St. Mary's University

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Determinants of Banks Liquidity: A Study on Selected Commercial Banks in Ethiopia

A Thesis Submitted to the School of Graduate Studies of St. Mary's University in Partial Fulfillment of the Requirements for The Degree of MBA in Accounting and Finance

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This is to certify that this thesis prepared by Belay Molla, entitled; **"Determinants of Banks Liquidity: A Study On Selected Commercial Banks In Ethiopia"** and submitted in partial fulfillment of the requirements for the degree of MBA 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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Abbreviation and Acronyms

AB:	Abbay Bank
AIB:	Addis International Bank
AIB:	Awash International Bank
BCBS:	Basel Committee for Banking Supervision
BIS:	Bank for International Settlement
BLUE:	Best Linear Unbiased Estimator
BIB:	Berhan International Bank
BOA:	Bank of Abyssinia
BUIB:	Buna International Bank
CBE:	Commercial Bank of Ethiopia
CBO:	Cooperative Bank of Oromia
CLRM:	Classical Linear Regression Model
CPI:	Consumer Price Index
DB:	Dashen Bank
DGB:	Debub Global Bank
DW:	Durbin-Watson
ENTB:	Enat Bank
FEM:	Fixed Effect Model
GDP:	Gross Domestic Product
IRL:	Interest Rate on Loans & Advances
IRM:	Interest Rate Margin
LCR:	The Liquidity Coverage Ratio
LIB:	Lion International Bank
LOLR:	Lender of Last Resort
MoFED:	Ministry of Finance Economic Development
NBE:	National Bank of Ethiopia
NIB:	Nib International Bank
NPL:	Non-performing loans
NSFR:	Net Stable Funding Ratio
OLS:	Ordinary Least Square
REM:	Random Effect Model

ROA:	Return on Assets
ROE:	Return on Equity
STIR:	Short Term Interest Rate
UB:	United Bank
WB:	Wugagen Bank
ZB:	Zemen Bank

Abstract

Liquidity creation is the main concerns of commercial banks since it is crucial for its existence; hence the main objective of this study was to identify the determinants of commercial banks liquidity in Ethiopia. In order to achieve the research objectives, data was collected from a sample of seven commercial banks in Ethiopia over the period from 2001 to 2015. Bank specific and macroeconomic variables were analyzed by using the balanced panel fixed effect regression model. Bank's liquidity is measured in three ratios: liquid asset to deposit and short term borrowing, liquid asset to total asset and loan to deposit and short term borrowing ratios. Results of panel data regression analysis showed that capital adequacy, nonperforming loan, profitability, interest rate margin and inflation had positive and statistically significant impact on Ethiopian commercial banks liquidity while bank size, loan growth and interest rate on loans had negative and statistically significant impact on Ethiopian commercial banks liquidity. Real GDP growth rate and short term interest rate had statistically insignificant impact on banks liquidity.

Key terms: *Balanced Panel Fixed Effect Regression Model, Ethiopian commercial banks Liquidity, liquidity determinants, Liquidity Ratio,*

CHAPTER ONE
1. INTRODUCTION

1.1 Background of the Study

Banks are financial institutions that play intermediary function in the economy through channeling financial resources from surplus (depositors) economic units to deficit (borrowers) economic unit; hence it remained and will continue to be an important institution for any economy as they play the most fundamental role in the payments system. Since the role of capital market in most developing countries is minimal, commercial banks become the most dominant financial institutions. Of the main functions of commercial banks is the availing of funds (monetary) to its customers; for a bank to be in a position to do so, it must be in a healthy liquidity position (Litter et al., 2004).

Banks indulge in treasury services providing a conduit for monetary policy implication. Banks do as well assist in foreign exchange dealings, earning a commission (spread of bid and offer rate). Banks do also provide trust services like unit trust in which the bank withholds assets for the next of kin charging a nominal fee. Apart from these, one of the central roles of banks is being a financial intermediary that facilitates credit to deficit users by channeling fund from surplus economic units. By this, banks are actually collecting short term deposit and issuing loans for long terms. This will create a liquidity problem to the bank. When a bank does not have enough liquidity to fulfill its obligation, the bank is said to face liquidity risk. According to the Bank for International Settlements/BIS (2008), liquidity is defined as bank's ability to acquire funds required to meet obligations when due without incurring any substantial losses. It's an agreed fact that all businesses including banks face liquidity risk. The banks liquidity risk is evident from its operations of providing mismatched maturities of deposits and loans (short-term deposits for long-term loan). As a consequence, banks fundamentally need to hold not only an optimal level of capital but also liquidity to maintain efficiency and operative excellence.

The Basel Committee has also emphasized the importance of banks' liquidity creation. Liquidity Coverage Ratio (LCR) was the key to the reformation of a resilient banking sector. The aim is to encourage the short term tolerance on liquidity risk profile of banks. This was made by making sure

banks have an adequate stock of unencumbered high-quality assets (HQLA) that liquidate easily in private markets in the case of emergency needs for a 30 calendar day liquidity stress scenario. LCR will provide a cushion for absorbing shock and economic stress (Bank for International Settlements, 2013).

According to Diamond & Dybvig, (1983) the main reason for bank fragility is due to the transformation of maturity and to provide insurance with regards to depositors liquidity needs. Besides that, a lot of financial institutions failed even though they were profitable due to liquidity mismanagement. Due to the unexpected shock and grievous loss in financial markets, determining liquidity is vital for a better understanding on the concept of liquidity risk in relation with other financial risks. Then, without hesitation financial organizations liquidity is utterly crucial to the economic excellence of a country.

1.2 History of Banking System in Ethiopia

The introduction of modern banking in Ethiopia were traced back to 1905 with the agreement held between Emperor Minilik II and Mr.Ma Gillivray, representative of the British owned National Bank of Egypt. Following the agreement the first bank called Bank of Abyssinia was inaugurated in Feb. 16, 1906 by the Emperor and the bank was totally managed by the Egyptian National Bank, besides it was a private bank whose shares was sold in Addis Ababa, New York, Paris, London, Vienna (Mauri, 2010).

In 1931, Emperor Haile Selassie introduced reforms into the banking system and the Bank of Abyssinia was liquidated and became the Bank of Ethiopia, a fully government owned bank providing central and commercial banking services until the Italian invasion of 1936; then after Bank of Italy was formed a legal tender in Ethiopia. After Ethiopia regains its independence from fascist Italy in 1943, the State Bank of Ethiopia was established with two departments performing the separate functions of an issuing bank and a commercial bank.

In 1963, these functions were formally separated and the National Bank of Ethiopia (the central and issuing bank) and the Commercial Bank of Ethiopia are formed. Up to the period of 1974, several other financial institutions emerged including the state owned as well as private financial institution.

Following the declaration of command economy by Dergue regime in 1974 the government extended its control and nationalized all of previously established private banks and merged into one bank. After nationalization the Dergue regime leave only three government banks; the National Bank of Ethiopia, the Commercial Bank of Ethiopia and Agricultural and Industrial Development Bank (Mauri, 2010).

This situation was reversed when the socialist regime was overthrown in 1991. Subsequently, the licensing and supervision of Banking Business Proclamation No. 84/1994 was issued in 1994 which led to the beginning of a new era for Ethiopian banking sector. Following the enactment of the banking legislations in the country in the 1990s, a fairly good number of private banks have been established. To this end, by the fiscal year 2013/14, the total number of banks already operational in the country reached nineteen. Of these, three were government owned while the remaining sixteen were privately owned commercial banks. But, in 2016 the two governments owned commercial banks that are commercial bank of Ethiopia and construction and business bank have been merged to strengthen and continues its work in the name of commercial bank of Ethiopia that makes government owned banks two in number. As it is known Commercial banks work for profit and the NBE controls and gives license for commercial banks (National Bank of Ethiopia Quarterly Bulletin; September 2010).

1.3. Statements of the Problem

According to John Wiley & Sons (2016), the role of the financial sectors is to channel funds from surplus users (mostly from household, business and government) to deficit users (mostly to other business, government and household). The financial sector also provides a channel for higher authorities to conduct monetary policies, indeed avoiding undesired inflations by rearranging interest rate, selling and buying bonds and other measures. According to Mishkin & Eakins (2012), the general role of commercial banks is subdivided to;

- Retail banking services such as the acceptance of deposit, granting of loans and advances, and financial guarantees.
- Trade financing facilities such as letter of credit, discounting of trade bills, shipping guarantees, trust receipts and bankers acceptance.
- Treasury services.

- Cross border payment services.
- Custody services such as safe deposits and share custody.

It was known, that banks provide a medium to store surplus funds and lend out excess reserves (loan). Loans are regarded as the most profitable service yet the most risky service provided by banks. It is most risky due to the likeliness of credit risk which may eventually end up in liquidity shortage. According to Ericsson & Renault (2006), as default risk increases, liquidity risk also increases. This has caused banks to take measures like evaluating the type of borrowers and their creditworthiness. Banks also provide services of banker's acceptance where the bank guarantees payment of a stated cost of imports to the exporter on a specific date. Bankers' Acceptance is known for its high liquidity.

Banks in Ethiopia foster the growth of the economy breathing as a source of liquidity. According to the NBE annual report of 2014/15 Banks, insurance companies and microfinance institutions are the major financial institutions operating in Ethiopia. It is obvious that financial sectors are service sector, the service sector had contributed to Ethiopia's GDP with increasing trend from 9.0 % in 2013 to 10.2% in 2015 (NBE annual report, 2014/15).

According to the NBE annual report at the end of 2014/15, domestic liquidity, as measured by broad money supply (M2), reached Birr 371.2 billion reflecting a 24.7 percent annual growth that was Birr 145.38 billion at the end of 2010/2011 and at the same year quasi money, that comprises savings and time deposits, went up by 32.3 percent and reached Birr 216.6 billion that was Birr 69.21 billion in 2010/2011. The rapid growth, banks are essentially required to maintain timely cash flows in order to keep up with unusual large withdrawals. Regulators have also implemented heavy regulations, setting out a Liquidity Framework. This has forced banks to monitor their funding structure and its ability to handle short term liquidity problems and provide banks with a better means of assessing the present and future liquidity risk associated with its future liquidity position.

Liquidity risk is defined as the inability to obtain necessary cash at justifiable cost when required. It is undeniable, since banks face liquidity risk from time to time. So, banks are officially encouraged to maintain sufficient liquidity for each clientele. In Ethiopia, during the last two decades, the commercial banking sector has been playing important role in the economic development of the country. As banks dominate the financial sector in Ethiopia, the process of financial intermediation in

the country depends heavily on banks. Hence, keeping their optimal liquidity for banks in Ethiopia is very important to meet the demand by their present and potential customers. Furthermore, NBE has required banks to have their own liquidity policy (NBE, Bank Risk Management Guideline, 2010) which enforces banks to monitor their funding structure and their ability to handle short term liquidity problems and provide them with a better means of assessing the present and future liquidity risk associated with their future liquidity position. Hence, maintaining the optimum level of liquidity position is of utmost importance. However, the question comes next in mind is that, what are the factors that determine bank's optimum liquidity level. In this regard, studies conducted to assess the determinants of Ethiopian commercial banks liquidity are very scanty.

Only two related studies were conducted by Nigist (2015) and Mekbib (2016), which tries to identify the impact of bank specific and macroeconomic variables on liquidity of Ethiopian commercial banks. Of these studies, Mekbib (2016) did not include publicly owned commercial banks in his study because he believes that private commercial banks liquidity is not covered by any study. But Nigist (2016) tried to cover selected publicly owned and private Ethiopian commercial banks. According to her recommendation, since liquidity is very crucial to the existence of banks; factors that affect it should be identified.

Therefore there has to be further research on the area of factors that affecting liquidity of Ethiopian commercial banks by incorporating any other firm-specific and macroeconomic variables, and regulatory factors since regulations are subject to frequent change and also the researcher believed that there are other variables that affect banks liquidity in Ethiopia created by recent regulation as well as current economic environment. This initiated the researcher to conduct further investigation on the determinants of banks liquidity especially on selected commercial banks in Ethiopia.

1.4 Research Objectives

1.4.1 General Objective

The general objective of this study is to identify the determinants of bank liquidity.

1.4.2 Specific Objectives

The study aims to achieve the following specific objectives:-

i. Examine how internal (bank specific) factors will affect the commercial banks liquidity in Ethiopia.

ii. Examine how external (macroeconomic) factors will affect the liquidity of commercial banks in Ethiopia.

1.5 Research Questions

The central question of the study is "what are the factors of liquidity influencing commercial banks in Ethiopia?" Based on this central question, the specific research questions that are derived from objectives are;

1) Does the internal (bank specific) factors affect liquidity of commercial banks in Ethiopia?
2) Does the major external (macroeconomic) factor affect liquidity of commercial banks of Ethiopia?

1.6 Hypotheses of the Study

The purpose of the study mainly focuses on to identify the determinants of bank's liquidity on selected commercial banks in Ethiopia. In order to evaluate and identify the determinants and to break down the research questions, the following research hypotheses were tested in the case of Ethiopian selected commercial banks.

H1. Capital adequacy has positive and significant impact on banks liquidity.
H2. Bank size has positive and significant impact on banks liquidity.
H3. Profitability has negative and significant impact on banks liquidity.
H4. Nonperforming loans has negative and significant impact on banks liquidity.

H5. Interest rate on loans and advances has negative and significant impact on banks liquidity.

H6. Loan growth has negative and significant impact on banks liquidity.

H7. Interest rate margin has negative and significant impact on banks liquidity.

H8. GDP growth rate has negative and significant impact on banks liquidity.

H9. Inflation rate has positive and significant impact on banks liquidity.

H10. Short term interest rate has positive and significant impact on bank's liquidity.

1.7 Scope of the Research

The paper has confined in identifying the determinants of bank's liquidity on selected commercial banks in Ethiopia. In Ethiopia, currently there are sixteen private and one publicly owned commercial banks. Among this the study selected only seven commercial banks by using purposive sampling especially judgmental sampling that have at least fifteen years of experience for their availability of data up to the end of June 30, 2015.

The scope of the study was limited to see dependent variables that are liquid asset to deposit and short term borrowing (L1),liquid asset to total asset (L2) and loan to deposit and short term borrowing(L3) and also the impact of independent variables such as capital adequacy, bank size, nonperforming, loan growth, profitability, interest rate margin, interest rate on loans and advances, GDP growth rate, inflation rate, and short term interest rate on banks liquidity from the period 2001 to 2015 for seven commercial banks in the sample.

1.8 Significance of Study

In this study, the researcher examines a series of variables by introducing internal and external factors that may significantly affect the commercial banks' liquidity. It is believed that the outcome/result of this study will be used as a reference for commercial banks to focus and control over the variables that bring negative effects to its liquidity. It has also a great contribution to the existing knowledge in the area of factors determining commercial banks liquidity. Therefore, the study as a whole has great contribution to the supervisory authority, policy makers and other researchers to gain further insights on the effect that different bank-specific, industry specific and

general macroeconomic factors have on the liquidity position of commercial banks operating in Ethiopia.

1.9 Organization of the Study

The research report has been organized/ structured in to five chapters. The first chapter provides the general overview of the study. The second chapter reviews the related literatures on the determinants of bank's liquidity. The third chapter focuses on the methodology of the study. The fourth chapter will provided results and discussion. Finally, the last chapter will include conclusion and recommendations and at the end references and appendixes will attached.

CHAPTER TWO

2. LITERATURE REVIEW

This study would be devoted to asses/examine the variables that most influence the safety and soundness of commercial banks in terms of liquidity in Ethiopia. The researcher would thoroughly discuss the findings of past research on internal and external factors affecting liquidity of commercial banks in Ethiopia. The researcher would examine the factors influencing liquidity of banks using the theoretical framework in order to propose a conceptual framework.

2.1 Review of Related Literature

Financial institutions most important decisions are divided into profitability and liquidity. The recurring crisis has strained banks to prioritize liquidity instead of profitability. Financial buffs have speculated that the worst is yet to come. It is evident with Syria facing political collides and gold prices falling rapidly, have indeed trigged banks to lookout for financial distress. A financial institution may employ several sources to meet its liquidity needs. The sources include the sale of financial instruments, receipts of demand deposits, return on investments, interbank borrowings and funds from the central bank. This is agreed by Aspachs,et al.(2005), adding that banks may acquire liquidity by holding sufficient cash asset, reserves in central bank, interbank borrowing, investing in government securities and involvement in repurchase agreements (REPO). Banks can also interlink their assets and liabilities maturity period through interbank borrowings.

Studying on the uses of liquid funds, Rochet (2008) in his study has stated some uses of funds (liquidity needs):

Table 2.1: Uses of liquid funds

Asset Side	**Liability Side**
New application of loans	Large volume of deposit withdrawals
Expiry of financial instrument sold	Large number of depositor withdrawals
Off-balance sheet activities	Repayment of bonds sold

Source: - Rochet (2008)

Based on knowledge, when uses of funds exceed sources of funds, liquidity risk or illiquidity is present. As Rocht (2008) defined, illiquidity is the risk that the organization does not have the financial capacity to meet its short-term obligations.

2.2 Theoretical Perspectives of Bank Liquidity

2.2.1 Bank Liquidity

Liquidity at a bank is a measure of its ability to readily find the cash it may need to meet demands upon it. Liquidity can come from direct cash holdings in currency or on account at the Federal Reserve or other central bank. More commonly it comes from holding securities that can be sold quickly with minimal loss. This typically means highly creditworthy securities, including government bills, which have short-term maturities. Indeed if their maturity is short enough the bank may simply wait for them to return the principal at maturity. Short-term, very safe securities also tend to trade in liquid markets, meaning that large volumes can be sold without moving prices too much and with low transaction costs (usually based on a bid/ask spread between the price dealers will pay to buy -- the bid -- and that at which they will sell -- the ask.)(Douglas J. Elliott, 2014).

Table 2.2: Definition of Bank Liquidity

Author	**Year**	**Definition**
Yeager and Seitz	1989	The ability of a financial institution to meet all legitimate demand for funds.
Garber and Weisbrod	1992	The ability to convert an asset to cash quickly. Also known as "marketability''.
Hempel et al.	1994	
Bank for International Settlement	2008	The ability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses.
Moore	2009	The ability of an organization or financial institution to convert assets to cash without any obstructions.

Kleopatra Nikolaou	2009	Liquidity refers to the unhindered flow of funds between an agent of a financial system, with a particular focus on the flows among the central bank, commercial banks and markets.
Kimberly Amadeo	2013	Liquidity is the amount of capital that is available for meeting short-term obligations.

Source: Extracted from different literatures

Based on the above definitions, it is understood that a bank must possess adequate funds to meet the requirements of its customers. It is also understood that financial institutions may opt to other sources to meet the liquid demands of customers.

Some primary sources include interbank or central bank borrowings to satisfy customer needs at times of distress. Financial institutions may also opt to REPO transactions for short-term (1-7days) liquidity needs. It is important for us to appropriately measure bank liquidity because financial institutions that fail to meet customers' demands face illiquidity that may result to worsened financial system stability. Consequently, the researchers appropriately examine past studies on the measurement of bank liquidity creation.

The two most widely used approaches to measure liquidity risk of banks are by liquidity gap/flow approach and liquidity ratio/stock approach. The liquidity gap approach adapts the variation between assets and liabilities both currently and future periods. A positive liquidity gap means for deficit, requiring for liabilities to be increased (Bessis, 2009). The liquidity gap treats liquid reserves as a reservoir: the bank computes the required liquidity by comparing inflows and Outflows during a specified period.

On the other hand, liquidity ratio uses various ratios to identify liquidity tendency. The various ratios label for immediate viable source of funding. This indeed entitles portfolio of assets that can be sold off without any fuss and also adequate amounts of stable liabilities. Most importantly, ready credit line with other financial institutions. Various authors like Moore (2010), Rychtárik (2009), or Praet & Herzberg (2008) have also provided similar understandings with liquidity ratios such as liquid assets to total assets, liquid assets to deposits and short term financing, loans to total assets and loans to deposits and short term borrowings (as cited in Vodová, 2011).In short, the liquidity ratio carries varies balance sheet ratios to identify liquidity needs.

Even tough, both approaches are intuitively appealing. Researches find the liquidity gap approach is more confusing as it is data intensive yet no standard method to forecast inflows and outflows. So, academic literatures prefer liquidity ratio due to a more standardized method (Crosse & Hempel, 1980; Yeager &Seitz, 1989; Hempel, et al., 1994; Vodova, 2011). Referring to Crosse & Hempel (1980), the most extensively used ratio is the loan-to-deposit ratio and liquid asset-to-total assets ratio. When these ratios are low, they indicate for high liquidity. However, the setback of loan-to-deposit ratio is it does not consider other assets available for conversion into cash, while the liquid asset-to-total asset ratio ignores the flow of funds from repayments, increases in liabilities and the demand for bank funds. Providentially, these ratios are likely to move in parallel ways (Crosse & Hempel, 1980).

2.2.2 Determinants of Commercial Banks Liquidity Theory

The determinants of bank's liquidity level can be classified into four broad categories. These include: the opportunity cost of liquidity holding, moral hazard motives, bank specific characteristics and macroeconomic fundamentals, as discussed here below.

2.2.2.1 Opportunity Cost of Liquidity Holdings

The early literature on bank's liquidity buffers views liquidity management at banks as akin to a standard inventory problem (Baltensperger, 1980; Santomero, 1984). The costs of keeping a stock of liquid assets of a particular size are weighed against the benefit of reducing the chance of being 'out of stock'. The key prediction of these theories is that the size of the liquidity buffer should reflect the opportunity cost of return foregone from holding liquid assets rather than loans. It should also relate to the distribution of liquidity shocks the bank may face, and in particular to the volatility of the funding basis as well as the cost of raising funds (eg in the interbank market) at short notice. In an extension of this literature, Agenor, et al. (2004) test whether the credit crunch in Thailand, 1998 was related to supply or demand factors, and to this end estimate a banks' demand function for reserves. They derive a demand function for excess reserves that depends both on the distribution of the deposits withdrawals, the external cost of finance (penalty rates applied by the central bank) and the impact of regulation.

The determination of a bank's optimal liquidity buffer involves a trade-off between self-insurance against liquidity risk and the returns from illiquid, higher-yielding assets. Baltensperger (1980) as well as Santomero (1984) for instance argue that the size of banks' liquidity buffers is determined by

the opportunity costs to hold liquid assets. Similar arguments can be found in Agénor et al. (2004) who shows, using aggregate data for Thailand, that bank's liquidity holdings are positively related to the volatility of the money market rate, which proxies the need for self-insurance.

Unfortunately, we cannot observe liquidity risk exposure and banks' investment opportunities directly. We can, however, observe banks' structure and operating environment as well as their realized liquid buffers. Based on the trade-off described above, we can therefore hypothesize as to the manner in which different firm-specific and environmental aspects of a bank's business should affect its liquid buffer. In particular, any observed factor that would be expected to lower (raise) liquidity risk should reduce (increase) observed liquidity buffers.

2.2.2.2 Moral Hazard Motives

As noted above, banks have three possible layers of insurance; a buffer of liquid assets in banks' individual portfolios, unsecured lending/borrowing in the interbank market and central banks' Leander of Last Resort (LOLR). Repullo (2003) develops a model of strategic interactions between the central bank and one representative bank and shows that the presence of LOLR support may affect the bank's choice as regards the share of liquid assets in its portfolio. The central banks' objective is to trade off the fiscal cost of lending to the bank and the cost of the bank's failure. The bank's objective is to maximize the expected payoffs to its shareholders. Given this set-up, Repullo (2003) determines the equilibrium strategy of the bank taking into account the LOLR's response function and vice-versa. One finding is that, the choice among risky assets is not related to the presence of the LOLR. Nevertheless, the presence of a LOLR is shown to influence the level of the optimal buffer of liquid assets: the share of safe assets in the bank's portfolio decreases with the introduction of a LOLR.

In an empirical study, Gonzalez Eiras (2003) draws conclusions consistent with Repullo (2003). He examines how Argentinean banks changed the amount of their liquidity holdings and demands after a Repo Agreement was implemented at the end of 1996, which enhanced the ability of the central bank to act as LOLR. He founds that this particular event implied a reduction in the banks' liquidity holdings. That is, the greater the potential support from the central bank in case of liquidity crises, the lower the liquidity buffer the banks hold.

2.2.2.3 Bank specific (internal)Factors

A) Capital Adequacy and Bank Liquidity

Table 2.3: Definition of Capital Adequacy

Author	Year	Definition
Richard Cantor	2001	Capital adequacy is the sufficient funds to absorb losses to protect depositors, creditors, and official institutions in the interest of maintaining banking system stability.
BNM – Capital adequacy framework	2008	The regulatory requirement for the banking institution to meet its obligations if they fall due, while also maintaining the confidence of customers, depositors, creditors and other stakeholders in their dealings with the institution.
Prasit Udomsirikul, Seksak Jumreornvong, and Pornsit Jiraporn	2011	The capacity of a financial institution's net worth to absorb potential adverse changes in the value of its assets without becoming insolvent.
Samson Ogege, Harley Tega Williams, and Apollos Emerah	2012	The amount of capital funds a bank or other financial institutions have to hold as required by the financial regulator.
Ritab al-Khouri	2012	Indicates a bank's financial ability to pay depositors whenever they demand their money and still have enough funds to increase the bank's assets through additional lending.

Source: Extracted from different literatures

Authorities have put forth capital requirements to preserve liquidity among financial institutions and also promote public confidence towards financial providers. This fact is enticed by Robert Anderson (n.d.), stating minimum capital requirement is necessary to take up unexpected losses simultaneously reducing the risk of insolvency, while ensuring banking institutions have adequate capacity to operate the intermediation function, which is compulsory for the progress of the economy.

In another aspect generated by Bunda & Desquilbet (2008), where higher equity ratio means for lesser liquid assets required for sound banking practices. Yet this hypothesis received much criticism from other researchers. From analysis, it is found that past studies stated below have gathered two varying relationships between bank capital and liquidity creation.

Firstly, in disagreement to the fact that higher capital requirement provides higher liquidity to financial institutions. Evidence found include from (Diamond & Rajan, 2000, 2001) where research on "Financial Fragility Structure" stating that depositors will be charged a nominal fee for the intermediary service of loaning out their respective deposits. However, this fee differs according to the borrowers' capability of repayment. For those with higher risk borrowing but are reluctant to incur higher cost, will provoke depositors to withdraw their funds. In extreme scenarios, the possibility of bank runs. Bank runs will definitely cause liquidity problems to banks. It is also found in Gorton and Winston (2000) proposing the "Crowding Out Effect" indeed meaning for preference of banks to shift investors' funds to capital accounts in purpose to meet higher capital requirements. Yet investments in capital accounts are prone to financial volatility and cyclical ups and downs. Also in facts, capital investments are not insured and cannot be withdrawn as desired. This indeed lowers liquidity creation. Similarly, Heuvel (2007) argued that higher capital requirements hinder the amount of asset a bank can hold issuing deposits. Hence, higher capital requirement regulations can be exorbitantly costly to banks.

Secondly, in agreement to higher capital requirements provide higher liquidity to financial institutions. Where risk absorption theory is realized for "Higher capital improves the ability of banks to create liquidity". This evidence is provided by Diamond & Dybvig (1983) and Allen & Gale (2004) stating that liquidity creation exposes banks to risk. This activity being directly related to one of the roles played by financial intermediaries (risk transformation) (Al-Khouri, 2012). The greater liquidity needs of banks, most likely for banks to incur higher losses due to the disposal of illiquid assets at available market prices rather than the desired prices to meet the customers' obligations. This however, can be absorbed via higher capital levels. Also in fact, Bhattacharya & Thakor (1993) and Coval & Thakor (2005) emphasized the point by quoting that "bank capital absorbs risks and expands banks risk-bearing capacity". Briefly, higher capital ratios allow banks to create more liquidity. Repullo (2004) has as well stated that higher bank capital allows for more efficient absorption of risk.

Consecutively, Al-Khouri (2012) has also consistent findings to above which states that bank capital increases bank liquidity through its ability to absorb risk. This concludes that recent studies also agree that a positive and significant relationship exist between bank capital and liquidity.

B) Bank size and Bank Liquidity

Table 2.4: Definition of Bank Size

Author	Year	Definition
Boyd and Runkle	1993	The magnitude a bank, which is also associated with the concept of economies of scale.
David B., Audretscha, Julie Ann Elstonb	2002	What a bank owns, including loans, reserves, investment securities, and physical assets.
Rauch, Steffen, Hackethal and Tyrell	2009	Total asset a bank owns.
Allen N. Berger and Christa H.S. Bouwman	2007	Net-asset figures are useful in gauging bank size. Bank size is what the bank possesses. Bank size is useful to measure bank agility and popularity too. ➢ Large banks (GTA exceeding $3 billion) ➢ Medium banks (GTA $1 billion - $3 billion) ➢ Small banks (GTA up to $1 billion)
Cornett, McNutt, Strahan, and Tehranian	2011	Total assets or total net assets are also used to describe a fund's size.

Source: Extracted from different literatures

Based on the above definitions, it is understood that bank size is defined broadly as the banks net total asset. Review results presented below discuss the relationship between bank size and liquidity.

To best knowledge the term 'too big to fail' is applicable here, where regulators are most likely to reimburse for any insolvency encountered by large institutions. Large banks take advantage of this to indulge in high risk activities. This has caused liquidity creation to differ among banks according to their sizes. This indeed branches to both positive and negative relationship between bank size and bank liquidity. This is agreed by Deléchat et al. (2011), who found that liquidity ratios grant higher liquidity with bank size but also begins to decrease slightly after a certain level in bank size.

In agreement for positive effect of bank size and liquidity, Rauch, et al.(2009) and Berger & Bouwman (2009), state that smaller bank tend to emphasis on intermediation processes and transformation activities they do have smaller amount of liquidity. It is known that liquidity creation varies according to banks organizational structures too. Merger and Acquisition structured banks are seen to hold the highest amount of liquidity creation back in the years. Back in 2012, Tesfaye proposed that moral hazard problem arises due to the protection provided by regulators. Iannotta, Nocera & Sironi (2007) also stated this to be true encouraging larger banks to venture into riskier assets. This caused much dependence on the central bank for liquidity needs.

In contrary, Audretsch & Elston (2002) state that smaller firms have relatively lesser liquidity constrains, meaning having relatively more liquid assets. Kashyap & Stein (1997) and Kashyap, et al. (2002) also find a strong effect of bank size on holdings of liquid assets, with smaller banks being more liquid as they face constraints in accessing capital markets. Hence, there are negative relationship between bank size and liquidity.

C) Profitability and bank liquidity

Table 2.5: Definition of Bank Profitability

Author	Year	Definition
Owolabi, S. A., Obiakor, R. T., and Okwu, A. T.	2011	Profitability is a measure of the amount by which a company's revenues exceeds its relevant expenses.
Michael Webber	2013	Profitability is a business term that is used to mean the likelihood of a business venture earning the desired level of income and incentives, within a specific period of time, under certain prevailing business conditions.
Pavla Vodová	2013	Profitability is a measure of the amount by which a company's revenues exceeds its relevant expenses.
Victor Curtis Lartey, Samuel Antwi, and Eric Kofi Boadi	2013	Bank profitability is the ability of a bank to generate revenue in excess of cost, in relation to the bank's capital base.
Myrna R. Berrío	2013	Profitability is the measure of the difference between the purchase price and the costs of bringing to market.

Source: Extracted from different literatures

Recent crisis has highlighted the vitality of sound liquidity management of a bank. In response, regulators are developing new liquidity frameworks to make stable and resilient financial system. However, there is often that, these two variables pose a conflicting relationship (dilemma of maintaining liquidity or profitability exist). A financial manager has to ensure, on one hand, that the firm has adequate cash reserves as a contingency plan for any emergency while ensuring that the funds of the bank are available for investment with good value.

Liquidity needs constrain a bank from investing all its cash though profitability comes from either investing it or bank lending activities. Since banks need to be both profitable (shareholders demands) and liquid (legal regulations), there is inherently conflicts between the two and the need to balance both. In this regard, the liquidity (legal regulations) is different for non-bank businesses. Therefore, banks should always strike a balance between liquidity and profitability to satisfy shareholders' wealth aspirations as well as regulatory requirements.

As all this fact is agreed by Owolabi et al. (2011), whose research result provide evidence that, there is a trade-off between profitability and liquidity in that increase in either one would decrease the other, which mean more liquidity implies less profitability. Subsequently, Bordeleau & Graham (2010), their research analyses the consequences of holding liquid assets on bank profitability for a sample of large Canadian and U.S. banks and results suggest that profitability will be improved for banks that hold some liquid assets, however, there is a limit to it where holding further liquid assets reduce a banks' profitability, holding all else constant. Moreover, empirical studies reveal that this relationship varies depending on the condition of the economy and bank's business model. According to the author, banks must also consider the tradeoff between liquidity shocks to resilience and the cost of holding lower return liquid assets as the latter may affect a banks' ability to generate income, increase capital and extend credit.

Various methods are available to measure bank profitability. According to Vodova (2013), it employed return on equity (ROE) ratio as the proxy for banks' profitability. The results suggest a negative influence on bank profitability (measured by return on equity) and bank liquidity creation. This is consistent with standard finance theory which emphasizes the negative correlation of liquidity and profitability. Other than ROE, alternative bank profitability indicator such as ROA and NIM are also suggested on a research done by Parameswar, et al. (2012). Their result evidence that a strong capital, liquidity, and profitability ratios in the pre-crisis phase are seen to point to high liquidity creation in the crisis phase. Al-Khouri (2012), who examines the empirical effect of bank capital and

other micro and macro-characteristics on liquidity creation, used ROA as proxy of profitability on one of his independent variable.

D) Non-performing loan and bank liquidity

Table 2.6: Definition of Non-performing loans

Author	Year	Definition
Abdul Ghafoor Awan	2009	A Non-performing loan is a loan that is in default or close to being in default. Many loans become non-performing after being in default for 90 days, but this can depend on the contract terms.
Joseph, Edson, Manuere, Clifford & Michael	2012	Non-performing loans are also known as "bad loans", impaired loans or problem loans which are ninety days or more past due or no longer accruing interest and are not generating income.
Muhammad Nawaz	2012	Non-performing loans are loans that the customers fail to meet their obligations problems
Berríos	2013	Impaired loans are those loans with a high likelihood of default.
Adriaan M. Bloem and Cornelis N. Gorter	n /d	A loan is nonperforming when payments of interest and principal are past due by 90 days or more, or at least 90 days of interest payments have been capitalized, refinanced or delayed by agreement, or payments are less than 90 days overdue, but there are other good reasons to doubt that payments will be made in full.

Source: Extracted from different literatures

Based on the above definitions, it is understood that NPLs are loans that a bank customer fails to meet his contractual obligations on either principal or interest payments exceeding 90days. NPLs are loans that give negative impact to banks in developing the economy. Rise of non-performing loan portfolios significantly contributed to financial distress in the banking sector.

A definite fact, financial systems are responsible for managing complex and advance financial transactions. The banking systems play the central role of mobilizing and allocating resources in the market, conduit for savings and surplus funds channeled to deficit units. Financial institutions oversee that operations are being run effectively and efficiently. The financial term for this activity is known as "Risk Transformation" (riskless deposit to risky loans). Granting loans generate most profits for banks. However, it involves high risk and eventually the main contributor to non-performing loans (NPLs). A core substance for sustained and rapid economic progress is financial stability. Financial stability measures are immensely used, among various indicators of financial stability include banks' non-performing loan reflecting on its asset quality, credit risk and also its efficiency in the allocation of resources to productive sectors. NPLs are the main contributor to liquidity risk, which exposes banks to insufficient funds for operations. Liquidity risk is the outcome of credit risk, which is the inability of borrowers to meet their repayment obligation. According to Dolan & Collender (2001), credit risk is measured by the percentage of non-performing loans to total loans.

On analysis, NPLs are found to affect liquidity. Firstly, Toby (2008), in his study quoted that the use of minimum liquidity ratio (MLR) as a monetary policy tool has an inverse association with industry asset quality measured with NPLs. As MLR rises further coupled with an outcome where bank liquidity ratio (BLR) rises, industry NPLs are expected to fall, and vice-versa. Hence, he concluded that the reason behind scheming excess liquidity may bring about adverse outcomes increasing NPLs. Equally, Joseph, et al. (2012), further findings indicate that NPLs have a negative relationship towards banks performance be it liquidity or profitability. Clearly, NPLs reduce profits and liquidity of banks. Similarly, Gupta (1997) added that NPLs does affect profits of banks and eventually to liquidity crunch and hinders growth in Gross Domestic Product (GDP) (as cited in Sharma, 2005).

Besides the above, further research has led us to the same negative relationship between NPLs and profitability, exposing banks to greater risk of liquidity and distress. This fact is without doubt proven by past researches Nawaz, et al. (2012). Other researchers have also verified that NPLs not only affects financial institutions but also non-financial institutions. However, the most affected by

NPLs are financial institutions such as commercial banks and mortgage financing institutions (Bloem & Gorter, 2001). Prominent economist have that failing banks tend to deviate from efficient frontier banks. The reasoning is that inefficient institutions fail to optimize their portfolio decision by lending less than demanded (Barr et al., 1994).

E) Loan growth and bank liquidity

Since lending is the principal business activity for most commercial banks the loan portfolio is typically the largest asset and the predominate source of revenue (Comptroller's Hand book 1998). However, it is one of the greatest sources of risk to a bank's safety and soundness because loans are illiquid assets; increase in the amount of loans means increase in illiquid assets in the asset portfolio of a bank.

In practice the amount of liquidity held by banks is heavily influenced by loan demand that is the base for loan growth. If the demand for loans is weak, then the bank tends to hold more liquid assets (i.e. short term assets), whereas if demand for loans is high they tend to hold less liquid assets since long term loans are generally more profitable (Pilbeam, 2005). Hence, the growth in loans and advances has negative impact on banks liquidity.

F) Interest Rate on Loans & Advances and Bank Liquidity

Keynesian liquidity preference theory states that when liquidity preference rises interest rates will also rise as people hold onto liquid assets (Keynes 1936). Lending rate is the bank rate that usually meets the short and medium-term financing needs of the private sector. This rate is normally differentiated according to creditworthiness of borrowers and objectives of financing, the availability of money in the market, tenure of the loan, the type and value of collateral, the economic sector of the loan and on the specific terms of the contract. Bank lending rate is measured by average interest rate on lending. The higher the interest rate on loans & advances is expected to encourage banks to grant more loans to customer. Therefore, interest rate on loans & advances has negative relationship with liquidity.

G) Interest rate margin and Banks liquidity

Interest rate margin is the amount of interest rate paid by borrowers that force liquidity holders to part it. According to the liquidity preference theory, lenders need high interest rate which includes the interest rate margin/ liquidity premium in order to lend. The basic idea underlining this theory is that lenders of funds prefer to lend short, while borrowers generally prefer to borrow long. Hence borrowers are prepared to pay interest rate margin/ a liquidity premium to lenders to induce them to

lend long (Pilbeam, 2005). The size of interest rate margin/ liquidity premium increases with the time to maturity. Therefore, as they got higher premium, lenders give up their liquid money.

According to Keynes (1964) liquidity preference theory, in the general theory, consists in the statement that "the rate of interest at any time being the reward for parting with liquidity is a measure of the unwillingness of those who possess money to part with their liquid control over it; the rate of interest is the price which equilibrates the desire to hold wealth in the form of cash with the available quantity of cash". Hence, higher interest rate margin/higher liquidity premium will force banks to lend more and reduce their holding of liquid assets. Interest rate margin is the difference between the gross cost paid by a borrower to a bank and the net return received by a depositor (Brock & Suarez 2000). Therefore, there is a negative relationship between interest rate margin and banks liquidity.

2.2.2.4 Macroeconomic (External) Factors

A) GDP Growth and Bank Liquidity

Table 2.7: Definition of Gross Domestic Product

Author	**Year**	**Definition**
Andrew Ang, Monica Piazesizz, and Min Wei	2006	GDP is an indicator of the economic health of a country, as well the gauge a country's standard of living.
Karl E. Case, Ray C. Fair, and Sharon M. Oster	2009	GDP is the total market value of a countries output with production factors located within a country.
Chung-HuaShen, Yi-Kai Chen, Lan-Feng Kao, and Chuan-Yi Yeh	2009	GDP is the measurement of level of economic activity of a country.
Juan Pablo Painceira	2010	The market expenditure on final goods and services produced equal to consumption, investment, government expenditure and net exports.
Koray Alper, Timur, Hulagu, Gursu Keles	2012	Monetary value of all final goods and services produced in a country within a time.

Source: Extracted from different literatures

Based on the above definitions, it is understood, GDP is a countries financial health indicator. It is hypothesized from previous studies, that macroeconomic factors affect bank liquidity. For example, Gavin & Hausmann (1998) justified that bank failures are to a degree caused by macroeconomic shock. This fact is also supported by Shen, et al. (2009). Indisputably, GDP is a macroeconomic factor that affects bank liquidity. For which, a major recession or crises in business operations reduces borrowers' capability to service obligations which increases banks' NPLs and eventually banks insolvency (Gavin &Hausmann, 1998).

In reference to Painceira (2010), research on liquidity preference during different business cycle states that banks liquidity fondness is low in the course of economic boom. Where, banks confidently expect to profit by expanding loan able funds to sustain economic boom, while restrict loan able funds during economic downturn to prioritize liquidity. To sum up, banks prefer high liquidity due to lower confidence in reaping profits during economic downturn. Aspachs et al., (2005) has also inferred that banks prioritize liquidity when the economy plummets, during risk lending opportunities, while neglecting liquidity during economic boom when lending opportunities may be favorable. Thus, to best knowledge, banks forgo liquidity inducing lending during economic growth. Even Valla et al., (2006) reported a negative relationship between liquidity and GDP real growth.

Consequently, Bordo, et al. (2001), opinions and suggests on a different view. They say during recession it is likely for an increase in the number of loan default. This causes depositors to perceive high solvency risk and immediately tend to withdraw deposits held at financial institutions. Subsequently, financial institutions face bank run causing liquidity risk, resulting in bank insolvency. Other researchers have also agreed to the findings of Bordo et al. (2001). Alper et al., (2012) exemplified that during economic expansion banks would issue more loans and run down their liquidity buffer. Moreover, it's harder for banks to attract deposits during economic expansion, consequently increasing their financing gap.

B) Inflation rate and bank liquidity

Inflation reflects a situation where the demand for goods and services exceeds their supply in the economy or the purchasing power of money become weak when compare with other notes other things are the same. Central banks care about the welfare effects of changing the inflation target. Existing monetary theories generally agree that inflation increases the opportunity cost of holding liquidity and thus distorts the allocation of resources which require liquidity in transaction; besides, a

growing theoretical literature also describes mechanisms whereby even predictable increases in the rate of inflation interfere with the ability of the financial sector to allocate resources effectively. Specifically recent theories emphasize the importance of informational asymmetries in credit markets and demonstrate how increases in the rate of inflation adversely affect credit market frictions with negative repercussions for financial sector (both banks and equity market) performance and therefore long-run real activity (Huybens & Smith, 1999).

The features of these theories indicated that there is an informational friction whose severity is endogenous and hence an increase in the rate of inflation drives down the real rate of return not just on money but on assets in general. As of Huybens & Smith (1999) the implied reduction in real returns worse the credit market frictions which leads to the rationing of credit, hence credit rationing becomes more severe as inflation rises. As a result the financial sector makes fewer loans, resource allocation is less efficient, and intermediary activity diminishes with adverse implications for capital/long term investment. Besides, the amount of liquid or short term assets held by economic agents including banks will rise with the rise in inflation. High inflation rate and sudden changes of inflation have a negative impact on real interest rates and bank's capital. In this respect, the bank's non-performing loans will expand, collateral security values deteriorate and value of loan repayments on banks loans declines. This way, it has been found that inflation rate significantly determines bank liquidity (Heffernan, 2005).

C) Short Term Interest Rate and Bank Liquidity

Interest rate is the price that has to be paid by a borrower of money to a lender of money in return for the use of the funds. Short term interest rate is the rate paid on money market instruments. Money market instruments are securities that when issued have a year or less to maturity, which includes Treasury bills, commercial papers, bankers' acceptances, certificates of deposit, repurchase agreements and Eurocurrency deposits. Treasury bills are the most important since they provide the basis for all other domestic short term interest rates. The money market is important because many of these instruments are held by banks as part of their eligible reserves, that is, they may be used (are eligible) as collateral if bank wishes to raise funds from central bank because they are short maturing and have less default risk. Therefore, the higher short term interest rate induces banks to invest more in the short term instruments and enhance their liquidity position (Pilbeam, 2005). Therefore, there is a negative relationship between interest rate margin and banks liquidity.

2.2.3 Bank liquidity creation and financial fragility theory

Banks perform valuable activities on either side of their balance sheets; on the asset side, they make loans to difficult, illiquid borrowers thus enhancing the flow of credit in the economy. On the liability side, they provide liquidity on demand to depositors. As of Diamond & Rajan (1998) Depositors get better access to their funds than they would if they invested directly and earned the same expected return: this is liquidity creation. Borrowing firms too can find the bank to be a more reliable source of funding than another firm or individuals: banks insure borrowers against the liquidity risk that funding will be cut off prematurely.

Diamond & Dybvig (1983) stated that banks can transform illiquid assets into more liquid demand deposits. Through this function of liquidity providers, banks create liquidity as they hold illiquid assets and provide cash and demand deposits to the rest of the economy. Diamond & Dybvig emphasize the "preference for liquidity" under uncertainty of economic agents to justify the existence of banks: banks exist because they provide better liquidity insurance than financial markets; however, as banks are liquidity insurers they face transformation risk and are exposed to the risk of run on deposits. Moreover, the higher is liquidity creation to the external public, the higher is the risk for banks to face losses from having to dispose of illiquid assets to meet the liquidity demands of customers. The practical importance of liquidity during crises is buttressed by financial intermediation theory, which indicates that the creation of liquidity is an important reason why banks exist.

The early contributions by Bryant (1980), Diamond & Dybvig (1983) argue that banks create liquidity by financing relatively illiquid assets such as business loans with relatively liquid liabilities such as transactions deposits. While the recent contributions of Holmstrom & Tirole (2010), Kashyap et al. (2002) suggests that banks also create liquidity off the balance sheet through loan commitments and similar claims to liquid funds.

A natural justification for the existence of deposit taking institutions, thereby giving also an explanation for the economically important role of banks in providing liquidity, was initially modeled by (Bryant, 1980; Diamond & Dybvig, 1983). The researchers showed that by investing in illiquid loans and financing them with demandable deposits, banks can be described as pools of liquidity in order to provide households with insurance against idiosyncratic consumption shocks. However, this structure is also the source of a potential fragility of banks since in case of an

unexpected high number of depositors deciding to withdraw their funds for other reasons than liquidity needs, a bank run will result (Friedman & Schwartz, 1963).

The models of Bryant-Diamond/Dybvig have been subject to a large number of follow-up papers, extending or testing the models. From these, the relevance for this study was that the papers by Calomiris & Kahn (1991), Qi (1998), and Diamond & Rajan (2001) which develop and emphasize the point that demandable debt has interesting incentive implications for disciplining the bank management.

The argument goes like this: on their asset side banks have illiquid loans whose market prices would be below their internal values in case of a fire sale. Having to sell or to call loans prematurely would involve a loss; the greater part of the activities which banks undertake and need to undertake to monitor their loans, which includes their active involvement in the governance of borrowing corporations are not really observable for outsiders. But at least a certain part of a bank's liability are call or sight deposits which are by definition and by law to be paid back on demand and on a first come first serve basis. This rule of distribution makes depositors wary that they might be late or stand too far behind in the waiting line in the case a bank encounters problems and it makes them even aware of what little information they may have on the monitoring activity of the bank.

This situation can lead to a bank run, and the danger of a run is what induces banks to do what their depositors want them to do, namely to be active delegated monitors in the spirit of Diamond (1984). Based on this argument, Diamond & Rajan (2001) raised the question whether or not financial fragility is a desirable state for banks. They argue that the existence of the fragility itself gives banks the right incentives to create liquidity. According to them, any kind of regulation, such as capital standards, impair this liquidity creation and should thus, be avoided.

Kashyap (2002) conducted a related analysis justifying the existence of banks' liquidity creation. They argued that because banks carry out lending and deposit taking under the same roof, synergies must exist between these two tasks. These synergies can be found in the way deposits and loan commitments are secured through the holding of liquid assets as collateral against withdrawals. They regard these liquid assets as costly overheads. These overheads can be shared by the two separate functions, hence the synergy.

Diamond & Rajan (2005) provides a detailed analysis of the link between liquidity shortages and systemic banking crises. And it is argued that the failure of a single bank can shrink the pool of

available liquidity to the extent that other banks could be affected by it, hence a contagion effect is the result. However, as solvency and liquidity effects interact it is hard to determine the root of a crisis.

Many different definitions of liquidity risks were provided in the literature sources of (Jenkinson, 2008; Diamond &Rajan, 2001; Chaplin et al., 2000). Accordingly, the literature analysis showed that liquidity risk is the risk that a bank may not meet its obligations (Jenkinson, 2008) as the depositors may call their funds at an inconvenient time, causing fire sale of assets (Diamond & Rajan ,2001). Also a comptroller of the currency acting in USA, define liquidity risk as a risk arising from a bank's inability to meet its obligations when they come due without incurring unacceptable losses (Comptroller's Hand book 2001). According to the definition of the Basel committee on banking supervision (1997), liquidity risk arises from the inability of a bank to accommodate decreases in liabilities or to fund increases in assets.

Therefore in easier terms, liquidity risk can be defined as the risk of being unable to liquidate a position timely at a reasonable price (Muranaga & Ohsawa 2002). Generally, liquidity risk arises from the fundamental role of banks in the maturity transformation of short term deposits into long term loans. As of Basel Committee on Banking Supervision (2008), it includes two types of risk: funding liquidity risk and market liquidity risk.

Funding liquidity risk is the risk that the bank will not be able to meet efficiently both expected and unexpected current and future cash flow and collateral needs without affecting either daily operations or the financial condition of the firm while market liquidity risk is the risk that a bank cannot easily offset or eliminate a position at the market price.

According to Crockett (2008), the dimension of market liquidity risk includes market depth (the ability to execute large transactions without influencing prices unduly); tightness (the gap between bid and offer prices); intermediacy (the speed with which transaction can be executed); and resilience (the speed with which underlying prices are restored after disturbance).

Market liquidity risk and funding liquidity risk tend to reinforce each other: disruptions can easily spread from funding liquidity to market liquidity or vice versa (Baranyai, 2008). There is strong interaction between funding liquidity risk and market liquidity risk, especially in periods of crisis. Drehmann & Nikolau (2009) pointed to the fact that shock to funding liquidity can lead to asset sales

and may lead to decrease of asset prices. Lower market liquidity leads to higher margin which increase funding liquidity risk.

Events in the second half of 2007 and early 2008 highlight the crucial importance of liquidity to the functioning of markets and the banking sector as well as links between funding and market liquidity risk, interrelationships of funding liquidity risk and credit risks, reputation effects on liquidity and other links among liquidity and other typical banking features. Hence, liquidity risk is not an "isolated risk" like credit or market risks; although credit risks often arise as a liquidity shortage when the scheduled repayments fall due but a "consequential risk", with its own intrinsic characteristics that can be triggered or exacerbated by other financial and operating risks within the banking business (Chen et al., 2005).

2.2.4 Measurements of liquidity risk

As it is known financial institutions can utilize a number of sources to meet its liquidity needs, such as accepting new deposits, maturing assets, borrowed funds and/or using the discount window (i.e. borrowing from the central bank). Given that access, measurement and management of liquidity is an important activity in most commercial banks. Before seeing the methods of measuring liquidity risk, butter to introduce the sources of liquidity risk and possible ways to overcome with it.

There are three main sources of liquidity risks; the first one is on the liability side of the balance sheet, here there is a large uncertainty on the volume of withdrawals of deposits or the renewal of rolled over interbank loans, especially when the bank is under suspicion of insolvency or when there is an aggregate liquidity shortage, the second is on the asset side of the balance sheet, here there is an uncertainty on the volume of new requests for loans that a bank will receive in the future, and the third one is off-balance sheet activities, like credit lines and other commitments, positions taken by banks on derivative markets (Rochet, 2008).

As stated in different literatures, since liquidity risk is a very serious phenomenon of banks there is some methods to overcome it. Hence, there are three mechanisms that banks can use to insure against liquidity crises: firstly, banks hold buffer of liquid assets on the asset side of the balance sheet; a large buffer of assets such as cash, balances with central banks and other banks, debt securities issued by governments and similar securities or reverse repo trades reduce the probability that liquidity demands threaten the viability of the bank. Second strategy is concerned with the liability side of the

balance sheet. Banks can rely on the interbank market where they borrow from other banks in case of liquidity demand; however, this strategy is strongly linked with market liquidity risk. The last strategy concerns the liability side of the balance sheet, as well. The central bank typically acts as a Lender of Last Resort/LOLR to provide emergency liquidity assistance to particular illiquid institutions and to provide aggregate liquidity in case of a system wide shortage (Aspach et al., 2005).

As of the Comptroller's Handbook (2012) the process of liquidity risk measurement of banks' should be commensurate with its size, complexity, and liquidity risk profile. Similar to a bank's policy limits and targets; the measurement of liquidity should be comprehensive and prospective. To be comprehensive, the measurement of liquidity must incorporate all of the cash flows and liquidity implications from all material assets, liabilities, off-balance sheet positions and other activities, including the potential options embedded in the institution's assets and liabilities.

Hence, measurements' of liquidity position of banks helps to identify their real liquidity risk exposures and to implement the appropriate liquidity risk management strategies that help banks to perform properly and profitably. Liquidity risk measurement helps to present liquidity position in terms of numbers and figures. As indicated in different literatures, there were various ways of measuring liquidity risk;

There are two basic traditional methods for measuring liquidity risk; these are liquidity gap/ flow approach and liquidity ratios/ stock approach. The liquidity gap/ flow approach is expressed as the difference between assets and liabilities at both present and future dates. At any date, a positive gap between assets and liabilities is equivalent to a deficit that has to be filled. This approach focuses on comparing the variability in bank's inflows and out flows to determine the amount of reserves that are needed during a period. Here flow approach treats liquid reserves as a reservoir: the bank assesses its liquidity risk by comparing the variability in inflows and outflows to determine the amount of reserves that are needed during a period.

The second approach for measuring liquidity risk is liquidity ratio/ stock approach; which focused on the asset and liability sides of the balance sheet employing ratios to identify liquidity trends. These ratios reflect the fact that bank should be sure that appropriate, low-cost funding is available in a short time; this might involve holding a portfolio of assets than can be easily sold (cash reserves, minimum required reserves or government securities), holding significant volumes of stable

liabilities (especially deposits from retail depositors) or maintaining credit lines with other financial institutions (Moore & Bassis, 2009).

However, both approach of liquidity risk measurement has their limitations. Hence, the basic limitation of liquidity gap/ flow approach is that; it is more data intensive and there is no standard technique to forecast inflows and outflows. While the liquidity ratio/ stock approach is that; even if it is possible to calculate them only on the basis of publicly available data from banks´ balance sheets and it is easy to interpret their values, the disadvantage of this ratio is the fact that they do not always capture all, or any of liquidity risk (Vodová, 2013).

Liquidity measures can be also one dimensional or multi-dimensional. One dimensional liquidity measures take only one variable into account whereas multi-dimensional liquidity measures capture different variables in one measure. Furthermore, the measures can be subdivided into; time related, volume related and model based; also there is other ways of measuring liquidity risk, i.e. net liquidity statement, in this method the bank can assess its liquidity position by listing the sources and uses of the liquidity. Liquidity index, this measures the potential losses the institution could suffer from a sudden or fire sale disposal of assets compared with the amount it would receive under normal market conditions when the disposal can be done in an unhurried way (Vonwyss, 2004).

More significantly the Basel Committee on Banking Supervision proposed the financing gap for banks to measure their liquidity risk. The financing gap is the difference between the bank's average loans and average deposits divided by total assets' of the bank. The larger the financing gap, the more the bank needs to borrow in the money markets and the greater the liquidity problems in the future due to increased deposit withdrawals and/or increased exercise of loan commitment (Basel Committee on Banking Supervision, 2000). Researchers (for instance, Rafique & Malik, 2013; Vodová, 2011) used financing gap for measuring of liquidity in their study. Therefore, for the purpose of this study the financing gap was used in measuring liquidity of Ethiopian commercial banks.

2.3 Empirical Evidence

Since liquidity is the main concerns of banks, many studies were done regarding the factors that determining the liquidity of commercial banks in different countries of the word. So that, it is quite

difficult to present the results of all the studies available on the topic of this research, hence the most related studies were taken.

2.3.1 Related Empirical Studies in Advanced Countries

Bank specific and macroeconomic determinants of liquidity of English banks were studied by (Aspachs et al., 2005). The researchers used unconsolidated balance sheet and profit and loss data for a panel of 57 UK-resident banks, on a quarterly basis, over the period 1985 to 2003. They assumed that the liquidity ratio as a measure of the liquidity was dependent on the following factors: Probability of obtaining the support from LOLR, which should lower the incentive for holding liquid assets, interest rate margin as a measure of opportunity costs of holding liquid assets expected to have negative impact, bank profitability which is according to finance theory negatively correlated with liquidity, loan growth, where higher loan growth signals increase in illiquid assets, size of the bank expected to have positive or negative impact, gross domestic product growth as an indicator of business cycle negatively correlated with bank liquidity, and short term interest rate, which should capture the monetary policy effect with expected negative impact on liquidity.

The study made on bank specific determinants of liquidity on English banks studied (Valla et al., 2006) and assumed that, the liquidity ratio as a measure of the liquidity should be dependent on the following factors: bank profitability and loan growth had negatively correlated with liquidity while size of the bank is ambiguous. Liquidity created by Germany's state-owned savings banks and its determinants has been analyzed by (Rauch et al. 2009). In the first step they attempted to measure the liquidity creation of all 457 state owned savings banks in Germany over the period 1997 to 2006 and they analyzed the influence of monetary policy on bank liquidity creation. To measure the monetary policy influence, the study developed a dynamic panel regression model. According to this study, the following factors determine bank liquidity: monetary policy interest rate, where tightening monetary policy expected to reduces bank liquidity, level of unemployment, which is connected with demand for loans having negative impact on liquidity, savings quota affect banks liquidity positively, size of the bank measured by total number of bank customers have negative impact, and bank profitability expected to reduce banks liquidity.

Vodova (2011) examined the determinants of liquidity of commercial banks in Czech Republic through four liquidity ratios and related them with bank specific and macroeconomic data over a period from 2001 to 2010. This study observed drop of banks' liquidity as a result of the Global

financial Crisis. The study reveals that the share of liquid assets in total assets and liquid asset in deposits and short term funding decreases with bank profitability, higher capital adequacy and bigger size of banks. In their opinion big banks rely on the interbank market and on liquidity assistance of Lender of Last Resort (LOLR). Liquidity measured by share of loans in total assets and in deposits and short term borrowings increases with growth of domestic product. They did not find any significant relationship between interest rates on loans, interest rate on interbank transactions or monetary policy interest rates, interest rate margins, the share of non-performing loans and the rate of inflation with liquidity.

The study made by Lucchetta (2007) on the hypothesis that 'interest rates affect banks' risk taking and the decision to hold liquidity across European countries'. The liquidity measured by different liquidity ratios should be influenced by: behavior of the bank on the interbank market. The more liquid the bank is, the more it lends in the interbank market. The results of the study revealed that the risk-free interest rate negatively affects the liquidity retained by banks and the decision of a bank to be a lender in the inter-bank market. Conversely, the inter-bank interest rate has a positive effect on such decisions. Typically, it is the smaller, risk-averse banks that lend in the inter-bank markets. Meanwhile, the risk-free interest rate is positively correlated with loans investment and bank risk-taking behavior.

Vodova (2013) had also studied on the determinants of liquidity of Polish commercial banks. The data cover the period from 2001 to 2010. The results of panel data regression analysis showed that bank liquidity is strongly determined by overall economic conditions and dropped as a result of financial crisis, economic downturn and increase in unemployment. Bank liquidity decreases also with higher bank profitability, higher interest rate margin and bigger size of banks. On contrary, bank liquidity increases with higher capital adequacy, inflation, share of nonperforming loans and interest rates on loans and interbank transaction.

2.3.2 Related Empirical Studies in Emerging Economies

Moore (2010) investigated the effects of the financial crisis on the liquidity of commercial banks in Latin America and Caribbean countries and specifically addresses the behavior of commercial bank liquidity during crises in Latin America and the Caribbean. They identify the key determinants of liquidity, and to provide an assessment of whether commercial bank liquidity during crises is higher or lower than what is consistent with economic fundamentals. The regression model was estimated

by using ordinary least squares. The result of the study showed that the volatility of cash-to-deposit ratio and money market interest rate have negative and significant effect on liquidity. Whereas, liquidity tends to be inversely related to the business cycle in half of the countries studied, suggesting that commercial banks tend to error on the side of caution by holding relatively more excess reserves during downturns.

Karlee et al. (2013) studied the determinants of liquidity of 15 commercial banks in Malaysia in period (2003-2012). They used bank specific factors; size of bank, capital adequacy, profitability, credit and macroeconomic factors such as GDP, interbank rate, financial crisis. The empirical results show that all factors included are significant except interbank rate. The factors with positive influence on bank liquidity are Non-Performing Loan, Profitability and Gross Domestic Product. On the other hand, factors to bring negative effect to bank's liquidity are Bank Size, Capital Adequacy, and Financial Crisis. While Interbank Rate turned out insignificant

The other study made by Vodová (2012) aimed to identify the determinants of liquidity of commercial banks in Slovakia. In order to meet its objective the researcher considered the data for bank specific factors over the period from 2001 to 2009. The data was analyzed with panel data regression analysis by using an econometric package Eviews7and the findings of the study revealed that bank liquidity decreases mainly as a result of higher bank profitability, higher capital adequacy and with the size of bank. The level of non-performing loans has no statistically significant effect on the liquidity of Slovakia commercial banks.

In another study from Pakistan, Malik & Rafique (2013) examines bank specific and macroeconomic determinants of commercial bank liquidity in Pakistan. Their study period covers from 2007 to 2011. They have used two models of liquidity. The first model L1 is based on cash and cash equivalents to total assets. The second model L2 is based on advances net of provisions to total assets. Their results suggest that, Non-Performing Loan (NPL) and Return on Equity (ROE) have a negative and significant effect with L1. Capital adequacy (CAP) and inflation (INF) are negatively and significantly correlated with L2, Additionally there is a significant and positive impact of financial crisis on the liquidity of commercial banks. The central bank regulations greatly affect the liquidity of commercial banks which means tight monetary policy can regulate the undesirable effect of inflation on liquidity.

The study made by Vodová (2013) with the aim of identifying the determinants of liquidity of Hungarian commercial banks which cover the period from 2001 to 2010 and used panel data regression analysis. The result of the study showed that bank liquidity is positively related to capital adequacy of banks, interest rate on loans and bank profitability and negatively related to the size of the bank, interest rate margin, monetary policy interest rate and interest rate on interbank transaction.

Sushil et al. (2013) had made a study on the relationship between liquidity of selected Nepalese commercial banks and their impact on financial performance and found that capital adequacy, share of non-performing loans in the total volume of loans had negative and statistically significant impact on banks liquidity whereas loan growth, growth rate of gross domestic product on the basis price level, liquidity premium paid by borrowers and short term interest rate had negative and statistically insignificant impact on banks liquidity. Bank size had positive and significant impact and inflation rate had positive and insignificant impact on banks liquidity.

2.3.3 Related Empirical Studies in African Countries

Chagwiza (2011) made a study on Zimbabwe, regarding the commercial banks liquidity and its determinants. The main objective of his study was to identify the determinants of liquidity in Zimbabwean commercial banks. The result of his study revealed that, there is a positive link between bank liquidity and capital adequacy, total assets, gross domestic product and bank rate. While the adoption of multi-currency, inflation rate and business cycle have a negative impact on liquidity. The other studies made by Laurine (2013) in Zimbabwe regarding Zimbabwean Commercial Banks Liquidity Risk Determinants after dollarization. The aim of his paper was that empirically investigating the determinants of Zimbabwean commercial banks liquidity risk after the country adopted the use of multiple currencies exchange rate system. To attain the intended objective, panel data regression analysis was used on monthly data from the period of March 2009 to December 2012. The result of the study revealed that, capital adequacy and size have negative and significant influence on liquidity risk whereas spread and non-performing loans have a positive and significant relationship with liquidity risk. Reserve requirement ratios and inflation were also significant in explaining liquidity during the studied period.

Agbada & Osuji (2013) studied the efficacy of liquidity management and banking performance in Nigeria using survey research methodology. Data obtained were first presented in tables of percentages and pie charts. The data were empirically analyzed by Pearson product-moment

correlation coefficient. Findings from the empirical analysis were quite robust and clearly indicate that there is significant relationship between efficient liquidity management and banking performance and that efficient liquidity management enhances the soundness of a bank.

A study made by Fadare (2011), on the banking sector liquidity and financial crisis in Nigeria with the aim of identifying the key determinants of banking liquidity and assessing the relationship between determinants of banking liquidity and financial frictions within the economy. It was employed a linear least square model and time series data from 1980 to 2009. The study found that monetary policy rate and lagged loan-to-deposit ratio were significant for predicting banking sector liquidity. It also showed that a decrease in monetary policy rate, volatility of output in relation to trend output, and the demand for cash, leads to an increase in current loan-to-deposit ratios; while a decrease in currency in circulation in proportion to banking sector deposits; and lagged loan-to-deposit ratios leads to a decline in current loan-to-deposit ratios.

The other study made by Mohamed(2015) on Tunisian banks shows that , financial performance, capital / total assets, operating costs/ total assets, growth rate of GDP, inflation rate, delayed liquidity have significant impact on bank liquidity while size, total loans / total assets, financial costs/ total credits, total deposits / total assets does not have a significant impact on bank liquidity.

2.3.4 Related Empirical Studies in Ethiopia

Tseganesh (2012) made study on determinants of banks liquidity and their impact of financial performance on commercial banks in Ethiopia. The aim of her study was concerned with two points; identify determinants of commercial banks liquidity in Ethiopia and see the impact of banks liquidity up on financial performance through the significant variables explaining liquidity. The data was analyzed by using balanced fixed effect panel regression model for eight commercial banks in the sample covered the period from 2000 to 2011 and the result of her study indicate that capital adequacy, bank size, share of nonperforming loans in the total volume of loans, interest rate margin, inflation rate and short term interest rate had positive and statistically significant impact on banks liquidity whereas real GDP growth rate and loan growth had statistically insignificant impact on banks liquidity. Also the result of her study revealed that; among the statistically significant factors affecting banks liquidity, capital adequacy and bank size had positive impact on financial performance whereas, non-performing loans and short term interest rate had negative impact on

financial performance while interest rate margin and inflation had negative but statistically insignificant impact on financial performance. At the end she concluded as, the impact of bank liquidity on financial performance was non-linear/positive and negative.

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

Also in the same year, the researcher studied capital adequacy and found that the capital adequacy of all banks in Ethiopia were above threshold, means there was sufficient capital that can cover the risk-weighted assets. Depositors who deposit their money in all banks were safe because all the studied banks fulfilled NBE requirement (Worku, 2006).

Also Semu (2010) conducted study with the intention to assess the impact of reducing or restricting loan disbursement on the performance of banks in Ethiopia. It also attempts to examine the possible factors that compel the banks to reduce or restrict lending. For his study, the researcher used Quantitative method particularly survey design approach was adopted. The finding of the study revealed that deposit and capital have statistically significant relationship with banks' performance measured in terms of return on equity (ROE). New loan and liquidity have relationship with banks' performance measured in terms of both return on asset (ROA) and ROE. However, the relationship was found to be statistically insignificant. Deposit and capital have no statistically significant relationship with banks' performance in terms of ROA. The study suggested that when banks face lending constraints, they have to use their funds like by purchasing treasury bills and bonds. Moreover, banks must develop non-interest generating services. Excess cash maintained by banks should be used by diversifying credit options and to avoid inefficiencies.

Nigist Melese (2015) conducted a study on the determinants of banks liquidity by investigating bank specific and macroeconomic factors affecting commercial banks liquidity by using financing gap for measurements of liquidity. The data covered the period from 2007-2013 for the sample of ten commercial banks in Ethiopia and used secondary data. Both bank specific and macroeconomic variables were analyzed by employing the balanced panel fixed effect regression model and the result of the study revealed that capital adequacy, profitability, and real GDP growth rate have negative and statistically significant impacts on liquidity of Ethiopian commercial banks while bank size has

positive and statistically significant impact on liquidity. Whereas nonperforming loan, loan growth, inflation rate, and interest rate margin were found to be statistically insignificant/ has no any impact on liquidity of Ethiopian commercial banks for the tested period.

Mekbib Shumet (2016) put their effort on determinants of liquidity in commercial banks of Ethiopia especially on private commercial banks of Ethiopia. He investigates bank specific and macroeconomic factors affecting commercial banks liquidity. In order to achieve the research objectives, data was collected from a sample of six private commercial banks in Ethiopia over the period from 2000 to 2015. Bank specific and macroeconomic variables were analyzed by using the balanced panel fixed effect regression model. Bank's liquidity is measured in three ratios: liquid asset to deposit, liquid asset to total asset and loan to deposit ratios. The findings of the study revealed that, bank size and loan growth has negative and statistically significant impact on liquidity; while non-performing loans, profitability and inflation have positive and statistically significant impact on liquidity of Ethiopian private commercial banks. However, capital adequacy, interest rate margin, real GDP growth rate , interest rate on loans and short term interest rate have no statistically significant effect on the liquidly of Ethiopian private commercial banks.

2.4. Summary and Knowledge Gap

In line with the above theoretical and empirical review; liquidity is important to all business specially for banking industry since their function is creations of liquidity on both the asset and liability side of their balance sheet. It suggested that commercial banks liquidity can be affected by different factors such as bank specific, macroeconomic and regulatory factors. As it is evident in different literature (for instance Vodová, 2011 & 2013) the most important task is to choose the appropriate explanatory variables. Hence, the selection of variables for this study is on the basis of previous studies that are reviewed in the literature and the idea of the researcher and, so it focused on bank specific and macro-economic variables that determine the liquidity of commercial banks in Ethiopia.

Unlike the empirical studies, theory on bank liquidity was well documented. According to the review, most of the empirical studies were done on the area of bank liquidity following the U.S. subprime mortgage crisis. 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 and its measurement. Studies cited above suggested that commercial banks' liquidity was determined both

by bank specific factors (such as size of the bank, capital adequacy, Non-performing loan, profitability, Loan growth and factors describing risk position of the bank), macroeconomic factors (such as different types of interest rates and indicators of economic environment) as well as the central bank decisions. Hence, as it was clearly indicated in the empirical review, most of the studies regarding the determinants of banks liquidity were done on the word wide base, some of them were done in Africa. However to the knowledge of the researcher, it is possible to say few or finger counted studies in Ethiopia concerning to banks liquidity but most of them disregard studying determinants of liquidity directly, rather studying on points like the relationship between liquidity and performance of banks in Ethiopia (Worku, 2006; Semu, 2010; Tseganesh, 2012).

Nigist (2016) tries to cover selected publically owned and private Ethiopian commercial banks. According to her recommendation, since liquidity is very crucial to the existence of banks; factors that affect it should be identified, therefore there has to be further research on the area of factors that affecting liquidity of Ethiopian commercial banks by incorporating any other firm specific and macroeconomic variables, and regulatory factors since regulations are subject to frequent change and also the researcher believed that there are other variables that affect banks liquidity in Ethiopia created by recent regulations as well as current economic environment.

Therefore, the researcher aims to investigate the determinants of banks liquidity on selected commercial banks of Ethiopia with additional variables that are created by regulations and current financial environment by involving more number of commercial banks with large dataset (2001-2015).

CHAPTER THREE

3. RESEARCH METHODOLOGY

Introduction

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. Therefore research methodology had include research design, research approach sampling technique and sample size, source of data & data collection methods, method of data analysis, Variable Definition & Hypotheses of the Study, model specification and conceptual frame work are discuss below.

3.1 Research Design

The design of a study is the blue print of the study and it defines the study type (descriptive, correlation, semi-experimental, experimental, review, meta-analytic) and subtype (e.g., descriptive-longitudinal case study, explanatory, exploratory), research question, hypotheses, independent and dependent variables, data collection methods and a statistical analysis plan. Research design is the framework that has been created to seek answers to research questions (Hair et al., 2011)

A research design could be categorized into three namely descriptive exploratory, and explanatory. According to Hair et al. (2011), exploratory study is performed when the researcher has little information such as if you are unsure of the precise nature of the problem (Saunders et al., 2009, p. 139). A number of researchers have claimed that the exploratory approach leads to new and useful theories. But there is also the danger that the research will produce false leads or useless theories (Armstrong, 1970, p.2). As to the descriptive studies, they are designed to obtain data that describe the characteristics of the topic of interest in the research (Hair et al., 2011, p.148). The objective of descriptive study is to represent an accurate profile of persons, events or situations (Robson, 2002, cited in Saunders et al., p. 140). In descriptive research, the research problem is structured and well understood (Ghauri & Grønhaug, 2005, p. 58). The last category is explanatory study (Saunders et al., 2009, p. 140) or in some book scaled "causal research design" (Hair et al., 2011, p.147). In other words, it is to explain the causal relationship between variables (Saunders et al., 2009, p. 140). Based

on the study of three research designs and the purpose of this research, the explanatory study is the most suitable for the topic. Even though this research starts with the description about liquidity of commercial banks, its ultimate goal is to test if the relationship exists between dependent and independent variables.

3.2 Research Approach

In this study the researcher used panel data model. Moreover, to achieve the objectives the student researcher adopted the quantitative research approach which is numerical. The aim of this research was to determine to determine the relationship between the explanatory variables and the liquidity of commercial banks in Ethiopia. The study would provide a reliable and practical evidence to verify a significant result of bank liquidity determinants.

According to Eldabi, et al. (2002), a quantitative research was carried out to examine a social setting by identifying individual components and explaining the phenomenon in term of constructs and relationship between constructs. Hence, quantitative research plays a role in emphasis on methodology, procedure and statistical measures of validity. It also relies on the measurement and analysis of statistical data to produce quantifiable conclusion.

For the determinants of liquidity among commercial banks in Ethiopia, the researcher would include fifteen years of data from 2001 until 2015. The data needed for the study would be acquired from annual reports of seven commercial banks in Ethiopia for bank specific factors and industry data from NBE as well as MOFED to external factors. All the data would represent dependent and independent variables.

3.3 Sample Size and Sampling Procedure

A sample design is a definite plan for obtaining a sample from the sampling frame. It refers to the technique or the procedure the researcher would adopt in selecting some sampling units from which inferences about the population is drawn.

Sampling is the process of choosing smaller and more manageable number of study units from a defined study population. Since the goal of quantitative research is to generalize the results of the work to the whole of the research population, the sample should be selected carefully using the

correct procedure. The sampling strategy adopted can affect the quality of a piece of research (Dawson, 2002; Cohen et al., 2000). Thus, attention should be paid to rigorous sampling; otherwise, the basis of the survey's applicability to wider contexts is seriously undermined.

Therefore, this study also goes through all the necessary steps of sampling design. First, the sample frame is determined. Then, from the sample frame, proper size of the sample, which can represent the population, is determined. Once the sample size is determined, then the researcher would also clearly state the procedures of selecting participants of the study.

Accordingly, the population of the study would include all commercial banks (both public as well as private) currently operating in the country. According to NBE (2015/16), there are seventeen commercial banks in the year 2015/16. These are; Commercial Bank of Ethiopia, Awash International Bank S.C (AIB), Dashen Bank S.C (DB), Bank of Abyssinia S.C (BOA), Wogagen Bank S.C (WB), United Bank S.C (UB), Nib International Bank S.C (NIB), Cooperative Bank of Oromia S.C (CBO), Lion International Bank S.C (LIB), Oromia International Bank S.C (OIB), Zemen Bank S.C (ZB), Buna International Bank S.C (BUIB), Birehan International Bank S.C (BIB), Abbay Bank S.C (AB),Addis International Bank S.C (AIB), Debub Global Bank S.C (DGB), and Enat Bank S.C (ENTB).The first one is publically owned and the remaining sixteen's are privately owned commercial banks.

There are two main types of sampling procedures: probability sampling and non-probability sampling. Choosing the type of sampling technique depends upon the area of research, research methodology, and preference of the researcher (Dawson, 2002). Probability sampling involves selecting elements randomly in that the selection of any one element is independent of the selection of the other elements while non-probability sampling is used to make description other than generalization (Dawson, 2002). Therefore, according to the nature of the study and the nature of the population the researcher would employ non-probability sampling system to select sample commercial banks.

There are different methods of non- probability sampling. Among this, purposive sampling is the most applicable method. Even though there may be bias on sample selection, it would be useful to get the best data from samples which have availability of data about the study area.

Determination of economical sample size is a major challenge for a researcher in conducting a survey (Bordens & Abbott, 2005). There is no a standard rule for the determination of sample size. Both

large and small sample sizes have their own limitations. Too large a sample might become unwieldy and too small a sample might be unrepresentative. What matters in the determination of sample size is representativeness of the sample to a population. Therefore, the correct sample size depends on the purpose of the study and the nature of the population under scrutiny (Cohen et al., 2000).

According to this the researcher has drawn the sample included those commercial banks having at least fifteen (15) years working experience in Ethiopia (i.e. from 2001 to 2015) for the availability of data and to increase the sample size purposely. Hence, In Ethiopia there is seven commercial banks having at least fifteen years working experience which included: Commercial Bank of Ethiopia (CBE), Awash International Bank S.C (AIB), Dashen Bank S.C (DB), Bank of Abyssinia S.C (BOA), Wogagen Bank S.C (WB), United Bank S.C (UB) and Nib International Bank S.C (NIB). Therefore, it is possible to draw a relationship among variables using 105 observations; across seven banks over fifteen years (i.e. the matrix for the frame was 15*7 that included 105 observations).

3.4 Sources of Data and Data Collection Methods

Only secondary data had used for the study. Conducting appropriate data gathering instruments helped researchers to combine the strengths and amend some of the inadequacies of any source of data to minimize risk of irrelevant conclusion. Consistent and reliable research indicates that research conducted by using appropriate data collection instruments increase the credibility and value of research findings (Koul, 2006). Accordingly, structured document review was used for this research to collect required information, which is relevant for addressing the objectives of the study. Data would be collected from audited financial statements (balance sheet and income statement) of each commercial bank included in the sample and various journals and publications of NBE and MoFED for the macroeconomic data from 2001 to 2015. All data would be aggregated on annual basis and the figures/ratios for each variable would be computed from the audited financial reports of respective sample banks as of June 30 of each year.

3.5 Methods of Data Analysis

After the data is collected, it has been organized and financial ratios were computed for each of the seven (7) bank-specific variables and for the three liquidity ratios for each of the sample commercial banks. And then, the next step was analyzing and interpreting them accordingly to achieve the stated objectives. In this study two type of statistical analysis have been used to test the proposed hypotheses. These are descriptive statistics and inferential statistics/multiple regression analysis to see the effect (relationship) of explanatory or independent variables on the dependent variable. The descriptive statistics of both dependent and independent variables were calculated over the sampled periods. This helps to convert the raw data in to a more meaningful form which enables the researcher to understand the ideas clearly. And then interpret with statistical description including standard deviation, mean, and minimum & maximum. Then, correlation analyses between dependent and independent variables were made and finally a multiple linear regression and t-test analysis will be used to determine the relative importance of each independent variable in influencing liquidity of Ethiopian commercial banks. To conduct this, the researcher would use statistical tools E-views8 Software. The researcher would also perform required diagnostic tests to ensure whether the assumptions of the classical linear regression model (CLRM) are being met and not violated.

3.6 Variable Definition & Hypotheses of the Study

This study is focused on to identify the determinants of bank's liquidity in Ethiopian commercial banks through testing the hypotheses regarding the relationships between liquidity of banks with bank specific and macroeconomic factors affecting it. It is apparent that the most significant task is to select the appropriate explanatory variables. As it was discussed in the literature review part, some determinant factors which have positive relation with liquidity in one country may have negative relation with other country and some determinant factors which have significant impact on liquidity in one country may not have significant impact on liquidity in another country. Various bank specific and macroeconomic variables were conducted in the previous studies made worldwide; in this study some variables (bank specific and macroeconomic) was included. The study would also consider which determinant factors could influence the liquidity of commercial banks in Ethiopia context. Therefore, the following variables were selected based on Ethiopian context and previous relevant studies. The description and operational definition of selected variables is discussed here under.

3.6.1. Dependent Variables

Liquidity of Banks

Most academic literatures prefer liquidity ratio due to a more standardized method and therefore, this study would use liquidity ratios, to measure liquidity of commercial banks, due to the availability of data. For the purpose of this study, the following three types of liquidity ratios, which are most of the time used by the National Bank of Ethiopia and which were previously used by Vodova (2011, 2012, 2013), Tseganesh (2012), Rafique & Malik (2013), Chagwiza (2014), Nigist (2015) and Mekbib (2016) are adopted.

(a) Liquid Asset to Deposit & Short Term Borrowing Ratio (L1):

According to NBE directive No SBB/57/2014, liquid asset includes cash (local & foreign currency), 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 and other assets as the National Bank may from time to time declare to be liquid assets. Accordingly, deposit refers to demand (current) deposits, savings deposits and fixed time deposits of banks while short term borrowing refers any borrowing secured from the National Bank of Ethiopia or any other interbank loans with maturity period of less than one year.

This ratio indicates the percentage of short term obligations that could be met with the bank's liquid assets in the case of sudden withdrawals. It is to ascertain whether the bank's short-term assets are readily available to pay off its short-term liabilities. As deposits are able to be withdrawn at any point in time they play an important role on the bank's liquidity position. This ratio is more focused on the bank's sensitivity to selected types of funding i.e. customer deposit Vodova (2013). The higher this ratio signifies that the bank has the capacity to absorb liquidity shock and the lower this ratio indicates the bank's increased sensitivity related to deposit withdrawals.

$$\mathbf{L1} = \frac{\textbf{Liquid Asset}}{\textbf{(Deposit + Short term Borrowing)}}$$

(b) Liquid Asset to Total Asset Ratio (L2):

The liquid asset to total asset ratio gives information about the general liquidity shock absorption capacity of a bank. In general when the ratio is high, it tells us that the bank has a capacity to absorb liquidity shock and that the bank is in a better position to meet its withdrawals. While, the higher this ratio may indicate inefficiency since liquid assets, most of the time non-earning assets, yield lower income. As a result maintaining optimum level of liquidity is required to optimize the trade-off between liquidity and profitability by investing excess liquid asset to generate higher return Vodova (2013).

$$L2 = \frac{\text{Liquid Asset}}{\text{Total Asset}}$$

(c) Loans to Deposit & Short Term Borrowing Ratio (L3):

As per NBE directive No SBB/43/2008, loans & advances means any financial asset of a bank arising from a direct or indirect advances fund by a bank to a person that is conditioned on the obligation of the person to repay the fund on a specified date or on demand with interest. Loans & Advances are the major portion of a bank's asset and it is the most earning asset of a bank. This ratio tells us the percentage of funding sources tied up by illiquid asset. It relates illiquid asset with liquid liability. This ratio also indicates the percentage of deposit locked in to illiquid asset. The ratio reflects the proportion of the customers' deposits that has been given out in the form of loans and the percentage that is retained in the liquid forms. The ratio serves as a useful planning and control tool in liquidity management since commercial banks use it as a guide in lending and investment decision. Unlike the above two liquidity measures, the higher this ratio, the less the liquidity of the bank is and interpreted inversely (Mekbib, S. 2016).

$$L3 = \frac{\text{Loan and Advances}}{\text{(Deposit + Short term Borrowing)}}$$

3.6.2. Independent Variables

This section describes the independent variables that are used in the econometric model to estimate the dependent variable i.e. liquidity of commercial banks.

Capital Adequacy of Banks (CAP):

Capital is the amount of own fund available to support the bank's business and act as a buffer in case of adverse situation (Athanasoglou et al**.,** 2005). Capital of a bank includes paid up capital, undistributed profit (retained earnings), legal reserve or other reserves and surplus fund which are kept aside for contingencies. Regulators in most countries define and monitor CAP to protect depositors, thereby maintaining confidence in the banking system. Though capital adequacy ratio is measured by the ratio of total capital to risk weight asset, in some literatures it can be also measured by the ratio of capital to total asset and then in this study, the proxy for capital adequacy is the ratio of total capital of the bank to total asset of the bank.

This ratio measures how much of bank's asset are funded with owner's funds and is a proxy for the capital adequacy of a bank by estimating the ability to absorb losses. As it is discussed in the literature review part, there are two opposing theoretical views regarding to the relationship between banks liquidity and capital adequacy. Some previous studies such as the "financial fragility-crowding out" theories predicts that higher capital reduces liquidity creation (Diamond & Rajan (2000, 2001) and hence, there is negative relationship between capital adequacy and bank liquidity whereas, Al-Khouri (2012) found that, bank capital increases bank liquidity through its ability to absorb risk and thus the higher is the bank's capital ratio, the higher is its liquidity creation. Therefore, the current study expects that there is a positive relationship between capital adequacy & liquidity and draws the following hypothesis.

H1*: Capital adequacy has positive and significant impact on bank's liquidity*

Size of the Bank (SIZE):

The bank's total asset is another bank specific variable that affects the liquidity of a bank. Bank size measures its general capacity to undertake its intermediary function. There are two opposing arguments regarding the relationship between bank liquidity and bank size. The first view is the "too big to fail" hypothesis which considers negative relationship between bank size and liquidity whereas; the second view considers there is a positive relationship between bank size and liquidity .

In this study, bank size is measured by the natural logarithm of total asset of the bank (Poorman & Blake 2005; Shen et al., 2010) and it is expected positive relationship between bank size and liquidity and then draws the following hypothesis.

H2*: Bank size has positive and significant impact on bank's liquidity*

Loan Growth of the Bank (LG):

According to NBE directive No. SBB/43/2008, loans & advances means any financial asset of a bank arising from a direct or indirect advances fund by a bank to a person that is conditioned on the obligation of the person to repay the fund on a specified date or on demand with interest. Loans & advances are the major earning asset of the bank. Loans & advances are granted to customer from the amount collected from depositors of the bank. In this regard, when banks transform short term deposits to long term loans, which have a maturity mismatch, they will be vulnerable to liquidity problem**.** Therefore, the increase in loan means increase in illiquid assets and decrease in short term/liquid assets. As it was discussed in the literature review part, it is expected that, there is a negative relationship between bank loan growth and liquidity. For this study loan growth is measured by the annual growth rate of outstanding gross loans & advances of the bank and the following hypothesis is drawn.

H3*: Loan growth has negative and significant impact on bank's liquidity*

Non-performing Loans (NPL):

Non-performing loans means loans & advances whose credit quality has deteriorated such that full collection of principal and/or interest in accordance with the contractual repayment term of the loan or advance is in question according to NBE directives (NBE directive No SBB/43/2008). The rise of non-performing loan portfolios in banks significantly contributed to financial distress in the banking sector. Non-performing loans are the main contributor to liquidity risk, which exposes banks to insufficient funds for operations. As loans & advances are the major portion of bank's asset, when they become non-performing, it will affect both profitability and liquidity of the bank.

For the purpose of this study, the proxy for non-performing loans is the share of non-performing loans on total volume of loans & advances. Based on prior studies, it is expected that there is a negative relationship between non-performing loans and liquidity of the bank and as a result the following hypothesis is drawn.

***H4**: The share of non-performing loans in the total volume of loans & advances has negative and significant impact on bank's liquidity*

Profitability of the Bank (ROA):

Liquidity needs constrain a bank from investing its entire available fund. Banks need to be both profitable and liquid which are inherently conflicts between the two and the need to balance them. As more liquid asset is investing on earning assets such as loans & advances, profitability will increase by the expense of liquidity. As a result, banks should always strike a balance between liquidity and profitability to satisfy shareholders' wealth aspirations as well as liquidity requirements. The study made by Owolabi, et al. (2011) evidence that, there is a trade-off between profitability and liquidity in that, the increase in either one would decrease the other. The other study made by Vodova (2013), suggest a negative influence on bank profitability (measured by return on equity) and bank liquidity. Most commonly, profitability is measured by return on asset (ROA) and return on equity (ROE). For the purpose of this study, the proxy measure for profitability is return(ROA) on asset that measures the overall financial performance of banks and the return on asset (ROA) is measured by the ratio of net profit before tax to total asset

$$\text{ROA} = \frac{\text{Net profit before tax}}{\text{Total asset}}$$

Accordingly, the following hypothesis has been drawn,

***H5**: Profitability has negative and significant impact on bank's liquidity*

Interest Rate Margin (IRM):

In the financial intermediation process, a bank collects money on deposit from one group (the surplus unit) and grants it out to another group (the deficit unit). These roles involve bringing together people who have money and those who need money. In such intermediation function, the bank will earn interest from loans & advances and pay interest for depositors. If a bank has done a good job of asset and liability management, it can earn substantial income on its assets and pay low costs on its liabilities. Thus, how well a bank manages its assets and liabilities is measured by the spread between the interest earned on the bank's assets and interest costs on its liabilities.

Although there are number of ways to calculate the interest rate margin, for the purpose of this study, it is defined as the difference between interest income from loan and advances as a fraction of the total loan and advances and the interest paid out on deposit as a percentage of total deposits (previously used by Azeez et al., 2013). As this interest rate margin increases, banks are encouraged to grant more loans from short term deposit and it lowers liquidity, thus the following hypothesis is drawn

H6*: Interest rate margin has negative and significant impact on bank's liquidity*

Interest rate on Loans & Advances (IRL):

It is the lending interest rate in which banks levied on borrowers. The lending interest rate on banks may vary depending on the tenure of the loan, the type and value of collateral, the economic sector of the loan etc. As a result, it is advisable to take the average. For the purpose of this study, interest rate on loans & advances is defined as interest income from loans & advances as a fraction of total loans & advances. The higher the interest rate on loans & advances is expected to encourage banks to grant more loans to customer. Based on prior studies, interest rate on loans & advances are expected to have negative relationship with liquidity and as a result the following hypothesis is drawn

H7*: Interest rate on loans and advances has negative and significant impact on bank's liquidity*

Gross Domestic Product (GDP):

GDP is an indicator of the economic health of a country as well as the gauge of a country's standard of living. It is the measurement of level of economic activity of a country. According to previous studies, when the economy is at boom or goes out of recession, economic units including banks are optimistic and increase their loans & advances and as a result decrease their holding of liquid assets. On the other hand, during recession, business operations reduce borrowers' capability to service their obligation which increases bank's NPLs and eventually decreases bank's liquidity (Gavin & Hausmann, 1998). For the purpose of this study, GDP is measured by the annual real growth rate of gross domestic product (Aspachs et al., 2005) and it is hypothesized to affect banking liquidity negatively.

***H8**: Real GDP growth rate has negative and significant impact on bank's liquidity*

Inflation rate:

According to the recent theory of information asymmetry in the credit market an increase in the rate of inflation drives down the real rate of return not just on money, but on assets in general. The implied reduction in real returns exacerbates credit market frictions. Since these market frictions lead to the rationing of credit, credit rationing becomes more severe as inflation rises. As a result, the financial sector makes fewer loans, resource allocation is less efficient, and intermediary activity diminishes with adverse implications for capital/long term investment. In turn, the amount of liquid or short term assets held by economic agents including banks rise with the rise in inflation, hence there was a positive relationship between inflation and banks liquidity. To proxy inflation rate the percentage change in CPI was used as of (Huybens & Smith, 1999).

***H9:** Inflation rate has positive and significant impact on banks liquidity*

Short Term Interest Rate (STIR):

Interest rate is the price that has to be paid by a borrower of money to a lender of money in return for the use of the funds. Short term interest rate is the rate paid on money market instruments that have less than one year maturity. The most popular money market instrument (securities) in Ethiopia is Treasury bills. Treasury bills are the most important since they provide the basis for all other domestic short term interest rates. The Treasury bills in Ethiopia have a maturity period of 28, 91, 180 and 364 days (NBE/TRB/001/2011). The higher short term interest rate induces banks to invest more in the short term instruments and enhance their liquidity position Pilbeam (2005). Treasury Bills are considered as liquid asset of the banks. In this study the proxy for short term interest rate is the annual weighted average interest rate of Treasury Bills and the following hypothesis is drawn

***H10**: Short term interest rate has positive and significant impact on bank's liquidity*

In general, the study considered the above ten independent variables as a determinant for banks liquidity of Ethiopian private commercial banks. Table 3.1, below summarizes the dependent and independent variables of the study with their respective operational definition and expected signs.

Table: 3.1. Description of the variables and their expected relationship

Variables	**Symbol**	**Operational Definition**	**Source**	**Expected sign**
Dependent				
Liquidity (L1)	L1	The ratio of liquid asset to deposit & short term financing	Annual report	NA
Liquidity (L2)	L2	The ratio of liquid asset to total asset	Annual report	NA
Liquidity (L3)	L3	The ratio of loan to deposit & short term financing	Annual report	NA
Independent				
Capital Adequacy	CAP	Share of equity on total asset	Annual report	Positive
Size of the bank	SIZE	Natural logarithms of total asset	Annual report	Positive
Loan growth	LG	Annual growth rate of loans & advances	Annual report	Negative
Non-performing loans	NPL	Share of non-performing loans on total volume of loans	Annual report	Negative

Profitability	ROA	The ratio of net profit before tax to total asset	Annual report	Negative
Interest rate margin	IRM	The difference between interest income from loan and advances as a fraction of the total loans and advances and the interest paid out on deposit as a percentage of total deposits.	Annual report	Negative
Interest rate on Loans & Advances	IRL	Interest income from loans and advances as a fraction of total loans and advances	Annual report	Negative
Gross domestic product	GDP	Annual real Growth rate of gross domestic product	NBE Publication	Negative
Inflation	INF	Annual general consumer price index	NBE Publication	Positive
Short term interest rate	STIR	Annual weighted average interest rate of Treasury Bills	NBE Publication	Positive

As it can be seen from Table 3.2 above, it is expected that four factors could have positive impact on bank liquidity and the rest of the factors are expected to have negative impact on bank liquidity

3.7 Model Specification

As it was discussed in the research design section of this study, the nature of data used is a balanced panel data which was deemed to have advantages over simple cross sectional and time series data.

Panel data involves the pooling of observations on the cross sectional over several time periods (Brooks 2008). The panel data or longitudinal data comprises of both cross-sectional elements and time-series elements; the cross-sectional element is reflected by the sample of Ethiopian commercial banks and the time-series element is reflected in the period of study (2001-2015). This study, considered whether the use of the particular variable makes economic sense in Ethiopian commercial banks context. The regression model used for this study was adopted from Vodova (2011, 2102, 2013), Tseganesh (2012), Rafique & Malik (2013), Nigist (2015) and Mekbib (2016). Thus, the following equation indicated the general model for this study.

$$Lit = \alpha + \beta Xit + \delta i + \varepsilon it$$

Where L_{it} is one of the three liquidity ratios for bank i in time t, X_{it} is a vector of explanatory variables for bank i in time t, α is constant, β are coefficient which represents the slope of variables, δ_i denotes fixed effects in bank i and ε_{it} is the error term. The subscript i denote the cross-section and t representing the time-series dimension.

Therefore, the general models which incorporate all of the variables to test the determinants of bank's liquidity were:

$$L1it = \alpha + \beta 1\,(CAPit) + \beta 2\,(SIZEit) + \beta 3\,(LGit) + \beta 4\,(NPLit) + \beta 5\,(ROAit) + \beta 6\,(IRMit) + \beta 7\,(IRLit)) \beta 8\,(GDPt) + \beta 9\,(INFt) + \beta 10\,(STIRt) + \delta i + \varepsilon it \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(Model 1)}$$

$$L2it = \alpha + \beta 1\,(CAPit) + \beta 2\,(SIZEit) + \beta 3\,(LGit) + \beta 4\,(NPLit) + \beta 5\,(ROAit) + \beta 6\,(IRMit) + \beta 7\,(IRLit)) + \beta 8\,(GDPt) + \beta 9\,(INFt) + \beta 10\,(STIRt) + \delta i + \varepsilon it \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(Model 2)}$$

$$L3it = \alpha + \beta 1\,(CAPit) + \beta 2\,(SIZEit) + \beta 3\,(LGit) + \beta 4\,(NPLit) + \beta 5\,(ROAit) + \beta 6\,(IRMit) + \beta 7\,(IRLit)) + \beta 8\,(GDPt) + \beta 9\,(INFt) + \beta 10(STIRt) + \delta i + \varepsilon it \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(Model 3)}$$

Where:

***L1it*:** represents the bank's liquidity measured by liquid asset to deposit & short term borrowing ratio of ith bank on year "t"

L2it: represents the bank's liquidity measured by liquid asset to total asset ratio of ith bank on year "t"

L3it**:** represents the bank's liquidity measured by loan to deposit & short term borrowing ratio of ith bank on year "t"

CAPit**:** is capital adequacy ratio of ith bank on the year "t"

SIZEit**:** is the size of ith bank on the year "t"

LGit**:** is the loan growth rate of ith bank on the year "t".

NPLit**:** is the share of non-performing loan on total volume of loans & advances of ith bank on the year "t".

ROAit: is the return on asset of ith bank on the year "t".

IRMit: is interest rate margin of ith bank on the year "t".

IRLit**:** is interest rate on loans of ith bank on the year "t"

GDPt: is the real gross domestic product growth of Ethiopia on the year "t".

INFt**:** is the inflation rate in Ethiopia on the year "t".

STIRt**:** is the short term interest rate of Ethiopia on the year "t".

δi**:** denotes fixed effects in bank "i" .

εit**:** is a random error term

The bank specific variables are both cross-sectional and time variant whereas the macroeconomic variables are only time variant but are converted into panel data type by including macroeconomic variables for each cross sectional unit.

Among the above models, the first model, in which liquidity is measured by liquid asset to deposit and short term borrowing ratio (L1) was used as a benchmark in this study while the other two ratios are used for robustness check. This ratio is also favored by the National Bank of Ethiopia in which the liquidity requirement directive is issued based on this ratio.

3.8. Conceptual Framework

On the basis of the hypotheses that developed from the literature part and the regression model of the study, the following conceptual frame work was developed

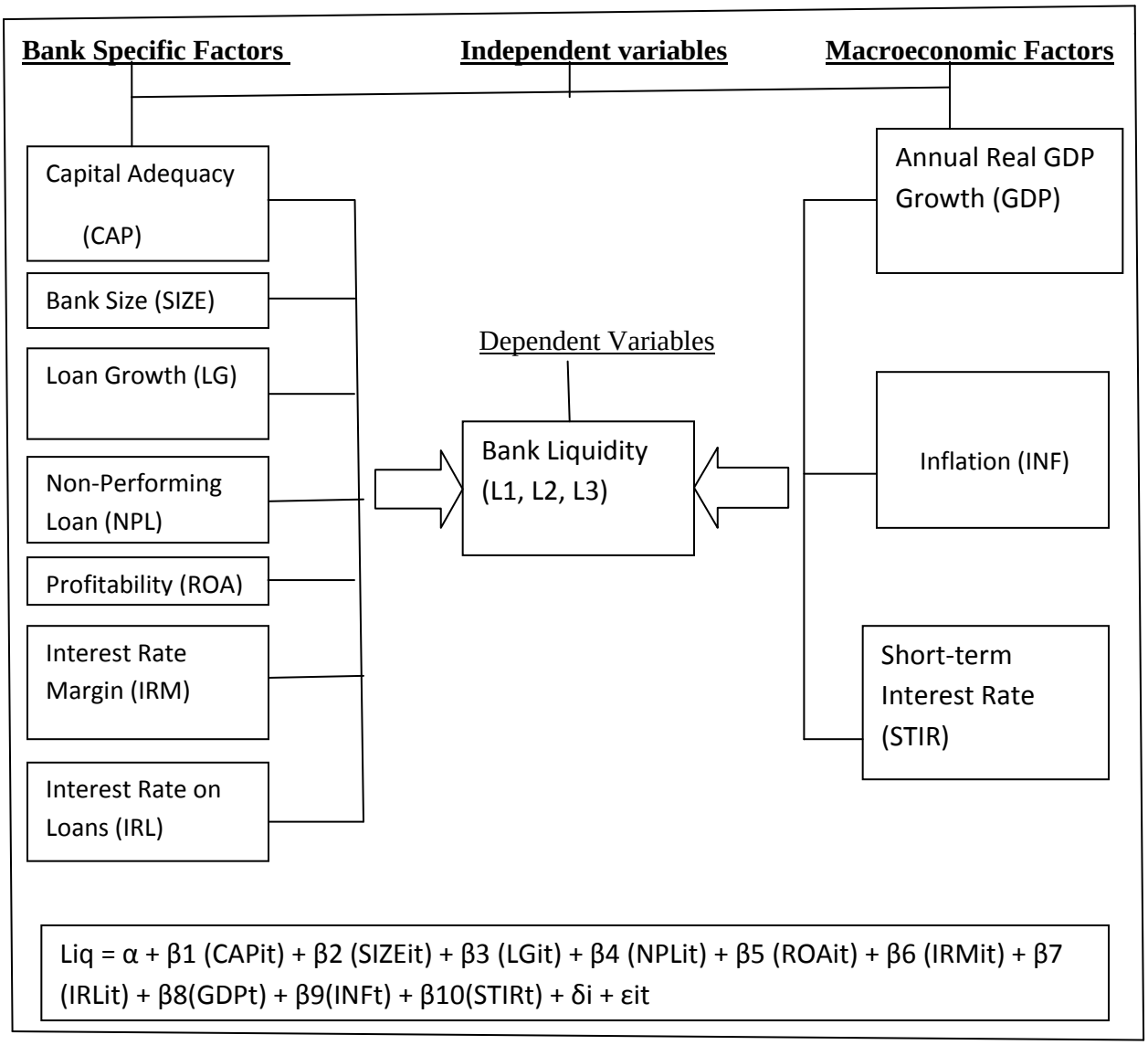


Figure 3.1 Summary of the conceptual framework

Source: own design

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

The preceding two chapters deal with literatures related to the topic and research methodology. In this chapter, detail analyses about the descriptive statistics and regression result have been made.

Specifically, this chapter has included five sections. The first section presented descriptive analysis of the dependent and independent variables using graphs and charts to provide an insight on the distribution of the data by bank and across time. The second section presented the correlation analysis result of dependent and independent variables. Section three presented the classical linear regression model assumptions diagnostic test results. The fourth section presented the results of the regression analysis and finally discussion of the regression results were presented under section five.

4.1. Descriptive Analysis

This section presents the summary of data used in the regression model and provides statistical descriptive analysis of the dependent and independent variables. The descriptive analysis is important in providing an insight about the distribution of the data by bank and across time as well as their averages.

4.1.1 Descriptive Analysis of Dependent Variables

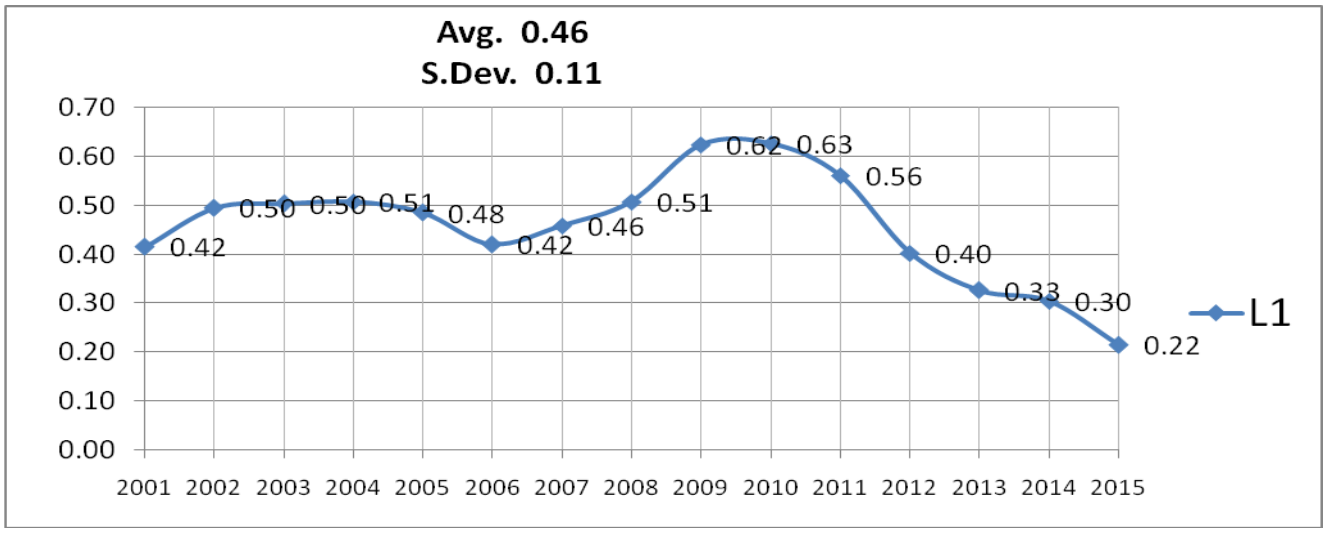
The dependent variable of the study is liquidity of commercial banks in Ethiopia. As described in the literature part, the two most widely used approaches to measure liquidity of banks are liquidity gap approach (flow approach) and liquidity ratio approach (stock approach). Though both approaches are intuitively applying, the flow approach is more data intensive and there is no standard technique to forecast liquidity inflows and outflows. As a result, the stock approaches are more popular in practice and in the academic literature due to the availability of a more standardized method. The most popular stock ratios which are used in this study are liquid asset-to- deposits and short term borrowing ratio, liquid asset-to-total asset ratio and total loans and advances-to- deposit and short term borrowing ratio.

Liquid Asset to Deposit and Short Term Borrowing Ratio (L1)

One of the liquidity measures of this study is liquid asset-to-deposit and other short-term borrowings ratio. The National Bank of Ethiopia also uses this ratio as the measurement of banks liquidity level and the liquidity requirement directive is based on this ratio. As per NBE directive number SBB/57/2014 issued by the National Bank of Ethiopia, any licensed commercial banks are required to maintain liquid asset of not less than fifteen percent (15%) of its net current liabilities (which includes the sum of demand deposits, saving deposits, time deposits and similar liabilities with less than one-month maturity) and they cannot give any type of loan if the liquidity of commercial banks in Ethiopia is below 15%.

As shown in figure 4.1.1 below, the overall average liquid asset-to-deposit and other short term borrowing ratio of the studied banks was 46%. The standard deviation of 11% shows moderate dispersion from its mean. The ratio shows consistent decrement from the period 2004 to 2006 and then it has shown increments from the period 2007 to 2010 and reaches the maximum ratio of 63%. After 2010, it shows consistent decrement and reaches the minimum 22% in the year 2015. Accordingly both are by far above the minimum liquidity requirement standard of the supervisory authority which is currently 15%. In general, the higher this ratio signifies that the bank has the capacity to absorb liquidity shock and the lower this ratio indicates the bank's increased sensitivity related to deposit withdrawals.

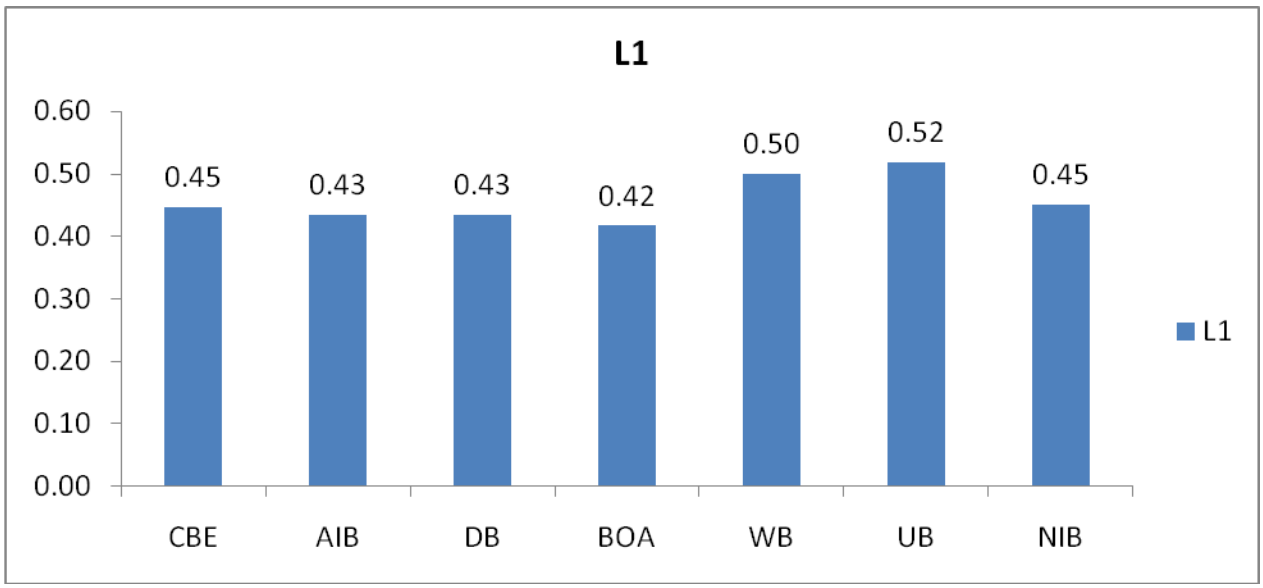
Figure -4.1.1: Average liquid asset-to-deposit & short term borrowing ratio of studied banks



Source: Excel output from financial statements of sampled banks and own computation

Figure 4.1.2 below depicts the overall average liquidity ratio of the studied banks for the period from 2001 to 2015 individually. On average, Bank of Abyssinia has shown the minimum liquid asset to deposit ratio (L1) of 42%. On the other hand, United Bank has shown on average the maximum liquid asset to deposit ratio (L1) of 52%.

Figure 4.1.2: Average liquid asset-to-deposit & short term borrowing ratio of each studied banks



Source: Excel output from financial statements of sampled banks and own computation

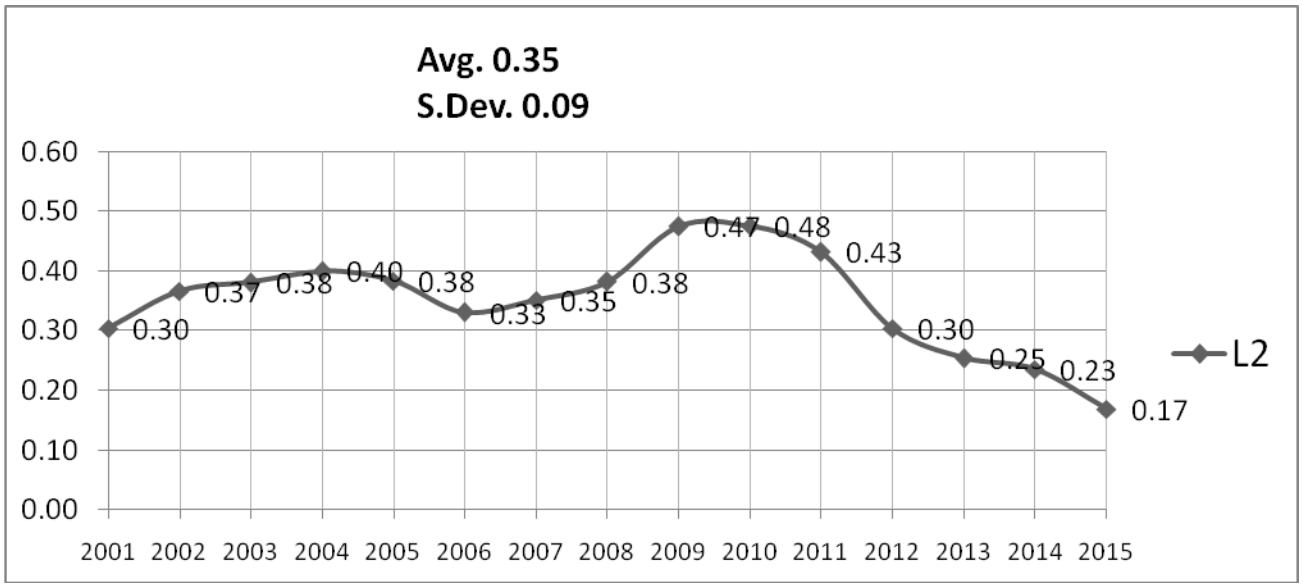
Liquid Asset-to-Total Asset Ratio (L2)

The other measure of bank liquidity is liquid asset-to-total asset ratio which gives information about the long-term 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. This measure of liquidity was taken as benchmark measure.

As shown in figure 4.1.3 below, the average liquid asset to total asset ratio of studied commercial banks for the period from 2001 to 2015 was 35%. The standard deviation of 9% shows that there is little dispersion from the average liquid asset-to-total asset ratio. The ratio had shown increasing trends for the period from 2006 to 2010 and maximum liquid asset to total asset ratio of the studied

banks reaches 48%. While it has shown a decreasing trend from 2010 onwards and reaches the minimum ratio of 17% in the year 2015.

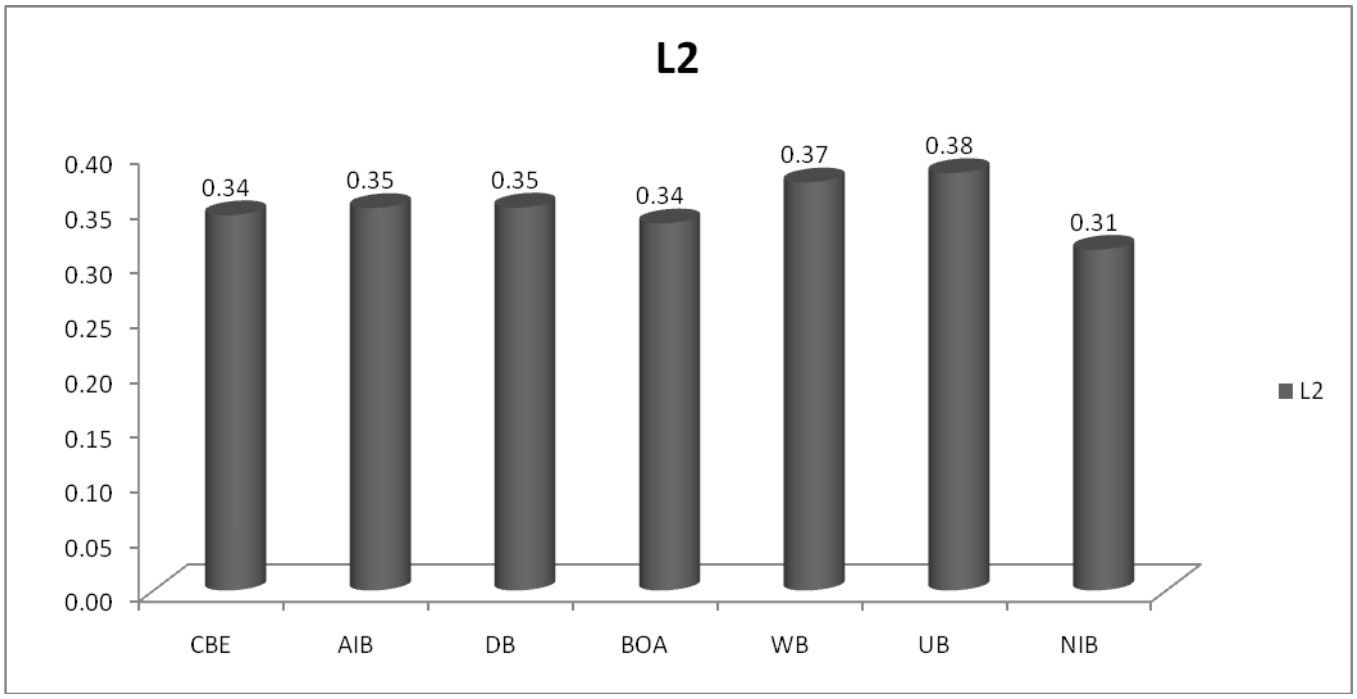
Figure 4.1.3: Average liquid asset to total asset ratio of studied banks



Source: Excel output from financial statements of sampled banks and own computation

As figure 4.1.4 indicates NIB international bank has shown the minimum liquid asset to total asset ratio (L2) of 31% while United Bank has shown the maximum liquid asset to total asset ratio (L2) of 38%.

Figure 4.1.4: Average liquid asset to total asset ratio of each studied banks



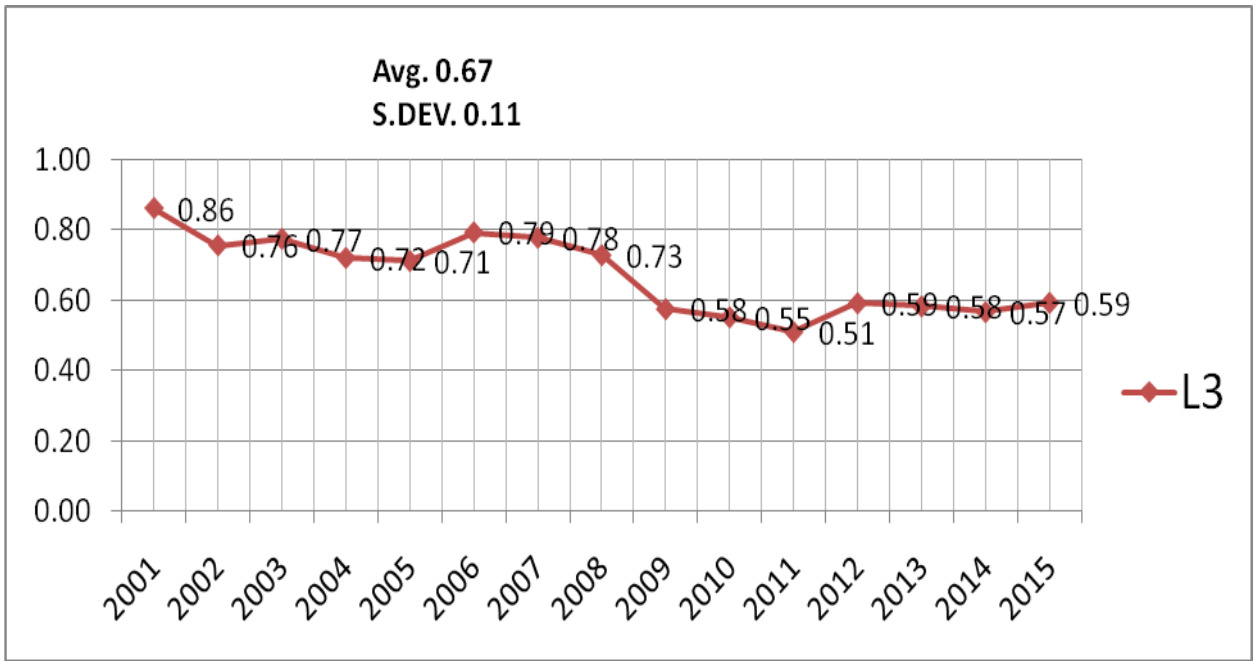
Source: Excel output from financial statements of sampled banks and own computation

Loans & Advances to Deposits and short term borrowing Ratio (L3)

Loan & Advances to deposit and other short-term borrowing ratio relates illiquid assets with volatile liabilities. It indicates what percentage of the volatile funding of the bank is tied up in illiquid loans. This ratio serves as a useful planning and control tool in liquidity management since commercial banks use it as a guide in lending and investment decision. Unlike the above two ratio measures, the higher this ratio is the less the liquidity of the banks and interpreted inversely.

Figure 4.1.5 below, shows that the average loan to deposit ratio of the studied commercial banks was 67% which is below the good benchmark of 80% as per the international standards. The maximum loan to deposit ratio of 86% was registered in the year 2001 and fluctuate over time. This indicates that, on average selected commercial banks in Ethiopia have lower amount of volatile deposits which are tied up with low amount of loans to total deposits and short term borrowings. On the other hand, the minimum loan to deposit ratio of 51% was registered in the year 2011. The standard deviation of 11% shows there is moderate dispersion of loan to deposit ratio from its mean value.

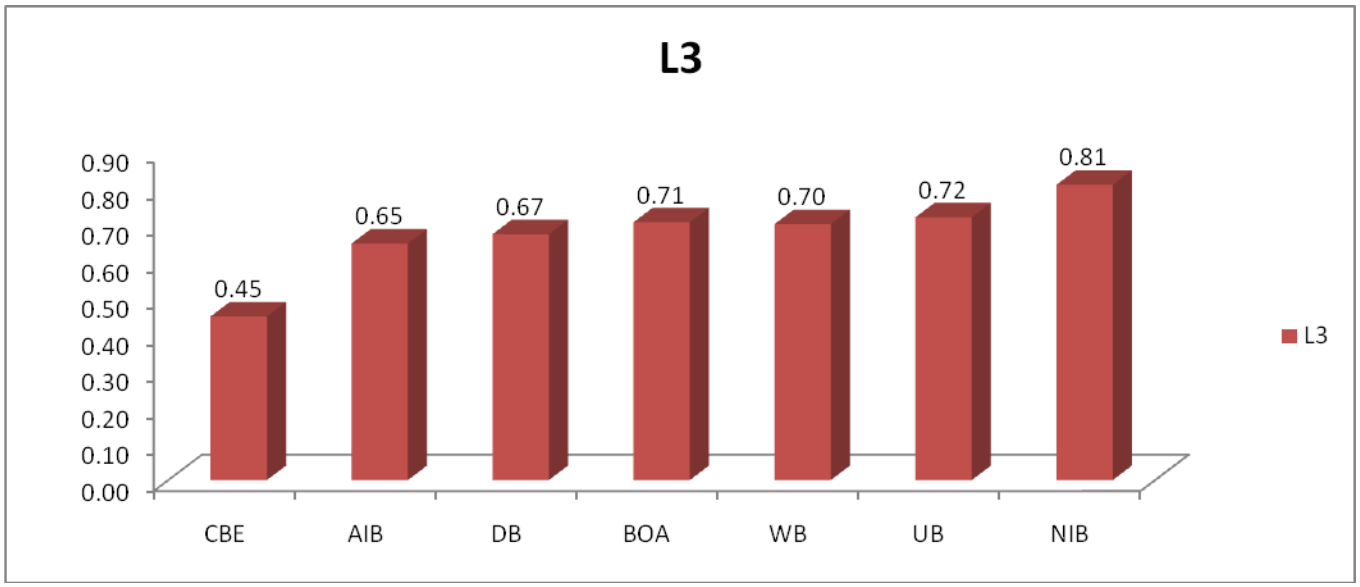
Figure 4.1.5: Average loan to deposit ratio of studied banks



Source: Excel output from financial statements of sampled banks and own computation

Figure 4.1.6 below depicts the Commercial Bank of Ethiopia has shown the minimum loan to deposit ratio (L3) of 45%.On the other hand, Nib International bank has shown on average the maximum loan to deposit ratio (L3) of 81%.The figure shows that more experienced banks from sample banks has less average to deposit ratio and less experienced banks from sample banks has more average to deposit ratio.

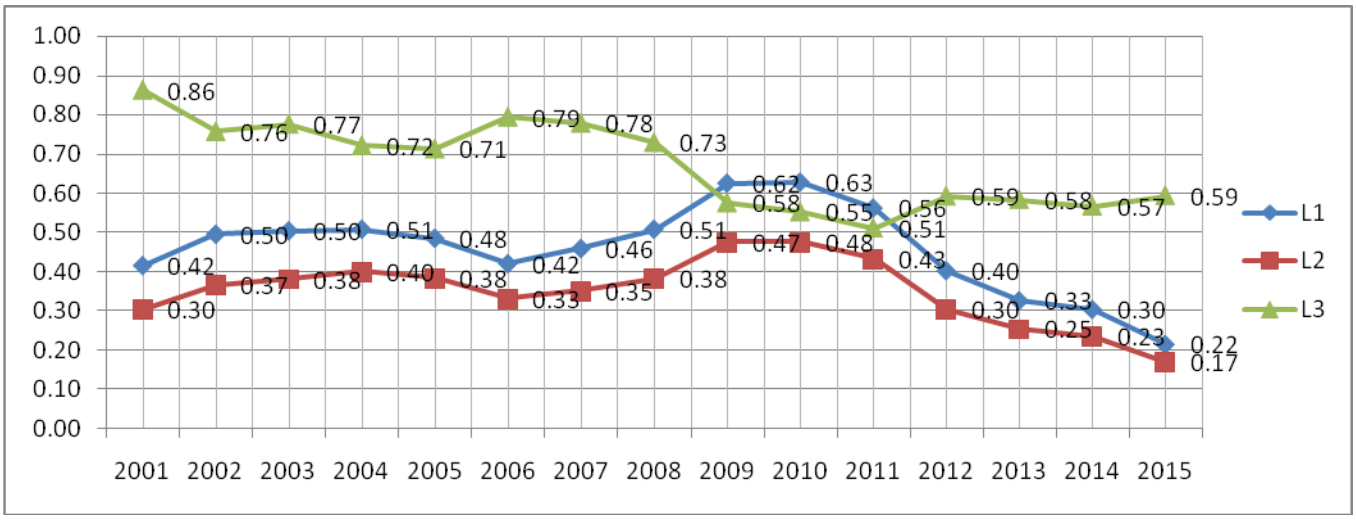
Figure 4.1.6: Average loan to deposit ratio of each studied bank



Source: Excel output from financial statements of sampled banks and own computation

Figure 4.1.7 below shows the two ratio's (L1 & L2) shows that, the liquidity of banks shows an increasing trends since 2006 up to 2010 and a decreasing trends starting from the year 2011 onwards after NBE has issued directive No MFA/NBEBILLS/001/2011 which requiring all private commercial banks to invest 27% of their every new loan disbursements in NBE bills with maturity of five years at a very low interest rate, 3%, far below from what banks pay as an interest for the deposit.

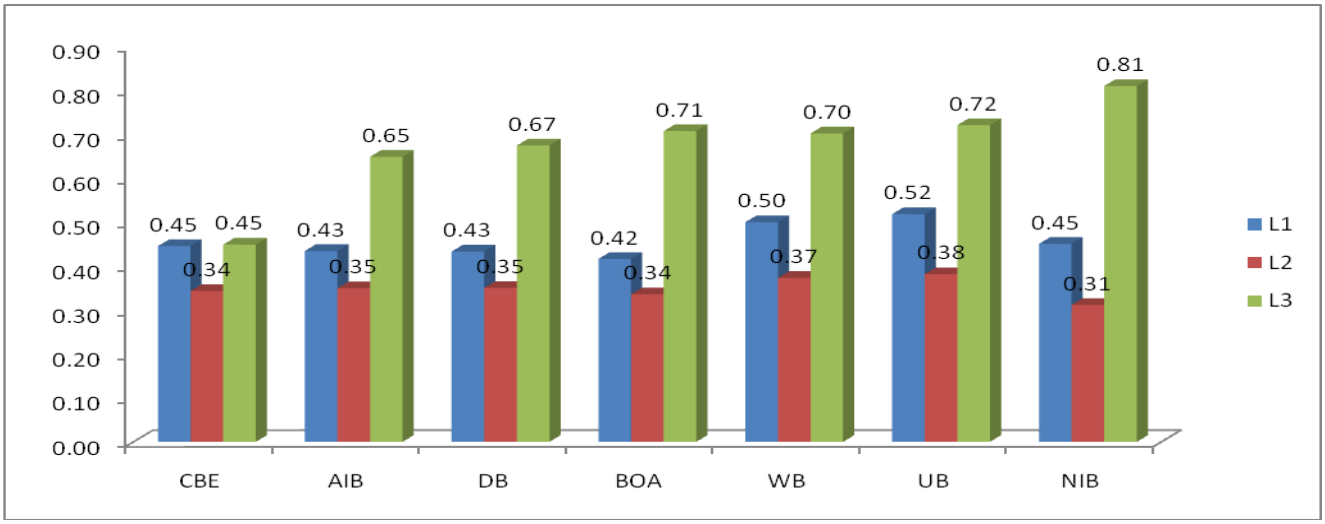
Figure 4.1.7: Summary of Average liquidity ratios of studied banks



Source: Excel output from financial statements of sampled banks and own computation

As figure 4.1.8 shows among the three ratio's, most banks loan to deposit & short term borrowing ratio (L3) has shown higher ratio's than the other two ratio measures except commercial bank of Ethiopia which is average liquid asset to deposit and short term borrowing ratio (L1) equal with loan to deposit and short term borrowing ratio (L3).

Figure 4.1.8: Summary of Average liquidity ratios of each studied banks



Source: Excel output from financial statements of sampled banks and own computation

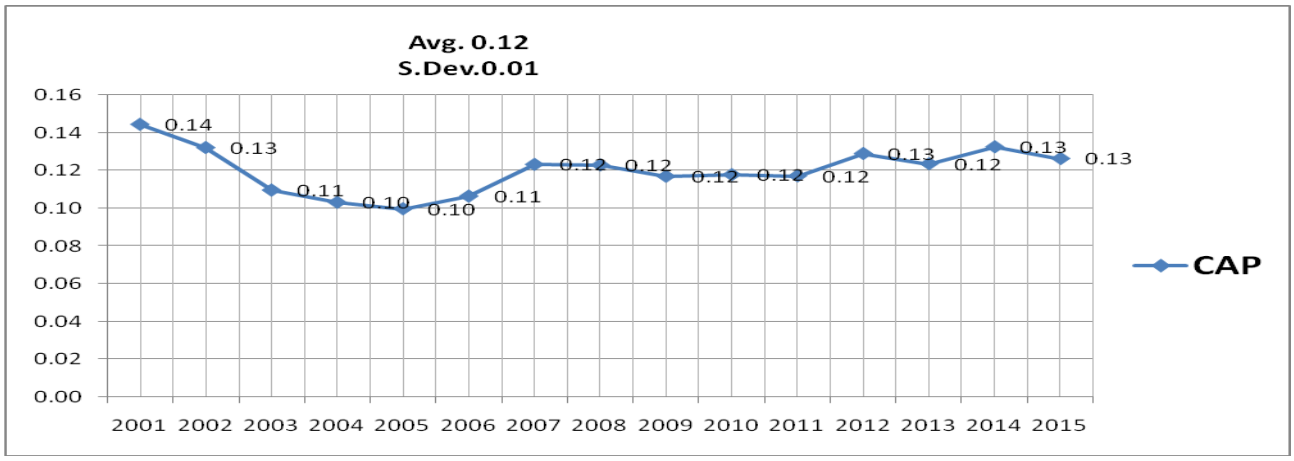
4.1.2 Descriptive Analysis of Independent Variables

The independent variables used in this study includes: capital adequacy ratio, bank size, loan growth, non-performing loans, return on asset, interest rate margin, interest rate on loans, gross domestic product, inflation and short term interest rate and discussed here under. The descriptive analyses of each independent variable are discussed here below.

Capital Adequacy Ratio (CAP)

As it was discussed in the literature part, capital adequacy refers to the sufficiency of funds available to absorb losses to protect depositors, creditors, etc. in the interest of maintaining financial system stability. As per Basel Committee on Banking Supervision (BCBS 2004) revised framework and NBE requirement (NBE directive no SBB/9/95) capital adequacy is measured by the ratio of regulatory capital to risk-weighted assets and accordingly a minimum of 8% is required. However, the proxy for capital adequacy measurement used in this study was the ratio of total equity to total asset. The higher this ratio entails the capability of the bank to absorb losses from its own capital. As it is shown on Figure 4.2.1 below, the average capital adequacy ratio of the studied banks were above the minimum requirement set by the NBE which is 8%. The maximum CAP ratio of 14% which was recorded in the year 2001 shows that, during that time the total asset of the studied banks were at its lowest level as compared to its capital. The average standard deviation of 1% for CAP reveals that, there was very little dispersion towards the mean capital adequacy ratio.

Figure 4.2.1: Average Capital Adequacy Ratio of studied banks

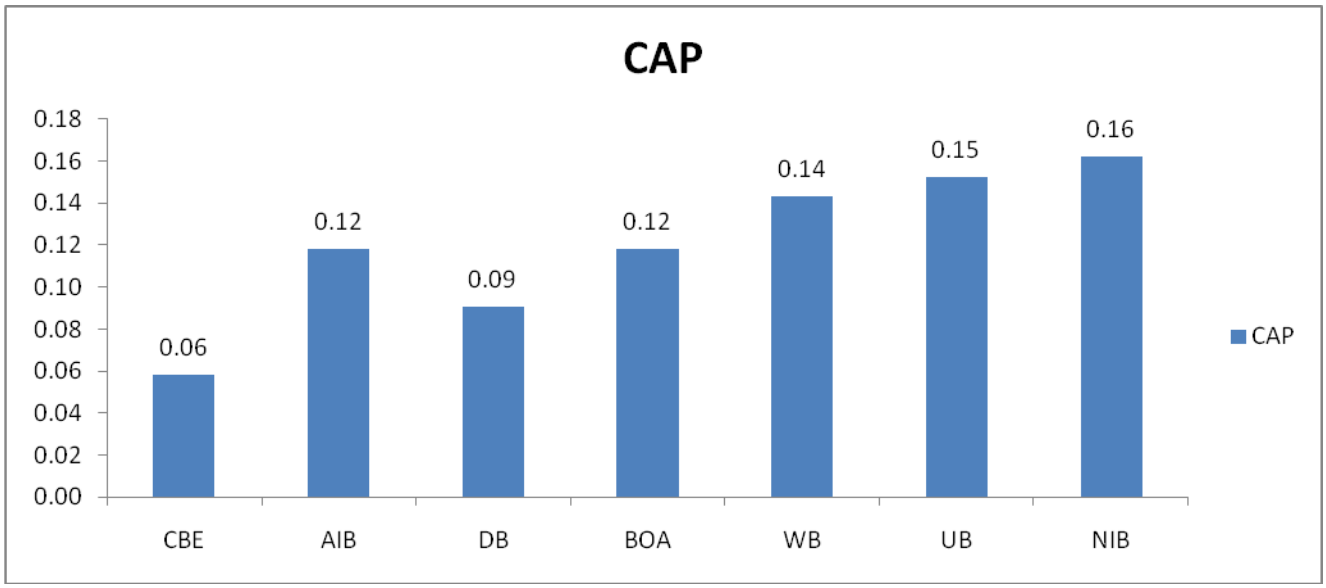


Source: Excel output from financial statements of sampled banks and own computation

The capital adequacy ratio reaches the minimum 10% in the year 2005. Starting from 2006, the average capital adequacy ratio shows consistent increasing trends up to 2015 with slight decrement in the year 2013. This indicates that private commercial banks have increased their capital by mobilizing funds from sale of additional shares and especially newly established banks make an effort to meet the increased minimum paid up capital requirement of 500 million set by the NBE on October 2011.

The following figure 4.2.2 shows the average capital adequacy ratio of the studied banks for the studied period. It reveals that, commercial bank of Ethiopia has shown the lowest average capital adequacy ratio of 6% and Nib International Bank shows the highest average capital adequacy ratio of 16% of the last fifteen years. It is also depicts that relatively oldest banks have lowest average capital adequacy ratio than the lately opened banks.

Figure 4.2.2: Average Capital Adequacy Ratio of each studied banks



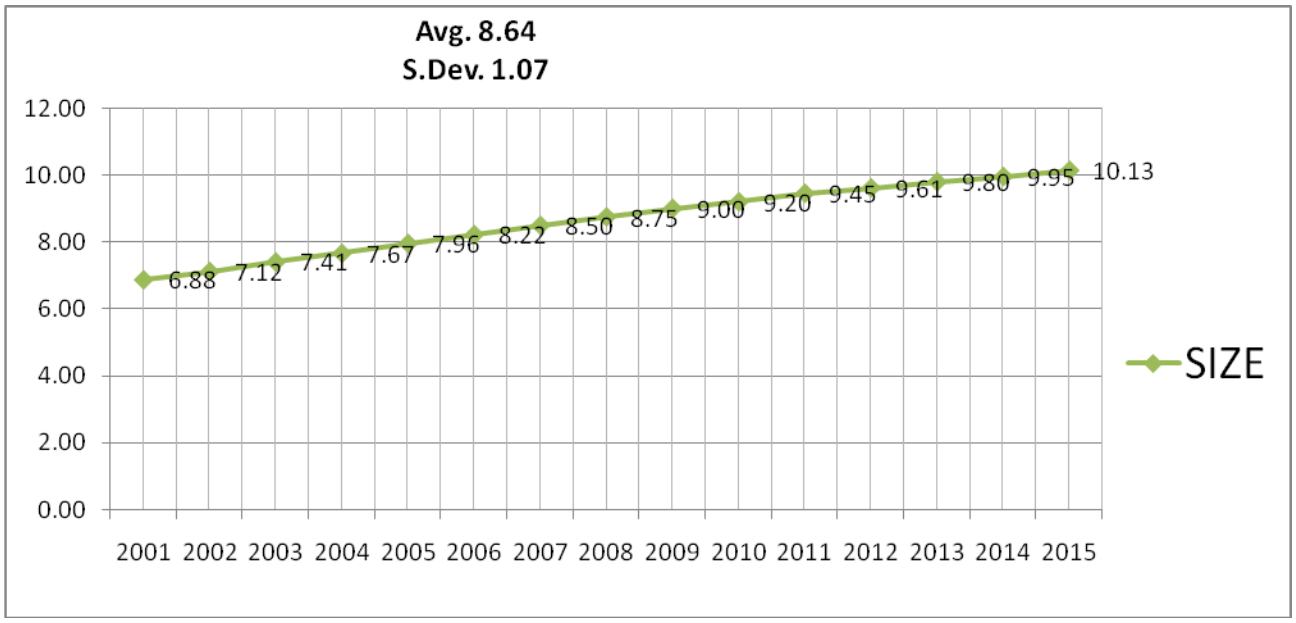
Source: Excel output from financial statements of sampled banks and own computation

Bank Size (SIZE)

Bank size is what a bank owns, including loans, reserves, investment securities, and physical assets or it is simply total asset a bank owns.. In this study, the proxy used to measure bank size was the natural logarithm of the total asset.

As it is shown in figure 4.2.3 below, the average total assets of Ethiopian selected commercial banks have shown consistent growth throughout the studied period. The standard deviation of 1.07 reveals that there was high dispersion of the average total asset of the banks with regard to its mean value. The mean value of bank size for the studied period was 8.64. The minimum value was recorded in the year 2001 which was the starting period of the study and the maximum value was recorded in the year 2015 which was the ending period of the study since the selected commercial banks shows consistent growth throughout the studied period

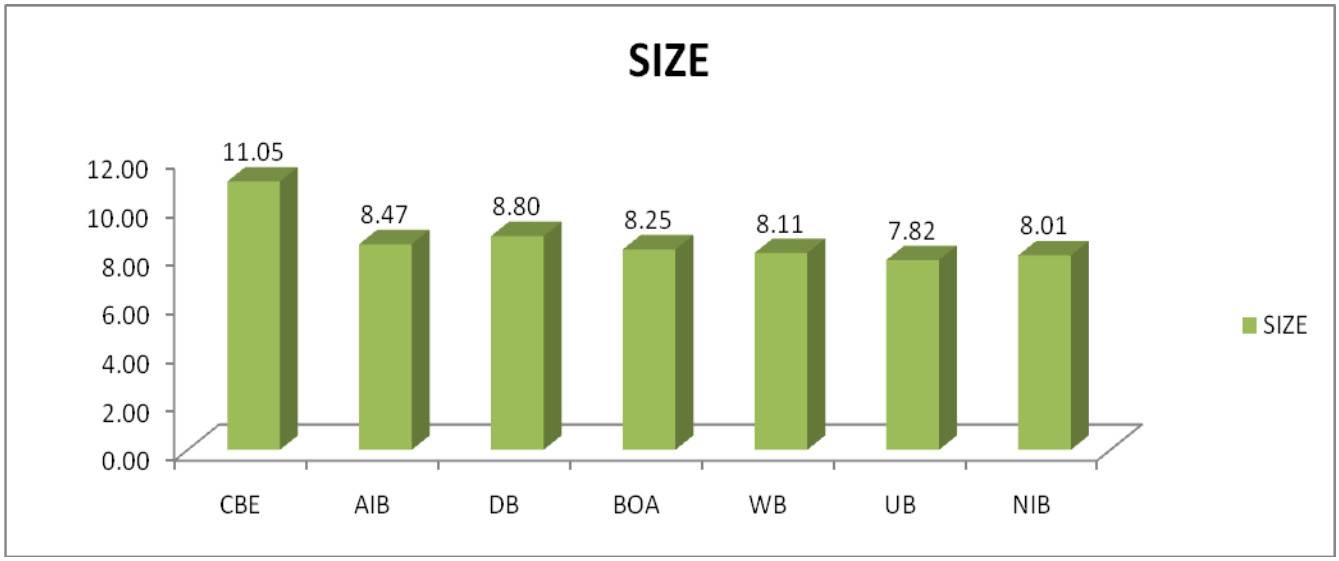
Figure: 4.2.3: Average natural logarithm of total asset of studied banks



Source: Excel output from financial statements of sampled banks and own computation

The following figure 4.2.4 shows the average natural logarithm of total asset of the studied banks for the studied period. It reveals that, commercial bank of Ethiopia has shown the highest average bank size of 11.05 and United Bank shows the lowest average bank size of 7.82 of the last fifteen years. It is also depicts that relatively oldest banks have highest average bank size than the lately opened banks in the studied period.

Figure: 4.2.4 Average natural logarithm of total asset of studied banks



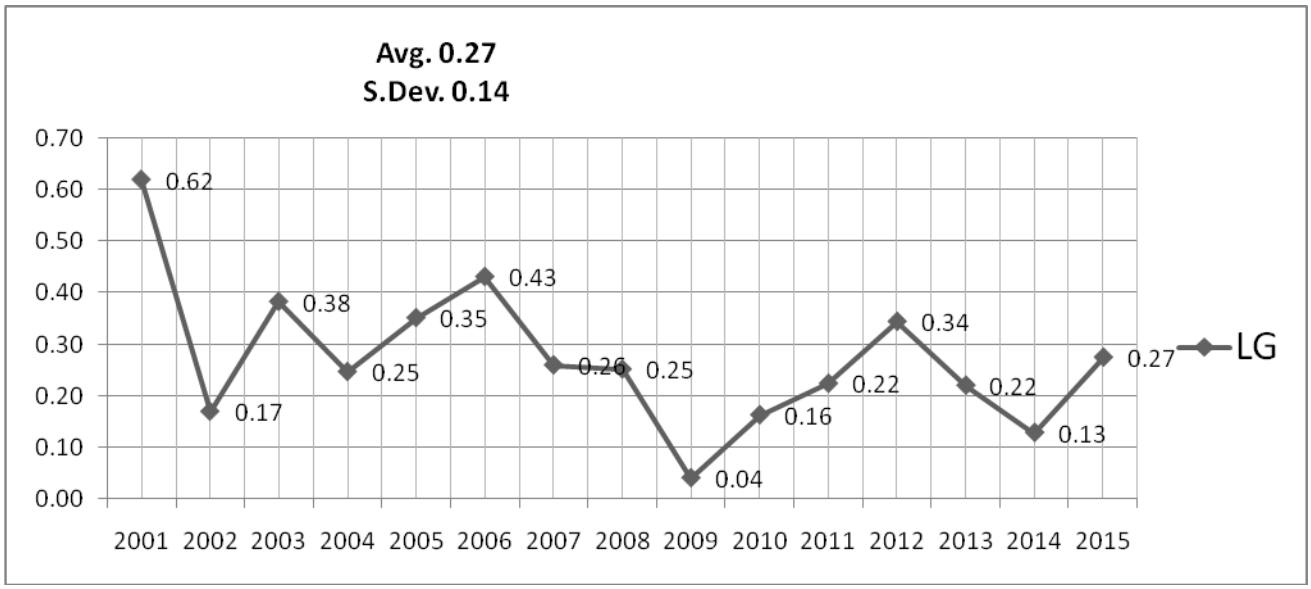
Source: Excel output from financial statements of sampled banks and own computation

Loan Growth Rate (LG)

The major role of commercial banks are its intermediation function in which a bank collects money on deposit from one group (the surplus unit) and funds it out to another group (the deficit unit). Hence, lending is the principal business activity for all commercial banks in Ethiopia and the loan portfolio is the largest asset and the predominate source of revenue. Loan growth is measured by the annual growth rate of total loans & advances of a bank.

As it is depicts in figure 4.2.5 below, the average loan growth rate of the studied banks was 27%. The maximum average loan growth rate was 62% which was registered in the year 2001 and the minimum average loan growth rate was 4% which was registered in the year 2009. The standard deviation of 14% indicates that there was high dispersion of the average loan growth rate towards its mean value. The average loan growth rate has decreased from 2006 onwards and reaches its minimum growth rate in the year 2009 and increase again until 2012.The upward/downward movement of the average loan growth rate tells us that the commercial banks were not shown consistent loan growth rate in the past fifteen years.

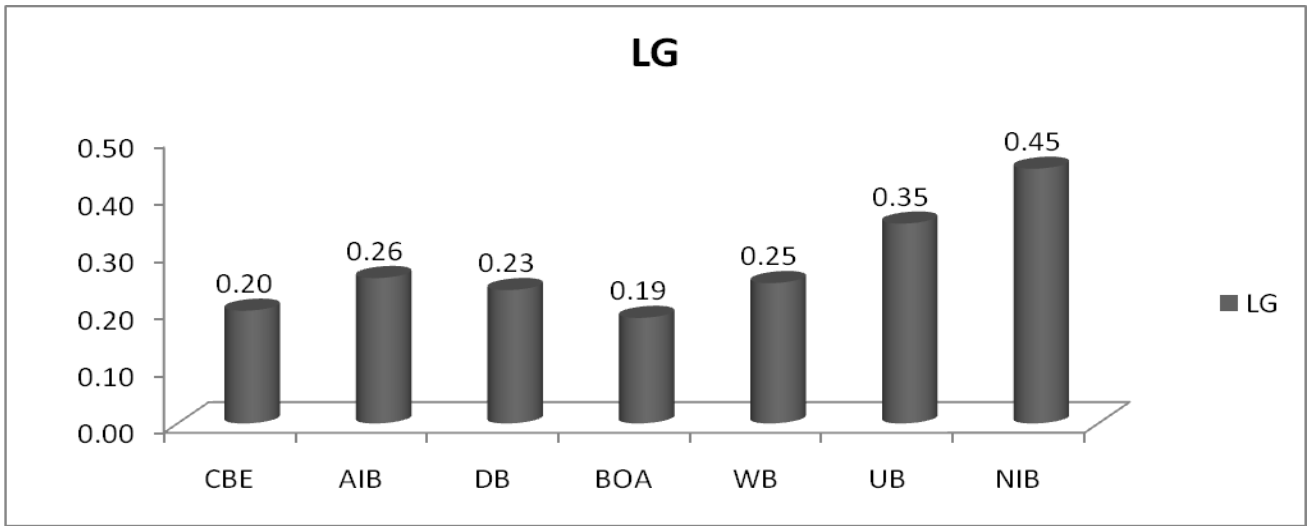
Figure 4.2.5 Average Loan Growth Rate of Studied Banks



Source: Excel output from financial statements of sampled banks and own computation

Figure 4.2.6 below shows that, on average Nib international bank has shown the highest loan growth rate of 45% that followed by United bank which has an annual growth rate of 35 % and Bank of Abyssinia has shown the lowest average loan growth rate of 19% and also followed by commercial bank of Ethiopia which is a growth rate of 20% during the studied period.

Figure 4.2.6 Average Loan Growth Rate of Each Studied Banks



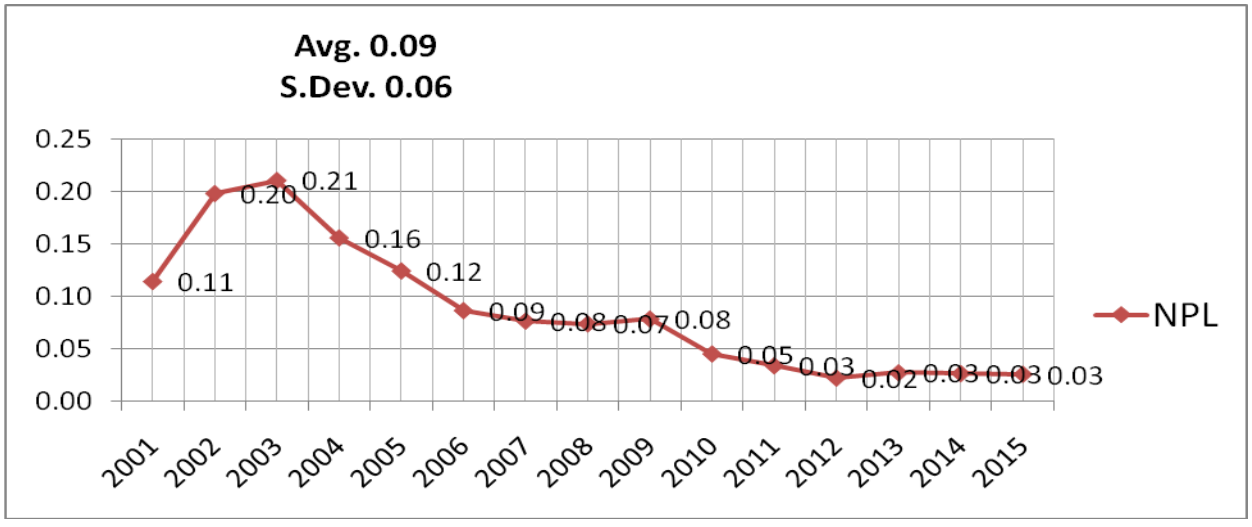
Source: Excel output from financial statements of sampled banks and own computation

Non-Performing Loans (NPL)

As it is putted on the literature review a Non-performing loan is a loan that is in default or close to being in default. Many loans become non-performing after being in default for 90 days, but this can depend on the contract terms. It is also defined by NBE, non-performing loan means loans & advances whose credit quality has deteriorated such that full collection of principal and/or interest in accordance with the contractual repayment term of the loan or advance is in question. In this study, NPL is measured by the share of non-performing loans from the total loans & advances of the bank. The National Bank of Ethiopia has provided direction to all commercial banks to maintain the NPL ratio below 5%.

Figure 4.2.7 below shows that, the average NPL ratio of the studied banks was 9% during the last fifteen years. The maximum average NPL ratio of 21% was recorded in the year 2003 and the minimum NPL ratio of 2% was recorded in the year 2012. As it is shown in the figure, the average NPL ratio has shown consistent decrement from 2003 up to the year 2015 with the slight increment in 2009 and a slight over decrement in 2012. The result indicates that the asset quality of the studied commercial banks has shown improvement and tries to meet NBE directive that the average NPL is not more than 5% from 2010 onwards with average NPL ratio of below 5%. On the other hand, the standard deviation of 6% reveals there is little dispersion on NPL ratio from its mean.

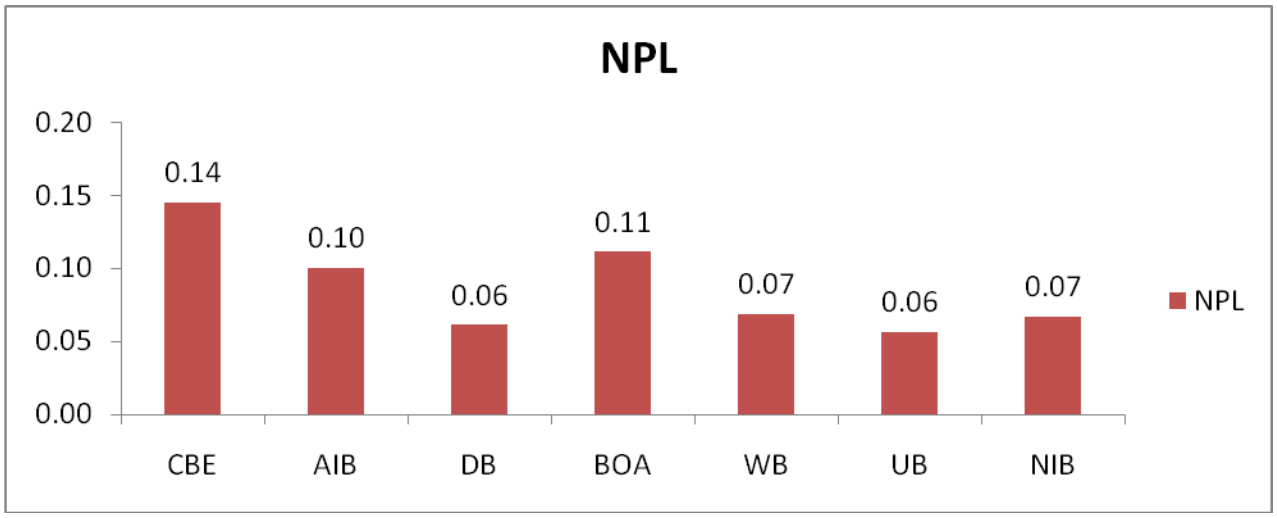
Figure 4.2.7: Average NPL Ratio of Studied Banks



Source: Excel output from financial statements of sampled banks and own computation

The following figure shows the average NPL ratio of each studied banks for the period from 2001 to 2015. As it is shown below, among the studied banks, commercial Bank of Ethiopia has on average 14% NPL ratio followed by Bank of Abyssinia which has on average 11% NPL ratio. On the other hand, Dashen Bank and United Bank have shown the lowest NPL ratio of 6% during the last fifteen years.

Figure 4.2.8: Average NPL Ratio of Each Studied Banks



Source: Excel output from financial statements of sampled banks and own computation

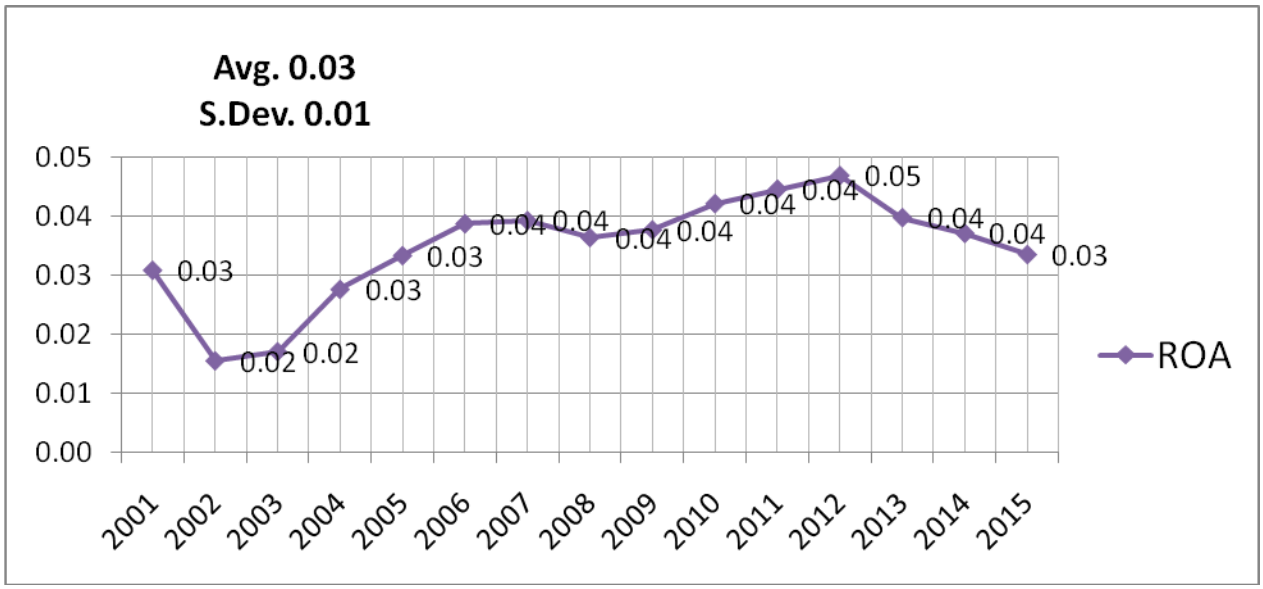
Profitability (ROA)

Profitability is a measure of the amount by which a company's revenues exceeds its relevant expenses. Profitability can be measured by return on asset (ROA) and return on equity (ROE). While for the purpose of this study, it was measured by the return on asset and the return on asset was measured by the ratio of net profit before tax to total asset.Net profit before tax was used in order to avoid the impact of different period's tax rate on the net profit of the bank.

Figure 4.2.9 below, shows that the average return on asset of studied banks for the period from 2001 to 2015 was 3%. The minimum return on asset of 2% was registered in the year 2002 and the maximum return on asset of 5% was registered on the year 2012. The figure depicts that the average return on asset shows consistent incremental trends from 2002 to 2012 with slight decrement in the year 2008 and 2009 and then a consistent decrement from 2012 onwards up to 2015. On the other

hand the standard deviation of 1% reveals that there was very little dispersion of average return on asset of studied banks towards their mean value.

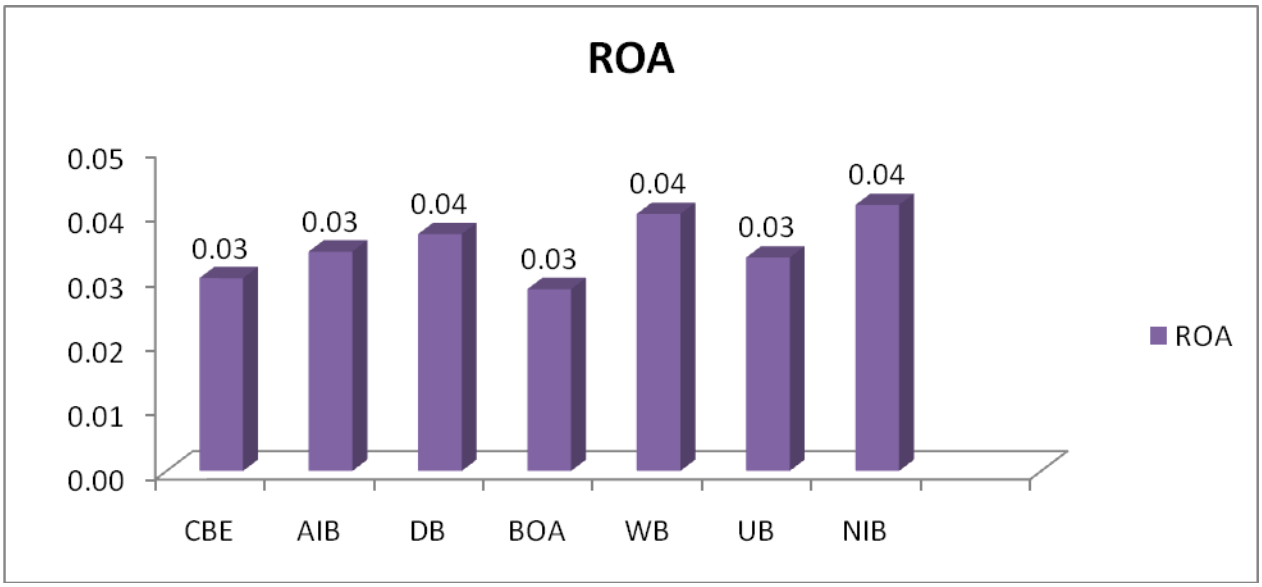
Figure 4.2.9: Average Return on Asset of Studied Banks



Source: Excel output from financial statements of sampled banks and own computation

Figure 4.2.10 below, shows that, the average ROA ratio of each studied banks was 3% and 4% that makes there is no as such major difference between the studied banks. However, the graph shows Bank of Abyssinia has shown the lowest average ROA which is nearly equals to 3% and Wegagen Bank and Nib International bank have shown the highest ROA ratio which is nearly equals to 4%.Though the net profit of older banks were higher in magnitude than newly opened banks, equivalently the total asset of the older banks was higher and as a result the ratio of ROA has not shown significant difference between the studied banks.

Figure 4.2.10: Average Return on Asset of Each Studied Banks



Source: Excel output from financial statements of sampled banks and own computation

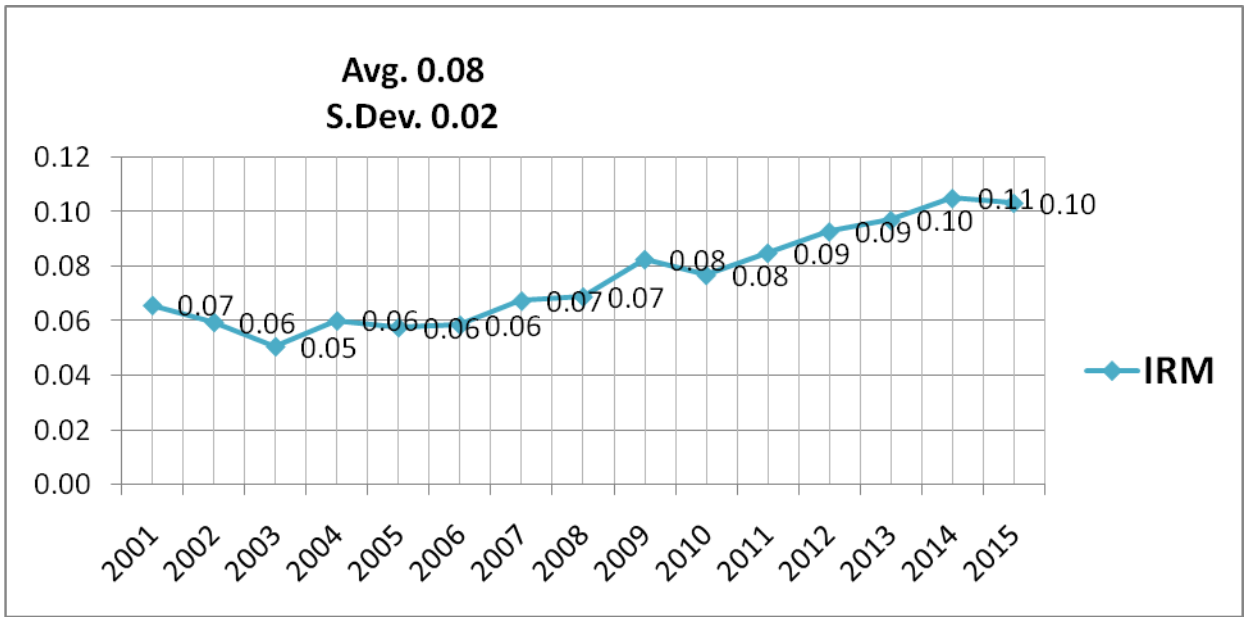
Interest Rate Margin (IRM)

Interest rate margin is the amount of interest rate paid by borrowers that force liquidity holders to part it. Interest rate margin in this study is computed by the difference between the interest earned on loans & advances as a fraction of total loans & advances and the interest paid out on deposit as a fraction of total deposits. The interest rate for loans and advances is freely determined by the board of directors of each bank and as a result banks have different lending interest rate. The interest rate margin depicts the net interest earned from intermediation activities of the bank.

The following figure shows the average IRM of studied banks for the period from 2001 to 2015. The following figure depicts that the average interest rate margin has shown an incremental trend form the year 2003 to 2015 with slight decrement in the year 2010 and 2015. The minimum and maximum interest rate margin was recorded in the year 2003(5%) and 2014(11%) respectively. The standard deviation of 2% reveals that there is little dispersion of the average interest rate margin from its mean value of 8% from 2001 to 2015.

The following figure shows the average IRM ratio of the studied banks for the period from 2001 to 2015.

Figure 4.2.11: Average Interest Rate Margin of Studied Banks



Source: Excel output from financial statements of sampled banks and own computation

As it shown in figure 4.2.12 above, the minimum average IRM of each studied banks for the period from 2001 to 2015 was 7% and the maximum average IRM was 9%. The minimum IRM was registered by Dashen bank, Awash International Bank, United Bank and Nib international bank with 7% and the maximum average IRM ratio was registered by commercial Bank of Ethiopia with 9% followed by Wegagen bank and bank of Abyssinia with 8%.

Figure 4.2.12: Average IRM of Each Studied Banks

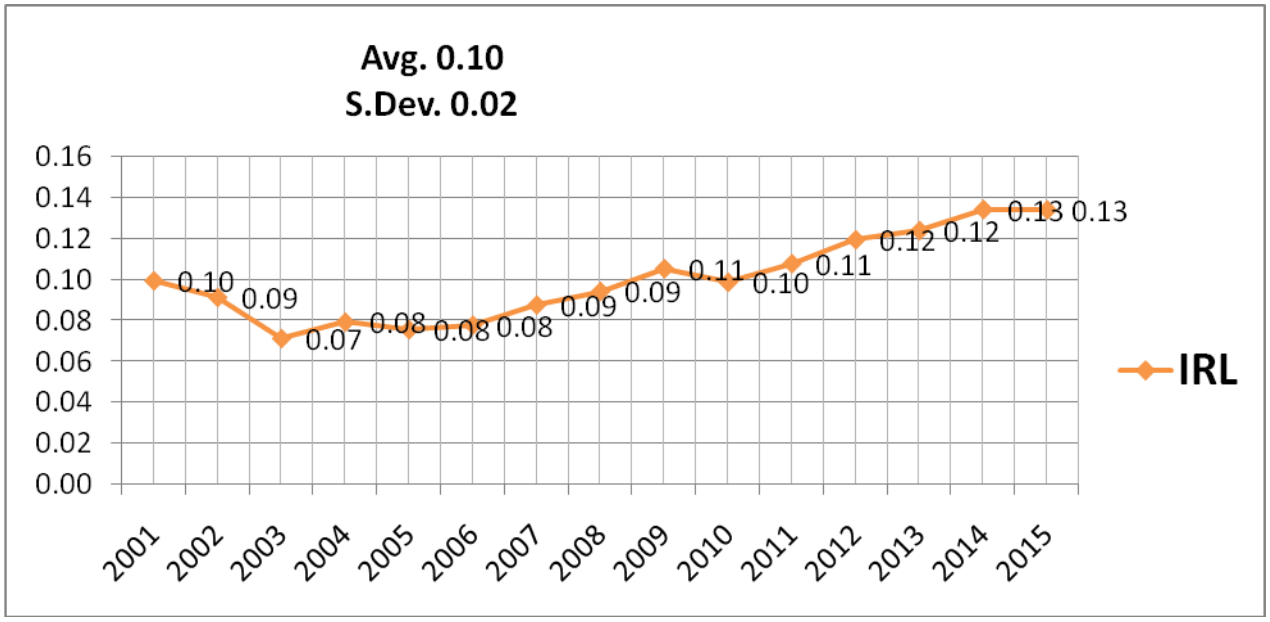
Source: Excel output from financial statements of sampled banks and own computation

Interest Rate on Loans & Advances (IRL)

This ratio is measured by the interest earned on loans & advances as a fraction of total loans & advances. This variable was included in the model in order to test the relationship of interest on loans & advances to the liquidity of the bank.

Figure 4.2.13 below, shows that the average interest rate on loans of studied banks for the period from 2001 to 2015 was 10%. The minimum average interest rate on loans and advances was recorded in the year 2003 which was 7% with consistent increment until 2015 with a slight decrement in 2010 and the maximum average interest rate on loans and advances was recorded in the year 2014 which was 13%. The standard deviation of 2% reveals that there is little dispersion of the average interest rate on loans from its mean value.

Figure 4.2.13: Average Interest rate on loans & advances of Studied Banks

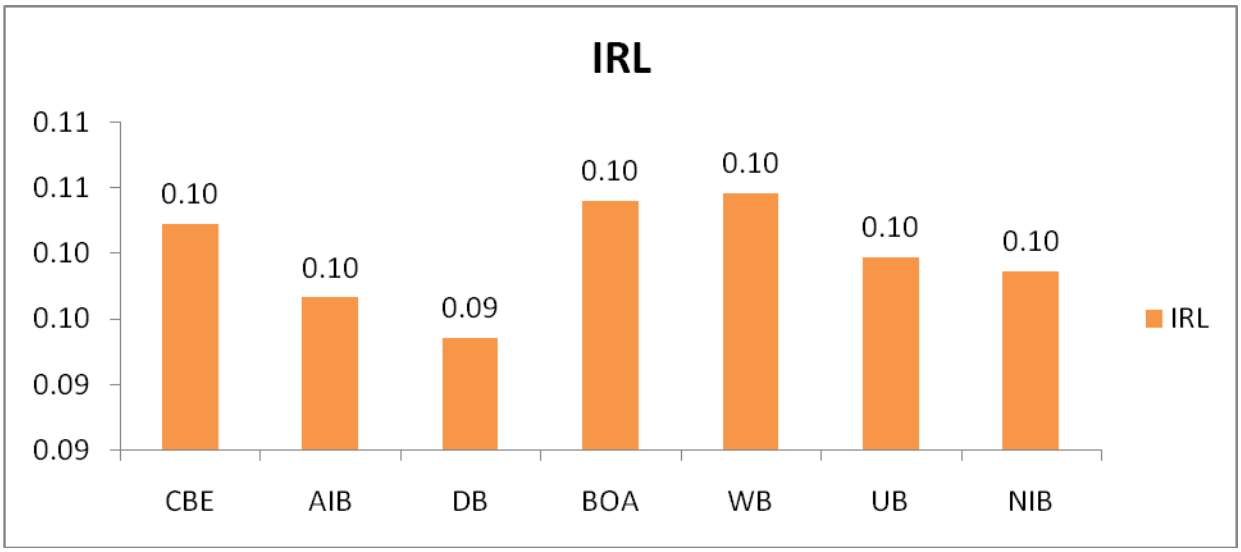


Source: Excel output from financial statements of sampled banks and own computation

As it shown in figure 4.2.14 below, the minimum average IRL of each studied banks for the period from 2001 to 2015 was 9% and the maximum average IRL was 10%. The minimum IRl was registered by Dashen bank and the maximum average IRL ratio was registered by all the other studied banks that are commercial Bank of Ethiopia, Awash international bank, Bank of Abyssinia,

United bank, Wegagen bank and Nib international bank. This indicates almost all commercial banks in Ethiopia have similar average IRL that was 10%.

Figure 4.2.14: Average Interest rate on loans & advances of each studied Banks



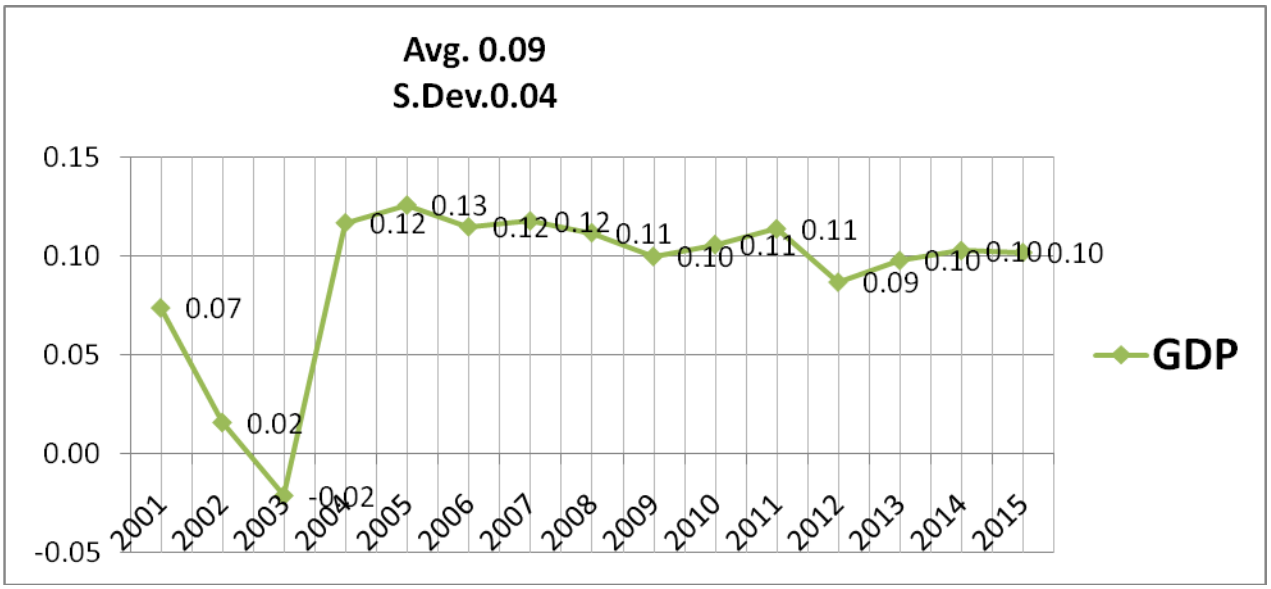
Source: Excel output from financial statements of sampled banks and own computation

Gross Domestic Product (GDP)

Gross Domestic Product (GDP) is an indicator of the economic health of a country, as well as the gauge of a country's standard of living. It is the measurement of level of economic activity of a country. For the purpose of this study, GDP is measured by the annual real growth rate of gross domestic product.

As it is shown in Figure 4.2.15 below, the average GDP growth rate of Ethiopia for the last fifteen years was 9%. The maximum real GDP growth rate was recorded in the year 2005 (i.e. 13%) and the minimum GDP which was also negative growth rate was recorded in the year 2003 (i.e. -2%). As it is shown in figure 4.2.15, the country has recorded on average a double digit (above10%) growth rate from 2004 onwards except for the year 2012 which was 9%. The standard deviation of 0.04 also indicates that there was little dispersion on the real GDP growth rate towards its mean.

Figure 4.2.15: Average Gross Domestic Product



Source: Excel output from NBE report and own computation

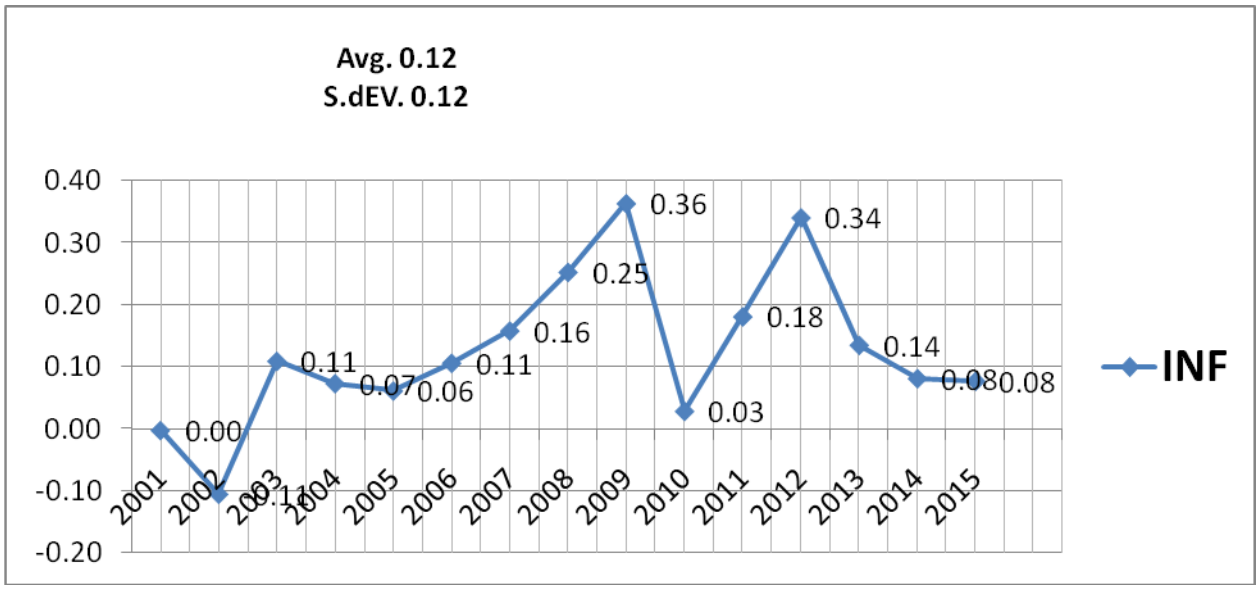
Inflation Rate (INF)

Another important macroeconomic variable which may affect liquidity of banks is the inflation rate. Inflation reflects a situation where the demand for goods and services exceeds their supply in the economy or the purchasing power of money become weak when compare with other notes other things are the same. During inflation, the central bank can raise the cost of borrowing and reduce the credit creating capacity of commercial banks. During inflation, it is expected that, banks will make fewer loans and the amount of liquid or short term assets held by economic agents including banks will rise. On the other hand, during inflation the cost of living will rise and deposits are expected to be reduced and as a result liquidity will be affected negatively.

Figure 4.2.16 below shows that, the mean value of the general inflation rate of Ethiopia over the past fifteen years was 12%, which was more than that of the average real GDP growth rate, interest rate margin as well as interest rate on loan which was basic for liquidity. The maximum inflation rate was recorded in the year 2009 (i.e. 36%) followed by the year 2012(34%) and the minimum inflation rate which was also negative was recorded in the year 2002 (i.e. -11%). As it is shown in the figure, the inflation rate was shown consistent increment from 2005 and reaches its maximum in the year

2009.The rate of inflation was highly dispersed over the periods under study towards its mean with standard deviation of 12%.

Figure 4.2.16: Average Inflation Rate



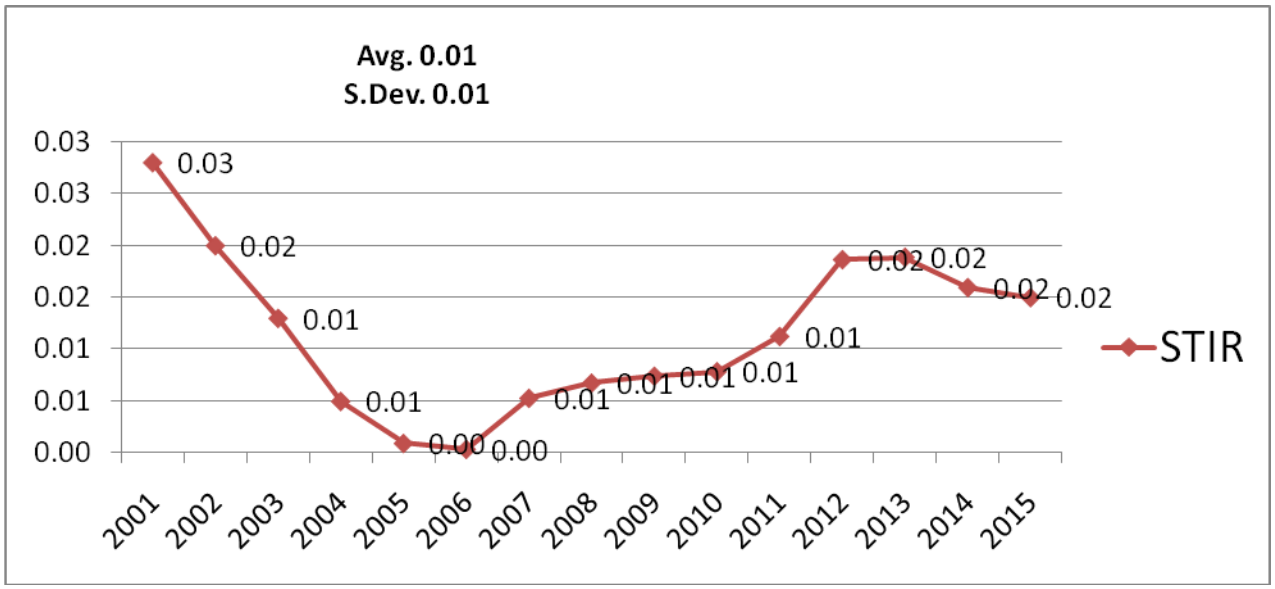
Source: Excel output from NBE report and own computation

Short Term Interest Rate (STIR)

Short term interest rate is the rate paid on money market instruments that have less than one year maturity. The most popular money market instrument (securities) in Ethiopia is Treasury bills. Treasury bills are the most important since they provide the basis for all other domestic short term interest rates. The higher short term interest rate induces banks to invest more in the short term instruments and enhance their liquidity position. In this study the proxy for short term interest rate is the annual weighted average interest rate of Treasury Bills.

As it is shown in figure 4.2.17 below, the average short term interest rate has declining from 2001 and reach the minimum rate in the year 2006 which was zero. From 2007 onwards the average short term interest rate has shown upward movement up to the year 2013 and there was slight downward movement in the year 2014 & 2015. The maximum short term interest rate was recorded in the year 2001(i.e. 3%) followed by the year 2002 which was 2%. The standard deviation of 1% refers there was very little dispersion towards its mean value.

Figure 4.2.17: Average Short Term Interest Rate



Source: Excel output from NBE report and own computation

4.1.3 Descriptive Statistics of the Data

This section provides the descriptive statistics of dependent and independent variables which helped to have the overall look at variables being studied. It indicated the result of all variables calculated as mean, median, standard deviation, minimum and maximum values with the number of observations under the study was demonstrated in tabular form.

Hence, table 4.1.1 below presented the descriptive statistics values of the study variables that were both dependent and independent variables for the study period and all variables comprised 105 observations. The study used the dependent variables are liquidity measured by liquid asset to deposit and short term borrowing ratio/L1, liquid assets to total assets ratio/L2 and loans to deposits and short term financing ratio/L3 and ten independent variables were included both bank specific and macro economic variables. Bank specific variables were capital adequacy, bank size, loan growth, nonperforming loan, profitability, interest rate margin and interest rate on loans while the remaining three variables; gross domestic product, inflation rate, and short term interest rate were macro economic variables of the study. Mean value shows the average value of all sampled banks in each variable; whereas the minimum and maximum values of each variable from all sampled banks were shown in the minimum and maximum statistics respectively. Sample variation from the mean was

shown in the standard deviation statistics which is the square root of variance and normally good if it is low.

Table 4.1.1 Descriptive statistics of the variables

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
L1	0.457	0.446	0.782	0.104	0.154	105
L2	0.349	0.347	0.594	0.082	0.115	105
L3	0.673	0.635	1.055	0.298	0.166	105
CAP	0.120	0.118	0.294	0.037	0.045	105
SIZE	8.643	8.695	12.628	5.366	1.474	105
LG	0.274	0.225	2.559	-0.123	0.291	105
NPL	0.087	0.058	0.520	0.006	0.086	105
ROA	0.035	0.038	0.057	-0.023	0.013	105
IRM	0.075	0.071	0.131	0.038	0.020	105
IRL	0.100	0.098	0.151	0.060	0.022	105
GDP	0.091	0.103	0.126	-0.021	0.040	105
INF	0.124	0.106	0.364	-0.106	0.120	105
STIR	0.012	0.011	0.028	0.000	0.008	105

Source: E-views8 output from financial statements of sampled banks and own computation

Liquidity measures the ability of commercial bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses. The mean value of L1 was 45.7% that was above the NBE requirement As per NBE directive number SBB/57/2014 issued by the National Bank of Ethiopia, any licensed commercial banks are required to maintain liquid asset of not less than fifteen percent (15%) of its net current liabilities (which includes the sum of demand deposits, saving deposits, time deposits and similar liabilities with less than one-month maturity). The standard deviations of 15.4% show little dispersion of liquid assets to deposit and short term borrowing ratio from its mean for the commercial banks in Ethiopia. The maximum and minimum value of L1 was 78.2% and 10.4% respectively. And hence, the maximum value of L1 was recorded by CBE on the year 2007 and the minimum value of L1 was also recorded by CBE on the year 2015.

The mean value of L2 was 34.9% that was above the NBE requirement before January, 2012 (i.e. 25% (Addis Fortune January 2012)). The standard deviations of 11.5% show little dispersion of

liquid assets to total assets ratio from its mean for the commercial banks in Ethiopia. The maximum and minimum values of L1 were 59.4% and 8.2% respectively. And hence, the maximum value of L2 was recorded by CBE on the year 2004 and the minimum value of L2 was also recorded by CBE on the year 2015.

The mean value of L3 was 67.3% that is slightly lower than the international standard for loans to deposit ratio (i.e. 75% (CBRC 2012)). This indicates on average for the commercial banks in Ethiopia lower amount of volatile liabilities/deposits were tied up with higher deposit and short term borrowings than loans that was given. There was medium dispersion of L3 towards its mean value among banks that is shown by the standard deviation of 16.6%. The maximum value of L3 was 105.5% which is far above the standard whereas the minimum value was 29.8% which is far below the standard. This indicates that there were some commercial banks in Ethiopia having extra liquidity (banks around 30% L3) and others were going to face liquidity shortages/risk (banks around 106% L3). Therefore, it can be concluded that loans to deposit and short term borrowing ratio was highly dispersed among commercial banks in Ethiopia. And hence, the maximum value of L3 was recorded by BOA on the year 2001 and the minimum value of L3 was recorded by CBE on the year 2007.

Among the bank specific independent variables as a proxy for capital adequacy, the ratio of equity to total assets was used. Hence, according to table 4.1.1 the mean value of capital adequacy was 12%. This indicated that from the total asset only 12% was covered by equity share holders whereas the remaining 88% was covered/ financed by external funds. This implies that as there is high dependency on external funds that arises from higher deposit mobilization. Also the mean value of 12% was above the international standard for capital adequacy i.e. 8% (Reporter, 13 March 2010) with the maximum and minimum values of 29.4% and 3.7% respectively. And hence, the maximum value of CAP was recorded by UB on the year 2001 and the minimum value of CAP was recorded by CBE on the year 2002.The standard deviation for capital adequacy was 4.5% revealed that there was little dispersion towards the mean among commercial banks in Ethiopia. In general, although the bank with minimum capital adequacy ratio of 3.7% would be exposed to liquidity risk, the capital adequacy of Ethiopian commercial banks was at a good position since the mean capital ratio of 12% was more than the National Bank of Ethiopia (NBE) requirement.

The size of banks was measured by natural logarithm of total asset (Ln(TA)) which has the mean value of 8.643 and the standard deviation from the mean was 1.474 which revealed some variation from its mean. Since, natural logarithm is used to reduce the variation of maximum and minimum

value; the values were 12.628 and 5.366 respectively. And hence, the maximum and minimum value pertains to CBE on the year 2015 and UB on the year 2001 respectively. In terms of bank size CBE outweigh some private banks more than 100%.

The mean value of the variable loan growth was 27.4% with maximum and minimum values of 255.9% and -12.3% respectively. And hence, the maximum and minimum value pertains to NIB on the year 2001 and CBE on the year 2003 respectively. In terms of loan growth commercial banks in Ethiopia were highly different with the standard deviation of 29.1%.

The other bank specific factor affecting liquidity of commercial banks was NPL that measures the asset/loan quality of banks. The mean value of the percentage of non-performing loans in the total amount of loans and advances to customers/NPL was 8.7% that is above the NBE requirement of not more than 5% in recent years and the maximum and minimum average value of NPL was 52% and 0.6% respectively. The 0.6% minimum value of NPL was for CBE bank on the year 2012. The maximum value of 52% indicates the presence of high credit risk in some of the banks. The maximum value of NPL was recorded by CBE on the year 2003. There was moderate dispersion of NPL among banks in Ethiopia that is shown by the standard deviation of 8.6%.

Return on asset (ROA) was used to proxy profitability of commercial banks which was the ratio of net income before tax to the total asset. The mean value or average return on asset of selected banks over a period between 2001 up to 2015 was 3.5%, which means that per one birr investment a bank generates 3.5% cents profit before tax between years from 2001 up to 2015. The maximum and minimum values were 5.7% and -2.3% respectively. And hence, the maximum value of ROA was recorded by WB on the year 2011 and the minimum value of ROA was recorded by CBE on the year 2002.The most profitable observation of 5.7% indicated that a bank generates 5.7% cents return per one birr investment whereas the least profitable observation of -2.3%, indicated that a loss of 2.3 cents per one birr investment. The standard deviation of 1.3% implies that there was little variation in profitability among Ethiopian commercial banks.

The other bank specific factors were related with interest rate that are interest rate margin (the difference between annual average lending and deposit rate) and short term interest rate (the annual weighted average interest rate on Treasury bill). The mean value of the interest rate margin over the period under study was 7.5% with the maximum and minimum values of 13.1% and 3.8%

respectively. And hence, the maximum and also the minimum value pertain to CBE on the year 2015 and 2002 respectively. There was little variation of interest rate margin towards its mean value over the periods under study with the value of standard deviation 2%.

The last dependent factor in this research is interest rate on loans. It is gained by dividing total loans and advances to interest revenue on the same year. The mean value of interest rate on loans over the period from 2001 to 2015 was 10% with the maximum and minimum values of 15.1% and 6% respectively. And hence, the maximum and also minimum value like IRM pertains to CBE on the year 2015 and 2002 respectively. There was little variation of interest rate margin towards its mean value over the periods under this study with the value of standard deviation 2.2%.

The remaining independent variables were the macroeconomic indicators (i.e. GDP, inflation and short term interest rate) that can affect banks liquidity position over time. The mean value of real GDP growth rate was 9.1% indicating the average real growth rate of the country's economy over the past 15 years. The maximum growth of the economy was recorded in the year 2005 (i.e. 12.6%) and the minimum was in the year 2003 (i.e. -2.1%). Since the year 2004 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 4%.

The general inflation rate (i.e.12.4%) of the country on average over the past fifteen years was more than the average GDP. The maximum inflation was recorded in the year 2009 (i.e. 36.4%) and the minimum was in the year 2002 (i.e. -10.6%). The rate of inflation was highly dispersed over the periods under study towards its mean with standard deviation of 12%.

The other macroeconomic factors were related with short term interest rate. On average the short term interest rate was 1.2% with maximum rate of 2.8% in the year 2001 and the minimum rate of 0.0004%(almost zero) in the year 2006. There was also little dispersion of short term interest rate towards its mean over the periods under study with standard deviation of 0.8%.

4.2 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 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) and a correlation coefficient of zero, indicates that there is no linear relationship between the two variables.

According to Brooks (2008), if it is stated that *y* and *x* are correlated, it means that *y* and *x* are being treated in a completely symmetrical way. Thus, it is not implied that changes in *x* cause changes in *y,* or indeed that changes in *y* cause changes in *x* rather, it is simply stated that there is evidence for a linear relationship between the two variables, and that movements in the two are on average related to an extent given by the correlation coefficient. Table 4.2.1 below, shows the correlation coefficient between the dependent variables and independent variables.

Table 4.2.1: Correlation matrix of the dependent and independent variables

	L1	**L2**	**L3**	**CAP**	**SIZE**	**LG**	**NPL**	**ROA**	**IRM**	**IRL**	**GDP**	**INF**	**STIR**
L1	1			0.138	-0.236	-0.204	0.367	0.004	-0.290	-0.343	-0.039	0.121	-0.287
L2		1		-0.038	-0.185	-0.289	0.420	-0.067	-0.319	-0.370	-0.002	0.129	-0.339
L3			1	0.473	-0.800	0.456	-0.029	-0.039	-0.583	-0.457	-0.208	-0.244	-0.006

Source: E-views8 output from financial statements of sampled banks and own computation

According to table 4.2.1 above, capital adequacy, non-performing loans, profitability and inflation are positively correlated with L1 with correlation coefficient of 0.138, 0.367, 0.004 and 0.121, respectively. While bank size, loan growth, interest rate margin, interest rate on loans GDP and short term interest rate are negatively correlated with L1 with correlation coefficient of -0.236, -0.204, -0.290, -0.343, -0.039 and -0.287 respectively. The linear relationship between profitability and L1 was statistically not different from zero. Nonperforming loan has shown the highest positive coefficient of 0.0.367 and interest rate on loans has shown the highest negative coefficient of -0.343 with respect to L1 while profitability (ROA) shows the lowest positive coefficient of 0.004 and GDP has shown the lowest negative coefficient of 0.039 in relation with L1.

Non-performing loans and inflation were positively correlated with L2 with 0.420 and 0.129 correlation coefficient, respectively. Capital adequacy, bank size, loan growth, interest rate margin, interest rate on loans and short term interest rate have negatively correlated with L2 with correlation coefficient of -0.038,-0.185,-0.289,-0.067,-0.319,-0.370,-0.002 and -0.339. The linear relationship between GDP and L2 was statistically not different from zero. Nonperforming loan like again L1 has shown the highest positive coefficient of 0.0.420 and interest rate on loans like again L1 has shown the highest negative coefficient of -0.370 with respect to L2 while inflation shows the lowest positive coefficient of 0.129 and GDP like again L1 has shown the lowest negative coefficient of 0.002 in relation with L2.

With regard to the third liquidity ratio (L3), the relation have to be interpreted in the reverse direction in which positive sign of the coefficient means negative linear relationship with liquidity and negative sign of the coefficient means positive linear relation with liquidity. There is a positive linear relation between L3 and Capital adequacy and loan growth with correlation coefficient of 0.473 and 0.456, respectively. Bank size, nonperforming loan, profitability, interest rate margin, interest rate on loans, gross domestic product, inflation and short term interest rate have negatively correlated with L3 with correlation coefficient of -0.800,-0.029,-0.039,-0.583,-0.457, -0.208,-0.244 and -0.006 respectively. The linear relationship between short term interest rate and L3 was statistically not different from zero. Among the independent variables, bank size has the highest negative correlation coefficient of -0.800 while capital adequacy has the highest positive correlation coefficient of 0.473 with L3. On the other hand, short term interest rate has the lowest negative correlation coefficient of -0.006 while loan growth has the lowest positive correlation coefficient of 0.456 with L3.

4.3. Testing the Classical Linear Regression Model (CLRM) Assumptions

In this section, the researcher carried out relevant diagnostic testing to identify for any violation of the underlining assumption of the classical linear regression model (CLRM). Five assumptions were made which ensures that the estimation technique, ordinary least squares (OLS), to have a number of desirable properties, and that hypothesis tests regarding the coefficient estimates could validly be conducted. Specifically, it was assumed that average values of the error-term is zero, the variance of the errors are constant (homoscedastic), the covariance between the error-terms are zero (no autocorrelation), the error-terms are normally distributed (normality) and explanatory variables are not correlated (absence of multicollinearity).

❖ **Testing for the Average value of the error-term is zero (E (ut) = 0) assumption**

The first CLRM assumption requires, the average value of the errors term should be zero. As per Brooks (2008), the first assumption required that the average value of the errors is zero (E (ut) = 0*)*. In fact, if a constant term is included in the regression equation, this assumption will never be violated. Therefore, since the constant term (i.e. α) was included in the regression equation, the average value of the error term in this study was expected to be zero.

❖ **Testing for the variance of the error-term is constant**
(Test for homoscedasticity assumption (Var (ut) = σ2))

The second assumption of CLRM is that, the variance of the error-term is constant; this is known as the assumption of homoscedasticity. If the errors do not have a constant variance or if the residual of the regression have systematically changing variability over the sample, they are said to be heteroscedastic means the estimated parameter will not be BLUE because of the inefficient parameter. To test the homoscedasticity assumption the White's test was applied having the null hypothesis of heteroscedasticity. Both F-statistics and Chi-square (χ2) tests statistics were applied to decide whether to reject the null hypothesis by comparing p-value with significant level. The following table shows E-views results for heteroscedasticity of the three dependant variables.

Table .4.3.1: Heteroskedasticity Test: white test results

	Liquidity 1(L1)	**Liquidity 2(L2)**	**Liquidity 3(L3)**
F-statistic	2.074471	1.880214	1.485270
Prob. F(65,39)	0.0709	0.0179	0.0927
Obs*R-squared	81.44394	79.59897	74.78808

Prob. Chi-Square(65)	0.0818	0.1051	0.1903
Scaled explained SS	51.93071	63.42367	44.78351
Prob. Chi-Square(65)	0.8798	0.5322	0.9738

***Source**: extracted from E-Views8 results*

In the case of L1, L2 and L3 both the *F*- and $\chi 2$ -test statistic give the same conclusion that there is evidence for the absence of heteroscedasticity. Since the *p*-values in all of the cases were above 0.05, the null hypothesis of heteroscedasticity should be rejected (appendix 4). The third version of the test statistic, 'Scaled explained SS', which as the name suggests is based on a normalized version of the explained sum of squares from the auxiliary regression, also give the same conclusion. Generally, in all of the regression models used in this study it was proved that the variance of the error term is constant or homoscedastic and we had sufficient evidence to reject the null hypothesis of hetroscedasticity.

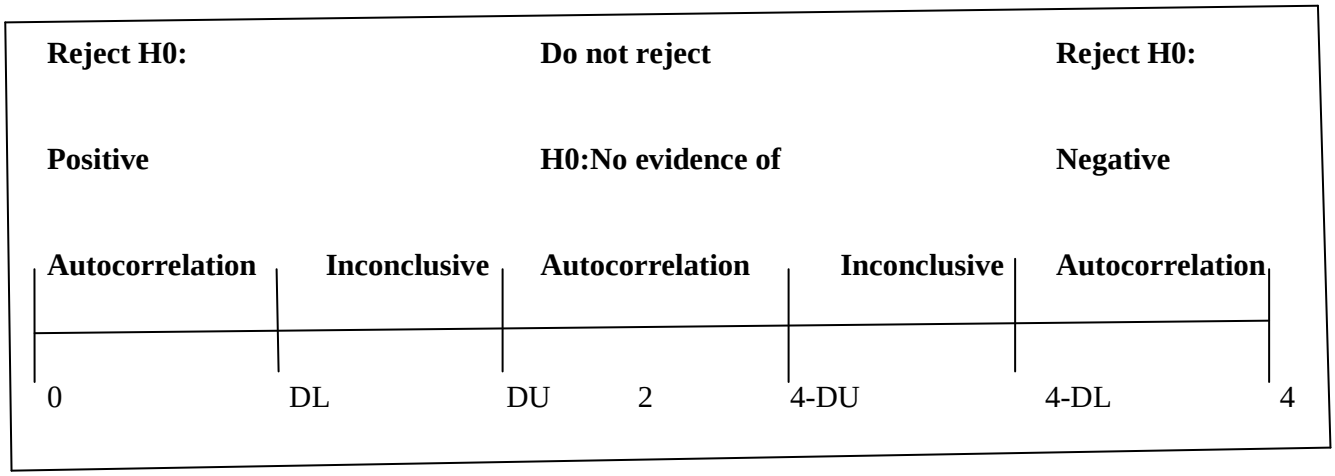
- **Testing for the covariance between the error-terms are zero-(no autocorrelation)**

Assumption three of the CLRM requires absence of autocorrelation or the covariance between the error terms is zero. In other words, it is assumed that the errors are uncorrelated with one another. If the errors are not uncorrelated with one another, it would be stated that they are 'auto correlated' or that they are 'serially correlated'.

The first step in testing whether the error series from an estimated model are auto correlated would be to plot the residuals and looking for any patterns. However, graphical methods are difficult to interpret in practice and hence a formal statistical test should also be applied. The simplest test is due to Durbin and Watson (1951). Durbin-Watson (DW) is a test for first order autocorrelation - i.e. it tests only for a relationship between an error and its immediately previous value *(ut = ρut−1 + vt).* DW is approximately equal to 2(1-p), where p is the estimated correlation coefficient between the error term and its first order lag (Brooks 2008).

According to Brooks (2008), the DW test does not follow a standard statistical distribution such as a *t, F, or χ2*. DW has 2 critical values: an upper critical value (*dU*) and a lower critical value (*dL)*, and there is also an intermediate region where the null hypothesis of no autocorrelation can neither be rejected nor not rejected. The rejection, non-rejection, and inconclusive regions are shown on the number line in figure 4.3.1 below

Figure 4.3.1: Rejection and non-rejection regions for DW test



The null hypothesis is rejected and the existence of positive autocorrelation presumed if DW is less than the lower critical value (dL); the null hypothesis is rejected and the existence of negative autocorrelation presumed if DW is greater than 4 minus the lower critical value (4-dL); the null hypothesis is not rejected and no significant residual autocorrelation is presumed if DW is between the upper critical value (dU) and 4 minus the upper critical limits (4-dU) (Brooks, 2008).

Therefore, The DW values of L1, L2 and L3 for 105 observations in this study are **1.879318**, **1.859064** and **1.949824,** respectively (Appendix 5). This revealed that there was no serious evidence of autocorrelation in the data since the DW test result approaches two (2) because as per Brook (2008) stated above there is no autocorrelation problem if the *DW* is near 2.

- **Test for Normality**

The fourth important diagnostic test conducted in this paper is the normality assumption. According to Brooks (2008), one of the most commonly applied test for normality is the Bera-Jarque (BJ) test. The entire distribution is characterized by the mean, variance, skewness and kurtosis. Skewness measures the extent to which a distribution is not symmetric to its mean value and kurtosis measures

how fat the tails of the distribution are (Brooks, 2008). Thus a normal distribution is not skewed and is defined to have a coefficient of kurtosis of three and a coefficient of excess kurtosis of zero. If the standardized residuals are normally distributed, the histogram should be bell-shaped and BJ statistic would not be significant. The p-value of the normality test should be bigger than 0.05 to not reject the null of normality at 5% level.

In this study, the researcher used BJ normality test to test the null hypothesis of normally distributed assumption. As shown in the histogram in the Appendix (6), kurtosis approaches to three which were 2.591176, 2.988368 and 2.49403 for L1, L2 and L3 respectively. On the other hand the p-value for the BJ test were 0.108942, 0.128226 and 0.409704 for L1, L2 and L3 respectively which is not significant even at 10% level of significant to reject the null hypothesis. Thus the result of the test implies that the data were consistent with a normal distribution assumption.

- **Test for Multicollinearity**

This is the other assumptions of CLRM and concerned with the existence of relationship between explanatory variables. If an independent variable is an exact linear combination of the other independent variables, then we say the model suffers from perfect collinearity, and it cannot be estimated by OLS (Brooks, 2008). The condition of multicollinearity exists where there is high, but not perfect, correlation between two or more explanatory variables (Cameron & Trivedi 2009; Wooldridge, 2006). Churchill & Iacobucci (2005) stated that when there is multicollinearity, the amount of information about the effect of explanatory variables on dependent variables decreases. As a result, many of the explanatory variables could be judged as not related to the dependent variables when in fact they are. This assumption does allow the independent variables to be correlated; they just cannot be perfectly correlated. If we did not allow for any correlation among the independent variables, then multiple regressions would not be very useful for econometric analysis.

Even if how much correlation causes multicollinearity is not clearly defined, there is an argument provided by different authors. Hair et al (2006) argue that correlation coefficient below 0.9 may not cause serious multicollinearity problem. Malhotra (2007) stated that multicollinearity problem exists when the correlation coefficient among variables is greater than 0.75. Kennedy (2008) suggests that any correlation coefficient above 0.7 could cause a serious multicollinearity problem leading to inefficient estimation and less reliable results. This indicates as there is no consistent argument on the level of correlation that causes multicollinearity.

Therefore, in this study correlation matrix for ten independent variables of the study shown below in the table 4.3.2 had been estimated. From the result of the following correlation matrix table, the highest correlation value of 0. 0.852005 was observed between interest rate on loans and interest rate margin, followed by the correlation value of 0.674708 between bank size and interest rate margin. Since there is no correlation value above 0.9 according Hair et al. (2006), hence it was possible to conclude that there was no multicollinearity problem in this study.

Table 4.3.2: Correlation Matrix of Explanatory Variables

	CAP	SIZE	LG	NPL	ROA	IRM	IRL	GDP	INF	STIR
CAP	1									
SIZE	-0.497	1								
LG	0.211	-0.314	1							
NPL	-0.266	-0.215	-0.265	1						
ROA	0.281	0.214	0.199	-0.622	1					
IRM	0.073	0.675	-0.212	-0.460	0.410	1				
IRL	0.186	0.522	-0.221	-0.466	0.344	0.652	1			
GDP	-0.053	0.332	-0.074	-0.468	0.521	0.291	0.202	1		
INF	-0.030	0.333	-0.112	-0.320	0.404	0.279	0.196	0.296	1	
STIR	0.223	-0.015	0.110	-0.033	-0.129	0.315	0.485	-0.480	-0.226	1

Source: E-views8 output from financial statements of sampled banks and own computation

- **Choosing Random effect (RE) versus fixed effect (FE) models**

According to Gujarati (2004), 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 fixed effect model/FEM and random effect model/REM. Hence the choice here is based on computational convenience. On this score, FEM may be preferable. Since the number of time series (i.e. 15 year) is greater than the number of cross-sectional units (i.e. 7 commercial banks), FEM is preferable in this case.

According to Brooks (2008); Verbeek (2004) and Wooldridge (2004), it is often said that the REM is more appropriate when the entities in the sample can be thought of as having been randomly selected from the population, but a FEM is more plausible when the entities in the sample effectively

constitute the entire population/sample frame. Hence, the sample for this study was not selected randomly and equals to the sample frame, FEM is appropriate.

4.4 Results of the Regression Analysis

In this section the results of fixed effect regression model were presented. The regression results have their own implications, and hence beta indicates each variable's level of influence on the dependent variable which may has a coefficient of negative or positive. P-value indicates at what percentage or precession level of each variable is significant and R-squared values indicate the explanatory power of the model and in this study adjusted R-squared 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. In this study, liquidity is measured by the ratio of liquid asset to deposit & short term borrowing ratio (L1), liquid asset to total asset ratio (L2) and loan to deposit & short term borrowing ratio (L3).

Determinants of Bank Liquidity Measured by Model- 1

The empirical model used in this study to identify the statistically significant determinants of Ethiopian commercial banks liquidity measured by liquid asset to deposit & short term borrowing ratio (L1) was:

$$L1it = \alpha + \beta 1\,(CAPit) + \beta 2\,(SIZEit) + \beta 3\,(LGit) + \beta 4\,(NPLit) + \beta 5\,(ROAit) + \beta 6\,(IRMit) + \beta 7\,(IRLit)) + \beta 8\,(GDPt) + \beta 9\,(INFt) + \beta 10\,(STIRt) + \delta i + \varepsilon it \quad \textbf{…….. (Model 1)}$$

The following table presents the regression result of the determinants of commercial bank's liquidity measured by the ratio of liquid asset to deposit & short term borrowing (L1).

Table 4.4.1: Regression results of liquidity measured by L1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.691205	0.198716	3.478352	0.0008
CAP	0.940141	0.415749	2.261319	0.0260**
SIZE	-0.024576	0.018788	-1.308084	0.1940
LG	-0.179715	0.056745	-3.167031	0.0021***
NPL	0.708535	0.220197	3.217732	0.0018***
ROA	2.917670	1.431767	2.037810	0.0444**
IRM	7.065049	3.456060	2.044249	0.0437**
IRL	-8.597884	3.200174	-2.686693	0.0085***
GDP	0.244837	0.470582	0.520286	0.6041
INF	0.239638	0.116294	2.060625	0.0421**
STIR	2.112613	3.127694	0.675454	0.5010

R-squared	0.450382
Adjusted R-squared	0.391912
F-statistic	7.702798
Prob(F-statistic)	0.000000

The coefficient estimates are ***significant at 1 %(strong effect), **significant at 5 %(medium effect) and significant at 10 %(weak effect).

Source: E-views8 output from financial statements of sampled banks and own computation

Table 4.4.1 above shows the results of the regression analysis on the determinant of the dependent variable (liquidity) which was measured by the ratio of liquid asset to deposit and short term borrowing and the independent variables which includes both bank specific variables and macroeconomic variables for the sample of seven Ethiopian commercial banks. The coefficient of determination in this model is given by R-squared of 0.450382 and Adjusted R-squared of 0.391912, which means 39.19% of variation of Ethiopian commercial bank's liquidity (L1) can be explained by the variation on capital adequacy, bank size, loan growth, non-performing loans, return on asset, interest rate margin, interest rate on loans, gross domestic product, inflation and short term interest rate. The remaining 60.81% of changes was explained by other determinants which are not included in this model. Thus, the explanatory power of the model is medium. The value of F-statistics is

7.702798 with p-value of 0.000000 which is used to measure the overall significance of the model. Thus, the p-value of F-statistics is zero at six digits, the null hypothesis is rejected and the model is significant even at 1% significant level.

As it is shown on table 4.4.1 above, capital adequacy (CAP), loan growth (LG), non-performing loans (NPL), profitability (ROA), interest rate margin (IRM), interest rate on loans and advances (IRL) as well as inflation (INF) had statistically significant factors affecting liquidity of Ethiopian commercial banks which is measured by L1. Among the statistically significant variables, loan growth (LG) and interest on loans and advances (IRL) had negatively related with liquidity (L1) whereas capital adequacy (CAP), non-performing loans (NPL), profitability (ROA), interest rate margin (IRM) and inflation (INF) have positively related with liquidity (L1).

The above table also indicates that, loan growth, nonperforming loan and interest on loans and advances had statistically significant influence on Ethiopian commercial bank's liquidity (L1) at 1% significant level. The other statistically significant variables, capital adequacy, profitability, interest rate margin and inflation had statistically significant impact on liquidity (L1) at 5% significant level. The other variables such as bank size (SIZE), gross domestic product (GDP) and short term interest rate (STIR) were statistically insignificant impact on liquidity (L1). On the other hand, the coefficient sign of bank size, profitability, nonperforming loans, interest rate margin and gross domestic product were contrary to the researcher's expectation whereas the coefficient sign of capital adequacy, loan growth, interest rate on loans, inflation and short term interest rate were in-line with his expectation.

Determinants of Bank Liquidity Measured by Model- 2

The empirical model used in this study to identify the statistically significant determinants of Ethiopian commercial bank's liquidity measured by liquid asset to total asset ratio was:

$$L2it = \alpha + \beta 1\,(CAPit) + \beta 2\,(SIZEit) + \beta 3\,(LGit) + \beta 4\,(NPLit) + \beta 5\,(ROAit) + \beta 6\,(IRMit) + \beta 7\,(IRLit)) + \beta 8\,(GDPt) + \beta 9\,(INFt) + \beta 10\,(STIRt) + \delta i + \varepsilon it \quad \textbf{(Model 2)}$$

Table 4.4.2: Regression result of liquidity measured by L2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.589719	0.148371	3.974635	0.0001
CAP	0.127320	0.310417	0.410158	0.6826
SIZE	-0.024185	0.014028	-1.724099	0.0880*
LG	-0.144700	0.042369	-3.415254	0.0009***
NPL	0.546811	0.164409	3.325918	0.0013***
ROA	1.999378	1.069023	1.870286	0.0646*
IRM	3.728298	2.580452	1.444824	0.1518
IRL	-4.706754	2.389395	-1.969851	0.0518*
GDP	0.324870	0.351358	0.924611	0.3575
INF	0.199735	0.086830	2.300293	0.0236**
STIR	0.877869	2.335278	0.375916	0.7078

R-squared	0.449286
Adjusted R-squared	0.390699
F-statistic	7.668746
Prob(F-statistic)	0.000000

The coefficient estimates are ***significant at 1 %(strong effect), **significant at 5 %(medium effect) and significant at 10 %(weak effect).

Source: E-views8 output from financial statements of sampled banks and own computation

The coefficient of determination in this model is given by R-squared of 0.449286 and Adjusted R-squared of 0.390699, which means 39.07% of variation of Ethiopian commercial bank's liquidity (L2) can be explained by the variation on capital adequacy, bank size, loan growth, non-performing loans, profitability, interest rate margin, interest rate on loans, gross domestic product, inflation and short term interest rate. The remaining 39.77% of changes was explained by other determinants which are not included in this model. Comparing with L1, the explanatory power of the independent variables on the dependent variable is slightly lower in the case of L2. The value of F-statistics is 7.668746 with p-value of 0.000000 which is used to measure the overall significance of the model. Thus, the p-value of F-statistics is zero at six digits, the null hypothesis is rejected and the model is significant even at 1% significant level.

As it can be seen from the above table, loan growth (LG) and non-performing loans (NPL) were statistically significant at 1% significant level, inflation (INF) was statistically significant at 5% significant level and bank size (SIZE), profitability (ROA) and interest rate on loans and advances (IRL) were statistically significant at 10% significant level. The significant level of loan growth, nonperforming loan and inflation had similar result with L1 whereas profitability and interest rate on loans and advances had 10% significant level in the case of L1 and 5% and 1% significant level respectively in the case of L2. But bank size is significant level for l2 but not for l1 and capital adequacy and interest rate margin are significant level for L1 but not for L2, Thus, indicates more or less unless there are differences in the level of significant, those independent variables which had statistically significant impact in the determination of liquidity in the case of L1 had also statistically significant impact on the determination of bank's liquidity of Ethiopian commercial banks in the case of L2. On the other hand, all the coefficient sign of the independent variables are similar with the coefficient sign of liquidity measured by liquid asset to deposit ratio /L1. Similar to the result on L1, we also found that; gross domestic product and short term interest rate had no statistically significant influence on the liquidity measured by L2.

Among the independent variables bank size, loan growth and interest rate on loans had negatively related with L2 whereas, capital adequacy, non-performing loans, profitability, interest rate margin, gross domestic product, inflation and short term interest rate had positively related with L2. Thus the overall result shows that, bank liquidity (L2) decreases with higher bank size, loan growth and interest on loans & advances while increases with higher non-performing loans, profitability and inflation. In this regard, loan growth, interest rate on loans and inflation had coefficient sign which is in-line with the researcher expectation while the coefficient sign of the other statistically significant variables are contrary to the expectation. The regression result shows that, statistically significant influence of bank size, non-performing loans and inflation on liquidity which is measured by L2 was consistent with the result found on the study made by Tseganesh (2012), Mekibeb (2016) and Malik et al. (2013).

Determinants of Bank Liquidity Measured by Model -3

The empirical model used in this study to identify the statistically significant determinants of Ethiopian commercial banks liquidity measured by loan to deposit & short term borrowing ratio was:

$$L3it = \alpha + \beta 1\ (CAPit) + \beta 2\ (SIZEit) + \beta 3\ (LGit) + \beta 4\ (NPLit) + \beta 5\ (ROAit) + \beta 6\ (IRMit) + \beta 7\ (IRLit)) + \beta 8\ (GDPt) + \beta 9\ (INFt) + \beta 10(STIRt) + \delta i + \varepsilon it \quad \textbf{……} \quad \textbf{(Model 3)}$$

The following table shows the regression result of the determinants of commercial banks liquidity measured by the ratio of loan to deposit & short term borrowings.

Table 4.4.3: Regression result of liquidity measured by L3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.189597	0.147017	8.091556	0.0000
CAP	0.591338	0.307585	1.922516	0.0576*
SIZE	-0.047108	0.013900	-3.389143	0.0010***
LG	0.095771	0.041982	2.281236	0.0248**
NPL	-0.359769	0.162909	-2.208401	0.0296**
ROA	0.594104	1.059271	0.560861	0.5762
IRM	-5.722787	2.556912	-2.238163	0.0276**
IRL	2.786343	2.367599	1.176864	0.2422
GDP	-0.216658	0.348153	-0.622307	0.5352
INF	-0.053137	0.086038	-0.617592	0.5383
STIR	-1.357061	2.313975	-0.586463	0.5590

R-squared	0.741476
Adjusted R-squared	0.713973
F-statistic	26.96022
Prob(F-statistic)	0.000000

The coefficient estimates are ***significant at 1 %(strong effect), **significant at 5 %(medium effect) and significant at 10 %(weak effect).

Source: E-views8 output from financial statements of sampled banks and own computation

Table 4.4.3 above, presents the determinants of Ethiopian commercial banks liquidity measured by the ratio of loans to deposit & short term borrowings/L3. This ratio measures the amount of volatile liabilities (i.e. deposits and short term borrowing) tied up with illiquid assets (i.e. loans). As high value of this ratio means low liquidity, these results have to be interpreted in reverse: positive sign of

the coefficient means negative impact on liquidity and conversely. As it is depicted in the above table, the R-square and adjusted R-square of the model was 0.741476 and 0.713973 respectively. This result implies that, the explanatory power of the model is high and indicates that the change in the independent variables can explain 71.3973% of the change in the dependent variable. The explanatory power of model 3, liquidity measured by loan to deposit and short term borrowing ratio, is better than the explanatory power of liquidity measured by L1 & L2.The value of F-statistics is 26.96022 with p-value of 0.000000 which is used to measure the overall significance of the model. Thus, the p-value of F-statistics is zero at six digits, the null hypothesis is rejected and the model is significant even at 1% significant level.

As it can be seen from the above table, bank size (SIZE) was statistically significant at 1% significant level, loan growth (LG), non-performing loan(NPL) and interest rate margin (IRM) were statistically significant at 5% significant level and capital adequacy (CAP) was statistically significant at 10% significant level. Whereas, profitability (ROA), interest on loans &advances gross (IRL), domestic product (GDP), inflation (INF) and short term interest rate (STIR) had statistically insignificant impact on banks liquidity measured by L3.

As it is shown on table 4.4.3 above, among the independent variables, bank size, non-performing loans, interest rate margin, gross domestic product, inflation and short term interest rate had negatively related with liquidity (L3) and indicate their positive impact on liquidity of Ethiopian commercial banks. The other variables; capital adequacy, loan growth, profitability and interest rate on loans had positively related with liquidity which is measured by loan to deposit ratio and have negative impact on liquidity. The coefficient sign of capital adequacy, nonperforming loan, interest rate margin, and inflation were in-line with the researcher expectation whereas the coefficient sign of the other independent variables were contrary to the expectation.

In general among the macroeconomic variables, gross domestic product (GDP) and short term interest rate (STIR) had no statistically significant effect on the liquidity of Ethiopian commercial banks in all of the three liquidity measures while the other macroeconomic variable and the entire bank specific variables included in this study had statistically significant impact on liquidity of Ethiopian commercial banks at least in one of the three liquidity measures stated above.

4.5. Discussion of the Regression Results

In this section, the relationship between the dependent variable and each independent variable were discussed on the basis of the findings on this study. The dependent variable, liquidity of Ethiopian commercial banks, were measured by: - liquid asset to deposit & short term borrowings ratio (L1), liquid asset to total asset ratio (L2) and loan to deposit & short term borrowing ratio (L3) and the independent variables were capital adequacy, bank size, loan growth, non-performing loans, profitability, interest rate margin, interest rate on loans & advances, gross domestic product, inflation and short term interest rate. Thus, the regression result of each bank specific and macroeconomic variables were discussed in each the liquidity measures.

Capital Adequacy and Bank's Liquidity

In this study, capital adequacy was measured by the ratio of total capital of the bank to total asset of the bank and it was hypothesized that capital adequacy has positive and significant impact on bank's liquidity. Based on the regression result, capital adequacy was statistically significant impact on the determination of liquidity of Ethiopian commercial banks which was measured by L1. The coefficient sign of 0.940141 reveals that, there is a positive relation between liquidity of commercial banks measured by L1 and capital adequacy of banks. This indicates that, when capital to total asset is increases by 1 unit, the liquidity of Ethiopian commercial banks is also increased by 0.940141 units being other variables remains constant. This positive relation of the share of capital to total asset is consistent with the assumption that a bank with sufficient capital adequacy should be liquid too and in line with the risk absorption theory proposed by Diamond & Dybvig (1983) and it is also in line with the hypothesis and the findings of Vodova (2013) on Hungary commercial banks.

According to Vodva (2011) the higher capital to total assets ratio of banks the higher the capacity of the bank to absorb risks and create higher level of liquidity to the external public through deposits and loans. In other words, higher capital ratio of banks create positive signal to the external public and attract more deposits. In turn this enable banks to hold more liquid assets that create better potential to liquidity creation to the external public. Based on the regression result, capital adequacy was statistically insignificant impact on the determination of liquidity of Ethiopian commercial banks which was measured by L2. The coefficient value of the variable (i.e. 0.12732) indicate a percentage rise/decline in capital to total asset ratio of banks result in less proportionate (i.e. 12.73%) rise/decline in liquidity position of commercial banks in Ethiopia. Generally, reject the first research

hypothesis (i.e. there is positive and significant relationship between capital adequacy and bank liquidity).

Based on the regression result, capital adequacy was statistically significant impact on the determination of liquidity of Ethiopian commercial banks which was measured by L3 and As high value of this ratio means low liquidity, these results have to be interpreted in reverse: positive sign of the coefficient means negative impact on liquidity and conversely. The coefficient sign of 0.591338 reveals that, there is a negative relation between liquidity of commercial banks measured by L3 and capital adequacy of banks. This indicates that, when capital to total asset is increases by 1 unit, the liquidity of Ethiopian commercial banks is also decreases by 0.591338 units being other variables remains constant. Hence, our conclusion for the impact of capital adequacy on banks liquidity should be based on the first model/L1.

Bank Size and Bank's Liquidity

The proxy for bank size in this study is the natural logarithm of total asset and hypothesized as bank size has positive and significant impact on bank's liquidity. The result in this study found that bank size had a negative and statistically insignificant impact on liquidity of Ethiopian commercial banks which was measured by L1. On the other hand, the result in this study found that bank size had a negative and statistically significant impact on liquidity of Ethiopian commercial banks which was measured by L2 at 10% significant level. The negative sign of the coefficient indicates an inverse relationship between bank size and bank's liquidity. This finding is fully corresponds to the well-known "too big to fail" hypothesis and seems that if big banks assuming themselves as "too big to fail", their motivation to hold liquid asset is limited. According to the "too big to fail" argument, large banks would benefit from an implicit guarantee, thus decrease their cost of funding and allows them to invest in riskier assets (Iannotta et al., 2007). Therefore, "too big to fail" status of large banks could lead to moral hazard behavior and excessive risk exposure. In case of a liquidity shortage, they rely on a liquidity assistance of Lender of Last Resort (Vodova, 2011).

The result of L1 & L2 reveals that, being other variables constant, a one unit change on bank size had resulted in a 0.024576 units and 0.024185 units respectively, change on liquidity of Ethiopian commercial banks in opposite direction. This was consistent with the findings of Vodova (2011) on Hungary Commercial banks, Vodova (2013) on Poland Commercial Banks and Mekibeb (2016) on Ethiopian private commercial banks but opposite to the findings of Malik and Rafique (2013) on

Pakistan commercial banks. Generally, the result in both L1 & L2 reveals that, bank liquidity decreases with the size of the bank in which medium and small sized banks may hold a buffer of liquid asset

On the other hand, bank size had positive relation and statistically significant impact on liquidity of Ethiopian commercial banks which was measured by L3.The coefficient sign of -0.047108 reveals that, there is a positive relation between liquidity of commercial banks measured by L3 and size of banks. This indicates that, when bank size increases by 1 unit, the liquidity of Ethiopian commercial banks is also increases by 0.047108 units being other variables remains constant. Hence, our conclusion for the impact of capital adequacy on banks liquidity should be based on the third model/L3.

Loan Growth Rate and Bank's Liquidity

As lending is the principal business activity of commercial banks, loans & advances is the major asset of a bank. In this study, the annual growth rate of gross loans and advances to customers was used as a proxy for loan growth. The result of the study indicated that, loan growth had a negative and statistically significant impact on liquidity of Ethiopian commercial banks measured by L1 and L2 at 1% significant level as well as L3 at 5% significant level. The negative relation and statistically significant impact of loan growth on liquidity was in line with hypothesis.

The negative impact of loan growth on liquidity was based on the argument that, when loans & advances of a bank increases, the amount of illiquid asset in the total asset portfolio would also increases and leads to reduction on the level of liquid asset position of the bank. This negative sign of the coefficient indicates an inverse relationship between loan growth and liquidity. According to the regression result, a one percent change in the loan growth rate, keeping other things constant, had resulted in 17.97%, 14.47% and 9.58% change on the level of liquidity of commercial banks measured by L1, L2 and L3 respectively in the opposite direction. Therefore, the study fails to reject the hypothesis saying, loan growth has negative and significant impact on bank's liquidity.

Non-Performing Loans and Bank's Liquidity

The rise of non-performing loan portfolios in banks significantly contributed to financial distress in the banking sector. The proxy for non-performing loans is the share of non-performing loans on total

volume of loans & advances. The regression result of the model indicates that non- performing loans had positive and statistically significant impact on liquidity of Ethiopian commercial banks measured by L1 and L2 at 1% and L3 at 5% level of significant respectively.

Although the coefficient sign on the relationship between non-performing loans and liquidity was estimated as negative, the results of the regression showed the opposite effect. This could be a sign of prudent policy of banks that, they offset the higher credit risk with better portfolio quality and cautious liquidity risk management. The result reveals that, taking all other things constant, a 1 unit change on non-performing loans ratio had a 0.708535, 0.546811 & 0.359769 unit change on liquidity of commercial banks measured by L1, L2 and L3 in the same direction. The positive and statistically significant impact of non-performing loans on liquidity was consistent with the result of Malik and Rafique (2013) on Pakistan commercial banks and Vodava (2011) on Czech Republic commercial banks while the positive sign was opposite to our expectation.

Therefore, the hypothesis stated; the share of non-performing loans in the total volume of loans & advances has negative and significant impact on bank's liquidity was rejected.

Profitability and Bank's Liquidity

Profitability in this study is measured by the profitability (ROA). The regression result shows that, profitability had positive and statistically significant impact on liquidity measured by L1 and L2 at 5% & 10% level of significant respectively. This positive relation was inconsistent with our expectation and finance theory which emphasizes their negative relationship. The coefficient of 2.91767 and 1.999378 for L1 & L2 respectively revealed that, taking other independent variables constant, a one unit change on profitability had a 2.91767 & 1.999378 unit changes on liquidity of Ethiopian commercial banks measured by L1 & L2 respectively in the same direction. This positive relation shows that, higher profitability leads to increase banks liquidity. However, as the major profitability of banks comes from loans and advances and in return the increase on loans leads to decrease in liquid asset, the result should have been in the opposite direction. In general, the result of this study was consistent with the findings of Vodova (2011) on Hungary commercial banks but opposite to Vodova (2011, 2013) on Poland and Slovakia commercial banks respectively.

Based on the regression result, profitability was statistically insignificant impact on the determination of liquidity of Ethiopian commercial banks which was measured by L3. While the coefficient sign of

0.594104 reveals that, there is a negative relation between liquidity of commercial banks measured by L3 and profitability of banks. This indicates that, when profitability increases by 1 unit, the liquidity of Ethiopian commercial banks is also increased by 0.594104 units being other variables remains constant.

Therefore, the hypothesis which states that profitability has negative and significant impact on bank's liquidity has been rejected.

Interest Rate Margin and Bank's Liquidity

In this study, interest rate margin (IRM) was measured by the difference between interest income on loan and advances as a fraction of total loan and advances and the interest paid out on deposit as a fraction of total deposits. The regression result shows that, interest rate margin had positive and statistically significant impact on liquidity measured by L1 and L3 at 5% level of significant. This positive relation was inconsistent with the researcher expectation. The coefficient of 7.065049 and -5.722787 for L1 & L3 respectively revealed that, taking other independent variables constant, a one unit change on interest rate margin had a 7.065049 & 5.722787 unit changes on liquidity of Ethiopian commercial banks measured by L1 & L3 respectively in the same direction. This positive relation shows that, higher interest rate margin leads to increase banks liquidity.

On the other hand, interest rate margin had positive and statistically insignificant impact on liquidity of commercial banks measured by L2. The positive effect of interest rate margin highlights the fact that higher interest rate margin do not encourage banks to lend more rather it encourage banks to hold more liquid assets. The coefficient of 3.728298 of L2 in this study indicated that, a one unit change on interest rate margin leads to 3.728298 unit changes on liquidity of Ethiopian commercial banks measured L2.

Therefore, the hypothesis which states that interest rate margin has negative and significant impact on bank's liquidity has been rejected.

Interest Rate on Loans & Advances and Bank's Liquidity

Interest rate on loans & advances as a fraction of total outstanding loans & advances was taken as a measure for interest rate on loans (IRL).The result of the study indicated that, Interest rate on loans & advances had a negative and statistically significant impact on liquidity of Ethiopian commercial banks measured by L1 and L2 at 1% and 10% significant level respectively. The negative relation

and statistically significant impact of Interest rate on loans & advances on liquidity was in line with hypothesis.

The negative impact of Interest rate on loans & advances on liquidity was based on the argument that, when loans & advances of a bank increases, the amount of illiquid asset in the total asset portfolio would also increases and leads to reduction on the level of liquid asset position of the bank. This negative sign of the coefficient indicates an inverse relationship between Interest rate on loans & advances and liquidity. According to the regression result, a one unit change in the Interest rate on loans & advances, keeping other things constant, had resulted in 8.597884 & 4.706754 unit changes on the level of liquidity of commercial banks measured by L1 & L2 respectively in the opposite direction.

Based on the regression result, Interest rate on loans & advances was statistically insignificant impact on the determination of liquidity of Ethiopian commercial banks which was measured by L3. While the coefficient sign of 2.786343 reveals that, there is a negative relation between liquidity of commercial banks measured by L3 and Interest rate on loans & advances of banks. This indicates that, when Interest rate on loans & advances a 1 unit changes, the liquidity of Ethiopian commercial banks is also changed by 2.786343 units being other variables remains constant.

IRL had statistically significant impact on liquidity for L1 and l2 and the coefficient sign of IRL correspond to our expectation for L1, L2 & L3 but it was opposite to the result obtained from Czech Republic commercial banks (Vodova, 2011). As a result, the hypothesis, interest rate on loans & advances has negative and significant impact on liquidity should be fail to reject for L1 and L2.

GDP Growth Rate and Bank's Liquidity

GDP was one of the macroeconomic variables that affect liquidity of commercial banks in Ethiopia and it was measured by the real growth rate. As per the regression result, GDP had positive and statistically insignificant impact on liquidity measured by L1, L2 and L3. This independent variable has no significant impact on liquidity in any of the three measures. This implies that during the study period, the growth rate of GDP of Ethiopia do not have impact on the liquidity of Ethiopian commercial banks. Hence, the hypothesis stating; real GDP growth rate has negative and significant impact on bank's liquidity should be rejected.

Inflation Rate and Bank's Liquidity

The other macroeconomic variable included in this study was the inflation rate of Ethiopia and was measured by the annual general consumer price index. Inflation had positive and statistically significant impact on liquidity of Ethiopian commercial banks measured by L1 & L2 at 5% significant level while it has insignificant impact when liquidity is measured by loan to deposit ratio/L3. This positive relation was based on the theory that during inflationary economy, commercial banks are refraining from long term investment and prefer to hold risk free liquid asset. That is during, inflation it is expected that, banks will make fewer loans and the amount of liquid or short term assets held by economic agents including banks will rise. The positive relation was consistent with the findings of Vodova (2013) on Poland commercial banks, Tseganesh (2012) on Ethiopian commercial banks and Mekibeb (2016) on Ethiopian private commercial banks. The positive coefficient of 0.239638 , 0.199735 and -0.053137 for L1 , L2 and L3 respectively indicates that a one unit change on inflation rate of the country, other things being constant, liquidity of Ethiopian commercial banks leads to a 0.239638 , 0.199735 and -0.053137 unit change in the same direction.

Inflation rate had statistically significant impact on liquidity for L1 and l2 and the coefficient sign of inflation rate correspond to our expectation for L1, L2 & L3. As a result, the hypothesis, inflation rate has positive and significant impact on liquidity should be fail to reject for L1 and L2.

Short Term Interest Rate and Bank's Liquidity

In this study, the proxy for short term interest rate (STIR) is the annual weighted average interest rate of Treasury Bills. . As per the regression result, short term interest rate had positive and statistically insignificant impact on liquidity measured by L1, L2 and L3. This is the second independent variable that has no significant impact on liquidity in any of the three measures. This implies that during the study period, the change of short term interest rate of Ethiopia do not have impact on the liquidity of Ethiopian commercial banks. Hence, the hypothesis stating; short term interest rate has negative and significant impact on bank's liquidity should be rejected.

Table 4.4.4 Summary of actual and expected signs and impact of explanatory variables on the dependent variables

Explanatory variables	Expected sign & impact on liquidity	Actual sign & impact on			Decision
		L1	L2	L3	
CAP	+ve & Sign.	+ve & Sign.	+ve & Insign.	+ve & Sign.	Support L1
SIZE	+ve & Sign.	-ve & Insign.	-ve & Sign.	-ve & Sign.	Support L3
LG	-ve & Sign.	-ve & Sign.	-ve & Sign.	+ve & Sign.	Support All
NPL	-ve & Sign.	+ve & Sign.	+ve & Sign.	-ve & Sign.	Support All
ROA	-ve & Sign.	+ve & Sign.	+ve & Sign.	+ve & Insign.	Support All
IRM	-ve & Sign.	+ve & Sign.	+ve & Insign.	-ve & Sign.	Support All
IRL	-ve & Sign.	-ve & Sign.	-ve & Sign.	+ve & Insign.	Support L1 and L2
GDP	-ve & Sign.	+ve & Insign.	+ve & Insign.	-ve & Insign.	Rejected All
INF	+ve & Sign.	+ve & Sign.	+ve & Sign.	-ve & Insign.	Support L1 and L2
STIR	+ve & Sign.	+ve & Insign.	+ve &Insign.	-ve & Insign.	Rejected All

Source: Own Summarization

Note: Sign. = statistically significant

Insign. = Statistically insignificant

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

The preceding chapter presented the analysis of the findings, while this chapter deals with the major conclusions and recommendations based on the findings of the study. The chapter is organized in to two sub-sections, the first section presented the major conclusions of the study and the second section deals with the recommendation drawn from the study.

5.1. Conclusions

The main objective of this study was to identify the macroeconomic and bank specific determinants of liquidity of Ethiopian commercial banks. To comply with the objectives of the study, seven bank specific and three macroeconomic variables were used. The bank specific variables includes; capital adequacy, bank size, loan growth, non-performing loans, profitability, interest rate margin and interest rate on loans and advances and the macroeconomic variables were real GDP, inflation rate and short term interest rate. The study was used panel data for the sample of seven commercial banks in Ethiopia which had fifteen years of banking service over the period 2001 to 2015. The bank specific data were mainly collected from annual audited financial reports of the respective sample banks and the macroeconomic data were collected from NBE and MoFED.

Data was presented and analyzed by using descriptive statistics, correlation analysis and balanced fixed effect regression analysis to identify the determinants of liquidity of Ethiopian commercial banks which were measured by liquid asset to deposit & short term borrowing ratio (L1), liquid asset to total asset ratio (L2) and loan to deposit & short term borrowing ratio (L3). While before performing the regression analysis, test for CLRM assumption were conducted and all CLRM assumption were satisfied. As a result, the study focused on the result of L1, L2 and L3 model results. Fixed effect model/FEM was used based on convenience. Ten factors affecting banks liquidity were chosen and analyzed. From the list of possible explanatory variables, most of them proved to be statistically significant. With the only exception of capital adequacy of the bank, bank size and profitability, relations of all factors and the banks' liquidity were consistent in the three estimated models/L1, L2 and L3. The results of models enable us to make following conclusions.

Bank liquidity decreases with higher loan growth and increases with higher nonperforming loan, in three of liquidity measures/L1, L2 and L3. Interest rate margin had positive and significant impact on banks liquidity as per L1 & L3 but positive and insignificant impact as per L2. Inflation had also positive and significant impact on banks liquidity as per L1 & L2 but positive and insignificant impact as per L3.On the other hand Interest rate on loans had negative and significant impact on banks liquidity as per L1 & L2 but negative and insignificant impact as per L3. The coefficient sign for capital adequacy revealed positive and significant impact on liquidity as per L1 as well as negative and significant impact on liquidity as per L3 but negative and insignificant impact on banks liquidity as per L2. Bank size had negative and significant impact on liquidity as per L2 as well as positive and significant impact on liquidity as per L3 but negative and insignificant impact on banks liquidity as per L1. The other independent variable coefficient sign for profitability revealed positive and significant impact on liquidity as per L1 and L2 but negative and insignificant impact on banks liquidity as per L3. Even though, the number of statistically significant factors affecting liquidity different in the three measures their coefficient signs give the same conclusion except for capital adequacy, bank size and profitability. It is also found that gross domestic product and short term interest rate had no statistically significant effect on the liquidity of Ethiopia's commercial banks in the case of three measures/ L1 , L2 and L3 .

The relation between profitability (ROA) and bank liquidity was positive in the case of L1 as well asL2 and negative in the case of L3. But the negative impact of profitability on banks liquidity in the case of L3 was statistically insignificant/not different from zero. It could be useful to use another proxy to measure profitability than return on asset ratio used in this study. In addition to profitability it is better to use another proxy to measure and capital adequacy and bank size. The positive relationship between interest rate margin and banks liquidity in both liquidity measures was opposite to our expectation and it may indicate the presence of credit rationing and credit crunch in the economy or it could be due to credit cap and 27% investment on millennium dam bond from the total loan disbursement by commercial banks in the year 2011 until now. The positive and statistically significant impact of inflation was consistent with our hypothesis and the result of Huybens and Smith (1999). They argued that in the inflationary economy, economic units including banks refraining from long term investments due to the decline in the real value of their investments that aggravate the credit market rationing and prefer to hold risk free liquid assets. Generally, the study failed to reject five hypotheses that indicate the relationship between bank liquidity and capital adequacy, bank size, loan growth, interest rate on loans and general inflation rate whereas, the study

rejected the three hypotheses indicating the relationship between bank liquidity and nonperforming loan, profitability (ROA) and interest rate margin. The remaining two factors that are GDP growth rate and short term interest rate had insignificant impact on banks liquidity in Ethiopia.

5.2. Recommendations

This study was intended to investigate the determinants of liquidity of Ethiopian commercial banks; and hence on the basis of the findings of the study, the following recommendations were drown:

- The study result indicates the negative relationship between bank size and liquidity revealed that "too big to fail" hypothesis, in which big banks may motivated to disburse more loans and advances make their asset illiquid since loans are given for long period of time when compare to deposits. Thus, big banks needs to manage their liquidity position and shall give due attention on resource mobilization and liquidity management. In addition to that NBE has also a due attention and active supervision on big commercial banks in Ethiopia on their liquidity management.

- Ethiopian commercial banks should have liquidity risk management policy to ensure that they are operating to satisfy their profitability target as well as the ability of meeting the financial demands of their customers and also for the health and functioning of the real economy by maintaining optimum level of liquidity;

- Concerning to capital adequacy of Ethiopian commercial banks it become better if regulatory bodies like NBE make a periodic supervision and check up on capital strength of respective banks. Since, as it was discussed in the descriptive statistic part of this study; the bank with a capital adequacy ratio of 3.7 % during the test period which was far from the NBE requirement 8 % and would be exposed to liquidity problem which could be the problem of the banking sector as a whole because it has a contagious effect.

- Concerning to nonperforming of Ethiopian commercial banks it become better if regulatory bodies like NBE make a periodic supervision and check up nonperforming loans of respective banks. Since, as it was discussed in the descriptive statistic part of this study; the bank with a nonperforming loans ratio of 52% during the test period which was more far from the NBE requirement not more than 5% as well above a global standard not more than 15% and would be

exposed to liquidity problem which could be the problem of the banking sector as a whole because it has a contagious effect.

- Among the macroeconomic variables included in this study general inflation rate exists as significant key drivers of liquidity of Ethiopian commercial banks. This is a clearly indicates to all commercial banks in Ethiopia that they cannot ignore the macroeconomic indicators when strategizing to improve on their position of liquidity. Thus, banks in Ethiopia should not only be concerned about internal structures and policies/procedures, but they must consider both the internal environment and the macroeconomic environment together in developing their strategies to efficiently manage their liquidity position.

- In general, the findings of the study shows that bank specific variables have more statistically significant impact on the determination of liquidity of Ethiopian commercial banks. Since they are internal variables that can be controlled or minimized the risk by using internal liquidity management system. So, special emphasis shall be given to those bank specific variables.

Recommendation for further Study

As this study identifies only limited bank specific and macroeconomic variables for a sample of seven commercial banks in Ethiopia, there have to be further researches by using more complicated econometric model or dynamic panel model by adding more banks and years to increase the sample size that improve representativeness and also include more bank specific variables, macroeconomic variables and regulatory factors that affect the liquidity of Ethiopian commercial banks.

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Appendices

Appendix 1: Descriptive statistics of the dependent and independent variables (E-view)

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Sum	Sum Sq. Dev.	Observations
L1	0.457	0.446	0.782	0.104	0.154	0.306	2.572	2.443	0.295	47.984	2.468	105
L2	0.349	0.347	0.594	0.082	0.115	0.213	2.525	1.783	0.410	36.684	1.373	105
L3	0.673	0.635	1.055	0.298	0.166	0.262	2.536	2.146	0.342	70.702	2.871	105
CAP	0.120	0.118	0.294	0.037	0.045	0.822	5.113	31.352	0.000	12.637	0.211	105
SIZE	8.643	8.695	12.628	5.366	1.474	0.309	3.086	1.704	0.427	907.546	226.038	105
LG	0.274	0.225	2.559	-0.123	0.291	4.743	37.319	5546.451	0.000	28.724	8.830	105
NPL	0.087	0.058	0.520	0.006	0.086	2.329	9.705	291.629	0.000	9.120	0.764	105
ROA	0.035	0.038	0.057	-0.023	0.013	-1.300	6.155	73.137	0.000	3.652	0.017	105
IRM	0.075	0.071	0.131	0.038	0.020	0.479	2.461	5.278	0.071	7.927	0.041	105
IRL	0.100	0.098	0.151	0.060	0.022	0.287	2.253	3.881	0.144	10.487	0.049	105
GDP	0.091	0.103	0.126	-0.021	0.040	-1.875	5.357	85.808	0.000	9.569	0.163	105
INF	0.124	0.106	0.364	-0.106	0.120	0.420	2.914	3.116	0.211	13.006	1.507	105
STIR	0.012	0.011	0.028	0.000	0.008	0.372	2.395	4.025	0.134	1.221	0.006	105

Appendix 2: Correlation matrix of the dependent and independent variables (E-view)

	L1	L2	L3	CAP	SIZE	LG	NPL	ROA	IRM	IRL	GDP	INF	STIR
L1	**1**			**0.138**	**-0.236**	**-0.204**	**0.367**	**0.004**	**-0.290**	**-0.343**	**-0.039**	**0.121**	**-0.287**
L2		**1**		**-0.038**	**-0.185**	**-0.289**	**0.420**	**-0.067**	**-0.319**	**-0.370**	**-0.002**	**0.129**	**-0.339**
L3			**1**	**0.473**	**-0.800**	**0.456**	**-0.029**	**-0.039**	**-0.583**	**-0.457**	**-0.208**	**-0.244**	**-0.006**

Appendix 3: Test for Multicollinearity (E-view)

	CAP	SIZE	LG	NPL	ROA	IRM	IRL	GDP	INF	STIR
CAP	1	-0.497	0.211	-0.266	0.281	0.073	0.186	-0.053	-0.030	0.223
SIZE	-0.497	1	-0.314	-0.215	0.214	0.675	0.522	0.332	0.333	-0.015
LG	0.211	-0.314	1	-0.265	0.199	-0.212	-0.221	-0.074	-0.112	0.110
NPL	-0.266	-0.215	-0.265	1	-0.622	-0.460	-0.466	-0.468	-0.320	-0.033
ROA	0.281	0.214	0.199	-0.622	1	0.410	0.344	0.521	0.404	-0.129
IRM	0.073	0.675	-0.212	-0.460	0.410	1	0.652	0.291	0.279	0.315
IRL	0.186	0.522	-0.221	-0.466	0.344	0.652	1	0.202	0.196	0.485
GDP	-0.053	0.332	-0.074	-0.468	0.521	0.291	0.202	1	0.296	-0.480
INF	-0.030	0.333	-0.112	-0.320	0.404	0.279	0.196	0.296	1	-0.226
STIR	0.223	-0.015	0.110	-0.033	-0.129	0.315	0.485	-0.480	-0.226	1

Appendix 4: Heteroskedasticity test (E-view)

Heteroskedasticity test for L1

Heteroskedasticity Test: White

F-statistic	2.074471	Prob. F(65,39)	0.0709
Obs*R-squared	81.44394	Prob. Chi-Square(65)	0.0818
Scaled explained SS	51.93071	Prob. Chi-Square(65)	0.8798

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 04/16/17 Time: 08:12

Sample: 1 105

Included observations: 105

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	-0.044950	0.988455	-0.045475	0.9640
CAP^2	0.964304	2.663175	0.362088	0.7192
CAP*SIZE	-0.102850	0.236594	-0.434710	0.6662
CAP*LG	0.054119	0.743431	0.072797	0.9423
CAP*NPL	-0.553629	4.324595	-0.128019	0.8988
CAP*ROA	-26.61252	17.36471	-1.532563	0.1335
CAP*IRM	-0.238815	32.74226	-0.007294	0.9942
CAP*IRL	4.464065	29.44698	0.151597	0.8803
CAP*GDP	3.579690	5.187924	0.690004	0.4943
CAP*INF	-0.040095	1.098875	-0.036487	0.9711
CAP*STIR	-22.71763	22.77209	-0.997609	0.3246
CAP	1.227201	2.570271	0.477460	0.6357
SIZE^2	-0.003163	0.004724	-0.669592	0.5071
SIZE*LG	0.015071	0.027866	0.540848	0.5917
SIZE*NPL	-0.029106	0.121257	-0.240035	0.8116
SIZE*ROA	-1.103457	0.721227	-1.529973	0.1341
SIZE*IRM	0.369340	1.237445	0.298470	0.7669
SIZE*IRL	0.127043	1.239123	0.102527	0.9189
SIZE*GDP	-0.297567	0.538714	-0.552366	0.5838
SIZE*INF	-0.046124	0.056248	-0.820007	0.4172
SIZE*STIR	-1.933740	1.529865	-1.263994	0.2137
SIZE	0.124001	0.128018	0.968622	0.3387
LG^2	0.086942	0.071613	1.214049	0.2320
LG*NPL	0.792643	0.948200	0.835945	0.4083
LG*ROA	-0.110937	2.628538	-0.042205	0.9666
LG*IRM	-4.449684	6.345114	-0.701277	0.4873
LG*IRL	7.097146	7.271865	0.975973	0.3351
LG*GDP	-1.854836	1.318910	-1.406340	0.1675
LG*INF	0.147841	0.224342	0.658999	0.5138
LG*STIR	-3.247142	6.810136	-0.476810	0.6362
LG	-0.438809	0.484503	-0.905690	0.3707
NPL^2	-0.041755	1.313198	-0.031796	0.9748

NPL*ROA	2.461238	9.175849	0.268230	0.7899
NPL*IRM	7.477393	24.76716	0.301908	0.7643
NPL*IRL	5.394142	27.50490	0.196116	0.8455
NPL*GDP	-2.334877	2.120604	-1.101044	0.2776
NPL*INF	-0.344474	0.784875	-0.438890	0.6632
NPL*STIR	5.175649	22.37826	0.231280	0.8183
NPL	-0.678006	1.669708	-0.406063	0.6869
ROA^2	52.97879	28.88838	1.833914	0.0743
ROA*IRM	-118.4745	128.4352	-0.922445	0.3620
ROA*IRL	129.6097	121.0262	1.070923	0.2908
ROA*GDP	-10.89190	22.04999	-0.493964	0.6241
ROA*INF	-4.562737	3.628941	-1.257319	0.2161
ROA*STIR	-89.92316	121.5782	-0.739632	0.4640
ROA	7.884330	7.257552	1.086362	0.2840
IRM^2	-32.34637	141.9651	-0.227847	0.8210
IRM*IRL	37.62474	270.6810	0.139000	0.8902
IRM*GDP	81.59659	74.10847	1.101043	0.2776
IRM*INF	22.84993	9.398832	2.431146	0.0197
IRM*STIR	183.7485	248.3210	0.739964	0.4638
IRM	-9.849858	17.70436	-0.556352	0.5811
IRL^2	-12.86763	141.4616	-0.090962	0.9280
IRL*GDP	-84.41606	67.04957	-1.259010	0.2155
IRL*INF	-24.33014	10.48135	-2.321278	0.0256
IRL*STIR	-44.90450	249.7455	-0.179801	0.8582
IRL	2.356820	18.54787	0.127067	0.8995
GDP^2	25.73874	20.45722	1.258174	0.2158
GDP*INF	8.438933	5.961314	1.415616	0.1648
GDP*STIR	421.8078	225.5349	1.870255	0.0690
GDP	-3.712800	4.552035	-0.815635	0.4197
INF^2	1.757103	0.789322	2.226091	0.0319
INF*STIR	37.62509	18.18884	2.068581	0.0453
INF	-0.616585	0.888371	-0.694062	0.4918

STIR^2	533.2890	358.1897	1.488845	0.1446
STIR	-43.16750	28.71664	-1.503223	0.1408

R-squared	0.775657	Mean dependent var	0.012916
Adjusted R-squared	0.401751	S.D. dependent var	0.016371
S.E. of regression	0.012662	Akaike info criterion	-5.633628
Sum squared resid	0.006253	Schwarz criterion	-3.965425
Log likelihood	361.7655	Hannan-Quinn criter.	-4.957639
F-statistic	2.074471	Durbin-Watson stat	1.594691
Prob(F-statistic)	0.007900		

Heteroskedasticity test for L2

Heteroskedasticity Test: White

F-statistic	1.880214	Prob. F(65,39)	0.0179
Obs*R-squared	79.59897	Prob. Chi-Square(65)	0.1051
Scaled explained SS	63.42367	Prob. Chi-Square(65)	0.5322

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 04/16/17 Time: 08:13

Sample: 1 105

Included observations: 105

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.193302	0.639661	0.302195	0.7641
CAP^2	-0.815467	1.723425	-0.473167	0.6387
CAP*SIZE	-0.150546	0.153108	-0.983268	0.3315
CAP*LG	0.111753	0.481098	0.232288	0.8175
CAP*NPL	-1.258538	2.798582	-0.449706	0.6554

CAP*ROA	-19.29733	11.23725	-1.717264	0.0939
CAP*IRM	4.137446	21.18855	0.195268	0.8462
CAP*IRL	3.162162	19.05607	0.165940	0.8691
CAP*GDP	1.427711	3.357269	0.425260	0.6730
CAP*INF	0.186140	0.711117	0.261757	0.7949
CAP*STIR	-18.46354	14.73654	-1.252909	0.2177
CAP	1.717362	1.663303	1.032501	0.3082
SIZE^2	-0.002015	0.003057	-0.659227	0.5136
SIZE*LG	0.017240	0.018033	0.955994	0.3450
SIZE*NPL	-0.019386	0.078469	-0.247056	0.8062
SIZE*ROA	-0.931109	0.466729	-1.994968	0.0531
SIZE*IRM	-0.056276	0.800789	-0.070276	0.9443
SIZE*IRL	0.601093	0.801876	0.749609	0.4580
SIZE*GDP	-0.233705	0.348619	-0.670373	0.5066
SIZE*INF	-0.016633	0.036400	-0.456962	0.6502
SIZE*STIR	-1.744262	0.990024	-1.761839	0.0859
SIZE	0.072222	0.082845	0.871781	0.3887
LG^2	0.075532	0.046343	1.629844	0.1112
LG*NPL	0.794868	0.613610	1.295395	0.2028
LG*ROA	-0.195109	1.701010	-0.114702	0.9093
LG*IRM	-3.831380	4.106123	-0.933089	0.3565
LG*IRL	5.838716	4.705853	1.240735	0.2221
LG*GDP	-0.989031	0.853508	-1.158782	0.2536
LG*INF	0.153774	0.145179	1.059206	0.2960
LG*STIR	-2.997808	4.407054	-0.680229	0.5004
LG	-0.465257	0.313537	-1.483895	0.1459
NPL^2	0.346841	0.849812	0.408138	0.6854
NPL*ROA	-1.476613	5.937981	-0.248673	0.8049
NPL*IRM	1.046944	16.02761	0.065321	0.9483
NPL*IRL	10.18671	17.79929	0.572310	0.5704
NPL*GDP	-0.632743	1.372309	-0.461079	0.6473
NPL*INF	0.130128	0.507917	0.256199	0.7991

NPL*STIR	1.188770	14.48168	0.082088	0.9350
NPL	-0.877152	1.080520	-0.811787	0.4218
ROA^2	27.15257	18.69458	1.452430	0.1544
ROA*IRM	-61.40591	83.11446	-0.738811	0.4644
ROA*IRL	65.92823	78.31986	0.841782	0.4050
ROA*GDP	-4.696909	14.26924	-0.329163	0.7438
ROA*INF	-2.002163	2.348402	-0.852564	0.3991
ROA*STIR	-43.36827	78.67710	-0.551218	0.5846
ROA	7.966745	4.696591	1.696283	0.0978
IRM^2	19.00437	91.87012	0.206861	0.8372
IRM*IRL	-61.28815	175.1662	-0.349886	0.7283
IRM*GDP	40.07676	47.95793	0.835665	0.4084
IRM*INF	14.07067	6.082281	2.313388	0.0261
IRM*STIR	186.3990	160.6963	1.159945	0.2531
IRM	-1.172035	11.45705	-0.102298	0.9190
IRL^2	34.48051	91.54424	0.376654	0.7085
IRL*GDP	-46.25273	43.38989	-1.065979	0.2930
IRL*INF	-14.87646	6.782814	-2.193258	0.0343
IRL*STIR	-101.5425	161.6182	-0.628286	0.5335
IRL	-5.463605	12.00291	-0.455190	0.6515
GDP^2	22.92904	13.23851	1.731995	0.0912
GDP*INF	7.477493	3.857754	1.938302	0.0598
GDP*STIR	334.3263	145.9507	2.290679	0.0275
GDP	-3.777994	2.945766	-1.282517	0.2072
INF^2	1.360050	0.510795	2.662612	0.0112
INF*STIR	28.73682	11.77057	2.441412	0.0193
INF	-0.962885	0.574893	-1.674894	0.1020
STIR^2	469.7794	231.7959	2.026694	0.0496
STIR	-30.14518	18.58344	-1.622153	0.1128

R-squared	0.758085	Mean dependent var	0.007201
Adjusted R-squared	0.354894	S.D. dependent var	0.010202
S.E. of regression	0.008194	Akaike info criterion	-6.504040

Sum squared resid	0.002619	Schwarz criterion	-4.835836
Log likelihood	407.4621	Hannan-Quinn criter.	-5.828051
F-statistic	1.880214	Durbin-Watson stat	1.584617
Prob(F-statistic)	0.017944		

Heteroskedasticity test for L3

Heteroskedasticity Test: White

F-statistic	1.485270	Prob. F(65,39)	0.0927
Obs*R-squared	74.78808	Prob. Chi-Square(65)	0.1903
Scaled explained SS	44.78351	Prob. Chi-Square(65)	0.9738

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 04/16/17 Time: 08:16

Sample: 1 105

Included observations: 105

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.399317	0.593778	0.672502	0.5052
CAP^2	0.545490	1.599804	0.340973	0.7350
CAP*SIZE	0.078065	0.142125	0.549269	0.5860
CAP*LG	-0.100476	0.446589	-0.224985	0.8232
CAP*NPL	-0.902842	2.597841	-0.347536	0.7301
CAP*ROA	-16.36933	10.43121	-1.569265	0.1247
CAP*IRM	-24.68377	19.66870	-1.254977	0.2170
CAP*IRL	14.20082	17.68919	0.802797	0.4270
CAP*GDP	1.340846	3.116454	0.430247	0.6694
CAP*INF	0.418909	0.660109	0.634606	0.5294
CAP*STIR	-3.466173	13.67949	-0.253385	0.8013

CAP	0.307521	1.543995	0.199172	0.8432
SIZE^2	0.002746	0.002838	0.967812	0.3391
SIZE*LG	0.011829	0.016740	0.706645	0.4840
SIZE*NPL	0.009729	0.072840	0.133568	0.8944
SIZE*ROA	-0.253541	0.433250	-0.585207	0.5618
SIZE*IRM	-0.535319	0.743349	-0.720145	0.4757
SIZE*IRL	0.326020	0.744357	0.437988	0.6638
SIZE*GDP	-0.228481	0.323613	-0.706031	0.4844
SIZE*INF	-0.033540	0.033789	-0.992632	0.3270
SIZE*STIR	-0.847605	0.919010	-0.922303	0.3620
SIZE	-0.005906	0.076902	-0.076794	0.9392
LG^2	0.094330	0.043019	2.192748	0.0344
LG*NPL	0.539796	0.569596	0.947682	0.3491
LG*ROA	-0.367856	1.578997	-0.232968	0.8170
LG*IRM	-2.706460	3.811593	-0.710060	0.4819
LG*IRL	5.752757	4.368304	1.316931	0.1955
LG*GDP	-0.872614	0.792287	-1.101387	0.2775
LG*INF	0.079538	0.134765	0.590196	0.5585
LG*STIR	-7.272391	4.090938	-1.777683	0.0833
LG	-0.410903	0.291047	-1.411806	0.1659
NPL^2	-0.131881	0.788855	-0.167180	0.8681
NPL*ROA	-5.940274	5.512052	-1.077688	0.2878
NPL*IRM	-1.826052	14.87796	-0.122735	0.9029
NPL*IRL	9.701380	16.52255	0.587160	0.5605
NPL*GDP	-0.212674	1.273874	-0.166951	0.8683
NPL*INF	-0.007630	0.471485	-0.016184	0.9872
NPL*STIR	-3.748031	13.44291	-0.278811	0.7819
NPL	-0.589180	1.003015	-0.587409	0.5603
ROA^2	24.18768	17.35363	1.393811	0.1713
ROA*IRM	-30.30084	77.15270	-0.392739	0.6967
ROA*IRL	12.06721	72.70201	0.165982	0.8690
ROA*GDP	-10.60508	13.24572	-0.800642	0.4282

ROA*INF	-2.598378	2.179952	-1.191943	0.2405
ROA*STIR	23.37757	73.03362	0.320093	0.7506
ROA	5.538872	4.359706	1.270469	0.2114
IRM^2	17.49549	85.28032	0.205153	0.8385
IRM*IRL	-14.41610	162.6016	-0.088659	0.9298
IRM*GDP	21.16806	44.51793	0.475495	0.6371
IRM*INF	8.371008	5.646001	1.482644	0.1462
IRM*STIR	92.94889	149.1697	0.623109	0.5368
IRM	4.126165	10.63524	0.387971	0.7001
IRL^2	24.71384	84.97781	0.290827	0.7727
IRL*GDP	-32.77077	40.27755	-0.813624	0.4208
IRL*INF	-7.633615	6.296286	-1.212400	0.2327
IRL*STIR	-120.1416	150.0254	-0.800809	0.4281
IRL	-5.896178	11.14195	-0.529187	0.5997
GDP^2	25.97125	12.28892	2.113388	0.0410
GDP*INF	7.704836	3.581039	2.151564	0.0377
GDP*STIR	294.5750	135.4817	2.174278	0.0358
GDP	-3.598358	2.734467	-1.315927	0.1959
INF^2	1.037967	0.474156	2.189084	0.0346
INF*STIR	18.99689	10.92627	1.738643	0.0900
INF	-0.874335	0.533656	-1.638386	0.1094
STIR^2	501.7140	215.1693	2.331718	0.0250
STIR	-26.91965	17.25046	-1.560517	0.1267

R-squared	0.712267	Mean dependent var	0.007070
Adjusted R-squared	0.232713	S.D. dependent var	0.008684
S.E. of regression	0.007606	Akaike info criterion	-6.652904
Sum squared resid	0.002256	Schwarz criterion	-4.984700
Log likelihood	415.2775	Hannan-Quinn criter.	-5.976915
F-statistic	1.485270	Durbin-Watson stat	1.593325
Prob(F-statistic)	0.092725		

Appendix 5: Test for Autocorrelation (E-view)

Test for Autocorrelation for L1

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	11.74938	Prob. F(10,84)	0.0000
Obs*R-squared	61.22693	Prob. Chi-Square(10)	0.0000

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 04/17/17 Time: 09:38

Sample: 1 105

Included observations: 105

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.032396	0.159571	-0.203023	0.8396
CAP	0.078067	0.294698	0.264904	0.7917
SIZE	-0.007549	0.014437	-0.522864	0.6024
LG	0.039727	0.043813	0.906737	0.3671
NPL	0.067050	0.157486	0.425749	0.6714
ROA	-2.466979	1.024658	-2.407612	0.0182
IRM	1.288973	2.798054	0.460668	0.6462
IRL	-0.289568	2.592537	-0.111693	0.9113
GDP	1.069391	0.399552	2.676476	0.0089
INF	-0.072966	0.085414	-0.854268	0.3954
STIR	0.171034	2.557053	0.066887	0.9468
RESID(-1)	0.810679	0.103012	7.869780	0.0000
RESID(-2)	-0.177131	0.129902	-1.363581	0.1763
RESID(-3)	-0.154632	0.131378	-1.177001	0.2425

RESID(-4)	0.051259	0.144126	0.355653	0.7230
RESID(-5)	-0.261535	0.126644	-2.065120	0.0420
RESID(-6)	0.075949	0.134457	0.564857	0.5737
RESID(-7)	0.083768	0.137963	0.607178	0.5454
RESID(-8)	0.016119	0.135128	0.119290	0.9053
RESID(-9)	0.040464	0.130771	0.309424	0.7578
RESID(-10)	-0.268800	0.109672	-2.450932	0.0163

R-squared	0.583114	Mean dependent var	-3.12E-17
Adjusted R-squared	0.483855	S.D. dependent var	0.114195
S.E. of regression	0.082041	Akaike info criterion	-1.986337
Sum squared resid	0.565382	Schwarz criterion	-1.455545
Log likelihood	125.2827	Hannan-Quinn criter.	-1.771249
F-statistic	5.874688	Durbin-Watson stat	1.879318
Prob(F-statistic)	0.000000		

Test for Autocorrelation for L2

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	10.32145	Prob. F(10,84)	0.0000
Obs*R-squared	57.88826	Prob. Chi-Square(10)	0.0000

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 04/17/17 Time: 09:41

Sample: 1 105

Included observations: 105

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.028847	0.121620	0.237190	0.8131
CAP	0.007568	0.229010	0.033045	0.9737
SIZE	-0.008559	0.011122	-0.769617	0.4437
LG	0.018511	0.033975	0.544853	0.5873
NPL	0.022597	0.121656	0.185743	0.8531
ROA	-1.785482	0.798147	-2.237033	0.0279
IRM	1.486969	2.096714	0.709190	0.4802
IRL	-0.735373	1.949132	-0.377282	0.7069
GDP	0.704043	0.317334	2.218616	0.0292
INF	-0.063293	0.065387	-0.967975	0.3358
STIR	0.433628	1.993276	0.217545	0.8283
RESID(-1)	0.804440	0.105250	7.643167	0.0000
RESID(-2)	-0.153140	0.133316	-1.148699	0.2539
RESID(-3)	-0.227695	0.136413	-1.669157	0.0988
RESID(-4)	0.123916	0.150345	0.824212	0.4122
RESID(-5)	-0.270112	0.131500	-2.054092	0.0431
RESID(-6)	0.070303	0.143374	0.490347	0.6252
RESID(-7)	0.053712	0.144948	0.370558	0.7119
RESID(-8)	0.012594	0.136773	0.092083	0.9269
RESID(-9)	-0.028417	0.133598	-0.212703	0.8321
RESID(-10)	-0.195798	0.112639	-1.738276	0.0858

R-squared	0.551317	Mean dependent var	7.98E-17
Adjusted R-squared	0.444487	S.D. dependent var	0.085263
S.E. of regression	0.063549	Akaike info criterion	-2.497163
Sum squared resid	0.339229	Schwarz criterion	-1.966371
Log likelihood	152.1010	Hannan-Quinn criter.	-2.282075
F-statistic	5.160724	Durbin-Watson stat	1.859064
Prob(F-statistic)	0.000000		

Test for Autocorrelation for L3

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	7.901221	Prob. F(10,84)	0.0000
Obs*R-squared	50.89362	Prob. Chi-Square(10)	0.0000

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 04/17/17 Time: 09:42

Sample: 1 105

Included observations: 105

Presample missing value lagged residuals set to zero.

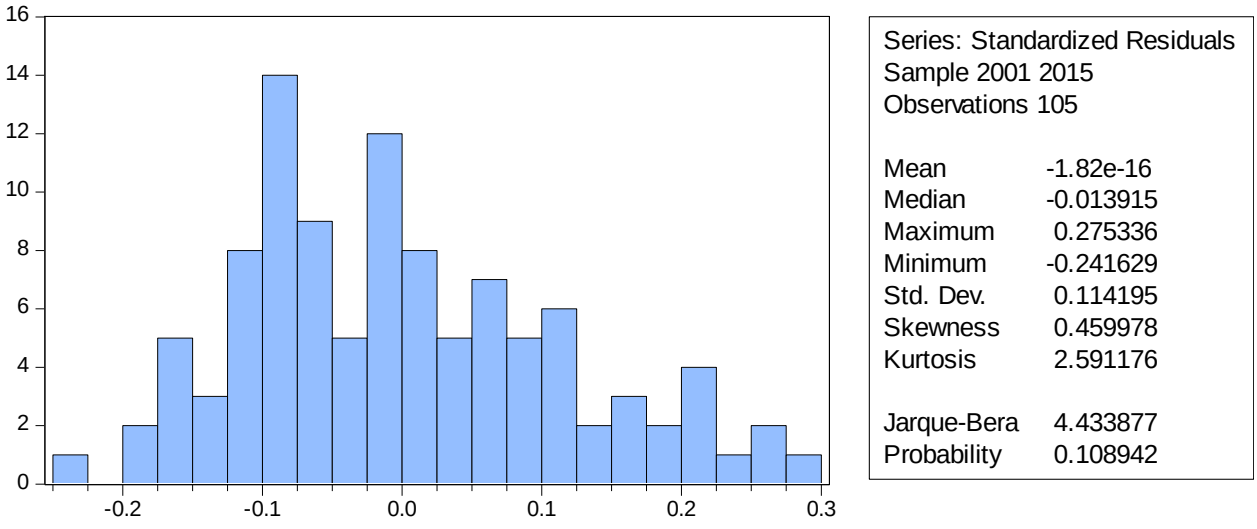
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.066683	0.123240	0.541079	0.5899
CAP	-0.135179	0.246294	-0.548852	0.5846
SIZE	-0.003040	0.011082	-0.274358	0.7845
LG	-0.019182	0.034911	-0.549446	0.5842
NPL	-0.086029	0.130004	-0.661740	0.5099
ROA	1.780657	0.876951	2.030509	0.0455
IRM	0.867367	2.060920	0.420864	0.6749
IRL	-1.144332	1.934527	-0.591531	0.5558
GDP	-0.425759	0.312985	-1.360317	0.1774
INF	0.005928	0.069438	0.085367	0.9322
STIR	1.102587	1.918762	0.574635	0.5671
RESID(-1)	0.748899	0.112368	6.664674	0.0000
RESID(-2)	-0.037246	0.132150	-0.281844	0.7788
RESID(-3)	-0.204317	0.126826	-1.611009	0.1109
RESID(-4)	-0.038267	0.136194	-0.280972	0.7794
RESID(-5)	-0.040866	0.132504	-0.308415	0.7585

RESID(-6)	0.082551	0.132498	0.623038	0.5349
RESID(-7)	-0.069389	0.140393	-0.494251	0.6224
RESID(-8)	0.102054	0.131017	0.778938	0.4382
RESID(-9)	-0.066048	0.131811	-0.501078	0.6176
RESID(-10)	-0.135163	0.119130	-1.134587	0.2598

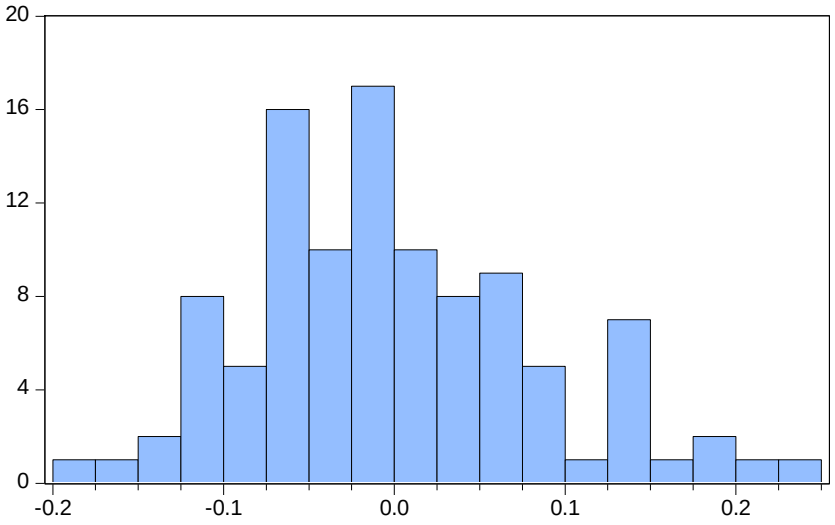
R-squared	0.484701	Mean dependent var	-1.06E-18
Adjusted R-squared	0.362011	S.D. dependent var	0.084485
S.E. of regression	0.067482	Akaike info criterion	-2.377061
Sum squared resid	0.382519	Schwarz criterion	-1.846269
Log likelihood	145.7957	Hannan-Quinn criter.	-2.161974
F-statistic	3.950611	Durbin-Watson stat	1.949824
Prob(F-statistic)	0.000005		

Appendix 6: Normality test (E-view)

Normality test for L1



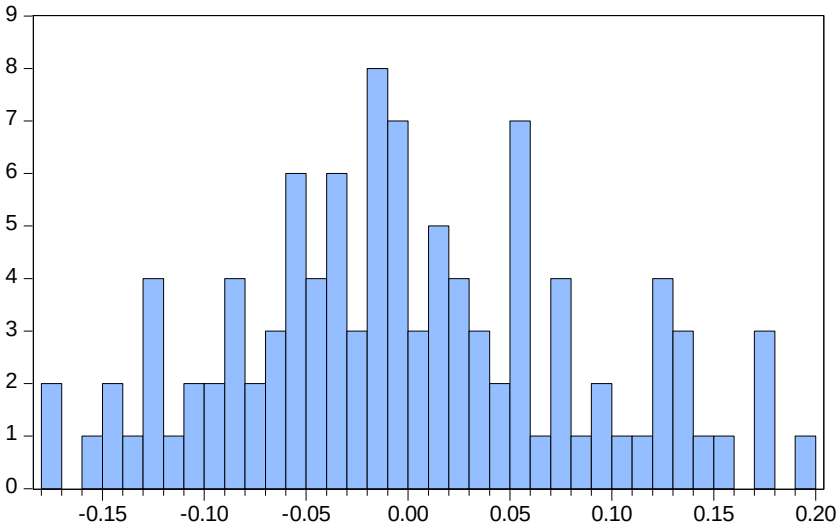
Normality test for L2



Series: Standardized Residuals
Sample 2001 2015
Observations 105

Mean	-2.59e-17
Median	-0.008747
Maximum	0.231744
Minimum	-0.194549
Std. Dev.	0.085263
Skewness	0.484463
Kurtosis	2.988368
Jarque-Bera	4.107916
Probability	0.128226

Normality test for L3



Series: Standardized Residuals
Sample 2001 2015
Observations 105

Mean	-5.74e-17
Median	-0.008050
Maximum	0.193636
Minimum	-0.174521
Std. Dev.	0.084485
Skewness	0.195056
Kurtosis	2.494303
Jarque-Bera	1.784639
Probability	0.409704

Appendix 7: Result of Fixed Effect Model (E-view)

Result of Fixed Effect Model for L1

Dependent Variable: L1

Method: Panel Least Squares

Date: 04/16/17 Time: 09:10

Sample: 2001 2015

Periods included: 15

Cross-sections included: 7

Total panel (balanced) observations: 105

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.691205	0.198716	3.478352	0.0008
CAP	0.940141	0.415749	2.261319	0.0260
SIZE	-0.024576	0.018788	-1.308084	0.1940
LG	-0.179715	0.056745	-3.167031	0.0021
NPL	0.708535	0.220197	3.217732	0.0018
ROA	2.917670	1.431767	2.037810	0.0444
IRM	7.065049	3.456060	2.044249	0.0437
IRL	-8.597884	3.200174	-2.686693	0.0085
GDP	0.244837	0.470582	0.520286	0.6041
INF	0.239638	0.116294	2.060625	0.0421
STIR	2.112613	3.127694	0.675454	0.5010

R-squared	0.450382	Mean dependent var	0.456987
Adjusted R-squared	0.391912	S.D. dependent var	0.154033
S.E. of regression	0.120115	Akaike info criterion	-1.301871
Sum squared resid	1.356202	Schwarz criterion	-1.023837
Log likelihood	79.34825	Hannan-Quinn criter.	-1.189207
F-statistic	7.702798	Durbin-Watson stat	1.758412
Prob(F-statistic)	0.000000		

Result of Fixed Effect Model for L2

Dependent Variable: L2

Method: Panel Least Squares

Date: 04/16/17 Time: 09:13

Sample: 2001 2015

Periods included: 15

Cross-sections included: 7

Total panel (balanced) observations: 105

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.589719	0.148371	3.974635	0.0001
CAP	0.127320	0.310417	0.410158	0.6826
SIZE	-0.024185	0.014028	-1.724099	0.0880
LG	-0.144700	0.042369	-3.415254	0.0009
NPL	0.546811	0.164409	3.325918	0.0013
ROA	1.999378	1.069023	1.870286	0.0646
IRM	3.728298	2.580452	1.444824	0.1518
IRL	-4.706754	2.389395	-1.969851	0.0518
GDP	0.324870	0.351358	0.924611	0.3575
INF	0.199735	0.086830	2.300293	0.0236
STIR	0.877869	2.335278	0.375916	0.7078

R-squared	0.449286	Mean dependent var	0.349370
Adjusted R-squared	0.390699	S.D. dependent var	0.114894
S.E. of regression	0.089684	Akaike info criterion	-1.886201
Sum squared resid	0.756055	Schwarz criterion	-1.608167
Log likelihood	110.0255	Hannan-Quinn criter.	-1.773536
F-statistic	7.668746	Durbin-Watson stat	1.762438
Prob(F-statistic)	0.000000		

Result of Fixed Effect Model for L3

Dependent Variable: L3

Method: Panel Least Squares

Date: 04/16/17 Time: 09:14

Sample: 2001 2015

Periods included: 15

Cross-sections included: 7

Total panel (balanced) observations: 105

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.189597	0.147017	8.091556	0.0000
CAP	0.591338	0.307585	1.922516	0.0576
SIZE	-0.047108	0.013900	-3.389143	0.0010
LG	0.095771	0.041982	2.281236	0.0248
NPL	-0.359769	0.162909	-2.208401	0.0296
ROA	0.594104	1.059271	0.560861	0.5762
IRM	-5.722787	2.556912	-2.238163	0.0276
IRL	2.786343	2.367599	1.176864	0.2422
GDP	-0.216658	0.348153	-0.622307	0.5352
INF	-0.053137	0.086038	-0.617592	0.5383
STIR	-1.357061	2.313975	-0.586463	0.5590

R-squared	0.741476	Mean dependent var	0.673356
Adjusted R-squared	0.713973	S.D. dependent var	0.166161
S.E. of regression	0.088865	Akaike info criterion	-1.904529
Sum squared resid	0.742324	Schwarz criterion	-1.626495
Log likelihood	110.9878	Hannan-Quinn criter.	-1.791864
F-statistic	26.96022	Durbin-Watson stat	1.755935
Prob(F-statistic)	0.000000		

Appendix 8: List of Commercial Banks in Ethiopia

No.	Bank Name	Year of Establishment	Ownership
1	Commercial Bank of Ethiopia	1963	Public
2	Awash International Bank	1994	Private
3	Dashen Bank	1995	Private
4	Bank of Abyssinia	1996	Private
5	Wegagen Bank	1997	Private
6	United Bank	1998	Private
7	NIB International Bank	1999	Private
8	Cooperative bank of Oromia	2004	Private
9	Lion International Bank	2006	Private
10	Oromia International Bank	2008	Private
11	Zemen Bank	2008	Private
12	Bunna International Bank	2009	Private
13	Birhan International Bank	2009	Private
14	Abbay Bank	2010	Private
15	Addis International Bank	2011	Private
16	Debub Global Bank	2012	Private
17	Enat Bank	2013	Private

Source: *National bank of Ethiopia*