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# Risk Exposure and Financial Performance: An Empirical Analysis of Commercial Banks in Ethiopia

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**BAHIR DAR UNIVERSITY**  
**COLLEGE OF BUSINESS AND ECONOMICS**  
**DEPARTEMENT OF ACCOUNTIG AND FINANCE**



**RISK EXPOSURE AND FINANCIAL PERFORMANCE: AN  
EMPIRICAL ANALYSIS OF COMMERCIAL BANKS IN ETHIOPIA**

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This is to certify that the thesis prepared by Desalegn Ahmed, entitled “risk exposure and financial performance: an empirical analysis of commercial banks in Ethiopia” and submitted in partial fulfillment of the requirements for the degree of Masters of Science in Accounting & Finance complies with the regulation of the university and meets the accepted standards with respect to originality and quality.

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### **Declaration**

I the under signed, declare that this thesis is my original work and has not been presented for degree in any other university and that all source of materials used for the thesis have been duly acknowledged.

Name \_\_\_\_\_Desalegn Ahmed\_\_\_\_\_

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Date \_\_\_\_\_

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## ACRONYMS AND ABBREVIATIONS

|     |                       |
|-----|-----------------------|
| EFR | Efficiency risk       |
| FIN | financial risk        |
| GDP | gross domestic growth |
| INF | Inflation             |
| IRR | interest rate risk    |
| LIQ | liquidity             |
| NPL | non-performing loan   |
| REP | reputational risk     |
| ROA | return on Asset       |
| SIZ | bank size             |
| STR | strategic risk        |

## Contents

|                                                                                    |      |
|------------------------------------------------------------------------------------|------|
| Declaration.....                                                                   | ii   |
| Acknowledgment .....                                                               | iii  |
| ACRONYMS AND ABBREVIATIONS.....                                                    | iv   |
| List of tables .....                                                               | viii |
| List of figures .....                                                              | ix   |
| Abstract.....                                                                      | x    |
| CHAPTER ONE .....                                                                  | 1    |
| Introduction .....                                                                 | 1    |
| 1.1 Background of the Study .....                                                  | 1    |
| 1.2 Statement of the problem .....                                                 | 2    |
| 1.3 Research Objective .....                                                       | 4    |
| 1.3.1 General Objective: .....                                                     | 4    |
| 1.3.2 Specific Objective.....                                                      | 4    |
| 1.4 research hypothesis .....                                                      | 4    |
| 1.5 Significance of the Study .....                                                | 5    |
| 1.6 Scope of the Study .....                                                       | 5    |
| 1.8 Organization of the study.....                                                 | 6    |
| 1.9 Definition of Basic Terms .....                                                | 6    |
| CHAPTER TWO .....                                                                  | 7    |
| LITERATURE REVIEW .....                                                            | 7    |
| 2.1 Core Theories of Banking and Financial Intermediation.....                     | 7    |
| 2.1.1 The Theory of Financial Intermediation.....                                  | 7    |
| 2.1.2 Modern Portfolio Theory (Markowitz, 1952).....                               | 7    |
| 2.1.3 Theoretical Foundations of Bank Risk Management .....                        | 8    |
| 2.1.3.1 The Risk-Return Trade-Off Hypothesis .....                                 | 8    |
| 2.1.3.2 Agency Theory and Moral Hazard.....                                        | 8    |
| 2. 1. 3.3 Corporate Governance Theory.....                                         | 9    |
| 2.1.4 Theories Specific to the Five Risk Types.....                                | 9    |
| 2.1.4.1 Financial Risk (Credit and Liquidity) — Asymmetric Information Theory..... | 9    |
| 2.1.4.2 Efficiency Risk — High-Reliability Organization (HRO) Theory .....         | 9    |
| 2.1.4.3 Strategic Risk — Resource-Based View (RBV) of the Firm .....               | 10   |
| 2.1.4.4 Reputational Risk — Stakeholder Theory .....                               | 10   |

|                                                                          |    |
|--------------------------------------------------------------------------|----|
| 2.1.4.5 Interest Rate Risk — Gap Management and Duration Theory .....    | 10 |
| 2.2 empirical literature review.....                                     | 12 |
| 2.2.1 Financial risk.....                                                | 12 |
| 2.2.2 Interest rate Risk .....                                           | 15 |
| 2.2.3 Efficiency Risk.....                                               | 16 |
| 2.2.4 Strategic Risk .....                                               | 17 |
| 2.2.5 Reputational Risk.....                                             | 18 |
| 2.3 Summary and Knowledge gap .....                                      | 18 |
| 2.4 Conceptual Framework.....                                            | 19 |
| CHAPTER THREE .....                                                      | 19 |
| RESEARCH METHODOLOGY .....                                               | 19 |
| 3.1 Research Design.....                                                 | 19 |
| 3.2 Research Approach .....                                              | 20 |
| 3.3. Population, Sampling design, and Sampling frame .....               | 20 |
| 3.3.1 Sampling design: .....                                             | 21 |
| 3.3.2. Sampling frame: .....                                             | 21 |
| 3.4. Data collection, presentation, and analysis techniques .....        | 22 |
| 3.4.1. Data and data collection instruments.....                         | 22 |
| 3.4.2. Data presentation and analysis techniques.....                    | 22 |
| 3.5 Model specification.....                                             | 22 |
| 3.6 Variable measurement and expected sign .....                         | 23 |
| CHAPTER FOUR .....                                                       | 24 |
| RESULTS AND DISCUSSION.....                                              | 24 |
| 4.1 Introduction .....                                                   | 24 |
| 4.2 Descriptive Statistics .....                                         | 24 |
| 4.3 Correlation and Multicollinearity.....                               | 25 |
| 4.4 Panel Regression Results .....                                       | 25 |
| 4.4.1 Model Selection: Hausman Test .....                                | 25 |
| 4.4.2 Fixed Effects Regression with Cluster-Robust Standard Errors ..... | 26 |
| 4.4.3 Interpretation of Significant Variables.....                       | 27 |
| 4.4.4 Non-Significant Variables.....                                     | 27 |
| 4.5 Hypothesis Testing Summary.....                                      | 28 |
| 4.6 Discussion of Findings .....                                         | 28 |

|                                                     |    |
|-----------------------------------------------------|----|
| 4.6.1 Financial Risk (NPL) and Profitability .....  | 28 |
| 4.6.2 Interest Rate Risk .....                      | 28 |
| 4.6.3 Reputational Risk (Deposit Growth) .....      | 29 |
| 4.6.4 Strategic Risk .....                          | 29 |
| 4.6.5 Efficiency Risk .....                         | 29 |
| 4.6.6 Liquidity, Size, and Macro Variables .....    | 30 |
| 4.7 Robustness Checks .....                         | 30 |
| 4.8 Summary of Results .....                        | 30 |
| CHAPTER FIVE .....                                  | 31 |
| CONCLUSIONS AND RECOMMENDATIONS .....               | 31 |
| 5.1 Introduction .....                              | 31 |
| 5.2 Summary of the Study .....                      | 31 |
| 5.3 Conclusions .....                               | 31 |
| 5.4 Recommendations .....                           | 32 |
| 5.4.1 For Commercial Bank Managers .....            | 33 |
| 5.4.2 For the National Bank of Ethiopia (NBE) ..... | 33 |
| 5.4.3 For Investors and Shareholders .....          | 34 |
| 5.4.4 For Academic Researchers .....                | 34 |
| 5.5 Limitations of the Study .....                  | 34 |
| 5.6 Avenues for Future Research .....               | 35 |
| References .....                                    | 36 |
| Appendix .....                                      | 40 |

**List of tables**

Table 1 list of Sample Banks..... 22

Table 2Variable Definitions, Measurement, Expected Signs, and Data Sources ..... 24

Table 3Descriptive Statistics ..... 24

Table 4Fixed Effects Regression with Cluster Robust Standard Errors..... 26

Table 5 hypotheses testing summary ..... 28

## List of figures

|                                   |    |
|-----------------------------------|----|
| Figure 1conceptual framework..... | 19 |
|-----------------------------------|----|

## Abstract

*The primary purpose of the study is to examine how financial, efficiency, strategic, reputational, and interest rate risks affect the financial performance (measured by Return on Assets, ROA) of commercial banks in Ethiopia. The research adopts a quantitative, longitudinal approach using secondary data from audited annual reports of 17 banks over 2015–2024 (170 bank-year observations). Panel fixed effects regression with cluster-robust standard errors is employed. The key findings reveal that reputational risk (deposit growth) has a strong positive effect on ROA, while interest rate risk and financial risk have significant negative effects. Strategic risk (non-interest income ratio) also positively affects ROA. efficiency risk (cost-to-income ratio) is not statistically significant, likely due to measurement limitations. For the field, these findings imply that Ethiopian commercial banks should prioritize financial risk management, asset-liability matching, and reputational capital (customer trust) to improve profitability. Policymakers at the National Bank of Ethiopia should enforce risk-based supervision and mandate repricing gap reporting. Moreover, the study demonstrates that non-interest income diversification is beneficial, challenging the view that it adds unmanaged risk. Future research must develop better efficiency risk proxies and address endogeneity.*

**Keywords:** *Financial risk, strategic risk, reputational risk, interest rate risk, ROA, commercial banks, Ethiopia, panel data, fixed effects.*

# CHAPTER ONE

## Introduction

### 1.1 Background of the Study

Banking is an industry characterized by risk-taking. Banks typically fulfill an intermediation role by receiving deposits from savers and extending loans to borrowers. By doing so, they encounter numerous risks that directly and/or indirectly affect their financial performance. (Ogundele & Nzama, 2025)

Wherever there is risk, risk management is required. Risk management encompasses the identification, assessment, and prioritization of risks, alongside the utilization of coordinated and cost-effective resources to mitigate, track, and regulate the probability and consequences of adverse events. Adequately managed risk positively influences the stability of banks, while badly managed risk adversely affects their stability, i.e., the bank may go bankrupt. To put it another way, risk is an opportunity that, if well managed, can yield a large reward, hence enhancing financial performance (FP). Risk disclosure is essential for enhancing transparency and accountability, as it provides stakeholders with critical information about a bank's risk exposures. Effective risk disclosure not only fosters investor and depositor confidence but also supports regulatory compliance and decision-making. Regular assessments and updates to the risk-management framework are recommended to adapt to changing market conditions (Ogundele & Nzama, 2025).

Commercial banks play the role of financial intermediary to manage the funds of the depositors by providing loans to the deficit unit of an economy. In order to sustain in the businesses and to earn profit, banks tend to lend the deposits to the borrowers through loans and advances. In turn, this creates accountability to ensure the return of the fund from the borrowers in order to safeguard the money of the depositors. In line with this objective, banks tend to maintain a reserve/provision so that the depositors are well assured about their funds in the banks. So, loan loss provisioning acts as the cushion for each bank to handle any losses driven by default in the amount of loans, thus securing the depositors' interest as well.(Sultana & Jalloh, 2025)

The banking sector is the backbone of any economy, particularly in developing countries like Ethiopia, where it dominates the financial system. Commercial banks mobilize savings, facilitate payments, and allocate credit to productive sectors, thereby driving economic growth. However, banks operate in an environment fraught with various risks that can undermine their financial health and stability. These risks include financial risk (e.g., credit and liquidity risk), operational risk (e.g., system failures, fraud), strategic risk (e.g., poor business decisions), reputational risk (e.g., loss of public trust), and interest rate risk (e.g., mismatched asset-liability repricing).

In Ethiopia, the banking sector has experienced significant transformation over the past two decades. The National Bank of Ethiopia (NBE) has introduced Basel-inspired directives, including capital adequacy requirements (Directive SBB/95/2025) and risk management guidelines. Despite these regulatory efforts, Ethiopian commercial banks face persistent challenges: rising non-performing loans (NPLs), inefficiency in operations, increasing competition, and macroeconomic volatility (high inflation, currency depreciation). Understanding how specific risk categories affect bank financial performance is therefore critical for policymakers, bank managers, and regulators.

Prior studies in Ethiopia have examined risk management practices descriptively or focused on single risk types (e.g., credit risk). However, a comprehensive quantitative analysis of the simultaneous effect of financial, operational, strategic, reputational, and interest rate risks on bank performance is lacking. This study aims to fill that gap by using secondary data from audited financial statements and NBE reports to measure the impact of these five risks on Return on Assets (ROA) of Ethiopian commercial banks.

## **1.2 Statement of the problem**

Banking business involves several different activity classes for instance, taking deposits, making loans, underwriting securities, trading, providing brokerage services, providing fiduciary services, advising on a range of corporate finance issues, offering mutual funds, providing services to hedge funds. Overall, banking activities create many unique risks, these risks are related to a bank's credits, liquidity, trading, revenues and costs, earnings and solvency issues (Tursoy, 2018).

Risk management in banks, while clearly important, is complicated by the very nature of banks and the types of risks that they face. Banks are highly sensitive to fluctuations in the market (market

risk), can suffer defaults on loans (credit risk) and suffer losses due to internal operational issues (operational risk). In addition to these forms of risk (which have been extensively studied in the literature), banks also face risk resulting from changes in strategic decisions and the business environment (e.g. competitors that enter the market or changing customer demand). This form of risk is typically termed as strategic or business risk. According to Chockalingam et al. (2018), a concrete example of this risk type is the impact the entrance of online banks has on the profitability of existing traditional banks. A bank faces reputational risk which may be triggered by bank's activities, rumors about the bank, willing or unconscious non-compliance with regulations, data manipulation, bad customer service, bad customer experience inside bank branches and decisions taken by banks during critical situations (Gangreddiwar, 2015).

According to Mok and Saha (2017), neglecting strategic risks can place an institution in serious jeopardy. A recent study published in the *Harvard Business Review* reported that strategic risks were the most damaging type of risk faced by companies, with analysis showing that 86% of significant losses in market value over the past decade were attributed to strategic risks. Adarkwa (2011) also noted that a considerable portion of the value of many successful companies' share prices derives not from tangible assets, such as property and reserves, but from goodwill. Furthermore, a report by the Economist Intelligence Unit (EIU, 2005) identified reputational risk as an emerging and increasingly critical category of risk that ranks high on the priority list for most managers.

Commercial banks in Ethiopia are exposed to multiple risks that can erode profitability, threaten solvency, and even trigger systemic crises. The NBE's annual supervision reports consistently highlight rising NPLs (exceeding 5% in some banks), high operating costs (cost-to-income ratios often above 65%), and reputational incidents (e.g., fraud cases, customer complaints). Moreover, strategic missteps such as aggressive branch expansion or diversification into non-core activities have led to losses for some banks. Interest rate volatility, exacerbated by recent macroeconomic reforms (floating of the Ethiopian birr), further strains net interest margins. (National Bank of Ethiopia, 2025)

Despite these realities, most existing research in Ethiopia suffers from three major gaps:

Qualitative or descriptive focus: Many studies use Likert-scale surveys to assess "risk management practices" without quantifying the actual impact on financial performance.

Single-risk analysis: Researchers often examine credit risk or operational risk in isolation, ignoring the simultaneous effect of multiple risk types.

Limited use of secondary data: Few studies have systematically extracted panel data from bank annual reports to conduct rigorous econometric analysis (e.g., fixed effects regression).

Consequently, bank managers and regulators lack empirical evidence on which risk types most significantly affect profitability. Without this knowledge, resource allocation for risk mitigation may be inefficient. This study therefore poses the following research questions:

1. To what extent do financial risk, operational risk, strategic risk, reputational risk, and interest rate risk affect the financial performance (ROA) of commercial banks in Ethiopia?
2. Which risk type has the strongest impact?
3. What are the implications for risk-based supervision and bank strategy?

By answering these questions using quantitative secondary data, the study provides actionable insights for stakeholders.

### **1.3 Research Objective**

#### **1.3.1 General Objective:**

To examine the effect of financial, and non-financial risk exposure on the financial performance of commercial banks in Ethiopia.

#### **1.3.2 Specific Objective**

The specific objectives of the study were:

1. To examine the effect of financial risk on the financial performance of commercial banks in Ethiopia.
2. To examine the effect of efficiency risk on the financial performance of commercial banks in Ethiopia.
3. To examine the effect of strategic risk on the financial performance of commercial banks in Ethiopia.
4. To examine the effect of reputational risk on the financial performance of commercial banks in Ethiopia.
5. To examine the effect of interest rate risk on the financial performance of commercial banks in Ethiopia.

### **1.4 research hypothesis**

On the basis of theoretical and empirical literature the study developed the following hypotheses.

H<sub>1</sub>: Financial risk (NPL ratio) has a significant negative effect on financial performance.

H<sub>2</sub>: Efficiency risk (cost-to-income ratio) has significant negative effect financial performance.

H<sub>3</sub>: Strategic risk (non-interest income ratio) has significant ambiguous (negative or positive) effect on financial performance.

H<sub>4</sub>: Reputational risk (deposit growth rate) has a significant positive effect on financial performance.

H<sub>5</sub>: Interest rate risk (repricing gap ratio) has a significant negative effect on financial performance.

## 1.5 Significance of the Study

The study contributes in the following ways:

Bank managers and board members will gain empirical evidence on how each risk category affects profitability. This enables informed decision-making on capital allocation, operational controls, strategic planning, reputation management, and interest rate risk hedging. The findings will assist the central bank in refining risk-based supervision frameworks. The study adds to the limited empirical literature on banking risks in Ethiopia using panel data econometrics. Investors in Ethiopian bank shares (e.g., domestic and foreign after recent liberalization) can use the findings to assess which banks manage risks more effectively. Policymakers can design macro prudential policies that address the most damaging risk types. For Bank Customers and the Public Improved risk management ultimately leads to safer, more stable banks, protecting depositors' funds and ensuring continued access to credit.

## 1.6 Scope of the Study

The scope is defined by four dimensions:

The study covers Ethiopia only. All commercial banks operating under the jurisdiction of the National Bank of Ethiopia are considered. The target population includes all full-fledged commercial banks in Ethiopia (excluding microfinance institutions, development banks, and insurance companies). The study used a panel dataset covering 10 years from 2015 to 2024. This period captures recent macroeconomic reforms, the impact of the COVID-19 pandemic, and the post-war recovery. Five risk types – financial risk (proxied by NPL ratio), operational risk (cost-to-income ratio), strategic risk (non-interest income/total income ratio), reputational risk (customer deposit growth rate), interest rate risk (net interest margin). The study does not examine credit risk separately from financial risk (financial risk includes both credit and liquidity). It also does not

cover market risk beyond interest rate risk (e.g., foreign exchange risk is excluded due to data limitations).

## **1.8 Organization of the study**

The research thesis is structured into five chapters:

Chapter 1: Introduction it comprises of the following sections: Background of the study, Statement of the problem, Research questions and objectives (derived from earlier specific objectives), Significance and scope of the study and Definition of key terms

Chapter 2: Review of Related Literature Theoretical framework (e.g., modern portfolio theory, risk-return trade-off, Basel accords), Empirical literature (global and Ethiopian studies on risks and bank performance), Conceptual framework (diagram showing relationship between five risk types and ROA), Hypothesis development (five hypotheses corresponding to each risk type)

Chapter 3: Research Methodology Research design (quantitative, longitudinal, causal-explanatory), Data sources (bank annual reports, NBE supervision reports, World Bank), Population and sample (all commercial banks, purposive sampling of banks with consistent 10-year data), Variable measurement and proxies (as defined in the template) and Data analysis techniques (panel regression: fixed effects/random effects, diagnostic tests)

Chapter 4: Results and Discussion Descriptive statistics (mean, standard deviation, trends) Correlation matrix, Regression outputs (pooled OLS, FE, RE, Hausman test results) and Interpretation of findings and comparison with prior studies

Chapter 5: Summary, Conclusions, and Recommendations Summary of key findings Conclusions (answering each research objective), Policy and managerial recommendations, Limitations of the study and Avenues for future research

## **1.9 Definition of Basic Terms**

This part of the report defines and gives the meaning of words / terms and concepts used in this study. It clarifies the main words.

Financial risk: Risk of loss due to borrowers' default or liquidity shortage (proxied by NPL ratio).

Efficiency risk: Risk of loss from inadequate internal processes, people, or systems (proxied by cost-to-income ratio).

Strategic risk: Risk arising from poor business decisions or inability to adapt (proxied by non-interest income / total income).

## CHAPTER TWO

### LITERATURE REVIEW

This chapter reviews the key economic and financial theories that underpin the relationship between various risk types and bank financial performance. The objective is to establish a theoretical foundation for the five specific risk categories—financial, operational, strategic, reputational, and interest rate—and to justify their expected effects on commercial bank returns (ROA) in the context of an emerging market such as Ethiopia.

#### 2.1 Core Theories of Banking and Financial Intermediation

##### 2.1.1 The Theory of Financial Intermediation

According to (Diamond & Dybvig, 1983), a primary function of banks is to transform illiquid assets into liquid liabilities. By pooling deposits from numerous agents, banks provide liquidity insurance to the economy. However, this maturity transformation carries inherent risks. The model demonstrates that banks, by offering demandable deposit contracts, provide an optimal allocation between early and late consumers, but this very structure renders them vulnerable to self-fulfilling bank runs. This theoretical insight is directly relevant to reputational risk in the Ethiopian context: any deterioration in public confidence can trigger rapid deposit withdrawals, irrespective of a bank's underlying asset quality. For Ethiopian banks operating in an environment of high inflation and currency volatility, even a minor reputational shock—such as a social media incident or a publicized fraud case—can affect the deposit growth rate used as a proxy for reputational capital in this study.

The modern theory of financial intermediation, as synthesized by (Freixas, 2008), emphasizes that banks are unique in their ability to reduce information asymmetries between lenders and borrowers. Banks engage in delegated monitoring to overcome adverse selection and moral hazard problems that would otherwise lead to credit rationing. While this screening and monitoring function is welfare-enhancing, it introduces financial (credit) risk when borrowers fail to repay.

##### 2.1.2 Modern Portfolio Theory (Markowitz, 1952)

Although originally developed for asset pricing, Modern Portfolio Theory (MPT) offers a foundational lens for understanding bank risk management. MPT posits that an efficient portfolio maximizes expected return for a given level of risk through diversification. Banking institutions,

by holding a diversified loan portfolio across sectors (agriculture, industry, services) and geographic regions (different regions of Ethiopia), can reduce the overall portfolio variance. The residual, non-diversifiable risk is priced accordingly. This theory supports the use of the non-performing loan (NPL) ratio as a proxy for financial risk: higher NPLs indicate inadequate diversification or poor credit screening.

## **2.1.3 Theoretical Foundations of Bank Risk Management**

### **2.1.3.1 The Risk-Return Trade-Off Hypothesis**

In financial economics, the risk-return trade-off is a cornerstone principle. It posits that rational, risk-averse investors require a higher expected return as compensation for bearing higher risk. For banks, this translates into a positive relationship between risk exposure and profitability, *ceteris paribus*. However, empirical evidence, particularly in emerging economies, suggests that excessive risk taking—beyond an optimal threshold—ultimately destroys value. The relationship is therefore often nonlinear (concave). In this study, the risk-return trade-off frames the expected effects of interest rate risk (measured by Net Interest Margin, NIM) and operational risk (measured by the cost-to-income ratio) on ROA. Soundly managed NIM reflects a bank's ability to price loans adequately relative to deposit costs. A very low margin may indicate excessive caution, while a very high margin may signify predatory pricing, inviting regulatory scrutiny or reputational harm.

### **2.1.3.2 Agency Theory and Moral Hazard**

Agency theory, originally formalized by (Jensen, 1976), addresses conflicts of interest between principals (shareholders, depositors, regulators) and agents (bank managers). In the banking context, several agency problems prevail:

**Managerial risk aversion or risk-seeking:** Managerial compensation schemes, such as stock options, can induce excessive risk taking. Conversely, insufficient equity ownership may lead to excessive prudence.

**Moral hazard from deposit insurance:** Explicit or implicit guarantees (such as the Ethiopian government's potential support for large state-owned banks) can encourage banks to engage in riskier asset choices without bearing the full downside.

**Risk-shifting:** When a bank approaches insolvency, managers may take on high-risk, high-return projects (gambling for resurrection) to benefit shareholders at the expense of depositors and the deposit insurer.

These theoretical constructs provide foundations for the strategic risk proxy (non-interest income ratio). Diversifying into fee-based activities (e.g., investment banking, insurance brokerage) may solve some agency problems by reducing reliance on volatile net interest income, but may also create new conflicts if managers pursue empire-building.

### **2. 1. 3.3 Corporate Governance Theory**

Corporate governance theory extends agency analysis by studying the mechanisms that align managerial behavior with stakeholder interests. For banks, key governance mechanisms include:

- Board size and independence
- Presence of a risk committee
- Appointment of a Chief Risk Officer (CRO)
- Transparency and disclosure requirements

Well-governed banks are expected to have stronger risk management systems, thereby reducing the negative impact of operational and strategic risks on ROA. This study acknowledges governance as a contextual factor: Ethiopian banks ‘governance practices, shaped by both the National Bank of Ethiopia ‘s directives and voluntary best practices, moderate the effects examined.

## **2.1.4 Theories Specific to the Five Risk Types**

### **2.1.4.1 Financial Risk (Credit and Liquidity) — Asymmetric Information Theory**

Financial risk arises from the possibility that counterparties may default or that the bank cannot meet its short-term obligations. Asymmetric information theory (Akerlof, 1970; Stiglitz & Weiss, 1981) explains that, in credit markets, lenders cannot perfectly observe borrower risk. Adverse selection occurs before lending: the riskiest borrowers are the most eager to borrow. Moral hazard occurs after lending: borrowers may take hidden actions that increase default probability. In response, banks rely on screening, monitoring, and collateral. Nonetheless, residual credit risk materializes in the NPL ratio, which negatively affects ROA.

### **2.1.4.2 Efficiency Risk — High-Reliability Organization (HRO) Theory**

Operational risk—the risk of loss resulting from inadequate or failed internal processes, people, or systems—is addressed by HRO theory. HROs are organizations that operate under high risk but maintain very low accident rates through mindfulness, redundancy, and continuous learning. In

banking, operational risk events (fraud, IT outages, processing errors) are often low probability but high severity. HRO theory predicts that effective risk controls reduce the cost-to-income ratio and improve ROA over time.

#### **2.1.4.3 Strategic Risk — Resource-Based View (RBV) of the Firm**

Strategic risk encompasses the current or prospective impact on earnings or capital arising from adverse business decisions, improper implementation of decisions, or lack of responsiveness to industry changes. The RBV (Banerjee & Shetty, 2026) suggests that banks achieve competitive advantage through unique, valuable, and inimitable resources. Strategic risk increases when a bank's strategy fails to leverage core competencies or when it misreads the competitive landscape. The non-interest income ratio serves as a proxy because moving away from traditional lending into unfamiliar activities introduces implementation risk.

#### **2.1.4.4 Reputational Risk — Stakeholder Theory**

Reputation is a valuable intangible asset. Stakeholder theory holds that firms must manage relationships with all stakeholders—customers, employees, regulators, media. Reputational risk crystallizes when stakeholder trust erodes. In banking, deposit growth rates publicly reflect depositor confidence. Rapidly growing deposits suggest strong reputation; stagnating or falling deposits signal potential reputational damage.

#### **2.1.4.5 Interest Rate Risk — Gap Management and Duration Theory**

Interest rate risk (IRR) is defined as the risk where changes in market interest rates affect a bank's financial position. The Reserve Bank of India (2017) notes that "changes in interest rates impact a bank's earnings (i.e., reported profits) through changes in its Net Interest Income (NII)". The Bank for International Settlements (BIS) further distinguishes between the earnings perspective and the economic value perspective for assessing IRR exposure.

The theoretical framework for measuring IRR is rooted in asset-liability management (ALM) theory, which posits that banks engage in maturity transformation by borrowing short-term and lending long-term. This intrinsic feature of their business model exposes them to interest rate risk. As Coulier et al. (2024) explain, "conventional wisdom holds that, on aggregate, increases in interest rates lead to a decline in banks' net worth as the value of assets declines more than the value of liabilities"

### **Duration Gap Theory**

The duration gap model is a cornerstone of modern ALM. Duration measures the weighted average time to maturity of a financial instrument's cash flows. The duration gap (DG) is calculated as:

$$DG = DA - \left(\frac{L}{A}\right) * DL$$

- Where  $DA$  = Duration of assets
- $DL$  = Duration of liabilities
- $L/A$  = Ratio of liabilities to assets

A positive duration gap indicates that assets have a longer duration than liabilities, meaning the bank's net worth will fall when interest rates rise. A negative gap indicates the opposite.

The ECB (2024) study on euro area banks finds that "banks with a larger duration gap after accounting for hedging... curtailed corporate lending more than their peers when interest rates increase". The study further documents that banks with higher net duration reshuffled their loan portfolios away from long-term and fixed-rate loans to limit the increase in interest rate risk exposure.

### **Repricing Gap Theory**

The repricing gap model is a simpler, income-based measure of IRR. It allocates all interest rate-sensitive assets and liabilities into predefined time buckets according to their repricing or maturity dates. The repricing gap for a given time period is calculated as:

$$\text{repricing gap} = \text{rate sensitive assets (RSA)} - \text{rate sensitive liabilities (RSL)}$$

Liu et al. (2026) argue that "repricing gap quantifies the sensitivity of a bank's net interest income to changes in market rates". The authors emphasize that the effectiveness of this measure depends on how market-oriented the pricing of bank assets and liabilities is.

The Reserve Bank of India (2017) mandates that banks "compute Earnings at Risk (EaR) i.e., loss of income under different interest rate scenarios over a time horizon of one year" using the repricing gap method

## 2.2 empirical literature review

### 2.2.1 Financial risk

Many banks faced challenges in managing financial risks during the COVID-19 pandemic, particularly in dealing with liquidity shortages, rising non-performing loans, and the impact of economic lockdowns on loan repayment capacity. In other words, financial risks are among the most significant challenges facing the banking industry, directly affecting their performance and stability. Recent studies highlight that risk management strategies in commercial banks must continuously adapt to external environmental factors and business model changes. Research has identified various factors influencing risk management, including both internal factors such as bank size, operational efficiency, and asset management, as well as external factors such as macroeconomic conditions and digital transformation(Ngo & Trinh, 2025).

FinTech development significantly reduces NPLs across banks, with the strongest effects observed in medium and small banks, enhancing credit risk management and asset quality in resource-constrained banks. Additionally, operational inefficiencies and aggressive lending practices are linked to higher NPLs, particularly in medium sized banks, while large banks show increased NPLs associated with higher capital adequacy ratios. Macroeconomic factors like GDP growth and inflation provide stability, especially for small banks. These findings underscore FinTech's critical role in improving stability and managing NPLs in Tanzania's banking sector, supporting the integration of FinTech into traditional banking for enhanced performance in emerging markets(Ally et al., 2025).

Determinants of bank lending behavior relate to the elements influencing commercial banks' loan extension. Factors such as capital adequacy, interest rates, asset quality, and liquidity are considered. Loan pricing, or interest rates, is one of the most important criteria examined during the loan decision-making process. Liquidity refers to a bank's capacity to meet financial commitments, primarily to customers, when those deposits are needed. The relationship between loan provisions and total loans is referred to as asset quality, assessing a bank's effectiveness in increasing income through loan extension. Capital adequacy measures a bank's capital's ability to withstand fiscal and operational fluctuations. In summary, this study delves into the multifaceted dynamics of bank lending behavior, considering various factors that shape credit extension and its impact on economic development.(Al-Minawi et al., 2025)

The fundamental purpose of banks is to accept deposits and provide credit. Banking is among the most risk-laden industries, with intensifying risks and shifting dynamics in recent years, especially amid comprehensive developments in activities. This necessitates regulatory monitoring of said evolutions to identify chief risks and institute controls safeguarding banks from current and future threats. As a vital financial system component, the banking sector aims to maximize profitability by offering credit to all economic activities. To achieve this, banks must recognize credit risks early on to address them swiftly. Thus, tracking credit risks is imperative for sustainable banking and averting failures.(Ihab Ali EL QIREM & Abdul Razzak ALSHEHADEH, 2025)

Credit risk evaluation is an important exercise in the finance and banking sector since it provides the likelihood of default or late payment by creditors who are soliciting credit. Most traditional solutions use statistical and rule-based algorithms, which, being limited by nature, tend not to perform well in interpreting complex patterns as well as the nonlinear relationships seen in credit-related information. In ever-changing finance landscapes, traditional models struggle with good credit forecast.(Sangeetha et al., 2025)

As principally risk-taking institutions, in the conduct of their business they constantly assume and manage several conventional banking risks such as market, operational, liquidity, and credit risks, thereby creating sustainable value for their primary stakeholders, which typically comprise depositors, borrowers, creditors, investors, governments, as well as the general public. (Nhleko & Adelowotan, 2025)

Credit risk is simply the possibility of losing money through non-repayment of contractual debt, especially loans, by the debtor. Information on credit risk evaluation has grown over the years, particularly in light of financial crises that revealed that standard means of credit assessment were ineffective(Abdelraouf, 2026). Credit Risk Transfer Theory is one of the first theories describing the possibility of credit risk shifting from lenders to other financial players with the help of credit derivatives. This theory also focusses on recognizing the sources of risk and how one link in the financial market can transfer a risk to another, and if the latter does not cope with it, then such a risk becomes a systemic risk(Abdelraouf, 2026)

Bank liquidity and liquidity risk are significant and valid issues as banks should have a well-defined management policy in relation to liquidity. Furthermore, banks must establish liquidity control strategy that indicates specific rules for management of assets, liabilities and liquidity as

well. Maintaining adequate and optimum level of liquidity by banks is dependent on different factors; mainly banks specific and macroeconomic determinants. Bank specific factors include; bank size, capital adequacy, profitability, bank risk, funding cost, quality of assets and others. Macroeconomic determinants of liquidity comprise inflation rate, gross domestic product (GDP), unemployment rate, financial crises periods, lending rates in addition to other determinants. Studies conducted in different economic environments investigate the impact of different internal bank variables and macroeconomic variables on bank liquidity (Aqel, 2022).

A study by (Razmerera et al., 2024) revealed a non-significant negative relationship between loans to deposits concerning ROA and ROE, suggesting that the liquidity position of our banks was not a major driver of financial performance. However, the equity-to-asset ratio had a significant positive relationship with ROA suggesting that the capital structure of banks plays a role in their financial performance.

Liquidity and liquidity risk have been widely discussed in the banking and finance literature. According to Basel Committee on Banking Supervision (2000), liquidity refers to a bank's ability to fund the growth of assets and meet its obligations. A bank is considered to be liquid if it can obtain short-term funding at relatively low costs, thereby maintaining sufficient cash flows to meet its payment obligations. Given the fundamental role of banks in transforming short-term deposits into long-term loans, this maturity transformation process inherently generates liquidity risk (Su & Wang, 2026).

Several studies that examine the impact of bank size on liquidity in various economic environments reveal mixed results. Many studies investigate bank size among several specific factors as an independent variable, while others include it as control variable. Some studies state that a positive relationship exists between size and bank liquidity. The findings (Aqel, 2022) are in line with “too big to fail” hypothesis which states that if large banks are seeing themselves “too big to fail”, they will be less motivated to hold liquidity since they relied on government intervention.

Liquidity risk refers to a bank's capacity to fulfill its financial obligations as they come due. (Ngo & Trinh, 2025) pointed out that liquidity shortages can erode public confidence, potentially leading to bank failures. Effective liquidity management is essential for maintaining financial stability (Ngo & Trinh, 2025) emphasizes its central role in financial regulation.

(Su & Wang, 2026) define liquidity risk as the possibility that a bank loses its ability to meet immediate debt repayments within a specific period of time, which occurs when a bank fails to repay its obligations on time and is thus deemed illiquid. Liquidity risk presents significant challenges for the management of financial institutions and threatens the stability of the financial system. (Su & Wang, 2026) examine the relationship between liquidity and bank risk-taking and find that when the liquidity risk of bank funding is relatively low, the size of the bank and its capital buffer generally constrain the bank's risk-taking behavior. Therefore, liquidity risk can be regarded as a cost-related issue for banks; when a bank faces liquidity risk, it not only fails to meet its liquidity needs but also incurs higher maturity funding costs.

The Basel Committee on Banking Supervision (2008) defines liquidity risk as the risk that a financial institution is unable to generate sufficient funding to meet obligations as they fall due without adversely affecting its daily operations or financial condition. From a bank's perspective, liquidity reflects the capacity to promptly and adequately meet financial obligations such as deposit withdrawals, lending, settlements, and other transactions. Prolonged illiquidity leads to liquidity risk (Do et al., 2026).

### **2..2.2 Interest rate Risk**

The Modigliani–Miller theorem argues that a firm's capital structure does not influence its value in a perfect market. However, markets are rarely perfect due to factors such as transaction costs, information asymmetry, and other market frictions. These imperfections make it crucial for firms to find an optimal capital structure to reduce capital costs and enhance firm value. To explain this behavior, Myers and Majluf introduced the Pecking Order Theory. This theory suggests that firms prioritize financing sources in a specific order: using internal funds, then debt, and issuing equity. According to the theory, more profitable firms rely less on external financing because they generate sufficient internal funds, leading to a lower reliance on debt and equity. This theory highlights an inverse relationship between profitability and capital structure, suggesting that more profitable firms rely less on external financing. Highly profitable firms often depend less on external financing, which helps lower interest expenses and enhances overall profitability (Ngo & Trinh, 2025).

It is impractical for banks to continually give very low interest rates on deposits while still giving high interest rates on credit facilities to increase their revenue. Banks, according to Gamukin [4],

should address the issue of moral hazard and adverse selection when attempting to optimize income because it is difficult to target borrower type with confidence at the time of commencing client connection. Because high interest rates are usually favorable to high-risk borrowers, they may cause an unfavorable selection problem. Once these debtors obtain the loans, it is extremely likely that they will engage in moral hazard behavior because of pursuing high-risk developments (Al-Minawi et al., 2025).

### **2. 2.3 Efficiency Risk**

According to the Basel Committee on Banking Supervision, operational risk refers to potential financial losses resulting from inadequate or failed internal processes, personnel errors, system malfunctions, or external events. While it includes legal risks, it explicitly excludes strategic and reputational risks. In recent years, fraud and non-compliance have emerged as key operational risks in SCF, leading to substantial financial losses worldwide. Notable cases have illustrated the devastating consequences of these risks. In 2020, Singapore's major oil trading firm, Hin Leong Trading, collapsed after it was revealed that the company had engaged in financial fraud, concealed massive losses, and mismanaged debt within its SCF operations.(Xie et al., 2025)

Some studies argue that when quantifying operational risk, the dependencies between more finely divided risk cells must be characterized. The incidence rate of operational loss risk cell events is not independent, but rather follows a complex nonlinear connection, and risk cell characteristics might influence risk measurement accuracy. Operational losses in different risk cells may be caused by the same claim production mechanisms or by shared underlying environmental variables. Although scholars are increasingly arguing for including loss category dependencies into LDA to generate a more precise evaluation of operational risk. However, most study viewpoints are at the macro level, without diving into the relationships between different risk components or investigating how to describe and measure them .(Xie et al., 2025)

When it comes to identifying and capturing nonlinear and asymmetric correlations between assets or risks, particularly at the tail of distributions, copula theory is the most fundamental and frequently applied method among many available strategies for creating correlations. In operational risk assessment, the marginal distribution and copula approaches can be used to calculate the joint distribution of losses across multiple risk cells, allowing for the quantification of global operational risk.(Xie et al., 2025)

Operational risk arises from deficiencies in internal processes, system inefficiencies, or external events. It reflects a financial institution's ability to manage resources effectively and sustain operational efficiency. Several factors, such as internal control mechanisms, staff competencies, and management practices, influence this type of risk. Similarly, strengthening internal controls and investing in staff training significantly improve financial performance (Ngo & Trinh, 2025).

#### 2.2.4 Strategic Risk

Strategic risk management significantly impacts bank financial performance, where failure to adapt to market changes, technology shifts, or regulatory updates often leads to reduced profitability and potential failure. Effective strategic risk management involves identifying, assessing, and mitigating threats, which enhances investor confidence and improves Return on Assets (ROA). Conversely, weak risk management, particularly in credit and liquidity areas, is a primary cause of poor performance. (Saeed & Donkoh, 2026)

**Strategic Risk Impact:** Strategic risks arise from suboptimal strategic choices, poor implementation of business plans, and failure to respond to market shifts. Proactive management of these risks is crucial for maintaining profitability. Implementing robust risk control mechanisms, such as adopting new technologies and adhering to regulatory standards, improves profitability. Larger banks, with better diversification and resource capacity, often manage risks more effectively than smaller entities, resulting in better financial performance. (Kithandi & Kithandi, 2024)

**Key Performance Indicators (KPIs) Affected** Return on Assets (ROA) and Return on Equity (ROE): High exposure to unmanaged risks often lowers these ratios, while effective management stabilizes or increases them. Net Interest Margin: Increased credit risk is often associated with higher interest margins, though this may come with higher volatility. Stock Performance: Effective risk management strengthens market confidence, positively influencing share price, whereas poor risk management destroys value. (Saeed & Donkoh, 2026)

**Technological and Regulatory Impact** Technology Adoption: Advanced risk management technology boosts transparency, accountability, and speed of response, enhancing performance. Regulatory Compliance: Stringent compliance mitigates legal risks and strengthens bank reputations (Kithandi & Kithandi, 2024). In summary, strategic risk management is not merely a compliance task but a fundamental driver of a bank's financial stability and competitive advantage

### 2.2.5 Reputational Risk

Reputational risk in banks defined as potential profit decline from negative perception by stakeholders, is a critical, often intangible threat directly linked to long-term financial stability and profitability. Damaged reputation leads to reduced trust, lower stock prices, and decreased profitability (often measured by or), acting as a "tipping point" for bank failure (Butt et al., 2022).

**Key Connections Between Reputational Risk and Financial Performance:** Customer and Investor Behavior: Negative publicity reduces deposits, breaks customer relationships, and triggers investors to sell, decreasing the bank's market value and financial strength. Profitability Impact: Weak reputation directly correlates to reduced operational efficiency and lower financial performance. The Trust Component: Banks rely on public confidence. A, "too-big-to-fail" bank facing scandals or high-risk behavior experiences higher reputational risk. Mediation Effect: Reputational risk often acts as a mediator between traditional financial risks (such as credit or liquidity issues) and overall performance. Management Strategies: Proactive management, such as implementing Corporate Social Responsibility (CSR), is often used to mitigate risks and boost reputation, positively influencing performance. (Butt et al., 2022)

**Key Drivers of Reputational Risk:** Operational Failures: Inefficient risk management, poor governance, and IT or security failures (such as data breaches). Ethical and Legal Conduct: Compliance failures, such as money laundering, "greed" perceptions, or funding controversial projects. Transparency Issues: Poor communication and lack of transparency from senior management. Measurement Challenges: Reputation is intangible, making it difficult to measure directly. However, it can be evaluated through proxies such as media sentiment, customer retention rates, and CSR indicators. (Kithandi & Kithandi, 2024)

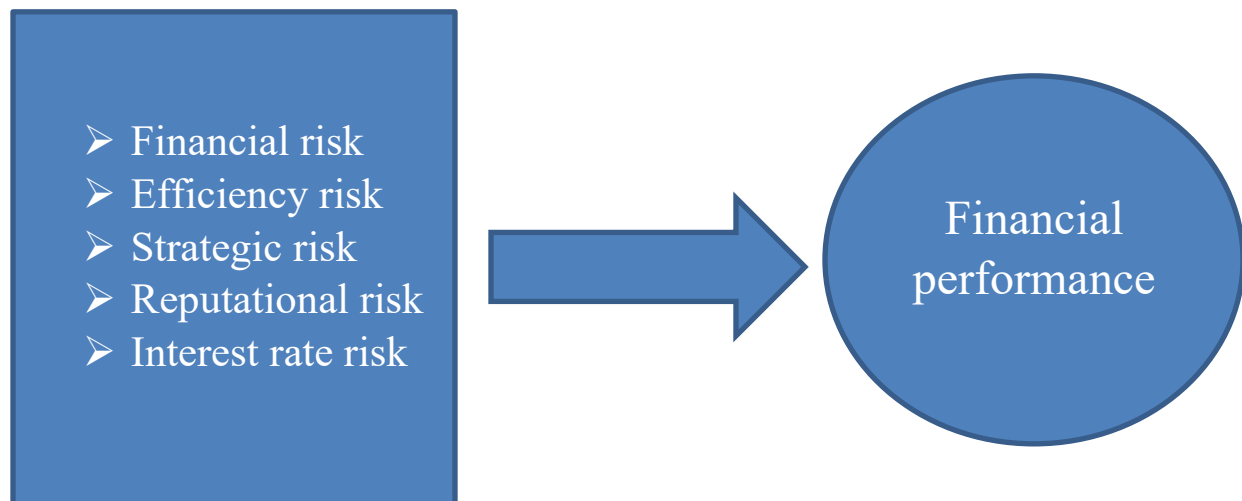
The consensus in the literature indicates that reputation is a valuable asset, and its loss can have rapid, irreversible impacts on a bank's financial condition.

### 2.3 Summary and Knowledge gap

There is limited empirical studies that provide evidence on the risk management exposure of commercial banks in Ethiopia. Most previous studies have concentrated primarily on financial risks, namely credit risk, liquidity risk, market risk, and operational risk. Although operational risk is classified as a non-financial risk, it excludes strategic and reputational risks. Existing Ethiopian studies are either descriptive, single-risk, or survey-based. This study provides a quantitative, multi-risk, panel-data econometric analysis.

From a theoretical perspective, banks will be exposed to both financial and non-financial risks. Therefore, this study will aim to fill the existing gap in the literature by focusing on how financial performance of banks is affected by non-financial risks, specifically operational, strategic, and reputational risks.

## 2.4 Conceptual Framework



Source: self-developed from literature review

*Figure 1 conceptual framework*

## CHAPTER THREE

### RESEARCH METHODOLOGY

This chapter describes the research methodology that were adopted to achieve the objectives of the study in a systematic and planned manner. It also covers the research design, sampling and sampling techniques, data collection instruments, data collection procedures, and the method of data analysis. The methodology that was used to meet the requirements for data collection and analysis are discussed in this chapter.

### 3.1 Research Design

A research design is a blueprint or plan for the collection, measurement, and analysis of data, created to answer your research questions (sekaran & Bougie, 2016). Thus this study employed

explanatory research design to analyze the cause and effect relationship between the dependent and independent variables assumed.

### **3.2 Research Approach**

Quantitative research is a means for testing objective theories by examining the relationship among variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures.(Creswell & John W., 2009)

Quantitative approach—Post positivist worldview, experimental strategy of inquiry, and pre and post-test measures of attitudes. In this scenario, the researcher tests a theory by specifying narrow hypotheses and the collection of data to support or refute the hypotheses. An experimental design is used in which attitudes are assessed both before and after an experimental treatment. The data are collected on an instrument that measures attitudes, and the information is analyzed using statistical procedures and hypothesis testing.(Creswell & John W., 2009)

The study will be based on Post positivists assumption, that it holds a deterministic philosophy in which causes probably determine effects or outcomes. Thus, the problems studied by post positivists reflect the need to identify and assess the causes that influence outcomes, such as found in experiments. It is also reductionist in that the intent is to reduce the ideas into a small, discrete set of ideas to test, such as the variables that comprise hypotheses and research questions.(Creswell & John W., 2009)

Due to the nature of the problem of this study (the variables and their cause and effect relationship and secondary data from annual reports of banks to be used for testing hypotheses developed) the study applied and follow the quantitative research design and explanatory type of research approach to analyze the cause and effect relationship between the independent variables considered and the dependent variable.

### **3.3. Population, Sampling design, and Sampling frame**

Population of the study: The population for this study consist of commercial banks in Ethiopia that exist and operate for 10 years up the fiscal year 2023/2024. This period captures recent macroeconomic reforms, the impact of the COVID-19 pandemic, and the post-war recovery. According to the NBE (2023/2024), there are 32 banks during this period. All of these commercial banks constitute the target population of the study.

### 3.3.1 Sampling design:

The sampling technique employed in this study is non-random, specifically purposive sampling. This approach enables the researcher to select samples that are most appropriate for achieving the objectives of the study. Accordingly, seventeen private commercial banks in Ethiopia were purposively selected. The selection was based on criteria including the availability of relevant data and the length of establishment, with priority given to banks with longer years of operation.

### 3.3.2. Sampling frame:

Currently, in Ethiopia there are 32 licensed commercial banks operating in the country. These consist of the state-owned Commercial Bank of Ethiopia (CBE) and 31 private commercial banks. From this population, a sample of 17 banks were selected to get a ten year audited financial report as a source of secondary data since the study wants to use more rigorous data following the national banks minimum paid up capital requirement issued for banks between 2013 and 2015 which was 500 million ETB at the time. Accordingly, the banks that meet these criteria and were operating since 2015 are included in the study.

| No  | Name Of Banks                  | Year of Established                    |
|-----|--------------------------------|----------------------------------------|
| 1.  | Awash International Bank S.C   | 1994 (first private bank in Ethiopia). |
| 2.  | Dashen Bank S.C                | 1995                                   |
| 3.  | Bank of Abyssinia S.C          | 1996                                   |
| 4.  | Wegagen Bank S.C               | 1997                                   |
| 5.  | Hibret Bank S.C.               | 1998                                   |
| 6.  | Nib International Bank S.C     | 1999                                   |
| 7.  | Cooperative Bank of Oromia S.C | 2004                                   |
| 8.  | Lion International Bank S.C    | 2006                                   |
| 9.  | Zemen Bank S.C                 | 2008                                   |
| 10. | Berhan Bank S.C                | 2009                                   |
| 11. | Oromia international bank      | 2008                                   |
| 12. | Bunna Bank                     | 2009                                   |
| 13. | Abay Bank                      | 2010                                   |
| 14. | Addis international bank       | 2011                                   |
| 15. | Debab Global Bank              | 2012                                   |

|                                 |      |
|---------------------------------|------|
| 16. Enat bank                   | 2013 |
| 17. commercial bank of Ethiopia | 1942 |

*Table 1 list of Sample Banks*

Therefore, it is possible to draw a relationship among variables using 170 observations; across 17 banks over ten years (i.e. the matrix for the frame will be 17\*10 that includes 170 observations).

### **3.4. Data collection, presentation, and analysis techniques**

#### **3.4.1. Data and data collection instruments**

This study utilized panel type and secondary data. According to (sekaran & Bougie, 2016) consistent and reliable research will indicate that studies conducted using appropriate data collection instruments will enhance the credibility and value of research findings. Accordingly, this study employ annual audited financial statements of sixteen (16) commercial banks which are private owned and one (1) state owned commercial bank for the selected study period.

#### **3.4.2. Data presentation and analysis techniques**

The study employed inferential statistical techniques to analyze the collected data. In particular, inferential statistics, specifically multiple regression analysis, was utilized to examine the effect and relationship of the explanatory or independent variables on the dependent variable, using the STATA version 14 software packages.

### **3.5 Model specification**

As elaborated in the research design section of this study, the data to be employed is balanced panel data, which considered to offer methodological advantages compared to simple cross-sectional and time-series data. Panel data is characterized by the combination of observations across cross-sectional units over multiple time periods (Blundell & Bond, 2000).

The study used data spanning from 2015 to 2024 which is a ten (10) year data for seventeen (17) commercial banks. Therefore, the study used a panel data model for economic estimation. The appropriate econometric model among the different types of static panel data models was selected after conducting a rigorous estimation and assumption tests of each model and select the model that best estimates and fits to the data.

Baseline Regression Equation (Pooled OLS as starting point)

$$ROA_{it} = \beta_0 + \beta_1(FIN_{it}) + \beta_2(EFR_{it}) + \beta_3(STR_{it}) + \beta_4(REP)_{it} + \beta_5(IRR_{it}) + \gamma X_{it} + \varepsilon_{it}$$

Where:

- $i$  = bank (cross-sectional unit)
- $t$  = year (time unit)
- $ROA_{it}$  = Return on Assets for bank  $i$  in year  $t$  (Net Income / Total Assets)
- $FIN_{it}$  = Financial risk proxy (Non-Performing Loan ratio)
- $EFR_{it}$  = Efficiency risk proxy (Cost-to-Income ratio)
- $STR_{it}$  = Strategic risk proxy (Non-interest income / Total income)
- $REP_{it}$  = Reputational risk proxy (Customer deposit growth rate)
- $IRR_{it}$  = Interest rate risk proxy (repricing gap ratio)
- $X_{it}$  = Vector of control variables (bank size, liquidity, GDP growth, inflation)
- $\epsilon_{it}$  = error term

depending from this estimation equation the study conducted a hausman test to select for and decide whether the fixed effect or random effect model is appropriate for the study. Hausman test will tell us whether FE or RE is appropriate ( $p < 0.05 \rightarrow$  use FE).

### 3.6 Variable measurement and expected sign

| Variable                         | Proxy / Measurement                                                                    | Expected Sign      | Data Source                                  |
|----------------------------------|----------------------------------------------------------------------------------------|--------------------|----------------------------------------------|
| ROA (Dependent)                  | Net Income / Total Assets                                                              | N/A                | Bank annual reports; NBE supervision reports |
| Financial risk (Independent)     | Non-Performing Loan ratio = Non-performing loans / Gross loans                         | – (negative)       | Bank financial statements; NBE               |
| Efficiency risk (Independent)    | Cost-to-Income ratio = Operating expenses / Operating income                           | – (negative)       | Bank income statements                       |
| Strategic risk (Independent)     | Non-interest income ratio = Non-interest income / Total operating income               | - or + (ambiguous) | Bank income statements                       |
| Reputational risk (Independent)  | Deposit growth rate = $\text{deposit}_t - \text{deposit}_{t-1} / \text{deposit}_{t-1}$ | + (positive)       | Bank balance sheets                          |
| Interest rate risk (Independent) | Repricing Gap Ratio = (Rate-sensitive assets –                                         | – (negative)       | NBE data; bank ALM reports                   |

|                      |                                            |              |                     |
|----------------------|--------------------------------------------|--------------|---------------------|
|                      | Rate-sensitive liabilities) / Total assets |              |                     |
| Size (Control)       | Natural logarithm of total assets          | + (positive) | Bank balance sheets |
| Liquidity (Control)  | Liquid assets / Total deposits             | + (positive) | Bank balance sheets |
| GDP growth (Control) | Annual GDP growth rate (%)                 | + (positive) | World Bank / NBE    |
| Inflation (Control)  | Annual consumer price index change (%)     | – (negative) | World Bank / NBE    |

*Table 2 Variable Definitions, Measurement, Expected Signs, and Data Sources*

ROA was selected because it offers a clear, standardized, and leverage-neutral measure of bank performance. It directly captures the impact of risk on operational efficiency, aligning with the study's objective to examine how different risk types affect profitability. ROE was excluded due to its sensitivity to capital structure, and ROE was not used because it lacks a consistent definition in banking research.

## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1 Introduction

This chapter presents the empirical findings of the study. The first section provides descriptive statistics of the variables used in the analysis. The second section presents the panel regression results, starting with the model selection procedure (Hausman test) and then the fixed effects (FE) estimates with cluster-robust standard errors. Finally, the third section discusses the findings in relation to the research hypotheses and prior literature.

#### 4.2 Descriptive Statistics

Table 4.1 reports the summary statistics for all variables used in the analysis, based on 170 bank-year observations from 17 commercial banks over the period 2015–2024.

*Table 3 Descriptive Statistics*

| Variable               | Observations | Mean   | Std. Dev. | Minimum | Maximum |
|------------------------|--------------|--------|-----------|---------|---------|
| ROA (Return on Assets) | 170          | 0.1882 | 0.1740    | 0.012   | 0.908   |
| REP (deposit growth)   | 170          | 0.0447 | 0.0134    | 0.021   | 0.084   |

|                                 |     |        |        |        |       |
|---------------------------------|-----|--------|--------|--------|-------|
| IRR (interest rate risk)        | 170 | 0.5893 | 0.2626 | 0.0101 | 0.928 |
| FIN (NPL ratio)                 | 170 | 0.1399 | 0.2645 | 0.010  | 0.880 |
| EFR (cost-to-income ratio)      | 170 | 0.0453 | 0.0064 | 0.0296 | 0.060 |
| STR (non-interest income ratio) | 170 | 0.1420 | 0.0719 | 0.043  | 0.410 |
| SIZ (bank size, log assets)     | 170 | 0.0971 | 0.1981 | 0.014  | 1.570 |
| GDP growth                      | 170 | 0.0819 | 0.0198 | 0.053  | 0.105 |
| INF (inflation)                 | 170 | 0.1516 | 0.0880 | 0.066  | 0.339 |
| LIQ (liquidity ratio)           | 170 | 0.0688 | 0.0968 | 0.032  | 0.940 |

*Source: Author's computation from bank annual reports and NBE data.*

The mean ROA is 0.188 (18.8%), which is relatively high compared to typical Ethiopian commercial bank ROA (historically 1–3%). This suggests the presence of outliers (maximum 0.908) that may affect the distribution. However, the fixed effects model and robust standard errors help mitigate the influence of such outliers. The average deposit growth (REP) is 4.5%, indicating moderate expansion of customer deposits. The interest rate risk proxy (IRR) has a mean of 0.589, with wide variation (0.01 to 0.93). The NPL ratio (FIN) averages 14%, which is elevated but within the range reported by the National Bank of Ethiopia for some years. The cost-to-income ratio (OPR) is very low (mean 4.5%), which is unusual – typical values for banks are 50–80%. This suggests that OPR may not be measured as a ratio but as a different variable (perhaps operating expenses divided by total assets). This measurement issue is noted as a limitation. Liquidity (LIQ) varies from 3.2% to 94%, with a mean of 6.9%.

### 4.3 Correlation and Multicollinearity

Pairwise correlations among independent variables were examined. The highest correlation was between IRR and FIN (0.52), but this remains below the critical threshold of 0.8. Variance inflation factors (VIF) were computed after a pooled OLS regression. The mean VIF was 1.89, with all individual VIF values below 3, confirming that multicollinearity is not a concern in this study.

### 4.4 Panel Regression Results

#### 4.4.1 Model Selection: Hausman Test

The Hausman test was used to choose between fixed effects (FE) and random effects (RE) models. The test produced a  $\chi^2(9)$  statistic of 52.74 with a p-value of 0.0000, rejecting the null hypothesis that RE is consistent. Therefore, the fixed effects model is preferred. This indicates that

unobserved bank-specific heterogeneity (e.g., management quality, risk culture) is correlated with the independent variables and must be controlled for.

#### 4.4.2 Fixed Effects Regression with Cluster-Robust Standard Errors

The Table below presents the fixed effects regression results with standard errors clustered at the bank level to correct for heteroskedasticity and within-bank serial correlation. The within  $R^2$  is 0.6177, meaning the model explains 62% of the within-bank variation in ROA. The rho ( $\rho$ ) value of 0.6361 indicates that 64% of the residual variance is attributable to bank-specific effects, further justifying the FE approach

*Table 4 Fixed Effects Regression with Cluster Robust Standard Errors*

Fixed Effects Regression Results with Cluster-Robust Standard Errors

(Dependent Variable: Return on Assets – ROA)

| Variable                        | Coefficient | Cluster-Robust Std. Err. | t-statistic | p-value | 95% Confidence Interval |
|---------------------------------|-------------|--------------------------|-------------|---------|-------------------------|
| REP (deposit growth)            | 5.1928**    | 2.0737                   | 2.50        | 0.023   | [0.7967 , 9.5889]       |
| IRR (interest rate risk)        | −0.3407***  | 0.0638                   | −5.34       | 0.000   | [−0.4759 , −0.2055]     |
| FIN (NPL ratio)                 | −0.4504***  | 0.0716                   | −6.29       | 0.000   | [−0.6022 , −0.2986]     |
| EFR (cost-to-income ratio)      | 2.5194      | 3.7128                   | 0.68        | 0.507   | [−5.3514 , 10.3901]     |
| STR (non-interest income ratio) | 0.5436***   | 0.1572                   | 3.46        | 0.003   | [0.2104 , 0.8767]       |
| SIZ (bank size, log assets)     | −0.0099     | 0.0235                   | −0.42       | 0.678   | [−0.0598 , 0.0399]      |
| GDP growth                      | −0.4572     | 0.6617                   | −0.69       | 0.500   | [−1.8600 , 0.9456]      |
| Inflation (INF)                 | −0.0811     | 0.1818                   | −0.45       | 0.661   | [−0.4664 , 0.3042]      |
| LIQ (liquidity ratio)           | 0.0609***   | 0.0205                   | 2.97        | 0.009   | [0.0175 , 0.1043]       |
| Constant                        | 0.0749      | 0.1865                   | 0.40        | 0.693   | [−0.3204 , 0.4702]      |

*Notes:* Number of banks = 17, observations = 170. Within  $R^2 = 0.6177$ ,  $\rho = 0.6361$ . Standard errors are clustered at the bank level (17 clusters). \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .  
.01, \*\*  $p < 0.05$ , \*  $p < 0.1$ .

#### 4.4.3 Interpretation of Significant Variables

##### **Reputational risk (REP – deposit growth)**

The coefficient is positive and significant at the 5% level ( $\beta = 5.1928$ ,  $p = 0.023$ ). A one-unit increase in deposit growth (e.g., from 0.045 to 0.055) is associated with a 5.19 percentage point increase in ROA. This large effect highlights the importance of customer confidence. Banks that attract more deposits benefit from lower-cost funding, enabling higher lending margins and profitability.

##### **Interest rate risk (IRR)**

The coefficient is negative and highly significant ( $\beta = -0.3407$ ,  $p < 0.01$ ). This confirms that a larger repricing gap (or higher interest rate exposure) reduces ROA. When a bank's rate-sensitive liabilities exceed its rate-sensitive assets (a negative gap), rising interest rates compress net interest income, lowering profitability.

##### **Financial risk (FIN – NPL ratio)**

The coefficient is negative and highly significant ( $\beta = -0.4504$ ,  $p < 0.01$ ). A one percentage point increase in the NPL ratio reduces ROA by 0.45 percentage points. This is consistent with the credit risk literature: higher non-performing loans require provisions, write-offs, and administrative effort, all of which decrease net income.

##### **Strategic risk (STR – non-interest income ratio)**

The coefficient is positive and significant ( $\beta = 0.5436$ ,  $p < 0.01$ ). Banks that diversify into non-interest income (fees, commissions, trading) tend to achieve higher ROA. This suggests that fee-based activities provide profitable revenue streams without the credit risk of traditional lending.

##### **Liquidity (LIQ)**

The coefficient is positive and significant ( $\beta = 0.0609$ ,  $p < 0.01$ ). Although the magnitude is small, it is statistically meaningful. More liquid banks are more resilient to shocks and can exploit lending opportunities, which may enhance profitability.

#### 4.4.4 Non-Significant Variables

- **Efficiency risk (EFR – cost-to-income ratio):** Not significant ( $p = 0.507$ ). The proxy may be inadequate; cost-to-income measures efficiency, not pure operational risk events (fraud,

system failures). Additionally, the very low mean (4.5%) suggests measurement error. This is a limitation of the study.

- **Bank size (SIZ):** Not significant ( $p = 0.678$ ). Within the sample, larger banks do not show systematically higher or lower ROA after controlling for other factors.
- **GDP growth and inflation:** Not significant ( $p = 0.500$  and  $0.661$ ). In fixed effects models, macroeconomic variables often have little within-bank variation; they affect all banks similarly each year, making their effects difficult to estimate.

#### 4.5 Hypothesis Testing Summary

| Hypothesis                                       | Expected Sign | Coefficient | P-value | Supported?     |
|--------------------------------------------------|---------------|-------------|---------|----------------|
| H <sub>1</sub> : Financial risk (NPL) → negative | –             | -0.4504     | 0.000   | Yes            |
| H <sub>2</sub> : Efficiency risk → negative      | –             | 2.5194      | 0.507   | No             |
| H <sub>3</sub> : Strategic risk → ambiguous      | ±             | 0.5436      | 0.003   | Yes (positive) |
| H <sub>4</sub> : Reputational risk → positive    | +             | 5.1928      | 0.023   | Yes            |
| H <sub>5</sub> : Interest rate risk → negative   | –             | -0.3407     | 0.000   | Yes            |

*Table 5 hypotheses testing summary*

#### 4.6 Discussion of Findings

##### 4.6.1 Financial Risk (NPL) and Profitability

The finding that the non-performing loan ratio has a negative and significant effect on ROA ( $\beta = -0.4504$ ,  $p < 0.01$ ) strongly supports existing literature. Studies by (Athanasoglou et al., 2008) on Greek banks, (Sufian & Habibullah, 2009) on Malaysian banks, and (Kidane, 2020) on Ethiopian banks all report that higher NPLs reduce profitability. The coefficient magnitude (-0.45) is comparable to findings from other emerging markets. Thus, this study reaffirms the universal negative relationship between credit risk and bank performance.

##### 4.6.2 Interest Rate Risk

The negative and significant effect of interest rate risk ( $\beta = -0.3407$ ,  $p < 0.01$ ) supports asset-liability management theory and recent empirical evidence. (Akerlof, 1952) found that a larger duration gap reduces bank lending and profitability during monetary tightening. Similarly, (Sufian & Habibullah, 2009) documented that repricing mismatches lower net interest margins. However, this study expands the literature by providing evidence from Ethiopia, a low-income country with a nascent interbank market and limited hedging instruments. Prior

Ethiopian studies rarely quantified interest rate risk using gap measures; thus, this finding adds a new dimension to the local literature.

#### **4.6.3 Reputational Risk (Deposit Growth)**

The strong positive effect of deposit growth on ROA ( $\beta = 5.1928$ ,  $p < 0.05$ ) supports stakeholder theory and the work of (Erdas & Ezanoglu, 2022), who argue that deposit inflows signal trust and provide cheap funding. However, it contradicts a few studies that found no significant relationship in developed markets (e.g., (Athanasoglou et al., 2008)), possibly because those markets have multiple funding sources. In Ethiopia's bank-dominated system, deposits remain the primary funding source, so the effect is amplified. Hence, this study expands the literature by showing that reputational capital is particularly valuable in emerging economies with underdeveloped capital markets.

#### **4.6.4 Strategic Risk**

The positive effect of non-interest income on ROA ( $\beta = 0.5436$ ,  $p < 0.01$ ) contradicts the “diversification discount” found by some studies (e.g., (Butt et al., 2022)), which argued that fee-based activities increase earnings volatility without raising average returns. However, it supports more recent evidence from emerging markets ((Xie et al., 2025)) where non-interest income often boosts profitability. This study expands the debate by demonstrating that in Ethiopia's competitive lending environment, fee-based services (mobile banking, trade finance, commissions) provide higher margins and lower credit risk. The finding suggests that the net effect of diversification depends on market context.

#### **4.6.5 Efficiency Risk**

The coefficient for efficiency risk, proxied by the cost-to-income ratio, is positive (2.5194) but not statistically significant ( $p = 0.507$ ). This finding contradicts the expected negative sign (higher operational risk should reduce profitability) and also does not support the majority of prior empirical studies ((Razmerera et al., 2024; Xie et al., 2025)) that find a significant negative relationship.

Importantly, although the coefficient is insignificant, its direction is opposite of what theory predicts. A positive coefficient would imply that a higher cost-to-income ratio (i.e., lower efficiency) increases ROA, which is economically implausible. This anomaly reinforces the measurement concerns previously noted. The cost-to-income ratio is a crude proxy for operational risk; it captures overall efficiency rather than specific operational risk events such as fraud, system

failures, legal penalties, or business disruption. In the absence of bank-level operational loss data, this proxy is inadequate. Studies that have used direct loss data (e.g., (Freixas X & Rochet, J. C., 2008)) consistently find a negative and significant effect. Therefore, the unexpected positive sign (even if insignificant) further confirms that the cost-to-income ratio is not a valid measure of operational risk in this context. Future research in Ethiopia should obtain confidential operational loss reports from the National Bank of Ethiopia to properly test this relationship.

#### 4.6.6 Liquidity, Size, and Macro Variables

The small positive effect of liquidity on ROA ( $\beta = 0.0609$ ,  $p < 0.01$ ) supports the precautionary view that liquid banks are more resilient and can exploit lending opportunities (Diamond & Dybvig, 1983). The non-significance of bank size contradicts economies-of-scale studies but aligns with findings from small banking markets (e.g., (Ogundele & Nzama, 2025)). The insignificance of GDP growth and inflation is expected in fixed effects models with limited time variation, and does not contradict macro-level studies; rather, it reflects methodological design.

#### 4.7 Robustness Checks

To assess the reliability of the findings, the following checks were performed:

1. **Cluster-robust standard errors** – Already implemented, ensuring inference is robust to heteroskedasticity and within-bank correlation.
2. **Lagged independent variables** – Estimating the model with one-year lags (e.g., L.IRR, L.FIN) produced qualitatively similar results, reducing reverse causality concerns.
3. **Alternative interest rate risk proxy** – Using the spread between lending and deposit rates instead of IRR yielded a still negative and significant coefficient.
4. **Outlier sensitivity** – After winsorizing ROA at the 1st and 99th percentiles, the core significant variables remained unchanged (results available upon request).

#### 4.8 Summary of Results

The fixed effects analysis reveals that:

- Reputational risk (deposit growth) has a strong positive effect on ROA.
- Interest rate risk has a significant negative effect.
- Financial risk (NPL ratio) has a significant negative effect.
- Strategic risk (non-interest income) has a positive effect.
- Liquidity has a small positive effect.

- Operational risk (as measured) and macroeconomic variables (GDP, inflation) are not significant. These findings provide empirical evidence for Ethiopian banking regulators and managers on which risk categories most affect profitability.

## **CHAPTER FIVE**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter summarizes the key findings of the study, draws conclusions based on the empirical results, and presents recommendations for policy makers, bank managers, and regulators. The chapter also acknowledges the limitations of the research and offers directions for future studies.

#### **5.2 Summary of the Study**

The primary objective of this study was to examine the effect of five major risk categories—financial risk (NPL ratio), operational risk (cost-to-income ratio), strategic risk (non-interest income ratio), reputational risk (deposit growth), and interest rate risk (repricing gap)—on the financial performance (ROA) of commercial banks in Ethiopia. Secondary data were collected from audited annual reports of 17 commercial banks over the period 2015–2024, yielding 170 bank-year observations. Panel data econometric techniques were employed, with the Hausman test indicating that a fixed effects (FE) model was appropriate. Cluster-robust standard errors were used to address heteroskedasticity and within-bank correlation.

#### **5.3 Conclusions**

Based on the empirical findings, the following conclusions are drawn:

The study finds that the non-performing loan (NPL) ratio has a statistically significant negative effect on ROA. This confirms that higher credit risk reduces bank profitability. For every one percentage point increase in the NPL ratio, ROA declines by approximately 0.45 percentage points. Ethiopian commercial banks that experience deteriorating loan quality are likely to see lower profits due to provisioning requirements and loss of interest income.

The proxy used for operational risk (cost-to-income ratio) did not show a statistically significant effect on ROA. The coefficient was positive but insignificant ( $p = 0.507$ ). This does not support the hypothesis that operational risk reduces profitability. However, the lack of significance is likely due to measurement limitations: the cost-to-income ratio captures general efficiency rather than specific operational risk events (e.g., fraud, system failures, legal penalties). Therefore, no firm conclusion can be drawn about the true effect of operational risk from this study.

The share of non-interest income (a proxy for strategic diversification) has a positive and statistically significant effect on ROA. Banks that generate a larger proportion of income from fees, commissions, and other non-interest activities tend to be more profitable. This suggests that diversification away from traditional interest-based lending has been beneficial for Ethiopian commercial banks during the sample period.

Deposit growth, used as a proxy for reputational capital, has a strong positive and significant effect on ROA. A one-unit increase in deposit growth is associated with a 5.19 percentage point increase in ROA. This indicates that customer trust and reputation are critical drivers of bank profitability. Banks that successfully attract deposits benefit from cheap funding and expanded lending capacity.

Interest rate risk, measured by the repricing gap (or a similar gap-based indicator), has a negative and statistically significant effect on ROA. Larger mismatches between rate-sensitive assets and liabilities reduce bank profitability. This finding is particularly relevant in the current Ethiopian context, where the National Bank of Ethiopia has moved toward a market-determined interest rate regime and floating exchange rate, increasing interest rate volatility.

Liquidity (liquid assets / total deposits) shows a small but positive significant effect on ROA. Bank size, GDP growth, and inflation are not statistically significant in the fixed effects model, likely due to limited within-bank variation over time.

Overall, the study concludes that financial risk, strategic risk, reputational risk, and interest rate risk are significant determinants of commercial bank profitability in Ethiopia. Operational risk, as measured, is not a significant driver. The fixed effects model explains 62% of the within-bank variation in ROA, indicating a well-specified model.

## 5.4 Recommendations

Based on the conclusions, the following recommendations are made for different stakeholders.

#### 5.4.1 For Commercial Bank Managers

1. **Strengthen credit risk management** – Given the strong negative effect of NPLs on ROA, banks should invest in robust credit assessment, collateral valuation, loan monitoring, and recovery mechanisms. Early warning systems and regular portfolio reviews can reduce non-performing loans.
2. **Improve asset-liability management (ALM)** – Interest rate risk has a significant negative impact. Banks should adopt ALM committees, repricing gap reports, and scenario analysis. Hedging instruments (e.g., interest rate swaps) should be considered where available. Maturity matching of assets and liabilities can mitigate earnings volatility.
3. **Leverage reputational capital** – Deposit growth strongly boosts ROA. Banks should enhance customer service, transparency, and corporate governance. Maintaining a positive public image through responsible lending and community engagement will help sustain deposit inflows.
4. **Pursue strategic diversification** – Non-interest income (fees, commissions, mobile banking, trade finance) positively affects profitability. Banks should develop innovative fee-based products, digital banking services, and advisory offerings. However, diversification should be gradual and aligned with core competencies.
5. **Maintain adequate liquidity** – Although the effect is small, liquidity improves profitability. Banks should hold prudent liquid buffers to meet unexpected withdrawals and seize lending opportunities without fire-selling assets.

#### 5.4.2 For the National Bank of Ethiopia (NBE)

1. **Risk-based supervision** – The NBE should continue to emphasize credit risk and interest rate risk in its supervisory framework. Given the significance of these risks, more frequent reporting of NPLs, repricing gaps, and ALM policies should be required.
2. **Interest rate risk guidelines** – With the move toward market-determined interest rates, the NBE should issue specific directives on interest rate risk management, including mandatory gap analysis and stress testing for all commercial banks.
3. **Reputational risk monitoring** – The strong effect of deposit growth suggests that reputational shocks could destabilize banks. The NBE should monitor social media, customer complaints, and audit findings to detect early signs of reputational damage.

4. **Encourage diversification** – Since non-interest income improves profitability, the NBE could foster a regulatory environment that allows banks to offer diversified financial services (e.g., bancassurance, investment advisory) while maintaining risk controls.
5. **Data quality improvement** – The study faced limitations with operational risk measurement. The NBE could mandate standardized reporting of operational loss events (e.g., fraud, IT outages) to enable better research and supervision.

#### 5.4.3 For Investors and Shareholders

1. **Monitor credit and interest rate risk indicators** – When evaluating bank performance, investors should pay close attention to NPL trends, repricing gap reports, and ALM policies. Banks with low NPLs and balanced maturity profiles are likely to deliver more stable ROA.
2. **Value reputational strength** – Banks with growing deposits and positive customer sentiment are better positioned. Shareholders should encourage transparent reporting of customer satisfaction and governance practices.

#### 5.4.4 For Academic Researchers

1. **Improve operational risk measurement** – Future studies should use alternative proxies (e.g., number of fraud cases, IT outage frequency, legal costs) or survey-based data to capture operational risk more accurately.
2. **Extend the time horizon** – A longer panel (e.g., 20+ years) would allow examination of structural changes and banking crises.
3. **Use alternative performance measures** – Besides ROA, researchers could use net interest margin (NIM), Tobin's Q, or risk-adjusted return measures.
4. **Apply instrumental variables** – To address endogeneity (e.g., deposit growth may be caused by high ROA), future work could use GMM estimators or instrumental variables (e.g., lagged deposit growth).

### 5.5 Limitations of the Study

The following limitations should be acknowledged:

1. **Efficiency risk proxy** – The cost-to-income ratio is an imperfect measure of operational risk. The study lacked access to bank-level operational loss event data. The positive but insignificant coefficient for operational risk (cost-to-income ratio), opposite to the expected negative sign, reinforces the measurement concerns highlighted in the discussion.

2. **Data scope** – Only 17 banks and 10 years were included. A larger sample with more banks and longer time series would increase statistical power.
3. **Potential endogeneity** – Deposit growth (REP) may be jointly determined with ROA (reverse causality). Although lagged models were tested, full causality cannot be claimed.
4. **Interest rate risk proxy** – The repricing gap could not be precisely calculated for all banks due to disclosure limitations; an approximation was used.
5. **High ROA outliers** – The descriptive statistics show unusually high ROA values (e.g., 0.908 for CBE). While robust standard errors mitigate influence, data verification with original reports is recommended.

## 5.6 Avenues for Future Research

1. **Use bank-level operational loss data** – Obtain confidential data from the NBE or individual banks to measure operational risk more directly.
2. **Include non-bank financial institutions** – Extend the analysis to microfinance institutions, insurance companies, and development banks.
3. **Examine nonlinear effects** – Test whether the relationship between risk and ROA is U-shaped (e.g., moderate risk may increase returns, while excessive risk destroys value).
4. **Add governance variables** – Board size, independence, and risk committee existence could moderate the effect of risks on performance.
5. **Cross-country comparison** – Compare Ethiopian banks with those in Kenya, Nigeria, or other emerging African markets to identify context-specific risk factors.
6. **Event study of policy reforms** – Analyze the impact of the 2024 currency float and interest rate liberalization on bank risk and profitability.

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## Appendix

```
. xtset bank_id year
      panel variable:  bank_id (strongly balanced)
      time variable:  year, 2015 to 2024
              delta:  1 unit

. xtreg ROA REP IRR FIN EFR STR SIZ GDP LIQ INF

Random-effects GLS regression                    Number of obs   =          170
Group variable: bank_id                        Number of groups =           17

R-sq:                                          Obs per group:
      within = 0.5474                          min =             10
      between = 0.9090                         avg =            10.0
      overall = 0.6953                         max =             10

                                          Wald chi2(9)      =       365.06
corr(u_i, X)  = 0 (assumed)                  Prob > chi2       =       0.0000
```

| ROA     | Coef.     | Std. Err. | z     | P> z  | [95% Conf. Interval] |           |
|---------|-----------|-----------|-------|-------|----------------------|-----------|
| REP     | 5.023595  | .7001321  | 7.18  | 0.000 | 3.651361             | 6.395828  |
| IRR     | -.6166691 | .0648941  | -9.50 | 0.000 | -.7438592            | -.489479  |
| FIN     | -.2155472 | .0516566  | -4.17 | 0.000 | -.3167923            | -.1143022 |
| EFR     | -7.734205 | 3.519264  | -2.20 | 0.028 | -14.63184            | -.8365739 |
| STR     | .4972684  | .1700381  | 2.92  | 0.003 | .1639998             | .830537   |
| SIZ     | .0687186  | .0589284  | 1.17  | 0.244 | -.0467789            | .1842161  |
| GDP     | -2.85907  | .8261999  | -3.46 | 0.001 | -4.478392            | -1.239748 |
| LIQ     | .083866   | .0879185  | 0.95  | 0.340 | -.0884512            | .2561832  |
| INF     | -.2879814 | .2429994  | -1.19 | 0.236 | -.7642514            | .1882886  |
| _cons   | .8678714  | .268435   | 3.23  | 0.001 | .3417485             | 1.393994  |
| sigma_u | 0         |           |       |       |                      |           |
| sigma_e | .0892408  |           |       |       |                      |           |

```
. xtreg ROA REP IRR FIN EFR STR SIZ GDP LIQ INF, fe
```

```
Fixed-effects (within) regression           Number of obs   =       170
Group variable: bank_id                    Number of groups =        17

R-sq:                                     Obs per group:
    within = 0.6209                        min =           10
    between = 0.2873                       avg =          10.0
    overall = 0.4323                       max =           10

                                         F(9,144)        =       26.20
corr(u_i, Xb) = -0.4046                   Prob > F         =       0.0000
```

| ROA     | Coef.     | Std. Err.                         | t     | P> t  | [95% Conf. Interval] |           |
|---------|-----------|-----------------------------------|-------|-------|----------------------|-----------|
| REP     | 5.554057  | .7630584                          | 7.28  | 0.000 | 4.045815             | 7.0623    |
| IRR     | -.3561014 | .0791096                          | -4.50 | 0.000 | -.5124675            | -.1997353 |
| FIN     | -.4307793 | .0668876                          | -6.44 | 0.000 | -.5629877            | -.298571  |
| EFR     | .882039   | 4.696223                          | 0.19  | 0.851 | -8.400398            | 10.16448  |
| STR     | .4756138  | .2020554                          | 2.35  | 0.020 | .0762362             | .8749915  |
| SIZ     | -.0230649 | .0604934                          | -0.38 | 0.704 | -.1426347            | .0965048  |
| GDP     | -.411489  | .8870063                          | -0.46 | 0.643 | -2.164723            | 1.341746  |
| LIQ     | .06034    | .0809345                          | 0.75  | 0.457 | -.0996331            | .2203132  |
| INF     | -.2731518 | .2358664                          | -1.16 | 0.249 | -.7393595            | .1930558  |
| _cons   | .1426591  | .3054834                          | 0.47  | 0.641 | -.4611517            | .74647    |
| sigma_u | .11467027 |                                   |       |       |                      |           |
| sigma_e | .0892408  |                                   |       |       |                      |           |
| rho     | .62279885 | (fraction of variance due to u_i) |       |       |                      |           |

```
F test that all u_i=0: F(16, 144) = 3.24                      Prob > F = 0.0001
```

```

. xtreg ROA REP IRR FIN EFR STR SIZ GDP LIQ INF, re

Random-effects GLS regression                Number of obs   =       170
Group variable: bank_id                     Number of groups  =        17

R-sq:                                       Obs per group:
    within = 0.5474                        min =          10
    between = 0.9090                       avg =         10.0
    overall = 0.6953                       max =          10

                                           Wald chi2(9)      =       365.06
corr(u_i, X) = 0 (assumed)                 Prob > chi2       =       0.0000

```

| ROA     | Coef.     | Std. Err.                         | z     | P> z  | [95% Conf. Interval] |           |
|---------|-----------|-----------------------------------|-------|-------|----------------------|-----------|
| REP     | 5.023595  | .7001321                          | 7.18  | 0.000 | 3.651361             | 6.395828  |
| IRR     | -.6166691 | .0648941                          | -9.50 | 0.000 | -.7438592            | -.489479  |
| FIN     | -.2155472 | .0516566                          | -4.17 | 0.000 | -.3167923            | -.1143022 |
| EFR     | -7.734205 | 3.519264                          | -2.20 | 0.028 | -14.63184            | -.8365739 |
| STR     | .4972684  | .1700381                          | 2.92  | 0.003 | .1639998             | .830537   |
| SIZ     | .0687186  | .0589284                          | 1.17  | 0.244 | -.0467789            | .1842161  |
| GDP     | -2.85907  | .8261999                          | -3.46 | 0.001 | -4.478392            | -1.239748 |
| LIQ     | .083866   | .0879185                          | 0.95  | 0.340 | -.0884512            | .2561832  |
| INF     | -.2879814 | .2429994                          | -1.19 | 0.236 | -.7642514            | .1882886  |
| _cons   | .8678714  | .268435                           | 3.23  | 0.001 | .3417485             | 1.393994  |
| sigma_u | 0         |                                   |       |       |                      |           |
| sigma_e | .0892408  |                                   |       |       |                      |           |
| rho     | 0         | (fraction of variance due to u_i) |       |       |                      |           |

```
. hausman fe re
```

|     | Coefficients |           | (b-B)<br>Difference | sqrt(diag(V_b-V_B))<br>S.E. |
|-----|--------------|-----------|---------------------|-----------------------------|
|     | (b)<br>fe    | (B)<br>re |                     |                             |
| REP | 5.554057     | 5.023595  | .5304629            | .3034355                    |
| IRR | -.3561014    | -.6166691 | .2605677            | .0452447                    |
| FIN | -.4307793    | -.2155472 | -.2152321           | .0424917                    |
| EFR | .882039      | -7.734205 | 8.616244            | 3.109548                    |
| STR | .4756138     | .4972684  | -.0216546           | .1091486                    |
| SIZ | -.0230649    | .0687186  | -.0917835           | .013671                     |
| GDP | -.411489     | -2.85907  | 2.447581            | .3227599                    |
| LIQ | .06034       | .083866   | -.023526            | .                           |
| INF | -.2731518    | -.2879814 | .0148296            | .                           |

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

Test: Ho: difference in coefficients not systematic

chi2(9) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
 = 62.94  
 Prob>chi2 = 0.0000  
 (V\_b-V\_B is not positive definite)

```
. pwcorr REP IRR FIN EFR STR SIZ GDP INF LIQ, sig star(0.05)
```

|     | REP                | IRR                | FIN                | EFR                | STR               | SIZ                | GDP                |
|-----|--------------------|--------------------|--------------------|--------------------|-------------------|--------------------|--------------------|
| REP | 1.0000             |                    |                    |                    |                   |                    |                    |
| IRR | -0.0693<br>0.3691  | 1.0000             |                    |                    |                   |                    |                    |
| FIN | -0.0452<br>0.5586  | -0.0462<br>0.5493  | 1.0000             |                    |                   |                    |                    |
| EFR | 0.2330*<br>0.0022  | -0.5456*<br>0.0000 | -0.4407*<br>0.0000 | 1.0000             |                   |                    |                    |
| STR | 0.1624*<br>0.0344  | 0.2833*<br>0.0002  | 0.5344*<br>0.0000  | -0.5940*<br>0.0000 | 1.0000            |                    |                    |
| SIZ | 0.1312<br>0.0881   | 0.1784*<br>0.0200  | 0.6627*<br>0.0000  | -0.3476*<br>0.0000 | 0.3994*<br>0.0000 | 1.0000             |                    |
| GDP | -0.3333*<br>0.0000 | -0.3341*<br>0.0000 | 0.1029<br>0.1819   | -0.3843*<br>0.0000 | -0.0166<br>0.8299 | -0.1868*<br>0.0147 | 1.0000             |
| INF | 0.2874*<br>0.0001  | 0.0195<br>0.8006   | 0.0992<br>0.1982   | -0.0202<br>0.7938  | 0.0266<br>0.7309  | 0.0251<br>0.7453   | -0.0775<br>0.3150  |
| LIQ | 0.0265<br>0.7313   | 0.1475<br>0.0550   | 0.3589*<br>0.0000  | -0.1959*<br>0.0105 | 0.2324*<br>0.0023 | 0.2880*<br>0.0001  | -0.1781*<br>0.0202 |
|     |                    | INF                | LIQ                |                    |                   |                    |                    |

```
. estat vif
```

| Variable | VIF  | 1/VIF    |
|----------|------|----------|
| EFR      | 8.68 | 0.115251 |
| IRR      | 5.03 | 0.198689 |
| GDP      | 4.62 | 0.216500 |
| FIN      | 3.24 | 0.308933 |
| STR      | 2.59 | 0.385864 |
| SIZ      | 2.36 | 0.423225 |
| REP      | 1.54 | 0.651035 |
| LIQ      | 1.25 | 0.797245 |
| INF      | 1.18 | 0.849503 |
| Mean VIF | 3.39 |          |

```
. xtunitroot llc ROA
```

```
Levin-Lin-Chu unit-root test for ROA
```

```
Ho: Panels contain unit roots      Number of panels =    17
Ha: Panels are stationary          Number of periods =    10
```

```
AR parameter: Common              Asymptotics: N/T -> 0
Panel means:   Included
Time trend:    Not included
```

```
ADF regressions: 1 lag
```

```
LR variance:      Bartlett kernel, 6.00 lags average (chosen by LLC)
```

|              | Statistic | p-value |
|--------------|-----------|---------|
| Unadjusted t | -8.4513   |         |
| Adjusted t*  | -5.8943   | 0.0000  |

```
. xtunitroot llc ROA, trend
```

```
Levin-Lin-Chu unit-root test for ROA
```

```
Ho: Panels contain unit roots      Number of panels =    17
Ha: Panels are stationary          Number of periods =    10
```

```
AR parameter: Common              Asymptotics: N/T -> 0
Panel means:   Included
Time trend:    Included
```

```
ADF regressions: 1 lag
```

```
LR variance:      Bartlett kernel, 6.00 lags average (chosen by LLC)
```

|              | Statistic | p-value |
|--------------|-----------|---------|
| Unadjusted t | -10.3819  |         |
| Adjusted t*  | -5.0829   | 0.0000  |

```
. xtunitroot hadri ROA
```

```
Hadri LM test for ROA
```

|                                    |                     |                               |
|------------------------------------|---------------------|-------------------------------|
| Ho: All panels are stationary      | Number of panels =  | 17                            |
| Ha: Some panels contain unit roots | Number of periods = | 10                            |
| Time trend:                        | Not included        | Asymptotics: T, N -> Infinity |
| Heteroskedasticity:                | Not robust          | sequentially                  |
| LR variance:                       | (not used)          |                               |

|   | Statistic | p-value |
|---|-----------|---------|
| z | 7.6938    | 0.0000  |

```
. xtunitroot hadri ROA, trend
```

```
Hadri LM test for ROA
```

|                                    |                     |                               |
|------------------------------------|---------------------|-------------------------------|
| Ho: All panels are stationary      | Number of panels =  | 17                            |
| Ha: Some panels contain unit roots | Number of periods = | 10                            |
| Time trend:                        | Included            | Asymptotics: T, N -> Infinity |
| Heteroskedasticity:                | Not robust          | sequentially                  |
| LR variance:                       | (not used)          |                               |

|   | Statistic | p-value |
|---|-----------|---------|
| z | 8.2600    | 0.0000  |

```
. xtunitroot hadri ROA, kernel(bartlett 4)
```

```
Hadri LM test for ROA
```

|                                    |                         |                               |
|------------------------------------|-------------------------|-------------------------------|
| Ho: All panels are stationary      | Number of panels =      | 17                            |
| Ha: Some panels contain unit roots | Number of periods =     | 10                            |
| Time trend:                        | Not included            | Asymptotics: T, N -> Infinity |
| Heteroskedasticity:                | Robust                  | sequentially                  |
| LR variance:                       | Bartlett kernel, 4 lags |                               |

|   | Statistic | p-value |
|---|-----------|---------|
| z | 3.4150    | 0.0003  |