RELATIONSHIP AND BEHAVIOUR OF LIQUIDITY AND PROFITABILITY IN COMMERCIAL BANKING INDUSTRY OF ETHIOPIA

A thesis submitted to the School of Graduate Studies of Addis Ababa University in partial fulfillment of the requirements for the Degree of Executive Masters of Business Administration

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June, 2016
Addis Ababa

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Declaration

I, the undersigned declare that this thesis is my original work. Furthermore, all sources of materials used for the thesis had been duly acknowledged.

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Certification

This is to certify that **Belay Nega Belayneh** has done a study on the topic "*Relationship and behavior of Liquidity and Profitability in the commercial banking industry of Ethiopia*". This study is of his original work and all the sources of materials used for the thesis had been duly acknowledged.

Advisor's Name: Dr. Yitbarek Takele

Signature: ___________________________

Date: _______________________________

Place: Addis Ababa University

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List of acronyms

ARDL	Autoregressive distributed lag
BCBS	Basel Committee on Banking Supervision
CBE	Commercial Bank of Ethiopia
CUMSUM	Cumulative sum of recursive residuals
CUMSUMQ	Cumulative sum of squares of recursive residuals
IMF	International Monetary Fund
NBE	National bank of Ethiopia
OLS	Ordinary least square

Abstract

Resilient and profitable banks can contribute immensely to the development of financial sector in particular and the country's development in general. The study employed autoregressive distributed lag (ARDL) to examine the relationship and behavior of liquidity and profitability of the commercial banking industry in Ethiopia. Quarterly consolidated financial statements of fifteen commercial banks that covers the period 2003Q2 – 2014Q3 is used for this study. Augmented Dickey Fuller (ADF) is used to test for unit root. In attempt to draw valid conclusion, diagnostic tests are carried out for serial correlation, heteroscedasticity, and normality. In order to check the stability of long-run coefficients that form the error-correction term in combination of short-run dynamics, cumulative sum of recursive residuals test (CUSUM) and the cumulative sum of squares of recursive residuals test(CUSUMQ) is applied to the residuals of the models. The estimation result of the error correction model shows that the speed of adjustment of liquidity and profitability to long run equilibrium is faster in the commercial banking industry of Ethiopia. The results of ARDL estimation shows that loan growth, bank size, credit risk, saving deposit growth, demand deposit growth, and fixed deposit growth are key determinants of liquidity both in the short and long term. While non-interest income and operating expenses management are the key determinants of profitability both in the short and long term. The result of pairwise Granger causality test shows that neither unidirectional nor bidirectional pattern of causality exists between liquidity and profitability.

Key words: *ARDL, Liquidity, Profitability, Granger causality, Error correction model, Commercial banking industry*

Chapter One: Introduction

This thesis empirically examines the impact of bank specific factors (capital adequacy, credit risk, management quality, profitability, loan growth, bank size, demand deposit growth, saving deposit growth and fixed deposit growth) on the liquidity as well as the impact of bank specific factors (capital adequacy, bank size, credit risk, non-interest income, liquidity, and operating expenses management) on the profitability of commercial banking industry in Ethiopia both in the short and long run. The causalities between liquidity and profitability are also analyzed. This chapter is organized in eight sections. Background information on the thesis and statement of the problem are dealt with in the first and second section. Objective of the study and Research questions and hypothesis are presented in the third and fourth sections respectively. Benefit of the study is described in the fifth section. Scope and limitations of the study are discussed in the sixth and seventh sections. The final section presents the organization of the thesis.

1.1 Background of the study

The role that banks play in the financial sector differs from country to country. Allen and Carletti (2008) assert that role of banks varies depending on the way the financial sector is structured. They report that there exists different structure of financial sector in Euro area, United Kingdom, United States of America, Japan, and non-Japan Asia. Accordingly, the financial system of Euro area is bank-based and the role of stock markets is insignificant. United Kingdom is an exception to the Euro area where both the stock market and bank loans are significant, but the bond market is small. Non-Japan Asia is analogous to the United Kingdom. United States of America is highly market based, i.e., the role of stock and bond markets is quiet significant, bank loans are small. In the case of Japan, bank loan, stock and bond markets are all significant. The financial sector of under developed economies according to Demirguc-Kunt and Levine (1999) is mainly bank-based and role of bond and stock market goes in parallel with the country's economic development.

According to bank of international settlements BIS (2011) banks are focal point for financial intermediation process between savers and investors. One of the basis for sustainable growth in economy is a sound banking system. In as much as sturdy banking system contributes to economic growth, bank failures have detrimental effect on the economy. The financial crisis that began in 2007 showed that the weakness of the banking system can be contagious to the economy that has the effect of shrinking liquidity and access to credit. Following the crisis the Basel committee of banking supervision has come up with reforms that are expected to strengthen the capital and liquidity rules in attempt to ensure the resilience of the banking system BCBS (2015). Qualitative analysis made by KPMG shows that the implementation of this rules are expected to put significant pressure on profitability of banks KPMG (2011).

In the case of Ethiopia, the financial sector is bank based. 78.9 percent of the assets are owned by three largest commercial banks IMF (2014). Commercial Bank of Ethiopia (CBE), a dominant player in the industry, is owned by the state. According to NBE (NBE Annual Report, 2013/14), CBE owns 67% of the assets and provides 58% of the loans and advances in the commercial banking industry as at August, 2015. The total capital of the banking industry reached Birr 26.4 billion as at end of June, 2014. The branch network share of state owned banks as at 2013/14 is 45.4%. The branch to population ratio as at 2013/2014 is 1:39,402. Of the total deposits made at banks, saving constitutes 49.8%, demand deposits 44% and time deposits 6.2%. Number of employees in the banking industry reached 49,531 as at June, 2014. The National Bank of Ethiopia issued a directive in order to introduce interbank money market in September, 1998. However, the total monetary value of the transactions made in the interbank money market since its inception is Birr 259.2 million. There is no transaction reported in the interbank money market since April, 2008.

International Monetary fund's country report IMF (2015) shows that the overall financial soundness indicators of Ethiopia's banking sector appears to be healthy. According to this report the capital adequacy of the banking industry as at March 2015 is 16.6% whereas the minimum requirement set by the NBE is 8%. The ratio of non-performing loans was 2.4%. But short-term liquidity problems are reported to have appeared at few banks in the course of the year 2015.

Ethiopia does not have stock market and the financial sector is highly dependent on the banking system. The fact that the country's financial sector relies on the bank system requires at most care in ensuring its resilience and sustainability. As a result, the NBE regulates, supervises issues different directives including but not limited to liquidity requirement (SBB/57/2014), capital requirement (SBB/50/2011) and asset classification and provisioning (SBB/43/2008) in attempt to ensure the soundness and resilience of banks.

1.2 Statement of the problem

Banks role in the society is liquidity creation and maturity transformation also called time intermediation. Banks create liquidity on balance sheet by way of taking deposits for relatively short time and providing same as loans to investors for longer period. Loans are illiquid assets for the banks as compared to deposits that are liquid liabilities in relative terms. Liquidity is also created by banks off balance sheet by issuing letter of guarantees. The process of transforming maturity is their main source of profit Diamond and Dybving (1983, 1986), (Diamond and Rajan, 2001), Kayshap, Rajan and Stein (2002), and Chatterjee (2015).

Banks must be liquid, profitable and safe to survive and thrive in the economy. Generally, banks are expected to maintain minimum levels of liquidity that keeps them safe and at the same time adequate profit should be generated for its shareholders. Higher levels of liquidity comes at cost as the opportunity cost of holding liquid assets is higher, i.e., the return that banks get on illiquid assets such as loans is higher than holding liquid assets. This shows that both the regulators and managers face trade off. This also implies profitability objective of banks should also be aligned with safeguarding the banks against liquidity risk (Acharya and Shin, 2009, Bonfim and Kim, 2012; and Opler, Pinkowitz, and Stluz, 1999).

However, in practice, right sizing liquidity-profitability relationship is still a real challenge in the financial world. The financial crises of 2008-09 revealed that a number of financial institutions including banks have failed due to lack of liquidity and/or poor liquidity management in situation where they were profitable Munteanu (2012).

If optimizing the liquidity-profitability relationship is key for banks to survive and thrive, and if experience from the recent financial crisis of 2008-09 reveals that profitable banks fail due to illiquidity, which may affect the financial and macroeconomic stability, then more must be known about determinants of both liquidity and profitability as well as their short run and long run causality and behavior.

The purpose of this study was to empirically examine the determinants of liquidity and profitability as well as understand the direction of causality between liquidity and profitability so that it could be used as input by policy makers and regulators in setting bank regulations. But coming up with optimum level liquid asset holding was not the purpose of this study.

1.3 Objective of the study

1.3.1 General objectives of the study

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

1.3.2 Specific objectives of the study

The specific objectives of this study are as follows:

1. To measure the extent to which liquidity is affected by bank specific determinants (capital adequacy, bank size, credit risk, loan growth, management quality, profitability, saving deposit growth, demand deposit growth, and fixed deposit growth) in the commercial banking industry of Ethiopia both in the short run and long run.
2. To measure the extent to which profitability is affected by bank specific determinants (capital adequacy, credit risk, liquidity, operating expenses management, non-interest income and bank size) in the commercial banking industry of Ethiopia both in the short run and long run.
3. To examine the causalities between liquidity and profitability in the commercial banking industry of Ethiopia.

1.4 Research questions and Hypothesis of the study

Research Questions:

The study attempted to provide empirical answer to the following research questions:

1) What are the bank specific determinants of liquidity in the commercial banking industry of Ethiopia?
2) What are the bank specific determinants of profitability in the commercial banking industry of Ethiopia?
3) What is the nexus between liquidity and profitability in the commercial banking industry of Ethiopia?

Research Hypothesis:

H_{a1}: There is a significant positive relationship between demand deposit growth and liquidity both in the short and long run in the commercial banking industry of Ethiopia.

H_{a2}: There is a significant positive relationship between saving deposit growth and liquidity both in the short and long run in Commercial Banking industry of Ethiopia.

H_{a3}: There is a significant positive relationship between fixed deposit growth and liquidity both in the short and long run commercial banking industry of Ethiopia.

H_{a4}: There is a significant negative relationship between loan growth and liquidity both in the short and long run in commercial banking industry of Ethiopia.

H_{a5}: There is a significant positive relationship between bank size and liquidity both in the short and long run in commercial banking industry of Ethiopia.

H_{a6}: There is a significant positive relationship between capital adequacy and liquidity both in the short and long run in commercial banking industry of Ethiopia.

H_{a7}: There is a significant negative relationship between credit risk and liquidity both in the short and long run in commercial banking industry of Ethiopia.

H_{a8}: There is a significant negative relationship between management quality (ratio of interest expenses to deposits) and liquidity both in the short and long run in commercial banking industry of Ethiopia.

H_{a9}: There is a significant positive relationship between profitability and liquidity both in the short and long run in commercial banking industry of Ethiopia.

H_{a10}: There is a significant positive relationship between capital adequacy and profitability both in the short and long run in commercial banking industry of Ethiopia.

H_{a11}: There is a significant positive relationship between bank size and profitability both in the short and long run of commercial banking industry in Ethiopia.

H_{a12}: There is a significant negative relationship between credit risk and profitability both in the short and long run in commercial banking industry of Ethiopia.

H_{a13}: There is a significant positive relationship between non-interest income and profitability both in the short and long run in commercial banking industry of Ethiopia.

H_{a14}: There is a significant positive relationship between liquidity and profitability both in the short and long run in the commercial banking industry in Ethiopia.

H_{a15}: There is a significant negative relationship between operating expenses management and profitability both in the short and long term in commercial banks of Ethiopia.

H_{a16}: Liquidity causes profitability in the commercial banking industry of Ethiopia and vice versa.

1.5 Benefits of the study

Both liquidity and profitability are critical for commercial banks to survive and thrive in the finance industry. The research is aimed at examining the relationship and behavior of liquidity and profitability in the commercial banking industry of Ethiopia. The beneficiaries of this study will primarily be commercial banks in Ethiopia. In addition, policy makers and regulators like NBE will also benefit from this study.

1.6 Scope of the study

The scope of this study is limited to bank specific determinants of liquidity and profitability. Industry specific and macroeconomic factors that may determine liquidity and profitability were out of the scope of this study. In terms of time, it covers the period starting from second quarter of 2003 up to third quarter of 2014 due to availability of data. Using quarterly data has advantages in terms of showing for intra-year dynamics and providing larger sample size IMF (2013).

Commercial banks operating in Ethiopia for less than five years were not included in this study due to limited observations for time series analysis. Thus, the data used in this study is consolidated financial statement of fifteen (15) banks out of the eighteen (18) commercial banks operating in Ethiopia. The excluded commercial banks are Debub Global Bank, Enat Bank and Addis International bank.

1.7 Limitations of the study

In this study, Industry specific and macroeconomic factors that may affect the relationship and behavior of liquidity and profitability of the commercial banking industry were not included. The analysis and conclusions were based on the secondary data sources, i.e. mainly on quarterly consolidated reports. Both the dependent and independent variables were proxied by numbers from this past data sources. The quarterly financial statements are not audited and the quality may not be as good as audited annual financial statements.

1.8 Organization of the thesis

The organization of the rest of the thesis is as follows. Chapter two reviews previous literature on liquidity and profitability behavior of banks. The third chapter reviews empirical studies on determinants of Liquidity and Profitability of Commercial Banks. This chapter also presents the conceptual and theoretical framework of the study. Chapter four presents research methodology and design. Chapter five presents data analysis and interpretation. Finally, conclusions, recommendations and direction for future research are presented in Chapter six.

Chapter Two: Theoretical Review of Literature

In this chapter reflections, synthesis and critics are made and arguments are built on the theoretical literature of bank liquidity and profitability. Basic theories of liquidity are also reviewed in this part.

2.1 Concepts and Definitions

2.1.1 Liquidity

Basel Committee of Banking Supervision BCBS (2000, P.1) defines liquidity as "*the ability of to fund increases in assets and meet obligations as they come due*." The significance of liquidity management to the macro economy in general and stability banks in particular appears to be well documented in theoretical literature. Among the notable literature in the field (Diamond and Dybvig, 1983) analyzed bank run and its impact on the monetary system, liquidity risk and deposit insurance; (Diamond and Rajan, 2001) describe how liquidity creation is the result of fragile capital structure of banks; Allen and Gale (2004) tried to show how asset price volatility and/or bank defaults can be instigated by shocks to liquidity requirements; and Bangia et al. (1999) tried to demonstrate that liquidity risk is part of the market risk and especially in emerging market excluding it can result in miscalculating the overall risk.

Cash on hand, deposits with National Bank and other local and foreign banks are sources of liquid assets. Liquidity management requires precaution due to the contribution of banks to the economy and the intrinsically fragile nature of the bank's business model (NBE Directive No. SBB/57/2014, and Diamond & Dybving, 1983).

Banks are expected to maintain the mandatory levels of liquidity requirement. In addition to this, cases of excess and insufficient levels liquidity should also be avoided. On the one hand, excess liquidity may affect profitability negatively and insufficient levels of liquidity has detrimental effect on business continuity on the other (Alshatti, 2015).

Basel Committee on Banking and supervision developed global standards for liquidity levels for the first time. Mandatory requirement that requires banks to maintain minimum liquidity levels was missing in majority of the countries including US before Basel III rules. In the case of Ethiopia NBE of Ethiopia requires all commercial banks to maintain liquid assets not less than fifteen percent (15%) of its net current liabilities (BIS (2011); NBE Directive No. SBB/57/2014, BIS 2011).

2.1.2 Types of Liquidity

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

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

2.1.3 Theories of Liquidity Management

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

I. Anticipated Income Theory

Anticipated income theory of liquidity management holds that the bank plans repayment of loans from anticipated income of the borrower. Collateral and expected income of the borrower are the basis for granting loan.

II. Shiftability Theory

Shiftability theory of liquidity management holds that banks can fulfill their liquidity requirement by supporting shifting of assets. This means liquidity can be fulfilled by selling of assets to banks with a better liquidity position. Reserves are minimized and investment in long term assets is encouraged under this approach. Individual banks the ability to sell or repurchase minimizes the possibility of liquidity crunch.

III. Liability Management Theory

The liability management theory of liquidity management holds that banks can fulfill their liquidity requirement, i.e., demand for loans and deposit withdrawal by way of borrowing from the money and capital market. In here, banks give much more emphasis to the liability side than the asset side of the balance sheet.

IV. Commercial Loan Theory

The commercial loan theory of liquidity management holds that bank's liquidity requirement can be fulfilled by way of providing short term loans that are self-liquidating in the course of continuous trade cycles that involve production and consumption. Accordingly, banks are expected to give working capital loans. But banks not loan for purchase of plants and equipment, houses, consumer goods, or for investing in stocks or bonds. The assumption that loans will get paid in the normal course of business is challenged as business face both face trough in as well.

2.1.4 Profitability

Athanasoglou, Delis & Stairkouras (2006) assert that the profitability performance of the banking system is off interest to its shareholders, regulators, and the finance sector as a whole. Profitability of banks plays part in ensuring the stability financial sector by enabling them to survive adverse situation.

The literature on bank profitability focuses both on the internal and external determinants. Financial statements, Balance Sheet and Income statement, are the source for analyzing internal determinants of bank profitability. It is usually termed as Bank Specific determinants of profitability. Internal determinants areas of influence for the bank's management. The external determinants of bank profitability, the industry specific and macroeconomic determinant, are out of the sphere of influence of the bank's management Athanasoglou, Delis & Stairkouras (2006) and Growe (2014). The focus of this study is on the bank specific determinants of profitability and it will be dealt with in the next chapter.

Chapter Three: Review of Empirical Studies and Conceptual Framework

In this chapter, gaps, anomalies, disagreements, and contradictions are identified in the methodologies and empirical findings. This chapter also discusses as to how the theoretical determinants and the variables chosen are linked in this study by way of defining the measures of the identified variables. The reason why the explanatory variables are chosen as well as the major empirical findings of foregoing studies is also discussed. Conceptual framework of the study is also presented in here.

After summarizing the foregoing studies, capital adequacy, profitability, credit risk, management quality, loan growth, bank size, demand deposit growth, saving deposit growth and fixed deposit growth were selected and included as bank specific explanatory variables of the consequent variable liquidity risk, in the study. Liquidity, credit risk, capital adequacy, non-interest income, bank size, and operating expenses management were selected and included as bank specific explanatory variables of the consequent variable profitability. Macroeconomic and industry specific variables that may determine liquidity and profitability of banks such as GDP growth, inflation rate, interest rate are excluded from the study due to time constraint.

3.1 Empirical Studies Review and Operationalization of Variables

Review of the major empirical findings of the previous studies is made in the section below. On top of this, key concepts and variables used in the conceptual framework are also operationalized.

Empirical studies have been made on the determinants of liquidity and profitability of commercial banks in Ethiopia Tseganesh, (2012); Daniel (2015), Nigist (2015), Berhanu (2015), Belete (2015) Birhanu (2012), Habtamu (2012), Amdemikeal (2015), Tesfaye (2014), Sori(2014), and Samuel (2015). The methodology and the type of data used in these studies has similarities and differences. Multiple regression was the methodology employed on the annual panel data in these studies. However, the variables used and findings of these studies are not all the same. These studies did not split the short and long term relationship between determinants of liquidity and profitability. The researcher didn’t come across a study made on determinants of commercial banks liquidity and profitability as well as attempt made to show the causality between liquidity and profitability using quarterly time series data so far. It also appears that the issue of what determines the liquidity and profitability of commercial banks in Ethiopia is yet to be settled.

3.1.1 Liquidity Risk

In order to measure liquidity risk of banks liquidity gap, i.e., the difference between assets and liabilities at any point in time and liquidity ratios is calculated from the balance sheet (Vodova, 2013). Review of academic literature shows that there are different ratios that are commonly used as indicators of bank liquidity (Roman and Sargu, 2014; Roman and Sargu, 2015, Munteanu, 2012; Vodova, 2013). These ratios include ratio of Liquid assets to demand deposit and Short term borrowing; ratio of liquid assets to total assets; ratio of loan to deposits and short term borrowing; and ratio of loans to total assets.

Ratio of Liquid assets to demand deposit and short term borrowing. This ratio shows how susceptible a bank is to different sources of funding. Fungáčová & Poghosyan (2009) used the ratio of liquid assets to demand deposit as a proxy for liquidity risk in their study of the determinants of bank interest margin in Russia. They argue that liquidity risk decreases as the liquid asset backing of demand liabilities increases. Marozva (2015) also employed the ratio of liquid assets to current liabilities as a proxy for market liquidity risk. Ratio of liquid assets to total assets. This ratio shows the bank's capacity to withstand liquidity shocks in a situation where market liquidity is the same for all the banks in the industry (Vodova, 2013).

Ratio of loan to deposits and short term borrowing. Jan Willem van den End (2013) asserts that a deposit base that is lower than loans creates funding gap. He also argues that economic growth and credit supply can suffer in a situation where significant number of banks operate with funding gap as negative shocks to market funding can create tension in the banking industry. Marozva (2015) also employed the ratio of Loan to deposit ratio as a proxy for funding liquidity risk. Ratio of loans to total assets. This ratio shows the proportion of bank assets held in illiquid loans.

Given the traditional deposit and loan based banking industry in Ethiopia, this study uses the ratio of liquid assets to Demand deposit and Short term borrowing as proxy to measure liquidity risk.

3.1.2 Profitability

Some of the studies made on profitability are country specific while others deal with group of countries. Country specific studies include US (Berger, 1995), UK (Kosmidou et al., 2008), Australia (Kosmidou et al., 2007), Malaysia (Guru et al., 1999), Brazil (Afanasieff et al., 2002), and Greece (Athanasoglou, Brissimis & Delis, 2005). Studies that focused on group of countries include (Molyneoux and Thorton, 1992, Kosmidou et al., 2007, Demirguc-Kunt and Huizinga, 1999, Athanasoglou, Brissimiss & Delis, 2005 and Petria et al. 2015). According to the conclusion made in these studies bank profitability is explained by internal factor to a significant extent though external factors as well affect profitability.

Composite indexes are also used to measure profitability of banks on top of profitability ratios Petria et al. (2015). The most commonly used proxies to measure profitability are return on assets (ROA) – the ratio of net profit to total assets and return on equity (ROE) – the ratio of net profits to equity.

Athanasoglou, Brissimis, & Delis (2005) argue that ROA shows the profit made from the bank's assets in relative terms and it also indicates the efficiency of the bank's management. The fact that ROA considers the risk associated with financial leverage makes it one of the important profitability measures. ROA could be influenced by the presence of off-balance-sheet assets as a drawback. Disregarding a risk that accompanies financial leverage is considered as one of the drawbacks of ROE. In the presence of off balance sheet business (Goddard et al., 2004, Berger and Bouman, 2009) suggest using ROE. Petria et al (2015) asserts that return on average assets (ROAA) and return on average equity (ROAE) increases the accuracy of the ratios than using year end results.

In this study ROA, the ratio of net income after tax to total assets is used as a proxy to measure profitability as it considers the risk associated with financial leverage and due to insignificance of off-balance sheet assets in commercial banking industry of Ethiopia.

3.1.3 Liquidity and profitability

Research has been undertaken on the relationship between liquidity and profitability and/or performance of banks. Some of the studies are country specific while others used data of different countries. Bourke (1989), using international data for the period 1972-81, found liquidity ratios are positively associated with profitability. Molyneux and Thornton (1992) in their research on determinants of profitability of European Banks found that profitability is negatively associated with profitability. Athanasoglou, Delis & Stairkouras (2006) study the profitability behavior of bank specific, industry related and macroeconomic determinates using an unbalanced panel data of South Eastern European credit institutions over the period 1998-2002. They report and empirical results showed that liquidity risk, measured by the ratio of loan to assets, has positive but insignificant relationship with the measures of profitability, i.e., Return on assets (ROA) – ratio of Net Profit before taxes to assets and Return on Equity (ROE) – Ratio of Net profits to Equity. Arif and Anees (2012) used deposits; cash reserves; liquidity gap; and high provisioning of nonperforming loans (NPLs) as proxy for liquidity and concluded that liquidity gap and NPLs has negative relationship with profitability whereas deposits and cash reserves has negative relationship. Tabari, Ahmadi & Emami (2013) examined effect of liquidity risk on profitability of Iranian commercial banks and found that among other variables liquidity risk impacted on profitability negatively. Lartey et al.(2013) analyzed the relationship between liquidity and profitability of listed banks in Ghana and found that there is a very week positive relationship.

Petria et al. (2015) assessed the key determinants of banks' in EU 27 member states for the period 2004 -2011 and find found that liquidity as one of the variables that has negative effect on proxies used to measure profitability, i.e., Return on average assets (ROAA) and Return on average equity (ROE). They measured liquidity risk as a ratio of loans to customer deposits. High loan to deposit ratio implies loans were given without growing the deposits which results in decline of bank's profit. Alshatti (2015) employed investment ratio, quick ratio, capital ratio, the ratio of net credit facilities to total assets as indicators of liquidity of Jordanian Commercial Banks and find found that increase in quick ratio and investment ratio has positive effect on profitability.

Bordeleau & Graham (2010) used a panel data of Canadian and American banks for the period 1997-2009 and find that found non-linear relationship exists between liquid asset holding and liquidity. Their findings further show that Holding liquid assets increases profitability up to a certain point, but holding further liquid assets results in decline in profitability. The proxies used for liquid assets are were cash and cash equivalents, deposit at financial institutions and government guaranteed security.

Kosmidou et al. (2008) used a panel data evidence to investigate the determinants of profit of domestic UK commercial banks for the period 1995 – 2005 and find found that relationship between liquidity and profitability is different for different profitability measures. In this case, liquidity is related negatively to Net Interest Margin and positively related to Return on Average Assets.

Review of the available literature shows that findings of different researchers contradict each other and are mixed. There is a difference in the research methodologies and variables used in the empirical studies. The proxies used to measure profitability and liquidity are also inconsistent. As a result, consensus is yet to be reached on what exactly is the relationship between liquidity and profitability.

3.1.4 Determinants of Liquidity

Empirical studies made on the determinants of liquidity focus on the bank specific and macro-economic factors that affect liquidity. But empirical research on this topic appears to be scant.

The major focus of the empirical research done so far is mainly on European and American banks. Previous studies used linear models in order to evaluate the impact of factors that influence liquidity (Munteanu, 2012, Vodova, 2012; Cucinelli, 2013, Roman & Sargu, 2014, and Roman & Sargu, 2015).

3.1.4.1 Capital Adequacy

There are two opposing hypothesis regarding the relationship between capital and liquidity. The "financial fragility - crowding out hypothesis". According to this hypothesis the bank capital has two different effects on liquidity. Firstly, greater bank capital ratio results in crowding out deposits and thus decreases liquidity creation. Secondly, according to the financial fragility hypothesis lower bank capital encourages liquidity creation. (Diamond and Rajan, 2000, 2001).

The other hypothesis on the relationship between bank capital and liquidity is "risk absorption" hypothesis. Allen and Gale (2004) assert that bank capital absorbs risk and enhances the risk bearing ability of the bank by creating liquidity. Hence, the impact of bank capital on liquidity is positive.

IMF and World Bank (2005), Bunda & Desquilbet (2008), Hovarth et al. (2012) use the ratio of total equity to total assets a proxy for capital adequacy. As in the case of Hovarth et al. (2012) this study uses the ratio of total equity to total assets as a measure for capital adequacy. The researcher expects that the adequate capital enables banks seize opportunity in a growing banking industry in Ethiopia. Thus, relationship between capital adequacy and liquidity is expected to be positive.

3.1.4.2 Credit risk

Credit risk shows the quality of the loans that banks give to their customers IMF and World Bank (2005). It also indicates the ability of the bank's borrowers to honor their contractual tis used to measure credit risk of banks is the ratio of impaired loans (non-performing loans) to total loans (gross loans) (IMF and World Bank, 2005, Munteanu, 2012, Roman & Sargu, 2015, and Alhassan et al.,2014). The lower the ratio of impaired loans to total loans the higher the quality of the assets.

Empirical studies on the impact of credit risk on liquidity shows mixed results. Credit risk is also called credit risk by some authors Kosmidou (2008). Roman and Sargu (2014) in their liquidity risk analysis of the new European member countries – Bulgaria and Romania report two different results for the two countries. Credit risk, as measured by the ratio of impaired loans to gross loans, is reported to be significantly positive and negative for Bulgaria and Romania respectively. Whereas Munteanu (2012) find that credit risk has significant negative impact on liquidity. This study uses the ratio of loan loss provisions to gross loans as a measure of credit risk as in (Roman & Sargu, 2015; Munteanu, 2012; Alhassan et al., 2014).

3.1.4.3 Management Quality

Management quality appears to be a variable that is difficult to measure. Review of previous literature in general reveals that different types of ratios have been used to measure management quality of banks. Ratio of interest expense to deposits and operating expenses to total assets are used as proxies to measure management quality empirically by Roman and Sargu (2013). In contrast, Avkiran and Cynthia (2012) use the ratio of non-interest expense to income as a proxy to measure management quality.

Empirical studies on the relationship between management quality and liquidity shows mixed result. A study made by Roman and Sargu (2015) to assess the impact of bank-specific factors on commercial banks in central European countries report different result for different countries. The relationship between management quality and liquidity is reported to be negative and significant for Czech Republic; positive and significant for Hungary; and positive and insignificant for Bulgaria. Munteanu (2012) also reported negative relationship between liquidity and management quality in an empirical research that identify the determinants of liquidity in Romania.

Empirical studies show that the ratio of interest expense to deposits is positively related to liquidity of Banks (Munteanu, 2012; Roman & Sargu, 2013; and Roman & Sargu, 2013). This study uses the ratio of interest expense to deposits as a measure for management quality. The researcher expects negative relationship between the ratios of interest expense to deposits. The relationship between liquidity is expected to be negative in this study owing to the fairly stable interest rate and growth in volume of deposits in the banking industry.

3.1.4.4 Profitability

Part of the profit that is not distributed to shareholders as dividend is usually retained in banks and this increases liquidity indirectly. As opposed to this, retained earnings will be negatively affected by loss made during the year. This has the impact of reducing the liquidity of the bank (Roman and Sargu, 2015).

Review of some of the empirical studies show that the impact of profitability on liquidity is not statistically significant and the results are also mixed at times depending up on the measures of profitability used (Roman and Sargu, 2015; Roman and Sargu, 2014; and Munteanu, 2012). Whereas, Daniel (2015) reports a negative and statistically significant relationship between liquidity and profitability in the study made to identify the determinants of liquidity of commercial banks in Ethiopia using panel data over the period 2000 to 2012. Vodova (2013) tries to identify determinants of liquidity of commercial banks in the Czech and Slovak over the period 2001 to 2010 using regression analysis and reports that effect of bank profitability on liquidity is negative. Kosmidou et al. (2008) use a panel evidence to investigate the determinants of profit of domestic UK commercial banks for the period 1995 – 2005 find that relationship between liquidity and profitability is different for different profitability measures. In this case, liquidity was related negatively to Net Interest Margin and positively related to return on average Assets.

In this study ROA, the ratio of net income after tax to total assets is used as a proxy to measure profitability as it considers the risk associated with financial leverage and due to insignificance of off-balance sheet assets in commercial banking industry of Ethiopia. In this study, positive relationship is expected between liquidity and profitability as increase in liquidity will boost the availability of loanable funds in a growing banking industry in particular and growing economy in general.

3.1.4.5 Loan growth

Empirical findings show that loan growth affect the liquidity of banks negatively Aspachs et al. (2005). This implies that liquidity position of banks could be affected negatively unless the growth of loans is matched with increase in new funds. Kohler (2012) asserts that high rates of loan growth should be under scrutiny of management and supervisors as it may indicate high risk taking.

Year on year growth of loan is used as a proxy to measure loan growth Aspachs et al. (2005), and Loutskina (2011). This study also uses the quarterly growth rate of loan as a proxy for loan growth. Loan growth is expected to have negative impact on liquidity in this study.

3.1.4.6 Demand, saving and fixed deposit growth

Review of unpublished documents of NBE shows that the traditional banking approach of taking deposits and making loans plays instrumental role in the commercial banking industry of Ethiopia. The common types of deposits in the commercial banks of Ethiopia are demand deposits, saving deposits and fixed time deposits. The latter two are interest bearing. The amount of deposit mobilized by the banking sector has increased tremendously over the period 2003- 2014. Interest revenue still takes the lion’s share of the share of the total revenue generated by the banks.

Deposit appear to be cheap source of funds for commercial banks in Ethiopia for two reasons. Firstly, interest is not paid on demand deposits and interest rate paid for savings has consistently been lower than the inflation rate over the period 2003-2014. Hence, the real saving rate is negative in Ethiopia. Negative real interest rates distorts financial intermediation IMF (2014). Bizarre at it may sound the magnitude of saving deposits is growing consistently in Ethiopia (NBE Annual report, 2013/14). The interbank money market is expensive relative to deposits and it is also far from active. The average interest rate recorded for the transactions in interbank money market is in the range of 7%-11%. This is higher than interest paid on saving deposits (NBE Annual report, 2013/14).

According to Kayshap et al. (2002) synergy exists between deposit taking and making loans as far as deposit withdrawals and loan disbursements are not perfectly correlated as the opportunity cost of holding liquid assets is shared among the two activities.

Deposits (demand, saving, and fixed time) are important source of funding for commercial banks in Ethiopia. Repurchase agreement (repos), deposit sharing arrangements and funding from financial markets are non-existent.

According to Comptroller's handbook (2012) growth in deposits supports banks to grow their assets and withstand liquidity shocks that could be faced. With this background, demand deposit growth, saving deposit growth and fixed deposit growth are used as proxies to measure impact of deposit growth on liquidity.

3.1.4.7 Bank size

Review of the empirical literature on the impact of bank size on liquidity appears to be mixed. Kashyap et al. (2002) reported that the effect of bank size on liquidity is strong and significant after analyzing a panel of U.S. banks. On the other hand, Aspachs et al. (2005) in their analysis of UK banks liquidity policy find that the impact of banks size on liquidity is insignificant.

In the case of Ethiopia as well the result of empirical studies are mixed. Brehanu (2015) and Nigist (2015) report positive and statistically significant relationship between bank size and liquidity whereas, Belete (2015) reports that the impact of bank size on profitability is insignificant.

Bank size is proxied by the natural logarithm of total bank assets (Delechat et al., 2014; and Curak et al., 2011). This study uses the natural logarithm of total bank assets as a measure for bank size. Positive relationship between size and profitability is expected in this study. IMF (2014) report that other Sub Saharan African countries are much better than Ethiopia in terms of all measures of financial access in general and financial access in particular. This study expects positive relationship between bank size and liquidity as branches give opportunity to mobilize deposits.

3.1.5 Determinants of Profitability

A number of studies use linear models in order to study the impact of factors that influence profitability of banks. The variables used in the study include bank specific, industry specific and macro-economic factors. But it appears that inconsistency exists in selection of the variables across the different empirical studies (Bourke, 1989; Molyneux & Thornton, 1992, Demirguc-Kunt& Huizinga, 2000; Goddard et al., 2004, Flamini et al., 2009; and Kosmidou et al., 2008).

3.1.5.1 Capital Adequacy (Solvency) Risk

Molyneux (1993) and Kosmidou et al. (2008) argue that decisive protection against risk of insolvency is provided by the strength bank's capital. In circumstances where the bank faces severe problem with credit risk, bad loans will be written off against shareholder's equity. Higher ratio of equity to total assets (lower leverage ratio) implies lower external funding requirement, decreases the likelihood that the bank will fail to pay back its debt, and reduces cost of capital and results in higher profitability. Nonetheless, it appears that empirical research findings on the relationship between capital adequacy and profitability is unsettled.

As mentioned earlier, bank's capital adequacy is commonly measured by the ratio of total equity to total assets. Higher ratio of equity to assets is considered as favorable in terms of reducing the need for external funding as well as financial distress and that eventually results in lower cost of capital and increase in profitability. At times of negative shocks, bankruptcy costs are also expected to be low as a result of the shield that higher ratio of equity to assets gives. Conversely, higher ratio of equity to assets also implies reduction in risk and leverage levels. Hence, some empirical results and theoretical expectations for the relationship between ratio equity to assets and profitability is positive (Athanasoglou, Brismiss & Delis, 2005, Athanasoglou, Delis & Stairkouras, 2006; Ameur and Mhiri, 2013; Molyneux & Thornton,1992; Kosmidou, 2007, Perera et al., 2013; Flamini et al. 2009, Ayaydin and Karakaya, 2014; Bourke,1989, Demirguc-Kunt and Huizinga,1999; Kosmidou et al., 2007).

Some authors argue that increase in risk level and decrease in equity should be accompanied by higher profits for shareholders. Thus, the relationship between capital adequacy and profitability is reported to be negative in studies of (Chronopoulos et al., 2012, Ali et al., 2011 and Goddard et al., 2004).

There are also studies that reported no significant relationship between capital adequacy and profitability. These includes Tesfaye (2014); Alper & Anbar (2011); Heffernan and Fu (2008), and Sufian & Noor (2012).

This study uses the ratio of equity to total assets in order to measure capital adequacy. This is also consistent with NBE's Directive No. SBB/9/1995 on capital adequacy. In this study, the relationship between the ratio of assets to equity and profitability of commercial banks in Ethiopia is expected to be positive.

3.1.5.2 Bank Size

Different studies made on the determinants of bank profitability identify bank size as one of the internal factors that impacts on profitability to account for economies or diseconomies of scale. Market power, technological efficiency and lower cost of funding are among the advantages that size can bring along supposedly. But the evidence on whether or not large banks take advantage by virtue of their big size relative to small banks is not conclusive (Curak 2011, Growe et al. 2014 and Kosmidou et al. 2008). On top of this, Anthanasoglou, Delis, & Stairkouras (2006) and Growe et al. (2014) argue that increase in bank size can be positive up to a certain point after which further increase in size starts to affect profitability negatively as a result of bureaucracy and other rigidities.

Findings of the studies made on bank size-profitability relationship are mixed (positive, negative and no relationship). Among the authors that come up Positive size-profitability relationship include (Athanasoglou, Delis, & Stairkouras, 2006; Sufian & Noor, 2012; Alper and Anbar, 20011; and Karimzadeh et al., 2013. Researchers that report negative size-profitability relationship include Perera et al., 2013; Kosmidou et al. (2007); Ameur & Mhiri, 2013). Researchers that report negative size-profitability relationship include (Goddard et al., 2004, Heffernan and Fu, 2008).

In many empirical studies, Bank size is proxied by the natural logarithm of total bank assets (Petria et al., 2015; and Curak et al. 2011 & Athanasoglou, Delis, & Stairkouras, 2006). This study uses the natural logarithm of total bank assets as a measure for bank size. Positive relationship between size and profitability is expected in this study.

3.1.5.3 Credit Risk

Credit risk is identified as one of the variables that impacts upon bank profitability. It shows the probability that the bank loses as a result of failure of the debtors to honor their obligations. Review of academic literature shows that the credit risk-profitability relationship is negative (Petria et al, 2015, Ćurak et al., 2011, Anthanasoglou, Delis and Stairkouras, 2006; Miller and Noulas, 1997). The ratio of loan loss reserves to gross or net loans granted by banks is used as a proxy to measure credit risk. Ratios like loans to assets, loans to deposit and provision to assets are reported to have produced poor results (Petria et al. 2015; Anthanasoglou, Delis and Stairkouras, 2006).

National bank of Ethiopia's directive SBB/43/2008 sets specific criterion for classification of loans and advances based their pre-established repayment programs for the purpose of setting provision percentage. The provision percentage ranges from 1% to 100% of the total outstanding loans principal balance depending on the classification of the loan. The amount of such provisions made by the commercial banks is examined by NBE.

This study uses the ratio of loan loss reserves to gross loans granted by the banks as a measure of credit risk. A ratio of loan loss reserves to gross loans that is high could be an indication of a credit risk that is on the high side due to unpaid loans. In the end this has the impact of decreasing the bank's profitability. Due to this, the expected relationship between credit risk and profitability in this study is negative.

3.1.5.4 Liquidity

The liquidity-profitability relationship appears to be mixed. Bourke (1989), Kosmidou et al. (2007) and Shen et al. (2009), and Athanasoglou, Delis & Stairkouras (2006) report positive relationship between liquidity and profitability contrary to the idea that holding liquid asset earns lower return. On the contrary, other research findings report negative relationship between liquidity and profitability that appears to be consistent with idea that holding liquid asset earns lower return (Molyneux and Thornton, 1992; Goddard et al, 2004; and Lee & Hseih, 2013)

A ratio of liquid assets to total assets is considered by some authors as better proxy for liquidity as compared to the ratio of loan to deposits. The latter only shows the nature of other liabilities Athanasoglou, Delis & Stairkouras (2006).

Acharya and Shin (2009) and Bonfim and Kim (2014) assert that return on illiquid assets (loans) is higher than liquid assets as a result the opportunity cost of holding liquid assets is higher in relative terms. On the other hand, Bordeleau and Graham (2010) argue that holding some liquid assets increases profitability up to a certain point after which keeping additional liquid assets results in decline in profitability, ceterus paribus.

As in the case of Fungacova & Poghosyan (2009) and Marova (2015) the ratio of liquid asset to demand deposit short-term borrowing is used to measure liquidity in this study. The volume of loanable funds is increased by increasing liquidity of the banks. As a result positive relationship is expected between liquidity and profitability.

3.1.5.5 Operating expenses management

Operating expenses include cost incurred in running the banks operation such as depreciation, legal fees, implementation of new technology, and restructuring costs of non-recurrent nature. Operating expenses exclude provisions made for losses on loans. Lower ratio of operating expenses to income show competency of management in managing costs. (Anthanasoglou et al., 2006; Kosmidou et al., 2008).

The idea that decrease in operating expenses will increase profitability and vice versa appears to be dominant in academic literature. (Bourke, 1989; Kosmidou et al. 2008; Petria et al. 2015). As opposed to this, Molyneux and Thornton (1992) report positive relationship. The argument they put forward is that part of the profit that should have been reported by the firm is paid to more productive human capital.

As in the case of Athanasoglou, Brissimis & Delis (2008), the ratio of operating expenses to total assets is used in this study. As excellence in management of operating expenses improves the profitability of bank this study expects negative relationship between the ratio operating expenses to total assets and profitability.

3.1.5.6 Non-Interest Income

Non-interest income includes service fees, gain on foreign exchange, rental income, dividend income, letter of credit opening fees and other sundry income. Some studies show that profitability of banks is affected positively and significantly by non-interest income (Tesfaye, 2014; Sufian 2011; and Alper and Anbar 2011). In other studies the impact of non-interest income on profitability is negative (Chronopoulos et al., 2012, Raza et al., 2013 and Tan Flores, 2012). This shows that the results of the study report mixed relationship between non-interest income and profitability.

The ratio of non-interest income to operating income (Alper and Anbar, 2011) or non-interest income to total assets (Sufian 2011) is used as a proxy to measure non-interest income. As in the previous study of Tesfaye (2014), this study uses the ratio of non-interest income to operating income as a proxy for non-interest income. In this study the relationship between non-interest income and profitability is expected to be positive.

3.1.5.7 National bank of Ethiopia bills (NBE bills)

Directive no. MFA/NBEBILLS/001/2011 requires private commercial banks to purchase government bonds. According to this directive private banks shall buy bonds that is equal to 27 percent of loans disbursements. The maturity period of the bond is five (5) years and the interest rate 3 percent. This interest rate is lower than the deposit rates. The purpose of introducing the NBE bills is to raise finance for projects and fund development bank of Ethiopia. International monetary fund country report (IMF, 2014) asserts that in a situation where NBE requires minimum reserve and liquidity requirements and short term loans shall at least be 40% of the total outstanding loans and advances excluding NBE bills, financial intermediation process suffers. IMF is of the opinion that NBE should not be purchased by private banks going forward.

In a study made on the impact of NBE's regulation on the performance on the performance of private banks in Ethiopia, Eden (2014), purchase of NBE bills has negative and statistically significant impact on net interest margin.

The limited data (15 quarterly observations) that the researcher got on purchase of NBE bills by private banks didn't lend itself to be one of the explanatory variables in time series analysis.

Table 3.1: Definitions and expected effect of explanatory variables of model A on Bank Liquidity

	Variable	Measure/Description	Expected relationship (+/-)
Dependent variable	Liquidity	Liquid assets / Demand deposit and Short term borrowing	
Determinants of liquidity	Capital Adequacy	Total Equity / Total Assets	+
	Credit risk	Loan loss provisions / Gross loans	-
	Management Quality	Interest expense / Deposits	-
	Loan growth	Annual growth rate of gross loans	-
	Bank size	Natural logarithm of Total Assets	+
	Saving deposit growth	Annual growth rate of saving deposits	+
	Demand deposit growth	Annual growth rate of demand deposits	+
	Fixed deposit growth	Annual growth rate of fixed deposits	+
	Profitability	Return on assets = Operating income after tax / Total Assets	+

Table 3.2: Definitions and expected effect of explanatory variables of model B on Bank Profitability

	Variable	Measure / Description	Expected effect
Dependent variable	Profitability	Operating income after taxe /Total assets	
Determinants of profitability	Capital adequacy	Total equity / total assets	+
	Bank size	Natural logarithm of Total Assets	+
	Credit risk	Loan lossprovisions / Gross loans	-
	Liquidity	Liquid assets / Demand deposit and Short term borrowing	+
	Operating expense management	Operating expense / Total Assets	-
	Non-interest income	Non-interest income / Operating Inc	+

3.2 Conceptual framework

The conceptual model below is developed based on previous research undertaken in order to show the relationship between liquidity and its determinants and profitability its determinants.

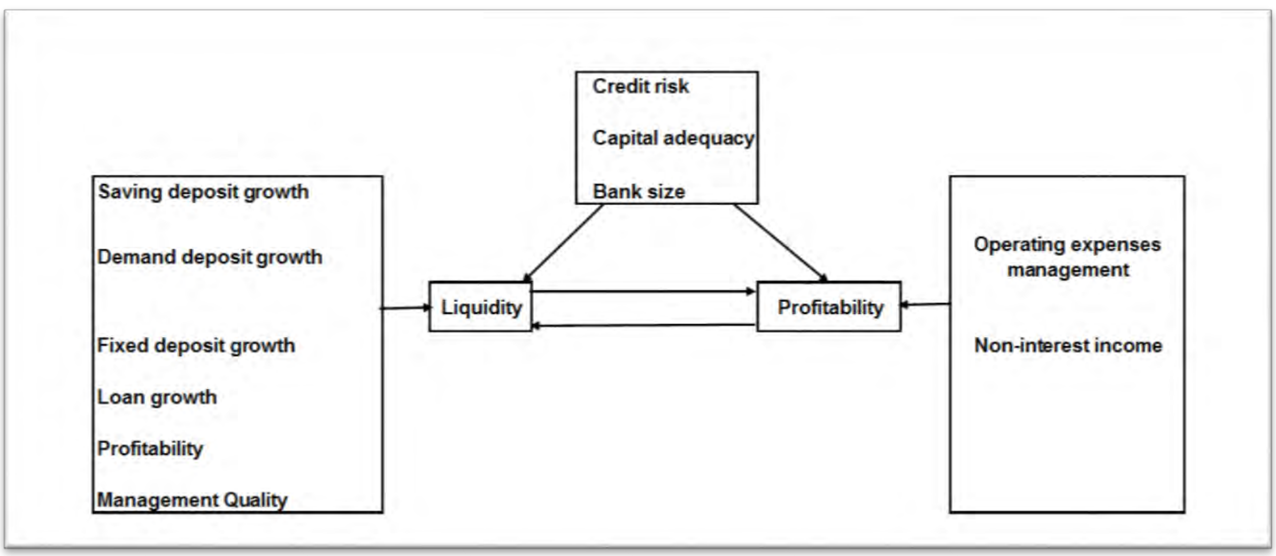

Figure 3.1 Conceptual framework

Chapter Four: Research Methodology and Design

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

4.1 Research design and approach

The main objective of this study was to empirically examine bank specific determinants of liquidity and profitability both in the short run and long run and as well as understanding the causalities between liquidity and profitability in the commercial banking industry of Ethiopia. The research method employed in this study is explanatory. Zikmund (2009) asserts explanatory studies look for explanations of the nature of certain relationships and helps to test hypothesis in order to provide an understanding of the relationship that exist between variables and draw inferences about the association and causality among variables. According to Cooper and Schindler (2001) reasons for phenomenon are explained in explanatory studies. Explanatory studies are not limited to observing and describing the condition as in the case of descriptive studies.

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

4.2 Data type and data source

This study uses secondary data that are quarterly consolidated financial statements for the banking industry. The data was obtained from National Bank of Ethiopia (NBE) for the period second quarter of 2003 to third quarter of 2014. The stated time period is selected due to the availability of data.

4.3 Data analysis techniques

As mentioned earlier, this study uses autoregressive distributed lag (ARDL) approach in order to examine the relationship and behavior of liquidity and profitability in the commercial banking industry of Ethiopia. The statistical software used for the analysis is Eviews9.

4.4 Autoregressive distributed lag modelling approach

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

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

4.5 Unit root test

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

4.6 Cointegration Test

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

4.7 Granger causality test

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

4.8 Model Specification

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

Model A: Liquidity and independent variables

LQ_{it} = f (CA, CR, MQ, ROA, BS, LG, SDG, DDG, FDG) ……………………………… **4.1**

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

$LQ = \alpha_o + \alpha_1 (CA) + \alpha_2 (CR) + \alpha_3 (MQ) + \alpha_4 (ROA) + \alpha_5 (LG) + \alpha_6 (SDG) + \alpha_7 (DDG) + \alpha_8 (FDG) + \alpha_8 (BS) + \varepsilon$ ………**4.2**

Where,

LQ = Ratio of liquid assets to demand deposits and short term borrowing

CA = Capital adequacy

CR = Credit Risk

ROA = Return on assets

LG = Loan growth

SDG = saving deposit growth

DDG = Demand deposit growth

FDG = Fixed deposit growth

MQ = Management quality

BS = Bank size

ε = Error term

α_{1}, α_{2}, α_{3}, α_{4}, α_{5}, α_{6}, α_{7}, α_{8} and α_{9} = Slope coefficients

Model B: Profitability and independent variables

ROA_{it} = f (CA, BS, CR, LQ, OPEM, NI) ………………………… …4.3

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

ROA = α_{o} + α_{1} (CA) + α_{2} (BS) + α_{3} (CR) + α_{4} (LQ) + α_{4} (OPEM) + α_{4} (NI) + ε …….4.4

Where,

ROA = Profitability measured by return on asset

CA = Capital adequacy

BS = Bank size

CR= Credit risk

LQ = Liquidity

OPEM = Operating expenses management

NI = Non-Interest Income

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

Chapter Five: Data analysis and interpretation

The result of data analysis is presented in this chapter. The chapter is organized in eight sections. Section 5.1 presents the result of unit root test; section 5.2 presents optimal lag selection; model stability and diagnostic tests are presented in section 5.3; results of ARDL bounds test for models A and B are presented in section 5.4; results of ARDL estimation results for models A and B are presented in Sections 5.5 and 5.6 respectively; section 5.7 presents Granger causality test result. The last section discusses the result of ARDL estimation and Granger causality test in detail against each of the hypothesis of the study.

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5. 1 Unit root test

The ARDL model allows us to proceed with estimation regardless of whether the underlying variables are I (0) or I (1). In order to check the stationarity of the variables augmented dickey fuller test (ADF test) is applied. But none of the variables shall be of integration order of I (2) to be able to proceed with ARDL estimation Pesaran et al. (2001).

The results of unit root test for liquidity (LQ), saving deposit growth (SDG), loan growth (LG), demand deposit growth(DDG), fixed deposit growth (FDG), capital adequacy CA), credit risk (AQ), management quality (MQ), and return on assets (ROA) are reported in Table 5.1. The result of the unit root test for these variables shows that none of the variables of integration of order I (2). With this test result we can proceed to ARDL bounds test.

Table 5.1: Model A - Unit root test at level and first difference

	Constant		Constant and Trend		No Contant, No Trend		
Variable	ADF Test statistic	Critical Value at 5% level of significance	ADF Test statistic	Critical Value at 5% level of significance	ADF Test statistic	Critical Value at 5% level of significance	Order of integration
LQ	-2.22384	2.928142	-2.067404	-3.513075	0.029452	-1.948313	At level
SDG	-1.67844	-2.935001	-2.304979	-4.198503	0.895951	-1.949097	At level
LG	-3.37186	-2.936942	-3.557646	-3.526609	-0.349867	-1.949856	At level
DDG	0.31266	-2.935001	0.927896	-3.523623	-0.950002	-1.949097	At level
FDG	-5.42081	-2.929734	-5.589787	-3.515523	0.165573	-1.949609	At level
CA	-2.18699	-2.928142	-2.291786	-3.513075	0.310141	-1.948495	At level
AQ	-4.43186	-2.928142	-0.797468	-3.513075	-7.130926	-1.948313	At level
MQ	-0.33511	-2.9355001	-2.204788	-3.523623	1.398117	-1.949097	At level
ROA	-2.27192	-2.941145	-2.417924	-3.523623	1.270897	-1.949097	At level

	Constant		Constant and Trend		No Contant, No Trend		
Variable	ADF Test statistic	Critical Value at 5% level of significance	ADF Test statistic	Critical Value at 5% level of significance	ADF Test statistic	Critical Value at 5% level of significance	Order of integration
LQ	-4.26972	-2.929734	-4.165817	-3.515523	-4.345483	-1.948495	I (I)
SDG	-8.49628	-2.935001	-8.392247	-3.523623	-8.467092	-1.949097	I (I)
LG	-4.74072	-2.941145	-4.727929	-3.533083	-4.803937	-1.949856	I (I)
DDG	-6.83699	-2.935001	-7.040527	-4.198503	-6.863098	-1.949097	I (I)
FDG	-5.18717	-2.938987	-5.10651	-3.529758	-5.252606	-1.949609	I (I)
CA	-8.98346	-2.929734	-8.999621	-3.515523	-9.009417	-1.948495	I (I)
AQ	-4.88649	-2.929734	-8.201565	-3.515523	-3.584094	-1.948495	I (I)
MQ	-3.73120	-2.935001	-3.75948	-3.523623	-3.394683	-1.949097	I (I)
ROA	-4.34360	-2.935001	-5.484671	-3.533083	-3.859438	-1.949097	I (I)

Source: Author’s computation of Eviews 9 results

The results of unit root test for liquidity (LQ), bank size (BS), non-interest income (NI), operating expenses management (OPEM), credit risk (CR), capital adequacy (CA), and (ROA) are reported in Table 5.2. The result of the unit root test shows that none of the variables are of integration of order I (2). With this test result one can proceed to ARDL co-integration test.

Table 5.2: Model B - Unit root test at level and first difference

	Constant		Constant and Trend		No Contant, No Trend		
Variable	**ADF Test statistic**	**Critical Value at 5% level of significance**	**ADF Test statistic**	**Critical Value at 5% level of significance**	**ADF Test statistic**	**Critical Value at 5% level of significance**	**Order of integration**
LQ	-2.223842	2.928142	-2.067404	-3.513075	0.029452	-1.948313	At level
BS	0.395645	-2.928142	2.279307	-3.513075	5.745148	-1.948313	At level
NI	-3.132345	-2.928142	-3.407884	-3.513075	-0.642629	-1.948313	**At level**
OPEM	-1.718461	-2.935001	-4.13235	-3.526609	-0.013084	-1.949097	**At level**
CR	-1.861239	-2.928142	-2.950159	-3.513075	0.512382	-1.948313	At level
CA	-2.187026	-2.928142	-2.291845	-3.513075	0.31029	-1.948495	At level
ROA	-2.271921	-2.941145	-2.417924	-3.523623	1.270897	-1.949097	At level

	Constant		Constant and Trend		No Contant, No Trend		
Variable	**ADF Test statistic**	**Critical Value at 5% level of significance**	**ADF Test statistic**	**Critical Value at 5% level of significance**	**ADF Test statistic**	**Critical Value at 5% level of significance**	**Order of integration**
LQ	-4.269721	-2.929734	-4.165817	-3.515523	-4.345483	-1.948495	I (I)
BS	-7.543332	-2.929734	-7.522456	-3.515523	-4.561881	-1.948495	I (I)
NI	-10.09998	-2.929734	-9.98079	-3.515523	-10.21462	-1.948495	I (I)
OPEM	-3.584408	-2.935001	-3.57388	-3.523623	-3.599443	-1.949097	I (I)
CR	-6.756538	-2.929734	-6.674575	-3.515523	-6.743241	-1.948495	I (I)
CA	-8.98463	-2.929734	-9.000818	-3.515523	-9.010571	-1.948495	I (I)
ROA	-4.343597	-2.935001	-5.484671	-3.533083	-3.859438	-1.949097	I (I)

Source: Author's computation of Eviews 9 results

The result of the unit root test in table 5.2 shows that none of the variables of integrated of order I (2). With this test result one can proceed to ARDL co-integration test.

5.2 Optimal lag selection

Optimal lag length is calculated using different criterion. This includes final prediction error (FPE), Akaike information criteria (AIC), Schwartz information criteria (SIC), and Hannan-Quinn information criteria (HQIC) Fabozzi (2014).

In the empirical study that examined the saving and investment nexus for china using co-integration test, Narayan (2005, P. 1984), asserts that the Schwarz Bayesian Criteria (SBC), using a maximum of 2 lags delivers robust results for small samples. A sample of 46 observations is considered as small sample for time series data. As a result, the optimal lag used for estimation of ARDL model in this study is two.

5. 3 Model stability and diagnostic tests

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

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

5.3.1 Test for residual autocorrelation

According to Fabozzi et al (2014) one of the assumed properties of error term is that no statistically significant correlation between adjacent residuals exists. It is also assumed that the independent variables are not correlated with the residuals. In the context of time series two adjacent time periods should not have significant correlation. The incidence of auto correlation in time series makes hypothesis testing of regression coefficients questionable by way of significantly miscalculating variances.

Breusch-Godfrey Serial Correlation LM Test for models A and B is reported in Table 5.3 and Table 5.4. The null hypothesis in this test is that there is no auto correlation. The test result at 5% level of significance reveals strong evidence that the null hypothesis cannot rejected in both models A and B. Thus, there is no autocorrelation problem in both the models.

Table 5.3: Model A - Breusch-Godfrey serial correlation LM test result

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.461092	Prob. F(2,22)	0.6366
Obs*R-squared	1.729935	Prob. Chi-Square(2)	0.4211

Source: Author's computation of Eviews 9 results

Table 5.4: Model B - Breusch-Godfrey serial correlation LM test result II

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.203576	Prob. F(1,30)	0.6551
Obs*R-squared	0.296566	Prob. Chi-Square(1)	0.5860

Source: Author's computation of Eviews 9 results

5.3.2 Test for residual heteroscedasticity

According to Fabozzi et al. (2014) another assumption about error term is that notwithstanding the level of the independent variable, the variance of the error term is constant or the same. Homoscedasticity is a situation where the stated assumption is complied with. Heteroscedasticity is a case where this assumption about the error term is violated. The null hypothesis in ARCH test is that the variance of the error are constant or homoscedastic, the alternative hypothesis being the variance of the error term is heteroscedastic.

Heteroscedasticity test for two models of this study reported in Table 5.5 and Table 5.6. The result at 5% level of significance shows that the null hypothesis cannot be rejected for all the models. Hence, the variance of the error in models A and B is homoscedastic.

Table 5.5: Model A - Heteroscedasticity test

Heteroskedasticity Test: ARCH

F-statistic	0.573666	Prob. F(1,40)	0.4532
Obs*R-squared	0.593833	Prob. Chi-Square(1)	0.4409

Source: Author's computation of Eviews 9 results

Table 5.6: Model B: Heteroscedasticity test

Heteroskedasticity Test: ARCH

F-statistic	0.084297	Prob. F(1,41)	0.7730
Obs*R-squared	0.088228	Prob. Chi-Square(1)	0.7664

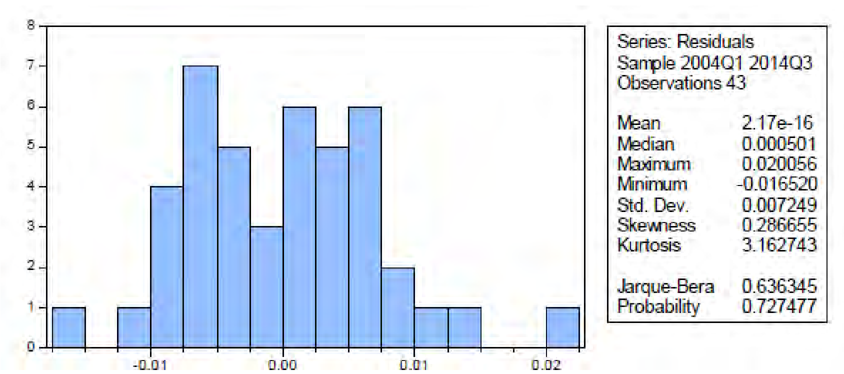
Source: Author's computation of Eviews 9 results

5.3.3 Normality Test

Jarque-Bera test statistic, chi-square test statistics and analysis of standardized residuals are the methodologies employed to test for normality of error terms. The null hypothesis in normality test is that the error terms are normally distributed. This study uses Jarque-Bera test statistic that is widely used in computer software packages Fabozzi et al. (2014).

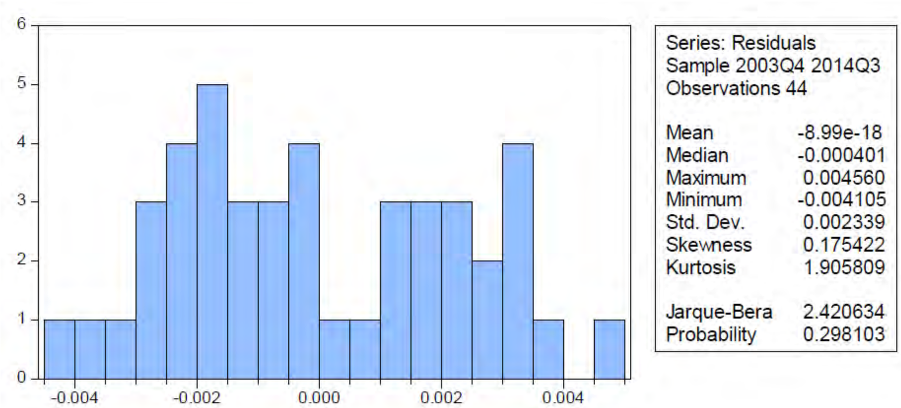
The normality test for models A and B is presented in table 5.7 and table 5.8 below. The result shows that the error terms are normally distributed for the two models as the null hypothesis cannot be reject due the probability value that is greater than 5%.

Figure 5.1: Model A - Normality Test



Source: Author's computation of Eviews 9 results

Figure 5.2: Model B - Normality Test

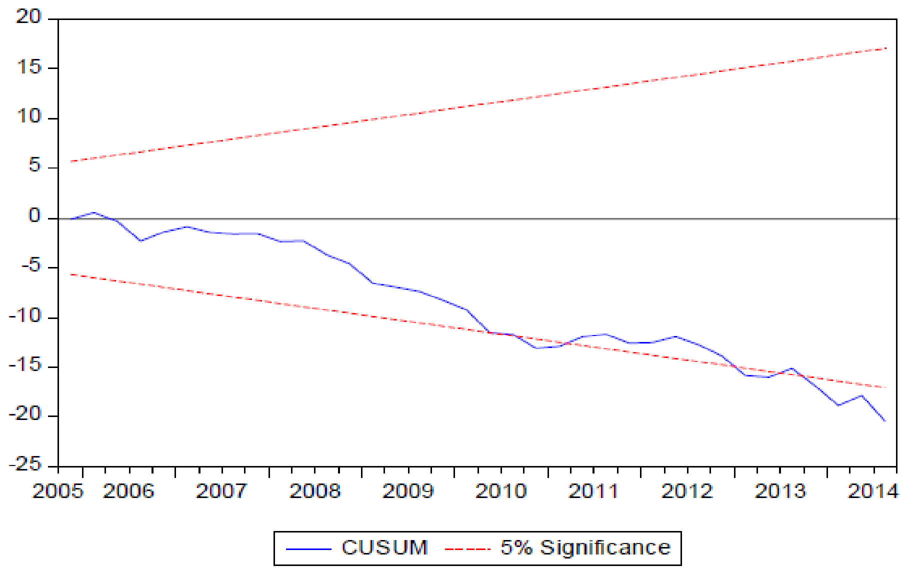


Source: Author's computation of Eviews 9 results

5.3.4 Model stability test

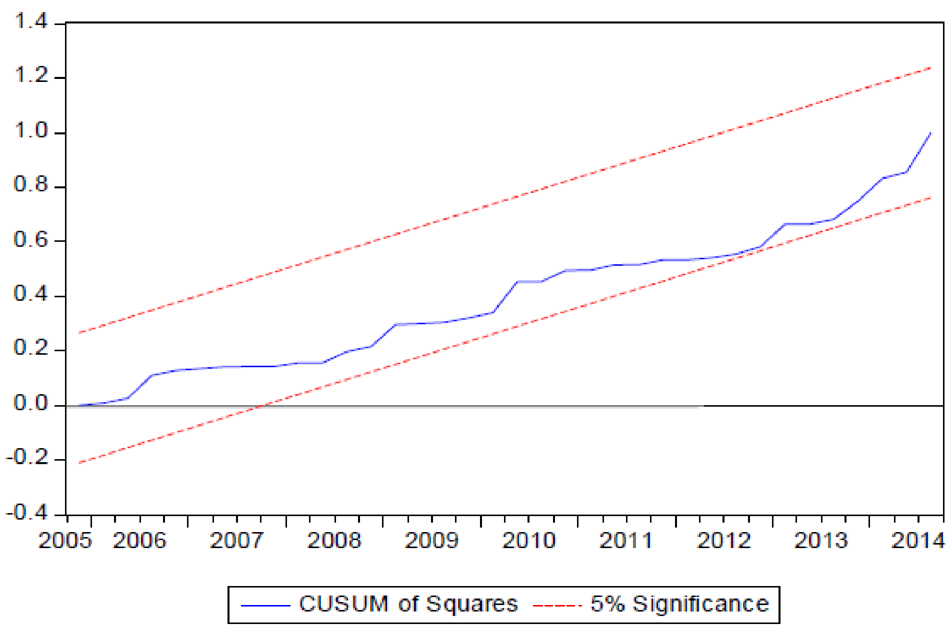
The stability test result for models A and B are presented in figure 5.3, figure 5.4, figure 5.5 and figure 5.6. The CUMSUM and CUMSUMQ tests for model A and B shows that both the models are stable in relative terms.

Figure 5.3: Model A - Plot of CUSUM



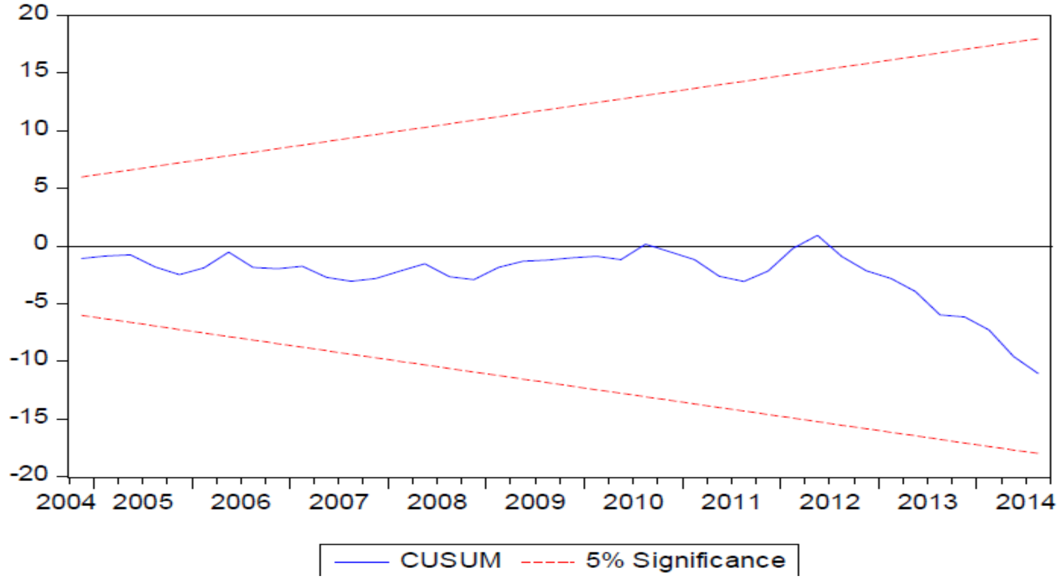
Source: Author's computation of Eviews 9 results

Figure 5.4: Model A - Plot of CUSUMQ



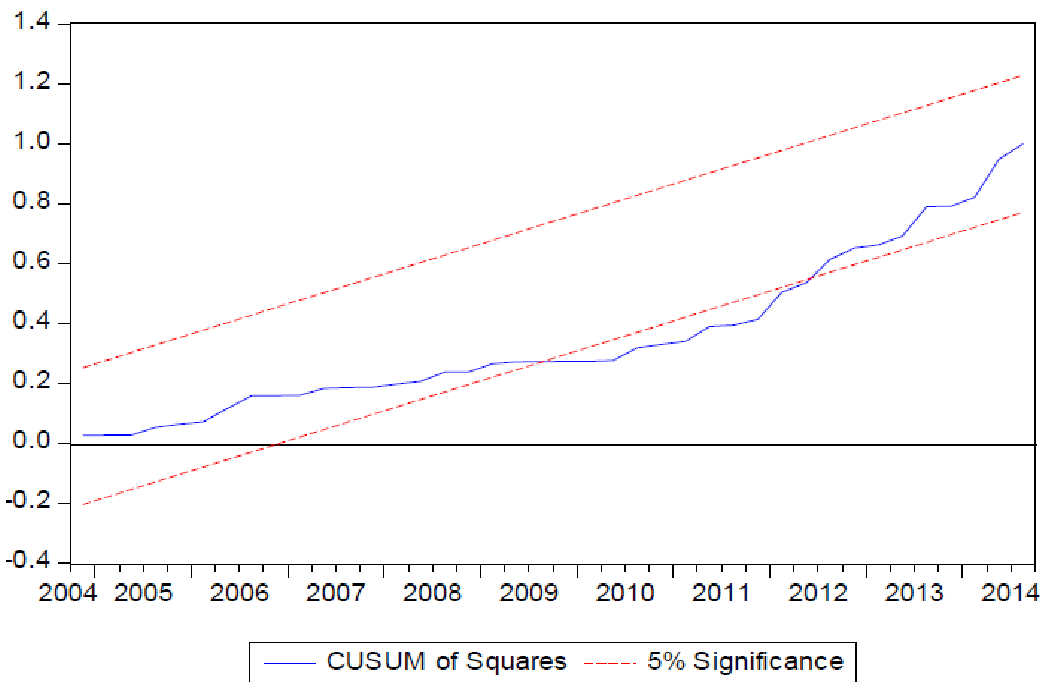
Source: Author's computation of Eviews 9 results

Figure 5.5.: Model B - Plot of CUSUM



Source: Author's computation of Eviews 9 results

Figure 5.6: Model B - Plot of CUSUMQ



Source: Author's computation of Eviews 9 results

5. 4 Result of ARDL bounds Test

ARDL bounds test result for the existence of long run relationships is presented in Table 5.7 below for model A. As can be seen in the table the F-statistics is higher than the critical bounds at 5% level of significance both at I0 bound and I1 bound. This shows that the null hypothesis that states that no long run relationship exists is rejected. As a result, it can be concluded that long run relationship exists between the variables.

Table 5.7: Model A – ARDL Bounds test result

ARDL Bounds Test
Date: 05/25/16 Time: 15:25
Sample: 2004Q1 2014Q3
Included observations: 43
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	5.570782	8

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	1.95	3.06
5%	2.22	3.39
2.5%	2.48	3.7
1%	2.79	4.1

Source: Author's computation of Eviews 9 results

ARDL bounds test result for the existence of long run relationships is presented in Table 5.8 below for model B. As can be seen in the table the F-statistics is higher than the critical bounds at 5% level of significance both at I0 bound and I1 bound. This shows that the null hypothesis that states that no long run relationship exists is reject. As a result, it can be concluded that long run relationship exists between the variables.

Table 5.8: Model B - ARDL bounds test result

ARDL Bounds Test
Date: 05/25/16 Time: 15:42
Sample: 2003Q4 2014Q3
Included observations: 44
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	3.721668	6

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Source: Author's computation of Eviews 9 results

5.5 Results of autoregressive distributed lag (ARDL) estimation for Model A

The ARDL estimation results for the determinants of liquidity is reported in Table 5.9 below. The long run statistics reveals that loan growth (LG), fixed deposit growth (FDG), demand deposit growth (DDG), credit risk (CR), bank size (BS), and saving deposit growth (SDG) are key determinants of liquidity of commercial banking industry in Ethiopia. The effect of profitability (ROA), management quality (MQ) and capital adequacy (CA) is found to be statistically insignificant.

The short run dynamics of model A is also reported in Table 5.9. The coefficients of (LG), fixed deposit growth (FDG), demand deposit growth (DDG), credit risk (CR), bank size (BS), and saving deposit growth (SDG) are all statistically significant determinants of liquidity in the short term at 5% level. Profitability (ROA), management quality (MQ) and capital adequacy (CA) are all insignificant in the short term.

The coefficient of $VECM_{t-1}$ is statistically significant (p-value = 0.0000) and negative. This shows that there is a long run relationship between the variables.

Table 5.9: Model A - ARDL estimation results for liquidity and independent variables

ARDL Cointegrating And Long Run Form
Dependent Variable: LQ
Selected Model: ARDL(1, 0, 0, 0, 2, 1, 1, 2, 2, 0)
Date: 05/25/16 Time: 09:59
Sample: 2003Q2 2014Q3
Included observations: 43

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LG)	-0.064666	0.011810	-5.475540	0.0000
D(FDG)	0.005597	0.001914	2.924189	0.0074
D(DDG)	0.041133	0.002913	14.120527	0.0000
D(CR)	0.089872	0.034363	2.615333	0.0152
D(CR(-1))	0.060515	0.051500	1.175044	0.2515
D(CA)	-0.004102	0.003711	-1.105355	0.2800
D(BS)	0.626766	0.147532	4.248354	0.0003
D(MQ)	-0.655638	0.744333	-0.880839	0.3871
D(MQ(-1))	-1.675835	0.547247	-3.062300	0.0053
D(ROA)	1.222014	1.215373	1.005465	0.3247
D(ROA(-1))	2.968694	1.007244	2.947344	0.0070
D(SDG)	0.050895	0.009903	5.139235	0.0000
CointEq(-1)	-0.760504	0.093480	-8.135440	0.0000

Cointeq = LQ - (-0.0850*LG + 0.0074*FDG + 0.0541*DDG + 0.1541*CR + 0.0037*CA + 0.2989*BS + 1.7568*MQ -2.9149*ROA + 0.0669*SDG -1.7151)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LG	-0.085030	0.015666	-5.427766	0.0000
FDG	0.007359	0.002599	2.831158	0.0092
DDG	0.054086	0.006527	8.286626	0.0000
CR	0.154136	0.073394	2.100115	0.0464
CA	0.003698	0.006541	0.565336	0.5771
BS	0.298910	0.135298	2.209271	0.0369
MQ	1.756756	1.245763	1.410185	0.1713
ROA	-2.914876	2.042256	-1.427283	0.1664
SDG	0.066922	0.010598	6.314758	0.0000
C	-1.715076	0.637415	-2.690673	0.0128

Source: Author’s computation of Eviews 9 results

5. 6 Results of autoregressive distributed lag (ARDL) estimation for Model B

The ARDL estimation results for the determinants of profitability is reported in Table 5.10 below. The long run statistics reveals that non-interest income (NI) and operating expenses management (OPEM) are key determinants of profitability of commercial banking industry in Ethiopia. The effect of liquidity (LQ), credit risk (CR), capital adequacy (CA) and bank size (BS) is found to be statistically insignificant.

The short run dynamics of model B is also reported in Table 5.10. The coefficients of D(OPEM) and D(NI) are statistically significant on profitability in the short term at 5% level. D(LQ), D(CR), D(CA), and D(BS) are all insignificant in the short term.

The coefficient of $VECM_{t-1}$ is statistically significant (p-value = 0.0001) and negative. This shows that there is a long run relationship between the variables. The coefficient of $VECM_{t-1}$ is -0.830573.

Table 5.10: Model B - ARDL estimation results for profitability and independent variables

ARDL Cointegrating And Long Run Form
Dependent Variable: ROA
Selected Model: ARDL(2, 1, 1, 2, 0, 0, 0)
Date: 05/25/16 Time: 15:39
Sample: 2003Q2 2014Q3
Included observations: 44

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ROA(-1))	0.121872	0.070080	1.739036	0.0920
D(OPEM)	-1.408185	0.120400	-11.695902	0.0000
D(NI)	0.025312	0.004970	5.092594	0.0000
D(LQ)	0.012721	0.010880	1.169192	0.2512
D(LQ(-1))	-0.025735	0.010505	-2.449883	0.0201
D(CR)	-0.012412	0.030881	-0.401929	0.6905
D(CA)	0.043750	0.049796	0.878586	0.3864
D(BS)	0.004141	0.004574	0.905364	0.3723
CointEq(-1)	-0.830573	0.178991	-4.640295	0.0001

Cointeq = ROA - (-0.8128*OPEM + 0.0148*NI + 0.0180*LQ -0.0149*CR + 0.0527*CA + 0.0050*BS -0.0124)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPEM	-0.812829	0.260622	-3.118799	0.0039
NI	0.014847	0.006729	2.206355	0.0349
LQ	0.017981	0.013360	1.345867	0.1881
CR	-0.014944	0.036149	-0.413395	0.6822
CA	0.052674	0.063325	0.831812	0.4119
BS	0.004986	0.005652	0.882208	0.3845
C	-0.012369	0.035970	-0.343862	0.7333

Source: Author’s computation of the Eviews 9 output

5. 7 Granger causality test

The pairwise granger causality test for liquidity and profitability is presented in table 5.11 below. The p-value is more than 5% and both null hypothesis that claims liquidity does not Granger cause profitability and profitability does not Granger cause liquidity cannot be rejected.

Table 5.11 Pairwise Granger causality test for Liquidity and Profitability

Pairwise Granger Causality Tests
Date: 05/25/16 Time: 20:28
Sample: 2003Q2 2014Q3
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LQ does not Granger Cause ROA	44	1.61304	0.2123
ROA does not Granger Cause LQ		0.16348	0.8498

Source: Author's computation of the Eviews 9 output

5. 8 Discussion of results

The result of the study is presented in the previous sections. In this section, analysis of each independent variable is made in light of its level of significance in determining liquidity and profitability. Depending on the findings of the study the research hypothesis outlined in chapter one may either be accepted or rejected. Finally, findings of this study are analyzed versus other related empirical studies.

Error correction term for liquidity

Table 5.9 shows that the coefficient of the error correction term ($VECM_{t-1}$) for liquidity is statistically significant (p-value = 0.0000) and negative. The coefficient of error correction term is -0.760504. This indicates that the adjustment process back to the long run equilibrium after a shock is 76% per quarter. The result also shows that though liquidity may temporarily deviate from its long run equilibrium, it will converge back to its equilibrium. Hence, the full adjustment requires one quarter and a month. The adjustment process that appears to be faster could be attributable to a minimum liquidity requirement set by NBE for the commercial banks to comply with.

Error correction term for profitability

Table 5.10 shows that the coefficient of the error correction term for profitability is statistically significant (p-value=0.0001) and negative. The coefficient of the error correction term is -0.830573. This indicates that the adjustment process back to the long run equilibrium after a shock is 83% per quarter. The result shows that though profitability may temporarily deviate from its long run equilibrium, it will converge back to its equilibrium. Hence, full adjustment requires one quarter plus nearly a month. The adjustment process that appears to be faster could be attributable to the robust profitability and growth of commercial banking industry in Ethiopia (IMF, 2014).

Liquidity and demand deposit growth

H_{a1}: There is a significant positive relationship between demand deposit growth and liquidity both in the short and long run in the commercial banking industry of Ethiopia.

The estimation result of ARDL estimation in table 5.9 shows that demand deposit growth has positive long term (p-value=0.0000) and short term (p-value =0.0000) relationship significant at 5% with liquidity. Hence the result confirmed the hypothesized sign. The null hypothesis is rejected and the alternative hypothesis, H_{a1}, that claims that there is significant positive relationship between demand deposit growth and liquidity both in the short and long term in the commercial banking industry of Ethiopia is supported. The result indicates that other explanatory variables remaining constant, a unit increase in demand deposit results in increase of liquidity by 5.4%.

In general, deposits appear to be the main source of funds for commercial banks. Demand deposit constitutes 44% of the total deposits in the commercial banking industry of Ethiopia. It is also a cheaper source of liquidity funding as compared to the interbank money market. The interbank money market in Ethiopia is not vibrant and its interest rate is higher compared to the non-interest bearing demand deposits.

Liquidity and saving deposit growth

H_{a2}: There is a significant positive relationship between saving deposit growth and liquidity both in the short and long run in Commercial Banking industry of Ethiopia.

The ARDL estimation result in table 5.9 shows that the relationship between saving deposit growth and liquidity is positive and significant both in the long term (p-value=0.0000) and short term (p-value=0.0000) at 5%. Result is as expected by the researcher. The null hypothesis is rejected and the alternative hypothesis, H_{a2}, that claims that there is significant positive relationship between saving deposit growth and liquidity in the commercial banking industry of Ethiopia is supported. The result indicates that other explanatory variables remaining constant, a unit increase in saving deposit results in increase of liquidity by 6.7%.

Saving takes the lion's share of deposits in commercial banks and it has reached record high levels in recent years (NBE report, 2013/14). It is one of the main sources of liquidity funding for commercial banks in the absence of well-developed money market. This could be the possible reason why saving deposit growth is significant in determining profitability.

Liquidity and fixed deposit growth

H_{a3}: There is a significant positive relationship between fixed deposit growth and liquidity both in the short and long run commercial banking industry of Ethiopia.

The ARDL estimation result in table 5.9 shows that fixed deposit growth has positive long term (p-value=0.0.0092) and short term (p-value =0.0.0074) relationship that is significant at 5%, with liquidity. Thus, the hypothesized sign is confirmed. The null hypothesis is rejected and the alternative hypothesis, H_{a3}, that claims that there is significant positive relationship between fixed deposit growth and liquidity in the commercial banking industry of Ethiopia is supported. The result indicates that other explanatory variables remaining constant, a unit increase in fixed deposit results in increase of liquidity by 0.74%.Though, the volume of fixed deposit is by far below saving and demand deposits, it one of the sources of liquidity funding. The result indicates that other explanatory variables remaining constant, a unit increase in fixed deposit results in increase of liquidity by 0.74%.

Liquidity and loan growth

H_{a4}: There is a significant negative relationship between loan growth and liquidity both in the short and long run in commercial banking industry of Ethiopia.

The ARDL estimation result in table 5.9 shows that loan growth has negative long term (p-value=0.0000) and short term (p-value =0.0000) relationship significant at 5% with liquidity. The null hypothesis is rejected and the alternative hypothesis, H_{a4}, that claims that there is significant negative relationship between loan growth and liquidity in the commercial banking industry of Ethiopia is supported. The result indicates that other explanatory variables remaining constant, a unit increase in loan results in increase of liquidity by 8.5%.This result is consistent with the findings of Aspachs et al. (2005) that reported negative relationship between liquidity and loan growth. This result is consistent with the findings of Aspachs et al. (2005) and Kohler (2012) that argue loan growth negatively affects the liquidity of banks.

Liquidity and bank size

H_{a5}: There is a significant positive relationship between bank size and liquidity both in the short and long run in commercial banking industry of Ethiopia.

The ARDL estimation result in table 5.9 shows that bank size has positive long term (p-value=0.0369) and short term (p-value =0.0003) relationship that is significant at 5% with liquidity. The null hypothesis is rejected and the alternative hypothesis, H_{a5}, that claims that there is significant negative relationship between bank size and liquidity in the commercial banking industry of Ethiopia is supported. The result indicates that other explanatory variables remaining constant, a unit increase in bank size results in increase of liquidity by 30%. The significant relationship between bank size and liquidity could possibly be due to the importance of outreach by way of branching out in the banking industry to collect deposits.

This result is consistent with the findings of Kashyap et al. (2002), Brehanu (2015) and Nigist (2015) that reported positive and statistically significant relationship between bank size and liquidity.

Liquidity and capital adequacy

H_{a6}: There is a significant positive relationship between capital adequacy and liquidity both in the short and long run in commercial banking industry of Ethiopia.

The ARDL estimation result presented in table 5.9 shows that capital adequacy has positive relationship with liquidity in the long run but it is insignificant (p-value=0.5771) at 5%. Table 5.9 also shows that short run relation is negative and insignificant (p-value=0.2800) at 5%. As a result, we failed to reject the null hypothesis. Thus, the alternative hypothesis that claims that there exists positive relationship between capital adequacy and liquidity is not supported.

The result of this study for the long run relationship between capital adequacy and liquidity is consistent with the "risk absorption" hypothesis that argue bank capital absorbs risk and enhances the risk bearing ability of the bank by creating liquidity. Hence, the impact of bank capital on liquidity is positive (Allen & Gale, 2004).

Liquidity and credit risk

H_{a7}: There is a significant negative relationship between credit risk and liquidity both in the short and long run in commercial banking industry of Ethiopia.

The hypothesized relationship between credit risk and liquidity is negative. However, ARDL estimation result in table 5.9 shows that credit risk has positive relationship with liquidity. The relationship is significant both in the long term (p-value=0.0.0464) and short term (p-value=0.0152) at 5%. Thus, the claim that there exists negative relationship between credit risk and liquidity in alternative hypothesis, H_{a7}, in commercial banking industry of Ethiopia is not supported. This result contradicts with Munteanu (2012), who reported that there is significant negative relationship between liquidity and credit risk.

However, the significant positive relationship between credit risk and liquidity is consistent with empirical findings of Roman & Sargu (2015) for Bulgaria in which significant positive relationship between liquidity and credit risk (credit risk) is reported. The reason they put forward for the positive result is that the central bank of Bulgaria requires banks to increase their liquidity holding every time increase in non-performing loans is registered.

The significant positive relationship between credit risk and liquidity reported in this study could possibly be due two reasons. Firstly, NBE directive SBB/57/2014 requires commercial banks to hold liquid assets that is equivalent to at least 15% of the net current liabilities. Banks that fail to comply with this requirement are not allowed to grant new loans without prior approval of NBE. This may imply that the efforts of the supervisory and regulatory body, NBE, is effective in this particular regard. Secondly, the actual non-performing loans (NPL) could be higher than loan loss provisions. NBE considers data on non-performing loans as classified and confidential due to this the researcher could not get access. The proxy used to measure credit risk in this study is the ratio of loan loss provisions to gross loans.

Liquidity and management quality

H_{a8}: There is a significant negative relationship between management quality (ratio of interest expenses to deposits) and liquidity both in the short and long run in commercial banking industry of Ethiopia.

The result estimation of ARDL model in table 5.9 shows that the relationship between management quality and liquidity is found out to be insignificant both in the long term (p-value=0.1713) and the short term (p-value=0.3871) at 5%. Thus, the claim that there exists significant negative relationship between management quality and liquidity in alternative hypothesis, H_{a8}, in commercial banking industry of Ethiopia is not supported. As a result, we failed to reject the null hypothesis.

This result contradicts with the finding of Munteanu (2012) that reported negative relationship between liquidity and management quality. However, it is consistent with the findings of Roman & Sargu (2015) for Hungary banks that reported positive and insignificant relationship between liquidity and management quality.

Liquidity and profitability

H_{a9}: There is a significant positive relationship between profitability and liquidity both in the short and long run in commercial banking industry of Ethiopia.

The estimation result of ARDL model in table 5.9 shows that the relationship between profitability and liquidity is found out to be insignificant both in the long term (p-value=0.1664) and the short term (p-value=0.3247). The alternative hypothesis, H_{a9}, that claims that there exists positive significant relationship between liquidity and profitability in commercial banking industry of Ethiopia is not supported. Thus, we fail to reject the null hypothesis.

However, this result is consistent with the findings of Roman and Sargu (2015) and Roman and Sargu (2014) that reported insignificant and negative relationship between liquidity and profitability for Bulgaria and Hungary.

Capital adequacy and profitability

H_{a10}: There is a significant positive relationship between capital adequacy and profitability both in the short and long run in commercial banking industry of Ethiopia.

The estimation result of ARDL in table 5.10 confirmed the hypothesized sign. But, the relationship between capital adequacy and profitability both in the long term (p-value=0.4119) and the short term (p-value=0.3864) is positive and insignificant at 5%. Thus, the claim that there exists positive significant relationship between capital adequacy and profitability in the alternative hypothesis, H_{a10}, in commercial banking industry of Ethiopia is not supported.

Nevertheless, the positive association between capital adequacy and profitability is consistent with the empirical findings of (Athanasoglou, Delis, & Stairkouras, 2006, Athanasoglou, Brissimis,

& Delis, 2005, Ameur and Mhiri, 2013, Molyneux and Thornton,1992, Kosmidou et al. 2007, Perera et al. 2013; Flamini et al.,2009, Ayaydin and Karakaya, 2014; Bourke,1989, Demirguc-Kunt and Huizinga,1999, and Kosmidou et al. 2007.

Bank size and profitability

H_{a11}: There is a significant positive relationship between bank size and profitability both in the short and long run of commercial banking industry in Ethiopia.

The estimation result of ARDL in table 5.10 confirmed the hypothesized sign. But, the relationship between bank size and profitability both in the long term (p-value=0.3845) and the short term (p-value=0.3723) positive and insignificant at 5%. Thus, the claim that there exists positive and significant relationship between bank size and profitability in the alternative hypothesis, H_{a11}, in commercial banking industry of Ethiopia is not supported. Thus, we failed to reject the null hypothesis. The possible explanation for the insignificant impact of bank size on profitability could be that increase in size may entail branch expansion that is accompanied by additional costs.

Nonetheless, the positive association between bank size and profitability is consistent with the empirical findings of (Athanasoglou, Delis, & Stairkouras, 2006, Sufian & Noor, 2012, Alper and Anbar, 2011, and Karimzadeh et al. 2013.

Credit risk and profitability

H_{a12}: There is a significant negative relationship between credit risk and profitability both in the short and long run in commercial banking industry of Ethiopia.

The result of ARDL estimation in table 5.10 confirmed the hypothesized sign. But, the relationship between credit risk and profitability is found out to be insignificant both in the long term (p-value=0.6822) and the short term (p-value=0.6905) insignificant at 5%. Thus, the claim that there exists negative and significant relationship between credit risk and profitability in the alternative hypothesis, H_{a12}, in commercial banking industry of Ethiopia is not supported.

The insignificant negative relationship between credit risk and profitability reported in this study could possibly be due two reasons. Firstly, the proxy used in this study is the ratio of loan loss provisions to gross loans. In reality, actual non-performing loans (NPL) could be higher than loan loss provisions. NBE considers data on non-performing loans as classified and confidential and the researcher could not get access to. Secondly, NBE directive SD/BSD/481/09 dated

December, 2009 requires banks to keep their NPL ratio to a maximum of 5% of total loans. This might have helped the banks not to take excessive risk.

However, the findings of this study contradicts the empirical findings of Petria et al. (2015), Ćurak et al. (2011), Anthanasoglou et al. (2006) and Miller and Noulas, (1997) that reported significant negative relationship between credit risk and profitability.

Non-interest income and profitability

H_{a13}: There is a significant positive relationship between non-interest income and profitability both in the short and long run in commercial banking industry of Ethiopia.

The result of ARDL estimation in table 5.10 shows that non-interest income has positive long term (p-value=0.0349) and short term (p-value =0.0000) relationship that is significant at 5% with profitability. The null hypothesis is rejected and the alternative hypothesis, **H_{a13}**, that claims that there exists significant positive relationship between non-interest income and profitability in the commercial banking industry of Ethiopia is supported. The result indicates that other explanatory variables remaining constant, a unit increase in non-interest income results in increase of profitability by 1.48%. This shows that impact of service charges, gain on foreign exchange, letter of credit opening charges, and commission on profitability of commercial banks in Ethiopia is significant.

This finding is consistent with empirical findings of Tesfaye (2014), Sufian (2011) and Alper and Anbar (2011) that assert the existence of significant positive relationship between non-interest income and profitability.

Liquidity and profitability

H_{a14}: There is a significant positive relationship between liquidity and profitability both in the short and long run in the commercial banking industry in Ethiopia.

The result of ARDL estimation in table 5.10 confirmed the hypothesized sign. But, the relationship between liquidity and profitability is found out to be positive but insignificant both in the long term (p-value=0.1881) and the short term (p-value=0.2512) at 5%. Thus, the claim that there exists positive significant relationship between liquidity and profitability in the alternative hypothesis, H_{a14}, in commercial banking industry of Ethiopia is not supported. This result contradicts with empirical findings of Molyneux and Thornton (1992), Goddard et al. (2004) and Lee and Hseih (2013) that reported negative impact of liquidity on profitability.

However, the finding of this study is consistent with empirical findings of Bourke (1989), Kosmidou et al. (2008), Shen et al. (2009) and Athanasoglou, Delis, & Stairkouras, 2006 that reported insignificant positive relationship between liquidity and profitability.

Operating expenses management and profitability

H_{a15}: There is a significant negative relationship between operating expenses management and profitability both in the short and long term in commercial banks of Ethiopia.

The result of ARDL estimation in table 5.10 shows that operating expenses management has negative long term (p-value=0.0039) and short term (p-value =0.0000) relationship that is significant at 5% with profitability. The null hypothesis is rejected and the alternative hypothesis, **H_{15}**, that claims that there exists significant negative relationship between operating expenses management and profitability in the commercial banking industry of Ethiopia is supported. The result indicates that other explanatory variables remaining constant, a unit decrease in operating expenses results in increase of profitability by 81%. This shows that cutting costs and holding grip on overhead costs could be significantly reflected in banks profitability. The result indicates that other explanatory variables remaining constant, a unit decrease in operating expenses results in increase of profitability by 81%.

This result is also consistent with the empirical findings of, Anthanasoglou, Delis, & Stairkouras (2006), Bourke (1989); Kosmidou et al. (2008); and Petria et al. (2015) that assert that excellence in management of operating expenses will result in increase in profitability.

Granger causality – Liquidity and profitability

H_{a16}: Liquidity causes profitability in the commercial banking industry of Ethiopia and vice versa.

Pair-wise Granger causality test result is reported in table 5.11. According to the test result, the alternative hypothesis that claims that liquidity Granger causes profitability and vice versa could not be supported. As a result, we fail to reject the null hypothesis that claims liquidity does not Granger cause profitability. We also fail to reject the null hypothesis that claims that profitability does not cause liquidity. Therefore, we can conclude that there is neither unidirectional or bidirectional causality between liquidity and profitability in the commercial banking industry of Ethiopia. This result is consistent with the findings of Olarewaju and Adeyemi (2015) that examined the causal relationship between liquidity and profitability and reported no significant unidirectional and bidirectional causal relationship between liquidity and profitability for most of the deposit banks of Nigeria.

Chapter 6: Conclusion and Recommendation

This chapter recaps the first five chapter of the paper briefly. The first part summarizes the major findings of the study. The second part puts forward recommendations and areas of deepening for further research.

6.1 Conclusion

In this study, an empirical framework was specified to investigate the bank-specific determinants of liquidity and profitability of the commercial banking industry in Ethiopia. The causality between liquidity and profitability is also examined.

Empirical findings indicate that loan growth, bank size, credit risk, saving deposit growth, demand deposit growth, and fixed deposit growth are bank specific factors that explain liquidity in the commercial banking industry of Ethiopia. The relationship between saving deposit growth, demand deposit and fixed deposit growth with liquidity is significant and positive. This is the result of heavy reliance of commercial banking industry in Ethiopia on deposits as a source of liquidity funding which is cheaper than the interbank bank money market that is not as such active. Loan growth has negative and significant relationship with liquidity. This consistent with other empirical findings. Bank size has positive and significant impact on liquidity. This could be attributable to the branch based approach to banking approach practiced in Ethiopia where outreach is important to mobilize deposit and boost liquidity. Credit risk affects liquidity positively and significantly. This could be attributable to the effectiveness of directives and targets implemented by the regulatory body. The impact of other bank specific variables such as profitability, capital adequacy and management quality are statistically insignificant and do not have impact on liquidity.

Non-interest income and operating expenses management are the bank specific variables that explain profitability in the commercial banking industry of Ethiopia. The relationship between non-interest income and profitability is positive and significant. This could be attributable to the positive contribution of service charges, gain on foreign exchange, letter of credit opening charges and commission. Operating expenses management is another variable that affects the profitability of banks significantly and negatively. This could suggest that banks could be more profitable by holding tight grip over overhead costs. The impact of other bank specific variables such as liquidity, credit risk, capital adequacy, and bank size are not statistically significant to explain profitability.

The error correction term is significant and negative both for liquidity and profitability. The speed adjustment both for and profitability takes about four months. In the case of liquidity the speedy adjustment could be attributable to the mandatory minimum liquidity requirement set by the NBE. While the speedy adjustment for profitability could be due to the growing industry and the robust profit. Investigation of the pattern of causality between liquidity and profitability shows there is neither unidirectional or bidirectional causality between liquidity and profitability in the commercial banking industry of Ethiopia.

6.2 Recommendation

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

- The analysis indicated that loan growth and bank size, are credit risk are significantly related to liquidity in the commercial banking industry of Ethiopia. Therefore, commercial banks should give greater emphasis to these significant variables in managing liquidity.

- The study showed that credit risk is significantly and positively related to liquidity. Thus, the attempt being made by National bank of Ethiopia to lower impaired loans by way of setting targets should be sustained.

- Saving deposit growth, demand deposit growth, and fixed deposit growth are significantly related to liquidity in the commercial banking industry of Ethiopia. Therefore, commercial banks should craft creative deposit mobilization strategies in order to sustain these source of liquidity funding. National Bank of Ethiopia should also consider diversifying funding sources rather than unduly relying on one source of funding.

- The study indicated that non-interest income is one of the key determinants of profitability in the commercial banking industry of Ethiopia. Thus, commercial banks should keep on getting focused on generating fee income and introduce fee based services as the credit risk exposure in this regard is also very low.

- Operating expenses management is another key determinant of profitability in the commercial banking industry of Ethiopia. Thus, banks should excel in controlling costs. Weighing the cost-benefits and striking the balance between intensive branch expansions versus introducing banking services that are supported by modern technology should be evaluated in this regard.

6.3 Direction for future research

Considering the importance of liquidity and profitability in the banking Industry, in the context of financial sector that is bank based and capital does existent, the researcher considers that it is appropriate deepening the analysis as a future research direction. Thus, I consider suitable to study how macroeconomic, bank regulation, and industry specific variables relate with liquidity and profitability.

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Appendix

1. Model A: Breusch-Godfrey serial correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.461092	Prob. F(2,22)	0.6366
Obs*R-squared	1.729935	Prob. Chi-Square(2)	0.4211

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 05/25/16 Time: 15:22
Sample: 2004Q1 2014Q3
Included observations: 43
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LQ(-1)	0.059422	0.133287	0.445824	0.6601
LG	-0.001210	0.012386	-0.097677	0.9231
FDG	0.000169	0.002017	0.083530	0.9342
DDG	-0.000262	0.003025	-0.086605	0.9318
CR	-0.009623	0.037001	-0.260072	0.7972
CR(-1)	0.006381	0.048042	0.132827	0.8955
CR(-2)	-0.005925	0.053403	-0.110947	0.9127
CA	-0.000323	0.003932	-0.082064	0.9353
CA(-1)	-0.000972	0.004274	-0.227423	0.8222
BS	0.015949	0.155905	0.102299	0.9194
BS(-1)	-0.039406	0.127630	-0.308751	0.7604
MQ	-0.128785	0.809408	-0.159110	0.8750
MQ(-1)	-0.062374	0.650249	-0.095924	0.9244
MQ(-2)	-0.036680	0.561941	-0.065274	0.9485
ROA	0.226877	1.318498	0.172072	0.8650
ROA(-1)	0.109057	1.106013	0.098603	0.9223
ROA(-2)	0.134121	1.048511	0.127916	0.8994
SDG	-0.003168	0.010904	-0.290539	0.7741
C	0.127949	0.563173	0.227194	0.8224
RESID(-1)	-0.056692	0.304402	-0.186240	0.8540
RESID(-2)	-0.271040	0.290715	-0.932323	0.3613

R-squared	0.040231	Mean dependent var	2.17E-16
Adjusted R-squared	-0.832286	S.D. dependent var	0.007249
S.E. of regression	0.009812	Akaike info criterion	-6.103877
Sum squared resid	0.002118	Schwarz criterion	-5.243756
Log likelihood	152.2333	Hannan-Quinn criter.	-5.786691
F-statistic	0.046109	Durbin-Watson stat	2.050958
Prob(F-statistic)	1.000000		

2. Model A: Heteroscedasticity Test

Heteroskedasticity Test: ARCH

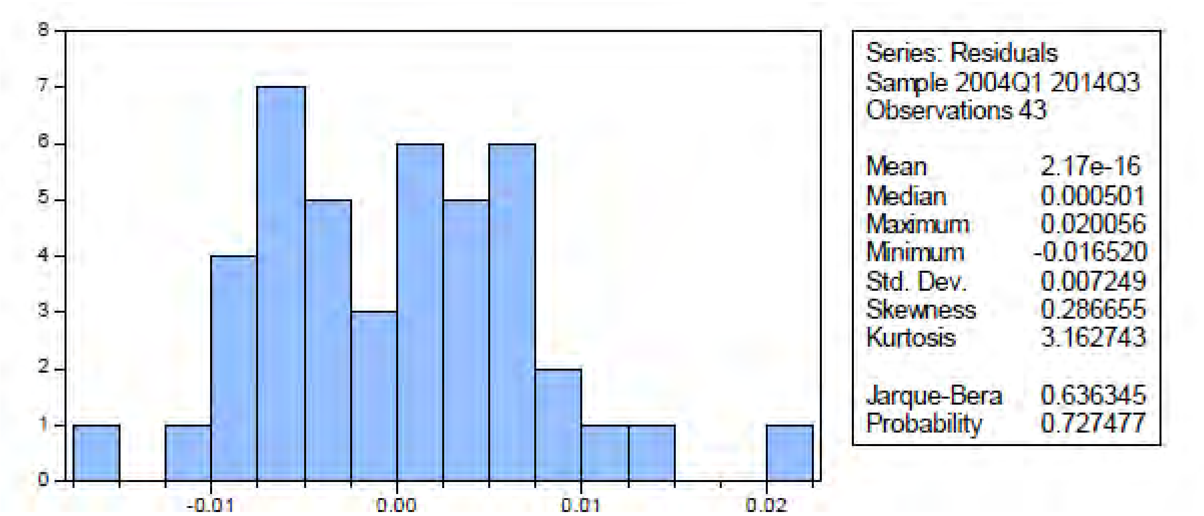
F-statistic	0.573666	Prob. F(1,40)	0.4532
Obs*R-squared	0.593833	Prob. Chi-Square(1)	0.4409

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/25/16 Time: 15:22
Sample (adjusted): 2004Q2 2014Q3
Included observations: 42 after adjustments

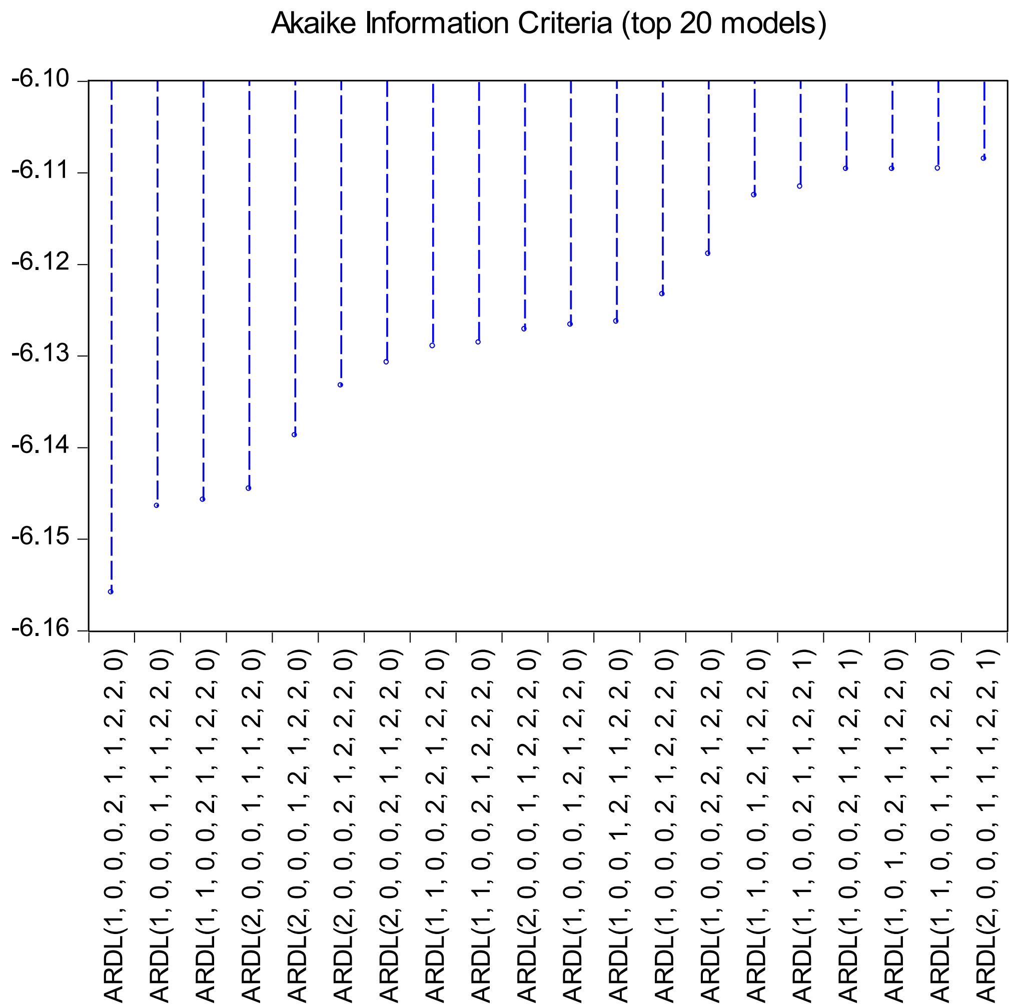
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.87E-05	1.45E-05	4.056820	0.0002
RESID^2(-1)	-0.118624	0.156619	-0.757408	0.4532

R-squared	0.014139	Mean dependent var	5.25E-05
Adjusted R-squared	-0.010508	S.D. dependent var	7.69E-05
S.E. of regression	7.73E-05	Akaike info criterion	-16.05084
Sum squared resid	2.39E-07	Schwarz criterion	-15.96809
Log likelihood	339.0676	Hannan-Quinn criter.	-16.02051
F-statistic	0.573666	Durbin-Watson stat	2.026124
Prob(F-statistic)	0.453245		

3. Model A: Normality Test



4. Model selection summary



5. Model A: ARDL Cointegrating and Long run form

ARDL Cointegrating And Long Run Form
Dependent Variable: LQ
Selected Model: ARDL(1, 0, 0, 0, 2, 1, 1, 2, 2, 0)
Date: 05/25/16 Time: 09:59
Sample: 2003Q2 2014Q3
Included observations: 43

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LG)	-0.064666	0.011810	-5.475540	0.0000
D(FDG)	0.005597	0.001914	2.924189	0.0074
D(DDG)	0.041133	0.002913	14.120527	0.0000
D(CR)	0.089872	0.034363	2.615333	0.0152
D(CR(-1))	0.060515	0.051500	1.175044	0.2515
D(CA)	-0.004102	0.003711	-1.105355	0.2800
D(BS)	0.626766	0.147532	4.248354	0.0003
D(MQ)	-0.655638	0.744333	-0.880839	0.3871
D(MQ(-1))	-1.675835	0.547247	-3.062300	0.0053
D(ROA)	1.222014	1.215373	1.005465	0.3247
D(ROA(-1))	2.968694	1.007244	2.947344	0.0070
D(SDG)	0.050895	0.009903	5.139235	0.0000
CointEq(-1)	-0.760504	0.093480	-8.135440	0.0000

Cointeq = LQ - (-0.0850*LG + 0.0074*FDG + 0.0541*DDG + 0.1541*CR + 0.0037*CA + 0.2989*BS + 1.7568*MQ -2.9149*ROA + 0.0669*SDG -1.7151)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LG	-0.085030	0.015666	-5.427766	0.0000
FDG	0.007359	0.002599	2.831158	0.0092
DDG	0.054086	0.006527	8.286626	0.0000
CR	0.154136	0.073394	2.100115	0.0464
CA	0.003698	0.006541	0.565336	0.5771
BS	0.298910	0.135298	2.209271	0.0369
MQ	1.756756	1.245763	1.410185	0.1713
ROA	-2.914876	2.042256	-1.427283	0.1664
SDG	0.066922	0.010598	6.314758	0.0000
C	-1.715076	0.637415	-2.690673	0.0128

6. Model A: ARDL Bounds Test

ARDL Bounds Test
Date: 05/25/16 Time: 15:25
Sample: 2004Q1 2014Q3
Included observations: 43
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	5.570782	8

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	1.95	3.06
5%	2.22	3.39
2.5%	2.48	3.7
1%	2.79	4.1

7. Model B: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.203576	Prob. F(1,30)	0.6551
Obs*R-squared	0.296566	Prob. Chi-Square(1)	0.5860

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 05/25/16 Time: 15:40
Sample: 2003Q4 2014Q3
Included observations: 44
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROA(-1)	0.104882	0.276511	0.379305	0.7071
ROA(-2)	-0.000856	0.071023	-0.012054	0.9905
OPEM	0.025456	0.134393	0.189412	0.8510
OPEM(-1)	0.166925	0.448981	0.371785	0.7127
NI	-0.000165	0.005049	-0.032594	0.9742
NI(-1)	-0.002666	0.008697	-0.306594	0.7613
LQ	0.001278	0.011381	0.112311	0.9113
LQ(-1)	-0.002803	0.014689	-0.190856	0.8499
LQ(-2)	0.000661	0.010743	0.061495	0.9514
CR	0.005126	0.033284	0.154000	0.8786
CA	0.009016	0.054262	0.166160	0.8691
BS	0.000621	0.004834	0.128491	0.8986
C	-0.006328	0.032897	-0.192357	0.8488
RESID(-1)	-0.168406	0.373245	-0.451194	0.6551

R-squared	0.006740	Mean dependent var	-8.99E-18
Adjusted R-squared	-0.423672	S.D. dependent var	0.002339
S.E. of regression	0.002791	Akaike info criterion	-8.671596
Sum squared resid	0.000234	Schwarz criterion	-8.103899
Log likelihood	204.7751	Hannan-Quinn criter.	-8.461066
F-statistic	0.015660	Durbin-Watson stat	1.997143
Prob(F-statistic)	1.000000		

8. Model B: Heteroscedasticity test

Heteroskedasticity Test: ARCH

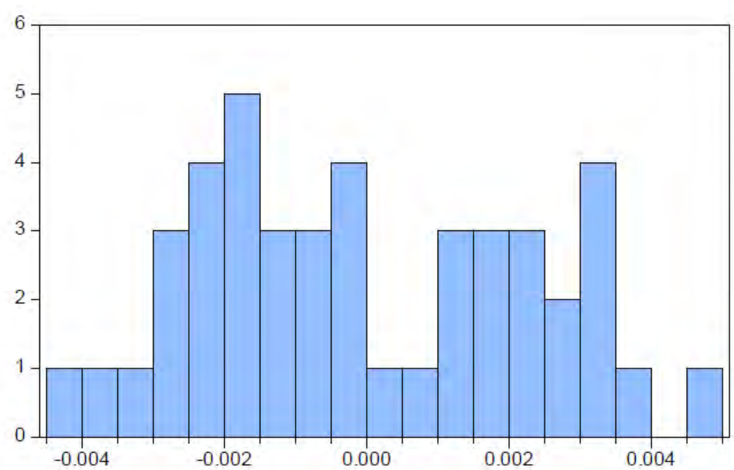
F-statistic	0.084297	Prob. F(1,41)	0.7730
Obs*R-squared	0.088228	Prob. Chi-Square(1)	0.7664

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/25/16 Time: 15:41
Sample (adjusted): 2004Q1 2014Q3
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.53E-06	1.17E-06	4.738347	0.0000
RESID^2(-1)	-0.045424	0.156452	-0.290340	0.7730

R-squared	0.002052	Mean dependent var	5.28E-06
Adjusted R-squared	-0.022288	S.D. dependent var	5.19E-06
S.E. of regression	5.25E-06	Akaike info criterion	-21.43157
Sum squared resid	1.13E-09	Schwarz criterion	-21.34966
Log likelihood	462.7789	Hannan-Quinn criter.	-21.40137
F-statistic	0.084297	Durbin-Watson stat	1.995321
Prob(F-statistic)	0.773020		

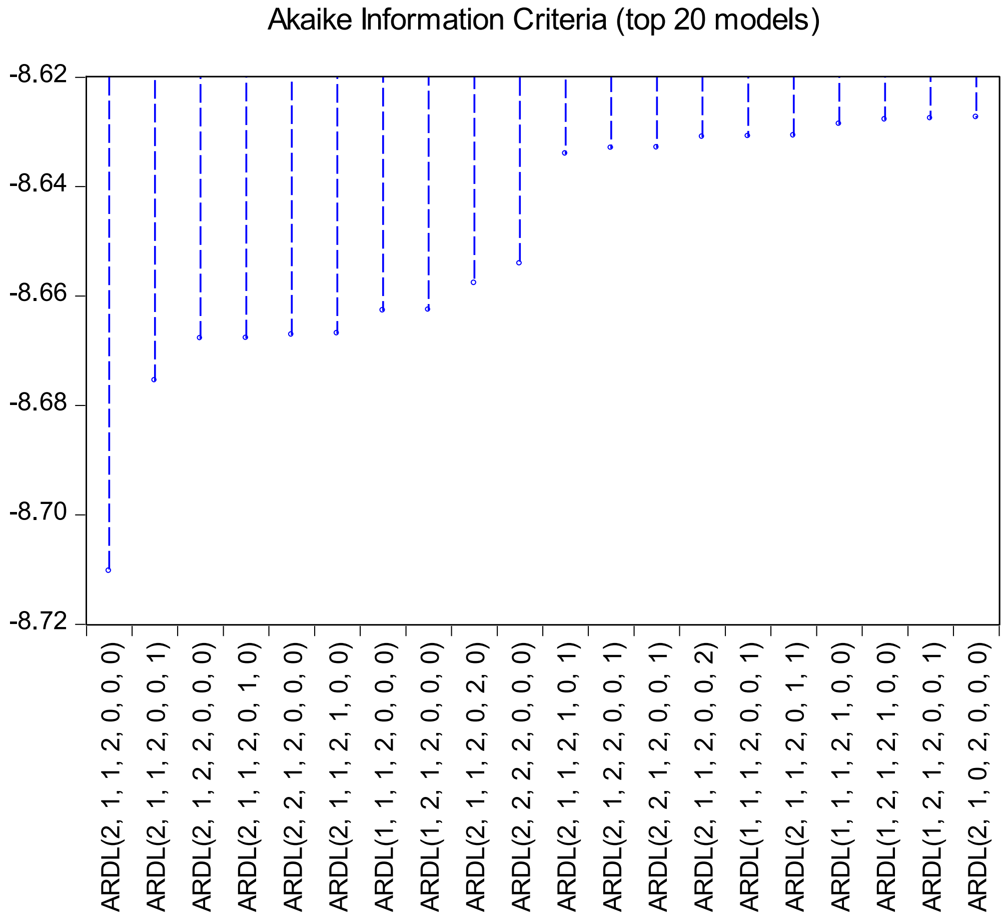
9. Model B: Normality Test



Series: Residuals
Sample 2003Q4 2014Q3
Observations 44

Mean	-8.99e-18
Median	-0.000401
Maximum	0.004560
Minimum	-0.004105
Std. Dev.	0.002339
Skewness	0.175422
Kurtosis	1.905809
Jarque-Bera	2.420634
Probability	0.298103

10. Model B: Model selection summary



11. Model B: ARDL Cointegrating and Long run form

ARDL Cointegrating And Long Run Form
Dependent Variable: ROA
Selected Model: ARDL(2, 1, 1, 2, 0, 0, 0)
Date: 05/25/16 Time: 15:39
Sample: 2003Q2 2014Q3
Included observations: 44

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ROA(-1))	0.121872	0.070080	1.739036	0.0920
D(OPEM)	-1.408185	0.120400	-11.695902	0.0000
D(NI)	0.025312	0.004970	5.092594	0.0000
D(LQ)	0.012721	0.010880	1.169192	0.2512
D(LQ(-1))	-0.025735	0.010505	-2.449883	0.0201
D(CR)	-0.012412	0.030881	-0.401929	0.6905
D(CA)	0.043750	0.049796	0.878586	0.3864
D(BS)	0.004141	0.004574	0.905364	0.3723
CointEq(-1)	-0.830573	0.178991	-4.640295	0.0001

Cointeq = ROA - (-0.8128*OPEM + 0.0148*NI + 0.0180*LQ -0.0149*CR + 0.0527*CA + 0.0050*BS -0.0124)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPEM	-0.812829	0.260622	-3.118799	0.0039
NI	0.014847	0.006729	2.206355	0.0349
LQ	0.017981	0.013360	1.345867	0.1881
CR	-0.014944	0.036149	-0.413395	0.6822
CA	0.052674	0.063325	0.831812	0.4119
BS	0.004986	0.005652	0.882208	0.3845
C	-0.012369	0.035970	-0.343862	0.7333

12. Model B: ARDL Bounds test result

ARDL Bounds Test
Date: 05/25/16 Time: 15:42
Sample: 2003Q4 2014Q3
Included observations: 44
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	3.721668	6

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Test Equation:
Dependent Variable: D(ROA)
Method: Least Squares
Date: 05/25/16 Time: 15:42
Sample: 2003Q4 2014Q3
Included observations: 44

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ROA(-1))	0.136883	0.071267	1.920714	0.0640
D(OPEM)	-1.354317	0.123773	-10.94194	0.0000
D(NI)	0.024466	0.004959	4.933493	0.0000
D(LQ)	0.011844	0.010976	1.079136	0.2889
D(LQ(-1))	-0.025734	0.010597	-2.428499	0.0212
C	-0.004672	0.029717	-0.157211	0.8761
OPEM(-1)	-0.661159	0.273585	-2.416650	0.0217
NI(-1)	0.012049	0.005996	2.009474	0.0533
LQ(-1)	0.013208	0.010958	1.205324	0.2372
CR(-1)	-0.017221	0.027781	-0.619881	0.5399
CA(-1)	0.043273	0.050850	0.850992	0.4013
BS(-1)	0.003411	0.004766	0.715564	0.4796
ROA(-1)	-0.872773	0.177889	-4.906287	0.0000

R-squared	0.960141	Mean dependent var	0.000117
Adjusted R-squared	0.944712	S.D. dependent var	0.011782
S.E. of regression	0.002770	Akaike info criterion	-8.698943
Sum squared resid	0.000238	Schwarz criterion	-8.171796
Log likelihood	204.3767	Hannan-Quinn criter.	-8.503452
F-statistic	62.22837	Durbin-Watson stat	1.978280
Prob(F-statistic)	0.000000		