidity coverage ratio (LCR) and Net Stable funding ratio (NSFR) to measure liquidity risk as proposed by Basel III.

## 2.7 Conceptual Framework

After careful study of literature review, the following conceptual framework is formulated to illustrate the effects of liquidity risk on financial performance of Ethiopian commercial banks. Therefore the following diagram discusses about the conceptual framework:



**Source:** Compiled by Researcher

## **Chapter Three**

### **Research Design**

#### **3.1 Research Methodology**

##### **3.1.1 Introduction**

Research methodology is the procedures by which researchers go about their work of describing, explaining and predicting phenomena (Rajasekar et al. 2013). Under this section the researcher see source and method of data collection, target population and sampling frame, sampling techniques and sample size, method of data analysis, variable definition and hypothesis of the study and model specification. The purpose of quantitative studies is for the researcher to project his or her findings onto the larger population through an objective process. Data collected, often through surveys administered to a sample or subset of the entire population, allow the researcher to generalize or make inferences. Results are interpreted to determine the probability that the conclusions found among the sample can be replicated within the larger population.

##### **3.2 Research Design**

Research design is a plan outlining how information is to be gathered for an assessment or evaluation that includes identifying the data gathering method(s), the instruments to be used, how the instruments would be administered, and how the information would be organized and analyzed (Assumptah & Muhari, 2017). Quantitative research design was used to meet the overall objective of the study and to test hypotheses under it.

##### **3.3 Source and Method of Data Collection**

The study use secondary data. As per Zikmund et al. (2009) secondary data are essential in instance when primary data can't be obtained and they are quickly available. Selecting appropriate and acceptable data gathering instrument help the researchers to combine the strengths and amend some of the inadequacies of any source of data to minimize risk of irrelevant conclusion. Data were collected from audited financial statement specifically balance sheet and income statement of the sample commercial banks and publication of NBE for the macroeconomic level data from 2007 up to 2016. The time period selected is based on the reason that is providing recent time observation.

### **3.4 Target population and sampling frame**

#### **I. Target Population**

The study populations are all government and private owned commercial banks found in Ethiopia. Presently, There are 16 commercial banks, namely, Commercial Bank of Ethiopia (CBE), Awash Bank S.C (AB), Dashen Bank S.C (DB), Wegagen Bank S.C (WB), Bank of Abyssinia S.C (BOA), United Bank S.C (UB), Nib international Bank S.C (NIB), Corporative Bank of Oromia S.C (CBO), Lion International Bank S.C (LIB), Zemen Bank S.C (ZB), Oromia International Bank S.C (OIB), Buna International Bank S.C (BUIB), Birhan International Bank S.C (BIB), Abay Bank S.C (ABB), Debub Global Bank S.C (DGB) and Enat Bank S.C (EB). All except commercial bank of Ethiopia are private owned commercial banks.

#### **II. Sampling Frame**

The sample was drawn from a list of population elements that often differs somewhat from the defined target population. Sampling frame is a list of elements from which the sample may be drawn (Zikumnd et. al 2009). The frame to draw samples intentionally includes those banks that have been operating the banking service in Ethiopia for 10 years. The reason behind taking ten years data was to increase the sample size. In Ethiopia there are nine commercial banks which start their operation before and on 2007 namely Commercial Bank of Ethiopia (CBE), Dashen Bank S.C (DB), Awash Bank S.C (AB), Wogagen Bank S.C (WB), United Bank S.C (UB), Nib International Bank S.C (NIB) and Bank of Abyssinia S.C (BOA), Cooperative Bank of Oromia S.C (CBO) and Lion Bank S.C (LB). Therefore the matrix sample frame will be  $10 \times 9$  that includes 90 observations.

### **3.5 Method of Data Presentation and Analysis Techniques**

To test the proposed hypotheses, statistical analyses carried out using the following methods: First, descriptive statistics of the variables (both dependent and independent) were calculated over the sample period. This is in line with Malhotra (2007), which states using descriptive statistics methods helps the researcher in picturing the existing situation and allows relevant information. Regression analysis technique is used for forecasting, and finding the causal effect relationship between the variables (Ray, 2015). Due to this the study uses an ordinary least square/OLS regression approach including all of its assumptions. The assumptions were used to see the applicability of the regression models developed to see the impact of liquidity risk on

financial performance of Ethiopian commercial banks through the significant factors explaining liquidity of commercial banks in Ethiopia. Data collected from different sources was analyzed by using STATA version 13 software package.

### **3.6 Variable definition and hypothesis**

#### **Dependent Variable**

##### **Return on Equity (ROE)**

Many Scholars extensively use return on asset (ROA) and return on equity (ROE) to measure financial performance for instance (Crane n.d.; Brealy 2001; Ross 2003). The ROE calculated net income divided by average stockholder equity. As per European central bank ROE is chosen over ROA due to three reasons first it proposes a direct assessment of the financial return of a shareholder's investment; second it is easily available for analysts, only relying upon public information; and third it allows for comparison between different companies or different sectors of the economy and also Samuel (2013) and Ross (2003) depict that ROA excludes the total assets off-balance sheet items thereby understating the value of assets and however most real world firms have debit. Due to the above justification the study was used ROE as dependent variable

$$\text{ROE} = \frac{\text{Net income}}{\text{Average stockholder equity}}$$

#### **Independent Variable**

##### **Liquidity Coverage Ratio (LCR)**

LCR is one of the measurements of liquidity. Basel committee (2011) describes LCR that banks hold sufficient high quality liquid asset/resources to satisfy liquid asset need over one month period of time under accurate stress scenario. Accordingly LCR helps the banks to have sufficient liquid asset in order to fulfill the cash outflow under stress scenario. Therefore, increase in liquidity coverage ratio means increase in liquid asset and decrease in illiquid asset. As the bank avail more liquid asset, the profit that the bank generate will decrease. As many study studied and as per the above argument the study expected that LCR will affect financial performance of commercial banks negatively. LCR was measured by the below formula.

$$\text{LCR} = \frac{\text{High Quality Liquid Asset}}{\text{Total Net Cash Flow}}$$

H1: *Liquidity coverage ratio has negative and significant effect on financial performance of commercial banks*

### **Net Stable Funding Ratio (NSFR)**

NSFR is the other measurement of liquidity risk. Basel (2011) explains NSFR that the banks set minimum amount of stable fund to fulfill the required stable fund arising from off-balance sheet commitment and obligation. It helps the bank “to promote resilience over a longer time horizon by creating additional incentives for a bank to fund its activities with more stable sources of funding on an ongoing structural basis and it has a time horizon of one year and has been developed to provide a sustainable maturity structure of assets and liabilities”. The ratio intended to limit over reliance on shorter wholesale fund during time buoyant market liquidity and encourage better assessment of liquidity risk across all on- and off-balance sheet items. As the bank avail liquid asset more than required fund, the profit that the bank generate will decrease. Therefore it is expected that there is negative relationship with commercial banks financial performance.

$$\text{NSFR} = \frac{\text{Total available stable fund}}{\text{Total required stable fund}}$$

H2: *Net stable funding ratio has negative and significant effect on financial performance of commercial banks.*

### **Non-Performing Loan (NPL)**

Non-performing loans are loan remain default in both principal and interest in contrary agreement of the contract for long period of time. European central bank defines NPL as loan that the borrower unable to pay the agreed installment or interest for more than 90 days. Therefore the bank must set aside more capital on the assumption that the loan will not be paid back. This reduces its capacity to provide loans and banks profitability. Then it makes fear on large number of depositor and they run against the bank. Maaka, (2013), Tseganesh (2013), Wanjik and Assumptah, (2017) use NPL as a variable to measure the impact of liquidity risk on financial performance. As per the above researcher and analysis the expected result is negative relationship between NPL and financial performance of commercial banks.

H3: *percentage of non-performing loan has negative and significant effect on financial performance of commercial banks*

### **Loan to Deposit Ratio (LTD)**

The Netherland Bank working paper describe LTD ratio as “the ratio measures the coverage of loans with stable funding, usually deposits from households and non -financial companies”. A high loans to deposits ratio means that the bank is issuing out more of its deposits in the form of interest-bearing loans, which, in turn, means it will generate more income. The problem is that the bank’s loans aren’t always repaid. Then the bank has to repay deposits on request, so having a ratio that’s too high puts the bank at high risk. On the other side a very low ratio implies that the bank at low risk, but it isn’t using its asset to generate more income and this end up with low profit. On the above reason the study were used LTD ratio as variable to measure liquidity risk and financial performance and would expected that loan to deposit ratio have negative relationship with financial performance of commercial banks. LTD ratio express as percentage.

$$\text{LTD} = \frac{\text{Total Loans}}{\text{Total Deposit}}$$

H4: *Loan to deposit ratio has negative and significant effect on financial performance of commercial banks.*

### **Cash Reserve Ratio**

Cash reserve ratio is a certain percentage of the total bank deposits that have to be kept in the current account with the control of national/ central bank. In other word it indicates that banks do not have access to that much amount for any economic activity or commercial activity. National Bank of Ethiopia (NBE) statutory reserve requirement obliges the banks to hold a proportion of their deposit with NBE. As stated on its goal which is to improve the soundness of the financial system statutory reserve requirement is one of the important monetary policy instrument and prudential regulation tools. However, according to Greuning and Bratanovic (2009) to manage the liquidity risk, the bank can address market liquidity rather than statutory liquidity. Therefore



the bank will not only depend on last resort liquidity requirement, manage its liquidity requirement through understand on the interrelationship between liquidity and other market and credit risk. Accordingly as much more cash reserve hold on national bank will decrease the profitability of the bank by bearing high opportunity cost. Further holding minimum amount of cash reserve on national bank will increase the profitability of the banks by investing/lending money to customer and get high interest income and return.

*H5: Cash reserve has negative and significant effect on financial performance of commercial banks*

### **Liquidity Ratio (LR)**

Liquidity risk is the risk that a bank or company unable to convert short term asset to cash without a loss of capital or without incurring additional cost. Liquidity ratios are a class of financial metrics used to determine a debtor's ability to pay off current debt obligations without raising external capital. Many literature use extensively financing gap, short term funding, liquid asset to customer and liquid asset to deposit as a measurement of liquidity risk. As proposed by Tseganesh (2013), this study use liquid asset to total asset ratio to measure liquidity of banks. Liquidity ratio measures the bank's ability to repay the short term debt out of its cash fund. As the general rule the higher the share of liquid assets in total assets, the higher the capacity to absorb liquidity shock, given that market liquidity is the same for all banks in the sample Tseganesh (2013). In other way the higher the liquid asset to total asset is the sign of inefficiency. Since high liquid asset yield low income, liquidity bear high opportunity cost for the banks. As per NBE, liquid asset includes cash, deposits with the National Bank, other local and foreign banks having acceptance by the National Bank and other assets readily convertible into cash expressed and payable in Birr or foreign currency having acceptance by the National Bank.

$$LR = \frac{\text{Liquid Asset}}{\text{Total Asset}}$$

*H6: Liquidity ratio has negative and significant effect on financial performance of commercial banks*

## **Inflation**

Inflation is a quantitative measure of the rate at which the average price level of a basket of selected goods and services in an economy increases over a period of time. Oner, 2010 define inflation as it is the rate of increase in prices over a given period of time. Inflation is typically a broad measure, such as the overall increase in prices or increase in the cost of living in a country. A chief measurement of inflation is the inflation rate which is the annualized percentage change in a general price index normally the consumer price index (CPI) over time (Audo, 2014). CPI is a measurement of inflation that examines the weighted average prices of a basket of goods and services which are of primary consumer needs. When the general price level rises, each unit of currency buys fewer goods and services. Consequently, inflation reflects a reduction in the purchasing power per unit of money a loss of real value in the medium of exchange and unit of account within the economy.

*H7: CPI growth rate has negative and significant effect on financial performance of commercial banks.*

## **Gross Domestic Product (GDP)**

GDP is the market value of all finished goods and services produced within a country in a year. It is the key macroeconomic factor that influences the financial performance of financial institution in any economy. GDP is expected to influence numerous factors related to the supply and demand for loans and deposit and at a time economy recessions the banks credit quality may deteriorates, NPL increases, deposit become decrease, thus reducing the bank returns. In other round when the economy growth encourage the banks to collect high amount of deposit, lend more amount of money, collect high interest income and improve the quality of asset. Thus the banks become illiquid and face liquidity risk. As indicated by different researcher GDP and financial performance are negatively related (e.g. Tseganesh, 2013; Nathnael, 2013; Ferrouhi, 2014).

*H8: GDP growth rate has negative and significant effect on financial performance of commercial banks.*

**Table 1 Variable description summery and their expected result**

| <b>Independent Variable</b> | <b>Definition</b>                                               | <b>Expected Result</b>          |
|-----------------------------|-----------------------------------------------------------------|---------------------------------|
| Liquidity Coverage Ratio    | The percentage of high quality liquid asset on net cash flow    | <b>Negative and Significant</b> |
| Net Stable Funding Ratio    | The percentage of stable fund on required stable fund           | <b>Negative and Significant</b> |
| Non-Performing Loan         | The percentage of non-performing loans on total volume of loans | <b>Negative and Significant</b> |
| Loan to Deposit Ratio       | The ratio of loan on deposit                                    | <b>Negative and Significant</b> |
| Cash reserve ratio          | the ratio of cash reserve held on NBE on total deposit          | <b>Negative and Significant</b> |
| Liquidity ratio             | The ability to repay the short term debt out of its cash fund   | <b>Negative and Significant</b> |
| GDP Growth rate             | growth rate of real gross domestic product                      | <b>Negative and Significant</b> |
| CPI                         | Annual growth rate of inflation                                 | <b>Negative and Significant</b> |

### **3.7 Model Specification**

The study was used panel/longitudinal data model. Gujarati, (2002) infers panel data in which the same cross sectional unit surveyed over time. Brook (2008) list the advantage of panel data in research as follows; first and perhaps it can address a broader range of issues and tackle more complex problems with panel data than would be possible with pure time series or pure cross-sectional data alone. Second, it is often of interest to examine how variables, or the relationships between them, change dynamically (over time). To do this using pure time-series data would often require a long run of data simply to get a sufficient number of observations to be able to conduct any meaningful hypothesis tests. But by combining cross-sectional and time series data, one can increase the number of degrees of freedom, and thus the power of the test, by employing information on the dynamic behavior of a large number of entities at the same time. The additional variation introduced by combining the data in this way can also help to mitigate

problems of multi collinearity that may arise if time series are modeled individually. Gujarati (2002) also infer panel data give “more informative data, more variability, less collinearity among variable, more degree of freedom and efficiently”.

The Third advantage is that by structuring the model in an appropriate way, we can remove the impact of certain forms of omitted variables bias in regression results. Gujarati (2002) also describe that by making data available for several thousand units, panel data can minimize the bias that might result if we aggregate individuals or firms into broad aggregates. Generally panel/longitudinal data described econometrically as follow;

$$Y_{it} = \alpha + \beta x_{it} + u_{it}$$

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

$$i = 1, \dots, N$$

Where;  $Y_{it}$  is the dependent variable,

$\alpha$  is the intercept term,

$\beta$  is a  $k \times 1$  vector of parameters to be estimated on the explanatory variables, and

$x_{it}$  is a  $1 \times k$  vector of observations on the explanatory variables,

$U_{it}$  is the error term which represents all those factors not includes

Shen et. al. (2009), Siaw (2013) and Muriithi et al. (2017) specified that the model to estimate the effect of liquidity risk on financial performance and therefore using the general model here the below the researcher incorporate all variable in to equation to know the impact of liquidity risk on ROE;

$$ROE_{i,t} = \alpha + \beta_1 (LCR_{i,t}) + \beta_2 (NSFR_{i,t}) + \beta_3 (NPL_{i,t}) + \beta_4 (LTD_{i,t}) + \beta_5 (CR_{i,t}) + \beta_6 (LR_{i,t}) + \beta_7 (CPI_{i,t}) + \beta_8 (GDP_t) + U_{i,t} \dots \dots \dots (1)$$

**Where,**

ROE<sub>i, t</sub>: Return on equity of  $i^{th}$  bank on year t, the proxies was the ratio of net income of the bank to average stockholder equity

$$ROE = \frac{Net\ Income}{Average\ Stockholder\ Equity}$$

**LCR i, t:** Liquidity coverage ratio of  $i^{\text{th}}$  bank on year t, the proxies was the ratio of high quality liquid asset to total net cash flow

$$\text{LCR} = \frac{\text{High Quality Liquid Asset}}{\text{Total Net cash flow}}$$

**NSFR i, t:** net stable funding ratios of  $i^{\text{th}}$  bank on year t, this proxy was the ratio of total available stable fund to total required stable fund

$$\text{NSFR} = \frac{\text{Total Available fund}}{\text{Total required stable fund}}$$

**NPL i, t:** non-performing loan of  $i^{\text{th}}$  bank on year t, the proxy's was the share of non- performing loan from the total loan portfolio of a bank

$$\text{NPL} = \frac{\text{Non performing loan}}{\text{Total loan}}$$

**LTD i, t:** loan to deposit ratio of  $i^{\text{th}}$  bank on year t, the proxies was the share of loan from total deposit of a bank

$$\text{LCD} = \frac{\text{Total Loan}}{\text{Total deposit}}$$

**CRR i, t:** cash reserve ratio of  $i^{\text{th}}$  bank on year t, the proxies was the percentage of total amount of deposit that should be hold as a reserve on national/central bank

**LR i, t:** liquidity ratio of  $i^{\text{th}}$  bank on year t, the proxies was the share of liquid asset to total asset of a bank.

$$\text{LR} = \frac{\text{Liquid Asset}}{\text{Total Asset}}$$

**CPIt:** the consumer price index growth rate of Ethiopia on the year t. The proxy was growth rate of CPI.

**GDP t:** the real domestic product/GDP growth of Ethiopia on the year t. The proxy was growth rate of real GDP

## Chapter Four

### Data Presentation and Analysis

#### 4.1 Introduction

The previous three chapters defined the problem, articulated the objectives, and reviewed literatures relevant to the topic. Furthermore, so as to meet the research objective and to test research hypotheses, the research design used in the study was also discussed. In this chapter the collected data are presented and analyzed. It has five sections. Under section 4.2 the descriptive statistics of the dependent and independent variables were presented followed by correlation analysis under section 4.3. Section 4.4 presents the test for the classical liner regression model/CLRM. Then, the results of the regression analysis were presented under section 4.5. Finally, discussions for the results of the regression analysis were made under section 4.6.

#### 4.2 Descriptive Statistics

The descriptive statistics of both independent and dependent variables are presented below. The dependent variable is return on equity (ROE). While the independent variables are liquidity coverage ratio, net stable funding ratio, liquidity ratio, non-performing loans, cash reserve ratio, loan to deposit ratio, gross domestic product rate and consumer price index.

|             | Mean     | Std. Dev | Maximum  | Minimum  | Observation |
|-------------|----------|----------|----------|----------|-------------|
| <b>ROE</b>  | 25.57948 | 14.29945 | 77.7097  | -7.40741 | 90          |
| <b>LCR</b>  | 54.54861 | 19.02304 | 101.4808 | 23.66595 | 90          |
| <b>NSFR</b> | 234.8839 | 61.69419 | 412.2427 | 41.79930 | 90          |
| <b>NPL</b>  | 2.601743 | 2.292204 | 14.23302 | 0.00000  | 90          |
| <b>LTD</b>  | 61.09319 | 12.08307 | 96.70037 | 29.68698 | 90          |
| <b>CRR</b>  | 21.00828 | 12.56001 | 55.50616 | 4.37123  | 90          |
| <b>LR</b>   | 34.01354 | 13.76147 | 63.52646 | 5.05299  | 90          |
| <b>GDP</b>  | 10.12000 | 1.052573 | 11.5     | 8.00000  | 90          |
| <b>CPI</b>  | 17.19556 | 12.22119 | 44.5     | 7.30000  | 90          |

**Source:** Financial statement of sampled commercial banks and own computation through STATA

**Table 2: Summary of Descriptive Statistics for Dependent and Independent Variables**

The mean value of ROE was 25.57%. This indicates that for every one birr in equity, commercial banks in Ethiopia generate on average 25.57 cents in profit. The value of standard deviation was 14.3%. This indicates that the dispersion of ROE between commercial banks in Ethiopia is moderate. The maximum and minimum value of ROE was 77.70% and -7.40% respectively. The negative value of ROE was for Lion International bank and it was on its year of establishment (i.e. 2007). As per the Basel (2008), Liquidity Coverage Ratio (LCR) is one of the liquidity measurements that measures bank's liquidity requirement over a 30-days stress scenario. The average liquidity coverage ratio of Ethiopian banks was 54.54% with standard deviation of 19.02%. The maximum and minimum values were 101.4% and 23.66% respectively. This indicates that commercial banks in Ethiopia have high quality liquidity asset to satisfy the customer cash needs whenever demanded. The Net Stable Funding Ratio (NSFR) computes amount of long-term, stable source of funding employed by an institution relative to the liquidity profiles of the asset funded and the potential for contingent calls on funding liquidity arising from off-balance sheet commitment and obligation. NSFR for banks was 234% with standard deviation of 61.69%. The maximum and minimum values were 412.24% and 41.79% respectively. This indicates that the available amount of stable funding is much higher than the required amount of stable funding for the commercial banks during the period of the study. The mean value of the percentage of non-performing loan in the total amount of loans and advances to customers/NPL/, which measures the resilience of banks enduring recession, was 2.6% with the maximum and minimum of 14.2% and 0% respectively. NPL was zero value for LIB, BOA, DB, WB and CBO. The maximum value of 14.5% indicates the presence of high credit risk in some of the banks. There was little dispersion of NPL among banks in Ethiopia that is shown by the standard deviation of 2.3%.

The mean value of Loan to Deposit (LTD), which measures the ability to bear stress by increasing loans, was 61.1% that is slightly lower than the international standard for loans to deposit ratio of 75% (CBRC 2012). This indicates on average for the commercial banks in Ethiopia lower amount of volatile deposits were tied up with illiquid loans. There was moderate dispersion of LTD towards its mean value among banks that is shown by the standard deviation of 12.1%. The maximum value of LTD was 96.7% which is far above the standard whereas the minimum value was 29.7% which is far below the standard. This indicates that there were some

commercial banks in Ethiopia having extra liquidity (banks around 30% LTD) and others were going to face liquidity shortages/risk (banks around 96.70% LTD). The mean value of the Cash reserve Ratio (CRR), which measures the ability of the banking system to mobilize deposits to meet credit demand, was 21% with 12.6% of standard deviation. The maximum and minimum value of CRR was 55.5% and 4.37% respectively. This indicates that the Ethiopian commercial banks deposit 21 percent of their deposit on reserve account at National bank account which was very high as compared to standard set by national bank of Ethiopia (5%).

The average value of Ethiopian commercial banks liquidity Ratio (LR), which indicates the level of cash and short-term debit in the financial system, was 34% with standard deviation of 13.76%. The minimum and maximum value of LR was 5% and 63.52% respectively. This indicates that thirty four percent of the total assets of Ethiopian commercial banks are liquid asset which is easily convertible in to cash. The value of standard deviation 13.76% indicates that there was moderate dispersion from the mean value of liquidity ratio in the case of commercial banks in Ethiopia. The macroeconomic indicators that can affect banks liquidity position over time was GDP. The mean value of GDP growth rate was 10.12% indicating the average growth rate of the country's economy over the past 10 years. The maximum growth of the economy was recorded in the year 2007 (i.e. 11.5%) and the minimum was in the year 2015 (i.e. 8%). Since the year 2007 the country has been recording double digit growth rate with little dispersion towards the average over the period under study with the standard deviation of 1.05%. The other macroeconomic variable was CPI which measures the effect of inflation on purchasing power. The mean value of CPI growth rate was 17.19% indicating the average inflation rate of the country over the past 10 years. The maximum CPI growth rate of the economy recorded in the 2008 (i.e. 44.5%) and the minimum was in the year 2016 (i.e. 7.3%). Since the year 2008 the country has been recording highest CPI rate high dispersion towards the average over the period under the study with the standard deviation of 12.22%. This may happen due to the world economy face its most dangerous crisis in the year 2008.



### 4.3 Correlation Analysis

Correlation is a way to index the degree to which two or more variables are associated with or related to each other. The primary objective of correlation analysis is to measure the strength or degree of linear association between two variables (Gujarati & Porter, 2009). The most widely used bi-variant correlation statistics is the Pearson product-movement coefficient, commonly called the Pearson correlation which was used in this study. Correlation coefficient between two variables ranges from +1 (i.e. perfect positive relationship) to -1 (i.e. perfect negative relationship). The study used correlation coefficient because the sample size of the study was 90. This idea supported by Mayers et.al, (2006) “As a sample size approaches to 100, the correlation coefficient of about or above 0.20 is significant at 5% level of significance”.

|      | ROE     | LCR     | NSFR    | NPL     | LTD     | CRR    | LR     | GDP<br>Rate | CPI |
|------|---------|---------|---------|---------|---------|--------|--------|-------------|-----|
| ROE  | 1       |         |         |         |         |        |        |             |     |
| LCR  | 0.3219  | 1       |         |         |         |        |        |             |     |
| NSFR | -0.0657 | 0.3033  | 1       |         |         |        |        |             |     |
| NPL  | 0.1458  | 0.5184  | 0.0808  | 1       |         |        |        |             |     |
| LTD  | -0.3410 | -0.3256 | -0.3886 | -0.0968 | 1       |        |        |             |     |
| CRR  | -0.2780 | 0.5488  | 0.1411  | 0.3996  | -0.0785 | 1      |        |             |     |
| LR   | -0.3317 | 0.5515  | 0.0857  | 0.4064  | -0.1342 | 0.8270 | 1      |             |     |
| GDP  | -0.0687 | 0.1085  | -0.1470 | 0.2037  | 0.1836  | 0.0742 | 0.1464 | 1           |     |
| CPI  | -0.0207 | 0.3065  | 0.0135  | 0.2633  | 0.0750  | 0.4138 | 0.3447 | -0.4099     | 1   |

**Source:** Financial statement of sampled commercial banks and own computation through STATA

**Table 3 Correlation Matrix between Dependent and Independent Variables**

ROE had positively correlated with LCR and statistically significant. This was not in accordance with Basel (2008) and the study hypothesis. On contrary NSFR and ROE had negatively correlated. But the linear relationship between ROE and NSFR was statistically insignificant and not different from zero. This was in line with the study hypothesis that was on the argument of high available stable funding; which was reduce the banks competition regarding loans, deposit and even the source of equity and debt investment. NPL had positive linear relationship with ROE but statistically insignificant/not different from zero.

Loan to deposit ratio /LTD and cash reserve ratio/CRR had negatively correlated with ROE and statistically significant. The other bank specific factors were liquidity ratio/LR had negatively correlated with ROE. The linear relationship between LR with ROE had statistically significant. This was in line with the study hypothesis that was on the argument of holding liquid assets yield lower income and bears high opportunity costs for the bank. The macroeconomic factor GDP rate had negatively correlated with ROE and statistically insignificant. This was in line with the study hypothesis. The other macroeconomic level variable CPI had negative correlated with ROE and statistically insignificant. This was also in line with the study hypothesis.

#### **4.4 Testing the assumption of Classical Linear Regression Model (CLRM)**

##### **1. Test for average value of the error term is zero ( $E(u_t) = 0$ ) assumption**

The first assumption required for CLRM is that the average value of the errors is zero. Brook, (2008) states this assumption as “if a constant term is included in the regression equation, this assumption will never be violated”. But what if financial theory suggests that, for a particular application, there should be no intercept so that the regression line is forced through the origin. If the regression did not include an intercept, and the average value of the errors was nonzero, several undesirable consequences could arise. However the constant term (i.e.  $\alpha$ ) was included in the regression equation; the average value of the error term in this study is expected to be zero.

##### **2. Test for homoscedasticity assumption ( $Var(u_t) = \sigma^2$ )**

It has been assumed that the variance of the errors is constant. This is known as the assumption of homoscedasticity (Brook, 2008). If the errors do not have a constant variance, they are said to be heteroscedastic. This study was used white test to examine the presence of heteroskedasticity across the range of explanatory variable. In table 4.3 below the P value is greater than 0.05 that is 0.1582 for the model and we couldn't reject the null hypothesis of homoscedasticity.

| . estat imtest, white                                                                |       |        |        |
|--------------------------------------------------------------------------------------|-------|--------|--------|
| White's test for Ho: homoskedasticity<br>against Ha: unrestricted heteroskedasticity |       |        |        |
| chi2(44)                                                                             | =     | 59.06  |        |
| Prob > chi2                                                                          | =     | 0.0641 |        |
| Cameron & Trivedi's decomposition of IM-test                                         |       |        |        |
| Source                                                                               | chi2  | df     | p      |
| Heteroskedasticity                                                                   | 59.06 | 44     | 0.0641 |
| Skewness                                                                             | 1.98  | 8      | 0.9816 |
| Kurtosis                                                                             | 2.21  | 1      | 0.1373 |
| Total                                                                                | 63.25 | 53     | 0.1582 |

**Source:** Financial statement of sampled commercial banks and own computation through STATA

**Table 4: Heteroskedasticity result using white test**

### 3. Test for absence of series Multicollinearity assumption

This assumption is concerned with the relationship that exists between explanatory variables. Brook (2008) describes multicollinearity as an implicit assumption that must be made while using the OLS estimation method to check the explanatory variables are not correlated with one another. If there is no relationship between the explanatory variables, they would be said to be orthogonal to one another. He further elaborates the occurrence of perfect multicollinearity is when there is an exact relationship between two or more variables. In this case, it is not possible to estimate all of the coefficients in the model. Perfect multicollinearity will usually be observed only when the same explanatory variable is inadvertently used twice in a regression. This assumption does allow the independent variables to be correlated but they cannot be perfectly correlated. How much correlation causes multicollinearity however, is not clearly defined. While Hair et al (2006) argue that correlation coefficient below 0.9 may not cause serious multicollinearity problem. Therefore, in this study correlation matrix for seven of the independent variables shown below in the table had been estimated. The results in the following correlation matrix show that the highest correlation of 0.8270 which was between liquidity ratio and cash reserve ratio. According to Gujarati (2004), the standard statistical method for testing

data for multicollinearity is analyzing the explanatory variables correlation coefficients (CC); condition index (CI) and variance inflation factor (VIF).

|          | LCR     | NSFR    | NPL     | LTD     | CRR    | LR     | GDP     |   |
|----------|---------|---------|---------|---------|--------|--------|---------|---|
| LCR      | 1       |         |         |         |        |        |         |   |
| NSFR     | 0.3033  | 1       |         |         |        |        |         |   |
| NPL      | 0.5184  | 0.0808  | 1       |         |        |        |         |   |
| LTD      | -0.3256 | -0.3886 | -0.0968 | 1       |        |        |         |   |
| CRR      | 0.5488  | 0.1411  | 0.3996  | -0.0785 | 1      |        |         |   |
| LR       | 0.5515  | 0.0857  | 0.4064  | -0.1342 | 0.8270 | 1      |         |   |
| GDP Rate | 0.1085  | -0.1470 | 0.2037  | 0.1836  | 0.0742 | 0.1464 | 1       |   |
| CPI      | 0.3065  | 0.0135  | 0.2633  | 0.0750  | 0.4138 | 0.3447 | -0.4099 | 1 |

**Source:** Financial statement of sampled commercial banks and own computation through STATA

**Table 5:** Correlation matrix of explanatory variables

The other detection mechanism of multicollinearity is variance inflation factor (VIF). VIF measures how much the variance of an estimated regression coefficient increases if your predictors are correlated (multicollinearity). When VIF is greater than 10, then the regression coefficients are poorly estimated and imperfect multicollinearity. On this study hence multicollinearity was not a concern with this data set because the average VIF was 2.07.

**Table 6:** Summery of VIF of explanatory variables

| Variable | VIF  | 1/VIF    |
|----------|------|----------|
| CRR      | 3.55 | 0.281985 |
| LR       | 3.43 | 0.291238 |
| LCR      | 2.09 | 0.477978 |
| CPI      | 1.75 | 0.572266 |
| GDPRate  | 1.51 | 0.661589 |
| NPL      | 1.48 | 0.674058 |
| LTD      | 1.45 | 0.688573 |
| NSFR     | 1.27 | 0.787862 |
| Mean VIF | 2.07 |          |

**Source:** Financial statement of sampled commercial banks and own computation through STATA

#### 4. Test for Normality Assumption ( $u_t \sim N(0, \sigma^2)$ )

It is assumed that the distribution of residuals is normal. If the residuals are normally distributed, the histogram should be bell-shaped and the Bera--Jarque statistic would not be significant. This means that the  $p$ -value given at the bottom of the normality test screen should be bigger than 0.05 to not reject the null of normality at the 5% level (Brook, 2008). The test result for the models provides a  $p$ -value of greater than 5% evidencing that residuals are normally distributed. As per the below table 4.6 The Jarque-Bera statistic has a  $P$ -value of 0.2184. This result implies that the  $p$ -value for the Jarque-Bera test is greater than 0.05 which indicates that there was no evidence for the presence of abnormality in the data. Thus, the null hypothesis that the data is normally distributed fail to reject since the  $p$ -value was in excess of 0.05.

|                                       |     |              |              |              |                 |
|---------------------------------------|-----|--------------|--------------|--------------|-----------------|
| <pre>. sktest uhat</pre>              |     |              |              |              |                 |
| Skewness/Kurtosis tests for Normality |     |              |              |              |                 |
| Variable                              | Obs | Pr(Skewness) | Pr(Kurtosis) | adj chi2 (2) | joint Prob>chi2 |
| uhat                                  | 90  | 0.9521       | 0.0860       | 3.04         | 0.2184          |

**Source:** Financial statement of sampled commercial banks and own computation through STATA

**Table 7: Summary of normality test: Bera--Jarque**

#### 5. Choosing Random Effect (RE) versus Fixed Effect (FE) Models

The results of testing the assumption of CLRM are not violated. So the study applied ordinary least square regression/OLS. Since this study use panel data there are two types of panel estimator model, namely fixed effect model and random effect model. Fixed effects models allow the intercept in the regression model to differ cross-sectional but not over time, while all of the slope estimates are fixed both cross-sectional and over time. Whereas random effects model proposes different intercept terms for each entity and again these intercepts are constant over time, with the relationships between the explanatory and explained variables assumed to be the same both cross-sectional and temporally (Brook, 2008).

As per Gujarati and Porter (2002) many of the researchers face a challenge regarding which model is better either fixed effect model (FEM) or random effect model (REM). But there are indicators to choose FEM or REM. For instance if  $T$  (the number of time series data) is large and

$N$  (the number of cross-sectional units) is small, there is likely to be little difference in the values of the parameters estimated by FEM and REM. Hence the choice here is based on computational convenience. On this score, FEM may be preferable. Since on this study the number of time series data (10 years) is greater than the number of cross sectional unit (9 commercial banks), So FEM is preferable. There is also the formal test to choose between FEM and REF which is called Hausman test (Gujarati and Porter, 2002). The null hypothesis for this test is that unobservable heterogeneity term is not correlated or random effect model is appropriate. If the null hypothesis is rejected then Fixed Effects method will employ (Brooks, 2008).

### Hausman Test of Hypothesis

H0: Random effect model is appropriate

H1: Fixed effect model is appropriate

| Variables | (b)<br>Fe  | (B)<br>Re  | (b-B)<br>Difference | sqrt(diag(V_b-V_B))<br>S.E. |
|-----------|------------|------------|---------------------|-----------------------------|
| LCR       | 0.5292953  | 0.5318309  | -0.0025356          | 0.1125401                   |
| NSFR      | -0.0491619 | -0.0801032 | 0.0309413           | 0.0167843                   |
| NPL       | -0.2415035 | 0.6679342  | -0.9094377          | 0.4054672                   |
| LTD       | -0.2059283 | -0.3814679 | 0.1755396           | 0.0724977                   |
| CRR       | -0.2219994 | -0.1722529 | -0.0497465          | 0.0462827                   |
| LR        | -0.4684319 | -0.6855904 | 0.2171585           | 0.1631172                   |
| GDPRate   | -1.222283  | -0.9865669 | -0.2357158          | .                           |
| CPI       | -0.0116198 | 0.0284117  | -0.0400315          | .                           |

|                  |        |
|------------------|--------|
| chi2(8)          | 17.15  |
| Probability>chi2 | 0.0285 |

**Source:** Financial statement of sampled commercial banks and own computation through STATA

**Table 8: Choosing Random effect (RE) versus fixed effect (FE) models using Hausman test**

Hausman specification test, the P-value of models is 0.0285, which is less than 5% level of significance. Hence, the null hypothesis of the random effect model is rejecting at 5 percent of

significant level. This implying that, fixed effect model is more appropriate than random effect model.

#### **4.5 Results of the Regression Analysis**

Under the following regression outputs the beta coefficient may be negative or positive; beta indicates that each variable's level of influence on the dependent variable. The positive beta coefficient means that variable has a positive impact on the dependent variable, and negative beta has a negative impact on the dependent variable. It has a message which says when independent variable increase by one percent the dependent variable will increase by beta amount but the independent variables should statistically has significant impact on the dependent variable. P-value indicates at what percentage or precession level of each variable is significant.  $R^2$  values indicate the explanatory power of the model or measure how well the regression model actually fits the data 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.

#### **Operational Model**

The operational panel regression model used to find the impact of bank liquidity up on financial performance through the significant factors explaining financial performance which were measured by Return on equity (ROE).

$$\text{ROE}_{i,t} = \alpha + \beta_1 (\text{LCR}_{i,t}) + \beta_2 (\text{NSFR}_{i,t}) + \beta_3 (\text{NPL}_{i,t}) + \beta_4 (\text{LTD}_{i,t}) + \beta_5 (\text{CR}_{i,t}) + \beta_6 (\text{LR}_{i,t}) + \beta_7 (\text{CPI}_{i,t}) + \beta_8 (\text{GDP}_{i,t}) + U_{i,t}$$

$$\text{ROE} = 54.76 + 0.53 \text{ LCR} - 0.049 \text{ NSFR} - 0.24 \text{ NPL} - 0.21 \text{ LTD} - 0.22 \text{ CRR} - 0.47 \text{ LR} - 0.1 \text{ CPI} - 1.22 \text{ GDP}$$

| . xtreg ROE LCR NSFR NPL LTD CRR LR GDPRate CPI, fe |           |                                   |                    |       |                      |           |
|-----------------------------------------------------|-----------|-----------------------------------|--------------------|-------|----------------------|-----------|
| Fixed-effects (within) regression                   |           |                                   | Number of obs      | =     | 90                   |           |
| Group variable: Bank                                |           |                                   | Number of groups   | =     | 9                    |           |
| R-sq: within                                        | =         | 0.2899                            | Obs per group: min | =     | 10                   |           |
| between                                             | =         | 0.8460                            | avg                | =     | 10.0                 |           |
| overall                                             | =         | 0.6073                            | max                | =     | 10                   |           |
| corr(u_i, Xb) = 0.3854                              |           |                                   | F(8,73)            | =     | 3.73                 |           |
|                                                     |           |                                   | Prob > F           | =     | 0.0011               |           |
| ROE                                                 | Coef.     | Std. Err.                         | t                  | P> t  | [95% Conf. Interval] |           |
| LCR                                                 | .5292953  | .1337099                          | 3.96               | 0.000 | .2628119             | .7957787  |
| NSFR                                                | -.0491619 | .0241331                          | -2.04              | 0.045 | -.0972591            | -.0010647 |
| NPL                                                 | -.2415035 | .6473039                          | -0.37              | 0.710 | -1.531578            | 1.048571  |
| LTD                                                 | -.2059283 | .1192692                          | -1.73              | 0.088 | -.4436315            | .0317748  |
| CRR                                                 | -.2219994 | .1497068                          | -1.48              | 0.142 | -.5203645            | .0763658  |
| LR                                                  | -.4684319 | .2072581                          | -2.26              | 0.027 | -.8814966            | -.0553672 |
| GDPRate                                             | -1.222283 | 1.136851                          | -1.08              | 0.286 | -3.488023            | 1.043458  |
| CPI                                                 | -.0116198 | .1011951                          | -0.11              | 0.909 | -.2133014            | .1900617  |
| _cons                                               | 54.76426  | 15.21643                          | 3.60               | 0.001 | 24.43795             | 85.09056  |
| sigma_u                                             | 5.0788556 |                                   |                    |       |                      |           |
| sigma_e                                             | 8.592063  |                                   |                    |       |                      |           |
| rho                                                 | .25893605 | (fraction of variance due to u_i) |                    |       |                      |           |
| F test that all u_i=0:                              |           |                                   | F(8, 73) =         | 1.88  | Prob > F = 0.0759    |           |

**Source:** Financial statement of sampled commercial banks and own computation through STATA

**Table 9: Fixed effect model regression results**

The explanatory power of the above model is high with the value of adjusted  $R^2$  of 60% with no first order autocorrelation. This indicates that 60% of the variation in ROE can be explained by the variation in those factors that can explain the variation in liquidity. Among all explanatory variables which affect the financial performance of Ethiopian commercial banks, six of them had statistically significant: namely net stable funding ratio, non-performing loan, loan to deposit ratio, cash reserve ratio, gross domestic product and consumer price index had negative impact on financial performance at 1% level of significance. The rest two explanatory variables such as Liquidity ratio and liquidity coverage ratio had statistically insignificant. However liquidity coverage ratio had negative impact on financial performance of Ethiopian commercial banks. On the other hand, liquidity ratio had positive impact on financial performance of Ethiopian commercial banks.



#### **4.6 Discussion on regression results**

##### **➤ Liquidity Coverage Ratio and Financial Performance**

Liquidity coverage ratio had positive and statistically significant impact on financial performance of Ethiopian commercial banks with p-value of 0.000 and coefficient value of 0.5293. The coefficient values indicate that if 1 birr rise/decline in liquidity coverage ratio result in 0.5293 birr rise/decline in financial performance of Ethiopian commercial banks. The coefficient sign of liquidity coverage ratio in the model equation was inconsistent with hypothesis. Since the coefficient was statistically significant we could say it shows positive impact on financial performance of Ethiopian commercial banks. This finding is consistent with Oluwatobi, Angola, & Abayomi (2018) that Liquidity coverage ratio had positive and significant impact on profitability of deposit money banks. This is also inline with Basel III framework that banks hold sufficient high quality liquid asset/resources to satisfy liquid asset need over one month period of time under accurate stress scenario. Therefore increase in liquidity coverage ratio means increase in liquid asset and decrease in illiquid asset and the bank profitability become increase. However this result was inconsistent with Muriithi and Waweru (2017) that Liquidity coverage ratio does not influence the financial performance of commercial banks holding all else constant.

##### **➤ Net Stable Funding Ratio and Financial Performance**

Net stable funding ratio was introduced in the Basel III framework to ensure that the banks hold minimum amount of stable funding based on the liquidity characteristics of their asset activities over one year horizon. This reduces maturity mismatches between the asset and liability items on the balance sheet and thereby reduces funding and rollover risk. On this study net stable funding ratio had negative and statistically significant impact on financial performance of Ethiopian commercial banks. This result is inconsistent with the result of Said (2014) that there was positive relationship between net stable funding ratio and financial performance. However Muriithi and Waweru (2017) suggested that short term investment and reduced maturity should reduce profitability. This might be the case, the Ethiopian commercial banks where they largely on short term investment and reduced maturity asset which affect financial performance negatively. If high available stable funding which consists of capital and deposit required competitive pressures will constrain banks to some extent resulting in competition for loan, deposit and even

the source of equity and debt investment. Finally this competition will lead to higher costs of doing business resulting instability. The value of the coefficient of NSFR was -0.048 indicating that the net stable funding ratio lower impacts on the on financial performance of Ethiopian commercial banks. In other words, 1 birr rise/decline in net stable fund result in 0.0488 birr rise/decline in return on equity. And also the researcher fail to reject the hypothesis saying net stable funding ratio has negative and significant impact on banks financial performance.

#### ➤ **Non-Performing Loan and Financial Performance**

Nonperforming loan in this study was measured by the ratio of provision for impairment losses to the total outstanding loan and advance to customer. On this study non-performing loan found negative but statistically insignificant impact on financial performance with p-value of 0.675 and coefficient value of -0.27221. The coefficient values indicate that if 1 birr rise/decline in non-performing loan result in 0.27221 birr rise/decline in financial performance of Ethiopian commercial banks. Due to the above result the researcher reject the hypothesis saying non-performing loan has not impact on banks financial performance of Ethiopian commercial banks. The negative and statistically insignificant impact of non-performing loans up on financial performance was due to the average ratio of non-performing loan of Ethiopian commercial banks were below the standard. This result was inconsistent with Tseganesh (2012) that non-performing loan increase banks holding of liquid asset increase (at the cost of decreasing loan provision by banks) and reduces the profitability of commercial banks in Ethiopia. This finding also inconsistent with Assumptah & Muhari (2017) that non-performing loan makes the bank to raise interest rate against loans advanced by the bank and that; non-performing loans reduce working capital of the bank hence blocking it from performing routine operations.

#### ➤ **Loan to Deposit Ratio and Financial Performance**

In this study loan to deposit ratio was measured by the ratio of the total loan and advance disbursed by Ethiopian commercial banks to their customer total deposit. The coefficient sign of loan to deposit ratio had negative and statistically significant at 10% significant level with p-value of 0.054 and coefficient value of -0.221. The coefficient values indicate that if 1 birr rise/decline in total loan and advance result in 0.221 birr rise/decline in financial performance of Ethiopian commercial banks. Due to the above result the researcher fail to reject the null

hypothesis saying loan to deposit ratio has negative and significant impact on banks financial performance of Ethiopian commercial banks. The result of the study suggested that Ethiopian commercial banks disburse on average 61.09% of their deposit as loan this was far from standard since Disalvo and Johanson (2017) infers that the standard of loan to deposit ratio was 80%. This indicates that the Ethiopian commercial banks was not used their asset to generate income and loans that commercial banks deliver to customers are not growing at the same pace as deposit. Finally, this end up with low profit. This result consistent with Badawi (2017) which conclude that the loan disbursed by the bank to bad debts will actually cause the bank's income decreased, it means LDR increases but the ROE decreased due to the decrease in income due to bad debts so that bank profits will drop. However this result inconsistency with Yunanto (2018) and Sirak Yifru (2015) which concludes that the value of loan to deposit ratio in the bank increases, the amount of loan disbursed to the public also increases. When the amount of loan disbursed to the community increases, the bank profit become goes up.

#### ➤ **Cash Reserve Ratio and Financial Performance**

Cash reserve ratio in this study measured by percentage of cash reserved held at national bank of Ethiopia to total cash and near cash items of Ethiopian commercial banks have. The coefficient sign of cash reserve ratio had negative but statistically insignificant with p-value of 0.141 and coefficient value of -0.21835. The coefficient values indicate that if 1 birr deposit/withdrawal from reserve account held at national bank of Ethiopia result in 0.21835 birr rise/decline in financial performance of Ethiopian commercial banks. Due to the above result the researcher reject the null hypothesis saying cash reserve ratio has not significant impact on banks financial performance of Ethiopian commercial banks. This result suggested that Ethiopian commercial banks reserve on average 21.01% their cash at national bank of Ethiopia. This was far from standard which was 5% set by national bank of Ethiopia under directives number SBB/55/2013. This result also suggested that as Ethiopian commercial bank held much more and more cash reserve at national bank of Ethiopia their profitability become decrease because Ethiopian commercial banks bear high opportunity cost. This result was inconsistent with Wanjiku & Assumptah (2017) and Abid & Lodhi (2015) which conclude that cash reserve and profitability had negative relationship and changes in CRR will have inverse impact on banks profitability. Further they conclude that cash reserves reduced the lending capacity of commercial banks and

that cash reserves can make bank loose a number of opportunities in the market. The other study which was conducted by Bassey ( 2015) suggested that cash reserve ratio of commercial banks have a significant impact on the profitability of returns to shareholders but has a weak impact on the profitability of returns to asset. These results suggest that despite the huge profit declared by Nigerian commercial banks annually; their liquidity management does not optimize the use of assets.

#### ➤ **Liquidity Ratio and Financial Performance**

In this study liquidity ratio was measured by the ratio of the total liquid asset of Ethiopian commercial banks to total asset. The coefficient sign of loan to liquidity ratio had negative and statistically significant with p-value of 0.024 and coefficient value of -0.4759. The coefficient values indicate that if 1 birr rise/decline in liquid assets result in 0.4759 birr rise/decline in financial performance of Ethiopian commercial banks. Due to the above result the researcher fail to reject the null hypothesis saying liquidity ratio has negative impact on banks financial performance of Ethiopian commercial banks. The significant and negative impact of liquidity ratio on financial performance of Ethiopian commercial banks due to the relationship between liquidity ratio and profitability and the investment on total assets predicts that bank invest more in assets then liquidity become decrease and profitability will be high. This result consistent with Maqbool, (2014) which conclude that there was relationship between liquidity ratio and profitability and the investment on total assets predicts that if bank invest more in assets then liquidity will be low and profitability will be high.

#### ➤ **CPI Growth Rate and Financial Performance**

Consumer price index (CPI) measures changes in the price level of market basket of consumer goods and services purchased by households. The coefficient sign of CPI had negative but statistically insignificant with p-value of 0.909 and coefficient value of -0.11. The coefficient value indicates that if CPI increases/decrease by 1% results in 0.11 birr rise/decline in financial performance of Ethiopian commercial banks. Due to the above result the researcher reject the null hypothesis saying CPI growth rate has not impact on banks financial performance of Ethiopian commercial banks. The insignificant and negative impact of CPI growth on financial performance of Ethiopian commercial banks could be an indication that performance of banks can be attributed to other firm specific characteristics and other macro-economic factors besides

the CPI growth rate. This result was consistent with Khan & Shahid, (2014) when the inflation rate is high indeed corporate financing is reduced, but demand for consumer financing and micro financing increased and high interest rate charged. And handsome returns earned from the investment of shareholders. However this result inconsistent with Huybens & Smith, (1997) which conclude that inflation negatively affects the bank performance because during a high inflationary period, rate of return is decreased. As a result, banks make fewer loans to corporations; resource allocation becomes less efficient and more risky.

#### ➤ **GDP Growth Rate and Financial Performance**

Gross domestic product (GDP) measures the overall economic wellbeing of the country. The coefficient sign of GDP had negative but statistically insignificant with p-value of 0.452 and coefficient value of -0.7109. The coefficient values indicate that if GDP grows by 1 percent results in 0.7109 birr rise/decline in financial performance of Ethiopian commercial banks. Due to the above result the researcher reject the null hypothesis saying GDP growth rate has not significant impact on banks financial performance of Ethiopian commercial banks. This result partially support that as the high economic growth improve the business environment due to this the competition between banks become increased this may reduce the Ethiopian commercial banks profit. This result inconsistent with Tan & Floros, 2012 which was conclude that the GDP growth is found to be significantly and negatively related to bank profitability in China. This result was also inconsistent with Shen et.al (2009) which was suggested that GDP had significantly positive effect on bank performance.

| <b>Explanatory Variable</b> | <b>Expected impact on financial performance (ROE)</b> | <b>Actual impact on financial performance (ROE)</b> |
|-----------------------------|-------------------------------------------------------|-----------------------------------------------------|
| LCR                         | Negative and Significant                              | Positive and Significant                            |
| NSFR                        | Negative and Significant                              | Negative and Significant                            |
| NPL                         | Negative and Significant                              | Negative and Insignificant                          |
| LTD                         | Negative and Significant                              | Negative and Significant                            |
| CRR                         | Negative and Significant                              | Negative and Insignificant                          |
| LR                          | Negative and Significant                              | Negative and Significant                            |
| GDPRate                     | Negative and Significant                              | Negative and Insignificant                          |
| CPI                         | Negative and Significant                              | Negative and Insignificant                          |

**Table 10: Summary of actual and expected signs of explanatory variables on the dependent variables**

## **Chapter Five**

### **Conclusion and Recommendations**

#### **5.1 Conclusion**

The basic function of banks in any economy is maturity transformation from short term deposit in to long term loan. This role makes banks inherently vulnerable to liquidity risk both of an institution-specific nature and markets as a whole. The aim of this study was to perceive the impact of liquidity risk on financial performance of Ethiopian commercial banks through the variable explaining liquidity risk. Nine commercial banks which operating the banking service in Ethiopia for 10 years were purposively selected. Eight variables that affect financial performances of Ethiopian commercial banks were chosen and analyzed. The panel data was used for the sample of nine commercial banks in Ethiopia from 2007 to 2016. Data was presented by using descriptive statistics. The balanced correlation and regression analysis for financial performance was conducted. Before performing OLS regression the models were tested for the classical linear regression model assumptions. The models fulfill all assumptions of the CLRM. Fixed effect model/FEM was used based on test. From the list of possible explanatory variables, six of them proved to be statistically significant. While two explanatory variables are statistically insignificant: namely Liquidity coverage ratio and liquidity ratio. The results regression using classic linear regression model enables us to make the following conclusions.

From the total eight independent variables four of them are significant namely: liquidity coverage ratio, net stable funding ratio, loan to deposit ratio and liquidity ratio. However there are four independent variables which were statistically insignificant namely: cash reserve ratio, portion of nonperforming loan from the total bank loan, CPI and GDP growth rate. Net stable funding ratio, loan to deposit ratio and liquidity ratio had negative coefficient in line with the hypotheses whereas liquidity coverage ratio had positive coefficient. These were opposite to hypotheses. Therefore, it can be concluded that the impact of liquidity risk was negatively affect the financial performance of commercial banks in Ethiopia.

## 5.2 Recommendation

Based the finding of this study the following recommendations were given;

The data suggests that the bank profit has negatively affected by net stable funding ratio meaning Ethiopian commercial banks held much more stable fund. It is advisable for a bank's management to invest the commercial banks stable funds on the market in the form of short term loan to earn profit. The data also suggested that banks financial performance has negatively affected by loan to deposit ratio, meaning Ethiopian commercial banks was not used their asset to generate income and loans that commercial banks deliver to customers are not growing at the same pace as deposit. It is advisable for banks to invest their asset to market either in the form of loan or other investments. The data also suggested that banks financial performance has negatively affected by liquidity ratio, meaning Ethiopian commercial banks was deposit asset above stated amount at national bank of Ethiopia. The overall effect indicates that liquidity risk has a negative effect on financial performance meaning Ethiopian commercial banks held much more liquid asset therefore it is advisable for a bank's management to invest the commercial banks tied up deposit/money on the market either in the form of loan or other investment and develop different new credit products like personnel loan, vehicles loan, mortgage schemes with various real estate companies, to generate high amount of profit. However the bank management pays the required attention to the liquidity management when they try to invest the tied up deposit.

The other recommendation is that the banks senior management formulates liquidity management strategy, policy and practices such as: the composition and maturity of assets and liabilities; the diversity and stability of funding sources; the approach to managing liquidity in different currencies, across borders, and across business lines and legal entities to manage liquidity risk and excessively hold liquid asset.

The other recommendation also is that treasury or finance departments of the commercial banks in Ethiopia that are mandated to manage liquidity risk consider strengthened of the banks liquidity to ensure a sound process for identifying, measuring, monitoring and controlling



liquidity risk. This process should include a robust framework for maintaining adequate liquidity through a comprehensive projection of cash flows arising from assets, liabilities and off-balance sheet items over an appropriate set of time horizons.

While this study provides some insights of the net stable funding ratio and liquidity coverage ratio, implications of the new liquidity frame works proposed by Basel committee. Therefore, there has to be further research on the area of liquidity risk and financial performance of Ethiopian commercial banks by incorporating net stable funding ratio, liquidity coverage ratio, others regulatory factors and other bank specific and macroeconomic factors.

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## Appendixes

### Appendixes I

| Bank | Year | ROE   | LCR    | NSFR   | NPL   | LTD   | CRR   | LR    | GDP Rate | CPI   |
|------|------|-------|--------|--------|-------|-------|-------|-------|----------|-------|
| AB   | 2007 | 38.78 | 43.16  | 182.86 | 4.34  | 80.72 | 17.74 | 29.45 | 11.50    | 17.30 |
| AB   | 2008 | 27.71 | 54.76  | 102.06 | 4.64  | 70.75 | 25.28 | 38.26 | 9.80     | 44.50 |
| AB   | 2009 | 21.23 | 68.53  | 213.77 | 5.50  | 54.67 | 39.50 | 49.62 | 10.30    | 9.60  |
| AB   | 2010 | 29.29 | 70.36  | 41.80  | 4.71  | 51.52 | 29.23 | 50.88 | 11.40    | 9.40  |
| AB   | 2011 | 32.08 | 54.68  | 255.39 | 3.64  | 51.48 | 31.44 | 40.02 | 8.70     | 33.20 |
| AB   | 2012 | 27.03 | 38.35  | 126.40 | 2.70  | 59.80 | 12.95 | 26.48 | 9.90     | 24.10 |
| AB   | 2013 | 28.03 | 32.49  | 160.53 | 2.30  | 61.46 | 9.24  | 24.04 | 10.30    | 8.10  |
| AB   | 2014 | 27.25 | 39.57  | 212.81 | 2.27  | 61.01 | 16.91 | 25.27 | 10.40    | 8.40  |
| AB   | 2015 | 22.98 | 25.66  | 214.44 | 1.74  | 67.40 | 10.03 | 16.26 | 8.50     | 10.10 |
| AB   | 2016 | 21.54 | 30.61  | 203.58 | 1.53  | 67.67 | 14.61 | 19.56 | 11.50    | 7.30  |
| BOA  | 2007 | 16.65 | 46.26  | 195.19 | 4.69  | 84.71 | 16.70 | 30.09 | 11.50    | 17.30 |
| BOA  | 2008 | 3.54  | 48.95  | 209.12 | 8.89  | 81.00 | 26.04 | 33.79 | 9.80     | 44.50 |
| BOA  | 2009 | 21.40 | 67.27  | 257.13 | 9.83  | 60.28 | 43.63 | 49.23 | 10.30    | 9.60  |
| BOA  | 2010 | 25.45 | 61.28  | 234.67 | 7.41  | 61.36 | 35.87 | 47.17 | 11.40    | 9.40  |
| BOA  | 2011 | 29.04 | 47.89  | 265.74 | 3.33  | 54.58 | 25.04 | 39.79 | 8.70     | 33.20 |
| BOA  | 2012 | 27.60 | 41.45  | 247.67 | 2.57  | 57.56 | 14.87 | 30.62 | 9.90     | 24.10 |
| BOA  | 2013 | 21.48 | 26.38  | 238.74 | 1.99  | 55.34 | 9.97  | 19.46 | 10.30    | 8.10  |
| BOA  | 2014 | 33.94 | 36.52  | 282.90 | 0.00  | 55.64 | 12.87 | 24.35 | 10.40    | 8.40  |
| BOA  | 2015 | 17.47 | 66.84  | 224.90 | 0.00  | 53.11 | 11.92 | 45.90 | 8.50     | 10.10 |
| BOA  | 2016 | 18.33 | 26.62  | 228.41 | 0.00  | 58.76 | 12.91 | 18.44 | 11.50    | 7.30  |
| CBE  | 2007 | 30.18 | 101.48 | 382.87 | 14.23 | 29.69 | 28.58 | 59.05 | 11.50    | 17.30 |



|     |      |       |       |        |      |       |       |       |       |       |
|-----|------|-------|-------|--------|------|-------|-------|-------|-------|-------|
| CBE | 2008 | 31.00 | 86.07 | 314.27 | 6.13 | 46.07 | 24.21 | 35.38 | 9.80  | 44.50 |
| CBE | 2009 | 40.01 | 83.72 | 274.46 | 3.11 | 48.07 | 18.24 | 26.29 | 10.30 | 9.60  |
| CBE | 2010 | 37.15 | 85.82 | 289.04 | 1.85 | 43.95 | 17.46 | 21.03 | 11.40 | 9.40  |
| CBE | 2011 | 48.46 | 74.76 | 219.99 | 2.45 | 42.43 | 16.84 | 26.48 | 8.70  | 33.20 |
| CBE | 2012 | 77.71 | 78.02 | 232.46 | 2.21 | 53.45 | 11.45 | 15.80 | 9.90  | 24.10 |
| CBE | 2013 | 72.83 | 75.59 | 239.90 | 2.61 | 46.95 | 9.95  | 18.01 | 10.30 | 8.10  |
| CBE | 2014 | 67.65 | 74.02 | 256.33 | 2.75 | 45.38 | 5.82  | 12.96 | 10.40 | 8.00  |
| CBE | 2015 | 62.85 | 81.13 | 412.24 | 3.10 | 47.43 | 4.37  | 5.05  | 8.50  | 10.10 |
| CBE | 2016 | 55.95 | 84.55 | 394.55 | 3.93 | 49.60 | 5.19  | 5.56  | 11.50 | 7.30  |
| CBO | 2007 | 1.90  | 59.49 | 258.99 | 1.26 | 86.28 | 41.13 | 41.27 | 11.50 | 17.30 |
| CBO | 2008 | 8.45  | 65.34 | 297.96 | 1.23 | 65.79 | 50.24 | 48.47 | 9.80  | 44.50 |
| CBO | 2009 | 1.55  | 51.28 | 221.27 | 1.36 | 75.57 | 29.42 | 35.37 | 10.30 | 9.60  |
| CBO | 2010 | 14.53 | 67.95 | 223.71 | 2.53 | 52.61 | 38.33 | 48.15 | 11.40 | 9.40  |
| CBO | 2011 | 21.74 | 72.52 | 256.49 | 2.00 | 40.49 | 31.81 | 48.67 | 8.70  | 33.20 |
| CBO | 2012 | 30.77 | 57.41 | 194.32 | 1.44 | 49.45 | 19.78 | 33.67 | 9.90  | 24.10 |
| CBO | 2013 | 36.74 | 68.46 | 216.39 | 1.72 | 47.39 | 17.53 | 51.97 | 10.30 | 8.10  |
| CBO | 2014 | 38.42 | 47.69 | 194.58 | 0.00 | 66.86 | 10.28 | 25.13 | 10.40 | 8.40  |
| CBO | 2015 | 24.98 | 51.39 | 175.31 | 0.00 | 89.12 | 7.81  | 21.26 | 8.50  | 10.10 |
| CBO | 2016 | 2.66  | 51.39 | 227.10 | 0.00 | 69.65 | 8.08  | 20.08 | 11.50 | 7.30  |
| DB  | 2007 | 40.19 | 42.69 | 113.60 | 2.48 | 82.04 | 18.28 | 27.66 | 11.50 | 17.30 |
| DB  | 2008 | 37.50 | 56.96 | 136.10 | 2.32 | 71.23 | 30.13 | 37.24 | 9.80  | 44.50 |
| DB  | 2009 | 30.49 | 65.85 | 181.81 | 2.30 | 56.17 | 45.56 | 48.32 | 10.30 | 9.60  |
| DB  | 2010 | 31.89 | 55.72 | 168.58 | 2.18 | 49.77 | 23.05 | 42.54 | 11.40 | 9.40  |
| DB  | 2011 | 35.77 | 55.98 | 169.92 | 1.99 | 52.51 | 26.68 | 42.47 | 8.70  | 33.20 |

|     |      |        |       |        |      |       |       |       |       |       |
|-----|------|--------|-------|--------|------|-------|-------|-------|-------|-------|
| DB  | 2012 | 40.44  | 43.51 | 157.89 | 2.15 | 57.76 | 17.06 | 32.96 | 9.90  | 24.10 |
| DB  | 2013 | 31.33  | 42.49 | 171.02 | 2.25 | 55.91 | 15.18 | 30.69 | 10.30 | 8.10  |
| DB  | 2014 | 30.69  | 40.42 | 183.28 | -    | 53.33 | 15.27 | 29.79 | 10.40 | 8.40  |
| DB  | 2015 | 26.41  | 31.30 | 191.23 | 1.68 | 58.18 | 12.21 | 22.33 | 8.50  | 10.10 |
| DB  | 2016 | 23.15  | 33.75 | 192.39 | 1.71 | 55.78 | 14.16 | 24.04 | 11.50 | 7.30  |
| LB  | 2007 | (7.41) | 52.94 | 372.84 | 1.33 | 61.48 | 28.43 | 63.16 | 11.50 | 17.30 |
| LB  | 2008 | (0.54) | 82.21 | 379.90 | 1.16 | 48.63 | 54.79 | 63.53 | 9.80  | 44.50 |
| LB  | 2009 | 1.45   | 53.94 | 269.73 | 1.05 | 66.82 | 28.33 | 46.48 | 10.30 | 9.60  |
| LB  | 2010 | 18.43  | 76.54 | 241.56 | 1.62 | 57.39 | 29.91 | 54.31 | 11.40 | 9.40  |
| LB  | 2011 | 14.71  | 74.65 | 317.47 | 1.45 | 52.13 | 48.28 | 50.48 | 8.70  | 33.20 |
| LB  | 2012 | 18.98  | 64.10 | 250.76 | 1.55 | 55.89 | 22.01 | 42.19 | 9.90  | 24.10 |
| LB  | 2013 | 22.65  | 50.78 | 267.05 | 1.30 | 62.59 | 12.69 | 33.43 | 10.30 | 8.10  |
| LB  | 2014 | 16.51  | 45.60 | 288.63 | 0.00 | 57.36 | 7.54  | 31.27 | 10.40 | 8.40  |
| LB  | 2015 | 20.77  | 37.17 | 245.81 | 0.00 | 63.50 | 6.42  | 26.20 | 8.50  | 10.10 |
| LB  | 2016 | 20.74  | 28.14 | 258.31 | 0.00 | 67.95 | 13.29 | 22.59 | 11.50 | 7.30  |
| NIB | 2007 | 21.41  | 49.60 | 178.54 | 3.41 | 96.70 | 16.11 | 26.70 | 11.50 | 17.30 |
| NIB | 2008 | 22.10  | 65.29 | 197.64 | 3.79 | 85.58 | 33.83 | 36.51 | 9.80  | 44.50 |
| NIB | 2009 | 23.16  | 77.35 | 236.60 | 4.60 | 67.36 | 39.92 | 48.57 | 10.30 | 9.60  |
| NIB | 2010 | 24.42  | 75.63 | 216.56 | 3.90 | 61.69 | 26.60 | 51.39 | 11.40 | 9.40  |
| NIB | 2011 | 23.61  | 69.58 | 275.48 | 4.12 | 53.64 | 35.84 | 51.24 | 8.70  | 33.20 |
| NIB | 2012 | 21.21  | 49.45 | 239.52 | 2.71 | 63.53 | 15.70 | 36.02 | 9.90  | 24.10 |
| NIB | 2013 | 18.75  | 30.80 | 254.08 | 2.50 | 68.26 | 8.45  | 24.66 | 10.30 | 8.10  |
| NIB | 2014 | 16.38  | 29.17 | 257.47 | 0.00 | 68.25 | 13.54 | 17.83 | 10.40 | 8.40  |
| NIB | 2015 | 16.28  | 23.67 | 251.17 | 0.00 | 70.53 | 8.83  | 13.56 | 8.50  | 10.10 |

|     |      |       |       |        |      |       |       |       |       |       |
|-----|------|-------|-------|--------|------|-------|-------|-------|-------|-------|
| NIB | 2016 | 16.60 | 31.14 | 254.43 | 0.00 | 60.47 | 9.83  | 18.81 | 11.50 | 7.30  |
| UB  | 2007 | 23.23 | 65.20 | 173.98 | 3.01 | 91.50 | 9.89  | 34.73 | 11.50 | 17.30 |
| UB  | 2008 | 22.00 | 61.44 | 223.55 | 2.68 | 76.11 | 24.94 | 42.64 | 9.80  | 44.50 |
| UB  | 2009 | 18.95 | 76.64 | 258.80 | 3.09 | 59.52 | 39.67 | 53.43 | 10.30 | 9.60  |
| UB  | 2010 | 30.14 | 66.31 | 280.92 | 3.65 | 55.32 | 39.60 | 55.54 | 11.40 | 9.40  |
| UB  | 2011 | 30.13 | 54.18 | 283.43 | 2.77 | 54.02 | 25.47 | 46.07 | 8.70  | 33.20 |
| UB  | 2012 | 29.74 | 42.14 | 261.97 | 2.33 | 60.46 | 14.13 | 32.58 | 9.90  | 24.10 |
| UB  | 2013 | 18.56 | 24.36 | 286.40 | 1.86 | 58.42 | 6.47  | 20.67 | 10.30 | 8.10  |
| UB  | 2014 | 14.28 | 32.67 | 269.54 | 1.44 | 56.93 | 8.90  | 28.50 | 10.40 | 8.40  |
| UB  | 2015 | 17.25 | 27.05 | 275.57 | 1.22 | 58.11 | 5.81  | 18.96 | 8.50  | 10.10 |
| UB  | 2016 | 18.04 | 27.74 | 223.01 | 1.30 | 65.46 | 7.01  | 16.90 | 11.50 | 7.30  |
| WB  | 2007 | 34.04 | 65.43 | 187.11 | 4.41 | 79.13 | 12.79 | 37.93 | 11.50 | 17.30 |
| WB  | 2008 | 27.54 | 82.43 | 207.26 | 5.92 | 79.11 | 30.75 | 43.72 | 9.80  | 44.50 |
| WB  | 2009 | 25.06 | 83.83 | 284.14 | 6.09 | 56.66 | 55.51 | 56.96 | 10.30 | 9.60  |
| WB  | 2010 | 23.66 | 75.01 | 210.03 | 3.97 | 63.06 | 25.06 | 52.87 | 11.40 | 9.40  |
| WB  | 2011 | 27.06 | 68.43 | 299.33 | 4.54 | 48.85 | 36.36 | 51.37 | 8.70  | 33.20 |
| WB  | 2012 | 22.86 | 53.93 | 242.08 | 2.43 | 61.92 | 11.87 | 33.43 | 9.90  | 24.10 |
| WB  | 2013 | 19.99 | 40.98 | 247.16 | 2.24 | 62.12 | 14.44 | 26.70 | 10.30 | 8.10  |
| WB  | 2014 | 15.34 | 25.24 | 125.35 | 1.67 | 54.92 | 5.38  | 15.92 | 10.40 | 8.40  |
| WB  | 2015 | 15.46 | 27.90 | 262.35 | 0.00 | 61.51 | 14.76 | 17.84 | 8.50  | 10.10 |
| WB  | 2016 | 14.39 | 26.37 | 237.87 | 0.00 | 67.75 | 10.73 | 19.13 | 11.50 | 7.30  |

**Source:** computed from financial statement

## Appendix II

Summary of descriptive statistics of all dependent and independent variables

```
. summarize ROE LCR NSFR NPL LTD CRR LR GDPRate CPI
```

| Variable | Obs | Mean     | Std. Dev. | Min       | Max      |
|----------|-----|----------|-----------|-----------|----------|
| ROE      | 90  | 25.57948 | 14.29945  | -7.407407 | 77.7097  |
| LCR      | 90  | 54.54861 | 19.02304  | 23.66595  | 101.4808 |
| NSFR     | 90  | 234.8839 | 61.69419  | 41.7993   | 412.2427 |
| NPL      | 90  | 2.601743 | 2.292204  | 0         | 14.23302 |
| LTD      | 90  | 61.09319 | 12.08307  | 29.68698  | 96.70037 |
| CRR      | 90  | 21.00828 | 12.56001  | 4.371229  | 55.50616 |
| LR       | 90  | 34.01354 | 13.76147  | 5.052995  | 63.52646 |
| GDPRate  | 90  | 10.23    | 1.018641  | 8.5       | 11.5     |
| CPI      | 90  | 17.19556 | 12.22119  | 7.3       | 44.5     |

**Source:** STATA output

Summary of correlation matrix between dependent and independent variables

```
. corr ROE LCR NSFR NPL LTD CRR LR GDPRate CPI
(obs=90)
```

|         | ROE     | LCR     | NSFR    | NPL     | LTD     | CRR     | LR     | GDPRate | CPI    |
|---------|---------|---------|---------|---------|---------|---------|--------|---------|--------|
| ROE     | 1.0000  |         |         |         |         |         |        |         |        |
| LCR     | 0.3219  | 1.0000  |         |         |         |         |        |         |        |
| NSFR    | -0.0657 | 0.3033  | 1.0000  |         |         |         |        |         |        |
| NPL     | 0.1458  | 0.5184  | 0.0808  | 1.0000  |         |         |        |         |        |
| LTD     | -0.3410 | -0.3256 | -0.3886 | -0.0968 | 1.0000  |         |        |         |        |
| CRR     | -0.2780 | 0.5488  | 0.1411  | 0.3996  | -0.0785 | 1.0000  |        |         |        |
| LR      | -0.3317 | 0.5515  | 0.0857  | 0.4064  | -0.1342 | 0.8270  | 1.0000 |         |        |
| GDPRate | -0.0912 | 0.0252  | -0.1281 | 0.1296  | 0.2057  | -0.0195 | 0.0359 | 1.0000  |        |
| CPI     | -0.0207 | 0.3065  | 0.0135  | 0.2633  | 0.0750  | 0.4138  | 0.3447 | -0.4099 | 1.0000 |

**Source:** STATA output

## Summary of test for homoscedasticity assumption using white test

```

. reg ROE LCR NSFR NPL LTD CRR LR GDPRate CPI

```

|          |            |    |            |                        |  |  |
|----------|------------|----|------------|------------------------|--|--|
| Source   | SS         | df | MS         | Number of obs = 90     |  |  |
| Model    | 11697.9001 | 8  | 1462.23751 | F( 8, 81) = 18.22      |  |  |
| Residual | 6500.31993 | 81 | 80.2508633 | Prob > F = 0.0000      |  |  |
| Total    | 18198.22   | 89 | 204.474382 | R-squared = 0.6428     |  |  |
|          |            |    |            | Adj R-squared = 0.6075 |  |  |
|          |            |    |            | Root MSE = 8.9583      |  |  |

| ROE     | Coef.     | Std. Err. | t     | P> t  | [95% Conf. Interval] |           |
|---------|-----------|-----------|-------|-------|----------------------|-----------|
| LCR     | .5318309  | .0722014  | 7.37  | 0.000 | .3881727             | .6754891  |
| NSFR    | -.0801032 | .0173405  | -4.62 | 0.000 | -.1146053            | -.0456011 |
| NPL     | .6679342  | .5045778  | 1.32  | 0.189 | -.3360173            | 1.671886  |
| LTD     | -.3814679 | .094706   | -4.03 | 0.000 | -.5699031            | -.1930327 |
| CRR     | -.1722529 | .1423728  | -1.21 | 0.230 | -.4555302            | .1110244  |
| LR      | -.6855904 | .1278619  | -5.36 | 0.000 | -.9399955            | -.4311853 |
| GDPRate | -.9865669 | 1.146079  | -0.86 | 0.392 | -3.266904            | 1.293771  |
| CPI     | .0284117  | .1027111  | 0.28  | 0.783 | -.1759511            | .2327745  |
| _cons   | 73.49321  | 13.37918  | 5.49  | 0.000 | 46.87285             | 100.1136  |

```

. estat imtest, white

```

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

```

chi2(44)      =      59.06
Prob > chi2   =      0.0641

```

Cameron & Trivedi's decomposition of IM-test

| Source             | chi2  | df | p      |
|--------------------|-------|----|--------|
| Heteroskedasticity | 59.06 | 44 | 0.0641 |
| Skewness           | 1.98  | 8  | 0.9816 |
| Kurtosis           | 2.21  | 1  | 0.1373 |
| Total              | 63.25 | 53 | 0.1582 |

Source: STATA output

## Summary of test for absence of series Multicollinearity assumption

```
. xtset Bank Year
      panel variable:  Bank (strongly balanced)
      time variable:  Year, 2007 to 2016
              delta:  1 unit
```

```
. corr LCR NSFR NPL LTD CRR LR GDPRate CPI
(obs=90)
```

|         | LCR     | NSFR    | NPL     | LTD     | CRR    | LR     | GDPRate | CPI    |
|---------|---------|---------|---------|---------|--------|--------|---------|--------|
| LCR     | 1.0000  |         |         |         |        |        |         |        |
| NSFR    | 0.3033  | 1.0000  |         |         |        |        |         |        |
| NPL     | 0.5184  | 0.0808  | 1.0000  |         |        |        |         |        |
| LTD     | -0.3256 | -0.3886 | -0.0968 | 1.0000  |        |        |         |        |
| CRR     | 0.5488  | 0.1411  | 0.3996  | -0.0785 | 1.0000 |        |         |        |
| LR      | 0.5515  | 0.0857  | 0.4064  | -0.1342 | 0.8270 | 1.0000 |         |        |
| GDPRate | 0.1085  | -0.1470 | 0.2037  | 0.1836  | 0.0742 | 0.1464 | 1.0000  |        |
| CPI     | 0.2907  | 0.0168  | 0.2536  | 0.0795  | 0.3932 | 0.3260 | -0.3340 | 1.0000 |

```
. estat vif
```

| Variable | VIF  | 1/VIF    |
|----------|------|----------|
| CRR      | 3.55 | 0.281985 |
| LR       | 3.43 | 0.291238 |
| LCR      | 2.09 | 0.477978 |
| CPI      | 1.75 | 0.572266 |
| GDPRate  | 1.51 | 0.661589 |
| NPL      | 1.48 | 0.674058 |
| LTD      | 1.45 | 0.688573 |
| NSFR     | 1.27 | 0.787862 |
| Mean VIF | 2.07 |          |

**Source:** STATA output

# Summary of test for normality assumption using Bera—Jarque

```
. predict uhat, residual

. hist uhat, normal
(bin=9, start=-27.796585, width=5.5419769)

. sum uhat, detail
```

| Residuals |             |           |             |           |    |
|-----------|-------------|-----------|-------------|-----------|----|
|           | Percentiles | Smallest  |             |           |    |
| 1%        | -27.79659   | -27.79659 |             |           |    |
| 5%        | -13.92909   | -19.87626 |             |           |    |
| 10%       | -9.003527   | -18.17335 | Obs         |           | 90 |
| 25%       | -4.08687    | -15.47857 | Sum of Wgt. |           | 90 |
| 50%       | -.6589348   |           | Mean        | -4.94e-08 |    |
|           |             | Largest   | Std. Dev.   | 8.57564   |    |
| 75%       | 6.036455    | 18.10848  |             |           |    |
| 90%       | 10.41853    | 18.59612  | Variance    | 73.5416   |    |
| 95%       | 15.27778    | 18.6023   | Skewness    | -.0609278 |    |
| 99%       | 22.08121    | 22.08121  | Kurtosis    | 3.915181  |    |

```
. sktest uhat
```

| Skewness/Kurtosis tests for Normality |     |              |              |             |                 |
|---------------------------------------|-----|--------------|--------------|-------------|-----------------|
| Variable                              | Obs | Pr(Skewness) | Pr(Kurtosis) | adj chi2(2) | joint Prob>chi2 |
| uhat                                  | 90  | 0.8007       | 0.0783       | 3.26        | 0.1956          |

```
.
```

Source: STATA output

## Summary of Choosing Random Effect (RE) versus Fixed Effect (FE) Models

```
. hausman fe re
```

|         | Coefficients |           | (b-B)<br>Difference | sqrt(diag(V_b-V_B))<br>S.E. |
|---------|--------------|-----------|---------------------|-----------------------------|
|         | (b)<br>fe    | (B)<br>re |                     |                             |
| LCR     | .5292953     | .5318309  | -.0025356           | .1125401                    |
| NSFR    | -.0491619    | -.0801032 | .0309413            | .0167843                    |
| NPL     | -.2415035    | .6679342  | -.9094377           | .4054672                    |
| LTD     | -.2059283    | -.3814679 | .1755396            | .0724977                    |
| CRR     | -.2219994    | -.1722529 | -.0497465           | .0462827                    |
| LR      | -.4684319    | -.6855904 | .2171585            | .1631172                    |
| GDPRate | -1.222283    | -.9865669 | -.2357158           | .                           |
| CPI     | -.0116198    | .0284117  | -.0400315           | .                           |

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(8) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
 = 17.15  
 Prob>chi2 = 0.0285  
 (V\_b-V\_B is not positive definite)

**Source:** STATA output



## Summary of Fixed Effect regression model result

```
. xtreg ROE LCR NSFR NPL LTD CRR LR GDPRate CPI, fe
```

Fixed-effects (within) regression

Group variable: Bank

R-sq: within = 0.2899  
between = 0.8460  
overall = 0.6073

Number of obs = 90  
Number of groups = 9  
Obs per group: min = 10  
avg = 10.0  
max = 10

F(8,73) = 3.73  
Prob > F = 0.0011

corr(u\_i, Xb) = 0.3854

| ROE     | Coef.     | Std. Err.                         | t     | P> t  | [95% Conf. Interval] |  |
|---------|-----------|-----------------------------------|-------|-------|----------------------|--|
| LCR     | .5292953  | .1337099                          | 3.96  | 0.000 | .2628119 .7957787    |  |
| NSFR    | -.0491619 | .0241331                          | -2.04 | 0.045 | -.0972591 -.0010647  |  |
| NPL     | -.2415035 | .6473039                          | -0.37 | 0.710 | -1.531578 1.048571   |  |
| LTD     | -.2059283 | .1192692                          | -1.73 | 0.088 | -.4436315 .0317748   |  |
| CRR     | -.2219994 | .1497068                          | -1.48 | 0.142 | -.5203645 .0763658   |  |
| LR      | -.4684319 | .2072581                          | -2.26 | 0.027 | -.8814966 -.0553672  |  |
| GDPRate | -1.222283 | 1.136851                          | -1.08 | 0.286 | -3.488023 1.043458   |  |
| CPI     | -.0116198 | .1011951                          | -0.11 | 0.909 | -.2133014 .1900617   |  |
| _cons   | 54.76426  | 15.21643                          | 3.60  | 0.001 | 24.43795 85.09056    |  |
| sigma_u | 5.0788556 |                                   |       |       |                      |  |
| sigma_e | 8.592063  |                                   |       |       |                      |  |
| rho     | .25893605 | (fraction of variance due to u_i) |       |       |                      |  |

F test that all u\_i=0: F(8, 73) = 1.88 Prob > F = 0.0759

Source: STATA output