Addis Ababa University

College of Business and Economics

Department of Accounting and Finance

Determinants of Liquidity in Commercial Banks of Ethiopia: The Case of Selected Private Banks

A Thesis Submitted In Partial Fulfilment of the Requirements for the Degree of Master of Science in Accounting and Finance

By

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DECLARATION

I, **Mekbib Shumet Yimer**, hereby declare that this research work entitled; "***Determinants of Liquidity in Commercial Banks of Ethiopia: The Case of Selected Private Banks***" submitted by me for the award of the degree of Master of Science in Accounting and Finance, is my original work and that all sources of materials used for the study have been duly acknowledged. I have carried out independently with the advice and comments of my advisor of the research, Abebe Yitayew (PhD).

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Advisor's Approval

This Thesis has been submitted for examination with my approval as a University advisor.

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This is to certify that this thesis prepared by Mekbib Shumet Yimer, entitled; "***Determinants of Liquidity in Commercial Banks of Ethiopia: The Case of Selected Private Banks*****"** and submitted in partial fulfilment of the requirements for the degree of Master of Science in Accounting and Finance complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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A b s t r a c t

Liquidity is one of the major concerns for banks and thus achieving the optimum level of liquidity is crucial. The main objective of this study was to identify the determinants of liquidity of private commercial banks in Ethiopia. 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 analysed 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.

Keywords: Determinants of Liquidity, Ethiopian Private Commercial Banks, Liquidity Ratio, Balanced Panel Fixed Effect Regression Model

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Acronyms

AIB: Awash International Bank S.C.

BCBS: Basel Committee for Banking Supervision

BIS: Bank for International Settlement

BLUE: Best Linear Unbiased Estimator

BOA: Bank of Abyssinia S.C

CAP: Capital adequacy

CBB: Construction and Business Bank

CBE: Commercial Bank of Ethiopia

CLRM: Classical Linear Regression Model

CPI: Consumer Price Index

DB: Dashen Bank S.C

DW: Durbin-Watson

ESRB: European Systemic Risk Board

FEM: Fixed Effect Model

GDP: Gross Domestic Product

HP: Hypotheses

INF: General inflation rate

IRL: Interest rate on Loans & Advances

IRM: Interest Rate Margin

JB: Jarque-Bera

LCR: The Liquidity Coverage Ratio

LG: Loan growth Rate

LOLR: Lender of Last Resort

MoFED: Ministry of Finance and Economic Development

NBE: National Bank of Ethiopia

NIB: Nib International Bank S.C

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 S.C

WB: Wegagen Bank S.C

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Chapter One: Introduction

1.1. Background of the study

Banks are financial institutions that play intermediary function in the economy through channelling financial resources from surplus economic units to deficit economic units. Especially in developing countries like Ethiopia, the role of capital market is nil, and as a result commercial banks become the most dominant financial institutions in the financial system. For banks to be effectively discharge their responsibilities of availing funds to customers, they must be in a healthy condition. As it was pointed out by Diamond and Dybvig (1983), one of the key reasons why banks may not be in healthy condition is their role in transforming maturity and providing insurance to depositors potential liquidity needs.

According to Bank for International Settlements (2008), liquidity is defined as "the ability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses". 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. As a consequence, banks fundamentally need to hold optimal level of liquidity to maintain efficiency and operative excellence. Effective & efficient liquidity management is a paramount importance as a liquidity problem in one bank may have industry wide repercussion. On the other hand, maintaining large amount of liquid asset affects profitability of a bank, that raises the importance of liquidity management and sustaining the optimal level of liquidity is a real art of bank"s management. In the banking industry, maintaining of optimum level of liquidity is greatly linked with the efficient banking operations. As per the study made by Malik and Rafique (2013), when the bank is not adequately manage its liquidity, it may lead to insolvency (in case of low liquidity) or low profitability (in case of high liquidity) and ultimately destroy the wealth of shareholder and breakdown of entire financial institution. Hence, maintaining the optimum level of liquidity is very important in order to make the bank successfully functioning and profitable. In this regard, the study made by Greuning and Bratonovic (2004) suggested that, in order to manage liquidity of banks, they must have a well-defined liquidity management policy that is communicated in the whole organization and there must be a liquidity control strategy that specifies certain rules regarding management of assets and liabilities.

The financial sector in Ethiopia has been experiencing major transformation on its operating environment following the downfall of the Dergue Regime. On top of this, sixteen private commercial banks have been opened during the last twenty years. The competition in the banking industry of Ethiopia becomes increasing from time to time as more new private domestic banks are joining to the industry. Especially, it creates competition among banks in terms of resource mobilization which leads to curiosity in liquidity management. Even, the private commercial banks vigilant the public banks to actively compete in the resource mobilization through expanding branch networks and implementation of new strategies.

The issue of determinants of bank‟s liquidity were studied by various researchers such as Vodova(2011, 2012, 2013), Malik & Rafique(2013), Chagwiza(2013), Fadare(2011) and shows that, bank liquidity is influenced by both bank specific and macroeconomic factors. However, those factors which were statistically significant impact on liquidity in one country may not be replicated in another country. In the context of Ethiopian banks, to the knowledge of the researcher, there is only one work on the assessment of determinants of the banks‟ liquidity which was conducted by Tseganesh (2012). The study was conducted by examining determinants of liquidity of commercial banks in Ethiopia, including public banks. However, factors affecting private commercial banks liquidity is still unexplored part. Therefore, empirical studies are essential to identify the determinants of liquidity of Ethiopian private commercial banks and hence this paper aims to study on the determinants of bank‟s liquidity in Ethiopian private commercial banks.

1.2. Statement of the problem

The fundamental role of a bank is to channel funds from surplus economic unit to deficit economic units. They also provide a channel for policy makers to conduct monetary policies that control the price and foreign exchange stability. However, the activity of the bank is not without problems, since banks have fundamental role in the maturity transformation of short-term deposits into long-term loans that inherently exposed for liquidity risk. In such circumstance, banks will be exposed to liquidity problem and may frustrate their costumers and may affect the financial sector as a whole. On the other hand, when banks hold excess liquid asset which are non-earning assets such as cash and non-interest bearing deposits, the bank‟s profitability will be affected. Hence, every bank have

to ensure that it operates to satisfy its profitability target and at the same time to meet the financial demands of its customers by maintaining optimum level of liquidity.

In recent days, following the financial crisis of 2007, liquidity risk has become one of the major concerns of financial institutions throughout the world. The financial crisis revealed that, liquidity becomes one of the top priorities of a bank‟s management to ensure the availability of sufficient funds to meet future demands at reasonable costs. Therefore, identifying the determinants of banks liquidity buffer has become the major concern of all banks and their regulators so as to mitigate liquidity risk.

In Ethiopia, during the last two decades, the private 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, the National Bank of Ethiopia has required banks to have their own liquidity policy (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 emphasising on private commercial banks are very scanty.

To the knowledge of the researcher, only one related study was conducted by Tseganesh (2012), which tries to identify the impact of bank specific and macroeconomic variables on liquidity of Ethiopian commercial banks including public banks. While there are no prior studies made which considers Ethiopian private commercial banks only and hence, the lack of sufficient research on the determinants of liquidity in the context of Ethiopian private commercial banks was initiated this study. Therefore, this study seeks to fill the gap by providing information about macroeconomic and bank specific factors that affects the liquidity of Ethiopian private commercial banks.

1.3. Objective of the study

There are many factors that determine bank‟s liquidity. This study is mainly focused on the determinants of liquidity on Ethiopian private commercial banks which enables them to determine their liquidity requirement and ensures their ability to meet up the depositors demand or their financial obligations and maximizing their shareholders value.

The general objective of this study is to identify the determinants of bank‟s liquidity in Ethiopian private commercial banks and the specific objectives are:

- To identify the macroeconomic determinants of bank‟s liquidity in Ethiopian private commercial banks
- To identify the bank specific determinants of bank‟s liquidity in Ethiopian private commercial banks

In line with the objectives of the study, the following research questions will be administered.

- What are the significant macroeconomic determinants of bank‟s liquidity in Ethiopian private commercial banks?
- What are the significant bank specific determinants of bank‟s liquidity in Ethiopian private commercial banks?

1.4. Hypotheses of the study

The purpose of this study is mainly focuses on to identify the determinants of bank‟s liquidity in Ethiopian private commercial banks. In order to evaluate and identify the determinants and to break down the research questions, the following major hypotheses will be tested in the case of Ethiopian private commercial banks.

H1: Capital adequacy has positive and significant impact on bank‟s liquidity
H2: Bank size has positive and significant impact on bank‟s liquidity
H3: Profitability has negative and significant impact on bank‟s liquidity
H4: Non-performing loans has negative and significant impact on bank‟s liquidity
H5: Interest rate on loans and advances has negative and significant impact on bank‟s liquidity
H6: Loan growth has negative and significant impact on bank‟s liquidity
H7: Interest rate margin has negative and significant impact on bank‟s liquidity

H8: Real GDP growth has negative and significant impact on bank‟s liquidity

H9: Inflation has negative and significant impact on bank‟s liquidity

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

1.5. Scope of the study

This paper is confined in identifying the determinants of bank‟s liquidity on Ethiopian private commercial banks. Though there are sixteen private and two publicly owned commercial banks in Ethiopia, the study selected only six privately owned commercial banks that have at least fifteen years of experience at the end of June 30, 2015.

1.6. Significant of the study

The issue of liquidity management has now got great attention in the Ethiopian banking industry. Moreover, the supervisory authority has required banks to have their own liquidity policy which enforces them 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. Thus, this study has great contribution to the Ethiopian commercial banks to assess their liquidity requirement and to produce their liquidity policy and to give due attention on those factors which have significant impact on bank‟s 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 will have great contribution to the supervisory authority, policy makers, commercial banks and other researchers to gain knowledge about their impact and the relationship between the macroeconomic and bank specific factors and liquidity of commercial banks.

1.7. Organizations of the paper

This research report was organized under five chapters. The first chapter provides the general overview of the study. The second chapter reviewed the related literatures on the determinants of bank‟s liquidity. The third chapter focuses on the methodology of the study. The fourth chapter was provided results and discussion. The final chapter includes conclusion and recommendations and at the end references and appendixes were attached.

Chapter Two: Review of Related Literatures

Banks play a central role in all modern financial systems. To perform its role effectively, they must be safe and be perceived as such. The single most important assurance is the economic value of a bank‟s assets to be worth significantly more than the liabilities that it owes. The difference represents a cushion of "capital" that is available to cover losses of any kind. However, the global financial crisis underlined the importance of a second type of buffer, the "liquidity" that enables banks to cover unexpected cash outflows. A bank can be solvent, by holding assets that exceed its liabilities on an economic and accounting basis, and still die a sudden death if the bank does not have enough liquidity to meet its obligations when they fall due including continuing obligation such as those to fund the holding of assets (BCBS, 2004).

Most importantly, the primary role of banks in the economy is to create liquidity by funding illiquid loans with liquid demand deposits or in other words banks actually collecting short term deposit and issuing loans for long terms (Diamond 1984, Ramakrishnan and Thakor 1984). This liquidity creation role exposed banks for liquidity problem that banks need to manage in order to prevent itself from a sudden death. When bank does not have enough liquidity to fulfil its obligation, the bank is said to face liquidity risk.

It is known that all businesses including banks face liquidity risk. However, the banks liquidity risk is inherent from its intermediation role of providing mismatched maturities of deposit and loans (short-term deposit for long-term loans). As a consequence, banks fundamentally need to hold an optimal level of liquidity to maintain efficiency and operative excellence.

This review of the literature part establishes the framework for the study and clearly identifying the gap in the literature that help to formulate the research hypotheses for the study. The remainder part of this chapter is organized as follows: Section 2.1 discusses about the theoretical aspects of bank liquidity and measurement of bank‟s liquidity. Section 2.2 discusses the determinants of bank‟s liquidity. Section 2.3 extensively reviews important related empirical studies in the area of developed, developing and least developed countries including related empirical studies in Ethiopia. Finally, section 2.4 summaries the chapter and briefly discuss the knowledge gap from past literatures.

2.1 Review of Related Theoretical Literature

2.1.1 Conceptual Background

A first requirement to study bank‟s liquidity buffers is to find an adequate definition of liquidity. The financial economics literature distinguishes between two concepts of liquidity: market liquidity and funding liquidity (Drehmann and Nikolaou, 2009). Market liquidity describes a particular characteristic of an asset: a high degree of market liquidity implies the ability to offset or eliminate a position in a given asset at or close to the current market price. This feature of the asset may not be constant over time. An asset which is currently market liquid may not necessarily have been market liquid in the past, nor need it be continuously market liquid in the future. Factors such as market concentration or the prevalence and distribution of asymmetric information may affect the degree of market liquidity.

Funding liquidity describes particular characteristics of a financial agent: it refers to its ability to meet obligations as they come due. 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. At any point in time, a financial institution is either funding liquid or not. Nevertheless, the two concepts are linked (Brunnermeier, 2009). Suppose a bank only holds assets which are perfectly market-liquid. In this case the bank will also be funding liquid, as long as it is solvent. Market liquidity, however, may vary over time, and an institution‟s funding liquidity may thus change accordingly. Suppose a sufficiently large portion of the bank‟s assets suddenly become perfectly market illiquid, while the bank remains solvent. The bank will no longer be able to honor its short-term obligations and will become distressed. This is, in fact, a stylized description of the difficulties encountered by a large number of financial institutions during 2007, the previously highly liquid market for mortgage-backed securities dried up. This situation 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.

For the purpose of this study, we require a measure of market-liquid assets held by banks to guarantee constant funding liquidity. Yet the example above highlights the difficulty of obtaining a

measure that adequately accounts for the dynamic nature of market liquidity. To circumvent this problem, we focus only on those assets in banks‟ portfolios which - virtually by their definition – are permanently market-liquid: cash and due from banks. We expect that this narrow definition of liquidity captures banks‟ qualitative choices about liquidity buffers.

Liquidity risk refers to the risk that a financial agent will be unable to meet obligations at a reasonable cost as they come due. In other words, it reflects the probability that the agent will become funding illiquid during a given time period. As explained in the previous section, banks‟ core business is to "borrow short and lend long" they are especially prone to liquidity risk. Banks manage the liquidity risk inherent in their balance sheets by maintaining a buffer of market-liquid assets - such as cash or government securities which anticipates their depositors‟ liquidity demands within the relevant timeframe.

As pointed out by Diamond and Dybvig (1983), banks thus benefit from the ability to pool liquidity risk over a large group of depositors. It would be undesirable for banks to invest only in perfectly market-liquid assets at all times as this would effectively eliminate the pooling advantage banks have compared to the liquidity risk management that could be undertaken by their individual customers. Yet, it would be equally undesirable for banks not to invest in market-liquid assets at all, as this would burden depositors with excessive liquidity risks.

Until recently, liquidity risk was not the main focus of banking regulators. The 2007-2009 crisis showed, however, how rapidly market conditions can change exposing severe liquidity risks in institutions, many times unrelated to capital levels. Now, there is wide agreement that insufficient liquidity buffers were a root cause of this crisis and the on-going disruptions of the world financial system, making the improvement of liquidity risk analysis and supervision a key issue for the years to come (Brunnermeier, 2009 and BCBS, 2008).

Efforts are underway internationally as well as in individual countries to establish or reform (existing) liquidity risk frameworks, most notably by the Basel Committee for Banking Supervision (BCBS). The BCBS‟s new regulatory framework (Basel III) proposes a short and long-term liquidity requirement to reinforce the resilience of banks to liquidity risks (BCBS, 2010 and BCBS, 2013). The Liquidity Coverage Ratio (LCR) is a short-term ratio requiring financial institutions to

hold enough liquid assets to withstand a thirty day stress period. The second measure, the Net Stable Funding Ratio (NSFR) aims at improving banks‟ longer-term, structural funding. BCBS (2013) also requires institutions to disclose certain elements regarding their fulfilment of these minimum requirements. Recently the European Systemic Risk Board (ESRB) has recommended national supervisory agencies to intensify the supervision of liquidity and funding risks as well (ESRB, 2013).

2.1.2 Bank liquidity Creation and Financial Fragility Theory

According to the theory of financial intermediation, an important role of banks in the economy is to provide liquidity by funding long term illiquid assets with short term liquid liabilities. 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. Banks perform valuable activities on either side of their balance sheets; on the asset side, they make loans to illiquid borrowers and on the liability side, they provide liquidity on demand to depositors. As of Diamond and 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 and Dybvig (1983) 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. In general, 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 usual justification for the existence of deposit taking institutions, thereby giving an explanation for the economically important role of banks in providing liquidity, was initially modelled by (Bryant 1980; Diamond and Dybvig 1983). They 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.

Kashyap et.al (2002) conducted a related analysis justifying the existence of bank‟s liquidity creation. They argued that as 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. Diamond and Rajan (2005) provides a detailed analysis of the link between liquidity shortages and systemic banking crises. 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. Generally, liquidity risk arises from the fundamental role of banks in the maturity transformation of short-term deposits into long term loans.

2.1.3 Quantitative Framework for Measuring Bank's Liquidity

Financial institution can mobilizes resources through new deposits, maturing assets, borrowed funds and/or using the discount window (borrowing from the central bank). While financial institution may encounter liquidity risk. According to Rochet (2008), the three sources of liquidity risk are; on the liability side, there is a large uncertainty on the volume of withdrawals of deposits or the rolled-over of inter-bank loans, on the asset side, there is an uncertainty on the volume of new requests for loans that a bank will receive in the future, and off-balance sheet items, like credit lines and other commitments taken by the bank.

Some of the mechanisms to insure liquidity crises are: banks hold buffer of liquid assets on the asset side of the balance sheet 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. The second strategy is, banks can rely on the interbank market where they borrow from other banks in case of liquidity demand. The last strategy is that, 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 (Aspachs et al. 2005).

The two most widely used approaches to measure liquidity of banks are by liquidity gap approach (flow perspective) or liquidity ratio approach (stock perspective). The liquidity gap/flow approach treats liquidity reserves as a reservoir which the bank assesses its liquidity risk by comparing the variability in inflows and outflows to determine the amount of reserves that are needed during the period. The liquidity gap approach adapts the variation between assets and liabilities both current and future period. A positive liquidity gap means for deficit, requiring for liabilities to be increased (Bassis, 2009).

The liquidity ratio/stock approach, in contrast, employs various balance sheet ratios to identify liquidity trends. 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. Various authors like Moor (2010), Rychtarik (2009), or Praet and Herzberg (2008) have also provided similar understandings with liquidity ratios such as liquid assets to total assets, liquid assets to deposits, loans to total assets and loans to deposits. In short, the liquidity ratio carries varies balance sheet ratios to identify liquidity needs.

Though both approaches are intuitively appealing, the flow approach is more data intensive and there is no standard technique to forecast inflows and outflows. As a result, the stock approaches are more popular in practice and the academic literatures, due to the availability of more standardized method (Crosse and Hempel 1980; Yeager and Seitz, 1989; Hempel et al. 1994). According to Crosse and Hempel (1980), the most popular stock ratios are liquid asset to deposit, loan-to-deposit ratio and the liquid asset-to-total asset ratio. When the higher the loan-to-deposit ratio (or the lower liquid asset to deposit ratio and the liquid asset-to-total asset ratio) the less able a bank to meet any additional loan demand (indicate for less liquidity). Both indicators have their shortcomings: the loan-to-deposit ratio does not show the other assets available for conversion into cash to meet demands for withdrawals or loans, while the liquid assets ratio ignores the flow of funds from repayments, increase in liabilities and the demand for bank funds. Nevertheless, according to Crosse and Hempel (1980), these ratios likely to move in parallel trend.

Hence, to meet the objectives of this study, the liquidity ratio/stock approach was chosen over the flow/liquidity gap approach. The researcher chooses to employ three liquidity ratios to overcome the shortcomings of one from the other. The researcher mainly chooses the liquid asset-to-deposit

ratio because the liquidity framework from NBE is favourable towards this ratio. Liquid asset-to-total assets ratio and loan-to-deposit ratio were used as a robustness check.

2.2. Determinants of Bank Liquidity

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

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) and 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 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.

2.2.3. Bank Specific Characteristics

The internal (bank-specific) factors are factors that are related to internal efficiencies and managerial decisions. Such factors include determinants such as bank profitability, capital adequacy, bank size, asset quality (non-performing loans), growth of loan, interest rate margin and the like.

Profitability and Bank Liquidity:

Profitability accounts for the impact of better financial soundness on bank risk bearing capacity and on their ability to perform liquidity transformation (Rauch et al. 2008 and Shen et al. 2010). A sound and profitable banking sector is better able to withstand negative shocks and contribute to the stability of the financial system (Athanasoglou et al. 2005). One of the highest yielding assets of a bank is loans & advances that provide the largest portion of operating revenue. In this respect, banks are faced with liquidity risk since loans and advances are funds from deposit of customers. The higher the volume of loans & advances extended to customers, the higher the interest income and highest profit potentials for banks but it affects liquidity of the bank. Thus, banks need to strike a balance between liquidity and profitability.

The relationship between profitability and liquidity varies among different literatures. According to Bourke (1989), banks holding more liquid assets benefit from a superior perception in funding markets, reducing their financing costs and increasing profitability. On the other hand, the studies made by (Molyneux and Thornton 1992; Goddard et al. 2004) argued that holding liquid asset imposes an opportunity cost on the bank and has an inverse relationship with profitability. Further, Myers and Rajan (1998) emphasized the adverse effect of increased liquidity for financial institutions stating that, "although more liquid assets increase the ability to raise cash on short-notice, they also reduce management‟s ability to commit credibly to an investment strategy that protects investors" which, finally, can result in reduction of the "firm‟s capacity to raise external finance" in some cases. Thus, this indicates the negative relationship between bank profitability and liquidity. The trade-offs that generally exist between return and liquidity risk are demonstrated by observing that a shift from short term securities to long term securities or loans raises a banks‟ return but also increases its liquidity risks. As a result of the two opposing views, the management of banks faced with the dilemma of liquidity and profitability.

Non-performing loans and Bank Liquidity:

Non-performing loans are 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 (NBE directive No.SBB/43/2008). According to (Ghafoor, 2009), non-

performing loans are loans that a bank customer fails to meet his/her contractual obligations on either principal or interest payments exceeding the scheduled repayment dates. Thus, 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.

The banking systems play the central role of mobilizing and allocating resources in the market by channelling fund from surplus economic units to deficit economic units. This activity of transforming short term deposit to long term loans & advances will generate most profits for banks. However, it involves high risk and eventually if not managed properly will leads to high amount of non-performing loans. The increased on non-performing loan reflects deteriorated asset quality, credit risk and its inefficiency in the allocation of resources. According to Bloem and Gorter (2001), though non-performing loans may affect all sectors, the most serious impact is on financial institutions which tend to have large loan portfolios. On the other hand, large volume of non-performing loans portfolio will affect the ability of banks to provide credit and leads to loss of confidence and liquidity problems. Therefore, the amount of non-performing loans has a negative impact on bank‟s liquidity.

Capital Adequacy and Bank Liquidity

Capital can be defined as common stock plus surplus fund plus undivided profits plus reserves for contingencies and other capital reserves. Besides, a bank‟s loan loss reserves which serve as a buffer for absorbing losses can be included as bank‟s capital (Patheja 1994). The primary reason why banks hold capital is to absorb risk including the risk of liquidity crunches, protection against bank runs, and various other risks. According to Moh‟d and Fakhris (2013), bank‟s capital plays a very important role in maintaining safety and solidarity of banks and the security of banking systems in general as it represents the buffer gate that prevents any unexpected loss that banks might face, which might reach depositors funds given that banks operate in a highly uncertain environment that might lead to their exposure to various risks and losses that might result from risks facing banks. The recent theories suggest that, bank capital may also affect banks‟ ability to create liquidity. These theories produce opposing predictions on the relationship between capital and liquidity creation.

Under the first view, the "financial fragility-crowding out" theories predicts that, higher capital reduces liquidity creation and lower capital tends to favour liquidity creation (Diamond and Rajan, 2000, 2001). They stated 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. Furthermore, Gorton and Winton (2000) show that a higher capital ratio may reduce liquidity creation through another effect: "the crowding out of deposits". They consider that deposits are more effective liquidity hedges for agents than investments in bank equity. Indeed, deposits are totally or partially insured and withdrawable at par value. By contrast, bank capital is not eligible and with a stochastic value that depends on the state of bank fundamentals and on the liquidity of the stock exchange. Consequently, higher capital ratios shift investors‟ funds from relatively liquid deposits to relatively illiquid bank capital. Thus, the higher is the bank's capital ratio; the lower is its liquidity creation.

The second view is that, higher capital requirement 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 and Dybvig (1983) and Allen and Gale (2004) stating that liquidity creation exposes banks to risk. The greater liquidity needs of banks, incur higher losses due to the disposal of illiquid assets at available market prices rather than the desired prices to meet the customers‟ obligations. Al-Khouri (2012) has also found that, bank capital increases bank liquidity through its ability to absorb risk. Thus, under the second view, the higher is the bank's capital ratio, the higher is its liquidity creation

Bank Size and Bank Liquidity:

When bank size grows it will help them to overcome the risk but it should be noted that it may leads also to failure. 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). If big banks are seeing themselves as "too big to fail", their motivation to hold liquid assets is limited. In case of a liquidity shortage, they rely on a liquidity assistance of Lender of Last Resort (Vodova, 2011). Thus, large banks are likely to perform higher levels of liquidity creation that exposes them to losses associated with having to sale illiquid assets to satisfy

the liquidity demands of customers (Kiyotaki and Moore, 2008). Therefore, "too big to fail" status of large banks could lead to moral hazard behaviour and excessive risk exposure and thus there can be negative relationship between bank size and liquidity.

In agreement for positive relationship between bank size and liquidity (Rauch et al ,2009 and Berger and Bouwman (2009), state that smaller bank tend to emphasis on intermediation processes and transformation activities and they do have smaller amount of liquidity. Hence, there can be positive relationship between bank size and liquidity.

Interest Rate Margin and Bank Liquidity

Interest rate margin is one of the most important factors that gauge the efficiency of financial institutions. 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 and Suarez 2000). According to (Azeez et al, 2013), interest rate margin is defined as 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. 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. 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.

According to the liquidity preference theory, lenders need high interest rate which includes the 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. 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 (Pilbeam 2005). Higher interest rate margin will force banks to lend more and reduce their holding of liquid assets. On the other hand, holding of liquid asset reduce the risk that banks may face liquidity shortage in case of unexpected withdrawals and thus as liquid assets increases, a bank‟s liquidity risks decreases, which leads to a

lower liquidity premium component of the net interest margin (Angabazo1997). Therefore, there is a negative relationship between interest rate margin and banks liquidity.

Loan Growth and Bank Liquidity

The loans & advances portfolio is the largest asset and the predominate source of revenue of banks. According to Diamond & Rajan (2002), lending is the principal business activity for banks. Since loans are illiquid assets, increase in the amount of loans means increase in illiquid assets in the asset portfolio of a bank. The amount of liquidity held by banks is heavily influenced by loan demand and it is the base for loan growth (Pilbeam 2005) . If demand for loans is weak, then the bank tends to hold more liquid assets whereas, if demand for loans is high they tend to hold less liquid assets since long term loans are generally more profitable. Therefore, loan growth has negative relationship with bank liquidity.

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.

2.2.4 Macroeconomic Fundamentals

The external or macro determinants are variables that are not related to bank management but reflect the economic and legal environment that affects the operation and liquidity positions of institutions. The macroeconomic factors that can affect bank‟s liquidity include factors such as GDP growth rate; inflation rate and short term interest rate among others.

GDP Growth and Bank Liquidity:

Gross Domestic Product (GDP) is one of the macroeconomic factors that affect liquidity of banks. 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). During economic boom, the demand for differentiated financial products is higher and may improve bank‟s ability to expand its loans and securities at higher rate and thus reduce liquidity. The other study made by Painceira (2010) stated that, banks liquidity fondness is low in the course of economic boom where banks confidentiality expects to profit by expanding loanable fund to sustain economic boom while restricted loanable fund during economic downturn to prioritize liquidity. In line with this argument the loanable fund theory of interest states that, the supply for loan increases when the economy is at boom or going out of recession (Pilbeam 2005).

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 favourable. On the other hand, the studies made by Bordo et al. (2001) suggested that 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.

The Rate of Inflation and Bank Liquidity:

Inflation reflects a situation where the demand for goods and services exceeds their supply in the economy. Existing monetary theories agree that, inflation increases the opportunity cost of holding liquidity and thus distorts the allocation of resources which require liquidity in transaction. 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 performance and therefore long-run real activity (Huybens and Smith 1998, 1999).

The feature of these theories is that, there is an informational friction whose severity is endogenous. Given this feature, an increase in the rate of inflation drives down the real rate of return not just on money, but on assets in general. According to Huybens and 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. Further, the amount of liquid assets held 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).

Short Term Interest Rate and Bank Liquidity:

Short term interest rate is the rate paid on money market instruments. Money market instruments are securities that have a year or less to maturity, which includes Treasury bills, commercial papers banker‟s acceptances, certificates of deposit, repurchase agreements. 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 as collateral if bank wishes to raise funds from central bank because they are short maturing and have less default risk. The higher short term interest rate induces banks to invest more in the short term instruments and enhance their liquidity position Pilbeam, (2005). Therefore, short term interest rate has positive relationship with liquidity.

2.3 Review of Related Empirical Studies

This section gives a brief review of the previous studies made on the determinants of bank‟s liquidity from both developed and developing nations. Moreover, most of the studies undertaken on bank liquidity consider both bank specific and macroeconomic factors to examine the determinants of liquidity of banks. So, the studies conducted in related to bank‟s liquidity are reviewed as follows.

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 analysed 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 analysed 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: behaviour 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 behaviour

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 behaviour 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 analysed 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 and 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 and 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 analysed 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 Tunisia 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

As to the author‟s knowledge, the first study was conducted by Tseganesh (2012). She studied the determinants of banks liquidity and their impact on financial performance on commercial banks in Ethiopia including both public and private banks. Her study focused on two stapes; first, to identify determinants of commercial banks liquidity in Ethiopia and then to see the impact of banks liquidity up on financial performance through the significant variables explaining liquidity. The data was analysed 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 non-performing 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.

2.4. Summary and knowledge Gap

The fundamental role of banks in the maturity transformation of short-term deposits into long-term loans makes banks inherently vulnerable to liquidity risk both of an institution-specific nature and that which affects markets as a whole. Virtually every financial transaction or commitment has implications for a bank‟s liquidity. Effective liquidity risk management helps to ensure a bank's ability to meet cash flow obligations, which are uncertain as they are affected by external events and other agents' behaviour.

Financial market developments in the past decade have increased the complexity of liquidity risk and its management. The global market turmoil that began in mid-2007 re-emphasized the importance of liquidity to the functioning of financial markets and the banking sector. The financial crisis illustrated how quickly liquidity can evaporate and that illiquidity can last for an extended period of time. The banking system came under severe stress, which necessitated central bank action to support both the functioning of money markets and, in a few cases, individual institutions.

As it was discussed in the literature review part, liquidity of banks can be affected by bank specific as well as macroeconomic factors. It was also discussed that some factors which have significant impact on liquidity of banks in one country may not have the same impact on another country. Thus it is important to identify the determinants of liquidity of Ethiopian commercial banks.

As to the knowledge of the researcher, there is only one study made by Tseganesh (2012) on the determinants of bank‟s liquidity on Ethiopian commercial banks including public banks. While there is no study made to identify the determinants of liquidity by taking private commercial banks only. Therefore, the objective of this study is to identify the determinants of liquidity of Ethiopian private commercial banks

Chapter Three: Research Methodology

This section discusses on the research question, hypothesis, approach and techniques adopted for the study with the aim of achieving the research objectives. The process of research usually entails problem identification, making hypothetical statements, collecting relevant data and then analysing the data using the relevant and appropriate statistical tools. This section explains the research design and provides details regarding the population, sample and sampling technique, the research instruments used in collecting data for the study and the data collection and data analysis methods. It also discusses about the model and the components of the model both the dependent and the independent variables.

3.1. Research Design

The research methodology begins by presenting the overall research design, as the research design provides an important framework & guidelines on how to collect and analyse data. The choice of appropriate research design will help the researcher to answer the research questions and to satisfy the research objectives. Therefore, it is a paramount to properly define and evaluate the research design before conducting the research.

According to Creswell (2009), there are three basic research approaches; these are quantitative, qualitative and mixed research approaches. The quantitative data research relies on the measurement and analysis of statistical data to produce quantifiable conclusions. Quantitative research is a means for testing objective theories by examining the relationship among variables (Creswell, 2009). Therefore, for this study quantitative research approach is used to see the relationship between the liquidity of private commercial banks and the bank specific and macroeconomic factors affecting banks liquidity in Ethiopia by establishing causal relationship. This study also adopted an explanatory approach by using balanced panel research design to meet the research objective. As explained by Bhattacherjee (2012), explanatory research attempts to identify causal factors and outcomes of the target phenomenon. According to Brooks (2008), a panel of data will embody information across both time and space and it measures some quantity about them over time. The advantage of using panel data is to address a broader range of issues and tackle more complex problems than would be possible with pure time-series or pure cross-sectional data alone. Panel data has also the advantage of giving more informative data as it consists of both

the cross sectional information, which captures individual variability, and the time series information, which captures dynamic adjustment (Brooks 2008 pp 488).

3.2 Source and Method of Data Collection

In order to carry out any research activity information should be gathered from proper sources. Consistent and reliable research indicates that research conducted by using appropriate data collection instruments increase the credibility and value of research findings (Koul, L 2006). The sources of data for this research were secondary sources. Bank specific data were collected from audited financial statements (i.e. Balance Sheet and Profit & Loss Statement) of each selected commercial banks included in the sample and macroeconomic data were collected from NBE and MoFED. The data were collected from 2000 to 2015 on annual base and the figures for the variables were on June 30th of each year under study.

3.3. Study Population & Sampling Frame

The study population includes all private commercial banks in Ethiopia. According to NBE report, at the end of June 30, 2015 there are sixteen privately owned commercial banks and two publicly owned commercial banks (Appendix IV) .The sampling frame for drawing the sample includes those privately owned commercial banks having at least fifteen years of experience as of June 30, 2015. As a result of it sixteen years of data (2000 to 2015) has been taken. The rationale for using sixteen years of data was to increase the number of observation.

3.4. Sampling Technique & Sample Size

For some researches, it is possible to collect data for the entire population as it can be manageable and data is available, while for some other researches data is collected on sample base. Sampling provides a valid alternative when it is impractical to survey the entire population and when there is budget and time constraint to surveying the entire population (Saunders et al, 2009). There are two types of sampling techniques; probability or representative sampling and non-probability or judgemental sampling. In the probability sampling, the chance or probability, of each case being selected from the population is known and is usually equal for all cases while in the non-probability sampling, the probability of each case being selected from the total population is not known (Saunders. et al, 2009). According to Bhattacherjee (2012), non-probability sampling is sampling

technique in which some units of the population have zero chance of selection or where the probability of selection cannot be accurately determined rather samples are selected based on certain non-random criteria, such as quota or convenience.

The sampling technique used in this research is a non-probabilistic sampling and among the non-probabilistic sampling methods, this research uses purposive sampling. As stated by Saunders et al (2009), purposive sampling is often used when working with small samples and when we wish to select cases that are particularly informative. Thus the researcher used purposive sampling by considering the availability of full data for the selected time period. In Ethiopia, there are eighteen commercial banks of which two of them are publicly owned and sixteen of them are privately owned. Among the sixteen private commercial banks, six of them have more than fifteen years of data. These banks are; Dashen Bank, Awash International Bank, Bank of Abyssinia, Wegagen Bank, NIB International Bank and United Bank. In order to have balanced panel data for sixteen years, those private commercial banks which have less than sixteen years in operation are not selected for this study. Therefore, six private commercial banks were selected and it was possible to draw a relationship among variables using 96 observations (6 banks x 16 year‟s data).

3.5. Methods of Data Analysis

After the data were collected, it was organized and financial ratios were computed for each bank of each bank specific variables. And then, the next step was analysing and interpreting them accordingly to achieve the stated objectives. In this study two type of statistical analysis was 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 meaning full 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 was used to determine the relative importance of each independent variable in influencing liquidity of Ethiopian private commercial banks. To conduct this, the researcher uses statistical tools E-views6 software. The researcher has also performed diagnostic

tests to ensure whether the assumptions of the classical linear regression model (CLRM) are violated or not.

3.6. Variable Definition & Hypotheses of the Study

This study is focused on to identify the determinants of bank‟s liquidity in Ethiopian private commercial banks through testing the hypotheses regarding to the relationships between liquidity of banks and 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. Though various bank specific and macrocosmic variables were conducted in the previous studies made worldwide, in this study some variables (bank specific and macroeconomic) were included .The study also considered which determinate factors could influence the liquidity of banks in the Ethiopia private commercial banks 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. Dependant Variables

Liquidity of Banks: Bank for International Settlements (2008) defines liquidity as "the ability of bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses". Liquidity can also be defined as a measure of the relative amount of asset in cash or which can be quickly converted into cash without any loss in value available to meet short term liabilities. As it was discussed in the literature, there are two methods of measuring liquidity of banks which are liquidity ratios (stock approach) and liquidity gap (flow approach). The liquidity gap is the difference between assets and liabilities whereas liquidity ratios are various balance sheet items ratios which identify liquidity trends .The liquidity measure provides suggestions about the level of liquidity on which the commercial banks are operating. The first approach, liquidity ratio, uses different balance sheet ratios and it is easy to compute whereas, the second approach, funding gap, is the difference between inflows and outflows which is difficult to measure because it is more data intensive and there is no standard technique to forecast inflows and outflows. Most academic

literatures prefer liquidity ratio due to a more standardized method and therefore, this study is intended to 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) and Chagwiza, (2014) are adopted.

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. 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.

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

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.

$$\mathbf{L2} = \frac{\boldsymbol{Liquid}\ \mathbf{Asset}}{\boldsymbol{Total\ Asset}}$$

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.

$$\mathbf{L3} = \frac{\mathbf{Loan}}{(\mathbf{Deposit + Short\ term\ \ Borrowing})}$$

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 and 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. This study considered 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 to 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 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 (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 of profitability is return 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

$$\mathbf{ROA} = \frac{\textbf{Net profit before tax}}{\textit{Total Asset}}$$

Accordingly, the following hypothesis is 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 reduces borrowers‟ capability to service their obligations which increases bank‟s NPLs and eventually decreases bank‟s liquidity. For the purpose of this study, GDP is measured by the annual real growth rate of gross domestic product and it is hypothesized to affect banking liquidity negatively.

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

Inflation (INF): Another important macroeconomic variable which may affect liquidity of banks is the inflation rate. During inflation, the central bank can raise the cost of borrowing and reduce the credit creating capacity of commercial banks. 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 performance. 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. For the purpose of this study, inflation is measured by the annual general consumer price index and a negative relationship between inflation rate and banks liquidity is expected.

H9: Inflation rate has negative and significant impact on bank's 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
Dependant				
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	+
Size of the bank	SIZE	Natural logarithms of total asset	Annual report	+
Loan growth	LG	Annual growth rate of loans & advances	Annual report	-
Non-performing loans	NPL	Share of non-performing loans on total volume of loans	Annual report	-
Profitability	ROA	The ratio of net profit before tax to total asset	Annual report	-
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	-

Interest rate on Loans & Advances	IRL	Interest income from loans and advances as a fraction of total loans and advances	Annual report	-
Gross domestic product	GDP	Annual real Growth rate of gross domestic product	NBE Publication	-
Inflation	INF	Annual general consumer price index	CSA reports	-
Short term interest rate	STIR	Annual weighted average interest rate of Treasury Bills	NBE reports	+

As it can be seen from Table 3.2 above, it is expected that three 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 private commercial banks and the time-series element is reflected in the period of study (2000-2015). This study, considered whether the use of the particular variable makes economic sense in Ethiopian private commercial banks context. The regression model used for this study was adopted from Vodova(2011,2102, 2013), Tseganesh(2012), Rafique & Malik (2013). Thus, the following equation indicated the general model for this study.

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

where L_{it} is one of the three liquidity ratios for bank i in time t, Xit is a vector of explanatory variables for bank i in time t, α is constant, β are coefficient which represents the slope of variables, δi denotes fixed effects in bank i and εit 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:

$$L1it = \alpha + \beta1\ (CAPit) + \beta2\ (SIZEit) + \beta3\ (LGit) + \beta4\ (NPLit) + \beta5\ (ROAit) + \beta6\ (IRMit) + \beta7(IRLit)) + \beta8\ (GDPt) + \beta9\ (INFt) + \beta10(STIRt) + \delta i + \varepsilon it$$ **……..(Model 1)**

$$L2it = \alpha + \beta1\ (CAPit) + \beta2\ (SIZEit) + \beta3\ (LGit) + \beta4\ (NPLit) + \beta5\ (ROAit) + \beta6\ (IRMit) + \beta7(IRLit)) + \beta8\ (GDPt) + \beta9\ (INFt) + \beta10(STIRt) + \delta i + \varepsilon it$$ **……..(Model 2)**

$$L3it = \alpha + \beta1\ (CAPit) + \beta2\ (SIZEit) + \beta3\ (LGit) + \beta4\ (NPLit) + \beta5\ (ROAit) + \beta6\ (IRMit) + \beta7(IRLit)) + \beta8\ (GDPt) + \beta9\ (INFt) + \beta10(STIRt) + \delta i + \varepsilon it$$ **……..(Model 3)**

Where:

***L1it*:** represents the bank"s liquidity measured by liquid asset to deposit & short term borrowing ratio of i**th** bank on year "t**"**

***L2it*:** represents the bank"s liquidity measured by liquid asset to total asset ratio of i**th** 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 i**th** 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 favoured 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

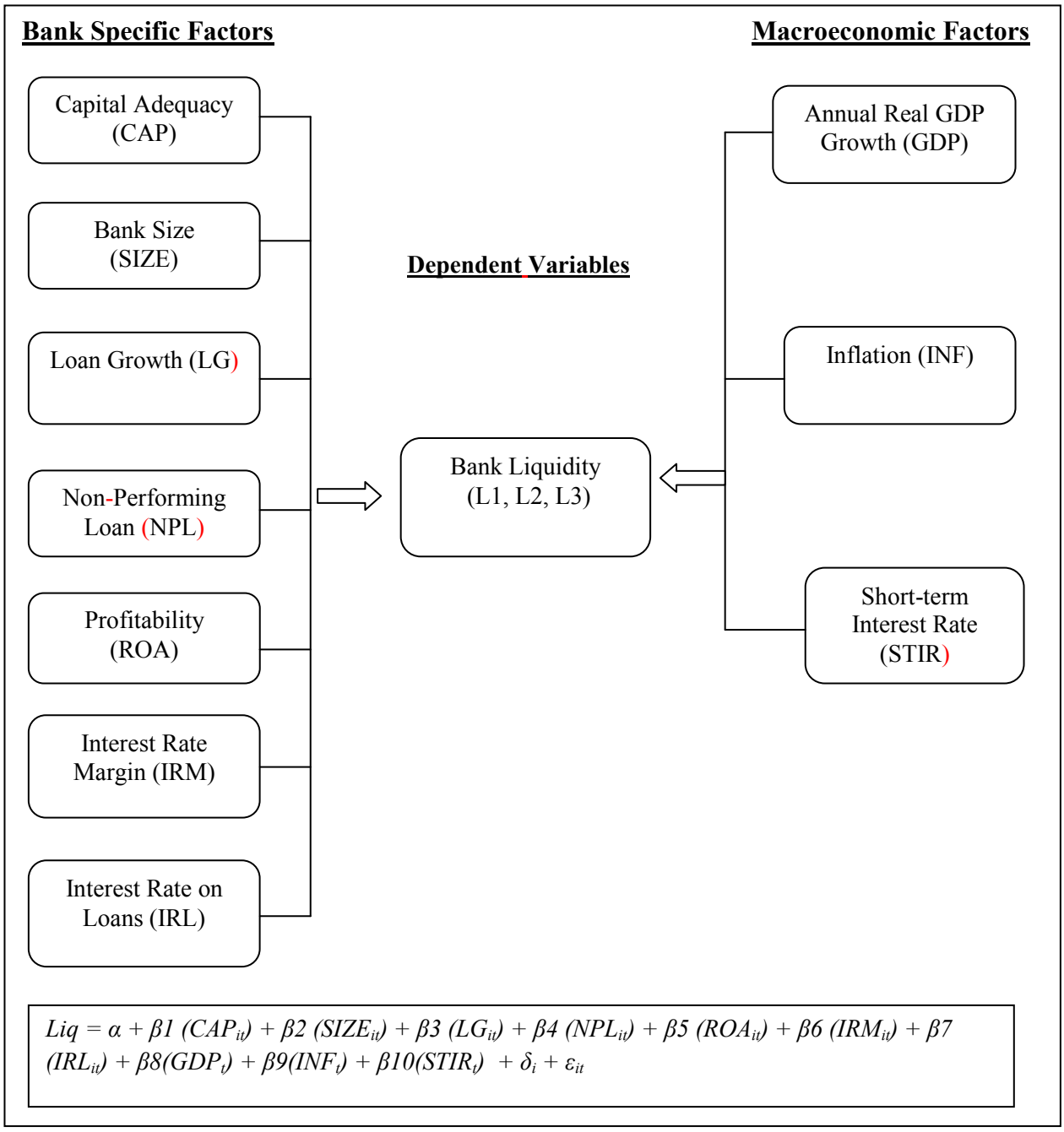


Figure 3.1 Summary of the conceptual framework

Chapter Four: Data Presentation and Analysis

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 dependant and independent variables using graphs and tables to provide an insight on the distribution of the data by bank and across time. The second section presented the correlation analysis result of dependant 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 dependant 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 Dependant Variables

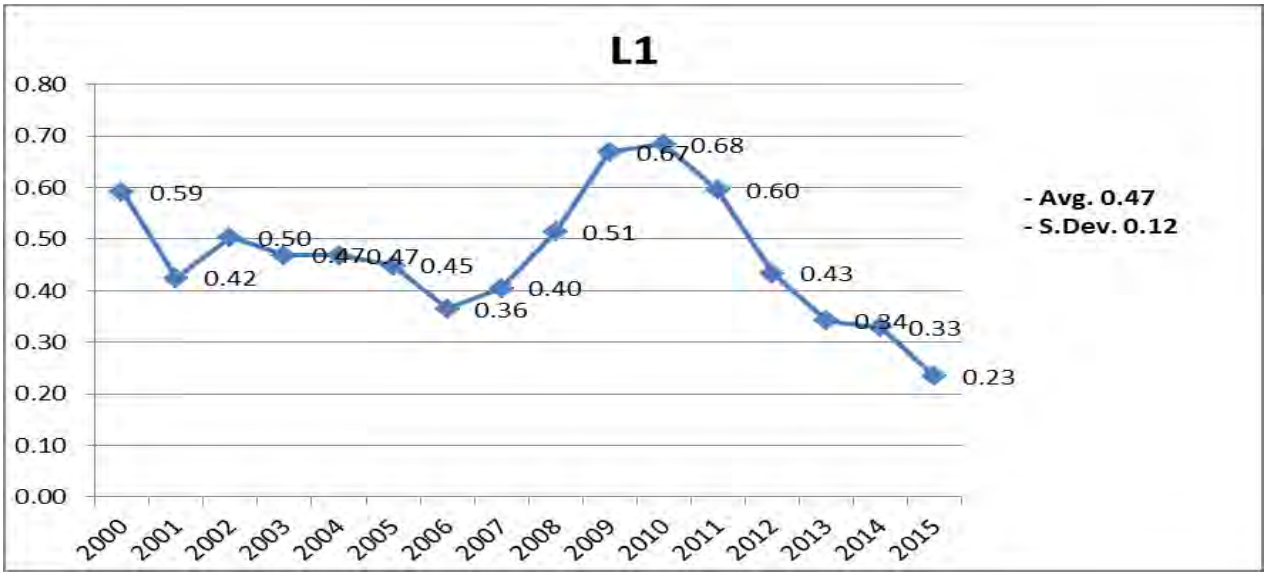
The dependant variable of the study is liquidity of private commercial banks in Ethiopia. As described in the literature part, the two most widely used approaches to measure liquidity of banks are liquidity gap approach (flow approach) and liquidity ratio approach (stock approach). Though both approaches 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).

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 47%. The standard deviation of 12% shows moderate dispersion from its mean. The ratio shows consistent decrement from the period 2002 to 2006 and then it has shown increments from the period 2007 to 2010 and reaches the maximum ratio of 68%. After 2010, it shows consistent decrement and reaches the minimum 23% 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

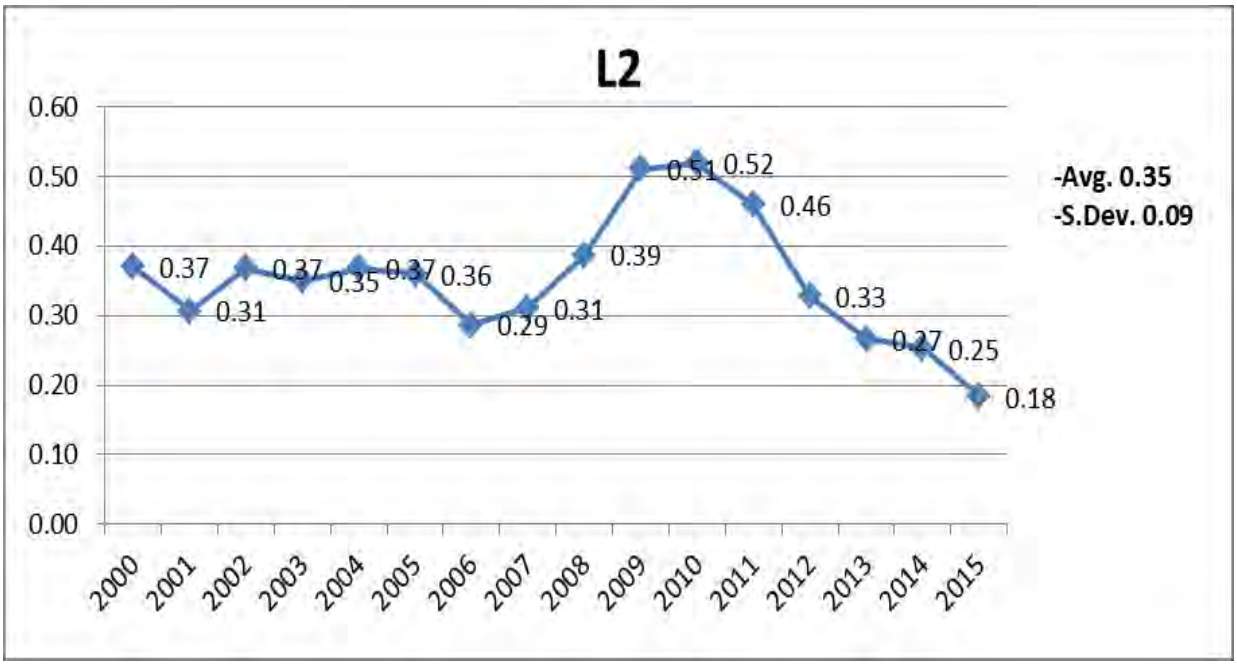


Liquid Asset-to-Total Asset Ratio (L2)

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 4.1.2 below, the average liquid asset to total asset ratio of studied commercial banks for the period from 2000 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 while it has shown a decreasing trend from 2010 onwards and reaches the minimum ratio of 18% in the year 2015. The maximum liquid asset to total asset ratio of the studied banks was 52% which was registered in the year 2010.

Figure 4.1.2: Average liquid asset to total asset ratio



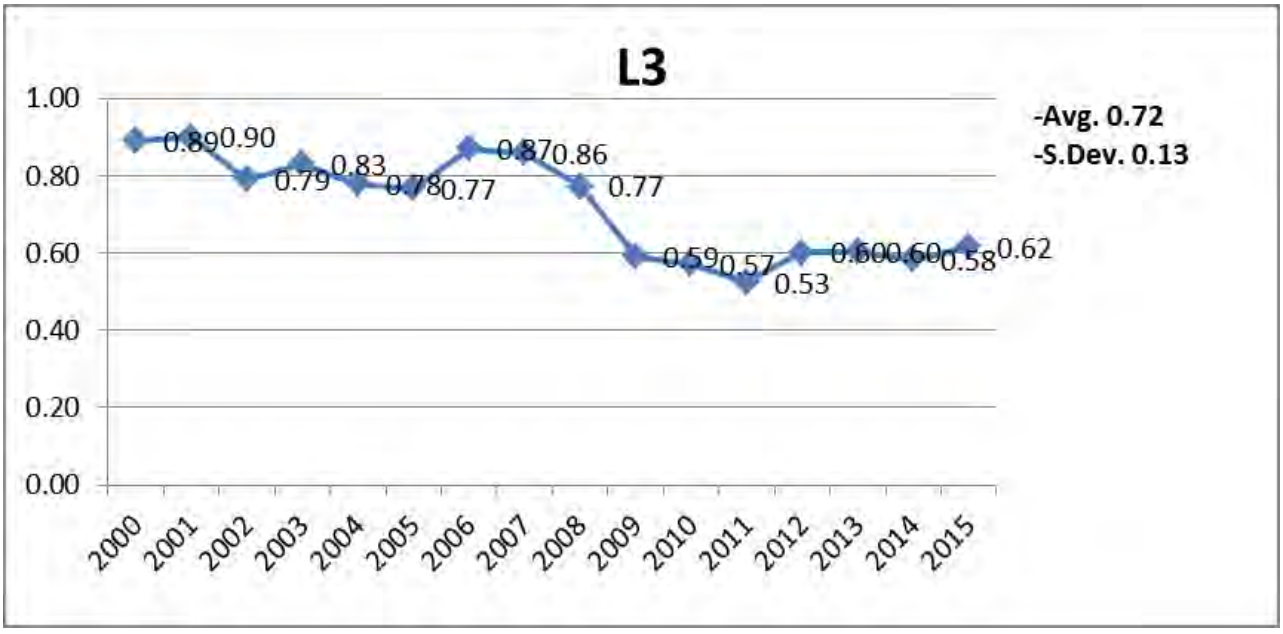
The above two ratio"s (L1 & L2) shows that, the liquidity of banks shows an increasing trends since 2006 up to 2010 and a decreasing trends in the year 2011 onwards after NBE has issued directive No MFA/NBEBILLS/001/2011 which requires all private commercial banks to purchase NBE bills based on their fresh loan disbursement.

Loans & Advances to Deposits 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 4.1.3 below, shows that the average loan to deposit ratio of the studied commercial banks was 72% which is below the good benchmark of 80% as per the international standards. The maximum loan to deposit ratio of 90% was registered in the year 2001. This indicates that, on average private commercial banks in Ethiopia have higher amount of volatile deposits which are tied up with illiquid loans. On the other hand, the minimum loan to deposit ratio of 53% was registered in the year 2011. The standard deviation of 13% shows there is moderate dispersion of loan to deposit ratio from its mean value.

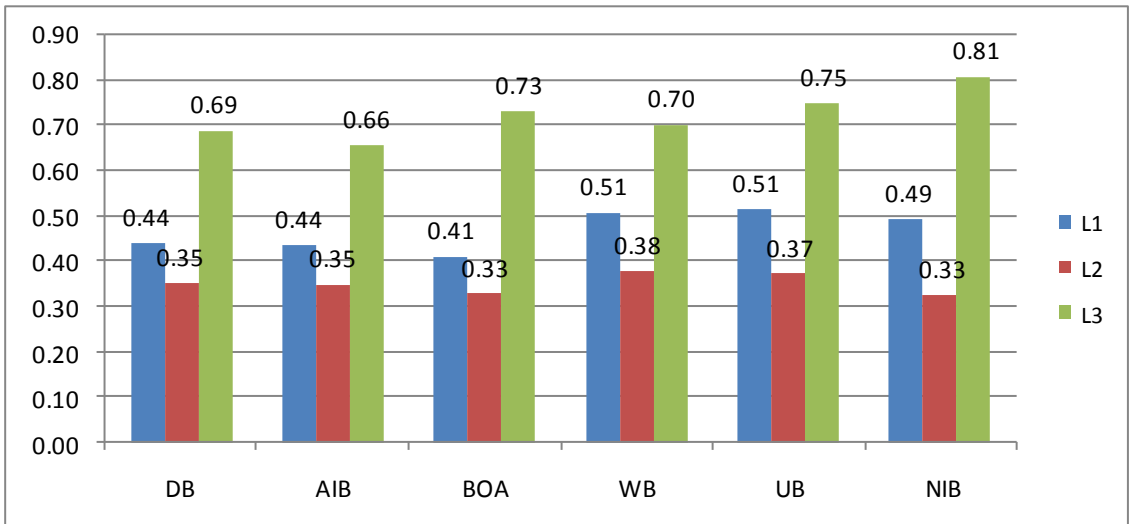
Figure 4.1.3: Average loan to deposit ratio



The average loan to deposit ratio of the studied private commercial banks has shown a decreasing trend from 87% in the year 2006 to 53% in the year 2011. While, from 2011 onwards the average loan to deposit ratio was shown slight increment from 53% to 62%.

Figure 4.1.4 below depicts the overall average liquidity ratio of the studied banks for the period from 2000 to 2015. On average, Bank of Abyssinia has shown the minimum liquid asset to deposit ratio (L1) of 41%, NIB international bank has shown the minimum liquid asset to total asset ratio (L2) of 33% and Awash International Bank has shown the minimum loan to deposit ratio (L3) of 66%. On the other hand, United Bank has shown on average the maximum liquid asset to deposit ratio (L1) of 51%, Wegagen Bank has shown the maximum liquid asset to total asset ratio (L2) of 38% and Nib International bank has shown on average the maximum loan to deposit ratio (L3) of 81%. Among the three ratio"s, loan to deposit & short term borrowing ratio (L3) has shown higher ratio"s than the other two ratio measures.

Figure 4.1.4: Average liquidity ratio of studied banks



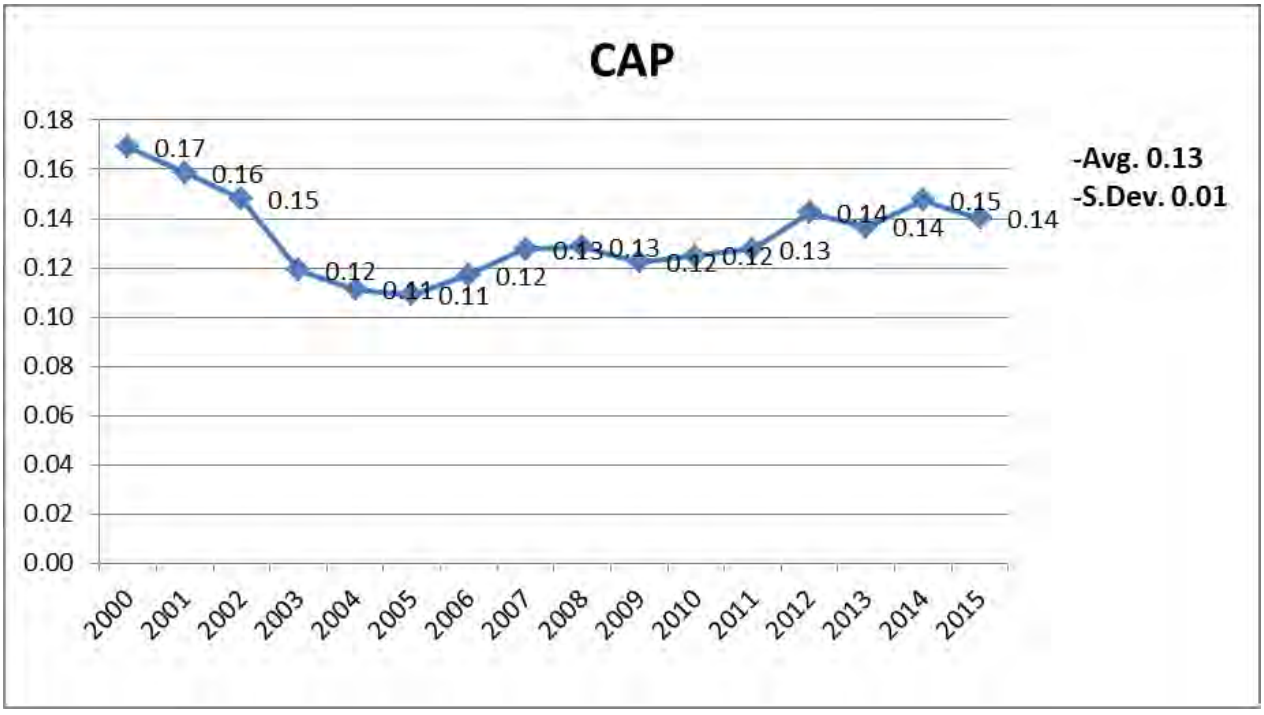
4.1.2 Descriptive Analysis of Independent Variables

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 17% which was recorded in the year 2000 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 1.6% for CAP reveals that, there was very little dispersion towards the mean capital adequacy ratio.

Figure 4.2.1: Average Capital Adequacy Ratio

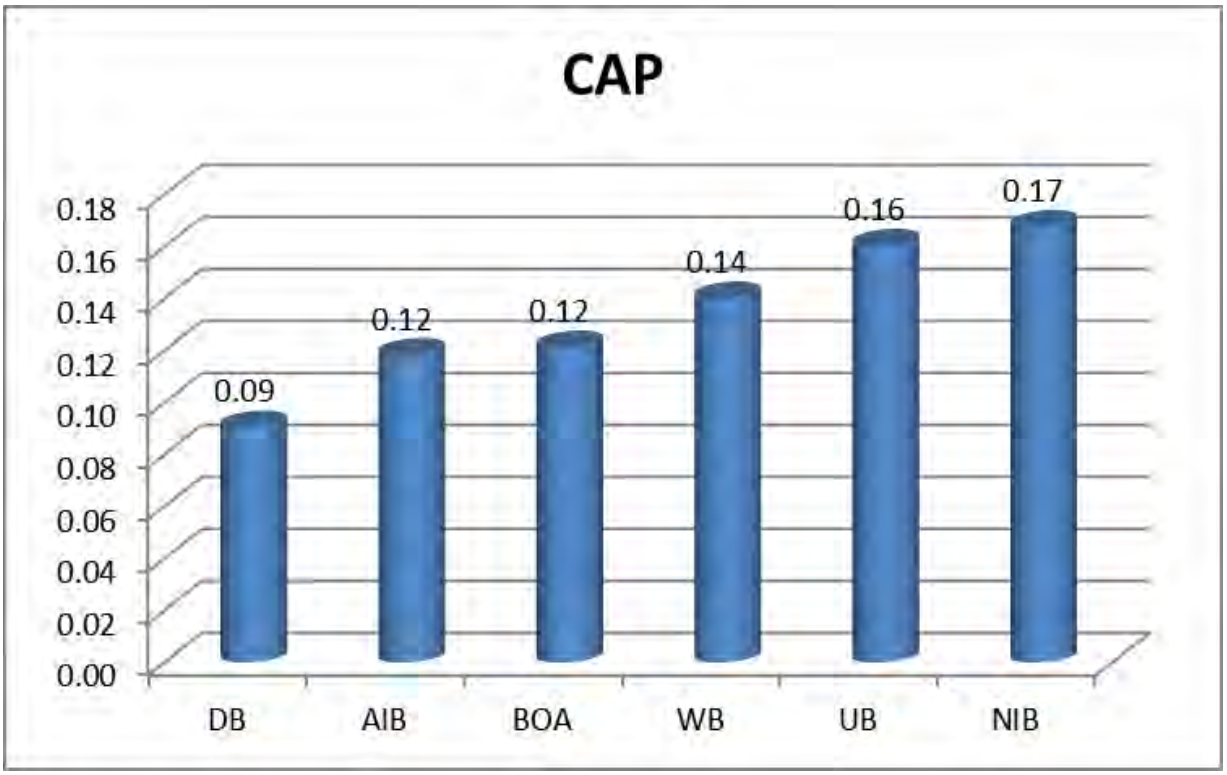


The capital adequacy ratio reaches the minimum 11% in the year 2005. Starting from 2006, the average capital adequacy ratio shows consistent increasing trends up to 2015 with slight decrement in the year 2009, 2010 and 2015. This indicates that private commercial banks have increased their

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, Dashen Bank has shown the lowest average capital adequacy ratio of 9% and Nib International Bank shows the highest average capital adequacy ratio of 16.7% of the last sixteen 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 CAP of Studied banks



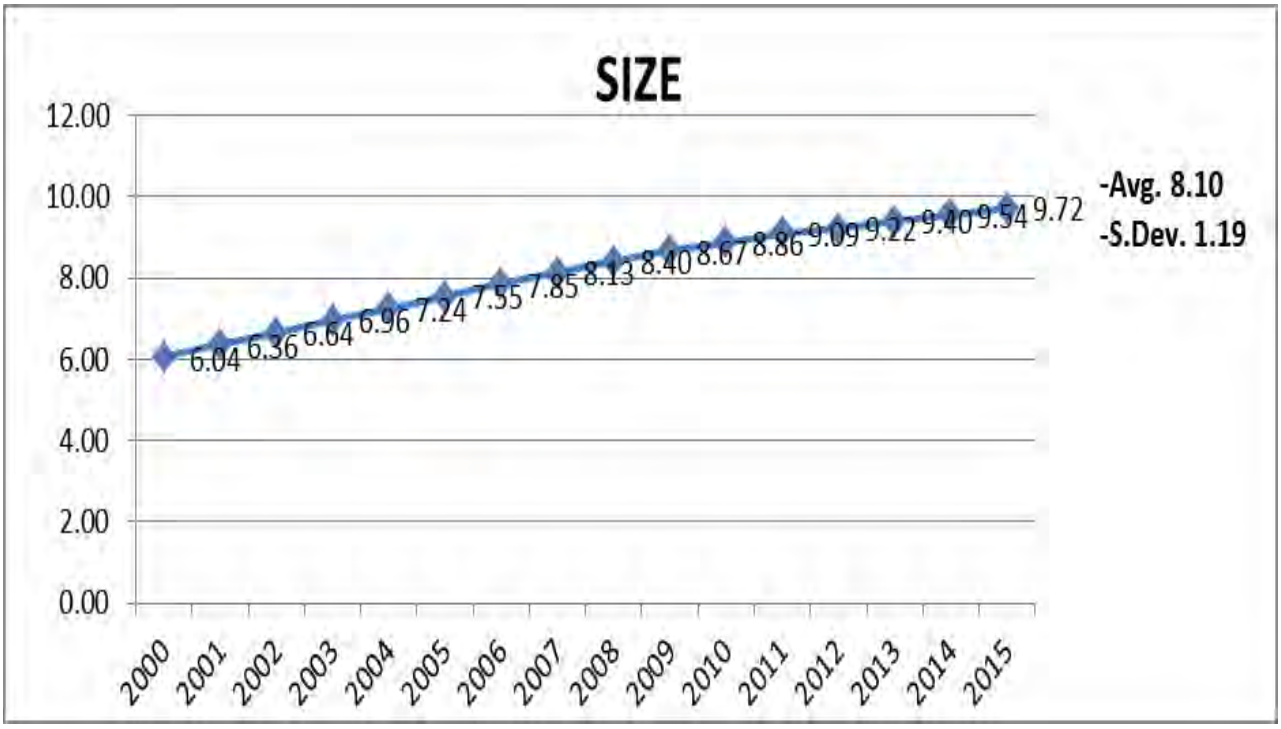
Bank Size (SIZE)

Bank size is what the bank possesses and it is useful to measure the bank‟s general capability to undertake its intermediary function. 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 private commercial banks have shown consistent growth throughout the studied period. The standard deviation of 1.19 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 8.10. The minimum value was recorded in the year 2000 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 private commercial banks shows consistent growth throughout the studied period.

Figure: 4.2.3: Average natural logarithm of total asset



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 4.2.4 below, the average loan growth rate of the studied banks was 31%. The maximum average loan growth rate was 78% which was registered in the year 2000 and the minimum average loan growth rate was 1% which was registered in the year 2009. The standard

deviation of 21% 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. This consistent decreasing trend in the average loans and advances growth rate has significant impact to increase the liquid asset to deposit ratio and liquid asset to total asset ratio during the stated period and it also indicates the decreasing trends of loan to deposit ratio during these periods. The upward/downward movement of the average loan growth rate tells us that private commercial banks were not shown consistent loan growth rate in the past sixteen years.

Figure 4.2.4 Average Loan Growth Rate

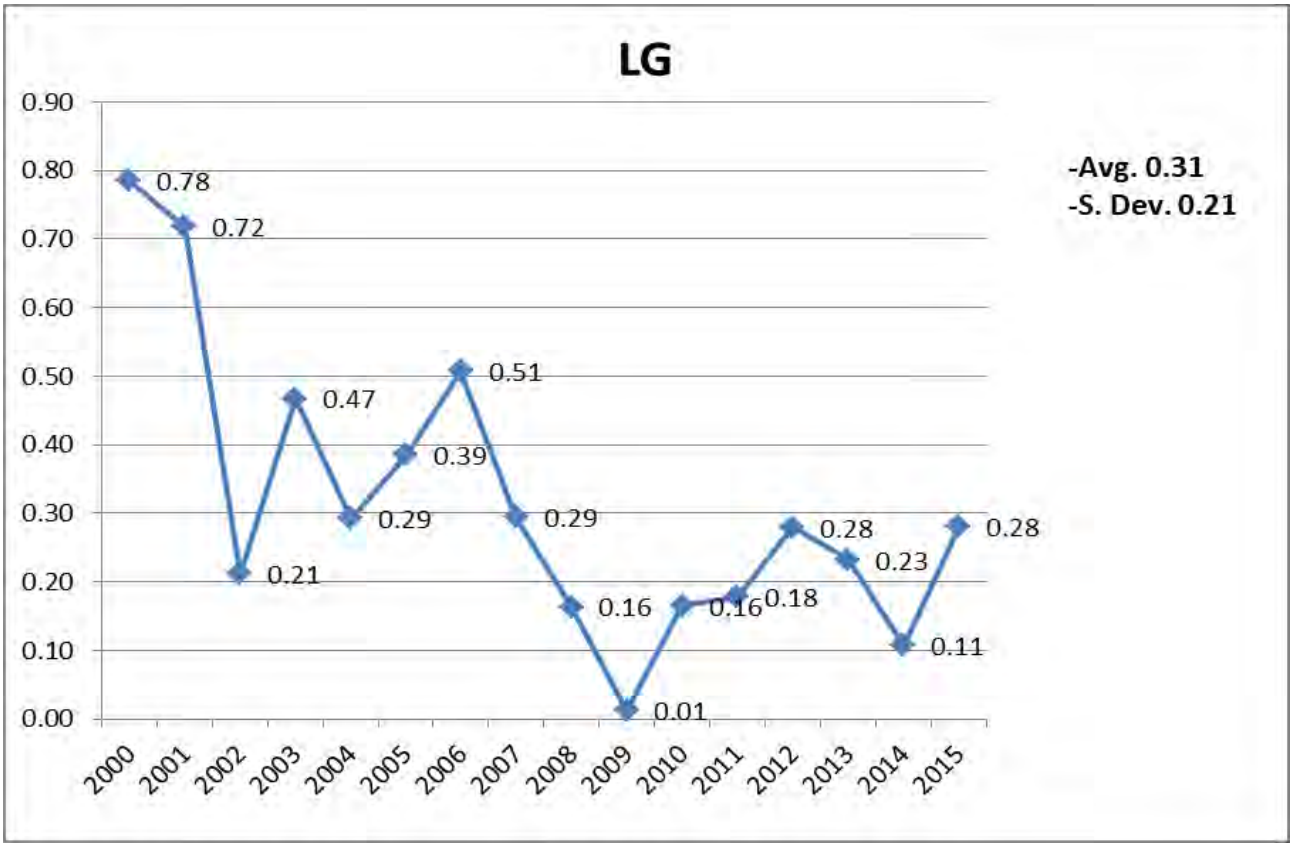
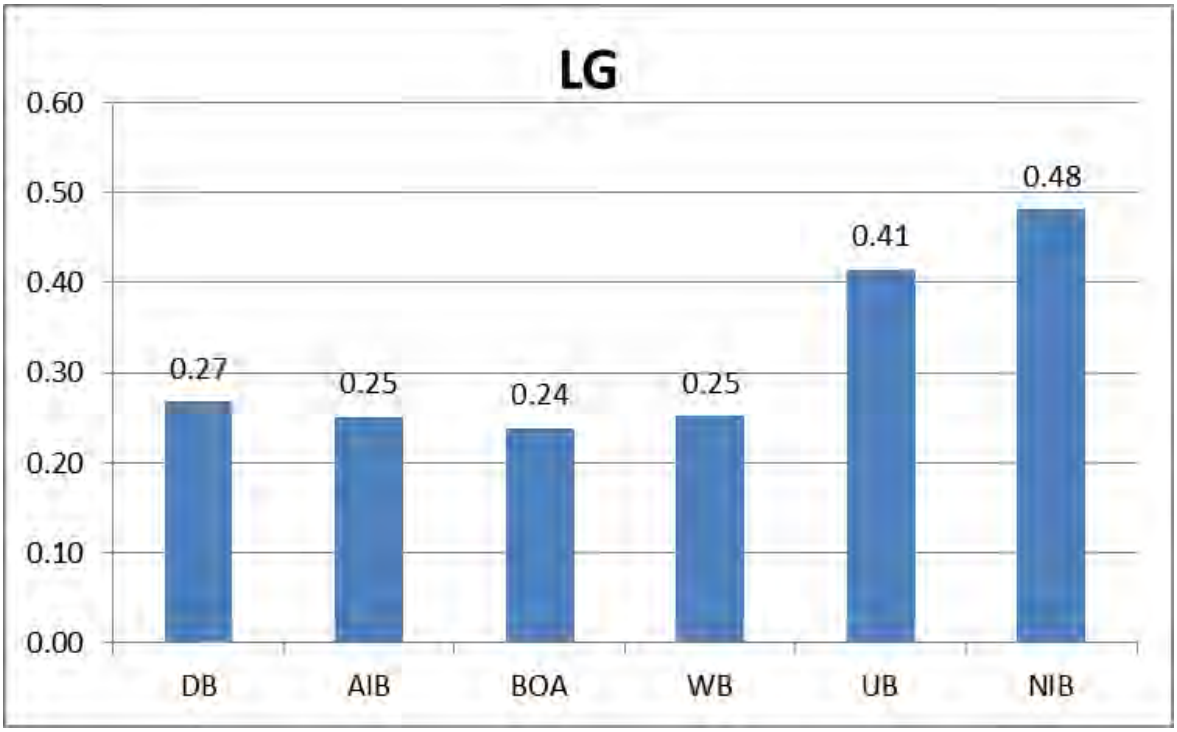


Figure 4.2.5 below shows that, on average Nib international bank has shown the highest loan growth rate of 48% and Bank of Abyssinia has shown the lowest average loan growth rate of 24% during the studied period. On the other hand form the sample banks, Dashen Bank, Awash International Bank, Bank of Abyssinia and Wegagen bank has shown on average 24% to 27% loan growth rate during the studied period.

Figure 4.2.5 Average Loan growth rate of sample banks

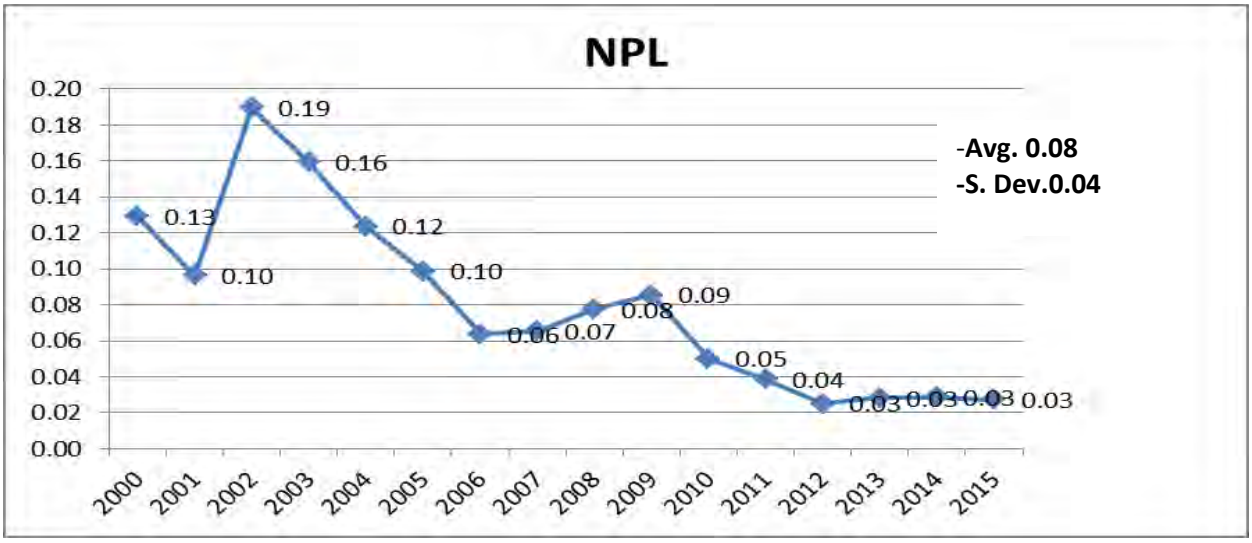


Non-Performing Loans (NPL)

As it is 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%.

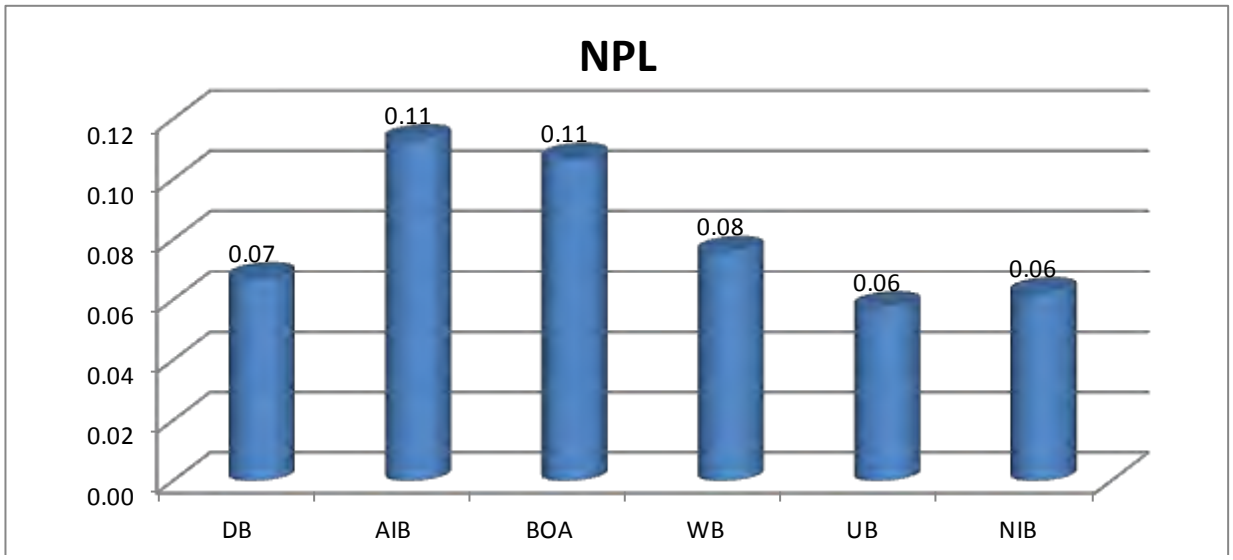
Figure 4.2.6 below shows that, the average NPL ratio of the studied banks was 8% during the last sixteen years. The maximum NPL ratio of 19% was recorded in the year 2002 and the minimum NPL ratio of 2.5% was recorded in the year 2012. As it is shown in the figure, the average NPL ratio has shown consistent decrement from 2002 up to the year 2006. The result indicates that the asset quality of the studied private commercial banks has shown improvement from 2010 onwards with average NPL ratio of below 5%. On the other hand, the standard deviation of 4% reveals there is little dispersion on NPL ratio from its mean.

Figure 4.2.6: Average NPL Ratio



The following figure shows the average NPL ratio of the studied banks for the period from 2000 to 2015.

Figure 4.2.7: Average NPL ratio of studied banks



As it is shown in the above figure, among the studied banks, Awash International Bank has on average 11.3% NPL ratio followed by Bank of Abyssinia which has on average 10.6% NPL ratio. On the other hand, United Bank has shown the lowest NPL ratio of 6.2% during the last sixteen years.

Profitability (ROA)

Profitability is the likelihood of a business earning the desired level of income within a specific period of time under certain prevailing business conditions. 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 4.2.8 below, shows that the average return on asset of studied banks for the period from 2000 to 2015 was 3.4%. The minimum return on asset of 1.5% was registered in the year 2003 and the maximum return on asset of 4.6% was registered on the year 2012. The figure depicts that the average return on asset shows consistent incremental trends from 2003 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 0.008 reveals that there was very little dispersion of average return on asset of studied banks towards their mean value.

Figure 4.2.8: Average Return on Asset

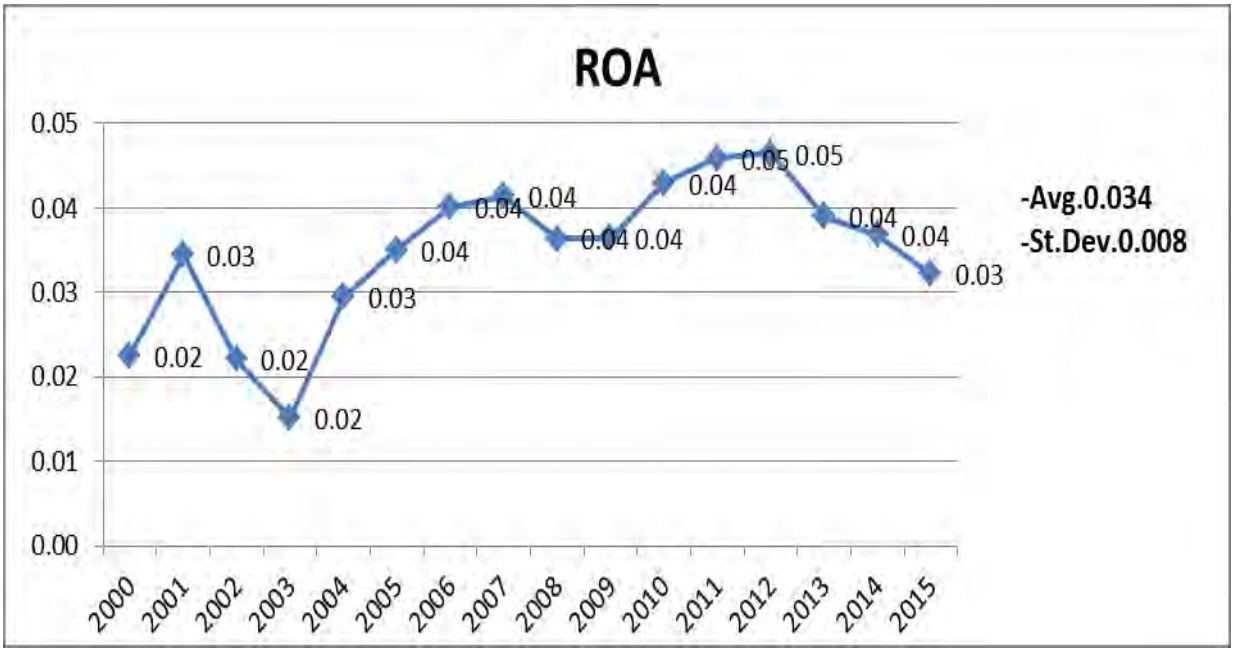
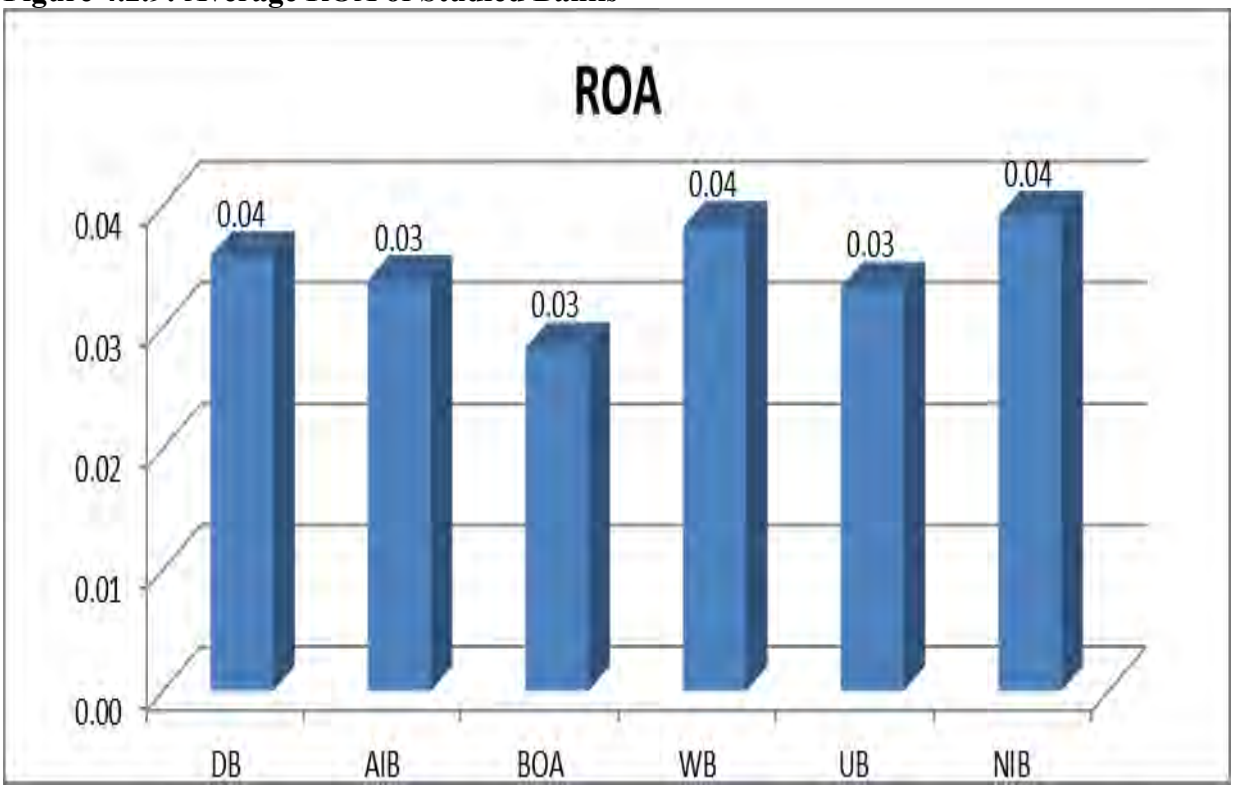


Figure 4.2.9 below, shows that, the average ROA ratio of studied banks was between 2.8% and 3.9% and there is no as such major difference between the studied banks. However, Bank of

Abyssinia has shown the lowest average ROA which is nearly equals to 2.8% and Wegagen Bank and Nib International bank have shown the highest ROA ratio which is nearly equals to 3.9%.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.

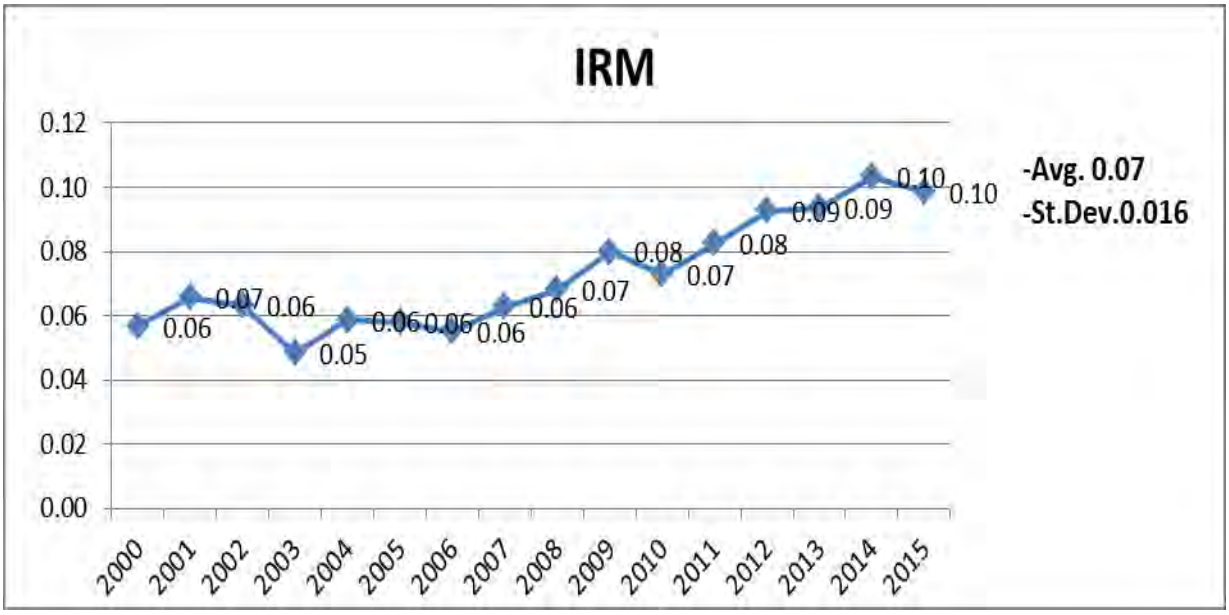
Figure 4.2.9: Average ROA of Studied Banks



Interest Rate Margin (IRM)

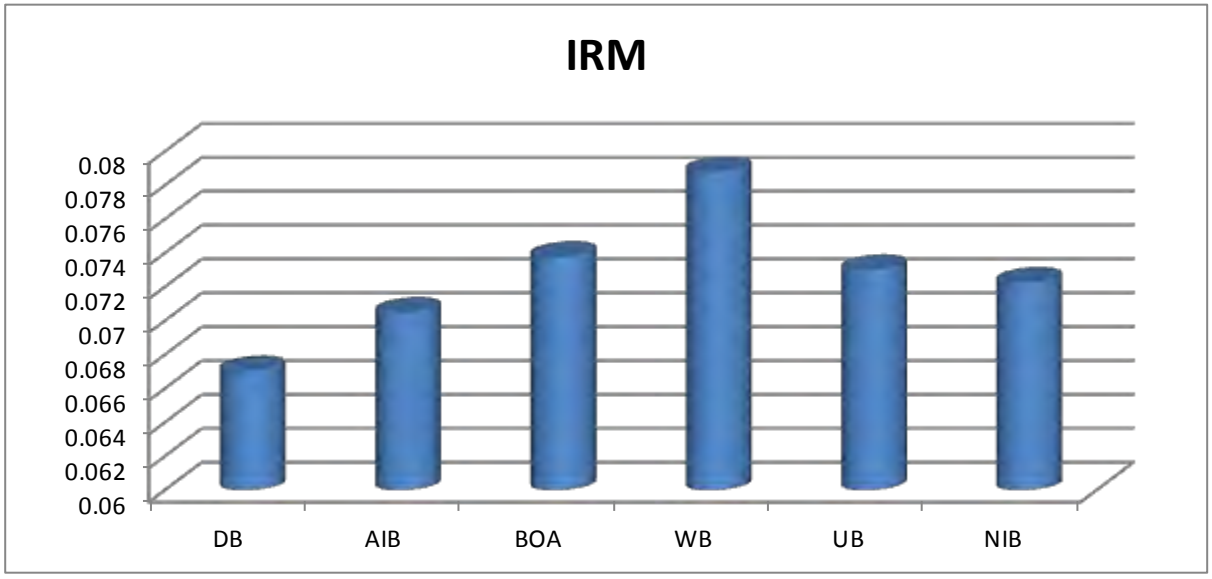
Interest rate margin in this study is computed by the difference between the interest earned on loans & advances as a fraction of total loans & advances and the interest paid out on deposit as a fraction of total deposits. The interest rate for loans and advances is freely determined by the board of 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 2000 to 2015.

Figure 4.2.10: Average Interest Rate Margin



The above 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(4.8%) and 2014(10.3%) respectively. The standard deviation of 1.6% reveals that there is little dispersion of the average interest rate margin from its mean value. The following figure shows the average IRM ratio of the studied banks for the period from 2000 to 2015

Figure 4.2.11: Average IRM of studied banks



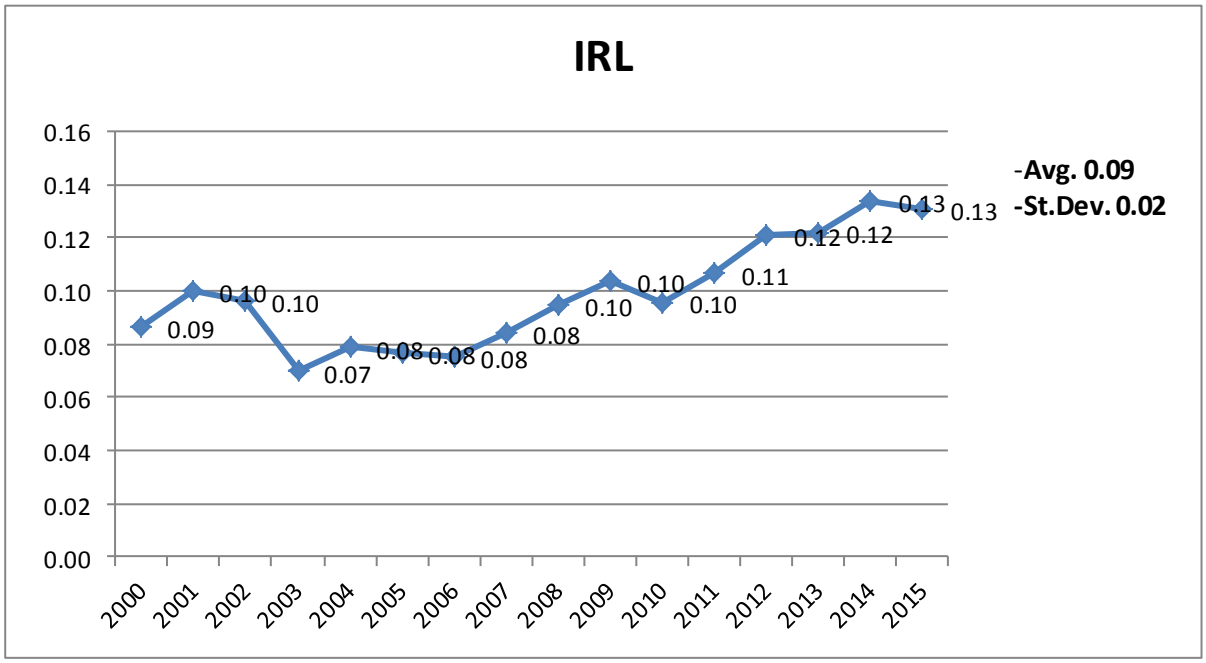
As it shown in figure 4.2.11 above, the minimum average IRM of studied banks for the period from 2000 to 2015 was 6.7% and the maximum average IRM was 7.9%. The minimum IRM was registered by Dashen bank followed by Awash International Bank and the maximum IRM was registered by Wegagen Bank followed by Bank of Abyssinia. Awash international Bank, Bank of Abyssinia, United Bank and Nib International Bank have shown on average 7.10% to 7.3% IRM ratios during the studied period.

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 4.2.12 below, shows that the average interest rate on loans of studied banks for the period from 2000 to 2015 was 9.8%. The minimum average interest rate on loans and advances was recorded in the year 2003 which was 7% and the maximum average interest rate on loans and advances was recorded in the year 2014 which was 13.4%. The standard deviation of 2% reveals that there is little dispersion of the average interest rate on loans from its mean value.

Figure 4.2.12: Average Interest rate on loans & advances

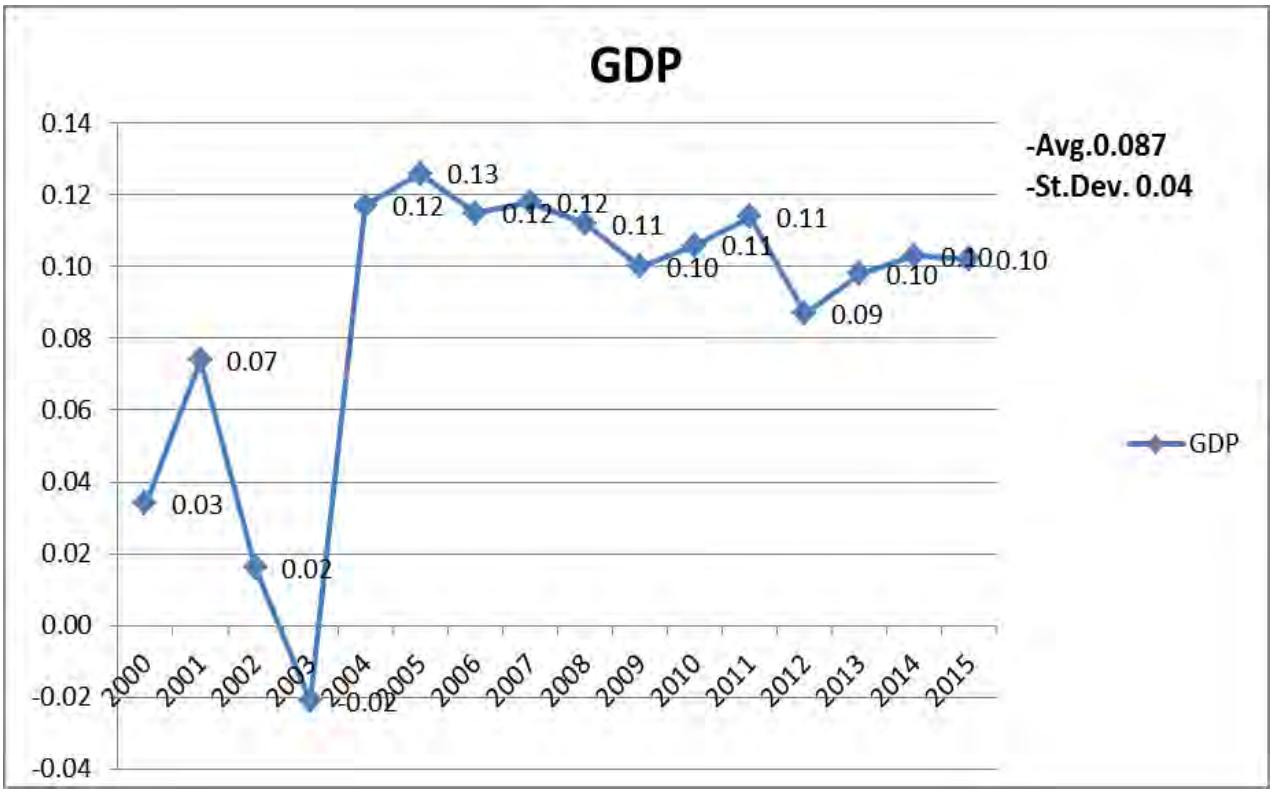


Gross Domestic Product (GDP)

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 4.2.13 below, the average GDP growth rate of Ethiopia for the last sixteen years was 8.7%. The maximum real GDP growth rate was recorded in the year 2005 (i.e. 12.6%) and the minimum GDP which was also negative growth rate was recorded in the year 2003 (i.e. -2.1%). As it is shown in figure 4.2.13, the country has recorded on average a double digit (above10%) growth rate from 2004 onwards except for the year 2012 & 2013 which was 8.7% and 9.8% respectively. The standard deviation of 0.04 also indicates that there was little dispersion on the real GDP growth rate towards its mean.

Figure 4.2.13: Average Gross Domestic Product

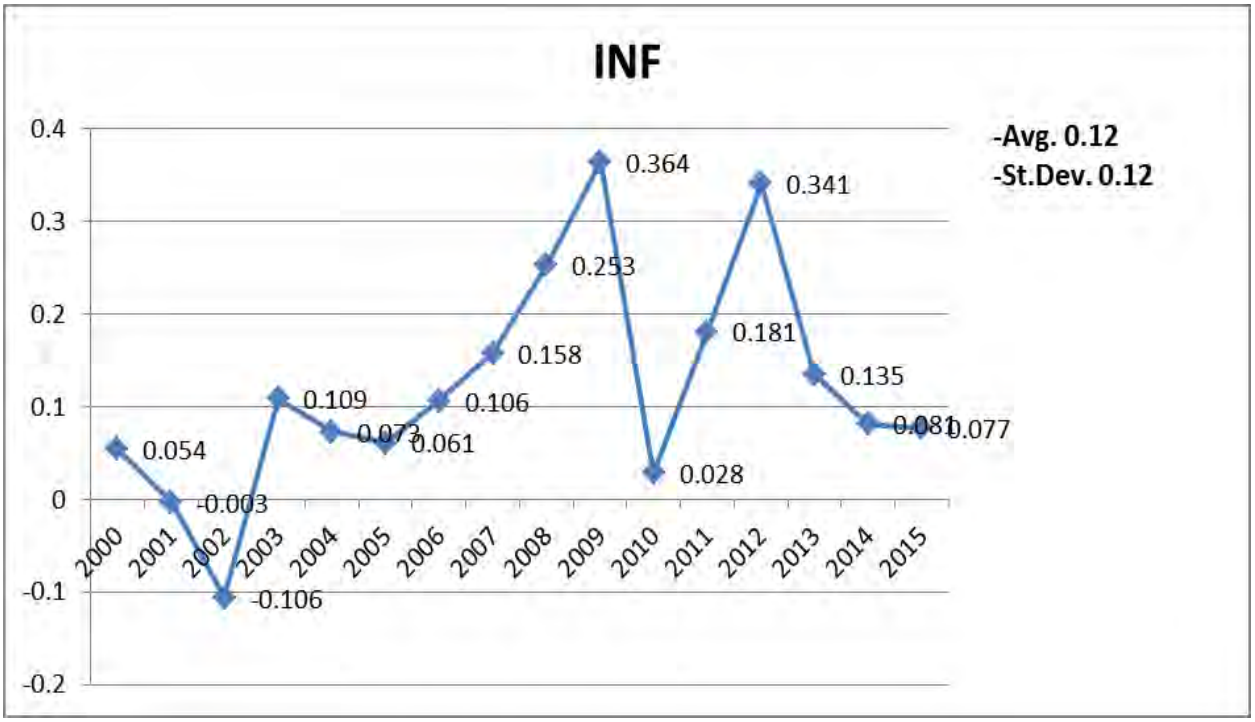


Inflation Rate (INF)

Another important macroeconomic variable which may affect liquidity of banks is the inflation rate. 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 4.2.14 below shows that, the mean value of the general inflation rate of Ethiopia over the past sixteen years was 11.9%, which was more than that of the average real GDP growth rate. The maximum inflation rate was recorded in the year 2009 (i.e. 36.40%) followed by the year 2012(34.10%) and the minimum inflation rate which was also negative was recorded in the year 2002 (i.e. -10.60%). 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 12.1%.

Figure 4.2.14: Average Inflation Rate

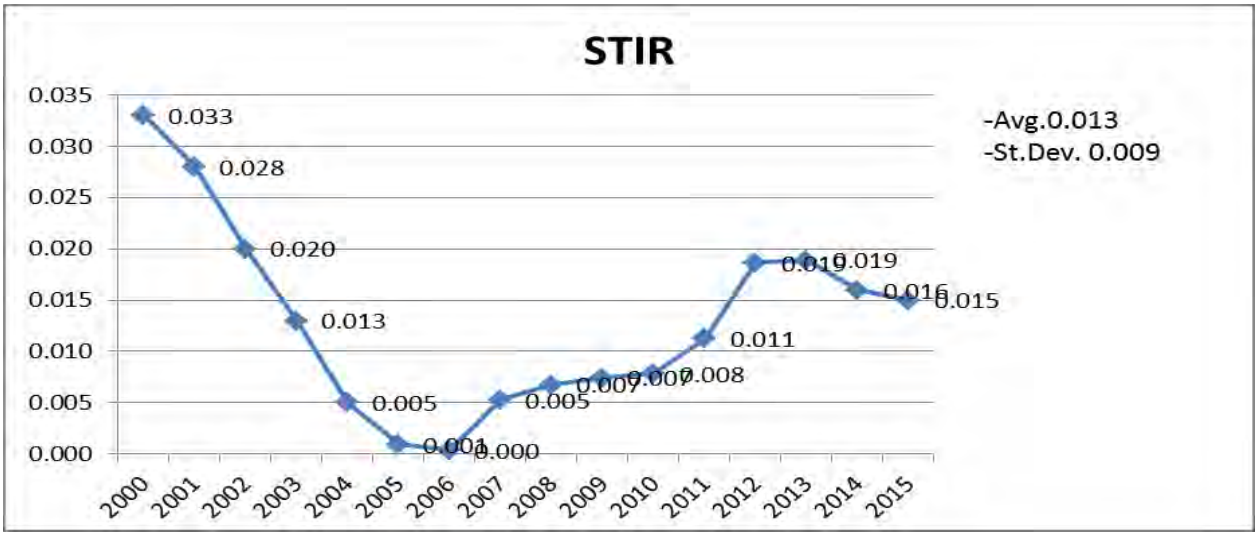


Short Term Interest Rate (STIR)

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 4.2.15 below, the average short term interest rate has declining from 2000 and reach the minimum rate in the year 2006 which was almost 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 2000(i.e. 3.3%) followed by the year 2001 which was 2.8%. The standard deviation of 0.9% refers there was very little dispersion towards its mean value.

Figure 4.2.15: Average Short Term Interest Rate



4.2 Correlation Analysis

In this section, the correlation between the dependant variables and the independent variables have been presented and analysed. According to Brooks (2008), correlation between two variables measures the degree of linear association between them.

To find the association of the independent variables with dependant variables Pearson Product Moment of Correlation Coefficient 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.

Table 4.2.1: Correlation matrix of the dependent and independent variables

	CAP	SIZE	LG	NPL	ROA	IRM	IRL	GDP	INF	STIR
L1	0.224	(0.285)	(0.033)	0.107	(0.008)	(0.225)	(0.288)	(0.103)	0.136	(0.022)
L2	(0.085)	(0.127)	(0.230)	0.190	0.0004	(0.203)	(0.265)	0.006	0.201	(0.188)
L3	0.324	(0.743)	0.584	0.219	(0.167)	(0.632)	(0.571)	(0.298)	(0.327)	0.097

Table 4.2.1 above, shows the correlation coefficient between the dependent variables and independent variables. Among the bank specific variables capital adequacy and non-performing loans are positively correlated with L1 with correlation coefficient of 0.224 and 0.107, respectively. While size, loan growth, interest rate margin and interest rate on loans are negatively correlated with L1 with correlation coefficient of 0.285, 0.033, 0.225 and 0.228, respectively. The correlation coefficient between return on asset and L1 is almost not different from zero. With regard to macroeconomic variables, inflation (INF) is positively correlated with L1 with correlation coefficient of 0.136. The other macroeconomic variables, gross domestic product (GDP) and short term interest rate (STIR) have negatively correlated with L1. Capital adequacy has shown the highest positive coefficient of 0.224 and interest rate on loans has shown the highest negative coefficient of 0.288 with respect to L1 while NPL shows the lowest positive coefficient of 0.107 and ROA has shown the lowest negative coefficient of 0.008 in relation with L1.

Non-performing loans and inflation have positively correlated with L2 with 0.19 and 0.20 correlation coefficient, respectively. Capital adequacy, size, loan growth, interest rate margin, interest rate on loans and short term interest rate have negatively correlated with L2. The correlation between L2 and return on asset and gross domestic product is almost not different from zero.

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, loan growth, non-performing loans and short term interest rate with correlation coefficient of 0.324, 0.584, 0.219 and 0.097, respectively. Size of the bank, return on asset, interest rate margin, interest rate on loans, gross domestic product and inflation have negatively correlated with L3. Among the independent variables, bank size has the highest negative correlation coefficient while loan growth has the highest positive correlation coefficient with L3. On the other hand, short term interest rate has the lowest positive correlation coefficient while return on asset has the lowest negative correlation coefficient 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

The first CLRM assumption requires, the average value of the errors term should be zero. As per Brooks (2008), if a constant term is included in the regression equation, this assumption will never be violated. Therefore, since the constant term was included in the regression equation, this assumption is expected to be not violated.

Testing for the variance of the error-term is constant

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 (χ^2) 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	1.271938	1.176128	1.037244
Prob. F(72,23)	(0.2635)	(0.3406)	(0.4690)
Obs*R-squared	76.72955	75.49503	66.43754
Prob. Chi-Square(72)	(0.3296)	(0.3662)	(0.4272)
Scaled explained SS	60.69715	60.61148	37.24630
Prob. Chi-Square(72	(0.8264)	(0.8284)	(0.9978)

Source: Computed from E-View results

The above table 4.3.1 and (Appendix II) indicates that, both the F-test- and χ^2 versions of the test statistic give the same conclusion that there is no evidence for the presence of heteroscedasticity for both L1, L2 & L3, since the p-values are considerably in excess of 0.05. The third version of the test statistic, „scaled explained SS‟ also gives the same conclusion. In general, the entire regression model used in this study reveals that the variance of the error term is constant or homoscedastic.

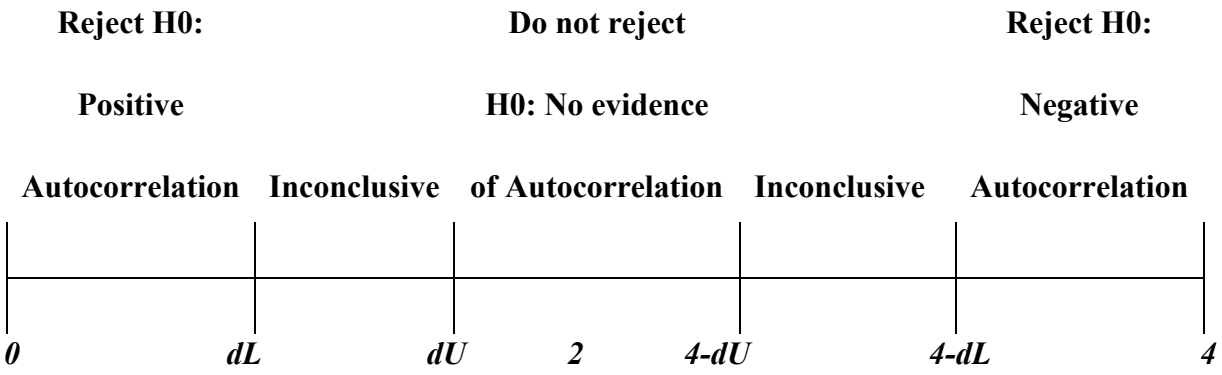
Testing for the covariance between the error-terms are zero-(no autocorrelation)

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 $(u_t = \rho u_{t-1} + v_t)$. 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* χ^2. 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).

This study have ten explanatory variables (k) with ninety six observations and as per the DW table in Appendix-IV for 95 observations with ten explanatory variables at 1% level of significance, the dL and dU values are **1.313** and **1.767,** respectively. Accordingly, the value of 4-dU and 4-dL are

2.233 and **2.687,** respectively. The DW values of L1, L2 and L3 for 96 observations in this study are **1.806052**, **1.781185** and **0.941291,** respectively (Appendix-I). The DW value of L1 and L2 lies in the no evidence of autocorrelation region where the null hypothesis of no autocorrelation do not be rejected. Whereas, the DW value of L3 lies below the lower limit (dL) and indicate the presence of first order positive autocorrelation between the error term and its lag in which the null hypothesis of no autocorrelation should be rejected. Hence, in this study, the focus will be on the results of liquidity one (L1) and liquidity two (L2).

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 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, we used BJ normality test to test the null hypothesis of normally distributed assumption. As shown in the histogram in the Appendix (III), kurtosis approaches to three which were 3.116518, 3.148091 and 2.430225 for L1, L2 and L3 respectively. On the other hand the p-value for the BJ test were 0.134789, 0.163076 and 0.452381 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

The test for multicollinearity helps to identify the correlation between explanatory variables and to avoid double effects of the independent variables. It describes the relationship between explanatory variables. When the explanatory variables are highly correlated with each other, there exists multicollinearity problem (Brooks, 2008). Though, there is no consistent argument on the level of

correlation that causes multicollinearity, Hair et al 2006(cited in Habtamu 2012) argues that correlation coefficient below 0.9 may not cause serious multicollinearity problems.

In this study correlation matrix for ten explanatory variables had been estimated. The results in the following correlation matrix show that the highest correlation of 0.764 existed between interest rate margin and interest rate on loans followed by correlation coefficient of 0.698 which is existed between bank size and interest rate margin.

Table 4.3.2: Correlation Matrix of Explanatory Variables

	CAP	SIZE	LG	NPL	ROA	IRM	IRL	GDP	INF	STIR
CAP	1.000									
SIZE	-0.304	1.000								
LG	0.327	-0.525	1.000							
NPL	-0.195	-0.514	-0.132	1.000						
ROA	0.162	0.457	-0.002	-0.597	1.000					
IRM	0.170	0.698	-0.367	-0.417	0.402	1.000				
IRL	0.154	0.625	-0.360	-0.321	0.297	0.764	1.000			
GDP	-0.149	0.533	-0.244	-0.501	0.587	0.320	0.203	1.000		
INF	-0.097	0.471	-0.252	-0.331	0.347	0.289	0.191	0.325	1.000	
STIR	0.354	-0.287	0.302	0.112	-0.243	0.170	0.339	-0.566	-0.266	1.000

Source: E-view results of sample private commercial banks

As it is shown in table 4.3.2 above, there is no correlation coefficient that exceeds or even near to 0.80. Thus, in this study there is no problem of multicollinearity.

Fixed Effect versus Random Effect Model

There are two classes of panel estimator approaches that can be employed in financial research: fixed effect and random effect models. The random effects model is more appropriate when the entities in the sample can be thought of as having been randomly selected from the population while fixed effect model is more appropriate when the entities in the sample effectively constitutes the entire population (Brooks, 2008). On the other hand, according to Gujarati (2004), if the number

of time series data is large and 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 and random effect model.

Accordingly in this study, the number of cross section units is six and the number of time series data is sixteen which is more than the cross section unit and as the sample of private commercial banks were not selected randomly, the fixed effect model is more appropriate than the random effect model and then the fixed effect model is used in this study.

4.4. Results of Regression Analysis

This section discusses the regression results of fixed effect model that determines the liquidity of private commercial banks in Ethiopia. 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 private commercial banks liquidity measured by liquid asset to deposit & short term borrowing ratio (L1) was:

$$L1it = \alpha + \beta1\ (CAPit) + \beta2\ (SIZEit) + \beta3\ (LGit) + \beta4\ (NPLit) + \beta5\ (ROAit) + \beta6\ (IRMit) + \beta7\ (IRLit)) + \beta8\ (GDPt) + \beta9\ (INFt) + \beta10(STIRt) + \delta i + \varepsilon it \ldots\ldots\ldots\ldots \textbf{(Model 1)}$$

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**

Dependent Variable: L1
Total panel (balanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.750169	0.192036	3.906408	0.0002
CAP	0.286856	0.348811	0.822382	0.4134
SIZE	-0.070739	0.023756	-2.977752	0.0039***
LG	-0.086416	0.047702	-1.811566	0.0739*
NPL	0.686996	0.266875	2.574219	0.0119**
ROA	2.625382	1.420207	1.848591	0.0683*
IRM	1.952791	3.251504	0.600581	0.5499
IRL	-0.817238	3.263736	-0.250399	0.8029
GDP	-0.165688	0.392581	-0.422048	0.6742
INF	0.621493	0.106552	5.832785	0.0000***
STIR	-1.277092	2.906786	-0.439348	0.6616

R-squared	0.727060		
Adjusted R-squared	0.667574		
F-statistic	12.22220	Durbin-Watson stat	1.806052
Prob(F-statistic)	0.000000		

****, **, and * denote significance at 1%, 5%, and 10% levels, respectively*

***Source**: Financial statement of sampled commercial banks and own computation through E-views 6*

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 six Ethiopian private commercial banks. The coefficient of determination in this model is given by R-squared of 0.727 and Adjusted R-squared of 0.6675, which means 66.75% of variation of Ethiopian private 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 33.25% of changes was explained by other determinants which are not included in this model. Thus, the explanatory power of the model is high. The value of F-statistics is 12.222 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, bank size (SIZE), loan growth (LG), non-performing loans (NPL), return on asset (ROA) and inflation (INF) had statistically significant factors affecting liquidity of Ethiopian private commercial banks which is measured by L1. Among the statistically significant variables, bank size (SIZE) and loan growth (LG) had negatively related with liquidity (L1) where as non-performing loans (NPL), return on asset (ROA) and inflation (INF) have positively related with liquidity (L1).

The above table also depicts that, bank size (SIZE) and inflation (INF) had statistically significant influence on Ethiopian private commercial bank‟s liquidity (L1) at 1% significant level. The other statistically significant variables, non-performing loans (NPL) had statistically significant impact on liquidity (L1) at 5% significant level and loan growth (LG) and return on asset (ROA) had statistically significant impact on liquidity (L1) at 10% significant level. The other variables such as capital adequacy (CAP), interest rate margin (IRM), interest rate on loans (IRL), 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, non-performing loans, return on asset, interest rate margin, inflation and short term interest rate were contrary to our expectations whereas the coefficient sign of capital adequacy, loan growth, interest rate on loans and gross domestic product were in-line with our expectations.

Determinants of Bank Liquidity Measured by Model- 2

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

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

The following table shows the regression result of the determinants of commercial bank‟s liquidity measured by the ratio of liquid asset to total asset.

Table 4.4.2: Regression result of liquidity measured by L2

Dependent Variable: L2
Total panel (balanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.600883	0.140905	4.264467	0.0001
CAP	-0.341738	0.255937	-1.335240	0.1857
SIZE	-0.046223	0.017431	-2.651784	0.0097***
LG	-0.076317	0.035001	-2.180403	0.0322**
NPL	0.532613	0.195818	2.719943	0.0080***
ROA	1.817973	1.042065	1.744586	0.0850*
IRM	1.967853	2.385765	0.824831	0.4120
IRL	-1.197405	2.394740	-0.500014	0.6185
GDP	0.012291	0.288053	0.042669	0.9661
INF	0.430734	0.078181	5.509410	0.0000***
STIR	-0.527044	2.132831	-0.247110	0.8055

R-squared	0.673491		
Adjusted R-squared	0.602329		
F-statistic	9.464157	Durbin-Watson stat	1.781185
Prob(F-statistic)	0.000000		

****, **, and * denote significance at 1%, 5%, and 10% levels, respectively*

***Source**: Financial statement of sampled commercial banks and own computation through E-views 6*

As it can be seen from the above table, bank size (SIZE), non-performing loans (NPL) and inflation (INF) were statistically significant at 1% significant level, loan growth (LG) was statistically significant at 5% significant level and return on asset (ROA) was statistically significant at 10% significant level. The significant level of bank size, inflation and return on asset had similar result with L1 whereas loan growth had 10% significant level in the case of L1 and 5% significant level in the case of L2, besides non-performing loan had 1% significant level in the case of L2 and 5%

significant level in the case of L1. Thus, 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 private commercial banks in the case of L2. On the other hand, except capital adequacy and gross domestic product, the coefficient sign of the other independent variables are similar with the coefficient sign of liquidity measured by liquid asset to deposit ratio. Similar to the result on L1, we also found that; capital adequacy, interest rate margin, interest rate on loans, gross domestic product and short term interest rate had no statistically significant influence on the liquidity measured by L2.

The coefficient of determination in this model is given by R-squared of 0.6734 and Adjusted R-squared of 0.6023, which means 60.23% of variation of Ethiopian private commercial bank‟s liquidity (L2) 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 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 9.464 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 4.4.2 above, among the independent variables capital adequacy, bank size, loan growth, interest rate on loans and short term interest arte had negatively related with L2 whereas, non-performing loans, return on asset, interest rate margin, gross domestic product and inflation had positively related with L2. Thus the overall result shows that, bank liquidity (L2) decreases with higher loan growth and with bank size while increases with higher non-performing loans, higher return on asset and higher inflation. In this regard, only loan growth had coefficient sign which is in-line with our expectations while the coefficient sign of the other statistically significant variables are contrary to our expectations. 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) 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 private commercial banks liquidity measured by loan to deposit & short term borrowing ratio was:

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

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

Dependent Variable: L3

Total panel (balanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.030614	0.164583	6.261990	0.0000
CAP	1.043630	0.310208	3.364291	0.0012***
SIZE	-0.066807	0.020564	-3.248783	0.0017***
LG	0.150357	0.039890	3.769341	0.0003***
NPL	-0.077008	0.226673	-0.339732	0.7349
ROA	1.200852	1.100848	1.090843	0.2786
IRM	-14.86575	2.619214	-5.675652	0.0000***
IRL	12.23717	2.424515	5.047267	0.0000***
GDP	-0.172920	0.338755	-0.510459	0.6111
INF	0.078824	0.084437	0.933519	0.3534
STIR	-8.712035	2.217826	-3.928187	0.0002***
R-squared	0.779603			
Adjusted R-squared	0.738279			
F-statistic	18.86543	Durbin-Watson stat		0.941291
Prob(F-statistic)	0.000000			

****, **, and * denote significance at 1%, 5%, and 10% levels, respectively*

***Source**: Financial statement of sampled commercial banks and own computation through E-views 6*

Table 4.4.3 above, presents the determinants of Ethiopian private commercial banks liquidity measured by the ratio of loans to deposit & short term borrowings. In contrast to the above two liquidity measures, high value of this ratio implies low liquidity and the result 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 0.7796 and 0.7382 respectively. This result implies that, the explanatory power of the model is high and indicates that the change in the independent variables can explain 73.82% of the change in the dependant variable. The explanatory power of model 3, liquidity measured by loan to deposit ratio, is better than the explanatory power of liquidity measured by L1 & L2 though it had first order serial autocorrelation problems. The value of F-statistics is 18.86543 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, capital adequacy (CAP), bank size (SIZE), loan growth (LG), interest rate margin (IRM), interest rate on loans (IRM) and short term interest rate (STIR) were statistically significant at 1% significant level. Whereas, non- performing loan, return on asset, gross domestic product and inflation had statistically insignificant impact on banks liquidity measured by L3. Among the statistically significant variables which determine liquidity in the case of L1 & L2, only bank size and loan growth had similar significant impact on 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 and short term interest rate had negatively related with liquidity (L3) and indicate their positive impact on liquidity of Ethiopian private commercial banks which means the increase in this independent variables will leads to the decrease in liquidity of commercial banks. The other variables; capital adequacy, loan growth, return on asset, interest rate on loans and inflation had positively related with liquidity which is measured by loan to deposit ratio and have negative impact on liquidity. The coefficient sign of bank size, loan growth, return on asset, interest rate on loans, inflation and short term interest rate were in-line with our expectation whereas the coefficient sign of the other independent variables were contrary to our expectation.

In general among the macroeconomic variables, gross domestic product (GDP) had no statistically significant effect on the liquidity of Ethiopian private commercial banks in all of the three liquidity measures while the other macroeconomic variables and the entire bank specific variables included in this study had statistically significant impact on liquidity of Ethiopian private 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 dependant variable, liquidity of Ethiopian private 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, return on asset, interest rate margin, interest rate on loans, 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. Since, there was first order autocorrelation problem in case of L3, our focus shall be on the result of L1 & L2.

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 insignificant impact on the determination of liquidity of Ethiopian private commercial banks which was measured by L1. While the coefficient sign of 0.286 reveals that, there is a positive relation between liquidity of private 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 private commercial banks is also increased by 0.286 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 and Dybvig (1983) and it is also in line with our hypothesis and the findings of Vodova(2013) on Hungary commercial banks.

On the other hand, capital adequacy had negative relation and statistically insignificant impact on liquidity of Ethiopian private commercial banks which was measured by L2. This result was opposite to our hypothesis and the coefficient sign was also in the opposite direction of our expectation. However, capital adequacy has positive and statistically significant impact on liquidity which was measured by L3.

In general, capital adequacy has no statistically significant impact on liquidity of Ethiopian private commercial banks as it was measured by L1 & L2 and thus the first hypothesis; capital adequacy has positive and significant impact on bank‟s liquidity was rejected in our findings.

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 significant impact on liquidity of Ethiopian private commercial banks which was measured by L1 and L2 at 1% significant level. This 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 behaviour 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 0.07 units and 0.046 units respectively, change on liquidity of Ethiopian private commercial banks in opposite direction. This was consistent with the findings of Vodova(2011) on Hungary Commercial banks, Vodova (2013) on Poland 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. Thus, the hypothesis: bank size has positive and significant impact on bank‟s liquidity should be rejected.

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 private commercial banks measured by L1 and L2 at 10% and 5% significant level respectively. 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 8.6%6 & 7.63% change on the level of liquidity of commercial banks measured by L1 & L2 respectively in the opposite direction. Therefore, the study fails to reject the third 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 private commercial banks measured by L1 and L2 at 5% and 1% level of significant respectively. Surprisingly, non-performing loans has statistically insignificant impact on liquidity which was measured by L3.

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 one percent change on non-performing loans ratio had a 68.69% change on liquidity of commercial banks measured by L1 and a 53.26% change on liquidity measured by L2 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 hypotheses 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 return on asset (ROA). The regression result shows that, profitability had positive and statistically significant impact on liquidity measured by L1 & L2 at 10% level of significant. This positive relation was inconsistent with our expectation and finance theory which emphasizes their negative relationship. The coefficient of 2.6253 and 1.8179 for L1 & L2 respectively revealed that, taking other independent variables constant, a one percent change on return on asset had a 262.53% and 181.79% change on liquidity of Ethiopian private 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. Therefore, the hypothesis stated; profitability has negative and significant impact on bank‟s liquidity should be 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. According to the regression result of this study, interest rate margin had positive and statistically insignificant impact on liquidity of commercial banks measured by L1 & L2. Even though, it had autocorrelation problem, interest rate margin had statistically significant impact on liquidity measured by loan to deposit ratio (L3) at 1% significant level. 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 1.952791 and 1.967853 of L1 & L2 in this study indicated that, a one percent change on interest rate margin leads to 195.279% and 196.785% change on liquidity of Ethiopian private commercial banks measured by L1 & L2 respectively. The positive coefficient as well of its statistically insignificant impact on liquidity was opposite to our hypothesis and expectation and thus the hypothesis stated; interest rate margin has negative and significant impact on bank‟s liquidity should be 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 regression shows that, interest rate on loans & advances had negative and insignificant impact on commercial banks liquidity measured by L1 & L2. In contrary to coefficient sign of the relation between interest rate margin and liquidity which was positive, the relation between interest rate on loans and liquidity was negative i.e. there exists an inverse relation. The negative relation was in line with finance theory in which the increase on interest rate on loans encourages banks to focus more on lending activities and as a result the share of liquid asset is decreasing. Though IRL had statistically insignificant impact on liquidity, the coefficient sign of IRL correspond to our expectation 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 rejected.

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 negative and statistically insignificant impact on liquidity measured by L1 while it had positive and statistically insignificant impact on liquidity measured by L2. It has also statistically insignificant impact on liquidity measured by loan to deposit ratio. The only independent variable which has no significant impact on liquidity in any of the three measures is GDP growth rate. This implies that during the study period, the growth rate of GDP of Ethiopia do not have impact on the liquidity of Ethiopian private 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 private commercial banks measured by L1 & L2 at 1% significant level while it has insignificant impact when liquidity is measured by loan to deposit ratio. 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 and Tseganesh(2012) on Ethiopian commercial banks. The positive coefficient of 0.621493 and 0.430734 for L1 & L2 indicates that a one percent change on inflation rate of the country, other things being constant, liquidity of Ethiopian commercial banks leads to a 62.14% and 43.07% respectively change in the same direction.

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. The regression result shows that, short term interest rate had negative and statistically insignificant impact on liquidity of commercial banks in Ethiopia as measured by L1 & L2. But STIR had negative and statistically significant impact on bank‟s liquidity measured by L3 at 1% significant level. The negative coefficient indicates that, the rate on Treasury bills had inverse relation with the liquidity of Ethiopian private commercial banks and it was opposite to the theory of higher short term interest rate induce banks to invest more on short term instruments and enhance their liquidity position. Thus, the negative coefficient and its statistically insignificant impact on liquidity tend to reject the hypothesis stated: short term interest rate has positive and significant impact on bank‟s liquidity.

In general, from section 4.5 above, it was clearly identified that among bank specific variables bank size, loan growth, non-performing loans and return on asset had statistically significant impact on bank‟s liquidity and among macroeconomic variables only inflation had statistically significant impact on the liquidity of Ethiopian private commercial banks measured by L1 and L2.

Chapter Five: 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 private 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 six private commercial banks in Ethiopia which had sixteen years of banking service over the period 2000 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 analysed by using descriptive statistics, correlation analysis and balanced fixed effect regression analysis to identify the determinants of liquidity of Ethiopian private 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 found a problem of first order positive autocorrelation in the case of L3, the other CLRM assumption were satisfied. As a result, the study focused on the result of L1 and L2 model results.

The result of this study confirmed that, among the bank specific variables; bank size, loan growth, non-performing loans and profitability had statistically significant impact on the determination liquidity of Ethiopian private commercial banks measured by L1 & L2. And among the macro-economic variables only inflation had statistically significant impact on liquidity of Ethiopian private commercial banks. Whereas capital adequacy, interest rate margin, interest rate on loans,

GDP and short term interest rate had no statistically significant impact on the determination of liquidity of Ethiopian private commercial banks.

The negative relationship between bank size and liquidity was opposite to our hypothesis but consistent with the "too big to fail" hypothesis. The coefficient sign for loan growth revealed negative relationship with liquidity and it was in line with our hypothesis and the finance theory. The result revealed a positive relationship between non-performing loans and liquidity with strong statistical significant. This result was not in line with our expectation but this could be a sign of prudent policy of banks that, they offset the higher credit risk with better portfolio quality and caution liquidity risk management. It was also found that profitability and liquidity had positively related and it was inconsistent with our hypothesis but it was consistent with Bourke (1989) result.

The positive and statistically significant impact of inflation was in consistent with our hypothesis but it is consistent with 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.

5.2. Recommendations

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

- Ethiopian private commercial banks should have liquidity 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 by maintaining optimum level of liquidity;
- The negative relationship between bank size and liquidity revealed the "too big to fail" hypothesis, in which big banks may encourage to disburse more loans and advances. Thus, big banks needs to manage their liquidity position and shall give due attention on resource mobilization and liquidity management.

- As loan growth has statistically significant and negative relation with liquidity, Ethiopian private commercial banks shall give priority so as to maintain the optimum level of loan growth as it affects both profitability and liquidity.
- Among the macroeconomic variables included in this study general inflation rate exists as significant key drivers of liquidity of Ethiopian private banks. This is a clear signal 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 reveals that, bank specific variables have more statistically significant impact on the determination of liquidity of Ethiopian private commercial banks, since they are internal variables that can be controlled by management, special emphasis shall be given to those significant variables.
- Recommendation for further study: As this study identifies only limited bank specific and macroeconomic variables for a sample of six private commercial banks in Ethiopia, there have to be further researches which include more bank specific variables, macroeconomic variables and regulatory factors that affect the liquidity of Ethiopian commercial banks.

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Appendices

Appendix I- Regression Result of L1, L2 & L3

L1

Dependent Variable: L1
Method: Panel Least Squares
Date: 02/13/16 Time: 15:10
Sample: 2000 2015
Periods included: 16
Cross-sections included: 6
Total panel (balanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.750169	0.192036	3.906408	0.0002
CAP	0.286856	0.348811	0.822382	0.4134
SIZE	-0.070739	0.023756	-2.977752	0.0039***
LG	-0.086416	0.047702	-1.811566	0.0739*
NPL	0.686996	0.266875	2.574219	0.0119**
ROA	2.625382	1.420207	1.848591	0.0683*
IRM	1.952791	3.251504	0.600581	0.5499
IRL	-0.817238	3.263736	-0.250399	0.8029
GDP	-0.165688	0.392581	-0.422048	0.6742
INF	0.621493	0.106552	5.832785	0.0000***
STIR	-1.277092	2.906786	-0.439348	0.6616

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.727060	Mean dependent var	0.467168
Adjusted R-squared	0.667574	S.D. dependent var	0.150946
S.E. of regression	0.087030	Akaike info criterion	-1.877759
Sum squared resid	0.590794	Schwarz criterion	-1.396943
Log likelihood	108.1324	Hannan-Quinn criter.	-1.683405
F-statistic	12.22220	Durbin-Watson stat	1.806052
Prob(F-statistic)	0.000000		

****, **, and * denote significance at 1%, 5%, and 10% levels, respectively*

L2

Dependent Variable: L2
Method: Panel Least Squares
Date: 02/13/16 Time: 15:33
Sample: 2000 2015
Periods included: 16
Cross-sections included: 6
Total panel (balanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.600883	0.140905	4.264467	0.0001
CAP	-0.341738	0.255937	-1.335240	0.1857
SIZE	-0.046223	0.017431	-2.651784	0.0097***
LG	-0.076317	0.035001	-2.180403	0.0322**
NPL	0.532613	0.195818	2.719943	0.0080***
ROA	1.817973	1.042065	1.744586	0.0850*
IRM	1.967853	2.385765	0.824831	0.4120
IRL	-1.197405	2.394740	-0.500014	0.6185
GDP	0.012291	0.288053	0.042669	0.9661
INF	0.430734	0.078181	5.509410	0.0000***
STIR	-0.527044	2.132831	-0.247110	0.8055

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.673491	Mean dependent var	0.351622
Adjusted R-squared	0.602329	S.D. dependent var	0.101263
S.E. of regression	0.063858	Akaike info criterion	-2.496954
Sum squared resid	0.318070	Schwarz criterion	-2.016139
Log likelihood	137.8538	Hannan-Quinn criter.	-2.302601
F-statistic	9.464157	Durbin-Watson stat	1.781185
Prob(F-statistic)	0.000000		

****, **, and * denote significance at 1%, 5%, and 10% levels, respectively*

L3

Dependent Variable: L3
Method: Panel Least Squares
Date: 02/13/16 Time: 16:10
Sample: 2000 2015
Periods included: 16
Cross-sections included: 6
Total panel (balanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.030614	0.164583	6.261990	0.0000
CAP	1.043630	0.310208	3.364291	0.0012***
SIZE	-0.066807	0.020564	-3.248783	0.0017***
LG	0.150357	0.039890	3.769341	0.0003***
NPL	-0.077008	0.226673	-0.339732	0.7349
ROA	1.200852	1.100848	1.090843	0.2786
IRM	-14.86575	2.619214	-5.675652	0.0000***
IRL	12.23717	2.424515	5.047267	0.0000***
GDP	-0.172920	0.338755	-0.510459	0.6111
INF	0.078824	0.084437	0.933519	0.3534
STIR	-8.712035	2.217826	-3.928187	0.0002***

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.779603	Mean dependent var	0.721917
Adjusted R-squared	0.738279	S.D. dependent var	0.153950
S.E. of regression	0.078759	Akaike info criterion	-2.093837
Sum squared resid	0.496238	Schwarz criterion	-1.666445
Log likelihood	116.5042	Hannan-Quinn criter.	-1.921078
F-statistic	18.86543	Durbin-Watson stat	0.941291
Prob(F-statistic)	0.000000		

****, **, and * denote significance at 1%, 5%, and 10% levels, respectively*

Appendix II- Hetroskedasticity test of L1, L2 & L3

L1

Heteroskedasticity Test: White

F-statistic	1.271938	Prob. F(72,23)	0.2635
Obs*R-squared	76.72955	Prob. Chi-Square(72)	0.3296
Scaled explained SS	60.69715	Prob. Chi-Square(72)	0.8264

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/13/16 Time: 16:25
Sample: 2000 2015
Included observations: 96
Collinear test regressors dropped from specification

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.115246	1.251736	-0.890959	0.3822
CAP	-0.153232	2.507225	-0.061116	0.9518
CAP^2	-1.673575	3.347804	-0.499902	0.6219
CAP*SIZE	-0.268876	0.275121	-0.977300	0.3386
CAP*LG	-0.926381	0.578858	-1.600361	0.1232
CAP*NPL	1.901844	4.996945	0.380601	0.7070
CAP*ROA	-0.045820	16.07242	-0.002851	0.9977
CAP*IRM	-55.21611	48.62342	-1.135587	0.2678
CAP*IRL	71.25911	49.83133	1.430006	0.1662
CAP*GDP	6.081187	6.542018	0.929558	0.3623
CAP*INF	0.173916	1.231230	0.141254	0.8889
CAP*STIR	-47.33411	33.70407	-1.404403	0.1736
SIZE	0.209775	0.200879	1.044289	0.3072
SIZE^2	-0.011369	0.010668	-1.065711	0.2976
SIZE*LG	-0.087812	0.049310	-1.780828	0.0882
SIZE*NPL	-0.550209	0.388104	-1.417684	0.1697
SIZE*ROA	0.362808	0.812981	0.446268	0.6596
SIZE*IRM	-1.021186	1.893843	-0.539214	0.5949
SIZE*IRL	1.342120	2.142995	0.626282	0.5373
SIZE*GDP	0.172094	0.615128	0.279770	0.7822
SIZE*INF	0.045702	0.080490	0.567791	0.5757
SIZE*STIR	-1.864864	2.173350	-0.858059	0.3997
LG	1.536010	0.667587	2.300839	0.0308
LG^2	-0.151938	0.086009	-1.766538	0.0906
LG*NPL	-2.102651	0.894322	-2.351111	0.0277
LG*ROA	-2.483896	3.337217	-0.744302	0.4642
LG*IRM	18.11294	8.705968	2.080520	0.0488
LG*IRL	-16.66602	9.118207	-1.827774	0.0806

LG*GDP	-1.147258	1.224765	-0.936717	0.3586
LG*INF	-0.200686	0.278941	-0.719458	0.4791
LG*STIR	7.613536	5.652777	1.346867	0.1911
NPL	6.581641	3.595362	1.830592	0.0802
NPL^2	-1.595698	1.870690	-0.853000	0.4025
NPL*ROA	3.763763	11.45456	0.328582	0.7454
NPL*IRM	82.24575	36.62187	2.245810	0.0346
NPL*IRL	-80.52278	34.25869	-2.350434	0.0277
NPL*GDP	-1.755443	2.851760	-0.615565	0.5442
NPL*INF	-0.257211	0.810881	-0.317200	0.7540
NPL*STIR	30.06519	23.93254	1.256247	0.2216
ROA	1.969755	6.476072	0.304159	0.7637
ROA^2	-2.052547	28.88977	-0.071048	0.9440
ROA*IRM	226.1823	156.8659	1.441884	0.1628
ROA*IRL	-243.1846	157.7795	-1.541294	0.1369
ROA*GDP	20.11834	23.01295	0.874218	0.3910
ROA*INF	-7.229349	4.231858	-1.708316	0.1010
ROA*STIR	140.1499	156.8181	0.893710	0.3807
IRM	-29.32826	23.74432	-1.235170	0.2292
IRM^2	28.03633	190.4245	0.147231	0.8842
IRM*IRL	149.1898	344.3054	0.433307	0.6688
IRM*GDP	46.84804	96.73098	0.484313	0.6327
IRM*INF	20.12912	14.60257	1.378464	0.1813
IRM*STIR	-64.89824	318.7252	-0.203618	0.8404
IRL	22.85966	22.83157	1.001230	0.3271
IRL^2	-174.5410	178.5302	-0.977655	0.3384
IRL*GDP	-12.49103	80.70058	-0.154782	0.8783
IRL*INF	-16.31442	14.08886	-1.157966	0.2588
IRL*STIR	242.7194	337.9760	0.718156	0.4799
GDP	-4.085046	4.978784	-0.820491	0.4204
GDP^2	-2.261947	14.20501	-0.159236	0.8749
GDP*INF	5.084834	5.745093	0.885074	0.3853
GDP*STIR	72.96348	130.4285	0.559414	0.5813
INF	-0.711388	0.655556	-1.085167	0.2891
INF^2	0.284024	0.606483	0.468314	0.6440
INF*STIR	22.13030	21.29870	1.039045	0.3096
STIR	-17.01970	16.27752	-1.045595	0.3066
STIR^2	58.50545	350.4811	0.166929	0.8689

R-squared	0.799266	Mean dependent var	0.007182
Adjusted R-squared	0.170882	S.D. dependent var	0.010504
S.E. of regression	0.009565	Akaike info criterion	-6.369532
Sum squared resid	0.002104	Schwarz criterion	-4.419559
Log likelihood	378.7375	Hannan-Quinn criter.	-5.581321
F-statistic	1.271938	Durbin-Watson stat	2.113859
Prob(F-statistic)	0.263519		

L2

Heteroskedasticity Test: White

F-statistic	1.176128	Prob. F(72,23)	0.3406
Obs*R-squared	75.49503	Prob. Chi-Square(72)	0.3662
Scaled explained SS	60.61148	Prob. Chi-Square(72)	0.8284

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/13/16 Time: 16:40
Sample: 2000 2015
Included observations: 96
Collinear test regressors dropped from specification

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.811338	0.695873	-1.165928	0.2556
CAP	-0.076069	1.393831	-0.054575	0.9569
CAP^2	-1.283689	1.861131	-0.689736	0.4973
CAP*SIZE	-0.164811	0.152947	-1.077569	0.2924
CAP*LG	-0.506387	0.321802	-1.573600	0.1292
CAP*NPL	0.876113	2.777931	0.315383	0.7553
CAP*ROA	-0.234667	8.935077	-0.026264	0.9793
CAP*IRM	-36.62147	27.03102	-1.354794	0.1886
CAP*IRL	46.47361	27.70253	1.677595	0.1070
CAP*GDP	3.677034	3.636877	1.011042	0.3225
CAP*INF	0.131932	0.684473	0.192750	0.8488
CAP*STIR	-30.14483	18.73697	-1.608843	0.1213
SIZE	0.143877	0.111674	1.288374	0.2104
SIZE^2	-0.007574	0.005931	-1.277160	0.2143
SIZE*LG	-0.051136	0.027413	-1.865423	0.0749
SIZE*NPL	-0.404190	0.215757	-1.873357	0.0738
SIZE*ROA	0.163090	0.451957	0.360852	0.7215
SIZE*IRM	-0.615347	1.052836	-0.584466	0.5646
SIZE*IRL	0.949314	1.191347	0.796841	0.4337
SIZE*GDP	0.020156	0.341966	0.058942	0.9535
SIZE*INF	0.026151	0.044747	0.584414	0.5646
SIZE*STIR	-1.482053	1.208222	-1.226640	0.2324
LG	0.978766	0.371129	2.637267	0.0147
LG^2	-0.095993	0.047814	-2.007605	0.0566
LG*NPL	-1.327346	0.497177	-2.669767	0.0137
LG*ROA	-1.939288	1.855245	-1.045300	0.3067
LG*IRM	11.60063	4.839873	2.396887	0.0251
LG*IRL	-11.06240	5.069048	-2.182344	0.0396

LG*GDP	-0.726529	0.680879	-1.067046	0.2970
LG*INF	-0.139577	0.155070	-0.900090	0.3774
LG*STIR	4.888045	3.142525	1.555451	0.1335
NPL	4.591676	1.998755	2.297269	0.0310
NPL^2	-1.185720	1.039965	-1.140154	0.2660
NPL*ROA	0.927499	6.367886	0.145653	0.8855
NPL*IRM	49.30122	20.35905	2.421588	0.0237
NPL*IRL	-47.29053	19.04529	-2.483056	0.0208
NPL*GDP	-1.132245	1.585367	-0.714184	0.4823
NPL*INF	-0.079779	0.450790	-0.176975	0.8611
NPL*STIR	16.09736	13.30472	1.209898	0.2386
ROA	2.828481	3.600216	0.785642	0.4401
ROA^2	-4.635952	16.06057	-0.288654	0.7754
ROA*IRM	154.0877	87.20579	1.766943	0.0905
ROA*IRL	-168.4249	87.71373	-1.920166	0.0673
ROA*GDP	11.11796	12.79350	0.869032	0.3938
ROA*INF	-4.245046	2.352599	-1.804407	0.0843
ROA*STIR	105.3372	87.17925	1.208283	0.2392
IRM	-18.75181	13.20008	-1.420583	0.1689
IRM^2	10.67175	105.8619	0.100808	0.9206
IRM*IRL	97.70941	191.4083	0.510476	0.6146
IRM*GDP	33.72263	53.77526	0.627103	0.5368
IRM*INF	12.07499	8.117946	1.487444	0.1505
IRM*STIR	-7.447275	177.1876	-0.042030	0.9668
IRL	14.25564	12.69266	1.123140	0.2730
IRL^2	-109.0707	99.24958	-1.098954	0.2832
IRL*GDP	-14.55941	44.86354	-0.324527	0.7485
IRL*INF	-10.03893	7.832364	-1.281725	0.2127
IRL*STIR	116.2446	187.8896	0.618685	0.5422
GDP	-2.114408	2.767835	-0.763921	0.4527
GDP^2	1.425194	7.896933	0.180474	0.8584
GDP*INF	3.684116	3.193846	1.153505	0.2605
GDP*STIR	62.21017	72.50859	0.857970	0.3998
INF	-0.481057	0.364441	-1.319986	0.1998
INF^2	0.227145	0.337159	0.673703	0.5072
INF*STIR	14.20029	11.84050	1.199299	0.2426
STIR	-9.743678	9.049096	-1.076757	0.2928
STIR^2	75.55880	194.8415	0.387796	0.7017

R-squared	0.786407	Mean dependent var	0.003842
Adjusted R-squared	0.117766	S.D. dependent var	0.005661
S.E. of regression	0.005317	Akaike info criterion	-7.543772
Sum squared resid	0.000650	Schwarz criterion	-5.593799
Log likelihood	435.1011	Hannan-Quinn criter.	-6.755561
F-statistic	1.176128	Durbin-Watson stat	2.119537
Prob(F-statistic)	0.340588		

L3

Heteroskedasticity Test: White

F-statistic	1.037244	Prob. F(65,30)	0.4690
Obs*R-squared	66.43754	Prob. Chi-Square(65)	0.4272
Scaled explained SS	37.24630	Prob. Chi-Square(65)	0.9978

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/13/16 Time: 16:58
Sample: 2000 2015
Included observations: 96

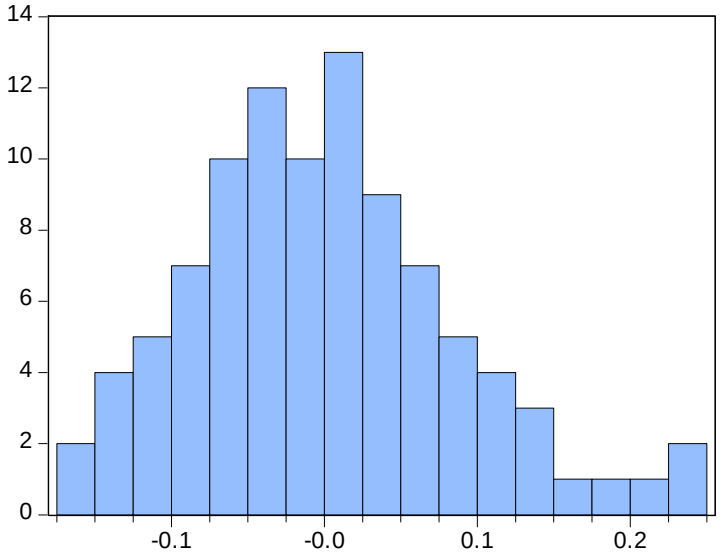
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.456592	0.768110	0.594436	0.5567
CAP	-2.152121	1.719019	-1.251947	0.2203
CAP^2	1.754202	2.335722	0.751032	0.4585
CAP*SIZE	0.287673	0.186372	1.543543	0.1332
CAP*LG	-0.479561	0.414754	-1.156255	0.2567
CAP*NPL	3.543347	2.978888	1.189486	0.2436
CAP*ROA	-12.91852	9.214313	-1.402006	0.1712
CAP*IRM	-7.902691	27.66375	-0.285670	0.7771
CAP*IRL	-7.211925	26.92453	-0.267857	0.7906
CAP*GDP	6.574105	4.139910	1.587983	0.1228
CAP*INF	0.674891	0.729887	0.924651	0.3625
CAP*STIR	29.97602	18.42327	1.627074	0.1142
SIZE	-0.092581	0.122839	-0.753678	0.4569
SIZE^2	0.004052	0.006393	0.633851	0.5310
SIZE*LG	-0.036396	0.032525	-1.119022	0.2720
SIZE*NPL	0.053706	0.184186	0.291583	0.7726
SIZE*ROA	0.030867	0.487663	0.063297	0.9500
SIZE*IRM	0.628277	1.085885	0.578585	0.5672
SIZE*IRL	-1.173166	1.087502	-1.078772	0.2893
SIZE*GDP	0.419998	0.358860	1.170365	0.2511
SIZE*INF	0.068779	0.053024	1.297122	0.2045
SIZE*STIR	1.522825	1.217639	1.250637	0.2207
LG	0.225626	0.391876	0.575758	0.5691
LG^2	0.005174	0.050818	0.101822	0.9196
LG*NPL	-0.293050	0.551854	-0.531027	0.5993
LG*ROA	-1.617430	2.069421	-0.781586	0.4406
LG*IRM	-1.100632	5.511655	-0.199692	0.8431
LG*IRL	2.471783	5.700727	0.433591	0.6677
LG*GDP	0.349710	0.749931	0.466323	0.6444

LG*INF	0.113091	0.178627	0.633115	0.5315
LG*STIR	-0.555427	3.818480	-0.145458	0.8853
NPL	-0.011180	1.795908	-0.006225	0.9951
NPL^2	-0.678783	1.062764	-0.638696	0.5279
NPL*ROA	-11.26717	8.064539	-1.397125	0.1726
NPL*IRM	-5.336397	23.87766	-0.223489	0.8247
NPL*IRL	-1.097773	21.56668	-0.050901	0.9597
NPL*GDP	1.120068	1.802282	0.621472	0.5390
NPL*INF	-0.073939	0.478847	-0.154410	0.8783
NPL*STIR	10.43987	13.74418	0.759585	0.4534
ROA	2.464936	4.463640	0.552225	0.5849
ROA^2	11.55770	19.84649	0.582355	0.5647
ROA*IRM	-114.6412	102.2826	-1.120828	0.2713
ROA*IRL	69.29979	96.60119	0.717380	0.4787
ROA*GDP	8.388030	15.44741	0.543006	0.5911
ROA*INF	-4.627290	2.509416	-1.843970	0.0751
ROA*STIR	55.48965	83.88323	0.661511	0.5133
IRM	7.032711	12.69638	0.553915	0.5837
IRM^2	8.394970	113.8944	0.073708	0.9417
IRM*IRL	-11.40366	199.0710	-0.057284	0.9547
IRM*GDP	-63.20087	54.22584	-1.165512	0.2530
IRM*INF	11.10448	7.099919	1.564028	0.1283
IRM*STIR	-86.69968	172.1518	-0.503623	0.6182
IRL	-1.718244	10.89185	-0.157755	0.8757
IRL^2	22.28093	96.55900	0.230749	0.8191
IRL*GDP	53.43147	45.44967	1.175618	0.2490
IRL*INF	-6.506642	7.042648	-0.923891	0.3629
IRL*STIR	35.16337	170.6945	0.206002	0.8382
GDP	-2.639493	3.110585	-0.848552	0.4029
GDP^2	-8.590591	7.341009	-1.170219	0.2511
GDP*INF	-2.679978	3.021091	-0.887090	0.3821
GDP*STIR	-87.20546	68.63794	-1.270514	0.2137
INF	-0.227118	0.440122	-0.516035	0.6096
INF^2	-0.374373	0.392786	-0.953121	0.3481
INF*STIR	-9.169172	12.74656	-0.719345	0.4775
STIR	-3.316081	10.62926	-0.311977	0.7572
STIR^2	-160.9278	180.1031	-0.893532	0.3787

R-squared	0.692058	Mean dependent var	0.006132
Adjusted R-squared	0.024849	S.D. dependent var	0.007372
S.E. of regression	0.007280	Akaike info criterion	-6.795553
Sum squared resid	0.001590	Schwarz criterion	-5.032564
Log likelihood	392.1866	Hannan-Quinn criter.	-6.082924
F-statistic	1.037244	Durbin-Watson stat	1.524306
Prob(F-statistic)	0.469008		

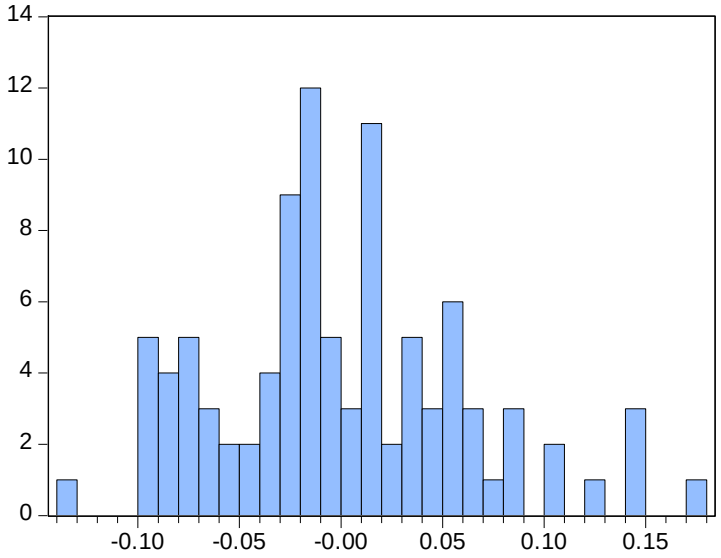
Appendix III: Normality Test of L1, L2 & L3

L1



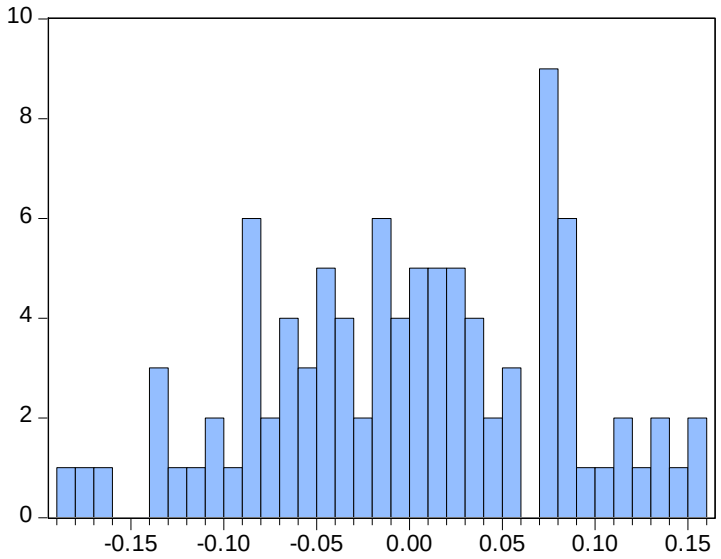
Series: Residuals	
Sample 2000 2015	
Observations 96	
Mean	-1.41e-16
Median	-0.006061
Maximum	0.230094
Minimum	-0.168457
Std. Dev.	0.085194
Skewness	0.497103
Kurtosis	3.116518
Jarque-Bera	4.008085
Probability	0.134789

L2



Series: Residuals	
Sample 2000 2015	
Observations 96	
Mean	-8.10e-18
Median	-0.007711
Maximum	0.175152
Minimum	-0.134773
Std. Dev.	0.062311
Skewness	0.470329
Kurtosis	3.148091
Jarque-Bera	3.627081
Probability	0.163076

L3



Series: Residuals	
Sample 2000 2015	
Observations 96	
Mean	-2.50e-16
Median	0.001074
Maximum	0.155100
Minimum	-0.183997
Std. Dev.	0.078719
Skewness	-0.134137
Kurtosis	2.430225
Jarque-Bera	1.586460
Probability	0.452381

Appendix IV: List of Commercial Banks in Ethiopia

No.	Bank Name	Year of Establishment	Ownership
1	Commercial Bank of Ethiopia	1963	Public
2	Construction & Business Bank	1983	Public
3	Awash International Bank	1994	Private
4	Dashen Bank	1995	Private
5	Bank of Abyssinia	1996	Private
6	Wegagen Bank	1997	Private
7	United Bank	1998	Private
8	NIB International Bank	1999	Private
9	Cooperative bank of Oromia	2004	Private
10	Lion International Bank	2006	Private
11	Oromia International Bank	2008	Private
12	Zemen Bank	2008	Private
13	Bunna International Bank	2009	Private
14	Birhan International Bank	2009	Private
15	Abbay Bank	2010	Private
16	Addis International Bank	2011	Private
17	Debub Global Bank	2012	Private
18	Enat Bank	2013	Private

Source: NBE June 30, 2015 report and each bank's annual financial reports

Appendix V: Durbin-Watson Statistic

Durbin-Watson Statistic: 1 Per Cent Significance Points of dL and dU

*k' is the number of regressors excluding the intercept

	k'=1		k'=2		k'=3		k'=4		k'=5		k=6		k'=7		k'=8		k'=9		k'=10	
N	dL	dU	dL	dU	dL	dU	dL	dU	dL	dU	dL	dU	dL	dU	dL	dU	dL	dU	dL	dU
6	0.390	1.142																		
7	0.435	1.036	0.294	1.676																
8	0.497	1.003	0.345	1.489	0.229	2.102														
9	0.554	0.998	0.408	1.389	0.279	1.875	0.183	2.433												
10	0.604	1.001	0.466	1.333	0.340	1.733	0.230	2.193	0.150	2.690										
11	0.653	1.010	0.519	1.297	0.396	1.640	0.286	2.030	0.193	2.453	0.124	2.892								
12	0.697	1.023	0.569	1.274	0.449	1.575	0.339	1.913	0.244	2.280	0.164	2.665	0.105	3.053						
13	0.738	1.038	0.616	1.261	0.499	1.526	0.391	1.826	0.294	2.150	0.211	2.490	0.140	2.838	0.090	3.182				
14	0.776	1.054	0.660	1.254	0.547	1.490	0.441	1.757	0.343	2.049	0.257	2.354	0.183	2.667	0.122	2.981	0.078	3.287		
15	0.811	1.070	0.700	1.252	0.591	1.465	0.487	1.705	0.390	1.967	0.303	2.244	0.226	2.530	0.161	2.817	0.107	3.101	0.068	3.374
16	0.844	1.086	0.738	1.253	0.633	1.447	0.532	1.664	0.437	1.901	0.349	2.153	0.269	2.416	0.200	2.681	0.142	2.944	0.094	3.201
17	0.873	1.102	0.773	1.255	0.672	1.432	0.574	1.631	0.481	1.847	0.393	2.078	0.313	2.319	0.241	2.566	0.179	2.811	0.127	3.053
18	0.902	1.118	0.805	1.259	0.708	1.422	0.614	1.604	0.522	1.803	0.435	2.015	0.355	2.238	0.282	2.467	0.216	2.697	0.160	2.925
19	0.928	1.133	0.835	1.264	0.742	1.416	0.650	1.583	0.561	1.767	0.476	1.963	0.396	2.169	0.322	2.381	0.255	2.597	0.196	2.813
20	0.952	1.147	0.862	1.270	0.774	1.410	0.684	1.567	0.598	1.736	0.515	1.918	0.436	2.110	0.362	2.308	0.294	2.510	0.232	2.174
21	0.975	1.161	0.889	1.276	0.803	1.408	0.718	1.554	0.634	1.712	0.552	1.881	0.474	2.059	0.400	2.244	0.331	2.434	0.268	2.625
22	0.997	1.174	0.915	1.284	0.832	1.407	0.748	1.543	0.666	1.691	0.587	1.849	0.510	2.015	0.437	2.188	0.368	2.367	0.304	2.548
23	1.017	1.186	0.938	1.290	0.858	1.407	0.777	1.535	0.699	1.674	0.620	1.821	0.545	1.977	0.473	2.140	0.404	2.308	0.340	2.479
24	1.037	1.199	0.959	1.298	0.881	1.407	0.805	1.527	0.728	1.659	0.652	1.797	0.578	1.944	0.507	2.097	0.439	2.255	0.375	2.417
25	1.055	1.210	0.981	1.305	0.906	1.408	0.832	1.521	0.756	1.645	0.682	1.776	0.610	1.915	0.540	2.059	0.473	2.209	0.409	2.362
26	1.072	1.222	1.000	1.311	0.928	1.410	0.855	1.517	0.782	1.635	0.711	1.759	0.640	1.889	0.572	2.026	0.505	2.168	0.441	2.313
27	1.088	1.232	1.019	1.318	0.948	1.413	0.878	1.514	0.808	1.625	0.738	1.743	0.669	1.867	0.602	1.997	0.536	2.131	0.473	2.269

28	1.104 1.244	1.036 1.325	0.969 1.414	0.901 1.512	0.832 1.618	0.764 1.729	0.696 1.847	0.630 1.970	0.566 2.098	0.504 2.229
29	1.119 1.254	1.053 1.332	0.988 1.418	0.921 1.511	0.855 1.611	0.788 1.718	0.723 1.830	0.658 1.947	0.595 2.068	0.533 2.193
30	1.134 1.264	1.070 1.339	1.006 1.421	0.941 1.510	0.877 1.606	0.812 1.707	0.748 1.814	0.684 1.925	0.622 2.041	0.562 2.160
31	1.147 1.274	1.085 1.345	1.022 1.425	0.960 1.509	0.897 1.601	0.834 1.698	0.772 1.800	0.710 1.906	0.649 2.017	0.589 2.131
32	1.160 1.283	1.100 1.351	1.039 1.428	0.978 1.509	0.917 1.597	0.856 1.690	0.794 1.788	0.734 1.889	0.674 1.995	0.615 2.104
33	1.171 1.291	1.114 1.358	1.055 1.432	0.995 1.510	0.935 1.594	0.876 1.683	0.816 1.776	0.757 1.874	0.698 1.975	0.641 2.080
34	1.184 1.298	1.128 1.364	1.070 1.436	1.012 1.511	0.954 1.591	0.896 1.677	0.837 1.766	0.779 1.860	0.722 1.957	0.665 2.057
35	1.195 1.307	1.141 1.370	1.085 1.439	1.028 1.512	0.971 1.589	0.914 1.671	0.857 1.757	0.800 1.847	0.744 1.940	0.689 2.037
36	1.205 1.315	1.153 1.376	1.098 1.442	1.043 1.513	0.987 1.587	0.932 1.666	0.877 1.749	0.821 1.836	0.766 1.925	0.711 2.018
37	1.217 1.322	1.164 1.383	1.112 1.446	1.058 1.514	1.004 1.585	0.950 1.662	0.895 1.742	0.841 1.825	0.787 1.911	0.733 2.001
38	1.227 1.330	1.176 1.388	1.124 1.449	1.072 1.515	1.019 1.584	0.966 1.658	0.913 1.735	0.860 1.816	0.807 1.899	0.754 1.985
39	1.237 1.337	1.187 1.392	1.137 1.452	1.085 1.517	1.033 1.583	0.982 1.655	0.930 1.729	0.878 1.807	0.826 1.887	0.774 1.970
40	1.246 1.344	1.197 1.398	1.149 1.456	1.098 1.518	1.047 1.583	0.997 1.652	0.946 1.724	0.895 1.799	0.844 1.876	0.749 1.956
45	1.288 1.376	1.245 1.424	1.201 1.474	1.156 1.528	1.111 1.583	1.065 1.643	1.019 1.704	0.974 1.768	0.927 1.834	0.881 1.902
50	1.324 1.403	1.285 1.445	1.245 1.491	1.206 1.537	1.164 1.587	1.123 1.639	1.081 1.692	1.039 1.748	0.997 1.805	0.955 1.864
55	1.356 1.428	1.320 1.466	1.284 1.505	1.246 1.548	1.209 1.592	1.172 1.638	1.134 1.685	1.095 1.734	1.057 1.785	1.018 1.837
60	1.382 1.449	1.351 1.484	1.317 1.520	1.283 1.559	1.248 1.598	1.214 1.639	1.179 1.682	1.144 1.726	1.108 1.771	1.072 1.817
65	1.407 1.467	1.377 1.500	1.346 1.534	1.314 1.568	1.283 1.604	1.251 1.642	1.218 1.680	1.186 1.720	1.153 1.761	1.120 1.802
70	1.429 1.485	1.400 1.514	1.372 1.546	1.343 1.577	1.313 1.611	1.283 1.645	1.253 1.680	1.223 1.716	1.192 1.754	1.162 1.792
75	1.448 1.501	1.422 1.529	1.395 1.557	1.368 1.586	1.340 1.617	1.313 1.649	1.284 1.682	1.256 1.714	1.227 1.748	1.199 1.783
80	1.465 1.514	1.440 1.541	1.416 1.568	1.390 1.595	1.364 1.624	1.338 1.653	1.312 1.683	1.285 1.714	1.259 1.745	1.232 1.777
85	1.481 1.529	1.458 1.553	1.434 1.577	1.411 1.603	1.386 1.630	1.362 1.657	1.337 1.685	1.312 1.714	1.287 1.743	1.262 1.773
90	1.496 1.541	1.474 1.563	1.452 1.587	1.429 1.611	1.406 1.636	1.383 1.661	1.360 1.687	1.336 1.714	1.312 1.741	1.288 1.769
95	1.510 1.552	1.489 1.573	1.468 1.596	1.446 1.618	1.425 1.641	1.403 1.666	1.381 1.690	1.358 1.715	1.336 1.741	1.313 1.767
100	1.522 1.562	1.502 1.582	1.482 1.604	1.461 1.625	1.441 1.647	1.421 1.670	1.400 1.693	1.378 1.717	1.357 1.741	1.335 1.765
150	1.611 1.637	1.598 1.651	1.584 1.665	1.571 1.679	1.557 1.693	1.543 1.708	1.530 1.722	1.515 1.737	1.501 1.752	1.486 1.767
200	1.664 1.684	1.653 1.693	1.643 1.704	1.633 1.715	1.623 1.725	1.613 1.735	1.603 1.746	1.592 1.757	1.582 1.768	1.571 1.779