



**ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
SCHOOL OF GRADUATE STUDIES**

**THE EFFECTS OF ASSET AND LIABILITY MANAGEMENT ON
THE FINANCIAL PERFORMANCE OF COMMERCIAL BANKS IN
ETHIOPIA**

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Declaration

I, Seble Mirutse, declare that this Thesis entitled “the effects of asset and liability management on the financial performance of commercial banks in Ethiopia” is my original work carried out with the help of my research advisor and all sources of materials used for the purpose of this Thesis have been duly acknowledged.

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Approval

This is to certify that the research paper prepared by Seble Mirutse on the title: “the effects of asset and liability management on the financial performance of commercial banks in Ethiopia” submitted in partial fulfillment of the requirements for the Degree of Master of Science in Accounting and Finance complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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List of acronyms

AIB	Awash International Bank S.C
ALM	Asset Liability Management
AQ	Asset Quality
BoA	Bank of Abyssinia S.C
CA	Capital Adequacy
CAMELS	Capital Adequacy, Asset Quality, Management Efficiency, Earning Quality, Liquidity, Sensitivity
CBE	Commercial Bank of Ethiopia
CBO	Cooperative Bank of Oromia S.C
CLRM	Classical Linear Regression Model
DB	Dashen Bank S.C
EQ	Earning Quality
LDCs	Least Developed Countries
LIB	Lion International Bank
LIQ	Liquidity
ME	Management Efficiency
NBE	National Bank of Ethiopia
NIB	Nib International Bank S.C
OIB	Oromia International Bank
ROE	Return on Equity
UB	United Bank
WB	Wegagen Bank S.C

Notation:

S	Sensitivity
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Abstract

The purpose of this study was to identify the effect of ALM on the Financial Performance of Ethiopian commercial banks with in the period from 2010 to 2019 using panel data. ALM is the process by which an institution manages its Statement of Financial Position in order to allow for alternative interest rate and liquidity states. ALM system has various functions to manage risks such as liquidity risk management, market risk management, trading risk management, funding and capital planning, profit planning and growth projection which helps for the survival and growth of the banks. The model used was CAMELS model. Profitability was measured by ROE. Nine commercial banks were purposively selected. The reasons for focusing on commercial banks were to maintain similarity of data. The study employed secondary data collected from the National Bank of Ethiopia; data selection was done based on the measurement of the banks specific variables under investigation. The study employed Quantitative research approach and explanatory design. The data was analyzed using Stata software version 14.2. Multiple linear regression model was used where random effect regression model was applied to study the impact and relationship of the independent variables with the dependent variable. The result of the study displays that capital adequacy, asset quality and management efficiency are statistically significant and have negative effect on profitability of Ethiopian commercial banks. Conversely, liquidity is found to be statistically significant with a positive effect. Whereas, earning quality and sensitivity to risk are found to be statistically insignificant. Thus, the study recommends to bank managers that due emphasis on the significant variables have a paramount importance to enhance profitability.

Key words: Asset Liability Management, Financial Performance, Commercial Banks

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

As Banks serve primarily as a medium which bridges the gap between surplus and deficit units in an economy, they are very vital organizations which help in the accomplishment of socioeconomic activities undertaken by individuals, business organizations and even sovereign states (Mabvur et al., 2012). Thus, the role of commercial banks in the resource allocation of a country is crucial (Ongore and Vincent, 2013).

Effective performance and reliability of its banks is one of the most important factors influencing consistent economic development of any country. The evaluation of soundness and stability of the commercial banks and the stability of the financial system of a country are closely related (Miletic, 2009). Banks act as the backbone of economic growth and prosperity by acting as a catalyst in the process of development. They train the habit of saving and mobilize funds from numerous small households and business firms spread over a wide geographical area. The funds mobilized are used for productive purposes in agriculture, oil and gas, industry and trade (Abayomi & Shalem, 2001).

As the banking sector is the life line of the economy, activity of banks should be treated with utmost care (Chandani et al., 2014). The banking industry contributes directly to national income and its overall growth. As the banking sector has a major impact on the economy as a whole, evaluation, analysis, and monitoring of its performance is very important (Dash & Das, 2009). Financial performance is highly influenced by management efficiency (Abdu, 2018).

The ability to obtain maximum profits depends on the feasible set of assets and liabilities determined by the management and the unit costs incurred by the bank for producing each component of assets (Atemnkeng, 2006).

Asset liability management is a process which enables institutions to manage their Statement of Financial Position in order to let alternative interest rate and liquidity states. It is the practice of

managing risks caused by mismatches between the assets and liabilities of the bank. ALM is an approach that provides institutions with mechanisms that make such risk acceptable. Ensuring liquidity; while protecting the earnings is the short-term objective of ALM in a commercial bank, maximizing the economic value of the bank is its long-term goal (Vaidyanathan, 1999).

ALM is a dynamic process of planning, organizing, coordinating and controlling combinations of costs and volumes, maturities, yields of assets and liabilities for the accomplishment of predetermined objectives. The purposes of ALM system is to manage risks such as liquidity risk management, market risk management, trading risk management, funding and capital planning, profit planning and growth projection (Kosmidou & Zopounidis, 2004). Asset liability management enables the firm to balance between its liabilities and assets. This in turn minimizes financial risks and hence improves profitability. The strategy of keeping bank asset and liability allows for achieving banking harmony which reflects in sound performance that actualizes profit maximization and attainment of desired liquidity preference (Angele, 2008). Perception about ALM helps to identify the risk and reward that an institution can be involved (Fabozzi and Kanishi, 1995).

One of the most widely-used frameworks for bank performance evaluation is the CAMEL model. The model originally had five parameters which were Capital Adequacy, Asset Quality, Management Efficiency, Earning Quality, and Liquidity. In order to make this method more comprehensive, the sixth parameter, Sensitivity to Market Risk, was added to the former parameters; which makes the model's name **CAMELS**. These components are critical for the survival of banks. Inadequacy in any parameter would result in increased likelihood of bank failure (Sahajwala and Bergh, 2000). Therefore, this model, as improved with the sixth component Sensitivity to risk, was employed in this study.

1.2 Statement of the problem

The role of commercial banks for the growth and sustainability of a country's economy is indisputable. The financial performance of banks highly depends on proper management of assets and liabilities which guarantees smooth and efficient functioning of the banking sector in a manner that it accommodates changes in the external environment. Since ALM plays a critical role in risk management, it is a must for banks to recognize the importance of asset liability management and apply effective risk management practices (Angelopoulos et al., 2001).

Due to the concurrent unstable financial markets and changes in interest rates, a wise portfolio management should give a great concern for asset liability management (Mahail, 2009). Since ALM has a direct effect on the financial performance of banks, it is wise to have an effective ALM process within banks that closely monitor and match both the assets and liabilities management. The entire size and complexity of the economy increases the importance of ALM and this is why it has to be considered (Vossen, 2010).

Various studies had been conducted on the financial performance of banks globally. Looking at the findings of some of the studies conducted outside Ethiopia to indicate the gap both globally and among the researchers conducted in Ethiopia; Aguenau, Alahrech and Bounakaya (2017) suggest that

Capital adequacy, Asset quality, Earnings performance, and liquidity have a positive impact on banks' efficiency with capital adequacy having the most significant impact. Boateng (2019) depicted that Earning stood out as the highly significant factor that affects the performance of banks. Then again, Zafar et al. (2017) cited in Boateng (2019) showed that only Asset Quality, Earning ability and Liquidity were found to affect significantly bank performance; Where earning is the most highly significant parameter. Accordingly, capital adequacy, management efficiency and sensitivity were positive and insignificant.

On the other hand, though different researches had been done in relation to financial performance of commercial banks of Ethiopia using CAMEL model, the researchers are very inconsistent in their findings. For example, taking only the studies that used ROE as a measure of profitability; concerning Asset quality, Mulalem (2015), Abdu (2018) and Melaku (2017) put that asset Quality is insignificant for profitability. Quite the opposite, Anteneh (2018) put that Asset Quality is significant for profitability. Then again, regarding earning quality, Adamu and Kenenisa (2017) and Anteneh (2018) found out that earning quality is insignificant for profitability. On the contrary, Mulalem (2015) found that earning quality significantly affected profitability. Therefore, this study aimed to fill this knowledge gap.

On top of that, as far as the researcher's knowledge is concerned, there is no research that was conducted on the effect of asset liability management on financial performance of Ethiopian commercial banks by taking Sensitivity to risk as an independent variable. But this study included an explanatory variable which was not used by the above stated researchers i.e. Sensitivity to

risk.(Sahajwala and Bergh,(2000) put that the components of the CAMELS Model arecriticalforthe survivalofbanks and that inadequacyinanyparameterwouldresultinincreasedlikelihoodofbank failure. Especially, since the component “Sensitivity to risk” is related to the main operation of Banks, it is obvious that it must be addressed.

1.3.Objectives of the study

1.3.1. General Objective

This study was intended to find out the effect of asset liability management on financial performance of commercial banks in Ethiopia.

1.3.2. Specific Objectives

The specific objectives of this study were:

1. To explore the impact of capital adequacy on the Ethiopian commercial banks’ financial performance.
2. To examine the outcome of Asset quality on the Ethiopian commercial banks’ financial performance.
3. The investigate the consequence of management efficiency on the Ethiopian commercial banks’ financial performance.
4. To explore the outcome of earning quality on the Ethiopian commercial banks’ financial performance.
5. To determine the result of liquidity on the Ethiopian commercial banks’ financial performance.
6. To examine the effect of sensitivity to risk on the Ethiopian commercial banks’ financial performance.

1.4. Hypothesis of the study

Accordingly, the followinghypotheses were developed basedonexistingtheoriesandempiricalstudies and weretested.

1. There is significant and positive relationship between Capital adequacy and performance
2. There is significant and negative relationship between Asset quality and performance
3. There is significant and negative relationship between Management efficiency and performance
4. There is significant and positive relationship between Earning quality and performance

5. There is significant and positive relationship between Liquidity and performance
6. There is significant and negative relationship between sensitivity to risk and performance

1.5. Significance of the Study

The financial sector, banking industry, is the backbone of a country's economy. Since Asset liability mix management is very important, ALM should be given great attention. Assets and liabilities are vital in wise portfolio management due to the concurrent unstable financial markets and changes in interest rates. Therefore, this study is significant because it had pointed out the effect of ALM on Ethiopian commercial banks' financial performance. The study is expected to have its implications for banks by indicating factors that can affect bank performance. The study is believed to contribute for further research as per the suggestions given by this study in this regard.

1.6. Scope and Limitation of the study

The study was restricted to Ethiopian commercial banks which are currently under operation. Nine private banks were used as a sample. The study covered a period of ten years starting from 2010 to 2019. Qualitative research approach and descriptive and explanatory research design was used. A dependent variable and 6 independent variables were considered in this study. The study was based on secondary data, financial statements of the sample Banks. Thus, is comprehensive only to the degree of accuracy of the data obtained from this secondary source.

1.7. Organization of the study

With regard to the organization, the thesis has five chapters. The first chapter is the introductory part and it contains background of the study, statement of the problem, general and specific objectives of the study, hypothesis, significance of the study, and scope and limitation of the study. Chapter two contains review of related literature and conceptual framework in the subject matter. The third chapter includes different elements of methodology, such as study area, research approach, research design, data collection, population and sampling, research instruments and data analysis. Chapter four deals with the analysis of the results and discussion. At last, the conclusions and policy implication are presented under chapter five.

CHAPTER TWO

LITERATURE REVIEW

This chapter presents the review of both theoretical and empirical studies related to asset liability management and financial performance of banks, in order to put the study within the context of the existing literature.

2.1. Conceptual Literature

2.1.1 Asset, Liability, Management and financial performance of commercial banks

As Banks serve primarily as a medium which bridges the gap between surplus and deficit units in an economy, they are very vital organizations which help in the accomplishment of socioeconomic activities undertaken by individuals, business organizations and even sovereign states (Kamoyo et al., 2012). The importance of bank financial performance can be appraised at the micro and macro levels of the economy. At the micro level, profit is the essential prerequisite of a competitive banking institution and the cheapest source of funds. At the macro level, a sound and profitable banking sector is better able to withstand negative shocks and contribute to the stability of the financial system (Aburime, 2008). Effective performance and reliability of its banks is one of the most important factors influencing consistent economic development of any country (Miletic, 2009).

As banks grant advances of long-term maturities for small number of debtors by collecting short term maturity deposits from number of individuals, these conversion activities expose banks to credit, interest rate and liquidity risks (Aburime, 2008).

Asset liability management is a process which enables institutions to manage their Statement of Financial Position in order to let alternative interest rate and liquidity states. It is the practice of managing risks caused by mismatches between the assets and liabilities of the bank. ALM

is an approach that provides institutions with mechanisms that make such risk acceptable. Ensuring liquidity, while protecting the earnings is the short-term objective of ALM in a commercial bank, maximizing the economic value of the bank is its long-term goal (Vaidyanathan, 1999).

The most important thing for bank management is to manage market liquidity risk and interest rate risk. Hence banks need a framework which enables them to combat these risks and help them to optimize the performance of the banks. In this scenario ALM is very useful and helpful tool to analyze the performance of banks (Kumar and Dhar, 2014). It has been also said that ALM is concerned with an attempt to match assets and liabilities in terms of maturity and interest rate sensitivity to minimize interest rate and liquidity risks (Zawalinska, 1999).

Due to the importance of Asset liability management, commercial banks shall establish an Asset & Liability Management Committee (ALCO) to manage its assets, liabilities and off-balance sheet items so as to fully meet the bank's contractual commitments. The terms of reference attached with NBE Directive No. SBB/57/2014 can be used by its ALCO (Yesuf, 2016).

The balanced portfolio theory has added better awareness regarding performance of banks (Nzongang and Atemnkeng, 2006). It was with the application of the Market power and Efficiency Structure theories that investigations on bank performance started in late 1980s. (Athanasoglou et al, 2005).

Financial performance of banks depends on the feasible set of assets and liabilities determined by the management and the unit costs incurred by the bank for producing each component of assets. Mismatch between assets and liabilities of firms can be managed by a strong ALM process which can minimize risks associated with failures that would be caused due to such mismatches (Atemnkeng, 2006).

A firm's overall financial well-being over a given period of time is measured by its financial performance. Some of the models used to assess bank performance are Balanced score card (BSC), Data Envelopment Analysis (DEA), Z score, Efficiency ratio (ER), ROE and ROA and CAMELS model. Balanced score card (BSC) is developed by Kaplan and Norton. BSC deals with

multiple measures of performance and offers a strategic framework, which specifically inspires the use of both financial and non-financial measures along four perspectives to measure firm performance which are financial, customers, internal business process, and learning and growth (Kaplan & Norton, 1996b). Considering BSC to have all the answers for choosing the most appropriate measures of company performance which are governed by the organization's strategic orientation and external competitive environment, it has received much attention as a tool within many industries including hospitality, health, manufacturing and banking (Ashton, 1998).

Data Envelopment Analysis (DEA) is one of the measures of bank performance which is used to measure the production or performance function of decision-making units (DMUs). The standard DEA model has an input and output orientation. An input orientation identifies the efficient consumption of resources while holding outputs constant. An output orientation identifies the efficient level of output given existing resource consumption (R. Hoque, 2012). Whereas, the Z-score method observes liquidity; profitability; reinvested earnings and leverage which are integrated into a single composite score (Roli Pradhan, 2014). It was developed by Professor Edward Altman in 1968 to provide a more effective financial assessment tool for credit risk analysts and lenders.

Efficiency is also used to measure performance. It was first introduced in Edgeworth's (1881) and Pareto's (1927) works as a performance measurement and was first empirically implemented in Shephard's (1953) book. It is defined as the firm's ability to convert its resources into revenues; the ability to generate the highest amount of output out of the lowest amount of input. Efficiency is calculated by dividing the firm's total expense excluding interest expenses over its total revenue where the lower the ratio, the greater the firm's efficiency and vice versa (Hays, Stephen, Arthur, 2009).

ROE and ROA are also among those used to measure financial performance. ROE reflects the ability of a bank's management to generate profits from the bank's assets. It is a measure of the company's efficiency at generating profit from every single unit of shareholders' equity (Prasanna, Chandra 2011). Whereas, ROA reflects the ability of a bank's management to generate profits from the bank's assets, although it may be biased due to off-balance sheet activities (Ahmed and Khababa, 1999).

The other model used to assess the financial performance of banks is the CAMELS model. This model was first developed in the U.S. and then started to be used by every bank and credit union in the U.S. and outside U.S. by different banking supervisory regulators. The components of this model at the initial were Capital adequacy, Asset quality, Management efficiency, Earning quality, and Liquidity which form the model's name CAMEL. Then in 1997 Sensitivity to market risk was added and the model's name becomes CAMELS.

2.2. Theoretical Framework

The theories regarding asset liability management and financial performance are discussed below.

2.2.1 Liquidity Preference Theory

Liquidity preference theory which is also known as liquidity preference hypothesis was first articulated by Keynes (1989). This theory describes that Investors need higher interest rate on securities with long-term maturities because they would prefer to hold cash, which involves less risk. When the investment is more liquid it is easy to sell it or easily converted in to cash with minimum risk and also the demand of money increase and decrease depends on the interest rate, when the interest rate decrease people demand more money to hold until the interest rate increase and vice versa.

The implication of this theory is that firms should maintain a best level of liquidity not to miss an opportunity that promise higher return in the future and Firms should work towards the balance through proper management of their asset and liability to achieve capital requirement and future higher return investment.

Credit risk is the risk that arises when debtors are not able to pay the money on time. It constrains the firm from investing in profitable investment that promises higher returns in future. Therefore, it is a must for financial institutions to assure the debtor's ability to pay the debt on time before giving out credit to the firm; it is important to know the credit worthiness of the firm to decrease the credit risk. (Jappelli and Pagano, 2002)

2.2.2 The Portfolio Theory

The portfolio theory approach denotes portfolio divergence. It describes that the preferred portfolio arrangement of commercial

banks are result of decision taken by the bank management. On top of that, the ability to obtain maximum profits depends on the feasible set of assets and liabilities determined by the management and the unit costs incurred by the bank for producing each component of assets (Nzongang and Atemnkeng, 2006).

The portfolio theory approach is the most applicable theory and plays a significant role in bank performance studies (Nzongang and Atemnkeng, 2006). According to this model, the optimum holding of each asset in a wealth holder's portfolio is a function of policy decisions determined by a number of factors such as the vector of rates of return on all assets held in the portfolio, a vector of risks associated with the ownership of each financial asset and the size of the portfolio.

2.2.3 Liability Management Theory

The liability management theory states that a bank can hold reserves through liabilities from different sources such as; issuing time certificates of deposit, borrowing from other commercial banks, borrowing from Central Bank, raising capital funds through issuing shares and by plugging back of profits. This theory recognizes the fact that asset structures of a bank have a prominent role to play in providing it with liquidity that it needs. As it enhances fundraising opportunities for execution of attractive investments, this approach is considered more aggressive than the other methods. Banks in U.S.A. adopted this strategy by sourcing for potential depositors more aggressively by creating marketing departments to be able to remain profitable business starting from 1960 (Osifisan (1993) cited in Ogbeifun et al 2018).

According to this theory, banks can satisfy liquidity needs by borrowing in the money and capital markets. So, there is no need to follow old liquidity norms like maintaining liquid assets, liquid investments etc. currently, banks have focused on liabilities side of the balance sheet. The central role of this theory was to consider both sides of a bank's balance sheet as sources of liquidity (Emmanuel, 1997).

2.2.4 Commercial Loan Theory

The commercial loan or the real bills doctrine theory which originated in England during the 18th century states that a commercial bank should forward only short-term self-liquidating productive

loans to business organizations. This is because, since they acquire liquidity, they can automatically liquidate themselves, as they mature in the short run and are for productive ambitions, there is no risk of their running to bad debts and such loans are high on productivity and earn income for the banks. Loans meant to finance the production, and evolution of goods through the successive phases of production, storage, transportation, and distribution are considered as self-liquidating loans(Emmanuel, 1997).

The commercial loan theory has certain defects. First, if a bank declines to grant loan until the old loan is repaid, the disheartened borrower will have to minimize production which will ultimately affect business activity. If all the banks pursue the same rule, this may result in reduction in the money supply and cost in the community. As a result, it makes it impossible for existing debtors to repay their loans in time. On the other hand, this theory believes that loans are self-liquidating under normal economic circumstances. But if there is depression, production and trade deteriorate and the debtor fails to repay the debt at maturity. In addition to this, this theory disregards the fact that the liquidity of a bank relies on the salability of its liquid assets and not on real trade bills. It assures safety, liquidity and profitability. The bank need not depend on maturities in time of trouble. At last, the general demerit of this theory is that no loan is self-liquidating. A loan given to a retailer is not self-liquidating if the items purchased are not sold to consumers and stay with the retailer. (Guthua,2013).

2.3. Factors Influencing Bank Financial Performance

The performance variances between banks show differences in the market served and differences in philosophy of the management; a function of external and internal influences (Koch 1995 cited in Olweny2011).

According to Ongore

Vincent Okoth(2013), bank performance is highly influenced by both internal and external factors. The internal factors are within the scope of the bank and are easy to be manipulated and differ from bank to bank. Bourke (1989) also put that the profitability of commercial bank can be affected by determinants of two types; the internal determinants which are management controllable and the external determinants which are beyond the control of management.

Management verdicts and policy aims like the level of liquidity, provisioning policy, capital adequacy, expense management and bank size, which are bank specific issues and ownership, market attentiveness, stock market growth and other macroeconomic factors which are external issues and are related to industrial structure have great impact of banks' financial performance (Athanasoglou et al 2005).

The main objective of regulatory and supervisory ratings systems is to measure the bank performance at internal level and its compliance with regulatory requirements to keep the bank on right track. These ratings are highly confidential and are only available to the bank management. External credit rating agencies examine and evaluate the banks and issue ratings for the general public and investors in particular (Haseeb, 2011). It has been also said that bank profitability is usually measured by internal determinants which include bank specific variables (Andreas and Gabrielle, 2009).

While evaluating banks' performance, CAMEL model is an effective tool and helps avoid banks' failure and inefficiencies by anticipating any potential risks and taking preventive actions (Uyen, 2011). CAMEL model is also the model recommended by Basle Committee on Bank Supervision and IMF (Baral, 2005). The CAMELS model is the most appropriate performance evaluation approach as its components cover and touch multiple aspects of a bank; it leaves no room for other variable to disturb its results. (Kongiri, 2012).

2.3.1 Effect of Capital Adequacy on financial performance

Türker Kaya (2001) cited in Serhat Yuksel, Hasan Dincer and Umit Hacıoglu (2015) put that capital adequacy reflects whether the bank has enough capital to bear unexpected losses arising in the future; whether banks have adequate capital in order to meet the withdrawal demand of its customers in crisis period. Maintaining a significant level of capital adequacy is necessary to prevent the bank from failure (Chen, 2003). Capital adequacy is an obvious indicator of the financial health of a banking system. It is very valuable for a bank to preserve & safeguard stakeholders' confidence and preventing the bank from being bankrupt.

Among the ratios used by several researchers to express capital adequacy are:

Capital Adequacy Ratio (CAR) which measures the ability of the bank in absorbing losses arising from risk assets. The higher the ratio represents better performance of the bank. It shall be computed as $\text{Tier I capital} + \text{Tier II capital} / \text{risk weighted asset}$. Tier I capital represents for Equity Share Capital + Disclosed Reserves and Tier II capital is the sum of Undisclosed Reserves + General loss Reserves + Subordinated term debts (Jayantak. 2012). Advancement to asset ratio is also used and it shows the portion of loans and advances deployed to the total funds. Higher the ratio better is the availability of funds for loans and advances out of their total assets and vice versa. (Jayantak. 2012).

2.3.2 Effect of Asset Quality on Financial Performance

Banks' asset quality which depends on exposure to specific risks, trends in non-performing loans, and the well-being and success of bank borrowers, plays a great role in regulating the level of the credit risk which is one of the factors that affect the health of a bank (Baral, 2005). The level of risk related with the asset must be taken in to account while banks make decisions to avoid risks and maximize financial performance (Aburime, 2008).

Since it captures the anticipation of management with regard to the performance of loans, the ratio of loan loss reserve to gross loans is a good measure of credit risk or asset quality (Koch, 1995) as cited on Olweny (2011). Demonstrating the trade-off between risk and return, returns of banks that assume more risk with high loans growth are higher (Hempel et al 1994 cited in Jonathan 2013).

2.3.3 Effect of Management Efficiency on financial performance

Management efficiency is used as an indicator of management's ability to control costs and is expected to have a positive relation with profits, since improved management of these expenses will increase efficiency and therefore raise profits (Flamini et al, 2009). Poor expenses management is the main contributor to poor profitability; management efficiency is one of the key drivers of profitability that is examined (Sufian and Chong, 2008).

Though the relationship between expenditure and profits seems straightforward implying that higher expenses mean lower profits and the opposite, this may not always be the case. The reason is that higher amounts of expenses may be associated with higher volume of banking activities and therefore higher revenues. In relatively uncompetitive

markets where banks enjoy market power, costs are passed on to customers; hence there would be a positive correlation between overhead costs and profitability (Flamini et al, 2009).

The cost to income ratio is used to measure banks' operational efficiency. Cost to income ratio shows the overheads or costs of running the bank, including staff salaries and benefits, occupancy expenses and other expenses such as office supplies. The cost to income ratio is calculated by dividing the overhead costs (costs of operating a bank) to the income generated before provisions (Kosmidou et al, 2004).

2.3.4 Effect of Earning Quality on financial performance

Earning

Quality basically determines the profitability of a bank and explains its sustainability and growth. It indicates the ability of a bank in generating revenue by using the asset, shareholder equity and using the proportion of gross income to assess the earnings performance of banks. The quality of earnings is the ability of earnings that are of high quality if it reflects the current operating performance of the company. Moreover, it reflects a good indicator of future operational performance and provides a good measure of the value of the company. Interest income to Total Revenue (II/TR) is one of the ratios used to calculate earning quality. It shows the share of a bank's interest income earned from advances out of the total revenue (Hamad, 2015 cited in Al-Zubaid et al 2018).

2.3.5 Effect of Liquidity on financial performance

Liquidity indicates the ability of the bank to meet its financial obligations in a timely and effective manner. Though there are differences among scholars with respect to the measurement ratios, total loans to customer deposits ratio is the most common financial ratio that reflects the liquidity position of a bank. The most common financial ratios that reflect the liquidity position of a bank are customer deposits to total assets and total loans to customer deposits (Said, 2003).

2.3.6 Effect of Sensitivity on financial performance

Sensitivity is the sixth component added to the previous five components of the CAMEL model making the model's name CAMELS. It measures how particular risk exposure can cause a mess to the bank's profitability. It specially reflects the degree to which interest rate changes can affect earnings

and hence the bank's capital (Suresh and Paul, 2014). It also shows the degree to which changes in exchange rates, commodity price and equity price can affect earnings.

Sensitivity can be measured by GAP analysis, a tool used to evaluate a bank's earnings exposure to interest rate movements. A bank's GAP over a given period is the difference between the value of its assets that mature during that period and the value of its liabilities that mature during the same period. If the difference is significant, it means interest rate changes have a great impact on net interest income. If the amounts of maturing assets exactly offset by the reprising liabilities, a balanced position will occur, the ratio will be 1.0. If the GAP ratio is less than 1.0, it means that the bank's liability matures earlier than its assets (an indication that the bank is liability sensitive). If the GAP ratio is greater than 1.0, it means that the bank's assets mature earlier than liabilities (an indication that the bank is asset sensitive). GAP is the difference between risk sensitive assets and risk sensitive liabilities. The GAP ratio is expressed as the ratio of risk sensitive assets to risk sensitive liabilities.

$$\text{GAP} = \frac{\text{RSA}}{\text{RSL}}$$

Where the sum of net advances, net investments and money at call (short term loan payable immediately on demand) is taken as rate sensitive assets and the sum of deposits and borrowings of the bank is taken as risk sensitive liabilities (Suresh and Paul, 2014).

2.4 Empirical Review

This section presents some of the studies conducted to examine the relationship between asset liability management and profitability of banks.

The study of Kosmidou & Zopounidi (2004) examines 2000 years balance sheet of one of the Greek banks with the aid of Goal programming found out that the best combination of variables (bond, deposit and facilities) with highest return was selected. A multicriteria methodology for bank's asset and liability management was used. Giokas & Vassiloglou (1991) concluded that management of banks should pursue goal of profit maximization and finest allocation of risks in their capital by applying a goal programming model in their study, using large banks in Greece as a case study.

Bordeleau and Graham (2010) in their study of the impact of liquidity on banks' profitability in

the Canadian and American context for a timeframe extending from 1997 to 2009 observed that the profitability of banks in Canada and America was increasing as their level of liquidity holdings was increasing as well to reach an inflection point where profitability started increasing but at a decreasing rate, and subsequently, it decreased. This research confirms that reaching a certain level of liquidity holdings diminishes banks' profitability because it's an opportunity cost of profitable investments.

Mihail (2009) did a study by taking a panel data of over 30 banks across Europe for the period from 2004 to 2011 on how asset liability management affects profitability of Banks. The vital goal of this study was to examine ALM in banks. He used canonical correlations analysis and linear dependency between two variables, i.e. (the structure of assets and liabilities.) was tested. It was concluded that attention must be given to the management of assets and liabilities, the risk level, earnings, liquidity, profit, solvency, the level of loans and deposits in order to be effective in banks,

Abdulazeez, Asish, and Rohani (2017) assessed the profitability of Saudi banks using the parameters of the capital adequacy, asset quality, and management quality, earning ability and liquidity framework for the period 2000-2014. Pooled ordinary least square and fixed effect model was used. Their results showed that domestic banks are more profitable than foreign banks; and foreign banks carry more credit risk in their portfolio. In contrast to domestic banks, operating expenses to total income for foreign banks is significant but negatively related to profitability, indicating that cost management inefficiency adversely affect the profitability of this group. Their results also indicated that banks with larger size are less profitable. The study failed to identify the effect of banks' capital adequacy, liquidity, and asset risk portfolio on their asset quality, efficiency and profitability on a stand alone basis between foreign and domestic banks rather focusing on earnings' ability of the studied banks.

Mohamed and Chithra (2016) have studied the financial performance of selected Conventional and Islamic Banks in the Kingdom of Bahrain using CAMEL model. Based on their study there are significant differences in the performance across the banks though they work

under the same socio, economic-political-legal and regulatory framework.

The research of Al-Tamimi (2010) used the CAMEL rating model to investigate the determinants of conventional and Islamic banks' performance in UAE and revealed that liquidity is a major determinant of conventional banks' performance.

Lizabeth M. Samuel (2018) evaluated the performance of selected commercial banks in India by using the CAMELS rating model; five years Data was used. The non-parametric analysis of the banks showed that all the selected banks conform to the capital adequacy requirement as per the Basel norms. In addition, all banks had sound asset quality and management efficiency. Yet, earnings capacities as well as the liquidity of the banks were not satisfactory.

Sheela and Bastray, (2014) studied the influence of Asset Liability Management on the Commercial banks' profitability in Indian. A case study of one Public Sector Bank namely Union Bank of India and one private sector bank namely ICICI bank. Gap Analysis Technique, the statistical tools, the multivariate statistical technique and Ratio analysis was used to interpret the financial statements and analyze the data. This study primarily based on secondary data, and endeavor to evaluate the interest rate risk that both the banks are exposed to, spread over a period from 2009 to 2014. The finding indicated that it is obvious that both banks are performing satisfactorily in terms of profitability and adequacy, but there is a need to address the immediate concern of liquidity. One of their findings was also Indian bank is more profitable with good Asset-Liability Management strategy, Therefore Investors would be motivated to invest in a bank which has high profitability ratio.

Mohammed Kamru Ahsan (2016) measured financial performance using CAMEL on selected Islamic Banks in Bangladesh. All the selected Islamic banks were found to be on strong position on their composite rating system. The banks were found to be sound in every respect.

Zafar et al (2017) examined the performance of banks in Pakistan using the CAMELS ratio. Capital adequacy, management efficiency and sensitivity were found to be positive and insignificantly related to bank performance. On the other hand, asset quality, liquidity and Earning quality were found to be negatively related with performance and was significant; where Earning quality found to be the most highly significant parameter. The fixed effect panel data was used for analysis.

Ahmad, Ahmad, and Adeel (2016) assessed all listed banks of Pakistan Stock Exchange during the time period of 2010-2015 to investigate the trade-off between liquidity and profitability in the banking sector. The key research method adopted to gather secondary data for the study was document investigation. The study showed that the banks' management should maintain optimum liquidity that will maximize profitability.

Nurazia and Evans (2005) examined whether the CAMELS ratio would be used to forecast bank failure. The results proposed that adequacy ratio, asset quality, management, earnings, liquidity and banks size are statistically significant in explaining bank failure. Olweny and Shipo (2011) found that the poor quality and low level of liquidity are the two major causes of bank failure. Ongore Kusa (2013) concluded that the financial performance of commercial banks in Kenya was driven mainly by board and management decision, while macroeconomic factors have insignificant contribution. Alabede (2012) concluded that in the presence of the effect of global financial condition only assets quality and market concentration are significant determinants of the Nigerian bank's performance. The study recommended that reducing nonperforming assets and introducing a policy to inspire a reasonable competition among the banks.

The research conducted by Kamau (2009) in Kenya using the nonparametric approach (DEA) found that surplus liquidity and efficiency ratio are significantly positively related, meaning that excess liquidity leads to inefficiency. Gweyi, Tobias, and Oloko (2016) assess the influence of liquidity risk on financial performance of deposit taking savings and credit co-operatives (DT-Saccos) in Kenya. The study adopted a descriptive research design. The target population for this study was 164 deposit taking Sacco societies licensed to undertake deposit-taking Sacco business in Kenya. The study adopted census and considered all the Deposit Taking Saccos for study. Secondary data was collected from 135 deposit taking Sacco's audited financial statement which represented 82.32% success rate. Data was analyzed using both descriptive and inferential statistics. The result indicates as liquidity risk has a negative and significant influence on financial performance.

Angele (2008) in her research on analysis of chosen strategies of asset and liability management in commercial banks, found out that the core problem in asset and liability management is the fact that the main asset of commercial bank credits cannot always be liquid, especially if the country's economy is in deep recession.

The major findings of the study conducted by Gyekyi (2011) on the effect of asset liability management on profitability of National Investment Bank in the New Juabeng Municipality in Ghana was that reduction in assets value leads to increase in banking profitability. In addition, profitability was found to increase or decrease directly with liability. The study used the goal programming method.

Tuffour, Owusu, and Boateng, (2018) evaluated internal and external determinants of bank profitability in Ghanaian banking industry. A panel data of 6 banks listed on the Ghana Stock Exchange was analyzed over the period 2010-2015. Pooled regression models were used. The statistical results revealed that capital adequacy, liquidity, total assets and real interest rate were the major determinants of bank profitability in Ghana. Liquidity was found to have significant negative effect on both profitability measures. while operating efficiency has negative and significant influence on only return on equity. Further, capital adequacy was positive and significant for determining both return on assets and return on equity, total assets found to have positive and significant influence on only return on assets. The study recommended that the bank management and regulator should stipulate optimum level for profitability determinants.

Onyekwelu, Chukwuani, and Onyeka (2018) using Ex-post facto research design evaluated liquidity's effect on financial performance of deposit money banks in Nigeria for sample of five banks. Ten years period; 2007-2016 secondary data were collected from the firms and were analyzed using multiple regression analysis. The results of this study showed that Liquidity has positive and significant effect on banks' profitability, that is, return on capital employed (ROCE) and recommended that the management should established liquidity level that will assure finest financial performance.

Saheed (2018) studied the effect of capital adequacy and operational efficiency on profitability of deposit money banks (DMBs) in Nigeria for the period of 2008-2016 using panel data of 15 listed banks drawn from the Nigerian stock exchange. Correlational research design was used to examine the effect of the bank specific factors on bank profitability. The study utilized feasible generalized least square (FGLS) and found that capital adequacy has a positive and significant relationship with

bank profitability while operational efficiency has a negative and significant relationship with bank profitability.

Tamiru (2013) in his study carried out on asset liability management and commercial Banks profitability in Ethiopia, examined the effect of ALM on commercial banks profitability. Profitability was measured by ROA as a function of balance sheet. The SCA model was used. Macroeconomic variables the real growth rate (GDP) and the general Rate of inflation were also incorporated in this study. The study covers the time period from 2005 to 2010 taking eight commercial banks as a sample. The pooled OLS method was used to estimate the regression result. The study showed that the profitability of commercial banks in Ethiopia is positively affected by assets management, except for fixed assets; which is negatively affected by liability management. The macroeconomic variables have negative effect on commercial banks profitability. The study concludes that assets management positively and liability management negatively affects profitability of Ethiopian commercial banks.

Mulalem (2015), on his study used CAMEL approach to analyze financial performance of commercial banks of Ethiopia using panel secondary data for the period 2010- 2014. Multiple regression model was used for analysis. ROE and ROA was used to measure financial performance. The study showed that CA, AQ and ME have negative relation while EQ and LiQ shows positive relationship with both profitability measures with strong statistical significance. But CA was found to be insignificant for ROA and AQ for ROE.

Abdu (2018) studied internal factors that can affect financial performance of Ethiopian private commercial banks, bank size, liquidity, management efficiency, asset quality and capital adequacy, by taking 6 banks as a sample for the period 2011-2017. Descriptive statistics was employed and ROE, ROA and net interest margin were used to quantify performance. The study declares that CA, ME and size of banks have positive and significant effect on all measures of performance. But liquidity had negative and significant impact on ROE while asset quality was not significant determinant of performance.

Anteneh (2018) conducted a study using CAMEL model by using sample of 11 commercial banks for the period 2011 to 2016. Bank size and net interest margin were also used together with the CAMEL variables and return on asset and return on equity were used to measure profitability. Panel data and descriptive statistics were used and it was shown that capital

adequacy, asset quality, management efficiency, liquidity, and net interest margin were significant variables to explain ROE, but earning quality and size of the bank were not significant variables to influence ROE.

Melaku (2017) analyzed performance of private commercial banks in Ethiopia using CAMEL model descriptive study. Six private banks were used as a sample for the period starting from 2007 to 2016. Fixed asset to total asset, net profit per employee, total loan per number of branches and total deposit per number of branches were also used on top of the CAMEL variables. The study showed that the CAMEL variables except asset quality were found to be significant.

Abdu (2018) studied bank specific factors that can affect financial performance of private commercial banks in Ethiopia, bank size, liquidity, management efficiency, asset quality and capital adequacy, by taking 6 banks as a sample for the period 2011-2017. Descriptive statistics was employed and return on equity, return on asset and net interest margin were used to measure performance. The study found that capital adequacy, management efficiency and size of banks have positive and significant effect on all measures of performance. But liquidity had negative and significant impact on ROE while asset quality was not significant determinant of performance.

2.5 Summary of Literature Review

This study was conducted to identify the effect of asset liability management on the financial performance of Ethiopian commercial banks. The literature review and the empirical studies show that since ALM has a direct impact on the financial performance of banks, having an effective AML process within banks is unquestionable to closely monitor and equalize the management of assets and liabilities. The studies addressed in the above literature showed how asset liability management using the CAMELS model affected profitability. Considering the researches conducted in Ethiopia, there is inconsistency in findings. For example, taking only the studies that used ROE as a measure of profitability; concerning Asset quality, Mulalem (2015), Abdu (2018) and Melaku (2017) put that asset Quality is insignificant for profitability. Quite the opposite, Anteneh (2018) put that Asset Quality is significant for profitability. Then again, regarding earning quality, Adamu and Kenenisa (2017) and Anteneh (2018) found out that earning quality is insignificant for profitability. On the contrary, Mulualem (2015) declare that earning quality is significant for profitability. On top of that, there is no research which used the variable sensitivity to risk to assess the financial performance of commercial banks. This study therefore, aims to find out what the effect of the CAMELS model components on the financial performance of Ethiopian commercial banks really is.

2.6 Conceptual frame work

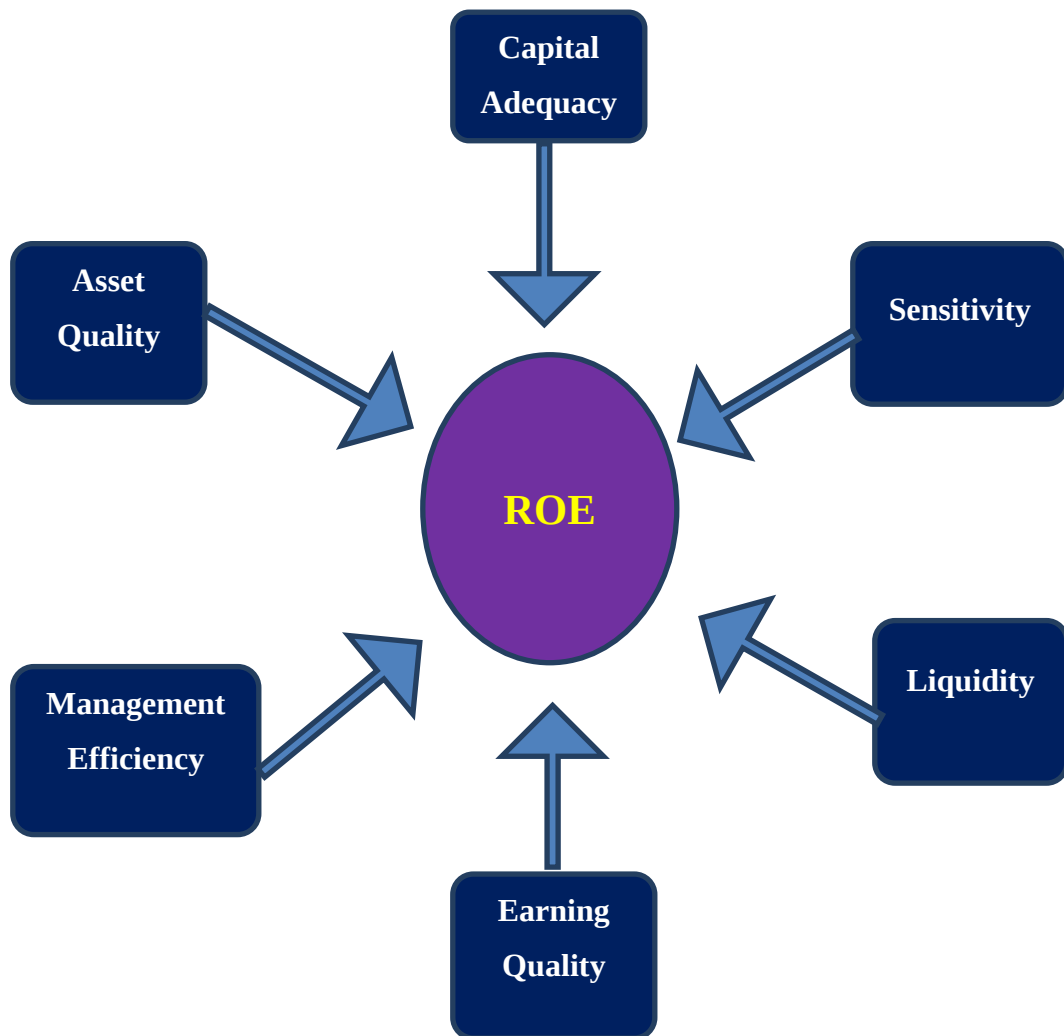


Figure 2. 1 Conceptual frame work for ALM and financial performance prepared based on literature (The CAMELS Model).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter of the study presents the overall research methods used in the study. These include the study area, research approach, research design, population and sample, variable definition, measurements, model specification, data collection, data validity and reliability, and data analysis. The study used the CAMELS model to identify the relationship between Asset liability management and profitability of commercial banks in Ethiopia

3.2 Study area

The study focuses on the effect of Asset Liability Management (ALM) on financial performance of Ethiopian Commercial Banks; the study area is Ethiopian banking industry. Ethiopian Banking industry consists of 17 commercial banks, one Government owned and 16 private commercial banks and one Development Bank which is owned by Government.

3.3 Research Approach

Research approach reveals the researcher's attitude as to how knowledge is constructed and gives information as to what method is to be employed in the study. There are three research paradigms; quantitative research, qualitative research, and mixed research (Creswell 2017). The essence of quantitative research is to use theory to frame and thus understand the problem at hand (Jonker and Pennink 2010). Quantitative research is a means for testing objective theories by examining the relationship among variables (Creswell 2017). Therefore, quantitative research

approach has been used in this study to investigate the effect of CAMELS components on the financial performance of Ethiopian commercial banks.

3.4 Research Design

A research design is a plan or a millstone of the study used to gain answers to research questions or problems. The choice of research design depends on objectives that the researchers want to achieve. Baridam (2001) suggested that the choice of a design is influenced by the purpose of the study, the study setting, unit of analysis and time horizon. As this study targeted to investigate the statistical association of the CAMELS components and financial performance of commercial banks, the research design used for this study was explanatory research design. Explanatory research design is a research design used to describe the dependent and independent variable and then make analysis between them.

3.5 Target Population

The target population of this study was all commercial banks registered by NBE and under operation. Currently, there are 17 commercial banks in Ethiopia: one government-owned and 16 private banks.

3.6 Sample Size and Sampling Method

The study was conducted on 9 Ethiopian commercial banks. Since it allows focusing on particular characteristics of a population that are of interest, purposive sampling was used. It is a type of sampling in which particular settings are deliberately selected. Accordingly, the selected banks as a sample for this study were AIB, DB, WB, OIB, BOA, UB, NIB, CBO and LIB.

3.7 The Study Variables

3.7.1 Dependent Variable

The dependent variable used for the study was the financial performance of the banks and measured by return on equity. It is of great interest to the shareholders. ROE is a measure of the company's efficiency at generating profit from every single unit of shareholders equity. ROE which is also referred to as net worth, allows investors to understand how their money is being put to productive use. Prasanna Chandra (2011) put that ROE is the most critical measure of performance in an

accounting sense. Return on equity is calculated as the ratio of net profit after tax to the stakeholders' equity.

3.7.2. Independent Variables

The independent variables used for the study were the CAMELS components i.e. Capital Adequacy, Asset Quality, Management Efficiency, Earning Quality, Liquidity and Sensitivity to risk.

Capital Adequacy

This component of the CAMELS model is a measurement that defines the solvency of a bank. Adequate capital reserve helps banks to expand and increase the confidence of depositors and regulators. The measure also provides a cushion for potential loan losses and other unanticipated problems. In effect, capital adequacy improves the stability and efficiency of the bank (Parvesh and Sanjeev, 2016). For the purpose of this study, the total equity to total assets ratio has been used as a measure of capital adequacy.

Asset Quality

This ratio is a measure of the degree of the financial strength of a bank. Measurement of asset quality is very significant since it depicts the profitability of the bank. The study used the ratio of allowance for doubtful loans to loans outstanding as a measure for assets quality, since loans and advances make up the large portion of bank assets. (Jayantak, 2012) put that it is the most standard measure to judge the assets quality.

Management Efficiency

This is another critical measure as it assures the survival and growth of a bank. The management efficiency ratio shows the obedience to the norms and regulations set, leadership and administrative competence, and the ability to stand any changing operational environment. Operating cost to operating income ratio was used for this study as a measure for management efficiency. The lower the ratio is the better performance of the management. (Sangmi and Nazir, 2010) put as operating cost to operating income ratio can be used to measure management efficiency.

Earning Capacity

This measure shows the bank's capacity to create proper returns in order to be in a position to expand, retain competitiveness and accumulate worthy retained earnings. High earnings quality reflects the Bank's current operating performance and its capacity of future operating performance. Higher income level is expected to minimize the likelihood of risk of a bank

(Cole and Gunther, 1998). The ratio interest income to total income was used as a measure of earnings quality. Total income of a bank is divided into two parts. Income from core activity i.e. income from lending operations) and income generated by non-core activities like investments, treasury operations, corporate advisory services etc. (Jayanta 2012).

Liquidity

Liquidity means the fund available with a bank to meet its credit demands and cash flow requirements. Banks with larger Volume of liquid assets are perceived safe since these banks will not be affected by unexpected withdrawals. However, custody of a larger volume of liquidity reduces management's capacity to pledge consistently to an investment strategy that protects investors' interest, which is considered as its negative effect. According to Parvesh and Sanjeev (2016) banks can maintain an adequate liquidity position by either increasing current liability or quickly converting their assets into cash. For the purpose of this study, the ratio of total loan to total deposit was used as a measure for liquidity where total deposits included demand deposits, savings deposits, term deposits and other deposits. The higher the ratio, the more credit the bank generates from its deposit received from customers.

Sensitivity

Sensitivity is the sixth component added to the previous five components of the CAMEL model making the model's name CAMELS. It measures how particular risk exposure can cause mess to the bank's profitability. It specially reflects the degree to which interest rate changes can affect earnings and hence the bank's capital (Suresh and Paul, 2014). It also shows the degree to which changes in exchange rates, commodity price and equity price can affect earnings.

Sensitivity can be measured by GAP analysis, a tool used to evaluate a bank's earnings exposure to interest rate movements. A bank's GAP over a given period is the difference between the value of its assets that mature during that period and the value of its liabilities that mature during the same period. If the difference is significant, it means interest rate changes have a great impact on net interest income. If the amounts of maturing assets exactly offset by the repricing liabilities, a balanced position will occur, the ratio will be 1.0. If the GAP ratio is less than 1.0, it means that the bank's liability matures earlier than its assets (an indication that the bank is liability sensitive). If the GAP ratio is greater than 1.0, it means that the bank's assets mature earlier than liabilities (an indication that the bank is asset sensitive). GAP is the difference between risk sensitive assets and risk sensitive liabilities. The GAP ratio is expressed as the ratio of risk sensitive assets to risk sensitive liabilities.

$$GAP = \frac{RSA}{RSL}$$

Where the sum of net advances, net investments and money at call (short term loan payable immediately on demand) is taken as rate sensitive assets and the sum of deposits and borrowings of the bank is taken as risk sensitive liabilities.(Suresh and Paul, 2014). Therefore, This Ratio was used for this study to measure sensitivity.

3.8 Model Specification of the study

To determine the relationship between the CAMELS components and the performance measure (ROE), a regression model was adopted. Because the independent variables are more than one, multiple regression model was deemed appropriate for the analysis of the data Brook(2008).The general multivariate regression model with K independent variables as Brook put is:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_K X_{Ki} + \epsilon_i \quad (i=1, 2, 3, \dots, n)$$

Where Y_i is the i^{th} observation of the dependent variable, $X_{1i}, \dots, X_{Ki}$ are the i^{th} observation of the independent variables, $\beta_0, \dots, \beta_K$ are the regression coefficients, ϵ_i is the i^{th} observation of stochastic error term, and n is the number of observations. Therefore, the effect of asset liability management on profitability based on the CAMELS model in both the FEM and REM are presented here under.

3.8.1 Linear Panel Data Model

To determine the relation between dependent and independent in this study the fixed effects model and the random effects model which are the most common linear panel data analysis models were used (where the REM was chosen over the FEM for the data in the study). Return on equity as a function six explanatory variables. The fixed effect model is given as.

$$ROE_{it} = \beta_0 + \beta_1 CA_{it} + \beta_2 AQ_{it} + \beta_3 ME_{it} + \beta_4 EQ_{it} + \beta_5 LIQ_{it} + \beta_6 S_{it} + \epsilon_{it}$$

And the random effect model is provided as:

$$ROE_{it} = \beta_0 + \beta_1 CA_{it} + \beta_2 AQ_{it} + \beta_3 ME_{it} + \beta_4 EQ_{it} + \beta_5 LIQ_{it} + \beta_6 S_{it} + \epsilon_{it} + \mu_{it}$$

Where, μ_{it} is random effect of the bank specific error y_i , and for $\varepsilon_{it} + \mu_{it} = \gamma_{it}$ the model is given as:

$$ROE_{it} = \beta_0 + \beta_1 CA_{it} + \beta_2 AQ_{it} + \beta_3 ME_{it} + \beta_4 EQ_{it} + \beta_5 LIQ_{it} + \beta_6 S_{it} + \gamma_{it}$$

Where:

Subscript i refers to firm i , and subscript t refers to year t .

ROE_{it} = denotes the dependent variable (profitability of Bank i at time t) measured by Return on Equity (net profit after tax / total equity)

β_0 = Intercept / Constant term

CA_{it} = Capital adequacy of bank i at time t (measured by ratio of total equity to total asset)

AQ_{it} = Asset quality of bank i at time t (measured by ratio of allowance for doubtful loans to loans outstanding)

ME_{it} = Management efficiency of Bank i at time t (measured by ratio of operating cost to operating income)

EQ_{it} = Earnings quality of Bank i at time t (measured by ratio of interest income to total income)

LIQ_{it} = Liquidity of Bank i at time t (measured by ratio of total loan to total deposit)

S_{it} = Risk Sensitivity of Bank i at time t (measured by ratio of Risk sensitive assets to Risk sensitive liabilities)

$\beta_1 - \beta_6$ = Coefficients of parameters

ε_{it} = The unobservable error term where i is cross-sectional and t is time identifier

γ_{it} , the gamma it , denotes the composite error.

Summing up, the random effects estimator and fixed effects estimator, both are models designed to handle the specific structure of panel data. That is, unobservable individual heterogeneity is taken in to account by both models. The difference between the two models is whether the individual specific time invariant effects are correlated with the regressors or not. Moreover, given that the fixed effects model is valid, the random effects estimator still produces consistent estimates of the identifiable parameters.

As it often might be unlikely to believe that the individual specific effects are uncorrelated with the relevant covariates, it is appealing to prefer the random effect estimator to the fixed effects estimator.

3.9 Data Collection

Secondary data Collected from Ethiopian National Bank which is the Central Bank of the Country was used for the study. Published financial statements of the sample banks were also used from the banks' websites. The study covered a 10 years period from the year 2010 to 2019.

Data selection was done based on the measurement of the bank specific variables under investigation. The foremost reason that this study focused on commercial banks was to maintain similarity of data.

3.10 Data Validity and Reliability

Publishing of any information has to attest to the validity and reliability and ensure that the statements show a true and fair view of the banks financial position. Therefore, to ensure validity and reliability of the data collection mechanism, only published data in the form of financial statements which is a requirement by law was used. The same financial statements were also obtained from the national bank of Ethiopia (NBE) Therefore, the data will be considered valid and reliable as it is collected from the attested documents.

3.11 Data Analysis

The study is based on panel data of select commercial banks in Ethiopia. The data constitutes cross-sectional and time series elements; where the cross-section relates to the selected banks and the time series with the 10 years data taken. Panel data was used, because it helps to identify a common group of characteristics and controls for individual heterogeneity, less colinearity among variables and path tendencies in the data which could not be achieved via time series and cross-sectional data (Baral, 2005). The data was analyzed using the statistical software known as Stata version 14.2. Trend Analysis, Descriptive Statistics, correlation analysis and regression analysis were applied to achieve aforementioned research objectives. To study the relationship between the dependent variable and the independent variables, correlation matrix was used. P value and t-statistics were used to study the significance of

independent variables and Regression coefficient to determine how each explanatory variable influence financial performance. Diagnostic tests of CLRM assumptions including Model specification, Multicollinearity, Heteroskedasticity, autocorrelation and normality tests were also conducted to ensure safe application of multiple linear regression model; since the assumptions underlying in CLRM must be fulfilled to say the regression model is acceptable.

CHAPTER FOUR

DATA PRESENTATION, ANALYSES AND DISCUSSION OF RESULTS

4.1 Introduction

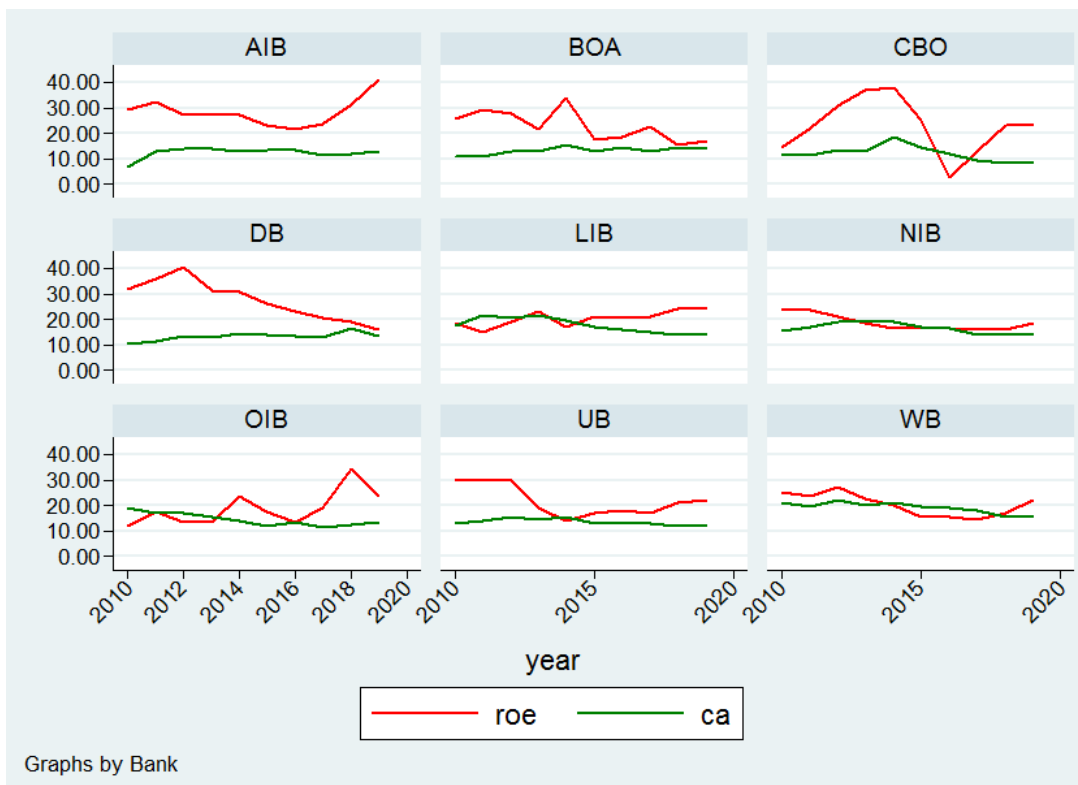
This chapter presents analysis of panel data of the selected banks in Ethiopia for the period from 2010 up to 2019 and the findings thereof. The variables verified in the study includes: Capital adequacy, Asset quality, Management Efficiency, Earning Quality, Liquidity, Sensitivity to risk and Return on Equity which was taken as a measure of profitability. The chapter is organized into two main parts, introduction and findings of the study, where part two is organized in two five subparts; sub part one, trend analysis, sub part two, descriptive statistics, sub part three correlation analysis, sub part four model selection and test for classical linear regression model assumptions and at last sub part five analysis of regression results.

4.2 Findings of the study

4.2.1 Trend Analysis

Return on equity and capital adequacy

Return on equity measures profitability of the banks; how much profit a company generates with the money shareholders have invested.



Source: Own computation using the data from 2010 to 2019, Stata 14.2 output

Figure 4.1: Trends of return on equity and capital adequacy

Figure 4.1 shows the profitability of banks as measured by return on equity and capital adequacy measured as the ratio of total equity to total asset. The trend is presented for nine commercial banks under the study period from 2010 to 2019. As clearly shown in the graph above, the trend of capital adequacy under the study period is more or less constant trend for all banks around 14 percent level. The trends of return on equity showed a variation across banks under the study period. Since 2016 return on equity or profitability for Awash international bank, cooperative bank of Oromia and for united bank shows an increasing trend from 21.5% to 41.1%, 3 % to 23% and 18 % to 22%. But the level of return on equity of Dashen bank, Oromia international bank and Bank of Abyssinia shows a downward trend since 2014 from 30.69 % to 16%, 34.2 % to 23.7% and 33.94% to 16.9% respectively. The trend of return on equity for Lion international bank, Nib international bank and Wegagen bank were stagnant under the study period around 19 %.

Return on equity and asset quality

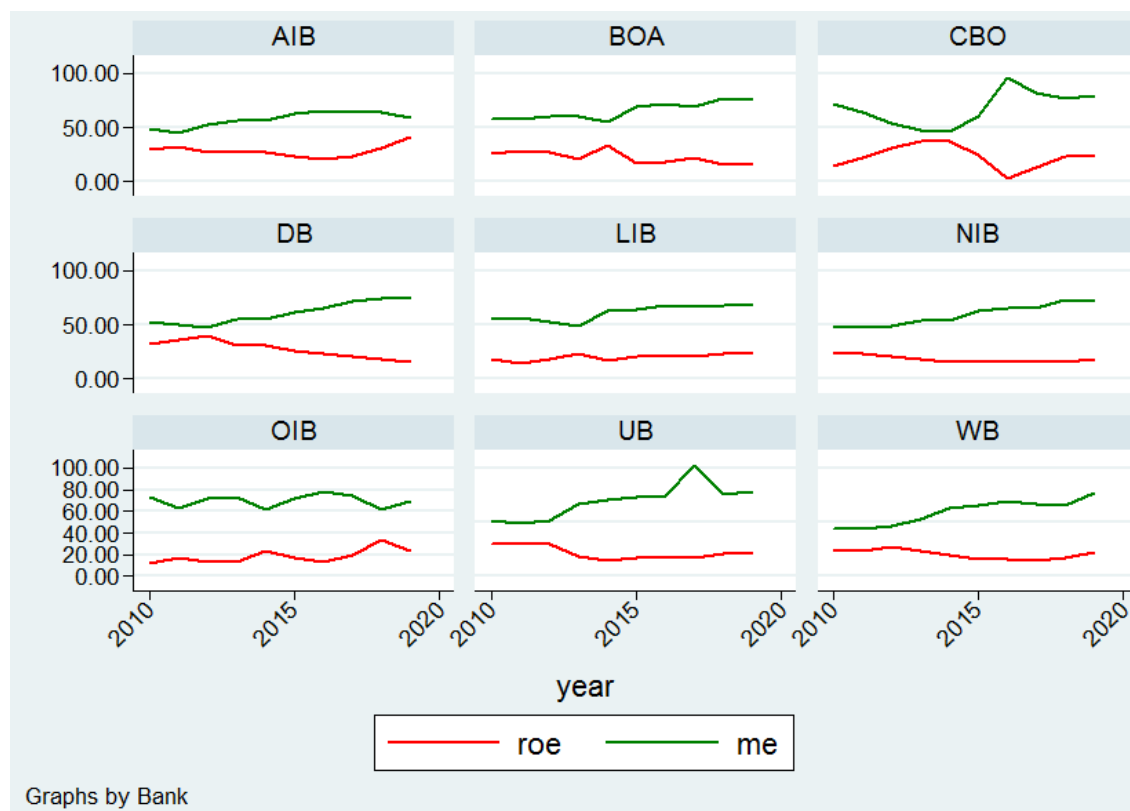


Source: Own computation using the data from 2010 to 2019, Stata 14.2 output

Figure 4.2: Trends of return on equity and asset quality

As per Figure 4.2 above, the trend of return on equity and asset quality for nine commercial banks of Ethiopia under the study period is depicted. More specifically, in average term the trends of asset quality for all banks it seems stagnant around zero but there is slight difference across banks. The trends of asset quality for cooperative bank of Oromia, Lion international bank and Wegagen bank showed increasing trend since 2015 from 0.0% to 3.41 %, 0.0% to 2.48% and 0.0% to 2.16% respectively. But the trend of asset quality form reaming commercial banks have almost stagnant trend around 1 percent during the study period.

Return on asset and management efficiency



Source: Own computation using the data from 2010 to 2019, Stata 14.2 output

Figure 4.3: Trends of return on equity and management efficiency

Figure 4.3 above have showed that the trend of return on equity and management efficiency for all sample commercial banks under the study period. Management efficiency of banks measured as the ration total operating cost to operating income. As clearly shown in the graph above the trend of management efficiency for bank of Abyssinia, Nib international bank, Dashen bank and Wegagen bank have an increasing trend from the period 2014 to 2019 i.e 55.82% to 76.12%, 54.10% to 72.16%, 55.36% to 76.11% and 66.55 % to 70.09% respectively. However, for cooperative bank of Oromia, united bank and Oromia international bank have showed a downward trend from the period 2016 to 2019 i.e 96.54% to 79.34%, 102.69% to 78.10% and 78.62 % to 69.01 %. The trend of management efficiency for Awash international bank and Lion international bank was almost constant around 60 percent.

Return on equity and earning quality



Source: Own computation using the data from 2010 to 2019, Stata 14.2 output

Figure 4.4: Trends of return on equity and earning quality

As per figure 4.4 the trend of return on asset and earning quality for all samples under the study period is presented. Earning quality is measured as the ratio of interest income to total income. As presented in the graph above overall trends of earning quality for all commercial banks registered an upward trend since 2014. More specifically, Nib international bank, united bank and bank of Abyssinia had registered higher increment as compared to other commercial banks from the period 2014 to 2019 i.e 67.03% to 85.7 %, 66% to 85% and 61.96 % to 81.71% respectively. But during the study period the lowest increment on earning quality was recorded on Oromia international bank and Addis international bank i.e 73.3 % and 74.2 % in 2019 respectively.

Return on equity and liquidity



Source: Own computation using the data from 2010 to 2019, Stata 14.2 output

Figure 4.5: Trends of return on equity and liquidity of banks

Figure 4.5 presented the trend of return on equity and liquidity of banks for all sample commercial banks under the study period. Liquidity indicates that the ability of the bank to meet its financial obligations in a timely and effective manner. Liquidity of the banks was measured as the ratio of total loan to total deposit. As per the graph above the trends of liquidity for Awash international bank, bank of Abyssinia and united bank showed increasing trend from 2015 to 2019 i.e 61 % to 79.3%, 53.11 % to 73.83% and 58.10 % to 74.7 % respectively. However, cooperative bank of Oromia recorded downward trend from 2015 to 2018 i.e 89 % to 61%. For the remaining commercial banks, the liquidity trend were almost stagnant since 2015 around 61 %.

Return on equity and sensitivity



Source: Own computation using the data from 2010 to 2019, Stata 14.2 output

Figure 4.6: Trends of return on equity and sensitivity

The trend of return on equity and risk sensitivity of banks is clearly presented in Figure 4.6 above. Risk sensitivity of banks measured as the ratio of risk sensitive asset to risk sensitive liabilities. As clearly indicated in the above figure the trend of risk sensitivity for Awash international bank, Dashen bank, bank of Abyssinia and Lion international bank is recorded in upward trend from the period 2014 to 2019 i.e 87.08 % to 98.55 %, 76.63 % to 102.9%, 81.77% to 96.7 % and 84.36 % to 97.1 % respectively. But the trend for Cooperative bank of Oromia, Nib international bank and Wegagen bank is showed as downward trend from the period 2015 to 2019 i.e 110.32% to 82.3%, 110.02 % to 94.67% and 104.26 % to 98 % respectively. The trend for Oromia international bank and united bank is more or less constant trend over time.

4.2.2. Descriptive statistics

Table 4.1 below summarizes by mean, standard deviation, minimum and maximum values the descriptive statistics of the dependent variable, ROE and the independent variables; capital adequacy, asset quality, management efficiency, earning quality, liquidity and sensitivity to risk for the sample banks for the period from 2010 to 2019.

Table 4.1 descriptive statistics of variables

Variables	Observation	Mean	Std. Dev.	Min	Max
ROE	90	22.43	6.96	3	41.1
CA	90	14.73	3.17	7.04	22.23
AQ	90	1.51	1.36	0	7.41
ME	90	63.41	11.29	43.78	102.69
EQ	90	63.19	11.79	37.9	85.7
LIQ	90	61.09	8.52	40	89
S	90	84.27	14.81	48.43	110.32

Own computation using Stata 14.2 output

Return on equity: As shown in table 4.1, ROE which is the measure of profitability shows that during the study period; 2010-2019, the average profitability of commercial banks of Ethiopia was 22.43 % with a range of minimum 3% and maximum 41%; which depicted that 41% was earned by the most profitable Ethiopian commercial banks during the study period. The standard deviation of ROE which infers the variation of Ethiopian commercial banks' profitability from the mean; being 6.9% showed that there was low variation.

Capital Adequacy: The measure of capital adequacy provides a cushion for potential loan losses and other unanticipated problems. In effect, capital adequacy improves the stability and efficiency of the bank (Parvesh and Sanjeev, 2016). For the purpose of this study, the total equity to total assets ratio has been used as a measure of capital adequacy. The mean value of capital adequacy being 14.73% which is above the minimum requirement of 12% (NBE minimum capital requirement directives No MFI/27/2015) indicates that around 15% of the total assets of the banking sector were financed by shareholders' equity. The stated mean value with a range of minimum 7% and maximum 22.23% and standard deviation of 3.1% showed that the capital adequacy of the banks across the study period do not have significant difference.

Asset Quality: This ratio is a measure of the degree of the financial strength of a bank. Measurement of asset quality is very significant since it depicts the profitability of the bank. The study used the ratio of allowance for doubtful loans to loans outstanding as a measure for assets quality. The output for asset quality of mean value 1.5% with a range of minimum 0%, maximum 7.4% and standard deviation 1.36% showed that there was almost no variation of asset quality among Ethiopian commercial banks during the study period. It also showed that current credit risk management practices being exercised before lending are less strict as the maximum value of 7.4% change from the minimum 0% showed.

Management Efficiency: The management efficiency ratio shows the obedience to the norms and regulations set, leadership and administrative competence, and the ability to stand any changing operational environment. Operating cost to operating income ratio was used for this study as a measure for management efficiency. The lower the ratio is the better performance of the management (Sangmi and Nazir, 2010). The average value of management efficiency was 63.41%, an indicator that overheads are high in the Ethiopian banking sector i.e. banks consume in average 63 cents to generate one-birr revenue. Related to this, the minimum value 43% and the maximum value 102.69% together with the 11.29% standard deviation showed that there was variation among management efficiency of the sample Ethiopian commercial banks during the study period.

Earning Quality: A high earnings quality reflects the Bank's current operating performance and its capacity of future operating performance. Higher income level is expected to reduce the likelihood of risk of a banks (Cole and Gunther, 1998). In this study, the ratio interest income to total income was used as a measure of earnings quality. The mean value of earning quality being 63.19% together with the minimum value of 37.9, maximum value 85.7% and standard deviation of 11.79% depicted that there was variation of earning quality among the sample commercial banks of Ethiopia during the study period.

Liquidity: According to Parvesh and Sanjeev (2016) Banks can maintain an adequate liquidity position by either increasing current liability or quickly converting their assets into cash. For the purpose of this study, the ratio of total loan to total deposit was used as a measure for liquidity. The mean value of liquidity being 61% displayed that the banking sector was very liquid during the study period, which is four times more than the current minimum regulatory requirement of National Bank of Ethiopia which is 15% (NBE Directives No. SBB/57/2014). Even the minimum

value, 40%, is more than twice of the minimum requirement. The 61% mean value showed that 61% of the deposits of commercial banks were converted to loan during the study period. The standard deviation of 8.52% showed that the liquidity ratio differs from bank to bank and from time to time within a specific bank. All sample banks have maintained the minimum level of liquidity requirement.

Sensitivity to Risk: Sensitivity to risk means the degree to which changes in conversion rates, commodity price and equity price can affect earnings quality of the banks. The mean value of sensitivity was 84.27% with a minimum value of 48.43 and a maximum of 110.32% and standard deviation of 14.8%. All together showed that there was high deviation from the mean in this regard; which showed that Ethiopian commercial banks had different level of risk sensitivity during the study period.

4.2.3. Correlation Analysis

In this section the correlation analysis between the dependent and explanatory variables were presented.

Table 4.2 Correlation matrix of dependent and independent variables

	ROE	CA	AQ	ME	EQ	LIQ	S
ROE	1.00						
CA	-0.2197	1.00					
AQ	0.3272	-0.1075	1.00				
ME	-0.6446	-0.3405	-0.4494	1.00			
EQ	-0.3713	-0.2655	-0.4281	0.6895	1.00		
LIQ	-0.1225	0.0016	-0.2831	0.3218	0.6084	1.00	
S	-0.2681	0.0673	-0.05210	0.4024	0.6691	0.07908	1.00

Own computation using Stata 14.2 output

As per the correlation table above, return on equity has negative relationship with capital adequacy, management efficiency, earning quality, liquidity and sensitivity of banks. The correlations clearly show that capital adequacy, management efficiency, earning quality, liquidity and sensitivity to risk of banks moves in opposite direction to profitability; while it has positive relationship with asset quality which implies that they move in the same direction. The correlation result also showed that profitability is most highly correlated with management efficiency.

Since correlation analysis just show the relationship and direction of dependent and independent variables but not the cause and effect association, regression analysis presented in the below part was taken as a remedy to fill this gap.

4.2.4. Model Selection and Test of CLRM assumptions

Holding the CLRM assumptions helps the estimators determined by OLS to have a number of desirable properties that is consistent, unbiased, and efficient. Therefore, tests of CLRM were conducted to ensure whether the data fits the basic assumptions of classical linear regression model or not. The two types of panel estimator approaches that can be used in financial research according to Brook, (2008) are the fixed effects models (FEM) and the random effects model (REM).

4.2.4.1 Specification Test

In this study the researcher used the specification tests in order to choose the suitable econometric model. In this regard, Hausman specification tests enable to determine which of the two models (fixed effects model or random effects model) is best suited in comparison to the data. The Hausman test (1987) can be used to many econometric problems that need specification. In this research case, the tested hypothesis offers guidance for choosing between fixed and random effects.

And therefore, it was hypothesized that:

H_0 = Random effect model

H_1 = Fixed effect model

And the Hausman test was applied and the result is given as follows;

Table 4. 3Hausman test

```
. hausman fe re
```

	Coefficients			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
ca	-.8976087	-1.091099	.1934904	.1408974
aq	-.5191734	-.6806271	.1614537	.1393628
me	-.6534199	-.6075555	-.0458644	.0213762
eq	.1243775	.055691	.0686865	.0253578
liq	.1972556	.1899193	.0073363	.0146311
s	-.0620463	-.0600975	-.0019488	.0093746

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

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
 = 3.65
 Prob>chi2 = 0.7237
 (V_b-V_B is not positive definite)

Source: Own computation using Stata 14.2 output

The results from the Hausman test led to the acceptance of the null hypothesis and rejection of the alternative hypothesis. The model used is therefore the random effects model.

4.2.4.2 Test for Normality

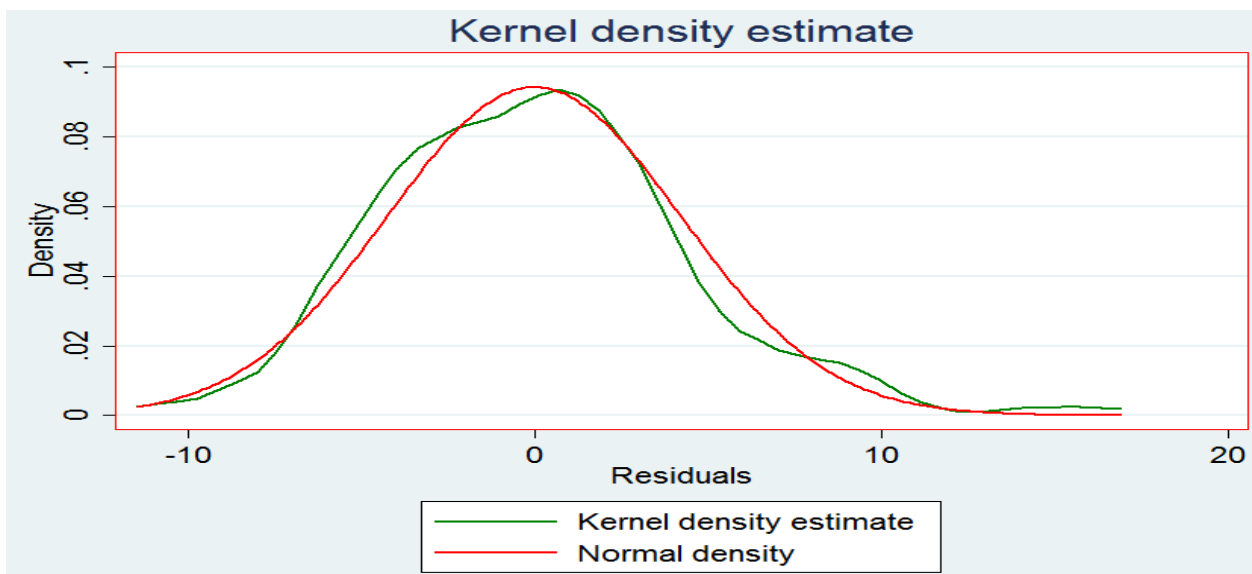
The normality assumption plays a crucial role in the validity of inference procedures, specification tests and forecasting. Non-normal error components in the panel data affect the performance of several tests, like the performance of panel heteroskedasticity tests severely affected. Among all the CLRM assumption the zero- mean value of the error term is the first one to be addressed. Thus, in order to test the normality of the data Shapiro-Wilk W test for normal data is used. According to Shapiro-Wilk W test for normal data, the data is normal if the p value is greater than 0.05 and not if p value is less than 0.05. In test Shapiro-Wilk W test the null hypothesis states that the error term of the model is normally distributed and if the P value is greater than 0.05 then the null hypothesis will be accepted.

Based on Shapiro-Wilk W test for normal data and residual plot below the error term is normally distributed since p value is 0.058 which is above 0.05. In this case, we have enough evidence to say error term of the model is normally distributed.

Table 4. 4 Shapiro-Wilk W test for residuals

Shapiro-Wilk W test for normal data					
Variable	Obs	W	V	z	Prob>z
r	90	0.97314	2.032	1.564	0.05895

Source: Own computation using Stata 14.2 output



Source: Own computation using Stata 14.2 output

Figure 4.7 Kernel density estimate

4.2.4.3 Test for Heteroskedasticity

The heteroskedasticity assumption states that the variance of the error term ($U_{it}U_{jt}$) across observation is unchanged. If the variance of the error term is not constant it is said to be heteroskedasticity (Wooldridge, 2004). In the presence of heteroskedasticity error terms in the model, the regression coefficient, results will be consistent estimates but the estimates will not be

efficient. The loss of efficiency of the estimates will lead to invalid inference through biased standard error (Gujarati, 2004). Modified Wald test for heteroskedasticity was used for testing whether the error variances are constant or not. The decision rule behind this test for Heteroskedasticity states that the significant result from the test is indicating the regression of the residuals on the predicted values reveals significant Heteroskedasticity. Even if the problem of Heteroskedasticity does not really matter in panel data approach, we must detect and give appropriate estimate to avoid biased estimation. And hence the problem of Heteroskedasticity was handled by using generalized least squares or using xtglm command in order to get unbiased estimators. After adjusting the heteroskedasticity problem the test presented as follows.

Modified Wald test for groupwise heteroskedasticity
in cross-sectional time-series FGLS regression model

$H_0: \sigma(i)^2 = \sigma^2$ for all i

chi2 (9) = 9.57
Prob>chi2 = 0.3860

Source: Own computation using Stata 14.2 output

4.2.4.4 Test for Multicollinearity

In the presence of multicollinearity, the explanatory variables correlated with each other and the regression coefficients possess large standard errors (in relation to the coefficient themselves). Because of the presence of multicollinearity in a given model, the coefficients cannot be estimated with great precision or accuracy (Gujarati, 2004). To check the presence of multicollinearity or not this study used Pearson pairwise correlation and variance inflation factor. Thus, as can be seen from the result below, since the VIF, 2.60 is less than 10 and no correlation matrix value of greater than 0.8, there is no multicollinearity problem.

Table 4.5 VIF Table

Variable	VIF	1/VIF
s	4.03	0.248358
eq	3.23	0.309182
liq	2.99	0.334756
me	2.27	0.440249
aq	1.71	0.583642
ca	1.34	0.747066
Mean VIF	2.60	

Source: Own computation using Stata 14.2 output

Table 4.6 Correlation analysis among independent variables

```
. pwcorr ca aq me eq liq s
```

	ca	aq	me	eq	liq	s
ca	1.0000					
aq	-0.1075	1.0000				
me	-0.3405	-0.4494	1.0000			
eq	-0.2655	-0.4281	0.6895	1.0000		
liq	0.0016	-0.2831	0.3218	0.6084	1.0000	
s	0.0673	-0.5210	0.4024	0.6691	0.7908	1.0000

Source: Own computation using Stata 14.2 output

4.2.4.5 Test for Autocorrelation

The covariance between two consecutive error terms i.e. ($U_{it}U_{jt} = 0$) we can say that the error term uncorrelated to each other or simply the error terms subject to autocorrelation Verbeek, (2000). The classical error component panel data model assumes serially uncorrelated disturbances, where the covariance between error terms over time is zero. If the error terms are correlated with one another, it is said to be they are autocorrelated or that they are serially correlated. A number of tests for the presence of autocorrelation in a fixed effects panel data model have been proposed in the literature. The Wooldridge test for autocorrelation in our panel data was used for testing serial correlation between error variances. From Wooldridge test for $N = 90$ observations and $k = 6$ number of explanatory variables taken at 5% level of significance, accepted the null which states that there is no first order autocorrelation.

Wooldridge test for autocorrelation in panel data
 H_0 : no first-order autocorrelation
 $F(1, 8) = 4.718$
 $\text{Prob} > F = 0.0616$

Source: Stata 14.2 out put

Test for cross-section dependency

Cross-sectional dependence arises because of the presence of common shocks and unobserved components that ultimately become part of the error term. If there is a cross-sectional dependency in

the model, the standard fixed effect and random effect estimators are consistent but not efficient, the estimated standard errors are biased. Lagrange multiplier (LM) test, developed by Breusch and Pagan (1980) is widely used in cross-sectional dependency test. Therefore, this study used Breusch Pagan cross-sectional dependency test. As per the test below, Breusch Pagan cross-sectional dependency test does not reject the null hypothesis of cross-sectional independence because of the p-value in both testes more than 0.05 i.e. 0.4012. Hence, there is enough evidence suggesting the absence of cross-section dependency in the model.

Breusch-Pagan LM test of independence: $\chi^2(36) = 37.477$, $Pr = 0.4012$
Based on 10 complete observations

Own computation using Stata 14.2 output

4.2.5. Analysis and Interpretation of Regression Result

Table 4. 7 Regression result

Variables	Coefficient	Std. Err.	t-statistic	p-value
CA	-1.185	0.1541	-7.69	0.000***
AQ	-0.70	0.4061	-1.72	0.085*
ME	-0.563	0.05648	-9.97	0.000***
EQ	-0.0045	0.0645	-0.07	0.9444
LIQ	0.1809	0.08582	2.11	0.035**
S	-0.0495	0.05735	-0.86	0.388
Cons	70.089	5.3186	13.18	0.0000
R ² within = 0.6616				Wald $\chi^2(6) = 161.98$
R ² between = 0.6668				Prob > $\chi^2 = 0.0000$
R ² overall = 0.6610				Observation = 90

Note: ***, **, & * indicates significance level at 1%, 5% & 10% respectively.

Source: Own computation using Stata 14.2 output

Therefore, according to the above regression result, the model developed to analyze the effect of ALM on the Ethiopian commercial banks' financial performance in this study was:

$$ROE_{it} = 70.089 - 1.1850CA - 0.7000AQ_{it} - 0.5631ME_{it} - 0.0045EQ + 0.1809LIQ_{it} - 0.0495S$$

Random effect Regression analysis of ROE

The regression Table 4.7 demonstrates the relationship between dependent variable (ROE) and six independent variables. As it is observed from the regression output, between and the overall R-square shows a value 0.6668 and 0.6610 respectively, which means 66 % variation on ROE was explained by independent variables; management efficiency, capital adequacy, asset quality, earning quality, liquidity and sensitivity of the banks collectively. The remaining 34 % of the variation is unexplained by the employed explanatory variables. From the total of six independent variables four variables were significant i.e. capital adequacy, asset quality, management efficiency and liquidity. But two variables were found not having significant effect on return on equity of Ethiopian commercial banks i.e. earning quality and sensitivity. From the random effect regression model the probability values of F-statistic tells us the overall significance the model (all independent variables altogether). Accordingly, the probability value of F-statistic was 0.0000 with Wald $\chi^2(6)$ of 161.98 the p-value was smaller than 0.05, therefore, we can say that overall the model is significant at 1% and the explanatory variables were jointly significant.

Capital Adequacy (CA)

As per table 4.7 presented that, the coefficient of capital adequacy measured by total capital to total asset is -1.185. The coefficient is negative and has statistically significant effect on return on equity at 1 percent level of significance. On the average holding other independent variables constant, when capital adequacy increased or decreased by 1 % then return on equity of banks in the study sample was decreased or increased by 1.185 %. Therefore, the study failed to accept the alternative hypothesis that capital adequacy has a positive effect on return on equity in private commercial banks of Ethiopia. This means, there is no sufficient evidence to support the positive relationship between return on equity and capital adequacy.

The negative relationship is not as expected and this negative relationship between capital adequacy and return on equity might be because a bank with high capital adequacy ratio has low financial performance i.e. return on equity. The possible reason for the negative relationship could be argued that high capital adequacy leads to low profits since banks with high level of capital ignores the

potentials investment opportunities or simply risk averse. The finding of this study is in line with the findings of Mulalem (2015). But the result of this study is inconsistent with the findings of Jayanta(2012), Chen (2003), Serhat Yuksel, Hasan Dincer and Umit Hacioglu (2015), Lizabeth Samuel (2018), Mohammed Kamru Ahsan (2016), Zafar et al. (2017), Nurazia and Evans (2005), Tuffour, Owusu, and Boateng, (2018), Saheed (2018), Adamu and kenenisa (2017), Anteneh (2018), Melaku (2017) and Abdu (2018). They argued that banks with adequate level of capital are in good position since it is necessary to prevent from failure and bankruptcy and then improve the performance of banks.

Asset quality (AQ)

As presented in the above table the coefficient of asset quality measured by non-performing loans to total loans is -0.7. The coefficient is negative and has statistically moderate significant effect on return on equity at 10 percent significance level. On the average holding other independent variables constant when, asset quality increased by 1 % then return on equity of banks in the study sample was decreased by 0.7 %. Therefore, the study failed to accept the null hypothesis that asset quality has a positive effect on return on equity of private commercial banks in Ethiopia. This means, there is enough evidence to support the positive relationship between return on equity and asset quality. The relationship is negative as expected and this negative relationship between asset quality and return on equity could be attributed to the fact that a bank which has high NPL has low level of financial performance i.e. return on equity. The possible reason for the significant negative relationship between asset quality and return on equity could be the low collectivity of the loans with their interest income according to the schedule in Ethiopian commercial banks.

The finding of this study is consistent with the findings of Baral (2005), (Aburime, 2008), Koch (1995), Olweny (2011), Jonathan (2013), Lizabeth Samuel (2018), Mohammed Kamru Ahsan (2016), Nurazia and Evans (2005), Mulalem (2015), Adamu and kenenisa (2017), Anteneh (2018), Melaku (2017), Abdu (2018) they proposed that the quality of asset depends on the level of doubtful loans and outstanding loans and hence asset quality affect performance of the banks. The lower the ratio of total doubtful loans to total loans means that the higher asset quality this in turn leads to the favorable for bank performance by minimizing risk related to loan. Poor asset quality is major causes of bank failures as a result high non-performing loan associated with low financial performance.

Management Efficiency

As per what table 4.7 presented, the coefficient of management efficiency measured by total operating cost to total operating income is -0.563. The coefficient is negative and has statistically significant effect on return on equity at one percent level of significance. The coefficient of management efficiency interpreted as holding constant other explanatory variables when management efficiency increased by one percent, the level of bank performance in terms of return on equity decreased by 0.563%. Therefore, the study failed to accept the null hypothesis that management efficiency has a positive effect on return on equity in Ethiopia private commercial banks. This means, there is enough evidence to support the positive relationship between return on equity and management efficiency measured as the ratio of total operating cost to total operating income. The relationship is negative as expected and this negative relationship between management efficiency and return on equity is because of a bank which has high total operating cost related to total operating income has low financial performance i.e return on equity.

The findings of this study is in line with the findings of Flamini et al. (2009), Sufian and Chong, 2008 and Kosmidou et al., 2004, Abdulazeez, Asish, and Rohani (2017), Lizabeth Samuel (2018), Sheela and Bastray, (2014), Mohammed Kamru Ahsan (2016), Ahmad, Ahmad, and Adeel (2016), Nurazia and Evans (2005), Ongore and Kusa (2013), Angele (2008), Gyekyi (2011), Tamiru (2013), Mulalem (2015), Adamu and Kenenisa (2017), Anteneh (2018), Melaku (2017) and Abdu (2018). They argued that management efficiency is one of the key determinants of profitability of banks. The lower ratio of total operating cost to total operating income leads to the higher management efficiency in turn this leads to profitability and performance of banks. But the result of this study inconsistent with the findings of Zafar et al. (2017).

Earnings quality

As presented in table 4.7, the coefficient of earning quality measured as interest income to total income is -0.0045. The coefficient is negative and has statistically insignificant effect on bank performance measured as return on equity. The coefficient interpreted as on the average holding

other explanatory variables constant when earning quality increased by one percent then return on equity decreased by 0.0045% but the effect is statistically insignificant. Therefore, the study failed to accept the alternative hypothesis that earning quality has a positive effect on return on equity in Ethiopia private commercial banks. This means, there is enough evidence to support the positive relationship between return on equity and earning quality.

The findings of this study is inconsistent with the findings of Hamad (2015) and Zubaid et al. (2018), Mihail (2009), Mohammed Kamru Ahsan (2016), Saheed (2018), Anteneh (2018) and Melaku (2017) they argued that earning quality explains the sustainability and growth of banks. It will also determine the performance of banks; the higher earning quality reflects the current and the future operational performance of banks; move in good way.

Liquidity

As table 4.7 above presented, the coefficient of liquidity measured as total loan to total deposit is 0.1809. The coefficient is positive and has statistically significant effect at 5 percent level of significance on bank performance measured in return on equity. The coefficient interpreted as on the average holding other explanatory variables constant when liquidity of banks increased by one percent then the level of bank performance measured as return on equity increased by 0.1809%. Therefore, the study failed to accept the null hypothesis that liquidity of banks has a negative effect on return on equity in Ethiopia private commercial banks. This means, there is enough evidence to support the negative relationship between return on equity and liquidity of banks measured as the ratio of total loan to total deposit. The relationship is positive as expected and this positive relationship between liquidity of banks and return on equity could be attributed to the fact that a bank which has high total loan relative total deposit has high financial performance i.e return on equity.

The finding of this study is consistent with the findings of Said (2003), Graham(2010), Mihail (2009), Al-Tamimi(2010), SheelaandBastray,(2014), Mohammed Kamru Ahsan (2016), Ahmad, Ahmad, and Adeel (2016), NuraziaandEvans(2005), Olwenyand Shipo(2011), Kamau(2009), Onyekwelu, Chukwuani, and Onyeka (2018) Gweyi, Anteneh (2018) and Melaku (2017) they argued that the ratio of total loan to total deposit reflects the most common liquidity position of banks. The higher level of liquidity in the banks reflects, higher interest income from the

loan and then increase the bank performance. But the result is inconsistent with the findings of Tobias, and Oloko (2016), Tuffour, Owusu, and Boateng, (2018), Abdu (2018).

Risk sensitivity

As presented in the table, the coefficient of risk sensitivity of banks measured as the ratio of risk sensitivity assets to risk sensitivity liabilities is - 0.049. The coefficient is negative and has statistically insignificant effect on bank performance measured in return on equity. On the average holding other explanatory variable constants when, risk sensitivity of banks increased by one percent then the level of bank performance measured in return on equity decreased by 0.0495 % in the study sample. But the effect is statistically insignificant. Therefore, the study rejects the alternative hypothesis that there is negative relationship between risk sensitivity of banks and return on equity. This means, there is enough evidence to support the positive relationship between risk sensitivity of banks and return on equity in Ethiopia private commercial banks. The result of the study is in line with the findings of Suresh and Paul, 2014) but inconsistent with the findings of Zafar et al. (2017).

CHAPTER FIVE

SUMMARY CONCLUSION AND RECOMMENDATIONS

5.1.Introduction

This chapter presents summary of research findings, conclusion and recommendations together with suggestions for future research. Accordingly, the first part deals with summary of the study findings, the second part put conclusion of the study as per the result, the third part presents the study recommendations. Finally, suggestions for further research has been given on the last part of this chapter.

5.2. Summary

The main objective of the study was to investigate the effect of asset liability management on financial performance of Ethiopian commercial banks based on the CAMELS model. The following hypotheses which were formulated in line with the specific objectives were tested.

1. There is significant and positive relationship between Capital adequacy and performance
2. There is significant and negative relationship between Asset quality and performance
3. There is significant and negative relationship between Management efficiency and performance
4. There is significant and positive relationship between Earning quality and performance
5. There is significant and positive relationship between Liquidity and performance
6. There is significant and negative relationship between sensitivity to risk and performance

The research used quantitative approach and descriptive design. Descriptive statistics, correlation and multiple regression analysis were conducted to analysis the panel, secondary data of 9 Ethiopian commercial banks taken as a sample for the period of 2010 to 2019. The study used Stata software version 14.2. the model selected as appropriate for the data was Random effect model. Since the

CLRM assumption tested were all found to be valid, the model was statistically appropriate to the data assuring that the data was represented consistently. The variables studied was ROE as a measure of performance and the CAMELS components; capital adequacy, asset quality, management efficiency, earning quality, liquidity and sensitivity to risk.

The findings of the descriptive study depicted that during the study period; 2010-2019, the average profitability of commercial banks of Ethiopia was 22.44 %. The standard deviation of ROE being 6.9% showed that there was low variation. The mean value of capital adequacy being 14.73% indicates that around 15% of the total assets of the banking sector were financed by shareholders' equity. The standard deviation of 3.1% showed that the capital adequacy of the banks across the study period do not have very significant difference. The output for asset quality of mean value 1.5% and standard deviation 1.36% showed that there was almost no variation of asset quality among Ethiopian commercial banks during the study period. The average value of management efficiency was 63.41%, an indicator that overheads are high in the Ethiopian banking sector where the 11.29% standard deviation showed that there was a significant variation among management efficiency of the sample Ethiopian commercial banks during the study period. The mean value of earning quality being 63.19% and standard deviation of 11.79% depicted that there was variation of earning quality among the sample commercial banks of Ethiopia during the study period. The mean value of liquidity being 61% displayed that the banking sector was very liquid during the study period, The 61% mean value showed that 61% of the deposits of commercial banks were converted to loan during the study period. The standard deviation of 8.52% showed that the liquidity ratio differs from bank to bank and from time to time within a specific bank. The mean value of sensitivity was 84.27% and standard deviation of 14.8%. showing that there was very high deviation from the mean in this regard; which showed that Ethiopian commercial banks had different level of risk sensitivity during the study period.

Whereas, the regression result showed that the between and the overall R-square shows a value 0.6668 and 0.6610 respectively, which means 66 % variation on ROE were explained by independent variables are management efficiency, capital adequacy, asset quality, earning quality, liquidity and sensitivity of the banks collectively. The remaining 34 % of the variation is unexplained by the employed explanatory variables. Capital adequacy, asset quality, management efficiency and liquidity were found significant. But earning quality and sensitivity were not significant. From the

random effect regression model the probability values of F-statistic tells us the overall significance the model (all independent variables altogether). Accordingly, the probability value of F-statistic was 0.0000 with Wald chi2(6) of 161.98 the p-value was smaller than 0.05, therefore, the model overall is significant at 1% and the explanatory variables were jointly significant.

Regarding the relationship of the explanatory variables with the explained variable, Capital adequacy, asset quality, management efficiency, earning quality and sensitivity were found to have negative relationship with profitability while liquidity was found to be the only variable having positive relationship with profitability.

5.3 Conclusion

As depicted by the R^2 and F-statistics, ROE was 66% explained by independent variables i.e. earning quality, capital adequacy, asset quality, management efficiency, liquidity and sensitivity of the banks collectively and only 34% by other factors, this shows that asset liability management has very great effect on profitability of Ethiopian commercial banks.

Capital adequacy found to be statistically significant at 1% level of significance, has very great effect on profitability with a negative relationship. Asset quality also has moderate effect on profitability; it is found to be statistically significant at 10% level of significance having negative relationship. Management efficiency is found to be the factor having the utmost effect on profitability being significant at 1% level of significance and great correlation with financial performance; have negative relationship. Earning quality and profitability have negative relationship but earning quality is found to be statistically insignificant. Liquidity is found to be the only factor that has positive relationship with financial performance with statistical significance at 5% significance level. Sensitivity and profitability have negative relationship but sensitivity is found to be statistically insignificant.

Based on the research findings, it has been concluded that capital adequacy, management efficiency and liquidity are the most important factors that affect the financial performance of Ethiopian commercial banks since they are significant at 1% and 5% significance level; where management efficiency is the utmost important factor having greater correlation with profitability of Ethiopian commercial banks. Asset quality is also one of the factors that affect financial performance of

commercial banks of Ethiopia; it was significant at 10% level of significance.

5.4. Recommendations

Since capital adequacy, asset quality, management efficiency and liquidity are the important factors that affect the financial performance of Ethiopian commercial banks, bank managers should give them due attention. Specially, great attention should be given for management efficiency to maximize profitability.

1. The research findings revealed that now a days there are less strict credit risk management practices. Thus, Ethiopian commercial banks need to advance their credit risk management dimensions.
2. Since a significant variation among management efficiency of Ethiopian commercial banks were observed and that management efficiency was found to be the utmost important factor affecting profitability, banks should pay great attention to qualified and dedicated man power and adherence of internal policies in this regard.
3. To use the opportunity of very rewarding investments and at the same time meet withdrawal and credit needs of customers, commercial banks of Ethiopia must manage their liquidity level.

5.5 Suggestion for further research

It will be of a great contribution to observe the financial performance of Ethiopian commercial banks by incorporating some other explanatory variables. One of the limitations of this study was that it focused only on bank specific factors. Though, there are different ratios that can be used in this regard, it is difficult to consider all at a time. So, this study used only some of the ratios available. Therefore, investigating the financial performance of Ethiopian commercial banks using different ratios may indicate a different result. The findings of this study base only on secondary data obtained from the NBE and is dependable only to the level of accuracy of the financial statements used. Therefore, investigating the issue by supporting with primary data, will play a paramount importance. At last since the CAMELS model can also be used to investigate financial performance of Insurances and other financial institutions, considering this will have its significance for managers of such institutions.

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Appendices

Appendices I: List of Commercial Banks operating in Ethiopia

S.No	Name of the Bank	Year of Establishment
1	Commercial Bank of Ethiopia	1974
2	Awash International Bank	1994
3	Dashen Bank	1995
4	Bank of Abyssinia	1996
5	Wogagen Bank	1997
6	United Bank	1998
7	Nib International Bank	1999
8	Cooperative Bank of Oromia	2004
9	Lion International Bank	2006
10	Oromia International Bank	2008
11	Zemen Bank	2008
12	Bunna International Bank	2009
13	Birhan International Bank	2009
14	Abay Bank	2010
15	Addis International Bank	2011
16	Debub Global Bank	2012
17	Enat Bank	2012

Source: www.nbe.gov.et

Appendices II: Ratios considered in the study

BANK	YEAR	ROE	CA	AQ	ME	EQ	LIQ	S
AIB	2010	29.30	7.04	4.71	48.91	44.20	51.50	68.29

AIB	2011	32.10	13.21	3.64	45.55	42.60	51.50	70.31
AIB	2012	27.00	13.83	2.70	52.23	60.20	59.80	88.14
AIB	2013	28.00	13.91	2.30	56.20	59.80	61.50	81.42
AIB	2014	27.20	12.97	2.27	56.87	56.70	61.00	87.08
AIB	2015	23.00	13.34	1.74	62.57	63.50	67.40	95.56
AIB	2016	21.50	13.29	1.53	65.09	68.10	67.70	90.27
AIB	2017	23.70	11.46	1.46	64.12	68.70	73.80	95.52
AIB	2018	31.30	11.75	0.82	63.72	77.70	72.00	91.19
AIB	2019	41.10	12.91	0.86	58.49	74.20	79.30	98.55
BOA	2010	25.45	10.96	7.41	58.13	55.84	61.36	56.82
BOA	2011	29.04	10.91	3.33	58.19	60.20	54.58	66.21
BOA	2012	27.60	12.96	2.57	60.09	68.80	57.56	77.68
BOA	2013	21.48	12.89	1.99	60.09	68.80	55.34	83.15
BOA	2014	33.94	15.36	0.00	55.82	61.96	55.64	87.34
BOA	2015	17.47	12.82	0.00	69.02	70.70	53.11	81.77
BOA	2016	18.33	14.29	0.00	71.37	67.21	58.76	86.00
BOA	2017	22.68	13.05	0.00	69.22	66.93	67.28	92.42
BOA	2018	15.74	14.40	1.17	76.61	83.12	69.75	94.43
BOA	2019	16.90	13.85	1.32	76.12	81.71	73.83	96.70
CBO	2010	14.50	11.81	2.53	71.87	58.30	52.60	53.00
CBO	2011	22.00	11.39	2.00	64.51	49.00	40.00	52.53
CBO	2012	31.00	13.52	1.44	54.02	57.00	49.00	70.25
CBO	2013	37.00	12.88	1.72	47.73	44.00	47.00	66.76
CBO	2014	38.00	18.43	0.00	46.14	48.00	67.00	83.07
CBO	2015	25.00	14.70	0.00	60.77	57.00	89.00	110.32
CBO	2016	3.00	11.76	0.00	96.54	77.00	70.00	91.40
CBO	2017	13.00	9.59	0.00	82.28	77.00	68.00	91.32
CBO	2018	23.00	8.63	0.00	76.65	74.00	57.00	78.20
CBO	2019	23.00	8.67	3.41	79.34	76.00	61.00	82.30
DB	2010	31.89	10.64	2.18	52.48	50.05	49.77	62.74
DB	2011	35.77	11.20	1.99	50.87	47.08	52.51	65.80
DB	2012	40.44	13.33	2.15	48.23	52.03	57.76	76.83
DB	2013	31.33	13.10	2.25	55.25	56.18	55.91	78.34
DB	2014	30.69	14.50	0.00	55.36	53.19	55.33	76.63
DB	2015	26.41	14.01	1.68	61.68	56.23	58.18	86.77
DB	2016	23.15	13.66	1.71	65.22	55.67	55.78	83.34
DB	2017	20.57	13.17	2.02	71.31	60.62	65.09	93.58
DB	2018	18.84	16.56	0.98	74.19	73.22	64.71	94.76
DB	2019	16.00	13.31	0.65	76.11	80.33	72.84	102.09
LIB	2010	18.43	17.73	1.62	54.92	50.77	57.39	56.56
LIB	2011	15.00	21.70	1.45	56.18	54.00	52.00	64.17

LIB	2012	19.00	20.62	1.55	52.32	53.00	56.00	75.11
LIB	2013	23.00	21.80	1.30	49.26	57.00	63.00	91.33
LIB	2014	17.00	19.85	0.00	62.81	61.00	57.00	84.36
LIB	2015	21.00	16.89	0.00	64.72	51.00	64.00	91.82
LIB	2016	20.74	15.80	0.00	68.23	58.92	67.95	94.86
LIB	2017	21.32	15.19	0.00	66.34	73.24	62.52	90.05
LIB	2018	23.99	14.21	2.48	68.13	77.82	64.96	92.04
LIB	2019	24.68	14.43	1.94	68.64	75.40	72.29	97.01
NIB	2010	24.42	15.46	3.90	48.75	47.85	61.69	71.48
NIB	2011	23.61	16.84	4.12	47.60	50.69	53.64	66.35
NIB	2012	21.21	18.94	2.71	48.71	57.10	63.53	87.53
NIB	2013	18.75	18.94	2.50	53.98	67.03	68.26	98.46
NIB	2014	16.38	18.87	0.00	54.10	67.03	68.25	102.98
NIB	2015	16.28	17.26	0.00	63.53	73.47	70.53	110.02
NIB	2016	16.60	16.61	0.00	65.63	79.74	60.47	95.03
NIB	2017	16.21	14.05	0.00	64.99	77.00	65.25	97.09
NIB	2018	16.26	13.91	0.00	73.55	83.67	62.44	91.59
NIB	2019	18.50	14.54	0.98	72.16	85.70	70.27	94.67
OIB	2010	12.00	18.95	1.14	73.20	37.90	44.90	48.43
OIB	2011	17.50	16.83	1.06	62.98	40.50	43.40	64.07
OIB	2012	13.50	16.90	1.29	71.59	53.40	48.20	81.74
OIB	2013	13.60	15.48	1.46	72.54	58.70	53.10	87.97
OIB	2014	23.70	14.04	0.00	62.33	59.90	50.60	73.56
OIB	2015	17.40	12.07	0.00	71.77	67.70	64.60	91.90
OIB	2016	13.50	13.33	0.00	78.62	73.60	55.30	81.38
OIB	2017	19.30	11.54	1.86	74.65	61.00	53.50	78.43
OIB	2018	34.20	12.50	0.79	62.00	66.50	58.60	82.87
OIB	2019	23.70	13.61	1.56	69.01	74.30	65.80	91.70
UB	2010	30.10	13.04	3.65	51.50	49.20	55.30	53.31
UB	2011	30.00	13.95	2.77	48.85	54.00	54.00	65.90
UB	2012	30.00	15.29	2.33	51.12	62.00	60.50	83.34
UB	2013	19.00	14.54	1.86	66.24	66.00	58.40	93.30
UB	2014	14.00	15.28	1.44	70.72	75.00	56.90	89.10
UB	2015	17.00	13.21	1.22	73.14	71.00	58.10	92.41
UB	2016	18.00	13.47	1.30	74.40	73.00	65.50	98.73
UB	2017	17.00	12.79	1.24	102.69	77.00	72.70	101.65
UB	2018	21.00	11.85	1.30	75.48	79.00	65.30	92.02
UB	2019	22.00	11.82	0.51	78.10	85.00	74.70	100.16
WB	2010	25.10	21.23	3.97	43.83	43.73	63.06	65.66
WB	2011	23.66	19.60	4.54	43.78	38.64	48.85	61.74
WB	2012	27.06	22.23	2.43	46.10	51.95	61.92	91.54

WB	2013	22.86	20.06	2.24	52.38	61.55	62.12	95.07
WB	2014	19.99	21.20	1.67	62.55	61.75	54.92	54.11
WB	2015	15.34	19.54	0.00	65.88	64.36	61.51	104.26
WB	2016	15.46	19.07	0.00	68.79	66.81	67.75	107.56
WB	2017	14.39	17.92	0.00	66.96	62.76	73.01	109.86
WB	2018	17.27	15.29	1.75	65.99	68.52	73.38	103.46
WB	2019	22.10	15.79	2.16	77.09	78.49	69.87	98.00

Appendices III: Descriptive statistics Stata 14.2 output

. xtsum roe ca aq me eq liq s

Variable		Mean	Std. Dev.	Min	Max	Observations	
roe	overall	22.43922	6.960336	3	41.1	N =	90
	between		3.480648	18.822	28.42	n =	9
	within		6.128333	2.489222	37.79922	T =	10
ca	overall	14.73467	3.177325	7.04	22.23	N =	90
	between		2.52367	12.138	19.193	n =	9
	within		2.090581	9.403667	21.02667	T =	10
aq	overall	1.518	1.364375	0	7.41	N =	90
	between		.4329301	.916	2.203	n =	9
	within		1.30117	-.358	7.149	T =	10
me	overall	63.41989	11.29641	43.78	102.69	N =	90
	between		4.758647	57.375	69.869	n =	9
	within		10.35635	41.57489	96.88589	T =	10
eq	overall	63.19511	11.79186	37.9	85.7	N =	90
	between		4.379834	58.46	69.12	n =	9
	within		11.03652	41.74511	85.06511	T =	10
liq	overall	61.09356	8.524998	40	89	N =	90
	between		3.368476	53.8	64.55	n =	9
	within		7.9042	41.03356	90.03356	T =	10
s	overall	84.27356	14.81003	48.43	110.32	N =	90
	between		4.68282	77.915	91.52	n =	9
	within		14.1289	49.25756	116.6786	T =	10

. sum roe ca aq me eq liq s

Variable		Obs	Mean	Std. Dev.	Min	Max
roe ca aq me eq	roe	90	22.43922	6.960336	3	41.1
	ca	90	14.73467	3.177325	7.04	22.23
	aq	90	1.518	1.364375	0	7.41
	me	90	63.41989	11.29641	43.78	102.69
	eq	90	63.19511	11.79186	37.9	85.7
liq s	liq	90	61.09356	8.524998	40	89
	s	90	84.27356	14.81003	48.43	110.32

Appendices IV: Correlation Matrix b/n dependent and independent variables

	ROE	CA	AQ	ME	EQ	LIQ	S
ROE	1.00	-0.2197	0.3272	-0.6446	-0.3713	-0.1225	-0.2681
CA	-0.2197	1.00	-0.1075	-0.3405	-0.2655	0.0016	0.0673
AQ	0.3272	-0.1075	1.00	-0.4494	-0.4281	0.2831	-0.05210
ME	-0.6446	-0.3405	-0.4494	1.00	0.6895	0.3218	0.4024
EQ	-0.3713	-0.2655	-0.4281	0.6895	1.00	0.6084	0.6691
LIQ	-0.1225	0.0016	-0.2831	0.3218	0.6084	1.00	0.07908
S	-0.2681	0.0673	-0.05210	0.4024	0.6691	0.07908	1.00

Appendices V: Random and Fixed Effect models' output /Hausman test/

```
. xtreg roe ca aq me eq liq s, fe
```

Fixed-effects (within) regression
Group variable: bank1

Number of obs = 90
Number of groups = 9

R-sq:

within = 0.6688
between = 0.5286
overall = 0.6316

Obs per group:

min = 10
avg = 10.0
max = 10

corr(u_i, Xb) = -0.1353

F(6, 75) = 25.25
Prob > F = 0.0000

roe	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
ca	-.8976087	.2343539	-3.83	0.000	-1.364466	-.4307518
aq	-.5191734	.4440961	-1.17	0.246	-1.403858	.3655114
me	-.6534199	.0635456	-10.28	0.000	-.7800092	-.5268307
eq	.1243775	.0729163	1.71	0.092	-.0208791	.2696342
liq	.1972556	.0882326	2.24	0.028	.0214873	.3730239
s	-.0620463	.0587814	-1.06	0.295	-.1791448	.0550522
_cons	63.21088	6.674435	9.47	0.000	49.91472	76.50703
sigma_u	2.4766868					
sigma_e	3.8417134					
rho	.29359374	(fraction of variance due to u_i)				

F test that all u_i=0: F(8, 75) = 2.78

Prob > F = 0.0094

```
. estimate store fe
```

```
. xtreg roe ca aq me eq liq s, re
```

Random-effects GLS regression
Group variable: bank1

Number of obs = 90
Number of groups = 9

R-sq:

within = 0.6616
between = 0.6668
overall = 0.6610

Obs per group:

min = 10
avg = 10.0
max = 10

corr(u_i, X) = 0 (assumed)

Wald chi2(6) = 161.98
Prob > chi2 = 0.0000

roe	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
ca	-1.091099	.187269	-5.83	0.000	-1.45814	-.7240585
aq	-.6806271	.4216626	-1.61	0.106	-1.507071	.1458164
me	-.6075555	.0598423	-10.15	0.000	-.7248443	-.4902668
eq	.055691	.0683649	0.81	0.415	-.0783018	.1896838
liq	.1899193	.087011	2.18	0.029	.0193808	.3604579
s	-.0600975	.058029	-1.04	0.300	-.1738323	.0536373
_cons	68.02288	5.850727	11.63	0.000	56.55567	79.4901
sigma_u	1.5119284					
sigma_e	3.8417134					
rho	.13411377	(fraction of variance due to u_i)				

```
. estimate store re
```

```
. hausman fe re
```

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
ca	-.8976087	-1.091099	.1934904	.1408974
aq	-.5191734	-.6806271	.1614537	.1393628
me	-.6534199	-.6075555	-.0458644	.0213762
eq	.1243775	.055691	.0686865	.0253578
liq	.1972556	.1899193	.0073363	.0146311
s	-.0620463	-.0600975	-.0019488	.0093746

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

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 3.65
Prob>chi2 = 0.7237
(V_b-V_B is not positive definite)

Appendices VI: Cross-sectional Independence test

```
. xttest2
```

Correlation matrix of residuals:

	__e1	__e2	__e3	__e4	__e5	__e6	__e7	__e8	__e9
__e1	1.0000								
__e2	-0.1374	1.0000							
__e3	0.6166	0.2605	1.0000						
__e4	-0.5316	0.2846	0.1024	1.0000					
__e5	0.4966	-0.2284	0.0481	-0.3949	1.0000				
__e6	0.4786	-0.5904	-0.1067	-0.3525	0.1574	1.0000			
__e7	0.1919	0.0061	0.1075	-0.1062	-0.0717	0.2915	1.0000		
__e8	-0.2355	-0.1109	-0.5188	-0.1923	0.0748	-0.1708	0.2475	1.0000	
__e9	0.6100	0.2040	0.5423	-0.3084	0.1562	0.1090	-0.3157	-0.3911	1.0000

Breusch-Pagan LM test of independence: $\chi^2(36) = 37.477$, Pr = 0.4012
Based on 10 complete observations

Appendices VII- Regression Output

Since there is a Heteroskedasticity problem in this model and to correct the problem it is recommended that to use GLS (Generalized least square) regression analysis in panel data.

The output presented in the following form.

```
. xtglsl roe ca aq me eq liq s
```

Cross-sectional time-series FGLS regression

Coefficients: generalized least squares
Panels: homoskedastic
Correlation: no autocorrelation

Estimated covariances	=	1	Number of obs	=	90
Estimated autocorrelations	=	0	Number of groups	=	9
Estimated coefficients	=	7	Time periods	=	10
			Wald chi2(6)	=	180.32
Log likelihood	=	-252.3308	Prob > chi2	=	0.0000

roe	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
ca	-1.185089	.1541514	-7.69	0.000	-1.48722	-.8829579
aq	-.7000735	.4061453	-1.72	0.085	-1.496104	.0959567
me	-.563192	.0564806	-9.97	0.000	-.6738919	-.4524921
eq	-.0045142	.0645653	-0.07	0.944	-.1310597	.1220314
liq	.1809124	.0858282	2.11	0.035	.0126922	.3491327
s	-.04954	.057358	-0.86	0.388	-.1619595	.0628795
_cons	70.089	5.318691	13.18	0.000	59.66456	80.51344