
ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

# The effects of liquidity risks and interest rates risks on profitability: Evidence from Ethiopian banks.

A Research Thesis Submitted to Addis Ababa University College of Business and Economics in Partial Fulfillment of the Requirements for Master's (M.sc) Degree in Financial Economics

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# Declaration

I hereby confirm that, I Dagem Fisseha have carried out independently a research work on ― the effects of liquidity risks and interest rates risks on profitability: Evidence from Ethiopian banks in Partial Fulfillment of the Requirements for Master's (M.sc) Degree in Financial Economics

This study is my own work that has not been submitted for any degree or diploma programs in this or any other institution, and that all references materials contained therein have been acknowledged.

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# Abstract

*This paper examined the effect liquidity risk and interest rate risk in selected Ethiopian commercial banks by analyzing how liquidity risk measures such as loan to deposit ratio and liquid asset to total asset ratio and, interest rate risk measures such as net interest margin and asset interest yield affect a bank's profitability measures return on assets and return on equity. The study's primary goals were to comprehend how liquidity risk and interest rate risk affect the profitability of Ethiopian commercial banks and to provide a foundation for further investigation of interest rate risk. To analyze the effects the study used an unbalanced panel data for a sample of 17 banks that have been operating for at least 10 years for the period 2010-2022. The study therefore has determined that liquidity risk does not have a significant effect on profitability for the selected Ethiopian banks in the given period when interest rate risk effects are also captured. The results also show that the net interest margin and asset interest yield have a positive effect on profitability measures. The implication being that interest rate risk which is inversely captured by net interest margin and asset interest yield, has a negative effect on profitability of the selected banks*


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# Chapter One

# 1. INTRODUCTION

## 1.1. Background of the Study

Risk factors of all kinds have an impact on financial institutions and assets. Liquidity risk and interest rate risk are two significant risks that financial institutions must consider when determining their worth and profitability. The consequences of the 2007 financial crisis have highlighted the significance of careful liquidity risk management in financial institutions. The liquidity crisis, which began in 2007 as a result of the collapse in credit quality of US subprime residential mortgages and coincided with a decline in housing prices in the US, had a significant impact on the real economy (Ebenezer, 2019). Consequently, it is essential to understand liquidity risks, particularly for less developed countries like Ethiopia that lack well-established institutions capable of providing bailouts for crashed institutions.

The main financial institutions in the financial system and the economy are commercial banks, which accept demand deposits, make loans, and offer other services to the general public. By acting as a middleman between depositors (savers) and borrowers (investors), these banks are able to turn a profit. In order for most economies to function, banks, as financial intermediaries, are essential (Acaravci & Çalim, 2013). An even greater role is played by the efficient operation of the banking sector in less developed countries like Ethiopia, where banks dominate the financial sector. Banks' intermediation role should be performed at the lowest possible cost and risk to achieve the best possible utilisation of limited resources.

According to the Bank for International Settlements (BIS, 2008), a bank's liquidity refers to its capacity to finance asset growth and pay obligations as they become due without sustaining unacceptably high losses. Determining the risks involved in banks is crucial because the banking system is critical to economies based on the contemporary market (Rahman et al., 2015). Understanding the risks posed by commercial banks is crucial for a number of stakeholders because their inability to fulfill all short-term obligations could have serious negative effects on the economy.

A bank’s performance are affected by multiple systemic risks and market shocks. To measure the performance of the banks, the study takes a comprehensive view of not just a single measure of a banks’ profitability. For capturing the profitability of the bank the study uses both the return on equity (ROE) and return on asset (ROA) estimates as used by multiple empirical researches (Alper & Anbar, 2011; Tafri et al., 2009).

According to Landier, Sraer, and Thesmar (2013), interest rate risk is the uncertainty around interest rates as a result of unpredictably fluctuating interest rates. The performance of financial institutions including banks, microfinance institutions, and SACCOs may be negatively impacted

by this volatility in interest rates. By altering the anticipated net interest revenue and costs, changes in interest rates have an impact on the financial health of commercial banks. Because of this, financial institutions are subject to interest rate risk when interest rates shift. (Creel, 2016)

Additionally, the bank's interest revenue comes from its assets, while its interest payments come from its liabilities. And, because interest rates on assets and liabilities can change over time, banks are exposed to interest rate risk because the contractual maturities of institutions' assets and liabilities may vary over time. Additionally, changes in the interest rate benchmark may cause inconsistencies in the assets and liabilities, which could have an impact on banks' net interest income. (Aruwa & Musa, 2014).

## 1.2. Statement of the problem

Due to their basic role in the maturity conversion of short-term deposits into long-term loans, banks are intrinsically sensitive to liquidity risk. The liquidity of a bank is also affected by almost every financial commitment or transaction. On the other hand, interest rate risk is also crucial to the banking industry. The underlying value of an institution's assets and obligations can be harmed by changes in interest rates, which can expose it to unfavorable fluctuations in the level of net interest income or other rate-sensitive income measures (Thanyaku, 2010). Economic theories also demonstrate that many risks are inextricably linked to one another and are inseparable, and a thorough examination of such factors is necessary to comprehend the whole spectrum of difficulties, which is why the study tries to include both the identified risks..

Banks experienced severe liquidity issues during the global financial crisis of 2007, which resulted in many financial institutions experiencing liquidity shortages. These issues also included the mismatch between assets and liabilities, the banks' inability to pay short-term obligations, and the collapse of a large bank, caused by too much leverage (Ebenezer, 2019). Since financial organizations exist in a setting defined by market imperfections, the observed bank failures underline the necessity of protecting depositors. This is particularly important in a nation like Ethiopia that lacks a financial market and has less established regulation.

The empirical findings for this study are aimed at assisting banks in emerging and developing countries to determine how interest rate risk and liquidity risk affect their institutions and prepare the bank management to promptly and effectively track and oversee the risk. With the establishment of financial markets in Ethiopia, analysis of liquidity risks will also become a highly relevant topic for commercial banks as they engage in buying long-term and/or short-term securities that would be a significant impact factor in determining their liquidity position. While interest rate risk will also be an area of concern for the banks as they balance the time differential between interest-bearing assets and the interest deposits they pay to depositors.

Regarding how interest rate risk and liquidity risk affect profitability, there doesn't seem to be much consensus in the studies that address these issues. Empirical research in Ethiopia overall, although plentiful in analyzing the sources of liquidity risks in banks, it has not much explored the

effects when interest rate effects are captured. And a significant amount of the studies in Ethiopia focus on understanding the determinants of liquidity risk in the banking industry rather than its effect on the banks, such as Leykun (2016), which empirically examines the determinants of liquidity risk in the Ethiopian banking sector for the period from 2005 to 2014, and Melese (2016), which identified the determinants of commercial banks liquidity in Ethiopia in the period from 2007-2013 by employing the balanced panel fixed effect regression model. While a limited amount of research exists in relation to the effects of interest rates in commercial banks, such as in Jima (2017), which explores the factors that determine net interest margin in the Ethiopian banking industry.

The uniqueness of this research also lies in its comprehensive nature in analyzing both interest rate risk and liquidity risk in a multi-model regression that captures their effects simultaneously on not only one measure of performance but bot return on assets (ROA) and (ROE), which is imperative for a better understanding of the profitability measures. Consequently, this research plans to employ a multi-model approach using panel data to understand the effects of liquidity risks and interest rate risks (captured by several proxy variables) on the profitability of commercial banks in Ethiopia.

## 1.3. Research Objective

### 1.3.1. General objective

The primary objectives of the study are to understand the impact of liquidity risk and interest rate risk on the profitability of Ethiopian commercial banks and to serve as a basis for further exploration of interest rate risk, which has been relatively unexplored in Ethiopia.

### 1.3.2. Specific objectives

The specific objective of the study is to determine whether the variables capturing risk components have a statistically significant effect and, if so, whether they have a negative or positive effect

Specifically:

- Determine the effect of liquidity risk (captured by total loans to total deposit ratio, and liquid asset to total asset ratio) on the profitability (measured by ROA and ROE) of commercial banks in Ethiopia.
- Determine the effect of interest rate risks (captured by the net interest margin and the asset interest yield) on profitability (measured by ROA and ROE) of commercial banks in Ethiopia.
- And Examine the effects of firm specific and macro-economic control variables on measures of profitability for the commercial banks of Ethiopia

## 1.4. Research question

The main research questions of the study are given below:

- What are the effects of loan to deposit ratio and liquid asset to total asset ratio on return on assets and return on equity?
- What are the effects of net interest margin and asset interest yield on return on assets and return on equity?
- What effect do firm specific control variables such as bank asset size, capital adequacy ratio and non-interest income to gross revenue ratio have in determining profitability measures—ROA and ROE?
- What effect do macro-economic control variables such as GDP growth rate, inflation rate and exchange rate growth rate have in determining profitability measures—ROA and ROE?

## 1.5. Significance of the study

Studies that explore the risks of commercial banks are important for multiple stakeholders, such as the government, investors, bondholders, bank managers, shareholders, and especially regulators, who formulate strategies geared toward preserving the development of the nation's banking sector.

Consequently, risk analysis in the banking industry is of great interest to policymakers and regulators who are in charge of maintaining financial stability, and research that highlights possible risks associated with banks is even more crucial for the relatively inexperienced regulatory institutions in Ethiopia. Understanding the significance and extent to which liquidity risk and interest rate risk affect the banking sector of Ethiopia would consequently be a major area of interest for the commercial bank regulator, the NBE.

The research can also give insight to bank managers in different ways. By focusing on the impact that liquidity risk can have on the performance of banks, the study will contribute to and help bank managers understand the impact of their liquidity position on their profitability. While analysis of interest rate risks will also be a critical insight for the managers in their effort to manage the composition of interest-bearing financial assets, such as bonds, in accordance with the interest on deposit.

Furthermore, with the expected establishment of financial markets in Ethiopia, in the coming years, the possibility of commercial banks engaging in the market and buying long-term or short-term securities will have an effect on their liquidity position, and research highlighting the effect of the risks involved will undoubtedly contribute to the proper management of liquidity risk. Finally, the study will also be useful for researchers in the field who can use the limitations as a

starting point to further explore the effects of interest rate risk on banks in the banking sector and further investigate other risk factors affecting the performance of commercial banks.

## 1.6. Scope and limitations of the study

This study focuses solely on determining the impacts of the two identified risks of liquidity and interest rate on the profitability of commercial banks; it does not explore other associated market risks such as foreign exchange rate, equity, and commodity prices, which could lead to losses in liquid portfolios or uncontrolled shocks in the economy. Furthermore, the research findings are limited by the quality of the data collected, which relies on the accounting standards of the commercial banks and presumes an accurate report has been published by the banks.

A note on the scope of the research: the study initially planned to analyze the effects of liquidity risk and interest rate risk not just on profitability but also on the firm value of the commercial banks, however, upon review, there was no available data to calculate the metric as the National Bank of Ethiopia had not kept available records on valuation metrics, and due to a lack of an official stock market for bank shares, the researcher could not find accurate panel data spanning the years required for the study. Consequently, the study has decided to limit its scope to analyzing the effects of the risks on profitability only, with the hope that after the official financial market is established, the effects of the risks on firm value could also be researched.

## 1.7. Hypothesis

A hypothesis, which is an expectation of what the researcher believes and a directly testable relational statement, is formulated for the study. The hypotheses below highlight the relationship between the general dependent and independent variables concerned in the study.

H1: Liquidity risk negatively influences the profitability of commercial banks in Ethiopia.

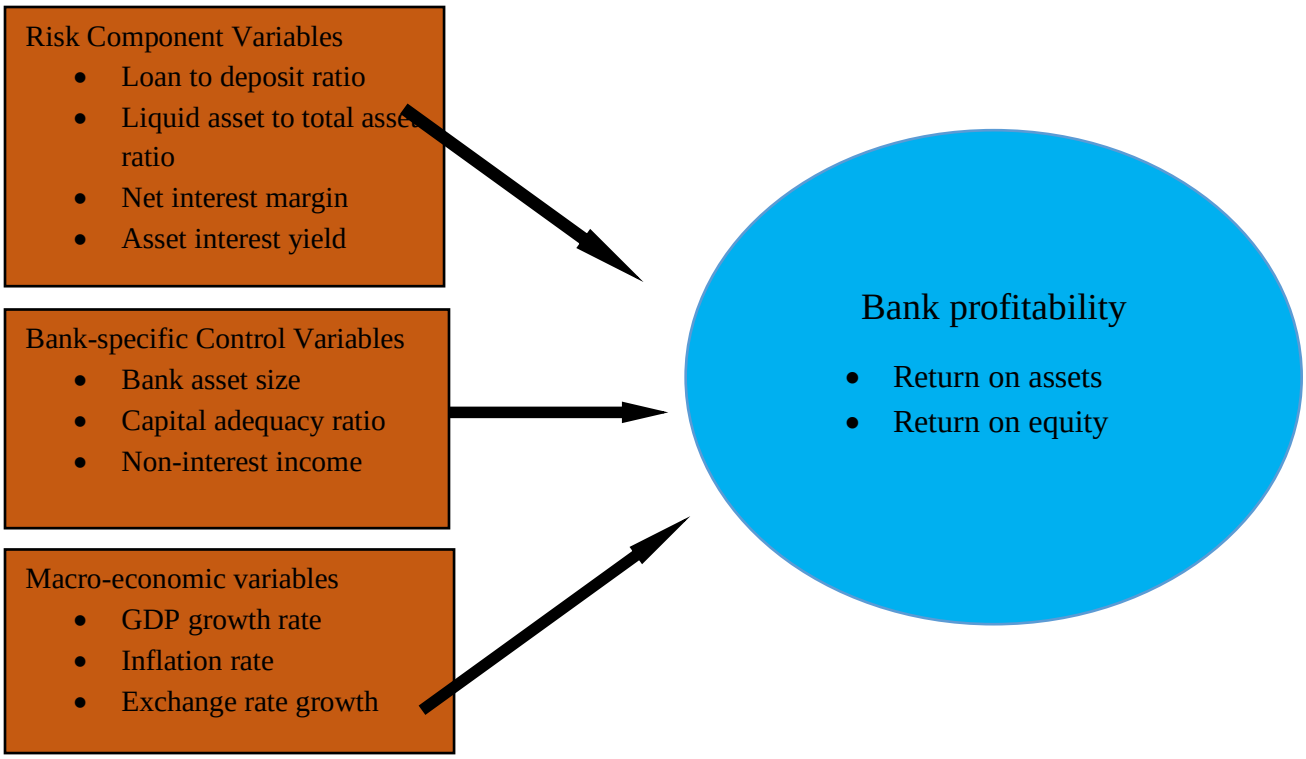
Based on theoretical reasoning, the expected relationship between financial performance and holding liquid assets, which have lower returns, has a negative influence on profitability.

H2: Interest rate risk negatively influences the profitability of commercial banks in Ethiopia.

Based on theoretical reasoning, this study, hypothesizes a negative influence of interest rate risk on profitability.

## 1.8. Conceptual Framework of the Study

The conceptual framework of the study is depicted below




### 1.9. Organization of the study

This study is structured in the following manner: In Chapter 1- Introduction, In Chapter 2- theoretical and empirical literature will be presented. Chapter 3- Methodology. Chapter 4 will highlight results and discussions, and finally, Chapter 5 will summarize the conclusion and recommendations.

# Chapter Two

# 2. Literature Review

### 2.1. Introduction

This chapter covers the literature review on liquidity risks and interest rate risks and their effects on profitability of commercial banks in Ethiopia. The chapter is divided into two parts. The theoretical framework will describe concepts, theories, and definitions of relevant topics, while the empirical literature reviews studies that have been conducted previously.

### 2.2. Liquidity and liquidity risk: Theoretical Framework

Liquidity is a notion that is derived from several economic viewpoints. According to Duttweiler (2011), liquidity is the capacity to make all overdue payments. A lack of liquidity will occur if payment obligations are not met. In the context of banking, liquidity means that a bank can adequately and promptly address financial obligations that arise during normal business processes, such as savings, advances, settlements, and other financial transactions. Liquidity risk will develop if there is a persistent lack of liquidity.

Liquidity difficulties may have an effect on a bank's profits and performance, and in the worst-case scenario, they might result in the collapse of a previously liquid bank. When a liquidity crisis occurs, banks may be compelled to borrow funds at an exceptionally high rate from the marketplace. A rapid sale in the bank's assets to solve the liquidity crunch, as a result of unmanaged liquidity risk the bank's capital structure can be impaired. If a financial institution is compelled to sell a large portion of its illiquid assets to meet its funding needs (possibly to meet capital adequacy requirements), there is a strong chance that it has not sold its assets at a fair market value. This scenario could also affect the entire banking industry, as it is usually the case that bank runs cause damage to the entire banking sector (Falconer, 2001).

### 2.2.1. Theories of Liquidity

The liquidity theories that describe the mechanics of liquidity needs in financial intuitions include: inventory management theory, liability management theory, Keynes liquidity preference theory, and demand for money theory.

**The Liability Management Theory**

This theory states that banks can solve their liquidity shortages by engaging in the financial market to meet additional liquidity demands. Large companies in Europe started the application, which later spread to the United States. The source of the theory is in the 1980s when the money market became prevalent (Goodhart, 2011).

**Keynes -Liquidity Preference Theory**

The economic literature has defined why companies hold liquid assets. Keynes (1936) stated that people and companies need liquidity for three reasons. Commonly known in economics as the transaction motive, speculative motive, and precautionary motive. The transaction motive is for people and companies to meet short-term liquidity obligations, such as cash for buying and selling commodities. The precautionary motive is that when the anticipated cash flow is not achieved, income will be utilized to pay short-term commitments that are cash based. Holding capital for speculative purposes involves the possibility that a company or an individual can seize unique chances that, if taken advantage of immediately, will benefit the company (Young, 2011).

**Theory of demand for money**

According to Miller and Orr's (1966) model of how much money businesses need, there could be economies of scale in cash management. The theory argues that larger businesses would store less

cash than smaller businesses and that the costs associated with borrowing money are fixed since they are unrelated to the loan's size. Because acquiring capital is generally more expensive for smaller businesses, they tend to keep more cash than bigger businesses. Businesses with more unpredictable cash flows are more likely to experience unanticipated cash flow degradation and consequent financial constraints. So, there should be a positive correlation between cash holdings and cash flow uncertainty (Young, 2011).

**Theory of Liquidity and Profitability Trade off**

Some of the early research efforts aimed to build models for optimal liquidity and cash balances, given the organization's finances, and included the theory known as Baumol's inventory management model, also known as liquidity-profitability tradeoff theory, which understood the dynamics of cash flows in businesses. The emphasis was on utilizing numerical models to balance the advantages and disadvantages of retaining cash (liquidity). These models aid in the understanding of the cash management issue by financial managers, but it has been shown that they are not true in reality. The model uses the concepts of marginal gains and losses from holding cash to determine their ideal level of holdings. A decreased risk of financial crisis, the ability to follow investment policy when financial limitations are fulfilled, and decreased expenses associated with borrowing outside capital or selling off current assets are all advantages of having cash on hand. Overall, the theory highlights that there is a trade-off between the liquidity and profitability of businesses (Young, 2011).

**Liquidity vs Profitability**

Comprehensive discussions and analyses of liquidity and profitability have been documented in the literature. While a company's current existence depends on its capacity to maintain liquidity, its long-term existence, progress, and development are contingent upon profitability. Therefore, profitability assures long-term existence, while liquidity guarantees immediate survival. Therefore, for any company to exist, both are crucial. Yet, throughout literature, most have suggested that profitability may be more essential than liquidity, whereas some believe the opposite is true, and still others have stated both are equally important (Alagathurai, 2013).

### 2.2.2. The Relationship between bank liquidity and financial performance

Having assets that are liquid, such as cash and government securities, is an opportunity cost for banks because they often yield a poor return. It is fair to assume that banks will maintain liquid assets to the degree that they contribute to maximizing the company's earnings in spite of regulation. Regulators have therefore often chosen to demand higher amounts of liquid assets (Goodhart, 2002).

The financial crisis that occurred between 2008 and 2009 was characterized by a lack of liquidity, which left banks without the funds they needed to meet their commitments when they became due (Longworth 2010). In addition, there is a prevalent perception that banks did not completely

understand the significance of managing liquidity risk and the consequences of this type of risk for the banking institution overall. In order to assist protect themselves against future liquidity or financing issues, officials have recommended that banks retain a greater amount of liquid assets than they did in the past. Loans are the major source of revenue for banks and have one of the highest yields for the bank. When the loans are credited to clients, using customer deposits, banks are exposed to liquidity risk. However, the possibility for profit for commercial banking institutions increases with the amount of loans provided and the amount of interest earned. As a result, it's crucial to keep in mind that banks with a great deal of loans will also face a greater liquidity risk (Dao, 2020).

In contrast to what one might anticipate in scenarios of perfect capital market functioning with symmetric information, where there is no relationship between earning and bank capital, A study conducted by Berger (1995) examined the statistical correlations between bank earnings and bank in the U.S. from 1983 to 1989 and discovered a positive relationship between liquidity and return on equity. The author claims that this outcome supports the "expected bankruptcy cost hypothesis." According to Berger's research, banks having greater amounts of liquidity observe a drop in financing costs which substantially exceeds the cost of retaining liquid assets. Which suggests that the effect of liquidity on profitability is favorable, with banks retaining assets that are more liquid benefiting from a better reputation in financial markets, lowering their borrowing costs, and boosting profitability.

Consequently, there is a complex link between liquidity risk and bank performance. Although certain research findings claim that having a substantial liquidity risk enhances the performance of banks by generating large interest income, others claim that having a high liquidity risk reduces bank efficiency due to the substantial costs involved with capital raising and financing. Several writers discover a connection that is beneficial as well as detrimental; others find a connection that is neither positive nor negative; while some authors also find no link at all as such there are several contrasting viewpoints on the relationship between liquidity risk and bank performance.

## 2.3. Interest rate risk

### 2.3.1. Interest rate risk

Interest rate risk is the susceptibility of a bank's present or future revenues and capital to changes in interest rates, according to Wong (1995). Movements in the interest rate may have a detrimental effect on the bank's earnings and economic worth. Changes in market interest rates may have an effect on the market value of the assets of banks, liabilities, and other items not on the balance sheet. Banks often utilize a strategy that considers the way fluctuations in interest rates may impact accrued or reported profits when evaluating interest rate risk. The Basel Committee on Bank Supervision (2004) noted that banks with variations in earnings have a major area of interest in interest rate risk analysis because declining earnings or any losses may undermine the bank’s

ability to maintain its financial health by jeopardizing its capital adequacy and eroding investor confidence.

The earliest research on the impact of interest rate changes on the banking system was conducted by Samuelson (1945). He claimed that because of the way a bank's assets and liabilities are structured, the value of its equity is subject to changes in interest rates. Hicks (1996) demonstrated that, when the discount rate changes, the relative duration of different payment streams is a critical factor in determining the present value of these cash flows. This was further supported by a study by Saunders (1981), which investigated the notion that banks serve as merely intermediaries between lenders and borrowers and found that profitability depends on the intensity of market competition and the interest rate risk to which the bank is exposed.

### 2.3.2. Interest rate risk sources

The sensitivity of a company's financial health to unfavorable changes in interest rates is explained by multiple factors. The following are a few typical causes of interest rate risk:

**The Re-pricing risk**

Banks face interest rate risk in a variety of ways as they act as financial intermediaries. Interest rate risk is primarily and frequently described in terms of timing disparities in the time to maturity (for fixed-rate assets) and repricing (for floating-rate liabilities) of bank financial assets, financial liabilities, and off balance sheet activities. These repricing inconsistencies are essential to the banking industry. But they may expose the earnings of a bank and its underlying financial worth to unforeseen changes when interest rates fluctuate. For instance, if interest rates rise, a bank that financed a long-term fixed-rate loan with a short-term deposit would see a fall in its possible future income as well as a decline in its overall value. (Singh, 2004).

**The yield curve risk**

Repricing inconsistencies may additionally subject a financial institution to variations in its projected yield curve's slope and shape. The curve depicts the relationship between the rate of interest (level) and the period until maturity, often known as the debt's term for a certain borrower in a particular currency. When unexpected fluctuations in the yield curve have a negative impact on a bank's income or underlying economic value, there is a risk associated with the yield curve. For instance, even when a long position in 10-year government bonds is hedged by a short position in 5-year government notes, the underlying economic value of the position might drop significantly if the yield curve steepens (Singh, 2004).

**The Basis risk**

Basis risk results from a lack of adequate adjustment in the rates earned and paid when interest rates change. It occurs when the difference between the rates received and paid on various instruments that otherwise have comparable properites is imperfect. These variations might result in unanticipated changes in the cash flows and profits spread across assets, liabilities, and off

balance sheet instruments. For instance, the institution runs the risk of the spread between the two index rates changing unexpectedly if a one-year loan is funded with a one-year deposit that reprices monthly based on the one-month US Treasury bill rate and one-month LIBOR (Singh, 2004).

**The Optionality risk**

The options included in many financial organizations' asset and liability positions are a crucial source of interest rate risk. The importance of instruments containing embedded options tends to be highest in non-trading activities. They include different kinds of Treasury bills and bonds with call or put clauses, loans that allow borrowers to pay off sums early, and many kinds of non-maturity deposit instruments that allow depositors to withdraw money whenever they choose, frequently without incurring fees. If improperly handled, the irregular payoff traits of instruments with flexibility characteristics can pose a serious risk, especially to those who sell them, because the held options, both obvious and integrated, are typically exercised to the holder's benefit and the seller's disadvantage (Singh, 2004).

### 2.3.3. Interest rate risk and banking performance - theory

The level of all interest-sensitive earnings and operational expenditures, as well as the banking institution's net interest income, are all impacted by fluctuations in interest rates. An excessive amount of interest rate risk can seriously jeopardize the financial institution's capital base. As a result, fluctuations in interest rates may negatively impact a financial institution's profits, finances, and overall worth. Interest rate risk management aims to keep a financial institution's exposure to interest rate risk within predetermined limits during a range of possible interest rate fluctuations Staikouras, 2003)

Financial intermediaries struggle mightily to manage their interest rate exposures given the unpredictable direction of interest rates. It is obvious that the time to maturity and re-pricing mismatch built in institutions' assets, liabilities, and off-balance-sheet positions determine the impact of changes in market rates. In principle, institutions that are "asset sensitive" or that have assets that are anticipated to appreciate in value more quickly than their obligations should profit from a rise in interest rates since, all else being equal, a greater rate should result in better net interest margins for these institutions. On the other hand, an increase in market interest rates would be anticipated to have a negative impact on the net interest margins of "liability sensitive" institutions, or those whose asset maturities are longer than their obligation durations (Ngalawa, 2014).

Since derivatives offer a simple way for banks to change their risk profile, they employ them as end users to mitigate on-balance sheet risks and as dealers to boost non-interest revenue. Banks are able to further reduce delegate costs through the use of derivative contracts to hedge against interest rate risk, which in turn helps banks to intermediate more successfully. On average, banks that use interest rate futures see much better growth in their portfolios of commercial and industrial loans. This lends credence to the argument that the use of derivatives enables banks to more

effectively manage interest rate risk, allowing them to keep more loans and generate more revenue from their lending operations (Brewer et al, 2001). Consequently, with the expected establishment of financial markets in Ethiopia, derivatives can be a useful tool in the future for banks to hedge their balance sheet risks, which are caused by the interest risk that they are exposed to. Additionally, banks can protect themselves from interest rate risk by choosing to pay floating-rate interest on their liabilities when cash flows are positively correlated with interest rates and paying fixed interest when cash flows are uncorrected or negatively correlated with interest rates.

## 2.4. Empirical Literature Review

Review of the relevant empirical studies analyzing the effects of liquidity risk and interest rate risks on profitability is described below.

### 2.4.1. Liquidity risk

Konadu (2009) did research on "Liquidity and Profitability: Empirical Evidence from Listed Banks in Ghana." The study's objectives include establishing and examining the correlation between banks' levels of liquidity and profitability from 2002 to 2006, as well as determining the link between the trends in liquidity and profitability of certain banks. Only banks that were trading on the Ghanaian stock exchange were included in the analysis. Liquidity ratios such as the current ratio, cash ratio, and net operating cash flow ratio were included in the study. The study's conclusions show a negative correlation between the profitability and liquidity levels of the Ghanaian banking sector.

Adebayo, Nworji, and David examined the profitability and liquidity management of Nigerian commercial banks in their 2011 study. According to the study's findings, profitability and liquidity are highly correlated. This suggests that, in commercial banks, profitability is significantly impacted by liquidity and vice versa. Ly (2015) looked at the connection between liquidity risk and the performance of European banks in the wake of the liquidity risk concerns from the banking crisis of 2008. An observational panel of the European Union's 27 nations was utilized as the sample in this study, which ran from 2001 to 2011. The main conclusions of this study indicate that there is a link between liquidity risk and bank performance that is negative.

In their 2014 study, Mamatzakis and Bermpei looked at the key variables that determine bank performance in Switzerland and the G7. It includes 97 banks in the sample. The examination of data from the panel reveals that liquidity has a detrimental influence on bank performance. However, the Z-Score's proxy for financial strength was seen to have a favorable impact. In 2015, John and Olusegun investigated how liquidity affected the performance of Nigerian banks. They employed a random selection of 13 banks between 2004 and 2012. Liquidity and bank performance are positively correlated, according to the findings of GMM modeling. According to their findings, banks should increase their liquidity for greater efficiency.

For the years 2005–2013, Rahman and Saeed (2015) assessed the effects of liquidity risk on the performance of selected commercial banks in Malaysia. Return on assets and return on equity have

been utilized as indicators of performance for banks. Liquidity indicators include the loan to deposit ratio, the liquid risky asset to total asset ratio, and the capital to asset ratio. The study discovered a negative correlation between bank performance and liquid risky asset to total asset ratio. According to the study's findings, there are conflicting effects of liquidity indicators on bank performance.

Marozva in 2015 examined the relationship between liquidity risk and bank performance using a number of South African banks from 1998 until 2014. In this study, the net interest margin is used as a proxy for the performance of banks. Liquidity risk has a negative and substantial correlation with bank performance, according to the results of the ARDL bound method.

The impact that liquidity risk has on the performance of Iranian banks was examined by Tabari et al. in 2013. Return on equity was used to evaluate a bank's performance. To determine the impact on bank performance, size, the square of the bank's size, liquidity risk, bank capital, the GDP, and the inflation rate were all used as independent variables. According to the study, bank performance is positively correlated with bank size, capital, GDP, and inflation, but negatively correlated with liquidity risk. The findings showed that liquidity risk had a negative impact on banks' performance. Contrarily, a sample of Moroccan banks was used in Ferrouhi's (2014) study on the financial performance of Moroccan banks over the years 2001 to 2012. Six ratios regarding liquidity and five determinants were employed, while the performance indicators used were the return on equity and the return on average asset. Bank size, FDI, and the onset of the financial crisis all have a favorable relationship with bank performance. On the other side, capital and unemployment have an adverse impact on the performance of banks. The study showed that liquidity ratios have a positive effect on bank performance.

Overall, some researchers—like Molyneux in 1992 support the idea that liquidity risk had a positive impact on profitability, while others—like Tabari et al (2013).—feel it has an adverse impact. Other study findings, such as those from publications by Ayaydin and Karakaya (2014), have indicated that the relationship between liquidity risk and bank performance is insignificant.

In Ethiopia, there have been numerous studies exploring the determinants of banks' profitability, which have sometimes included the effects of liquidity risk. However, most of the studies have been very limited in their analysis, as a large portion of this type of research uses a single liquidity risk measure and only captures liquidity risk in the periphery. While others only focus on internal bank specific factors without capturing macro-economic determinants. Another thing to note is that the majority of the trend in this type of research has been identifying the source and analyzing the determinants of liquidity risk in Ethiopian commercial banks. A selection of prominent research studies in Ethiopia relevant for this study have been discussed below.

The study by Tibebe and Gujral (2022) used panel data from 2010 to 2018 to examine the internal variables that determine commercial banks' profitability in Ethiopia. Return on asset, or ROA, has been employed in this study as the dependent variable. The study's key conclusions point to the statistically significant and favorable relationships between operation effectiveness, capital

adequateness, bank size, and the financial performance of banks. It was determined that there was no statistically significant association between the variables of liquidity risk, debt management, financing cost, and loan to asset ratio.

In the work by Tafa & Worku (2006) it is suggested that there was a negative relationship between the loan to deposit ratio and return on equity and that liquidity risk had an effect on the performance of commercial banks in Ethiopia. Additionally, the study also found that the ratio of liquid assets to total assets was favorable and positively correlated with return on equity. Teshome (2014) examined a variety of internal as well as external variables in his research on the drivers of bank profitability in Ethiopia using a sample of commercial banks to forecast their efficiency and profitability. The results showed that, even after accounting for macroeconomic circumstances and market concentration, inflation had a considerable influence on the financial performance of certain banks. Further bank-specific variables like total assets, non-interest expenses equity to total asset ratio, loan loss provisions, and noninterest income all had a significant impact on the profitability of certain commercial banks

In another study conducted by Tesfaye (2012) the goal was to pinpoint the factors that influence commercial banks' liquidity in Ethiopia before examining how those factors affect financial performance. The findings demonstrated that while non-performing loans and short-term interest rates had an adverse effect on financial performance, the banks liquidity, capital adequacy, and scale had statistically substantial positive effects. The researchers came to the conclusion that bank liquidity has a non-linear effect on financial performance.

Melese (2015) attempted, in a different research project, to pinpoint the factors that affected the liquidity of 10 commercial banks in Ethiopia between 2007 and 2013. The study's findings showed that while bank size has a favorable and statistically significant effect on liquidity, capital adequacy, profitability, and the real GDP growth rate have a detrimental impact on the liquidity of Ethiopian commercial banks. In contrast, it was determined that nonperforming loans, loan growth, inflation rate, and interest rate margin were statistically insignificant and had no effect on the liquidity of Ethiopian commercial banks throughout the test period.

Merin (2016) made an effort to look at factors that affected bank profitability in private Ethiopian banks from 2004 to 2011. The examination of factors, including labor productivity, liquidity, as well as market share, was one of the study's distinctive characteristics. Return on assets was employed in the study as a dependent performance indicator. Additionally, as explanatory factors, the study employed both bank-specific and external factors. The primary results of the research indicate that bank-specific factors were more crucial than external variables in explaining profitability. The profitability of the bank was favorably and substantially correlated with the size of the assets, liquidity, and non-interest earnings, while the financial performance of the bank as a whole was negatively correlated with the overhead efficiency and credit risk.

### 2.4.2. Interest rate risk

Many studies have examined the connection between interest rate risk and bank performance. However, the performance of commercial banks in advanced economies has been the subject of the bulk of research. According to Khawaja and Musleh's study from 2007, a rise in interest rates hurts both lenders and depositors while boosting performance. Therefore, when banks charge high rates of interest, they make a large profit from the borrower while simultaneously discouraging depositors by providing them little returns because they have no choice but to accept the bank's current rate.

Zagonov (2011) empirically examined the interest rate risk exposure of financial intermediaries across a sizable international data sample over the 1997-2009 period in a study to assess the relationship between financial intermediation and interest rate risk across the G10 economies. The outcomes demonstrated that for the majority of the investigated enterprises, interest rate exposure had a considerable influence on the firm's value. While Waseem and Abdul's (2014) study, which analyzed panel data from five large commercial banks in Pakistan over a four-year period, found a substantial negative link between interest rate risk and performance.

According to Kolopo and Dapo's (2015) research, which covered the years 2002 to 2011 and included a sample of Tier One Capital Banks in Nigeria, interest rates had a negligible impact on the performance of banks. Memmel, Seymen, and Teichert (2017) looked at German banks' exposure to interest rate risk and discovered that there is a little correlation between interest yield and interest rate risk. A correlation between greater predicted returns and interest rate exposure was also discovered by the study. The study, however, neglected other aspects of financial risk, such as credit, capital, and liquidity risk, and solely concentrated on interest rate risk.

Bank performance was shown to be adversely connected with interest rate risk in Zagonov, Kiswani, and Mash's (2009) study on how banks are influenced by interest rate risk. The results postulate that this may be attributed to management's inability to manage the risk

In their paper, Makkar, A., and Singh, S. (2013), explore the issue of interest rate risk in Indian commercial banks during the years 2008 to 2011. In order to predict the bank's financial position for various risky tactics under different macroeconomic situations, the GAP analysis was applied. According to the study's results, all of the examined banks have rising rate-sensitive assets and liabilities. These findings lead the study to the conclusion that some banks are subject to interest rate risk. Private sector banks fared better than public sector banks when considering the aggregate performance of all public and private sector banks.

Mbai (2006) conducted research on Kenyan commercial banks listed on the Nairobi Stock Exchange to determine the association between interest rate risk and net interest income. The findings demonstrated a significant direct correlation between interest rate risk and commercial banks' net interest income. Particularly, changes in the interest rate sensitivity gap are mostly responsible for variations in net interest revenue. It was discovered that the three types of interest rate sensitivity gaps all contributed favorably to net interest income.

In their study, Wambari (2017) sought to ascertain how interest rate risk affected the performance of commercial banks. The study found that the loan rate ratio has a positive effect on the financial stability of commercial banks. The deposit interest ratio, on the other hand, has a detrimental effect on how efficiently commercial banks run. Liquidity management thus has an impact on performance both favorably and unfavorably. The results of the study show a significant relationship between lending rate ratio and financial performance of commercial banks. Additionally, it was determined by the study that the deposit interest ratio had a detrimental effect on bank performance. As a consequence of the study's findings, it was advised that commercial banks in Kenya carefully monitor their lending interest rates given that the relationship between lending interest ratio and performance is direct. The report advises commercial banks to keep a close eye on the interest on deposits.

The topics pertaining to interest-rate risk and liquidity risk are examined by Ebenezer et al. (2019). The study uses a panel data estimate approach with data from 63 commercial banks in the ASEAN-5 nations from 2009 to 2017. The empirical findings show that among ASEAN banks, the loan to deposit ratio has a substantial positive influence on return on assets, whereas interest rate risk and bank size have a significant adverse impact. GDP and inflation, however, have a considerable positive impact on return on assets.

In Ethiopia, the topic of interest rate risk has been relatively unexplored; with few studies exploring topics in interest rate margin determinants and effects. This gap in research is one of the rationale for exploring the topic of interest rate risk in Ethiopia.

Jima (2018) investigated the factors that affect the net interest margin. Unbalanced panel data from financial statements of commercial banks in Ethiopia for the years 1997 to 2014 were utilized in the study. The data were analyzed using a fixed effect unbalanced panel model. The results of this research showed that scale efficiency, competition, and cost efficiency consistently had favorable and significant influence on net interest margin. On the opposite side, the net interest margin is negatively and significantly impacted by liquidity and managerial effectiveness. However, macroeconomic factors like GDP as well as inflation do not appear to have a large impact.

Asmare (2014) examined the variables influencing banks' interest rate spread for a total of eight commercial banks in Ethiopia for the years 2004 through 2013. The research investigation looked at the banking sector and particular macroeconomic factors that affected banks' interest rate spreads. The study's results demonstrate a statistically significant and favorable association between the banks' interest rate spread and credit risk, liquidity risk, reserve requirements, GDP, interest rate volatility, and exchange rate volatility. In contrast, there is a statistically significant negative correlation between return on assets, non-interest income, and the interest rate spread for banks. According to the paper, while developing strategies to increase their efficiency, banks in Ethiopia should consider the external environment as well, in addition to internal structures and rules.

# Chapter Three

# 3. Methodology

The methods used to analyze the study are described in detail in this chapter. It illustrates the study methodology, the forms and sources of data, the model definition, a brief overview of variables, and the data analysis methodologies.

## 3.1. Research Design

The explanatory research approach was used to formulate this study. Explanatory research designs evaluate the acquired data using econometric models to determine the importance of the parameters and coefficients of every variable being studied.

## 3.2. Nature and Sources of Data

The National Bank of Ethiopia's (NBE) banking supervision division and each commercial bank's audited yearly financial reports provided the bulk of the data for this study. The NBE, which is in charge of keeping the audited financial accounts of all commercial banks in the nation and overseeing their operations, records useful financial ratios that are used to track the banking sector's performance.

The variables chosen in this research for analysis, were selected based on empirical evidence and the researcher's professional judgment. The dataset on liquidity risk, interest rate risk, and control variables is taken from the audited reports of the selected banks and the National Bank of Ethiopia. It includes loan and advance to deposit ratios, liquid asset to total deposit ratios, net interest margins, asset interest yields, bank asset size, capital adequacy ratios, and non-interest income. The International Monetary Fund's economic data is used to extract and compute macroeconomic indicators such as the GDP growth rate, the exchange rate growth, and inflation rate. Previous research has established either direct or indirect effects of the selected bank-specific variables, and macroeconomic factors incorporated in the model.

## 3.3. Sampling Design

The total population of commercial banks in Ethiopia consists of 31 institutions including both government banks and privately owned banks. This study used a purposive sampling method, and a sample was chosen depending on the amount of time that the banks have been in operation. The researcher decided to choose reputable commercial banks that have been operating for at least ten years for the sample on the grounds that they are more established banks operating in the market, have a sizable market share, and influence the Ethiopian economy. Consequently, an unbalanced panel data for a sample of 17 banks that have been operating since 2012 was collected in the study. Lack of availability of data in certain years made the panel data unbalanced with a total of 210 observations collected from 2010-2022 for the sampled 17 banks. The selected banks include: Enat

Bank, Debub Global Bank, Addis International Bank, Oromia International Bank, Abay Bank, Berhan International Bank, Bunna International Bank, Zemen Bank, Lion International Bank, Cooperative Bank of Oromia, Nib International Bank, Hibret Bank, Wegagen Bank, Bank of Abyssinia, Dashen Bank, Awash International Bank, and the Commercial Bank of Ethiopia.

## 3.4. Description and definition of variables

### 3.4.1. Dependent variables

This research makes use of the widely used return on assets and return on equity ratios to measure banking performance. Return on assets (ROA) is an indicator of how productive the bank's assets are and is calculated as net income for the year divided by total assets, Arif & Anees (2012) is one study that employed ROA as a profitability indicator. Banks calculate their return on equity (ROE) by dividing net income by total equity. The financial return on an investor's investment is measured by the return on equity, which demonstrates how successfully a business utilizes investor capital to generate returns.

### 3.4.2. Independent Variables

**Risk components variables**

The loan to deposit ratio and the liquid asset to total asset ratio are used in this study as proxies for liquidity risk, which are supported by earlier research such as Spathis et al. (2002), Said & Tumin (2011), 2011; and Saeed (2013), respectively.

The loan to deposit ratio compares a bank's total loans to its total deposits for the same time period in order to determine how liquid the bank is. The loan-to-deposit ratio is used to gauge a bank's capacity to service all public obligations and its own capital by relying on loans made to the general public (Sari, 2018). Liquidity risk increases when the loan to deposit ratio rises. Therefore, the study expects a positive relationship between loan to deposit ratio and profitability since having a higher loan to deposit ratio would mean more loans have been disbursed by the bank, which would imply a larger portfolio and a higher profitability for the bank.

The liquid asset to total asset ratio shows how liquid the bank's assets are and what proportion of the assets are liquid. Since there will be more liquid assets on hand in the event of a liquidity shortfall, the liquidity risk decreases as the liquid asset to total asset ratio rises. The study anticipates a negative relationship between the liquid asset to total asset ratio and profitability since a higher ratio would indicate that a greater proportion of the bank's assets are liquid, which has lower returns for the bank.

In this study, two proxy variables—the net interest margin and the asset interest yield—capture interest rate risk. The net interest margin is calculated by dividing the bank's net interest earnings by the average interest-earning assets. In light of this, the net interest margin calculates the difference between interest revenue earned by banks and interest paid to depositors in relation to the assets' interest-earning potential. The asset interest yield, a measure of financial soundness that

contrasts an entity's interest revenue to its earning assets, is determined by the ratio of interest income to total bank assets.

The higher the net interest margin and asset interest yield, the lesser the bank's interest rate risk since it will create a buffer for possible shocks to the interest rate margins of the banks. The study expects that both net interest margin and asset interest yield to have a positive effect on profitability since having larger values of these variables would mean more yields per asset and a larger margin between what the bank charges compared to what it pays to depositors.

**Control variables**

Based on empirical research, several bank specific and macroeconomic variables have been chosen for this study. This includes: bank size, capital adequacy ratio, non-interest income to gross revenue ratio, GDP growth rate, inflation rate and exchange rate growth for the year.

**Bank specific control variables**

As a popular approach for estimating bank size, the natural log of total assets is employed in this study as a control variable. Scale economies or diseconomies that banks may encounter are captured by the bank's size. It is anticipated that asset size will have a positive impact on profitability.

A financial institution's overall safety and soundness can be determined by looking at its capital adequacy ratio, which is calculated as total equity divided by total assets. This study utilizes the capital adequacy ratio as a control variable. Prior research, such as Nguyen (2020) indicates that capital adequacy and bank profitability are positively correlated.

This research also takes into account the ratio of non-interest income to gross revenue. The non-interest income to gross revenue ratio effectively captures the significance of fee-based services offered by commercial banks and their product diversification. Although fee-based services often bring in less money than loans do, it is anticipated that they will boost the bank's profit and have a positive impact on profitability.

***Macro-economic control variables***

This study captures inflation in the model because, typically, consumers' purchasing power has decreased in nations with high inflation rates. Slow economic growth is a result of this circumstance, which harms a bank's operations. Consequently, the general inflation rate of the country has been considered for this study. Inflation is shown to be significant and beneficial for banks' performance, according to Vong and Chan (2006), since banks charge higher interest rates on loans when inflation is elevated.

The exchange rate is also taken into account because it is a significant factor that influences how well commercial banks perform when buying and selling foreign currency. Since Ethiopia imports more goods than it exports, resulting in a trade deficit, the impact of the declining power of the

birr may be a significant macroeconomic factor affecting the banks' profitability. Consequently, the growth rate of ETB/USD exchange rate for the year has been taken for the study.

Favorable economic growth boosts household income and other businesses in any nation, and GDP growth determines the pace of economic development. The macroeconomic variable is used in the study to control how the economic environment affects the banks' financial performance.

Table 3.4.2. Summary of variables

| | | Variables | Unit of measurements | Expected effects |
|---|---|---|---|---|
| **Profitability Measures** | | ROA | Percentage/ratio | N/A |
| | | ROE | Percentage/ratio | N/A |
| **Risk components** | **Liquidity Risk** | LD | Percentage/ratio | Positive |
| | | LATA | Percentage/ratio | Negative |
| | **Interest rate risk** | NIM | Percentage/ratio | Positive |
| | | AIY | Percentage/ratio | Positive |
| **Bank specific control variables** | | LSIZE | Percentage/ratio | Positive |
| | | CAR | Percentage/ratio | Positive |
| | | NIGR | Percentage/ratio | Positive |
| **Macro-economic control variables** | | GDP | Percentage (growth rate) | Positive |
| | | INF | Percentage | Positive |
| | | ER | Percentage (growth rate) | Positive |

## 3.5. Method of Data Analysis

To examine the data gathered for this study, descriptive statistics and econometrics methods are both used. The mean, standard deviation, minimum, and maximum values are used to examine and characterize the data set using descriptive statistical methods. On the other hand, this study uses an econometric analysis based on the panel data collected to estimate the model. A panel data estimation is used in this study as it takes into consideration the dataset's cross-sectional and time-series aspects. Inferentially, it provides more insightful data with lower variability, less collinearity between the variables, significantly lessening issues brought on by missing variables. Consequently, the study's intended goals are achieved by using estimation from unbalanced panel data that was gathered from 17 banks over a 12-year period. STATA 16 was used to compute the estimation.

### 3.5.1. Regression Analysis and Model specification

Based on the type of collected data sets, the panel models are estimated using fixed effect, random effect, or dynamic panel models. According to the Hausman test, the fixed effect model is used in this study to assess the impact of interest rate risk and liquidity risk on the profitability of commercial banks in Ethiopia.

The specified models based on the selected variables is described as follows.

$$\boldsymbol{ROA_{it}} = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 LD_{it} + \boldsymbol{\beta}_2 LATA_{it} + \boldsymbol{\beta}_3 NIM_{it} + \boldsymbol{\beta}_4 AIY_{it} + \boldsymbol{\beta}_5 LSIZE_{it} + \boldsymbol{\beta}_6 CAR_{it} + \boldsymbol{\beta}_7 NIGR_{it} + \boldsymbol{\beta}_8 GDP_{it} + \boldsymbol{\beta}_9 INF_{it} + \boldsymbol{\beta}_{10} ER_{it} + \boldsymbol{\varepsilon}_{it} \ldots\ldots\ldots \textbf{Model 1}$$

$$\boldsymbol{ROE_{it}} = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 LD_{it} + \boldsymbol{\beta}_2 LATA_{it} + \boldsymbol{\beta}_3 NIM_{it} + \boldsymbol{\beta}_4 AIY_{it} + \boldsymbol{\beta}_5 LSIZE_{it} + \boldsymbol{\beta}_6 CAR_{it} + \boldsymbol{\beta}_7 NIGR_{it} + \boldsymbol{\beta}_8 GDP_{it} + \boldsymbol{\beta}_9 INF_{it} + \boldsymbol{\beta}_{10} ER_{it} + \boldsymbol{\varepsilon}_{it} \ldots\ldots \textbf{Model 2}$$

Where β's are coefficients

- ROA stands for return on asset, and ROE stands for return on equity
- The liquidity risk component contains the loan to deposit ratio (LD) and liquid asset to total asset of bank (LATA).
- Interest-rate risk component contains net interest margin (NIM) and asset interest yield ratio (AIY).
- Control-variables includes bank size (LSIZE), Capital adequacy ratio (CAR), Non-Interest income to gross revenue ratio (NIGR), Inflation rate (INF), GDP growth rate (GDP), and exchange rate growth rate (ETB/USD) for the year (ER).
- While $\boldsymbol{\beta}_0$ is the Constant term $\boldsymbol{\varepsilon}_{it}$ is the Error term for observation i at time t

**Diagnostic tests and model specification tests**

The study has employed the following diagnostic tests to test the stability of the model.

Panel Unit Roots Test: Time series data are frequently thought to be non-stationary, and the existence of non-stationary variables might lead to erroneous regression findings. To verify for stationarity or the presence of a unit root in the time series data and prevent false positives, the research runs a panel unit root test.

Test for Heteroskedasticity: The study uses a modified Wald test for groupwise heteroskedasticity to test for heteroskedasticity in the model. This test involves testing the null hypothesis that the variance of the errors is constant (homoskedasticity) or not heteroskedasticity compared to the alternative hypothesis that the errors do not have a constant variance.

Test for Autocorrelation: The models used in this study are tested to determine whether the errors in the model are linearly independent of one another (uncorrelated with one another). A correlation of the error terms would result in an autocorrelation problem and would cause biases in estimation. The Durbin-Watson test and Breusch-Godfrey LM test for auto correlation are used to determine whether autocorrelation exists or not.

Test for Normality: The assumption in accurate regression models is the normality of the residuals in the model. This study tests the presumption that the error term has a normal distribution with a

mean of 0 and a fixed standard deviation. The error term's normality of distribution is checked using the skewness/kurtosis test.

Test for Multicollinearity: The study uses a correlation matrix of independent variables and a variance inflation factor test on the regression model to assess the independence of the explanatory variables and to identify any multicollinearity issues.

Omitted variable bias test: Ramsey's RESET test, a diagnostic test for omitted variable bias in the model, is used in the study to determine whether the model exhibits omitted variable bias.

Test for cross-sectional dependence: The study also examines the cross-sectional dependence in panel data models with fixed effects, to investigate the panel data models' common presumption that the error terms are independent across cross-sections. The residuals are examined for cross-entity correlation using the Pesaran Cross-Sectional Dependence test.

# Chapter Four

# 4. Results and Discussion

The findings of the study are presented in this chapter along with discussions. As described in the methodology, the analysis uses both descriptive tools and regression analysis. The descriptive statistics of variables involved is depicted in section 4.1 and 4.2 to understand the nature of the data collected. After which, in section 4.3 regression analysis starting from panel unit root tests is conducted. While using diagnostic and stability tests to confirm the fitness and suitability of the model described in the research, the regression dynamics among the variables are also depicted.

## 4.1. Descriptive Statistics of Variables

In this section, the dependent variable's descriptive statistics, Return on Assets (ROA) and Return on Equity (ROE) are shown, as are the explanatory variables: Loan and advance to deposit ratios (LD), Liquid asset to total asset ratios (LATA), Net interest margins (NIM), Asset interest yields (AIY), Log of bank asset size (LSIZE), Capital adequacy ratios (CAR), Non-interest income to revenue ratio (NIGR) which were taken from the audited reports of commercial banks, and macroeconomic variables such as GDP growth rate (GDP), exchange rate growth rate (ER) and inflation rate (INF) are described.

The values of the model's variables' mean, maximum, minimum, and standard deviation are shown in Table 4.1 below. These graphs provide an overview of the information utilized in the regression models.

Table 4.1 Descriptive statistics of variables

| Variables | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **ROA** | 210 | 2.771173 | 1.239636 | -7.506793 | 6.717239 |
| **ROE** | 210 | 21.12886 | 11.2648 | -25.24344 | 77.70858 |
| **LD** | 210 | 65.68395 | 12.50168 | 39.72224 | 97.96808 |
| **LATA** | 210 | 25.04342 | 12.15399 | 4.362481 | 57.89399 |
| **NIM** | 210 | 5.235 | 1.678749 | 1.225508 | 9.329667 |
| **AIY** | 210 | 6.632876 | 3.684112 | 1.072263 | 12.19993953 |
| **LSIZE** | 210 | 9.447892 | 1.500354 | 5.933862 | 13.80679 |
| **CAR** | 209 | 14.64462 | 5.105871 | 3.717103 | 38.24385 |
| **NIGR** | 210 | 35.13422 | 14.89879 | .2660029 | 76.68674 |

| | | | | | |
|---|---|---|---|---|---|
| **GDP** | 210 | 8.819078 | 2.039252 | 5.637303 | 12.55054 |
| **INF** | 210 | 16.41722 | 9.274091 | 6.63 | 33.94 |
| **ER** | 210 | 9.997626 | 5.573937 | 4.576271 | 20.14635 |

Source: Stata 16 output from the data collected on variables

Table 4.1 displays the descriptive statistics of all the variables for the imbalanced panel data of the variables from 2010 to 2022, with around 210 observations of each variable.

The sampled 17 banks in Ethiopia had a mean return on assets (ROA) of around 2.7%, as indicated in table 4.1 above. The data suggest that over time, an investment of one Birr in the total assets of the banks creates average earnings of ETB 2.77. In terms of one of the profitability indicators, ROA, the standard deviation across banks was 1.23%, with a range of -7.5% to 6.71%; this shows that there is a significant difference in the return on assets value during the specified time period.

The return on equity, on the other hand, has a mean value of 21.12%, meaning that the 17 banks in the given time period on average earned 21.1 birr on every 100 birr of share capital they have. With a standard deviation of 11% and a range from -25 to 77%, the return on equity is also fairly varied across the banks during the selected time period. For comparison, In the United States, the average return on equity (ROE) for U.S. banks between 2010 and 2019 ranged between about 5% and 12%. In the first quarter of 2020, as the COVID-19 pandemic had an impact on the banking industry, the average ROE for all U.S. banks fell to 3.22%; in 2021, before it rose to about 14 this year%. So the Return on equity calculated for the Ethiopian banks on average seems to exceed the returns observed in the United States indicating a more profitable investment for shareholders.

The dependent variables LD shows the ratio of loans and advances to the bank's deposits. The mean value of the ratio was 65.6%. The ideal loan to deposit ratio for the banking industry is typically between 80% and 90%. A bank that had a loan-to-deposit ratio of 100% would have lent clients one birr for every birr it had in deposits, which implies that a bank won't have a sizable amount of reserves on hand for anticipated or unforeseen eventualities. Consequently, the average loan to deposit ratio observed of 65.6% in Ethiopia indicates sub-par lending practices which imply that for every 100 birr of deposits the banks have they had lent only 65.6 birr as loans and advances to their customers, but this also implies that there is significant contingencies in case of unexpected losses or a buffer in case of bank runs.

The Liquid asset to total asset ratio had an average value of 25% during the described period, indicating that on average the banks have 1/4$^{th}$ of their assets in liquid positions, where they are able to liquidate these assets within a year's time in case of cash shortages. The standard deviation was observed at 12% and had a range from 4% to 57%. The value of the ratio also seems to have a significant deviation within the period.

The macroeconomic variables included in the model, such as the GDP growth rate, inflation rate, and exchange rate growth values, had average growth rates of 8.8%, 16.4%, and 9.9%,

respectively. The standard deviation and ranges of these values are also mentioned above in the table.

## 4.2. Regression Analysis: Results and Discussions

In this section results from regression analysis are presented. Consequently, under this section, results from pre-estimation analysis tests such as correlation analysis, and post-estimation diagnostic tests of the given model are presented. These includes, panel unit root test, multicollinearity test, auto correlation test, normality test, heteroskedasticity test and omitted variable bias test and cross-sectional dependence test.

### 4.2.1. Correlation analysis

Correlation between two variables measures the degree of linear association between them. The Pearson product moment of correlation coefficient was utilized to determine the relationship between each of the variables. The correlation coefficient's values are depicted between +1 and -1. A perfect positive link between the two variables is shown by a correlation coefficient of 1, whilst a perfect negative association is indicated by a correlation coefficient of -1. On the other hand, a correlation value of zero shows that there is no link (association) between two variables (Brooks, 2008).

The table below shows the correlation matrix among dependent and independent variables.

Table 4.2.1. Correlation matrix of dependent and independent variables

| | ROA | ROE | LD | LATA | NIM | AIY | LSIZE | CAR | NIGR | GDP | INF | ER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ROA** | 1.0000 | | | | | | | | | | | |
| **ROE** | 0.5766 | 1.0000 | | | | | | | | | | |
| **LD** | - 0.1264 | - 0.3122 | 1.0000 | | | | | | | | | |
| **LATA** | 0.1530 | - 0.0732 | 0.5087 | 1.0000 | | | | | | | | |
| **NIM** | 0.0929 | 0.1250 | 0.5498 | - 0.5958 | 1.0000 | | | | | | | |
| **AIY** | 0.0112 | 0.0130 | 0.3118 | - 0.2790 | 0.3273 | 1.0000 | | | | | | |
| **LSIZE** | - 0.0573 | 0.4312 | 0.1929 | - 0.1490 | - 0.4135 | 0.2882 | 1.0000 | | | | | |
| **CAR** | - 0.0598 | 0.5850 | - 0.1295 | 0.3955 | - 0.2300 | - 0.2009 | - 0.5363 | 1.0000 | | | | |
| **NIGR** | - 0.3428 | 0.0418 | 0.4798 | 0.4819 | - 0.6937 | - 0.3393 | - 0.3529 | 0.4808 | 1.0000 | | | |
| **GDP** | 0.1242 | 0.1100 | 0.6150 | 0.652 | 0.5164 | - 0.3125 | - 0.5469 | 0.1965 | 0.6490 | 1.0000 | | |
| **INF** | 0.0290 | 0.0126 | 0.3752 | 0.0760 | - 0.1601 | 0.1283 | 0.2458 | 0.0744 | 0.2286 | 0.5242 | 1.0000 | |
| **ER** | 0.1669 | 0.1449 | 0.2352 | 0.6072 | - 0.5206 | 0.3605 | 0.5494 | 0.1950 | 0.6354 | 0.6485 | 0.6223 | 1.00 |

(Source: own computation based on data collected)

The correlation result in Table 4.2.1 shows that loan to deposit ratio and non-interest income to gross revenue ratio, have a negative correlation with the dependent variable ROA. While the correlation result also depicts a negative relationship between loan to deposit ratio and ROE. There can also be observed that there is a reasonably positive relationship between loan to deposit ratio and liquid asset to total asset ratio (+0.5). While a negative correlation between net interest margin and liquid asset to total asset ratio (LATA) and non-interest income to gross revenue ratio (NIGR) can also be observed. The rest of the variables do not exhibit a strong correlation among each other

### 4.2.2. Panel unit root tests

The presence of non-stationary variables may lead to erroneous regression results; therefore, the study conducted a panel unit root tests to check the stationary and/or the presence of unit root in the panel data.

The study employed the fisher type test for panel unit root as it is an accurate test advised for unbalanced panel data and is according to the stata16 handbook. This was done to ensure that the data is stationary at level or first difference.

As a result, the ADF-Fisher panel unit root tests appropriate for unbalanced panel data were utilized in this work. It makes the assumption that each individual unit root process operates independently, employs chi square test statistics, and utilizes a chosen lag of 1 to eliminate higher-order autoregressive series components. The data in the table below showed that at the first difference, half of the variables are stationary.

Table 4.2.2. Panel unit root test results

| Variables | ADF test statistic (Inverse chi-squared value) variables at level form | ADF test statistic (Inverse chi-squared value) variables first difference from |
|---|---|---|
| **ROA** | 57.7336*** | |
| **ROE** | 60.0242*** | |
| **LD** | 6.3730 | 129.5759 *** |
| **LATA** | 148.7329*** | |
| **NIM** | 51.8092 * | 88.6513*** |
| **AIY** | 13.8385 | 126.0718*** |
| **LSIZE** | 68.2983 *** | |
| **CAR** | 57.7567*** | |
| **NIGR** | 31.3333 | 77.4735*** |
| **GDP** | 6.3307 | 183.6933*** |
| **INF** | 19.7211 | 112.7726*** |
| **ER** | 101.4459*** | |

***, **, * indicate significant at 1%, 5% and 10% level respectively.

The p-value in parenthesis in the table above indicates that the null hypothesis is rejected at a 1% level of significance. The panel unit root tests have a non-stationarity null hypothesis. The probability of the Augmented Dickie-Fuller, ADF-Fisher Chi-square statistic being significant at the 1% level of significance, either at first difference or level form, can be shown for all the variables. As a result, it disproves the null hypothesis that the variables have a unit root and demonstrates that they are stationary.

## 4.3. Regression model tests

The tests for appropriateness, assumptions, and regression model fitness are necessary for proper hypothesis testing and to ensure that the regression has accurate findings. Accordingly, the study has undergone the Hausman test as well as useful regression diagnostic tests, including normality, multicollinearity, heteroskedasticity, autocorrelation, and model specification tests.

### 4.3.1. Model Selection (Hausman test)

As Brooks (2008) noted in his book, fixed effects models and random effects models are the two main categories of panel estimator techniques that may be used in financial research. The Hausman test is used to determine whether fixed or random effects should be used, with the null hypothesis stating that the model should be based on random effects and the alternative stating that the fixed effects model is better. Based on this, a Hausman test is run to determine whether to use the random effects model or the fixed effects model.

Table 4.3.1. Hausman test results

| **Hausman test results for model 1 (ROA as dependent) and model 2 (ROE as dependent)** | | | |
|---|---|---|---|
| **Test statistic-Chi squared value** | | Calculated $Chi^2$ statistic p-value | |
| **Model 1** | Model 2 | Model 1 | Model 2 |
| **299.63** | 25.730 | 0.000*** | 0.0041*** |

***, **, * indicate significant at 1%, 5% and 10% level respectively.

The null hypothesis that the difference in coefficients is not systematic is rejected for this study based on the results, which are shown in the table, since it has a p-value of less than 0.05 for the regression models. Accordingly, the Hausman test shows that the fixed effect model is better suited to this research for both models.

### 4.3.2. Test for Heteroskedasticity

Heteroskedasticity testing was one of the tests for diagnosis used in this research. One of the presumptions for a stable regression model, according to Brooks (2008), has been that the variance of the errors is constant.

The model is tested for heteroskedasticity using a modified Wald test for groupwise heteroskedasticity. By computing a statistic for groupwise heteroskedasticity in the residuals of a fixed effect regression model, it tests the hypothesis. Under the homoskedasticity null hypothesis, the derived test statistic is a Chi-squared distributed statistic.

The table 4.3.2 the results of the Heteroskedasticity Test.

| **Wald test for group wise heteroskedasticity: for model 1 (ROA as dependent) and model 2 (ROE as dependent)** | | | |
|---|---|---|---|
| **Test statistic-Chi squared value** | | Calculated $Chi^2$ statistic p-value | |
| **Model 1** | Model 2 | Model 1 | Model 2 |
| **16.90** | 16.37 | 0.4677 | 0.4981 |

(Source: STATA 16 computation based on data collected)

The results of the table show that, the calculated p-value is greater than 0.05 and we fail to reject the null hypothesis of homoscedasticity in the model. Accordingly the modified Wald test for heteroskedasticity shows that the there is no groupwise heteroskedasticity for both of the models

### 4.3.3. Multicollinearity Test

The term "multicollinearity" refers to the issue that arises when the explanatory variables have a roughly linear connection, which results in incorrect regression estimations. Because some of the other variables have already taken into account one of the independent variables' effects or impacts on the model, multicollinearity also suggests that this independent variable is not actually required to the model. When one or more explanatory variables have strong linear relationships with one another, it occurs.

In order to test for multicollinearity amongst the explanatory variables in this study, the researcher will use the variance inflation factor (VIF) and correlation coefficient values derived in table 4.2.1.

When the correlation coefficient surpasses 0.80, researchers typically worry about multicollinearity. However, the results in table 4.2.1 indicate that there is no multicollinearity because the correlation between the variables does not approach 0.8. Also showing no multicollinearity across variables is the variance inflation factor, which was computed below.

The research, as usual, utilized a VIF threshold of 5. There is multicollinearity when the VIF value is more than 5. The findings, as displayed in the table below, suggest that there is no evidence of multicollinearity among the model's variables.

Table 4.3.3. The Variance inflation factor results in the explanatory variables

| **Variable** | **VIF** | **1/VIF** |
|---|---|---|
| **ER** | 2.03 | 0.493458 |
| **INF** | 1.85 | 0.539144 |

| | | |
|---|---|---|
| **LATA** | 1.83 | 0.546017 |
| **CAR** | 1.47 | 0.680325 |
| **NIGR D1.** | 1.43 | 0.698731 |
| **NIM D1.** | 1.42 | 0.702789 |
| **LSIZE** | 1.36 | 0.734865 |
| **GDP D1.** | 1.29 | 0.774870 |
| **LD D1.** | 1.25 | 0.800320 |
| **AIY D1.** | 1.12 | 0.896007 |
| **Mean VIF** | **1.51** | |

(Source: STATA 16 computation based on data collected)

### 4.3.4. Test for normality assumption

The residuals' normal distribution is the fundamental premise of an accurate regression model. The fit, stability, and reliability of the model may be affected if the residuals are not normally distributed. A normal distribution with a mean of 0 and a fixed standard deviation is assumed for the error term. In this study, the skewness/kurtosis test is used to assess the error term's normal distribution. The skewness/kurtosis test indicates that we fail to reject the null hypothesis of no skewness and no kurtosis.

Table 4.3.4. Test for normality assumption results

| **The skewness/kurtosis test of residuals: for model 1 (ROA as dependent) and model 2 (ROE as dependent)** | | | | | |
|---|---|---|---|---|---|
| **P-value (Skewness)** | | P-value (Kurtosis) | | P-value (joint) | |
| **Model 1** | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 |
| **0.5600** | 0.8702 | 0.3031 | 0.4267 | 0.4926 | 0.7170 |

(Source: STATA 16 computation based on data collected)

As can be seen from the results of the table, we fail to reject the null hypothesis of no skewness, and no Kurtosis, in both models, indicating a normal distribution of the error term in the models.

### 4.3.5. Test for Autocorrelation

This study employed the Durbin-Watson (DW) test for first order autocorrelation, which examines the connection between an error and its previous value. It also used the Breusch-Godfrey test to determine whether autocorrelation existed.

Table 4.3.5. Test for autocorrelation results

| **Breusch-Godfrey LM test for auto correlation: for model 1 (ROA as dependent) and model 2 (ROE as dependent)** | |
|---|---|
| **Test statistic-Chi squared value** | Calculated $Chi^2$ statistic p-value |

| **Model 1** | Model 2 | Model 1 | Model 2 |
|---|---|---|---|
| **0.545** | 0.085 | 0.4682 | 0.7710 |

(Source: STATA 16 computation based on data collected)

The calculated d-statistic for model 1 is 1.77, and for model 2 is 1.90, according to the Durbin-Watson test. Since the d-statistic values are approaching a value of 2, the results suggest that there was no significant evidence of autocorrelation in the data. According to Brook (2008), the model has no autocorrelation issue if the Durbin Watson (d-statistic) is roughly close to 2. To make it more robust, the absence of an autocorrelation problem was tested using the formal Breusch-Godfrey LM test for autocorrelation. which also shows that under the null hypothesis of no serial correlation, the p-values were not able to reject the null hypothesis, and consequently, the models did not have autocorrelation problems.

### 4.3.6. Test for cross-sectional dependence

This paper examines the cross-sectional dependence in panel data models with fixed effects. The error terms in panel data models are typically assumed to be independent across cross-sections. To determine if the residuals are associated between different entities, the Pesaran Cross-Sectional Dependence test is performed.

The unbalanced panel data in the study are tested by the Pesaran test for cross-sectional dependency using the techniques described in Pesaran (2004). The statistic developed by Pesaran has a typical normal distribution and can handle both balanced and unbalanced panels. The null hypothesis is that there is no correlation between residuals. The table below shows the test's findings.

Table 4.3.6. Test for cross-sectional dependence results

| **Pesaran test for cross-sectional dependence: for model 1 (ROA as dependent) and model 2 (ROE as dependent)** | | | |
|---|---|---|---|
| **Test statistic- value** | | Calculated p-value | |
| **Model 1** | Model 2 | Model 1 | Model 2 |
| **0.557** | 0.465 | 0.5776 | 0.6420 |

(Source: STATA 16 computation based on data collected)

The findings shown in the aforementioned table demonstrate that because the residuals have p-values greater than 0.05, we are unable to reject the null hypothesis that they are not correlated, indicating that there is no cross-sectional dependence in the variables and that neither model has associated residuals across entities.

### 4.3.7. Test for omitted variables

Ramsey's RESET test, which determines if the model has an omitted variable bias, is another diagnostic test used with the model. It checks for omitted variables in the model. The null hypothesis claims that there are no omitted variables in the model, and it is rejected if the p-value is less than 0.05.

Ho: model has no omitted variables

Table 4.3.7 Ramsey RESET test for omitted variables result

| **Ramsey RESET test using powers of the fitted values of ROA for model 1 and ROE for model 2** | | | |
|---|---|---|---|
| **Test statistic- value** | | Calculated p-value | |
| **Model 1** | Model 2 | Model 1 | Model 2 |
| **1.69** | 1.37 | 0.1716 | 0.2527 |

(Source: STATA 16 computation based on data collected)

From the result shown on the table, we are not able to reject the null hypothesis of this test which says that the model is correctly specified, because the p-value is larger than the conventional significance value of 0.05, implying that the models described do not have an omitted variable bias.

## 4.4. Model Estimation

The findings of the fixed effect regression model are reported in this section. Each of the variables' effects on the dependent variable might be positive or negative; the estimated beta coefficient highlights the level of influence each variable has on the dependent variable. P-values show what percentage level each variable is significant at, while R-squared values show how well the model explains the changes in the dependent variable.

The table below displays the findings from the study's fixed effect regression models. The panel regression model used to investigate how interest rate risk and liquidity risk affect profitability was

$$\boldsymbol{ROA_{it}} = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 LD_{it} + \boldsymbol{\beta}_2 LATA_{it} + \boldsymbol{\beta}_3 NIM_{it} + \boldsymbol{\beta}_4 AIY_{it} + \boldsymbol{\beta}_5 LSIZE_{it} + \boldsymbol{\beta}_6 CAR_{it} + \boldsymbol{\beta}_7 NIGR_{it} + \boldsymbol{\beta}_8 GDP_{it} + \boldsymbol{\beta}_9 INFL_{it} + \boldsymbol{\beta}_{10} ER_{it} + \boldsymbol{\varepsilon}_{it} \ldots\ldots \textbf{Model 1}$$

$$\boldsymbol{ROE_{it}} = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 LD_{it} + \boldsymbol{\beta}_2 LATA_{it} + \boldsymbol{\beta}_3 NIM_{it} + \boldsymbol{\beta}_4 AIY_{it} + \boldsymbol{\beta}_5 LSIZE_{it} + \boldsymbol{\beta}_6 CAR_{it} + \boldsymbol{\beta}_7 NIGR_{it} + \boldsymbol{\beta}_8 GDP_{it} + \boldsymbol{\beta}_9 INFL_{it} + \boldsymbol{\beta}_{10} ER_{it} + \boldsymbol{\varepsilon}_{it} \ldots\ldots \textbf{Model 2}$$

The table below reports the estimated outcomes of models 1 and 2's fixed effect panel regressions.

Table 4.4.1 Fixed effect estimation result for model 1

| *Model 1: ROA used as the dependent variable* | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std. Error | t-Statistic | P-value |
| LD | .0045426 | .0089672 | 0.51 | 0.619 |
| LATA | -.0125323 | .0071885 | -1.74 | 0.100* |
| NIM | .1063626 | .0263442 | 4.04 | 0.001*** |
| AIY | .0329023 | .0071127 | 4.63 | 0.000*** |
| LSIZE | .347575 | .0826886 | 4.20 | 0.001*** |
| CAR | .0650636 | .0294919 | 2.21 | 0.042** |
| NIGR | .0096437 | .0068884 | 1.40 | 0.181 |
| GDP | .0046825 | .0182108 | 0.26 | 0.800 |
| INF | -.0062231 | .0032479 | -1.92 | 0.073* |
| ER | .0204445 | .0027697 | 7.38 | 0.000*** |
| CONS | -3.007883 | 1.18417 | -2.54 | 0.022** |
| F(10,166) = 35.24 | | Within R-sq = 0.679 | | |
| Prob > F = 0.0000 | | Between R-sq = 0.382 | | Overall R-sq = 0.5699 |

***, **, * indicate significant at 1%, 5% and 10% level respectively.

The above-mentioned regression results show that the model is sound, and the F-statistic, which measures how strongly the model rejects the null hypothesis that all explanatory variables are equal to zero, is highly significant at 1% level. In addition, the model has Within-$R^2$ of 67.9%, Between-$R^2$ of 38.2% and an Overall-$R^2$ of 56.99%, in the fixed effect model. The Within-$R^2$ in fixed effect model explains how much of the variation in the dependent variable within each unit is captured by the model (i.e., how well do the model's explanatory variables account for variations in profitability within each of the banks over time). It means that the independent variables in the model account for more than 67% of the variance in the dependent variable, which is in accordance with the typical general guidelines of an R-squared value greater than 60%

The variables NIM AIY LSIZE CAR ER are statistically significant at 5% significance level, with their p-value, t-statistic and coefficient value as described in the table. The rest of the explanatory variables in the model are statistically insignificant at 5% significant level with inflation and liquid asset to total asset ratio being only statistically significant at 10% significance value. The constant term in the model is however, statistically significant at 5% significance level, with a coefficient of -3 indicating that if all the values of the explanatory variables were zero the average expected ROA for the banks in the period was -3%, however in practicality this has no real interpretation as the values of all explanatory variables such as GDP growth rate, or inflation rate cannot be at a zero value.

Table 4.4.2 Fixed effect estimation result for model 2

| *Model 2, ROE used as the dependent variable* | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std. Error | t-Statistic | P-value |
| LD | .0276137 | .065534 | 0.42 | 0.679 |
| LATA | -.2105461 | .1507245 | -1.40 | 0.182 |
| NIM | 1.456099 | .4339201 | 3.36 | 0.004*** |
| AIY | .3511786 | .0571077 | 6.15 | 0.000*** |
| LSIZE | 2.473232 | 1.079475 | 2.29 | 0.036** |
| CAR | -1.111388 | .4466078 | -2.49 | 0.024** |
| NIGR | .0366512 | .0688531 | 0.53 | 0.602 |
| GDP | .1502863 | .2474355 | 0.61 | 0.552 |
| INF | -.0670191 | .0290071 | -2.31 | 0.035** |
| ER | .2098789 | .0350148 | 5.99 | 0.000*** |
| CONS | -1.035195 | 15.72769 | -0.07 | 0.948 |
| F(10,166) = 23.20 | | Within R-sq = 0.6295 | | |
| Prob > F = 0.0000 | | Between R-sq = 0.864 | | Overall R-sq = 0.738 |

***, **, * indicate significant at 1%, 5% and 10% level respectively.

The regression results above indicate for model 2, show that the F-statistic, is highly significant at 1% significance value, rejecting the null hypothesis that all explanatory variables effect is zero. The model has Within-$R^2$ of 62.9%, Between-$R^2$ of 86.4% and an Overall-$R^2$of 73.8%, in the fixed effect model. The Within-$R^2$ in fixed effect model shows that the models explanatory variables account for changes 62.9% of the changes in profitability within a specific bank over the described time period.

The variables NIM AIY LSIZE CAR INF ER are statistically significant at 5% significance level, with their p-value, t-statistic and coefficient value as described in the table. The rest of the explanatory variables in the model are statistically insignificant at 5% significance level. The constant term in the model is also, statistically insignificant.

## 4.5. Discussions of the results

The findings of the fixed effect panel regression for the two models are discussed and explained in this section. It connects the findings to earlier empirical literature findings that are presented in chapter two of this study in order to understand the findings in terms of how liquidity risk and interest rate risk affect profitability measurements.

### 4.5.1. Liquidity risk and profitability

The results of the study shown in model 1, indicates that the loan to deposit ratio (LD) doesn't have a statistically significant effect on return on assets for the selected Ethiopian banks. While the liquid asset to total asset ratio (LATA) appears to have an effect only at 10% significant level, with the implication being a negative effect whereby ceteris paribus a 1% increase in the liquid asset to total asset ratio leads to a very small 0.012% decline in return on assets for the selected 17 banks in the sample. Therefore the effect of liquidity risk that is captured by loan to deposit ratio (LD) and liquid asset to total asset ratio (LATA) has only weak and almost no effect on the return on assets of the selected banks.

In model 2, both the loan to deposit ratio (LD) the liquid asset to total asset ratio (LATA) were found to be highly insignificant and had no effect on return on equity for the selected 17 banks in the sample. Therefore the effect of liquidity risk that is captured by loan to deposit ratio (LD) and liquid asset to total asset ratio (LATA) was found to have no effect on the return on equity measure of profitability.

Liquidity and profitability were theoretically expected to be negatively correlated, but this has not been the case in this research. Although many studies claim that high liquidity risk improves bank performance, empirical research from around the globe has shown that there can be cases where there is no relationship between liquidity risk and bank performance, such as some studies by Sufian & Chong (2008) and Almumani (2013), which indicate that there is little correlation between bank performance and liquidity risk.

While many studies in Ethiopia contend that high liquidity risk improves bank performance. The results of this research indicate that there is only a weak evidence that liquid asset to total asset ratio affects return on assets negatively (at 10% significance level) implying that the more liquid assets a bank has the lesser its return on assets (negative effect of liquidity risk on ROA), there is overall no statistically significant effect observed by other liquidity risk measures or in the effect on ROE in the second model. The findings of this research consequently indicate that liquidity risk has no statistically significant effect on profitability of commercial banks in Ethiopia when interest rate risk is captured.

### 4.5.2. Interest rate risk and profitability

According to the study's findings, which are shown in model 1, the net interest margin positively and significantly affects the return on assets for all banks at a 1% significance level. This suggests that, ceteris paribus, an increase in net interest margin of 1% will result in an increase in the return on assets of about 0.1%. While asset interest yield also has a positive significant effect on the return on assets at 1% significance level, implying that an increase in asset interest yield by 1% will increase the return on assets by approximately 0.032%, ceteris paribus.

Similar to model 1, the selected banks' net interest margin significantly increases return on equity at a 1% level of significance. Ceteris paribus, a 1% rise in net interest margin will result in a 1.45%

increase in return on equity. While asset interest yield which has a positive significant effect on the return on equity at the 1% significance level, accordingly, a 1% rise in asset interest yield will, ceteris paribus, result in an increase in the return on equity of about 0.35%.

As indicated in the earlier section, the higher the net interest margin and asset interest yield, the lesser the bank's interest rate risk since it will create a buffer for possible shocks on the interest rate margins of the banks. A high NIM can help a bank to weather interest rate fluctuations. When interest rates fall, banks typically earn less interest on their assets than they pay on their liabilities. This is because the interest rates on loans and investments typically fall faster than the interest rates on deposits. As a result, NIMs tend to narrow when interest rates fall, a higher NIM creates a buffer in case of interest rate risk.

The interest rate risk is explicable by the particular risks that banks confront, namely *Repricing risk*: This is the interest rate risk associated with timing variations in the maturity (for fixed-rate assets) and repricing (for floating-rate assets) of bank assets and liabilities. *Yield curve risk* is the danger that interest rates on a fixed-income instrument, such as a bond, will vary and impact its rate of return. *Basis risk* is a type of financial risk that results from a lack of perfect correlation between the rates received and paid on various financial instruments, with otherwise comparable features when interest benchmarks change. *Optionality risk* is associated with options included in many financial institutions' assets, and debt obligations. The repricing risk, which happens when interest rates are settled on liabilities on different periods from those on offsetting assets, can be a major source of risk for any bank, including Ethiopian banks.

The basis risk can also be an issue in the near future for the Ethiopian banks. A new policy that creates a benchmark for lending and deposit interest rates and represents the true worth of money based on inflation is anticipated to be introduced by the National Bank of Ethiopia (NBE). Within three years, it is anticipated that the policy would change the current interest rate system. The new rate will be utilized as a tool to transition away from the existing quantitative money control system and toward a market-driven interest rate system (Fortune, 2020).

The yield curve risk also can apply on the bonds that Ethiopian banks have in their assets while optionality risk although not a major issue right now due to the fact that not much securities are exchanged with put or call options, it might be a new source of risk when banks start to engage in derivative market in the very long-run.

Overall, the results of this study indicate a significant positive effect of net interest margin and asset interest yield on profitability measures ROA and ROE; meaning that as interest rate risk decreases (NIM and AIY increase) the bank's profitability measures also increase. Consequently this study has concluded that interest rate risk negatively affects bank profitability for commercial banks in Ethiopia.

### 4.5.3. Control variables and profitability

***The results of the study shown in model 1***, indicate that the from the three firm-specific control variables, asset size and capital adequacy ratio were found to have statistically significant effect on return on assets, while non-interest income to gross revenue ratio was not found to be statistically significant in affecting return on assets.

Furthermore, from the three macro-economic control variables, exchange rate growth was found to have statistically significant effect on return on assets; while inflation rate had weak evidence (10% significance level) to negatively affect return on assets. The GDP growth rate was not found to be statistically significant in affecting return on assets.

The effects in model 1 are such that, for the selected banks, the return on assets is significantly affected positively by the log transformed asset size at the 1% level. This suggests that, ceteris paribus, an increase in asset size of 1% will result in an increase in return on assets of around 0.34%.

Capital adequacy ratio has a positive significant effect on the return on assets at 5% significance level, implying that an increase in capital adequacy ratio by 1% will increase the return on assets by approximately 0.65%, ceteris paribus.

Furthermore, the macro-economic variable exchange rate growth has a positive significant effect on the return on assets at 1% significance level, implying that a 1% increase in etb/usd (1% depreciation of the birr) will increase the return on assets by approximately 0.65%, ceteris paribus

***The results of model 2,*** indicate that the from the three firm-specific control variables, asset size and capital adequacy ratio were found to have statistically significant effect on return on equity, while non-interest income to gross revenue ratio was not found to be statistically significant in affecting return on equity.

Furthermore, from the three macro-economic control variables, inflation rate and exchange rate growth were found to have statistically significant effect on return on equity, with inflation having negative effect and exchange rate growth having a positive effect. The GDP growth rate was also not found to be statistically significant affecting return on equity in model 2.

The effects in model 2 are such that the log transformed-asset size has a positive significant effect on the return on equity at 5% significance level for the all the banks. This implies that an increase in asset size by 1% will increase the return on equity by 2.47%, ceteris paribus.

Capital adequacy ratio has a negative and significant effect on the return on equity at 5% significance level, implying that an increase in capital adequacy ratio by 1% will decrease the return on equity by 1.11%, ceteris paribus.

At a 1% level of significance, the macroeconomic variable exchange rate growth has a positive significant influence on return on equity, which means that, ceteris paribus, a 1% increase in

etb/usd (or 1% depreciation of the birr) will enhance return on equity by about 0.2%. While the return on equity is negatively impacted by inflation at a 5% level of significance, ceteris paribus, a 1% increase in the inflation rate will result in a 0.06% decline in the return on equity.

The asset size of a bank's observed positive effect on return on assets and return on equity has been as expected with the implication that an increase in asset size will result in the bank having more infrastructure increasing its customer base and profits, especially for a country like Ethiopia whose banks operate with brick and mortar branches across the country the effect is clearly understandable. The larger the total asset size the better the bank's performance and profitability; this is in accordance with numerous research paper such as Tibebe & Gujral (2022) and Merin (2016) who found similar results of positive effect of asset size on bank profitability.

The capital adequacy ratio calculates a bank's available capital and determines if it has adequate capital in reserve to withstand a specific amount of losses before facing insolvency risk. The Capital adequacy ratio's positive effect in return on assets as such implies that the more capital the bank has compared to its assets, the better the financial soundness and further the more sound the financial institution the better its return on assets which empirically has been the case in studies such as Nguyen (2020) which have come to similar conclusions. The capital adequacy ratio's negative effect on return on equity is also understandable because of the fact that a better capital adequacy will mean having a large equity/ capital base reserve, this is expected to reduce the return on equity in banks. Overall, the capital adequacy ratio's effect on profitability has been mixed with it affecting return on assets positively and return on equity negatively.

The results of this study show that exchange rate growth has a positive effect on banks' profitability measures. It is argued that as the exchange rate rises, the relative price of commodities rises and leads to a relative high demand for money in the economy. Therefore, the demand for credit increases, which is expected to improve the bank's profitability. In accordance, the findings of this study suggest that as the Ethiopian birr depreciates the banks' profitability increases.

Inflation was found have a statistically significant negative effect on return on equity while it also had weak evidence of a negative effect on return on assets. The rationale behind the results can be explained by the fact that in Ethiopia there is a persistently high inflation rate while the interest rate the banks' charge on loans has not adequately adjusted quickly enough to capture the inflation rates observed. The disparities in the rates can be the reason why inflation was observed to have a negative effect on the banks' profitability.

The other finding of the study was that non-interest income to gross revenue ratio do not affect the profitability of banks and was not found to be relevant in determining either the return on assets or return on equity. The GDP growth rate was also not found to have a statistically significant effect on profitability of banks

# Chapter Five

# 5. Summary and Conclusion

## 5.1. Summary

This paper examined the effect liquidity risk and interest rate risk in selected Ethiopian commercial banks by analyzing how liquidity risk measures such as loan to deposit ratio and liquid asset to total asset ratio and, interest rate risk measures such as net interest margin and asset interest yield affect a bank's profitability, measured by return on assets and return on equity. The study's primary goals were to comprehend how liquidity risk and interest rate risk affect the profitability of Ethiopian commercial banks and to provide a foundation for further investigation of interest rate risk, which has not received much attention in Ethiopia. To analyze the effects the study used an unbalanced panel data for a sample of 17 banks that have been operating for at least 10 years for the period 2010-2022.

The study's econometric analysis looked at the variables in the model that impact the profitability measures, return on assets and return on equity. The model included bank specific control variables such as asset size, capital adequacy ratio and non-interest income to gross revenue ratio. In addition, possible macroeconomic determinants such as GDP growth rate, inflation rate and exchange rate growth were also captured in the model. The study utilized fixed effect panel model estimation as appropriate based on the results of the Hausman test on the data collected. The study also tested the unit root and confirmed the stationarity of the variables used in the model.

Further diagnostic tests were also run to show the stability and robust nature of the specified models. The test for heteroskedasticity, multicollinearity, normality of the residuals, autocorrelation, cross-sectional dependence and omitted variable bias were conducted. The results show, all the tests have had a desirable outcome that confirms the model's stability; there is no autocorrelation, no omitted variable bias, no multicollinearity, no heteroskedasticity, no cross-sectional dependence and normal distribution in the error term was observed.

The results of the study indicated that loan to deposit ratio and liquid asset to total asset ratio didn't have a statistically significant effect on profitability measures return on assets and return on equity for the selected Ethiopian banks, with only weak evidence that liquid asset to total asset ratio affected return on assets. The study therefore has determined that liquidity risk does not have a significant effect on profitability for the selected Ethiopian banks in the given period when interest rate risk effects are also captured.

The results also show that the net interest margin and asset interest yield have a positive statistically significant effect on profitability measures return on assets and return on equity for the selected Ethiopian banks. The implication being that interest rate risk which is inversely captured by net interest margin and asset interest yield, has a negative effect on profitability of the selected banks in Ethiopia.

Furthermore, the results also show that the from the three bank-specific control variables, asset size and capital adequacy ratio were found to have statistically significant effect on profitability measures. Asset size positively affecting both profitability measures ROA and ROE, and capital adequacy ratio affecting ROA positively and ROE negatively.

Finally, from the three macro-economic control variables, inflation rate and exchange rate growth were found to have statistically significant effect on both profitability measures for the selected Ethiopian banks, with inflation having negative effect and exchange rate growth having a positive effect.

GDP growth rate and non-interest income to gross revenue ratio were not found to be statistically significant in affecting on profitability measures return on assets and return on equity for the selected Ethiopian banks.

## 5.2. Conclusion and Implications

Based on the findings, the study has concluded the following

The liquidity risk observed in Ethiopian banks does not seem to have a significant effect on profitability measures when the effects of interest rate risk are captured. The results as such indicate that the banks should not directly focus on the liquidity of their assets but how the interest rate across their total assets have performed in order to improve their profitability.

The interest rate risk that banks face is a critical factor in determining the profitability of the banks and as such should be a major focus area for the banks. This is especially going to be relevant as Ethiopian banks try to modernize and adopt new loan products and credit facilities for their customer base, this is expected to bring with it complications in interest rate margins management, such as the Repricing risk described above, that is caused timing differences in maturity of loans compared to deposits. Therefore the banks need to pay a special attention to the timing disparities and set proper control measures.

Overall, Interest rate risk in Ethiopia although not historically a major issue it is expected to be a crucial factor that could possibly be of great importance for banks when interest rate benchmarks for saving deposits are gradually changed by the National Bank of Ethiopian and as they start to engage in buying long-term and short-term securities in the financial market. This is further emphasized by the fact that the banks in the period have had a highly varied net interest margin and have been performing differently in their profitability and the source can be traced back to the effects on interest rate risk.

Thus, this empirical study's conclusions highlight the necessity for banks to follow prudential and regulatory requirements and implement new risk management measures to manage their interest rate risks. The final implication for this study is that bank managers, policy makers and other stakeholders should also understand the nature of interest rate risk more and be mindful of its effects

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