



**ST. MARY UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**DETERMINANTS OF CREDIT RISK: THE CASE OF
PRIVATE COMMERCIAL BANKS IN ETHIOPIA**

BY: MAHLET AYELE

**FEBRUARY, 2024
ADDIS ABABA, ETHIOPIA**

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**THESIS SUBMITTED TO ST. MARY'S UNIVERSITY SCHOOL OF GRADUATE
STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF MASTER OF BUSINESS ADMINISTRATION**

**FEBRUARY, 2024
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DECLARATION

I, the undersigned, declare that this thesis is my original work, prepared under the guidance of **Simon Tarekegn (Asst. Prof.)**. All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted for any degree.

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ACKNOWLEDGEMENTS

I thank the Almighty God for being my guide all the way throughout my studies and for having brought me this far. All this would not have been achieved without the motivation and stimulation from my supervisor **Simon Tarekegn (Asst. Prof.)**. I would like to take this opportunity to thank my parents for the encouragement and support throughout this study period. Finally, I want to thank all employees of the commercial banks for their cooperation in providing the required data for the study.

LIST OF ACRONYMS AND ABBREVIATIONS

ABB - Abay Bank
ADIB - Addis International Bank
AIB - Awash International Bank
BIB - Birhan International Bank
BOA - Bank of Abyssinia
BUIB - Buna International Bank
CAR – Capital Adequacy Ratio
CBO - Cooperative Bank of Oromiya
CC - Credit Cap
CLRM - Classical Linear Regression Model
DB - Dashen Bank
DGB - Dehub Global Bank
DW - Durbin-Watson
EB - Enat Bank
FEM - Fixed Effect Model
GDP - Gross Domestic Product
INFL - General Inflation Rate
LIB - Lion International Bank
NBE - National Bank of Ethiopia
NIB - Nib International Bank
OIB - Oromiya International Bank
OLS - Ordinary Least Square
REM - Random Effect Model
ROE - Return on Equity
UB - United Bank
WB - Wegagen Bank
ZB - Zemen Bank

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ABSTRACT

The study was carried out to empirically examine bank-specific and macroeconomic determinants of Ethiopian private commercial banks' credit risk using balanced 13-year (2010–2022) annual audited financial statements of 12 banks and macroeconomic data. The study employed an explanatory research design and a quantitative research approach. Using the purposive sampling technique, the study covers 100% of the population, which operated for full years during the study period. The study included five bank-specific variables: liquidity, return on equity, capital adequacy ratio, bank size, and loan growth, and three macroeconomic factors: real gross domestic product growth rate, annual inflation rate, and lending rate. A random effect model was used for the credit risk. The empirical result revealed that all bank-specific and macroeconomic variables except liquidity, bank size, and return on equity are statistically significant in determining the credit risk of Ethiopian private commercial banks. The study suggests that commercial banks should focus on implementing risk-adjusted capital allocation, macro-prudential risk analysis, advanced credit scoring, and diversification of loan portfolios to manage credit risk effectively and maintain financial stability in evolving economic environments.

Keywords: *Bank Specific Variables, Credit Risk, Commercial Banks, Macroeconomic Variables, Return on Equity*

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

A crucial component of an economy is the banking system, which enables depositors and lenders to do business at reasonable costs (Koju et al., 2020). The banking system has a significant impact on the overall economy since it is necessary for the efficient allocation of financial resources (Rashid and Intartaglia, 2017). Credit risk, one of the main contributors to the economic downturn and a key sign of financial susceptibility, accounts for the majority of banking risks (Koju et al., 2020). Economic stability depends in part on credit risk, which is frequently reflected as nonperforming loans (NPLs) for banks (Priyadi et al., 2021).

According to Moudud-Ul-Huq et al. (2020), credit risk is the primary kind of risk that commercial banks take on. The risk drivers that are unique to each particular bank come first, followed by those that are impacted by the banking sector as a whole and the macroeconomic environment (Priyadi et al., 2021). Incekara and Çetinkaya (2019) found a statistically significant positive relationship between credit risk and the capital adequacy index as well as net income from profit sharing. However, they also discovered a negative relationship between GDP and credit risk.

High short-term interest rates increase credit risk, particularly for borrowers with the highest levels of debt (González-Aguado & Suárez, 2015). Durango-Gutiérrez et al. (2021) found that the size of the loan, the number of arrears, the borrower's guarantees, the credit analyst's assessment, the borrower's gender, and the level and trending direction of the stock exchange general index are the main factors that explain loan default. The link between credit risk and unemployment at the overall level was also shown to be very favorable by Bai (2021).

Earlier research listed the internal (Effendi et al., 2017) and external (Widarjono and Rudatin, 2021) factors influencing credit risk in the banking sector, specifically NPLs. These included financial ratios and bank characteristics. With variable outcomes among research studies, several studies also looked at the internal and external factors affecting NPF.

For instance, Firmansyah (2014) discovered that while efficiency and size of banks have no effect on NPF (Poudel, 2018) and inflation and GDP have a negative impact (Waqas et al., 2017; Tole et al., 2019), financing to deposit ratio (FDR) has a favorable impact. In contrast to inflation and PLS, which have a negative impact on the NPF, Priyadi et al. (2021) discovered that CAR and

ROA had an impact on the NPF. Additionally, they stated that none of the following factors affect NPF: economic growth, interest rates, finance to value, or operational expense ratios.

However, findings across the literature are inconsistent regarding the determinants of credit risk. For instance, while some studies show bank size reduces credit risk (Koju et al., 2018), others find larger banks face greater credit risk (Tole et al., 2019). Similar inconsistencies are found with factors like profitability, capital, loan growth, and macroeconomic indicators (Kharabsheh, 2019; Tole et al., 2019; Koju et al., 2018).

Given these mixed results, further investigation is needed into the drivers of credit risk, especially in developing country contexts. This study therefore analyzed both bank-specific and macroeconomic factors affecting credit risk in the lending activities of private commercial banks in Ethiopia. Focusing specifically on the case of Ethiopia will shed light on credit risk determinants in a unique developing economy with banking sector. Findings may provide an updated perspective compared to earlier Ethiopian studies given recent growth and changes in the country's banking industry. Thus, this study contributes to the empirical literature by clarifying determinants of credit risk in Ethiopia's banking sector. It provides policymakers updated evidence to support improved risk management and stability in this strategic sector for continued economic growth.

1.2. Statement of the Problem

NBE, in 2012, imposed a restriction stating that the proportion of Non-Performing Loans (NPLs) should not exceed 5% of the total loan outstanding. This regulation has had a positive impact on the NPLs of Ethiopian Commercial Banks (ECBs), leading to improvements. However, according to Mehari (2012), these improvements in NPL reduction are not primarily a result of enhanced credit risk control measures, monitoring systems, or measurement techniques. Instead, they can mostly be attributed to the practice of writing off and restructuring loans.

For example, NBE (2016) announced that a loan for a coffee trader was facing repayment difficulties, and as a result, ECBs were instructed to reschedule their loans. Dashen Bank, specifically, faced repayment challenges amounting to Birr 446,658,898, and their payment was rescheduled for June 30, 2016. Both writing off and restructuring of NPLs are measures taken after the loans have already become non-performing, implying that they are reactive actions rather than proactive preventive measures (Zelalem, 2013).

The issue regarding the prevention of NPLs in ECBs remains a question, as banks are still not meeting the maximum permissible limit of 5% for NPLs. The COVID-19 pandemic has had a severe impact on the asset quality of Ethiopian private commercial banks. According to recent data from the National Bank of Ethiopia (2021), the average non-performing loan ratio for private banks reached a five-year peak of 8.3% as of June 2021, up from 6.2% pre-pandemic. This rise in NPLs indicates credit risk has increased substantially following the economic slowdown and market uncertainty from COVID-19 containment measures.

Experts attribute the mounting NPLs to cash flow problems and weakened repayment capacity across many of the key sectors served by private banks in Ethiopia (Kokeb, 2021). Major client segments like manufacturing, domestic trade, construction, and tourism have faced heavy pandemic-related disruptions. Retail borrowers have also faced job losses or income instability, further driving delinquency rates higher on personal loans, credit cards, and mortgages. Profitability has declined as banks set aside more provisions to cover potential losses from souring loans. Managing asset quality continues to remain a top challenge for Ethiopian private banks as they support the recovery of the real economy post-crisis while safeguarding their balance sheets. Targeted loan restructuring programs adopted by larger private banks have provided temporary relief, but uncertainty persists around asset quality as support measures are unwound (Habtamu, 2021).

Furthermore, Messay (2017) indicates that, based on a table in Appendix VIII, the proportion of NPLs for most commercial banks exceeded the 5% limit set for their total loan outstanding. This suggests that NPLs continue to be a concern in the banking sector, and more efforts are required to address this issue effectively. Furthermore, existing literature suggests that credit risk (NPL) is influenced by both macroeconomic factors and bank-specific factors. However, the specific impact of these variables can vary depending on factors such as the overall economic condition, political stability, loan policies, and other contextual factors. It is worth noting that most of the studies on determinants of credit risk have been conducted in developed banking industries, and there is a scarcity of literature specifically focused on the Ethiopian banking industry.

To the best of knowledge of the researcher, only a limited number of studies have been conducted in the context of the Ethiopian banking industry with inconsistent findings, which implies that there is still a need for more research in this area. The unique characteristics and specific dynamics

of the Ethiopian banking sector might require a tailored approach when analyzing and addressing the issue of NPLs.

For instance, Dessie (2016) examined bank-specific and macroeconomic factors that play a role in determining the credit risk of Ethiopian commercial banks. Results using fixed effect panel regression exhibited that loan growth, return on equity, bank size, capital adequacy, loan to deposit, managerial efficiency, and gross domestic product have a negative and statistically significant effect on banks' CR. On the other hand, variables like state ownership have a positive and statistically significant effect on banks' CR. Tona (2017) examined the determinants of financial risk in Ethiopian private commercial banks. Bank-specific and macroeconomic variables were tested for the two dependent variables, credit and liquidity risk. The findings of the study for the credit risk model revealed that loan-to-deposit ratio (Liquidity), income diversification, non-performing loans, real GDP growth rate, and inflation have significant positive impacts on credit risk, whereas the return on assets has a significant negative impact on credit risk for Ethiopian private banks. The rest of the three bank-specific variables Loan growth, bank size, and operating inefficiency had no significant effect on the credit risk of Ethiopian private banks during the test period of 2001 to 2015.

Tehulu & Olana (2014) examined the bank-specific determinants of credit risk in Ethiopian commercial banks. The results revealed that credit growth and bank size have a negative and statistically significant impact on credit risk. whereas operating inefficiency and ownership have a positive and statistically significant impact on credit risk. Finally, the results indicate that profitability, capital adequacy, and bank liquidity have a negative but statistically insignificant relationship with credit risk. Ydeg (2021) examined the determinants of Credit and Liquidity risk in Ethiopian commercial banks. Bank-specific and macroeconomic variables were tested. The findings of the study for the credit risk model revealed that liquidity, loan growth, and profitability have a significant positive impact on the credit risk of Ethiopian commercial banks.

Asfaw & Veni (2015) analyzed the link between bank-specific factors and credit risk indicators. Its result revealed that credit growth and return on equity had a statistically significant negative impact on the credit risk indicator of the large Ethiopian private commercial banks. However, inefficiency and deposit rates had a statistically insignificant positive influence on the Credit risk

indicator. Adem (2022) examined the determinants of Credit Risk in the Ethiopian Banking Industry. The results suggest that political stability is negatively correlated with credit risk, while political instability does have a positive impact on bank credit risk. Credit risk was inversely related to increased operating efficiency, diversified earnings, and national currency appreciation. In contrast, greater bank size, rising inflation, and economic expansion all contribute to a high level of credit risk. The loan-to-asset ratio and profitability were shown to have a minor influence on nonperforming loans (NPLs).

Kitila et al. (2020) assessed the determinants of credit risk in selected commercial banks in Ethiopia. The result indicated that predictor variables like efficiency ratio, return on equity, and bank size have statistically significant positive effects on the dependent variable (credit risk). In addition, the study showed that capital adequacy had a statistically significant negative effect on predicting the dependent variable, credit risk. However, predictor variables like return on asset, leverage, and loan-to-deposit ratio did not have any statistically significant effect on credit risk. Jabir et al. (2020) investigated the perceptions of bankers on the determinants of credit risk in Ethiopian commercial banks. The study found that bank-specific determinants, poorly negotiated credit terms, compromised integrity in lending, poor credit risk assessment, and a higher rate of interest are the major causes of non-performing loans. Besides bank-specific factors, the study identified that the level of information sharing among banks has a direct impact on non-performing loans. The study also revealed that macroeconomic factors such as a rise in the inflation rate, unemployment, and foreign exchange rate decrease loan quality.

As is evident in the above review, previous studies have yielded varied results regarding the factors that affect credit risk in the banking sector, both internally and externally. However, the specific determinants of credit risk in Ethiopian commercial banks are not well understood due to the unique characteristics of the banking industry in Ethiopia, such as the prevalence of state banks, restrictions on foreign banks, and the absence of capital market, suggest determinants could differ from other countries. So findings on credit risk from other countries may not transfer directly to providing insights on factors affecting Ethiopian banks. This study sought to investigate both bank-specific and macroeconomic factors that contribute to credit risk in Ethiopian commercial banks. Additionally, loan growth, bank profitability, capital adequacy ratio, interest rate, liquidity, and income diversification may also have a significant impact on credit risk. Therefore, this study aims

to investigate the determinants of credit risk in Ethiopian commercial banks by examining both bank-specific and macroeconomic factors.

1.3. Hypothesis

Based on this specific objective the following hypotheses are developed.

Ngo et al. (2021) examined factors affecting credit risk in lending activities of joint-stock commercial banks in Vietnam and found that liquidity has positive effect on credit risk. Similarly, Calderon-Contreras et al. (2022) examined the determinants of credit risk in Peruvian municipal savings banks and concluded that liquidity ratio has a direct positive and significant influence on credit risk. In contrary, Kharabsheh (2019) investigated the determinants of credit risk in Jordanian commercial banks using a balanced panel dataset of all Jordanian commercial banks over the period 2000-2017 and found no relationship between bank liquidity and credit risk.

H1: Liquidity has a significant positive relationship with the credit risk of private commercial banks in Ethiopia.

Gulati et al. (2019) found that lower profitability, more diversification in the banking business, the large size of banks, a higher concentration of banks in lending, and low operating expenses on credit screening and monitoring activities (especially for public sector banks) increase the probability of default in India. Similarly, Zheng et al. (2018) conducted a study to identify the factors that affect bank credit risk and found that profitability, capital, and bank size are inversely associated with bank credit risk, whereas net interest margin and inefficiency have a positive effect. Morina (2020) also concluded that profitability of banks (ROA) has the largest and most significant impact on credit risk, namely non-performing loans as the credit risk measure.

H2: Bank profitability has a significant positive relationship with the credit risk of private commercial banks in Ethiopia.

Kharabsheh (2019) investigated the determinants of credit risk in Jordanian commercial banks using a balanced panel dataset of all Jordanian commercial banks over the period 2000-2017. The study found that credit risk increased as bank capital adequacy ratio increased. Similarly, Priyadi et al. (2021) examined the determinants of credit risk in Indonesian Shari'ah rural banks (SRBs) using internal and external factors. The study found that capital adequacy ratio (CAR) has a positive influence on nonperforming financing (NPF).

H3: The capital adequacy ratio has a significant positive relationship with the credit risk of private commercial banks in Ethiopia.

Effendi et al. (2017) concluded that inflation and GDP are the macroeconomic variables that affect NPF. Kharabsheh (2019) investigated the determinants of credit risk in Jordanian commercial banks using a balanced panel dataset of all Jordanian commercial banks over the period 2000-2017. The macroeconomic variables included indicated that as the unemployment rate increased, credit risk significantly increased, and a similar positive effect was also documented for the crisis effect. However, the results showed no significant impact of GDP growth or inflation. Similarly, Raiter (2021) concluded that GDP growth rate has significant negative effects on credit risk.

H4: GDP has a significant positive relationship with the credit risk of private commercial banks in Ethiopia.

Effendi et al. (2017) concluded that inflation is the macroeconomic variable that affect NPF. Raiter (2021) suggested that inflation, interest rates, and unemployment rates have significant positive impacts on credit risk. In contrast, Kharabsheh (2019) investigated the determinants of credit risk in Jordanian commercial banks using a balanced panel dataset of all Jordanian commercial banks over the period 2000-2017 and showed no significant impact of GDP growth or inflation.

H5: Inflation has a significant negative relationship with the credit risk of private commercial banks in Ethiopia.

Barra & Ruggiero (2023) investigated the impact of bank-specific factors on credit risk in Italy and found that volume of credit, and volume of intermediation costs are the main bank-specific factors affecting non-performing loans.

H6: Loan growth has a significant negative relationship with the credit risk of private commercial banks in Ethiopia.

Abusharbeh (2022) examined the determinants of credit risk in Palestine using panel data estimation. The results show that interest rate and credit supply have a positive impact on nonperforming loans (NPLs), while profitability has a negative affiliation with NPLs. Hang (2019) also analyzed the factors affecting the credit risk of commercial banks in Vietnam using panel data and found a negative correlation between credit risk and unemployment rate and real interest rate. Morina (2020) also concluded that interest rates on loans has the largest and most significant impact on credit risk, namely non-performing loans as the credit risk measure.

H7: The lending rate has a significant negative relationship with the credit risk of private commercial banks in Ethiopia.

Effendi et al. (2017) analyzed the factors influencing non-performing financing (NPF) in Sharia banking. The study concluded that bank size affect NPF and banks are recommended to maintain the financial performance and setting appropriate financial policies by monitoring the Bank size. Gulati et al. (2019) also found that lower profitability, more diversification in the banking business, the large size of banks, a higher concentration of banks in lending, and low operating expenses on credit screening and monitoring activities (especially for public sector banks) increase the probability of default in India. In line with this, Raiter (2021) concluded that size of the bank has significant negative effects on credit risk.

H8: Bank size has a significant negative relationship with the credit risk of private commercial banks in Ethiopia.

1.4. Objectives of the Study

1.4.1. General Objective

The general objective of this study is to investigate the determinants of credit risk of private Commercial banks in Ethiopia.

1.4.2. Specific objectives

This study tried to achieve the following specific objectives.

1. To investigate the effect of liquidity on the credit risk of private commercial banks in Ethiopia.
2. To analyze the influence of bank profitability on the credit risk of private commercial banks in Ethiopia.
3. To examine the effect of capital adequacy ratio on the credit risk of private commercial banks in Ethiopia.
4. To investigate the effect of GDP on the credit risk of private commercial banks in Ethiopia.
5. To analyze the influence of inflation on the credit risk of private commercial banks in Ethiopia.

6. To examine the effect of loan growth on the credit risk of private commercial banks in Ethiopia.
7. To establish the effect of lending rates on the credit risk of private commercial banks in Ethiopia.
8. To examine the influence of bank size on the credit risk of private commercial banks in Ethiopia.

1.5. Significance of the Study

The aim of this study is to provide valuable insights into the factors that contribute to credit risk in Ethiopian commercial banks. By identifying both bank-specific and macroeconomic factors, this research can help these banks develop effective management strategies to increase their performance and reduce their credit risk (non-performing loans). Additionally, the National Bank of Ethiopia can use the findings of this study to examine its policy in banking supervision and ensure that banks maintain asset quality. This study also contributes to the existing body of knowledge on the determinants of credit risk in the Ethiopian banking context and can inspire further research in this area. Ultimately, the results of this study can benefit both the banking industry and the broader economy by promoting financial stability and reducing credit risk.

1.6. Scope of the Study

This study concentrated on five bank-specific variables and three macroeconomic variables; liquidity, capital adequacy ratio, profitability, loan growth, bank size (bank-specific variables), and GDP, Inflation, and lending rates (macroeconomic variables) in order to investigate whether they result to a strong or weak relationship with the credit risk of private commercial banks in Ethiopia. The study took into account the credit risk of banks for the last 13 years that is from 2010 to 2022. As a result, the research included Ethiopian private commercial banks that started their operation in and before 2010, which are 12 private commercial banks that operate in Ethiopia. The study is conducted only on twelve (12) private commercial banks. Since the study covered a period of 13 years (2010 -2022), there are banks with an age of less than thirteen years. The study included all private banks, with 13 and above establishment years: Dashen Bank S.C (DB), Awash International Bank S.C (AIB), Wegagen Bank S.C (WB), United Bank S.C (UB), Nib International Bank S.C (NIB), Cooperative Bank of Oromia S.C (CBO), Lion International Bank S.C (LIB), Oromia International Bank S.C (OIA), Zemen Bank S. (ZB), Berhan Bank S.C, Bunna Bank S.C,

and Bank of Abyssinia S.C (BOA). Furthermore, the study used a quantitative data analysis methodology, which included secondary data (annual report) of the selected banks under study.

1.7. Organization of the Study

The study is structured into five chapters, each serving a specific purpose. The first chapter provides an overview of the study, including the background, problem statement, research objectives, significance, and scope. The second chapter reviews both theoretical and empirical literature related to credit risk in Ethiopian commercial banks, highlighting key findings and identifying gaps in current knowledge. Chapter three focuses on the research methodology, outlining the research design, data collection methods, and statistical techniques used to analyze the data. The fourth chapter presents the results of the study and provides a detailed discussion of the findings. This section included a quantitative analysis of the data collected, with tables and charts used to illustrate the results. Finally, the fifth chapter provides conclusions drawn from the study and provides recommendations for Ethiopian commercial banks and the National Bank of Ethiopia to improve their management strategies for credit risk.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1. Introduction

The review of the credit risk literature is covered in this chapter. It includes the theoretical underpinnings of credit risk and assesses the works of other academics on credit risk and its macroeconomic and microeconomic causes. It came to a conclusion by outlining the knowledge gap in an empirical assessment of credit risk and its factors.

2.2. Definition of Credit Risk

2.2.1. Credit Risk

As an economic middleman, banks' credit capital flows are always crucial to the expansion and development of the national economy, particularly in emerging nations. Effective credit capital flow control and credit risk reduction can improve capital use efficiency and speed up capital flows, supporting economic growth. Credit risk is one of managers' and policymakers' top concerns and areas of attention as a result. This study will first clarify ideas about credit risks in the banking industry.

Credit risk is the risk that arises when borrowers fail to fulfill their contractual responsibility to repay a loan in line with agreed conditions (Fitch, 1987). It is, along with interest rate risk, the primary risk involved in commercial banks' lending operations (Fitch et al., 2000). Koch and MacDonald (2014) demonstrated that while one commercial bank holds valuable assets, problems might arise when customers don't make regular payments, which results in customers' inability to fulfill their contractual obligations to pay principal and interest. According to Koch and MacDonald (2014), "credit risk" refers to any potential changes in net income and market value of the capital resulting from customers' late or missed payments.

According to Van Greuning & Bratanovic (2020), credit risk is the failure of borrowers to make interest or principle payments within the time frames stipulated in credit contracts. This is how commercial banks' business operations are by their very nature. Credit risk is the failure to pay your debts on time or, in worst-case scenarios, completely. This affects cash flows, which in turn affects the liquidity of commercial banks. Credit risk was defined by Lange et al. (2015) as the possibility of losing money when a commercial bank extends a credit loan to a client or the

possibility that the expected revenue flows from commercial bank loans cannot be completely realized in terms of quantity and needed duration.

According to the definition given above, credit risk is generally understood to be the risk of financial loss (direct or indirect) when borrowers fail to fulfill their obligations to make payments on time or are unable to pay them back.

2.2.2. Determinants of credit risk

Gross Domestic Product (GDP)

According to Virolainen (2004), business and economic cycles can contribute to bank risks. The bank will be riskier than previously as a result of the recession's worsening commercial and economic conditions. Boom periods are characterized by increased economic activity and a corresponding rise in household and company cash reserves. The borrower's ability to repay the loan might be enhanced by this circumstance, lessening the bank's credit risk. In most studies, GDP growth rates are the primary indicator of macroeconomic conditions. The ability of borrowers to repay their debt and their income may both decline in response to a decline in GDP growth rates. Both borrowers and lenders have faith in their ability to make an investment and repay the loans during prosperous economic times.

Inflation

The rate of inflation is another macroeconomic factor that could affect the bank's credit risk level (Carling et al., 2007). Money's worth might be diminished by inflation, which would reduce the bank's rate of return. A high rate of inflation will typically translate into a high rate of interest on loans. People attempt to predict inflation because it decreases the future worth of money. In order to make up for the losses brought on by inflation, banks would modify their interest rates based on the projection. Bank profitability may suffer if inflation is not foreseen and costs increase more quickly than income.

Increased inflation reduces the actual rates of return on bank assets, which leads to credit restrictions. As a result, financial intermediation will be reduced in high-inflation nations (Boyd et al., 2001). Although there is evidence that higher rates of inflation reduce the amount of bank assets and, thus, the amount of credit risk, higher inflation can also have a negative effect on

existing borrowers' incomes, which can lower the quality of loans that have already been made. *Ceteris paribus*, greater inflation rates may have the unintended consequence of banks taking fewer risks with their balance sheets if the credit restriction effect turns out to be more significant. Contrarily, both strong inflation and disinflation can have a negative effect on the financial sector and raise bank risk. Rapidly falling prices in an environment of high inflation will lead to high real interest rates, which will have a contractionary effect on the economy and increase credit risk as a result of borrowers' declining profits and higher risk-taking incentives similar to those seen when nominal interest rates rise (Mishkin, 1996).

Interest Rates)

The interest rate might be viewed as another factor that affects a bank's credit risk because it has an impact on the debt burden (Ali and Daly, 2010). The changing and fluctuating value of the interest rate has a substantial impact on a bank's credit risk since it affects how challenging it is for borrowers to make their loan payments (Belas et al., 2017). For borrowers, an increase in interest rates will result in an increase in debt burden; for banks, it will lead to a large proportion of nonperforming loans. The return on newly generated or variable-interest loans will also increase right away.

For banks, a key source of market risk is interest rate risk related to shifts in market interest rates. In addition, a rise in market interest rates carries the risk of higher credit risk despite having the immediate consequence of raising bank profits for newly created or variable-interest loans. According to asymmetric information theories, higher interest rates have a tendency to increase the issue of adverse selection, which refers to the credit relationship's selection of borrowers with a high possibility of unfavorable project outcomes, or "bad risks." Potential borrowers with safe projects will be discouraged by high-interest rates, which will cause the risk composition of the pool of loan applicants to move toward unfavorable risks. Additionally, borrowers' ex-post incentives will shift as a result of an increase in interest rates, leading them to take on riskier projects (borrowers' moral hazard) (Psillaki et al., 2010). Therefore, a rise in interest rates will, *ceteris paribus*, raise credit risk on banks' balance sheets in a situation of information asymmetries.

Exchange Rate

One of the main causes of economic instability in emerging markets is the volatility of the exchange rate. The borrower's ability to pay back the debts is impacted by the exchange rate (Lin et al., 2016). A currency's value in relation to another is expressed by the exchange rate. The primary challenge for businesses is the consistent depreciation of foreign currencies in relation to the local currency, as well as the challenges associated with retaining local clients as the price of imported goods and services rises and has an impact on the price of finished goods produced locally. As the domestic price of the foreign exchange rate increases, acquiring foreign products and services becomes more expensive, necessitating the use of more units of domestic currency to purchase the same amount of goods and services as previously. Due to the greater costs brought on by exchange rate depreciation, there is an increase in the demand for bank loans, which lowers the firm's profitability. The business is unable to pay its debts' interest and principal due to the decline in profitability.

Bank Size

The variety of the bank may also be related to the loan quality. Because diversity helps reduce credit risk, larger banks have a stronger capacity to manage it than smaller banks. According to Modern Portfolio Theory, diversification helps reduce unsystematic risk since large banks often have a higher number of borrowers with a diversity of industries. Empirical research suggests that diversifying income sources and loan portfolios can effectively minimize bank credit risk (Altman and Saunders, 1997). First, engaging in non-credit risk-taking operations like payment transactions, broking, and other similar activities may help banks diversify their revenue sources and provide less risky income, which reduces their incentives to fund speculative projects. Second, banks can reduce the volume of bad loans by making loans to a variety of borrowers.

Loan Growth

The pace of loan growth is one of the factors that impact and foreshadows credit risk in the banking industry. Magwedere & Chisasa (2023) noted that during a time of rapid credit growth, capital flows that are continuously poured into the economy will lead to a continuous increase in property value and better standards and benefits for economic agents. Credits with a higher degree of credit risk are easily issued as a result of this. In addition, during times of intense rivalry among

commercial banks, there is a tendency for rapid loan expansion, which leads to a lowering of credit criteria and a rise in credit risk in the future (Dell Ariccia et al., 2012). In addition, Chaibi & Ftiti (2015) contend that rapid credit expansion would affect how commercial banks handle risk and customer information, resulting in an increase in credit risk. In this study, the author makes use of the growth rate of loan items used by commercial banks to expand credit.

2.3. Overview of Credit Risk of Ethiopian Commercial Banks

Credit risk has become a growing concern for Ethiopia's emerging commercial banking sector. After longtime domination by state-owned banks, private and foreign banks now hold an expanding market share, driving increased competition and risk-taking (Mekonin, 2018). As banks aim to bolster lending and profits, their loan quality and credit risk management are being tested.

Currently, the average non-performing loan ratio for Ethiopian commercial banks sits above 5%, having deteriorated since 2016 (NBE, 2021). Experts warn asset quality could further weaken due to slowed economic growth and struggles in key sectors like manufacturing and exports that banks target (Ayenew et al., 2018). However, research on the drivers of credit risk in Ethiopia's evolving banking landscape remains limited.

Understanding risk factors is complicated by structural shifts in the industry, as the state loosens tight control and encourages modern practices (Bishu et al., 2020). Traditional factors like capital levels, operating costs, and loan concentrations impact risk among private players, though dynamics may differ at policy-oriented state banks (Kiyota et al., 2008). Macroeconomic instability and foreign exchange shortages also influence economy-wide lending conditions (NBE, 2019). As financial inclusion expands with growth in microfinance and digital lending options, consumer credit risk profiles are changing as well (Shimeles et al., 2009). Younger, lower-income households who previously lacked access present new underwriting challenges (Yalew et al., 2020). Overall, balancing prudence with support for fledgling ventures shapes the credit risk outlook.

In response regulators have implemented policies like interest rate caps, higher reserve requirements, and loan-to-value limits aiming to curb excessive risk-taking as the banking system evolves (Geda, 2006). But continued research is vital to inform supervision of credit risk amidst Ethiopia's dynamic growth and policy transitions in banking. Clear insight into financial and economic risk drivers can support greater stability industry-wide.

2.4. Theories

Over the years, researchers like Akerlof (1978) and Berger and DeYoung (1997) have created a number of theories and hypotheses to explain the causes and progression of non-performing loans in commercial banks. The lemon dilemma was first discussed by Akerlof in his influential 1978 essays. In his essay, he demonstrated how an imbalanced information market might cause items to disappear or to be offered at a low quality, where the bad products (Lemons) outnumber the good ones. In this situation, if information asymmetry causes the overall quality of consumers to be reflected on the entire group rather than on specific individuals, good customers may leave the market since they are not valued for their reputation. As a result, there would be more danger of non-performing loans piling up in the market and problematic clients remaining. As a result, the theoretical stances that will guide this research will lead to the formulation of hypotheses to examine the relationship between bank-specific characteristics and the occurrence of non-performing loans. The moral hazard theory, the information asymmetry theory, the theory of adverse selection, and the bad management hypothesis are among these hypotheses and theories.

2.4.1. Information Asymmetry Theory

According to this theory, information is asymmetric when one side of a transaction is more informed than the other (Kingu et al., 2017). Asymmetric information literature in the area of financial decision-making, according to Mishkin (1992), examines the effects of decisions depending on the disparity in information that each party has access to. Because they cannot view the borrowers' traits and activities, lenders find it challenging to determine whether or not the borrowers will return their loans (Dell' Aficcia, 1998). As a result, knowledge asymmetries lead to issues with moral hazard and adverse selection (Akerlof, 1978).

According to Castro (2013), lenders are unable to differentiate between excellent and bad borrowers since they all pay a standard interest rate that reflects their combined credit history. However, if this rate is greater than decent borrowers can pay, it will drive some of them out of the market, pushing banks to charge higher rates to the remaining unqualified borrowers (Barron & Staten, 2008). Adverse selection thus causes high-quality borrowers to be replaced by low-quality borrowers, which over time degrades the overall quality of the bank loan portfolio and eventually results in the accumulation of non-performing loans (Bofondi & Gobbi, 2003).

2.4.2. Moral Hazard Theory

According to the moral hazard theory put forward by Keeton and Morris in 1987, inadequate bank capital may promote moral hazard by raising the risk level in their loan portfolio. According to Jimenez and Saurina's (2007) theory, market competition would cause banks' profitability to decline; as a result, they would be prepared to take on greater risk in order to increase their profits and terrify their customers.

Moral hazard is a principal-agent issue for the banking industry (Kingu et al., 2017). Therefore, managers in the banking industry are motivated to make hazardous choices since they stand to receive greater profits and experience less personal risk. Conversely, depositors and stockholders have a greater downside risk (Jensen & Meckling, 1976). Similarly, to this, bank managers under capital pressure have a tendency to respond to moral hazard incentives by approving high-risk loans at high-interest rates on the grounds that such rates will increase earnings and the capital base. As a result, high-risk loans might lead to increased NPL levels, and high-interest rates could discourage borrowers. Kingu et al. (2017) contend that moral hazard is typically linked to bank management behavior through the bank balance sheet, including the bank size, loan growth, asset growth, deposit growth, and capital adequacy ratio, as changes in all of these items are associated with the decisions made by bank management.

2.4.3. Bad Management Hypothesis

According to Berger & DeYoung's (1997) "Bad Management Theory," commercial banks with effective management are seen to have a strong ability to monitor credit risk. Otherwise, poor management will result in a rise in credit risk. The authors also discussed the "bad luck" idea, according to which commercial banks lend money to their clients in exchange for a promise to collect the debts later. If, however, the clients fail to honor that promise, the banks suffer losses and receive a poor rating from the market and regulators.

According to the theory of bad management, bank managers may not have the necessary skills to control operational expenses, manage credit risk, or underwrite loans. This phenomenon is consistent with adverse selection. According to Berger & DeYoung (1997), the increase in non-performing loans brought on by adverse selection causes bank management to devote more resources to managing and supervising subprime loans. The operational expenditure eventually surpasses the interest income as a result of this. As a result, a greater cost-to-revenue ratio indicates

poor bank management with regard to loan portfolio underwriting, monitoring, and control (Louzis et al., 2012).

2.4.4. Financial Accelerator Model

Theoretically, business cycle models that explicitly include a role for financial intermediation provide a useful context for modeling NPL because they draw attention to the counter-cyclicality of credit risk and company failures (Williamson, 1987). The financial accelerator model, which was explored by Carlstrom & Fuerst (1997) and Kiyotaki & Moore (1997), has emerged as the most well-known theoretical framework for examining macro-financial links in relation to these models. As a result, it has an impact on how NPL is modeled as well as how it interacts with macroeconomic performance. Similarly, Messai and Jouini (2013) claim that there is considerable evidence in the academic literature to support a link between the NPL and other macroeconomic indicators. As a result, the macroeconomic situation affects how lenders evaluate potential borrowers and their capacity to repay loans. Revenue growth and a decline in financial hardship are both favored by an expanding economy (Messai & Jouini, 2013).

2.5. Empirical Literature Review

2.5.1. Global Studies

Koju et al. (2020) identified the significant indicators of the macroeconomic environment that influence credit risk in high-income countries. The study employs the system generalized method of moments estimator to avoid dynamic panel bias and endogeneity issues. The findings suggest that the payment ability of debtors in high-income countries can be mainly improved by increasing productivity and competitive export trade. The negative coefficient of exports and IVA show that the incentives provided for industrial development and trade openness greatly reduce the possibility of a financial crisis. The study recommends the government focus more on increasing exports and developing the industrial sectors. The findings specifically recommend adopting an expansionary fiscal policy to boost employment, per capita income, productivity, and industrial output so as to maintain a stable banking system.

Priyadi et al. (2021) examined the determinants of credit risk in Indonesian Shari'ah rural banks (SRBs) using internal and external factors. The study finds that internal factors such as capital adequacy ratio (CAR) and return on assets (ROA) have a positive influence on nonperforming

financing (NPF), while inflation and profit and loss sharing (PLS) financing ratio have a negative influence on NPF. External factors such as economic growth, interest rate, financing-to-deposit ratio (FDR), financing-to-value (FTV), and operating expense ratio (OER) do not have an influence on NPF in SRBs. The study suggests that SRBs need to adopt the right risk management mechanism to manage the credit risk arising from the financing of small and medium enterprises (SMEs).

Barra & Ruggiero (2023) investigated the impact of bank-specific factors on credit risk in Italy by considering cooperative and non-cooperative banks in different local markets. The authors find that regulatory credit policy, capitalization, volume of credit, and volume of intermediation costs are the main bank-specific factors affecting non-performing loans. The study suggests that cooperative banks' behavior seems to be in line with that of commercial rather than popular banks, casting doubts about the feasibility of their credit policies. The authors conclude that recent reforms involving popular and cooperative banks represent the first step toward the enhancement of the stability and efficiency of the Italian banking system.

Calderon-Contreras et al. (2022) examined the determinants of credit risk in Peruvian municipal savings banks. The paper concludes that there are seven variables that determine the credit risk of Peruvian municipal savings banks. Three of these variables (interest rate, unemployment rate, and liquidity ratio) have a direct, positive, and significant influence on credit risk, while four variables (GDP, efficiency of administrative expenses, solvency, and coverage of provisions) have a significant negative influence on credit risk. The variable with the greatest negative impact on credit risk is the coverage of provisions, while the variable with the greatest positive impact is the liquidity ratio in PEN. The study provides evidence on the main factors that determine credit risk and could help micro-financial institutions implement measures to control and mitigate credit risk.

Ngo et al. (2021) examined factors affecting credit risk in lending activities of joint-stock commercial banks in Vietnam. The paper concludes that both macroeconomic and microeconomic factors affect credit risk in lending activities of joint-stock commercial banks in Vietnam. The study found that credit risks in the previous year, bank size, liquidity, and inflation have positive effects on credit risk, while bank capital, profitability, and economic growth have negative ones. The paper also suggests ways to control and minimize credit risk in lending activities, such as managing and monitoring credit risk, strengthening risk management ability for medium and long-

term loans, finding solutions for bad debts, actively reminding customers to pay their debts, and building up a bank's credit risk early warning system. Additionally, the paper suggests calculating a suitable loan growth policy, setting up a lending policy in which profitability and credit risk are balanced, and aggressively controlling bank size.

Syamlan & Jannah (2019). The paper aims to analyze the factors that influence the level of risk-taking in Islamic banking in Indonesia. The study has independent variables such as bank size, leverage, bank age, competitor banks, Capital Adequacy Ratio (CAR), and Non-Performing Financing (NPF), with the dependent variable in the form of risk-taking as measured by Financing to Asset Ratio (FAR). The study was conducted on 8 Islamic banks with observation time from 2010 to 2017. The study concluded that Bank size has a positive and significant effect on risk-taking by Islamic banks. This indicates that the size of a bank measured using the number of assets affects the risk-taking by the bank. So it can be said that the bigger the size of a bank, the more courageous the bank is to take risks. Leverage has a significant negative effect on risk-taking by Islamic banks. Leverage is measured based on Third Party Funds (TPF) owned by banks influence risk-taking in the opposite way. That is, when bank deposits increase, banks tend to reduce the level of risk-taking. Bank age has a significant positive effect on risk-taking by Islamic banks. This indicates that the age of the bank influences risk-taking, where the older the age of a bank, the more its business experience and causes the bank to be more courageous in taking risks. Bank's competitors have a significant negative effect on risk-taking by Islamic banks. These results occur because of the relationship between the market share ratio and the Financing to Asset Ratio which both use assets in their calculations. When an asset rises, it will increase the market share value but decrease the value of FAR.

Duong & Huong (2017) identified the determinants of credit risks in Vietnamese commercial banks. The study concluded that there are two groups of determinants that may have an influence on credit risks: bank-specific determinants and macro determinants. The bank-specific determinants include credit risks being highly inertia, requiring continuous management of credit risks, and the negative impact of bank size and market share on credit risks. The macro determinants include the relationship between GDP growth and the credit risks of commercial banks. The study did not find any correlation between the effectiveness of general management, real lending interest rate, and credit risks in the business activities of Vietnamese commercial banks.

Achsani & Kassim (2021) examined the credit risk determinants in the Indonesian dual banking system using bank-specific variables. The study uses a dynamic panel data approach to fit the model and finds that profitability and size significantly affect credit risk, with a negative relationship for profitability and a positive relationship for size. The type of bank, whether Islamic or conventional, does not play a significant role in determining credit risk. The study also compares the results of conventional banking and Islamic banking models from 2016-2020 and finds that three out of four independent variables affect credit risk significantly in the Islamic banking model, while no independent variable significantly affects credit risk in the conventional banking model. The study concludes that there is different behavior between Islamic banks and conventional banks in credit risk, especially in the first period.

Muhamad Yusuf et al. (2021) conducted a study to determine the relationship between microeconomic factors with credit risk among selected commercial banks in Malaysia. The study used Panel Regression Fixed Effect (FE) model to examine the determinants of credit risk for commercial banks in Malaysia. The results of the study suggest that FE is the most fitting model estimator to be utilized. The study found that the determinants of credit risk for commercial banks in Malaysia return on asset (ROA), bank size, leverage, the ratio of capital, interest income, and return on equity (ROE).

Jović (2017) analyzed the determinants of credit risk in Serbia, particularly in the corporate and retail sectors. The results of the econometric analysis show that credit risk levels are affected by macroeconomic factors such as a drop in gross domestic product and the depreciation of the domestic currency against the euro. The impact of domestic currency depreciation was more pronounced in the first years of the crisis than at the end of the observed period, and therefore it acted as a secondary factor of credit risk increase in the corporate sector. The increase in non-performing loans in the corporate sector is predominantly the result of macroeconomic factors from the real economy, whose negative effects are evidence of the financial acceleration inherent in the decline stage of a business cycle. The analysis also identifies the type of ownership as an important credit risk factor, with foreign banks with identified operational problems at the group level and state-owned banks being more exposed to credit risk than privately owned domestic banks at the group level and foreign banks in which major operational problems at the group level have not been identified.

Raiter (2021) examined the factors responsible for credit risk in commercial banks using data from WDI and Bank scope databases. The study used Fixed Effect (FE) and Random Effect (RE) models to analyze the data. The results suggest that inflation, interest rates, and unemployment rates have significant positive impacts on credit risk, while bank efficiency, size of the bank, and GDP growth rate have significant negative effects on credit risk. The study also found that credit risk is lower in private banks than in state-owned banks. However, the findings do not support the hypotheses that exchange rates and regulatory capitals influence credit risk.

Morina (2020) analyzed the determinants of credit risk in commercial banks in Kosovo using regression analysis for a dataset covering a time series of 7 years (2012-2018). The data have been collected from publications of the Central Bank of Kosovo and the Kosovo Agency of Statistics and have been analyzed on a quarterly basis. The study analyzed 6 variables and used the statistical software SPSS 23 to perform the necessary analysis. The main findings of the study show that interest rates on loans and profitability of banks (ROA) have the largest and most significant impact on credit risk, namely non-performing loans as the credit risk measure. The empirical results of the study explain the determinants of credit risk for Commercial Banks in Kosovo. Through the construction of the econometric model, the importance of each of these determinants at the level of non-performing loans as a measure of credit risk is shown.

Kharabsheh (2019) investigated the determinants of credit risk in Jordanian commercial banks using a balanced panel dataset of all Jordanian commercial banks over the period 2000-2017. The study found that credit risk increased as bank capital ratio, operating inefficiency, and the growth rate in credit increased. Larger and more profitable banks faced lower credit risk. However, no effect was found on bank liquidity. The macroeconomic variables included indicated that as the unemployment rate increased, credit risk significantly increased, and a similar positive effect was also documented for the crisis effect. The results showed no significant impact of GDP growth or inflation. The outcome of this study provided evidence that credit risk was influenced by both internal and external factors and this was expected to have important implications for policy makers.

Zheng et al. (2018) conducted a study to identify the factors that affect bank credit risk. The study was conducted on panel data consisting of 322 observations with 22 commercial banks and 15 consecutive years. The study found that profitability, capital, and bank size are inversely associated

with bank credit risk, whereas net interest margin and inefficiency have a positive effect. The study also found that the consecutive addition of each variable is responsible for constructing an accurate model considering the variation and goodness of fit value in the respective model. However, no evidence was found in support of the macroeconomic variables used in the model. Lastly, the sensitivity of the model test argued in favor of the baseline model, which established the cause-and-effect relationship in a logical manner.

Hang (2019) analyzed the factors affecting the credit risk of commercial banks in Vietnam using panel data and the FEM-REM model. The study found that loan loss provision ratio has the most significant impact on credit risk, with an increase in loan loss provision leading to an increase in bad debts in the future. The study also found a negative correlation between credit risk and unemployment rate and real interest rate. However, the results of the study differ from previous studies due to the implementation of the State Bank's policy that commercial banks focused on restructuring bad debts through debt trading, which helped to reduce bad debt rates while interest rates tend to increase.

Abusharbeh (2022) examined the determinants of credit risk in Palestine using panel data estimation. The results show that interest and credit supply have a positive impact on nonperforming loans (NPLs), while profitability has a negative affiliation with NPLs. Palestinian commercial banks were able to cushion their NPLs during and after the global financial crisis. The paper provides a good understanding of credit quality and risk control, which can help in controlling credit default and protecting Palestinian banks from financial distress.

Gulati et al. (2019) investigated the factors that influence the formation of credit risk in the banking system in India. The study found that credit risk persists in the Indian banking industry and that this intensity is higher for gross NPLs than for net NPLs. The study also found that lower profitability, more diversification in the banking business, the large size of banks, a higher concentration of banks in lending, and low operating expenses on credit screening and monitoring activities (especially for public sector banks) increase the probability of default in India.

Khan et al. (2023) evaluated the determinants of credit risk and operational risk in the banking sector of Pakistan. The collected data consists of secondary data from three banks listed at Karachi stock exchange over the period of 17 years from 2000 to 2016. The study uses a panel regression model to find the cause and effect relationship for the under-consideration issue. The result shows

that credit risk and operational risk have a significant and positive relationship with NPLs, Gearing Ratio, and Operating Efficiency. Credit Risk and operational risk have positive but insignificant relationship with Liquid Assets (LA). The paper concludes that proper bank regulations should be pursued, backed up by sound credit analysis, and provision for suitable situations of credit loans.

Effendi et al. (2017) analyzed the factors influencing non-performing financing (NPF) in Sharia banking. The internal variables of the bank that affect NPF are RR, ROA, CAR, BOPO, and Bank size, while the macroeconomic variables of the bank that affect NPF are inflation and GDP. The study concludes that the factors influencing non-performing financing (NPF) at sharia banking are both internal and external variables. The internal variables of the bank that affect NPF are RR, ROA, CAR, BOPO, and Bank size, while macroeconomic variables of the bank that affect NPF are inflation and GDP. The paper recommends maintaining the financial performance and setting appropriate financial policies by monitoring the Bank size, BOPO, CAR, ROA, and RR ratios, and for regulators to control the macroeconomic variable, particularly the inflation rate.

Widarjono & Rudatin (2021) empirically analyzed the effect of financing diversification on Islamic banks' non-performing financing (NPF) using aggregate Islamic bank data. The study finds that higher concentrated financing generates high NPF, while higher asset and operating efficiency can reduce NPF. The instability of the exchange rate also generates high NPF. The results suggest that Islamic banks must lessen the highly concentrated financing by optimizing both PLS and non-PLS contracts to reduce Islamic banks' financing risk.

2.5.2. Related Studies in Ethiopia

Tole et al. (2019) examined the determinants of credit risk in Ethiopian commercial banks. The authors applied a fixed effect ordinary least square model to analyze the data. The study concludes that macro-economic and micro variables affect the level of credit risk in the Ethiopian commercial banking industry. The study found that LDR and BAS have a positive impact, while GDPR and LGR have a negative and significant effect on the level of asset quality in the Ethiopian banking industry. The paper also presents the descriptive statistics of the dependent and independent variables of the model, including the return on asset, CAR ratio, loan-to-deposit ratio, inflation rate, unemployment rate, and GDP growth rate.

Adem (2022) conducted a study to understand the relationship between political stability and credit risk. The article focuses on 16 Ethiopian banks to understand the mentioned relationship in

developing countries. From 2010 to 2020, data are obtained from the World Governance Indicators, World Development Indicators database and Ethiopia's National Bank. Based on a two-step dynamic panel estimator, the results suggest that political stability is negatively correlated with credit risk, while political instability does have a positive impact on bank credit risk. Credit risk was inversely related to increased operating efficiency, diversified earnings and national currency appreciation. In contrast, greater bank size, rising inflation and economic expansion all contribute to a high level of credit risk. The loan-to-asset ratio and profitability were shown to have a minor influence on nonperforming loans (NPLs).

Tehulu & Olana (2014) examined the bank-specific determinants of credit risk in Ethiopian commercial banks. The quantitative research approach was adopted for the study. A balanced panel data of 10 commercial banks both state-owned and privately owned for the period 2007 through 2011 has been analyzed using random effects GLS regression. The regression results revealed that credit growth and bank size have a negative and statistically significant impact on credit risk. Whereas, operating inefficiency and ownership have positive and statistically significant impacts on credit risk. Finally, the results indicate that profitability, capital adequacy, and bank liquidity have a negative but statistically insignificant relationship with credit risk.

Asfaw & Veni (2015) analyzed the link between bank-specific factors and credit risk over the period of 2006-2012. The three Panel data estimation methods, pooled OLS regression, fixed effect, and random effect model, were used for extracting good results and F-test ascertained the appropriateness of Pooled OLS regression model. Its result revealed that the credit growth and return on equity had a statistically significant negative impact on the Credit risk indicator of the large Ethiopian private commercial banks. However, inefficiency and deposit rate had a statistically insignificant positive influence on the Credit risk indicator. It means that inefficient bank as well as those Banks that charge high deposit rate is likely to incur higher problem loan.

Boru Lelissa (2014) investigated the factors that influence credit risk in Ethiopian commercial banks using both descriptive and econometric models. The study finds that the quantity of risk and quality of risk management-related variables has a significant influence on the credit risk level of banks. However, risk direction-related measures, which are mostly external focus, have limited influence on credit risk. The study also finds that the ratio of loans to total assets, credit concentration, and bank size have a significant relationship with credit risk exposure. The study

suggests that banks need to enhance their credit granting process and maintain an appropriate credit administration, measurement, and monitoring process to reduce credit risk. Additionally, the study finds that banks with a credit risk management system that can convert deposits into loans are exposed to less credit risk. The study concludes that improving competition in the loan market has a positive implication for ensuring a quality credit portfolio.

Dessie (2016) examined bank specific and macroeconomic factors that play in determining the credit risk of Ethiopian commercial banks. To achieve the intended objective this study employed explanatory research design. Deductive (quantitative) approach is used to test a theory or explanation by specifying narrow hypotheses and the collection of data to support or refute the hypotheses. Nonperforming loans was used as Credit risk measure. The study shows a down ward sloping trend of credit risk for Ethiopian commercial banks within the sample period. Results using fixed effect panel regression exhibited that, loan growth, return on equity, bank size, capital adequacy, loan to deposit, managerial efficiency and gross domestic product have negative and statistically significant effect on banks CR. On the other hand, variables like state ownership have a positive and statistically significant effect on banks CR. Thus, the overall findings indicate that both macroeconomic and bank specific factors do have statistically significant effects on credit risk.

For instance, Dessie (2016) examined bank-specific and macroeconomic factors that play a role in determining the credit risk of Ethiopian commercial banks. Results using fixed effect panel regression exhibited that loan growth, return on equity, bank size, capital adequacy, loan to deposit, managerial efficiency, and gross domestic product have a negative and statistically significant effect on banks' CR. On the other hand, variables like state ownership have a positive and statistically significant effect on banks' CR. Tona (2017) examined the determinants of financial risk in Ethiopian private commercial banks. Bank-specific and macroeconomic variables were tested for the two dependent variables, credit and liquidity risk. The findings of the study for the credit risk model revealed that loan-to-deposit ratio (Liquidity), income diversification, non-performing loans, real GDP growth rate, and inflation have significant positive impacts on credit risk, whereas the return on assets has a significant negative impact on credit risk for Ethiopian private banks. The rest of the three bank-specific variables Loan growth, bank size, and operating inefficiency had no significant effect on the credit risk of Ethiopian private banks during the test period of 2001 to 2015.

Ydeg (2021) examined the determinants of Credit and Liquidity risk in Ethiopian commercial banks. Bank-specific and macroeconomic variables were tested. This study directly examined indicators of financial risk in terms of credit risk and liquidity risk in an objective manner from a same range of variables. Bank specific and macroeconomic variables were tested for the two dependent variables credit and liquidity risk models by using the balanced panel fixed effect regression model. The findings of the study for the credit risk model revealed that liquidity, loan growth, and profitability have a significant positive impact on the credit risk of Ethiopian commercial banks.

Kitila et al. (2020) assessed the determinants of credit risk in selected commercial banks in Ethiopia. The result indicated that predictor variables like efficiency ratio, return on equity, and bank size have statistically significant positive effects on the dependent variable (credit risk). In addition, the study showed that capital adequacy had a statistically significant negative effect on predicting the dependent variable, credit risk. However, predictor variables like return on asset, leverage, and loan-to-deposit ratio did not have any statistically significant effect on credit risk. Jabir et al. (2020) investigated the perceptions of bankers on the determinants of credit risk in Ethiopian commercial banks. The study found that bank-specific determinants, poorly negotiated credit terms, compromised integrity in lending, poor credit risk assessment, and a higher rate of interest are the major causes of non-performing loans. Besides bank-specific factors, the study identified that the level of information sharing among banks has a direct impact on non-performing loans. The study also revealed that macroeconomic factors such as a rise in the inflation rate, unemployment, and foreign exchange rate decrease loan quality.

2.6. Literature Gap

Previous research has examined the internal and external factors influencing credit risk in the banking sector, particularly nonperforming loans (NPLs) (Effendi et al., 2017; Widarjono and Rudatin, 2021). The findings have been inconsistent, with some studies identifying significant effects of variables such as size (Poudel, 2018; Koju et al., 2018; Tole et al., 2019; Tehulu & Olana, 2014), operational efficiency ratio (OER) (Firmansyah, 2014), GDP growth rate (Waqas et al., 2017; Tole et al., 2019), return on assets (ROA) (Kharabsheh, 2019; Muhammad et al., 2020; Nugrohowati and Bimo, 2019), financing to deposit ratio (FDR), capital adequacy ratio (CAR)

(Priyadi et al., 2021; Nugrohowati and Bimo, 2019; Tole et al., 2019; Koju et al., 2018; Kharabsheh, 2019), inflation rate (INF) (Muhammad et al., 2020; Waqas et al., 2017; Tole et al., 2019), Loan growth (Ngo et al., 2021); Kharabsheh, 2019; Tehulu & Olana, 2014; Tole et al., 2019), and liquidity (Poudel, 2018; Tole et al. 2019) on credit risk. However, other studies have found opposing results or negligible impacts of these factors on credit risk.

Furthermore, different studies have presented conflicting results regarding the impact of bank size, economic development, interest rates, loan growth, bank profitability, bank capital, interest spread, and income diversification on credit risk. Additionally, variables like interest rate, liquidity, and income diversification have been found to have varying impacts on credit risk based on different research findings.

Given the inconsistent results from prior studies, this current study aims to investigate both bank-specific and macroeconomic factors that influence credit risk in the lending activities of commercial banks in Ethiopia. By addressing these factors, this research seeks to provide a clearer understanding of credit risk determinants in the Ethiopian banking sector.

2.7. Hypothesis

Based on the empirical literature review the following hypotheses are developed.

H1: Liquidity has a significant positive relationship with the credit risk of private commercial banks in Ethiopia.

H2: Bank profitability has a significant positive relationship with the credit risk of private commercial banks in Ethiopia.

H3: The capital adequacy ratio has a significant positive relationship with the credit risk of private commercial banks in Ethiopia.

H4: GDP has a significant positive relationship with the credit risk of private commercial banks in Ethiopia.

H5: Inflation has a significant negative relationship with the credit risk of private commercial banks in Ethiopia.

H6: Loan growth has a significant negative relationship with the credit risk of private commercial banks in Ethiopia.

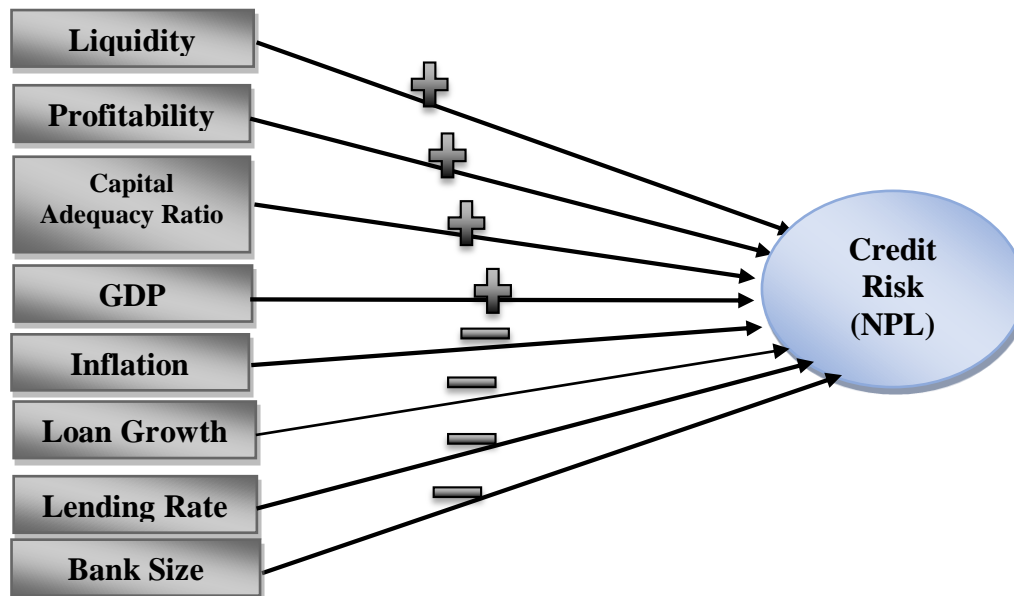
H7: The lending rate has a significant negative relationship with the credit risk of private commercial banks in Ethiopia.

H8: Bank size has a significant negative relationship with the credit risk of private commercial banks in Ethiopia.

2.8. Conceptual Framework

The discussion so far has shown that there is enough conceptual and empirical data to support the claim that bank-specific factors and macro-economic factors have an impact on credit risk of commercial banks. So, the aim is to determine if these factors affect commercial banks' credit risk in the context of the Ethiopian Banking Industry. In order to do this, a conceptual framework that illustrates the possible impact of liquidity, profitability, capital adequacy ratio, GDP, Inflation, loan growth, lending rate, and bank size (independent variables) on credit risk (dependent variable) is developed and is shown in figure 2.1 below. This framework is built on the foundation of the aforementioned empirical discussions. So, this conceptual framework offers a helpful foundation for directing attention on certain bank-specific and macroeconomic factors in our study.

Figure 2.1: Conceptual Framework of the Study



Source: Ngo et al. (2021).

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

This chapter describes the research design and methodology which are used in testing the effect of bank-specific factors and macroeconomic factors on the credit risk of commercial banks in Ethiopia. Elements discussed include; research design, target population, sample size, sampling procedure, data collection, and data analysis.

3.2. Description of the Study Area

This study is conducted in Ethiopian private commercial banks in Addis Ababa. The area is selected due to the fact that the main office of all private commercial banks is located in the capital city.

3.3. Research Design

A research design is an overall plan for relating the conceptual research problem to relevant and practicable empirical research. In other words, the research design provides a plan or framework for data collection and its analysis. The study adopted an explanatory research design as the study intends to determine the effect of bank-specific and macroeconomic on private commercial banks' credit risk.

3.4. Research Approach

In terms of research methodology, the study used a quantitative research strategy. According to Creswell (2009), the quantitative method includes inquiry tactics such as experiments and surveys, and data is collected on specified instruments that give numeric data that can be examined using statistical processes. It is a method of evaluating objective ideas by studying the connection between variables. It is useful since it uses a scientific methodology to assess the instrument's reliability and validity. It leverages a large sample size to reduce bias from the researcher's influence. As a consequence, the results may be trusted and extrapolated to a broader population. Therefore, the study employed the quantitative approach to examine the effect of bank-specific and macroeconomic factors on the credit risk of commercial banks in Ethiopia. It cannot, however, address concerns that cannot be measured.

3.5. Population and sampling procedure

Of the 32 banks, 30 are private commercial banks (See annex 1) such as; Dashen Bank S.C (DB), Awash Bank S.C (AIB), Wegagen Bank S.C(WB), United Bank S.C (UB), Nib International Bank S.C (NIB), Bank of Abyssinia S.C (BOA), Lion International Bank S.C (LIB), Cooperative Bank of Oromia S.C (CBO), Berehan International Bank S.C (BIB), Buna International Bank S.C (BUIB), Oromia International Bank S.C (OIB), Zemen Bank S.C (ZB), Addis International Bank S.C (AIB), Abay Bank S.C (AB), Enat Bank S.C (EB), Debub Global Bank S.C (DGB), ZamZam Bank, Hijra Bank, Siinqee Bank, Shabelle Bank, Amhara Bank, Ahadu Bank, Goh Betoch Bank SC, Tsedey Bank, Tsehay Bank, Gadaa Bank SC, Sidama Bank S.C, Siket Bank S.C, Rammis Bank S.C, and Omo Bank.

The target population is twelve (12) private commercial banks. The total population is 27 but for the study purpose, the sample size is twelve. Among the non-probability sampling techniques, purposive sampling is used to select samples from the total population. Non-probability sampling technique is selected because random sampling is not appropriate for the study. Since the study covered a period of 13 years (2010 - 2022), there are banks with the age of less than thirteen years which is why purposive sampling will be employed. The study included all private banks, with 13 and above establishment years. The sample size is twelve, which includes, Dashen Bank S.C (DB), AwashBank S.C (AIB), Wegagen Bank S.C (WB), United Bank S.C (UB), Nib International Bank S.C (NIB), Cooperative Bank of Oromia S.C (CBO), Lion International Bank S.C (LIB), Oromia International Bank S.C(OIA), Zemen Bank S. (ZB), Bank of Abyssinia S.C (BOA), Berhan International Bank, and Buna International Bank. Therefore, the matrix for the frame is 12*13 that includes 156 observations.

3.6. Data Collection and Analysis Techniques

3.6.1. Data and Data Collection Instruments

Applying appropriate data gathering instruments help researchers to combine the strengths and amend some of the inadequacies of any source of data to minimize risk of irrelevant conclusion. Consistent and reliable research indicates that research conducted by using appropriate data collection instruments increases the credibility and value of research findings (Koul, 2006). This study used secondary data from the private commercial banks in Ethiopia. According to (Kiecolt

& Nathan, 1985) secondary data is the use of information which is readily available from the previous study findings and can be accessed from different publications or sites. The use of secondary data is faster and also cost effective since it uses someone's information to achieve present objective. Data were obtained from bank's annual audited financial reports, as well as internet and website of the banks, for the period between 2010 and 2022 which is equivalent to 13 years. All data were collected on annual base.

3.6.2. Method of Data Collection and Analysis

This study used panel data which ensures enough data is available to the researcher because it contains both time series and cross-sectional dimensions thus, minimal biasness in parameter estimators (Baltagi, 2005). Annual audited financial statements of commercial banks operating in Ethiopia are obtained from the National Bank of Ethiopia (NBE) by submitting a formal request letter issued by my university. Data were collected for a period of thirteen (13) years from thirteen (13) private commercial banks in Ethiopia, number of observations totaling up to 156 samples which is sufficient for both time series and cross sectional dimension. Multiple regression was applied to analyze data collected from thirteen (13) sample populations which helps the researcher to gain more knowledge on the relationship between several independent variables (predictor) and dependent variable (Garson, 2014), thus being a good method of data analysis in this study which has eight (8) predictors (capital adequacy ratio, liquidity, banks' profitability, bank size, loan growth, GDP, inflation, and lending rate) and one dependent variable (credit risk).

To test the proposed hypotheses, statistical analyses was carried out using the following methods: First, descriptive statistics of the variables (both dependent and independent) are calculated over the sample period and this was in line with Malhotra (2007), which states using descriptive statistics methods helps the researcher in picturing the existing situation and allows relevant information. Then, a correlation analysis between dependent and independent variables was made. Finally, ordinary least square/OLS regression approach including all of its assumptions is employed. Data collected from different sources were recorded in excel sheet and analyzed by using E-views 9 software package.

3.7. Model specification and Measurement

3.7.1. Model Specification

The nature of data that used in this study allowed to use panel data model which is deemed to have advantages over cross sectional and time series data. Panel data involves the pooling of observations on the cross-sectional over several time periods.

As Brook (2008) stated the advantages of using panel data set; first and perhaps most importantly, it can address a broader range of issues and tackle more complex problems with panel data than would be possible with pure time-series or pure cross-sectional data alone. Second, it is often of interest to examine how variables, or the relationships between them, change dynamically (over time). To do this using pure time-series data would often require a long run of data simply to get a sufficient number of observations to be able to conduct any meaningful hypothesis tests. But by combining cross-sectional and time series data, one can increase the number of degrees of freedom, and thus the power of the test, by employing information on the dynamic behavior of a large number of entities at the same time. The additional variation introduced by combining the data in this way can also help to mitigate problems of multi-collinearity that may arise if time series are modeled individually. Third, by structuring the model in an appropriate way, we can remove the impact of certain forms of omitted variables bias in regression results. In analyzing the effect of bank-specific and macroeconomic factors on private commercial banks' credit risk in Ethiopia between 2010 and 2022 using the econometric method, the following regression equation is developed to explain the effect of bank-specific and macroeconomic factors on the credit risk of private commercial banks in Ethiopia.

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \dots + \beta_n X_{it} + \varepsilon$$

The econometrics model is extracted from the above equation as follows:

$$Y_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 LIQ_{it} + \beta_3 LG_{it} + \beta_4 BS_{it} + \beta_5 ROA_{it} + \beta_6 INTR_t + \beta_7 INFL_t + \beta_8 GDP_t + \varepsilon_{it}$$

$$Y_{it} = CRISK = \text{Credit Risk}$$

β_0 = level of credit risk in the absence of the independent variables

$\beta_1, \beta_2, \beta_3 \dots$ = Regression coefficients

CAR_{it} = Capital Adequacy Ratio

LIQ_{it} = Liquidity Ratio

LG_{it} = Loan Growth

BS_{it} = Bank Size

ROA_{it} = Return on Assets

INTR_{it} = Lending Rate

INF_{it} = Inflation

GDP_{it} = Gross Domestic Product

ε_{it} = Error

i = Name of Bank (1..... 13)

t = Time (2010 - 2022)

3.7.2. Measurement

3.7.2.1. Dependent Variable

The dependent variable in this study is credit risk proxied by nonperforming loans (NPLs). As per the National Bank of Ethiopia (NBE Directive No. SBB/66/2017), an NPL is defined as any loan facility that has unpaid principal and/or interest outstanding for over 90 days from the terms stipulated in the original loan contract. Thus, if customers do not service either interest or principal repayments as they fall due based on the loan repayment schedule for a period exceeding 90 days, the outstanding loan balance is categorized as nonperforming on the commercial bank's balance sheet per this NBE directive on asset classification. Given NPLs reflect loans in danger of effective default with material uncertainty around their repayment, the aggregate NPL figure represents the overall quality of a bank's loan book where higher NPL ratios signal poorer standards of credit risk management (Efrem, 2022; Tamene, 2020). By examining factors impacting observed NPL rates across Ethiopian commercial banks using regression analysis, this study provides direct insight on determinants influencing the realization of credit risk for this vital banking sector.

3.7.2.2. Independent Variables

Liquidity Ratio

The loan to deposit ratio (LTD) measures the proportion of customer deposit funds placed out as total loan assets. A higher LTD ratio indicates a more aggressive liquidity strategy by the bank in utilizing available depositor funding to generate interest income through lending activities. However, excessive expansion of loans relative to core deposits can expose banks to liquidity risks, particularly if sudden depositor withdrawals occur.

Gross Domestic Product

The gross domestic product (GDP) measures the market value of all final goods and services produced within a country over a given time period, typically one year. GDP growth traces overall economic output and activity levels. Rising real GDP signals improving business conditions, consumer capacity and repayment ability that may reduce credit risk. Declining economic productivity increases vulnerabilities that banks must monitor regarding debt service burdens for both individual and institutional borrowers.

Inflation

The inflation rate reflects the pace of overall price level increases across an economy. As inflation accelerates, money loses purchasing power. However, loans utilize fixed principal amounts set at earlier periods which become easier to repay in inflationary times. Extreme price changes distort decision-making, impacting banks' lending strategies and capabilities of estimating longer-term cash flows which are vital in credit underwriting processes. Generally, high inflation leads to higher interest rates that may influence customer borrowing behavior.

Lending Rate

The maximum lending rate established by the National Bank of Ethiopia (NBE) sets the ceiling for interest charges banks apply on loans provided to commercial borrowers or consumers. Changes in capped lending rates dictated by NBE policies directly shift credit access, demand and delinquency propensity among bank customers. Higher rates, though supporting bank profitability, may constrain lending or growth potential if set beyond tolerable levels for over-indebted borrowers. Thus prevailing NBE lending rate directives in a given period fundamentally shape the risk environment in which banks operate.

Capital Adequacy Ratio

The capital adequacy ratio (CAR) measures the amount of a bank's capital expressed as a percentage of its risk-weighted credit exposures. The CAR determines the bank's capacity to absorb potential losses while meeting obligations to depositors and other creditors. A higher CAR indicates larger capital reserves to continue lending during economic downturns. However, extremely elevated CAR levels could signal excess slack unutilized for productive assets. Research shows unclear or contradictory links between observed CAR rates and nonperforming financing (NPF), with potential short-term rises but long-term declines in NPF as capital buffers strengthen (Supriani and Sudarsono, 2018).

Return on Assets

The return on assets (ROA) ratio measures managerial efficiency in generating operating profits from bank assets. Through revenue growth and cost control, healthier ROA performance reflects stronger institutional capacity to cover credit losses and write-offs. Studies indicate robust profitability correlates with lower credit risk across banking contexts (Bhattarai, 2018; Gulati et al., 2019). However, when ROA expansion relies excessively on risky lending at the expense of prudent underwriting, the positive ratio may mask emerging troubles from laxity.

Bank Size

Bank size measures balance sheet footing via total reported assets. Some analysts suggest larger asset bases allow banks to diversify risks and leverage investments in enhanced credit risk infrastructure. However, conflicting evidence shows giant institutions face complexity risks, while smaller localized banks better understand their niche clientele (Ranjan and Dhal, 2003). Rapid bank growth could thus signal rising vulnerabilities instead of stability. No consensus exists on the exact effects of bank scale on credit risk tendencies.

Loan Growth

The pace of annual loan portfolio growth critically traces changing risk appetites. Excessively rapid credit expansion likely entails loosened lending standards and attracts unprepared novice lenders, sowing the seeds for subsequent asset troubles when economic winds shift (Gulati et al., 2019). However, very slow loan growth can also weaken profit engines available to absorb future shocks. Evaluating not just aggregate changes but asset quality indicators across both ups and downs provides prudent insights.

The measurement of dependent and independent variables are summarized under in table 3.1.

Table 3.1. Measurements of Variables

Variable Type	Variable	Measures	Measurement Scale
<i>Dependent</i>	<i>Credit Risk</i>	Measures the proportion of loans set aside to cover expected loan losses out of total loans issued in a year. Indicates credit risk protection.	<i>Loan Loss Provision/Total Loan</i>
<i>Independent</i>	<i>Capital Adequacy</i>	Capital adequacy ratio showing equity funds relative to total assets. Indicates ability to absorb losses	<i>Equity / Total Asset</i>
	<i>Liquidity</i>	Liquidity ratio of loan concentration compared to deposit funding base. High ratio signals aggressive lending strategy.	<i>Total Loans / Deposits</i>
	<i>Loan Growth</i>	Loan growth rate by comparing year-end to year-start loan levels. Rising growth can dangerously elevate credit risk	<i>Opening Loan – Closing Loan / Opening Loan</i>
	<i>Bank Size</i>	Scale of operations, measured through total assets.	<i>Natural Logarithm of Bank's Total Asset -</i>
	<i>Return on Assets (ROA)</i>	Profitability relative to asset base.	<i>Net Income / Total Asset</i>
	<i>Lending Rate</i>	Pricing of loan products, which affects credit access and risk appetite. Higher rates compensate for riskier lending	<i>Rate</i>
	<i>GDP</i>	Economic output change signaling rising/falling income levels and repayment capacity.	<i>Rate</i>
	<i>Inflation</i>	Inflation rate movement indicating changes in borrowing costs and consumer stress affecting credit risk.	<i>Rate</i>

Source: Summary of the researcher from empirical research

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1. Introduction

In the preceding chapters important literatures relating to the topic were reviewed that gives understanding about the topic and used to identify knowledge gap on the area. To meet the broad research objective and to answer research questions and to test research hypotheses under it the research design used for this study also discussed in the preceding chapter. In this chapter the data collected was presented and an important correlation and regression analysis finding was discussed.

4.2. Testing assumptions of classical linear regression model (CLRM)

4.2.1. Test for average value of the error term is zero ($E(u_t) = 0$) assumption

The first assumption required is that the average value of the errors is zero. In fact, if a constant term is included in the regression equation, this assumption will never be violated. Therefore, since the constant term (i.e. α) was included in the regression equation, the average value of the error term in this study is expected to be zero.

4.2.2. Test for homoscedasticity assumption ($\text{Var}(u_t) = \sigma^2$)

This is the variation of the residuals across all the observations under study. It has been assumed thus far that the variance of the errors is constant. This is known as the assumption of homoscedasticity. If the errors do not have a constant variance, they are said to be heteroscedastic. To test this assumption, the ARCH test was used having the null hypothesis of heteroscedasticity. Both F-statistic and chi-square (χ^2) tests statistic were used.

Table 4.1. Test for homoscedasticity

Heteroskedasticity Test: ARCH

F-statistic	2.301413	Prob. F(1,146)	0.1128
Obs*R-squared	2.421522	Prob. Chi-Square(1)	0.1276

Source: Financial statement of sampled private commercial banks and own computation through E-views 9.

Both the F- and χ^2 -test statistic gives the same conclusion that there is evidence for the absence of heteroscedasticity. In the case of credit risk both the F- and χ^2 -test statistic give the same

conclusion that there is evidence for the absence of heteroscedasticity. Since the p-values in all of the cases were above 0.05, the null hypothesis of heteroscedasticity should be rejected (appendix 1). The null hypothesis of heteroscedasticity should be rejected even at 10% level for the F-statistics and χ^2 test statistic. Generally, in all of the regression models used in this study it was proved that the variance of the error term is constant or homoscedastic and we had sufficient evidence to reject the null hypothesis of heteroscedasticity.

4.2.3. Test for absence of autocorrelation assumption ($\text{cov}(u_i, u_j) = 0$ for $i \neq j$)

The test for autocorrelation was made by using Breusch- Godfrey Serial Correlation LM Test. Breusch-Godfrey Serial Correlation LM Test is more general than the DW test, and can be applied in a wider variety of circumstances since it does not impose the DW restrictions on the format of the first stage regression. The null hypothesis is no autocorrelation between the error term and its lag. Breusch-Godfrey Serial Correlation LM (appendix-2) proved that both the F- and χ^2 -test statistic give the same conclusion that there is evidence for the absence of autocorrelation since the p-values in all of the cases were above 0.05.

Table 4.2. Test for autocorrelation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.578421	Prob. F(1,77)	0.0923
Obs*R-squared	6.630802	Prob. Chi-Square(1)	0.0741

4.2.4. Test for Normality assumption ($u_t \sim N(0, \sigma^2)$)

A normal distribution is not skewed and is defined to have a coefficient of kurtosis 3. Bera- Jarque formalizes this by testing the residuals for normality and testing whether the coefficient of skewness and kurtosis are zero and three respectively. Skewness measures the extent to which a distribution is not symmetric about its mean value and kurtosis measures how flat the tails of the distribution are. The Bera-Jarque probability statistics/P-value is also expected not to be significant even at 10% significant level (Brooks 2008). According to Gujarati (2004), the JB is a large sample test and our sample of 100 was equal to the frame was large; we considered the JB test also. As shown in the histogram kurtosis is almost 3 (i.e. 3.215705), and the Jarque-Bera statistics was not significant even at 10% level of significance as per the P-values shown in the histogram in the

appendix (i.e. 0.660553). Hence, the null hypothesis that is the error term is normally distributed should not be rejected and it seems that the error term in all of the cases follows the normal distribution.

4.2.5. Test for absence of series multi-collinearity assumption

This assumption is concerned with the relationship exist between explanatory variables. If an independent variable is an exact linear combination of the other independent variables, then we say the model suffers from perfect collinearity, and it cannot be estimated by OLS (Brooks 2008). Multi-collinearity condition exists where there is high, but not perfect, correlation between two or more explanatory variables (Cameron and Trivedi 2009; Wooldridge 2006). According to Churchill and Iacobucci (2005), when there is multi-collinearity, the amount of information about the effect of explanatory variables on dependent variables decreases. As a result, many of the explanatory variables could be judged as not related to the dependent variables when in fact they are. This assumption does allow the independent variables to be correlated; they just cannot be perfectly correlated. If we did not allow for any correlation among the independent variables, then multiple regressions would not be very useful for econometric analysis.

How much correlation causes multi-collinearity however, is not clearly defined. While Hair et al (2006) argue that correlation coefficient below 0.9 may not cause serious multi-collinearity problem. Malhotra (2007) stated that multi-collinearity problem exists when the correlation coefficient among variables is greater than 0.75. Kennedy (2008) suggests that any correlation coefficient above 0.7 could cause a serious multi-collinearity problem leading to inefficient estimation and less reliable results. This indicates that there is no consistent argument on the level of correlation that causes multi-collinearity. According to Gujarati (2004), the standard statistical method for testing data for multi-collinearity is analyzing the explanatory variables correlation coefficients (CC); condition index (CI) and variance inflation factor (VIF). Therefore, in this study correlation matrix for eight of the independent variables shown below in the table were estimated. The results in the following correlation matrix show that the highest correlation of -0.86163 which is between lending rate and GDP. Since there is no correlation above 0.9 according to Hair et al (2006), we can conclude in this study that there is no problem of multi-collinearity.

Table 4.3. Correlation matrix of explanatory variables

	ROE	CAR	LENDING RATE	LIQUIDITY	GDP	INFLATION	SIZE	LOAN GROWTH
ROE	1.00000	-0.32119	-0.27592	-0.14228	0.25027	-0.09177	-0.11321	0.00115
CAR		1.00000	-0.27584	0.02728	0.21895	-0.06079	-0.30206	0.10817
LENDING RATE			1.00000	0.55177	-0.86163	0.41294	0.50632	-0.06374
LIQUIDITY				1.00000	-0.48586	0.17992	0.09731	-0.02636
GDP					1.00000	-0.38592	-0.44978	0.07368
INFLATION						1.00000	0.24055	-0.01492
SIZE							1.00000	-0.11639
LOAN GROWTH								1.00000

Source: Financial statement of commercial banks and own computation through E-views 9.

4.2.6. Choosing Random effect (RE) versus fixed effect (FE) models

Random Effect versus Fixed Effect Models: Econometrics model used to examine the effect of ROE, CAR, Liquidity, Lending rate, Growth domestic product, Inflation, Bank Size, and loan growth on credit risk of private commercial banks in Ethiopia was panel data regression model which should be either fixed-effects or random-effect model. The study used Hausman Specification Test to identify whether fixed effect or random effect model is appropriate for study.

Table 4.4. Result of model selection Test: Hausman test

Correlated Random Effects - Hausman Test

Equation: Untitled

Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	2.862232	8	0.7507

Source: Developed by the researcher through E-views 9

As shown in Table 4.4, the Hausman specification test for this study has a p-value of 0.7507 for the regression models. This indicates that p-value is not significant and then the null hypothesis is not rejected justifying as random effect model is appropriate for the given data set in this study.

4.3. Descriptive statistics of the Data

The descriptive statistics for the dependent and independent variables are presented below. The dependent variable is banks credit risk. The independent variables were ROE, CAR, Liquidity, Lending Rate, GDP, Inflation, Bank Size, and Loan Growth which were used to see their effect on private commercial banks credit risk. Table 4.5 bellow presents the descriptive statistics of the dependent and independent variables.

Table 4.5. Descriptive statistics of dependent and independent variables

	Credit Risk	ROE	CAR	Lending Rate	Liquidity	GDP	Inflation	Size	Loan Growth
Mean	1.897751	20.60429	13.80130	12.84226	65.25793	8.873548	16.86387	9.715603	37.69413
Median	1.626499	20.19803	13.19783	12.75000	64.70592	9.000000	13.80000	9.382306	33.99075
Maximum	8.830813	42.43025	35.22122	14.25000	102.6248	11.40000	33.90000	18.55701	226.5363
Minimum	0.057650	0.041395	7.871502	11.88000	8.930823	6.100000	6.600000	6.174024	-52.96843
Std. Dev.	1.339570	7.665425	3.591663	0.958031	13.12706	1.776253	9.524090	2.339837	30.83788
Obs.	155								

Source: Financial statement of sampled commercial banks and own computation through Eviews 9

Credit Risk ranged from 0.0576 to 0.8.8308 and the standard deviation was 1.3395. It is noted here that the amount of the credit risk is considered somewhat not comparable between commercial banks in general, as it lacks a relative stability.

Table 4.1 also shows the descriptive statistics of ROE, CAR, lending rate, liquidity, GDP, inflation, size and loan growth. The mean value of ROE was 20.6% that was above the NBE requirement (i.e. 15%) (NBE Directive No. SBB/57/2014). The standard deviations of 7.6654 show higher dispersion of net income to total equity from its mean for the commercial banks in Ethiopia. The maximum and minimum values of CAR were 35.22% and 7.87% respectively. It is noted here that the proportion of capital adequacy ratio at the Ethiopian commercial banks is high, unstable and varied from one bank to another and from one year to another.

The average lending interest rate was related with interest rate that is lending interest rate. The mean value of the lending interest rate over the period under study was 12.84 % with the maximum and minimum values of 14.25% (in the year 2020) and 11.88 % (in the years 2011-2015) respectively. There was little variation of interest rate margin towards its mean value over the periods under study with the value of standard deviation 0.958%.

The average liquidity ratio was about 65.25% during the study period, and the liquidity ratio ranged from 8.93% to 102.62% with a standard deviation of 13.127, reflecting the presence of fluctuation in the liquidity ratio during the study period. From descriptive statistics table 4.5 revealed the following; the mean loan growth ratio for the studied period was 37.69% with a fluctuation of 30.83.

The mean value of real GDP growth rate was 8.87 % indicating the average real growth rate of the country's economy over the past 13 years. The maximum growth of the economy was recorded in the year 2011 (i.e. 11.4%) and the minimum was in the year 2020 (i.e. 6.1%). Since the year 2003 the country has been recording double digit growth rate with little dispersion towards the average over the period under study with the standard deviation of 1.77.

The general inflation rate (i.e. 16.86 %) of the country on average over the thirteen years was more than the average GDP. The maximum inflation was recorded in the year 2011 (i.e. 33.9%) and the minimum was in the year 2016 (i.e. 6.6%). The rate of inflation was highly dispersed over the periods under study towards its mean with standard deviation of 9.52, reflecting the presence of a fluctuation in the rate of inflation and its difference from one year to another. The inflation rate is relatively high during the study period.

Finally, it is noted that the dependent variable is normally distributed where the importance of the Jarque-Bera test was greater than 5%, which shows the normal distribution of the variable. The number of the observation within the study sample was 155, which reflect the data of 20 banks in thirteen years.

4.4. Correlation analysis

According to Brooks (2008), if y and x are correlated, it means that y and x are being treated in a completely symmetrical manner. Thus, it is not implied that changes in x cause changes in y , or indeed that changes in y cause changes in x rather, it is simply stated that there is evidence for a linear relationship between the two variables, and that movements in the two are on average related to an extent given by the correlation coefficient. Table 4.3 above shows the correlation coefficient between the dependent variables and independent variables.

Output of correlation analysis (Table 4.3) represented in matrix of pair-wise correlation. This study has calculated correlation of dependent variables with independent macroeconomic and bank specific variables. It was found that credit risk is negatively correlated with ROE, CAR, lending rate, GDP, and loan growth with a correlation coefficient of -0.2042, -0.035, -0.3038, -0.3065, and -0.1821 respectively. Table 4.3 also shows that liquidity, inflation, and size are positively correlated with a correlation coefficient of 0.2380, 0.2202, and 0.2013 respectively. The linear relationship between Credit risk & ROE, Lending rate & Credit risk, GDP & credit risk, CAR & Credit risk, Inflation & credit risk, SIZE & credit risk, liquidity & credit risk, and loan growth & credit risk was statistically different from zero/statistically significant.

4.5. Results of the regression analysis

Under the following regression outputs, the beta coefficient may be negative or positive; beta indicates that each variable's level of influence on the dependent variable. P-value indicates at what percentage or precession level of each variable is significant. R² values indicate the explanatory power of the model and in this study adjusted R² value which takes into account the loss of degrees of freedom associated with adding extra variables were inferred to see the explanatory powers of the models.

Results

Operational model: the operational panel regression model used to find the statistically significant bank specific and macroeconomic factors of private commercial banks' credit risk was:

$$ROE_{it} = \beta_0 + \beta_1(ROE_{it}) + \beta_2 (CAR_{it}) + \beta_3 (Lending\ Rate_{it}) + \beta_4 (Liquidity_{it}) + \beta_5 (GDP_t) + \beta_6 (Inflation_t) + \beta_7 (Size_{it}) + \beta_8 (Loan\ Growth_{it}) + \varepsilon_{it}$$

Table 4.6. Multiple Regression result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROE	-0.065676	0.106275	-0.617980	0.1382
CAR	-0.121009	0.049612	-2.439096	0.0159
Lending Rate	-0.133077	0.084367	-9.46713	0.0000
Liquidity	0.008311	0.009173	0.906000	0.3664
GDP	-0.034720	0.022119	-2.021767	0.0363
Inflation	0.153075	0.238909	1.059293	0.0424
Size	0.114677	0.097618	1.174751	0.2420
Loan Growth	-0.010189	0.002998	-3.398495	0.0009
C	-1.676830	2.695384	-0.622112	0.5355

R-squared	0.712935	Mean dependent var	4.476492
Adjusted R-squared	0.645500	S.D. dependent var	3.324175
S.E. of regression	2.188054	Sum squared resid	411.7317
F-statistic	22.16342	Durbin-Watson stat	1.973299
Prob(F-statistic)	0.000000		

Notes: $R^2 = 0.712935$; $Adj R^2 = 0.645500$; F-statistics = 22.16342 and Prob (F-statistics = 0.000000), and Durbin-Watson stat = 1.973299

Source: Financial statement of sampled commercial banks and own computation through E-views
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Table 4.7 presented results of credit risk as dependent variable and bank specific and macroeconomic explanatory variables for the sample of twelve private commercial banks in Ethiopia. The explanatory power of this model is high (i.e. around 71%). The regression F-statistic takes a value 22.16. F-statistics tests the null hypothesis that all of the slope parameters (β 's) are jointly zero. In the above case p-value of zero attached to the test statistic shows that this null hypothesis should be rejected even at 1% level of significance.

As it is shown in the above table capital adequacy ratio, lending interest rate, GDP, inflation, and loan growth were the statistically significant factors affecting credit risk of private commercial banks in Ethiopia. Capital adequacy ratio, lending rate, GDP, and loan growth had negative and statistically significant impact on credit risk at 1% and 5%. Inflation had positive and statistically significant impact on credit risk at 5%. Moreover, ROE, liquidity, and bank size had statistically insignificant (i.e. Prob = 0.1382, Prob = 0.3664, and Prob = 0.2420 respectively) impact on private

commercial banks credit risk in Ethiopia.

4.6. Discussion of the Regression Results

Table 4.7 present regressions out puts for the relationships between Bank Specific and Macroeconomic variables and credit risk. The results are discussed as follows.

4.6.1. Bank Specific Variables

As we have observed the model estimates there are five bank specific variables that are used in this study namely liquidity, capital adequacy ratio, ROE, bank size, and loan growth.

4.6.1.1.ROE and Credit Risk

The results showed that the coefficient of the ROE was negative but not statistically significant, which means that the ROE does not affect the credit risk of commercial banks in Ethiopia. While ROE is indicative of strong profitability, an excessively high ROE can potentially lead to increased credit risk for a bank, specifically through overly aggressive lending practices. This result differs from what is expected and with what was found by the previous studies such as Zheng et al. (2018) and Abusharbeh (2022) and Ngo et al. (2021) who concluded that profitability has a negative and significant effect on credit risk. Others such as Muhamad Yusuf et al. (2021) and Kharabsheh (2019) found that larger and more profitable banks faced lower credit risk. However, Gulati et al. (2019) found that lower profitability increases the probability of default in India. The coefficient estimate and the p-value was -0.065676 and 0.1382 respectively which was insignificant even at 10% confidence level. Since the coefficient was statistically insignificant we could not say it shows negative impact on banks' credit risk.

Generally, we reject the null hypothesis (i.e. there is significant and positive relationship between ROE and credit risk of commercial banks in Ethiopia).

4.6.1.2.Capital Adequacy Ratio and Credit Risk

The CAR determines the bank's capacity to absorb potential losses while meeting obligations to depositors and other creditors. A higher CAR indicates larger capital reserves to continue lending during economic downturns. However, extremely elevated CAR levels could signal excess slack unutilized for productive assets. Research shows unclear or contradictory links between observed

CAR rates and nonperforming financing (NPF), with potential short-term rises but long-term declines in NPF as capital buffers strengthen (Supriani and Sudarsono, 2018).

Sufian et al. (2008) also argue that capital adequacy ratio (CAR) has negative and statistically significant effect on credit risk, which means that the capital adequacy ratio affects the credit risk of private commercial banks in Ethiopia. This may be the result of an overly high capital adequacy ratio of commercial banks. This result is not in line what is expected and inconsistent with what was found by the previous studies such as Effendi et al. (2017) and Priyadi et al. (2021) who concluded that capital adequacy ratio (CAR) has a significant positive effect on credit risk.

The coefficient estimate and the p-value was -0.121009 and 0.0159 respectively which was significant even at 5% and 10% confidence level. Capital adequacy ratio in this equation was consistent with to the null hypothesis, but the direction is negative. Since the coefficient was statistically significant we fail to reject the null hypothesis.

4.6.1.3.Liquidity and Credit Risk

The regression result showed that the coefficient of liquidity was positive and statistically insignificant, which means that liquidity doesn't affect the credit risk of private commercial banks in Ethiopia. This result is in line with Khan et al. (2023) who evaluated the determinants of credit risk and operational risk in the banking sector of Pakistan and concluded that liquidity has positive but insignificant relationship with credit risk, though the finding is inconsistent with Ngo et al. (2021) and Calderon-Contreras et al. (2022) who determined that liquidity ratio has a direct, positive, and significant influence on credit risk. Kharabsheh (2019) also indicated that no effect was found on bank liquidity. The coefficient estimate and the p-value was 0.008311 and 0.3664 respectively which was insignificant even at 10% confidence level. Liquidity in this equation was inconsistent with the null hypothesis. Since the coefficient was statistically insignificant we rejected the null hypothesis.

4.6.1.4.Bank Size and Credit Risk

The coefficient signs of bank size show positive but statistically insignificant effect of bank size on banks' credit risk. The regression output in Table 4.7 reveals that there is a positive and insignificant relationship between bank size and credit risk of commercial banks in Ethiopia. The probability value of the variable (i.e. 0.2420) indicated that bank size is not a statistically

significant predictor of credit risk among private commercial banks in Ethiopia even at 10%. Therefore, we rejected the null hypothesis. This finding is inconsistent with Effendi et al. (2017), Muhamad Yusuf et al. (2021), and Ngo et al. (2021) who concluded that bank size has positive effects on credit risk in lending activities of joint-stock commercial banks in Vietnam and with Gulati et al. (2019) who concluded that the large size of banks increases the probability of default in India. Similarly, Duong & Huong (2017), Raiter (2021), and Zheng et al. (2018) found that bank size is inversely associated with bank credit risk.

4.6.1.5. Loan Growth and Credit Risk

This study found that there is a negative and significant relationship between loan growth and credit risk. This is consistent with the findings of Barra & Ruggiero (2023) who concluded that volume of credit is the main bank-specific factors affecting non-performing loans. Therefore, this finding disclosed that loan growth has negative and statistically significant (p -value=0.0009) relationship with credit risk of commercial banks in Ethiopia. The coefficient value of the variable (i.e. -0.010189) indicated a percentage rise/decline in loan growth of banks resulted in (i.e. 1.0189%) decline/rise in credit risk of commercial banks in Ethiopia. Generally, we fail to reject the null hypothesis (i.e. there is significant and negative relationship between loan growth and credit risk of commercial banks in Ethiopia).

4.6.2. Macroeconomic Variables

The researcher used three macroeconomic variables proxied with lending rate, inflation, and GDP in the regression model.

4.6.2.1. Lending Interest Rate and Credit risk

This study found that there is negative and significant relationship between lending interest rate and credit risk. This is consistent with the findings of Calderon-Contreras et al. (2022) examined the determinants of credit risk in Peruvian municipal savings banks and concluded that interest rate has a direct, positive, and significant influence on credit risk. Hang (2019) analyzed the factors affecting the credit risk of commercial banks in Vietnam using panel data and found a negative correlation between credit risk and real interest rate. However, Raiter (2021) and Abusharbeh (2022) show that that interest has a positive impact on nonperforming loans (NPLs), while Duong

& Huong (2017) and Priyadi et al. (2021) concluded that interest rate does not have an influence on NPF.

Therefore, this finding disclosed that lending interest rate has negative relationship with credit risk of commercial banks in Ethiopia. The coefficient value of the variable (i.e. -0.133077) indicated a percentage rise/decline in lending interest rate of banks resulted in (i.e. 13.3%) decline / rise in credit risk of commercial banks in Ethiopia. Generally, we fail to reject the null hypothesis (i.e. there is a negative and significant relationship between lending interest rate and credit risk of commercial banks in Ethiopia).

4.6.2.2. Inflation Rate and Credit Risk

The regression output in Table 4.7 reveals that there is a positive and significant relationship between inflation rate and credit risk. Therefore, this finding disclosed that inflation rate has a positive and significant relationship with credit risk of commercial banks in Ethiopia. The coefficient value of the variable (i.e. 0.153075) indicated a percentage rise/decline in inflation rate resulted in (i.e. 15.31 %) rise/decline in credit risk of commercial banks in Ethiopia. Therefore, we conclude that inflation had statistically significant effect on credit risk but positively. This finding is in line with Effendi et al. (2017), Raiter (2021), and Ngo et al. (2021) who revealed that inflation has a significant and positive effect on credit risk. This finding is however inconsistent with Priyadi et al. (2021) who revealed that inflation has a negative influence on NPF. Kharabsheh (2019) showed no significant impact of GDP growth.

4.6.2.3. Real GDP Growth Rate and Credit Risk

The coefficient sign of real GDP growth rate shows negative impact of real GDP growth rate on banks' credit risk. A strong economic condition creates more demand for goods and services which lead to more investment in different sectors hence increase the per capita income as well as the savings, collectively these factors convince to banks to issue more loans and advances (kashif and mohammed 2008). The regression output in Table 4.7 reveals that there is a negative and significant relationship between real GDP growth rate and credit risk of commercial banks in Ethiopia. The coefficient value of the variable (i.e. -0.034720) indicated a percentage rise/decline in real GDP growth rate resulted in (i.e. 3.47%) decline/rise in the credit risk of commercial banks in Ethiopia. This finding is consistent with what was found by Ngo et al. (2021), Jović (2017), Raiter (2021), and Calderon-Contreras et al. (2022) who reported that the economic growth has a

negative and statistically significant impact on the banks' credit risk. However, Effendi et al. (2017) found that GDP has significant positive effect on credit risk; while Kharabsheh (2019) and Priyadi et al. (2021) revealed that economic growth does not have an influence on NPF.

Finally, the adjusted explanatory power was 64.55%, which is considered high reflecting that the bank specific and macroeconomic variables jointly explain about two-third of the change in the credit risk of private commercial banks in Ethiopia. Durbin-Watson statistics (1.973299) show that the dependent variable does not suffer from the problem of the serial link. Moreover, the F-statistic (22.16342) shows that the study model is appropriate.

CHAPTER FIVE: COCNLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter is a synthesis of the entire thesis and contains a summary of findings, discussion of the findings, conclusions arrived at and recommendations. The conclusions and recommendations focused on addressing how bank specific and macroeconomic factors affect private commercial bank's credit risk.

5.2. Conclusions

The study examined the effect of bank specific and macroeconomic factors on private commercial banks' credit risk in Ethiopia from 2010-2022. Return on equity (ROE), capital adequacy ratio (CAR), liquidity, bank size, and loan growth were bank specific variables included in the study. Gross domestic product growth rate, inflation, and lending rate were the macroeconomic variables considered in the study. The panel data was used for the sample of twelve private commercial banks in Ethiopia from 2010 to 2022. Data was presented by using descriptive statistics. The balanced correlation and regression analysis for credit risk was conducted. Before performing OLS regression the model was tested for the classical linear regression model assumptions. The model fulfills all the assumptions of the CLRM. Random effect model/REM was used based on convenience.

The study findings showed that there was a highly significant relationship between private commercial banks' credit risk and capital adequacy ratio, real GDP growth rate, lending interest rate, inflation, and loan growth. The results also indicated that an increase in inflation cause credit risk to increase while a decrease in lending interest rate, GDP, capital adequacy ratio, and loan growth cause credit risk to increase. The study also showed insignificant relationship between liquidity, return on equity, and bank size and credit risk of private commercial banks in Ethiopia.

The study also established that there is a correlation between the macroeconomic variables and bank specific variable and commercial banks' credit risk with inflation having the highest value and loan growth having the lowest correlation value. Based on the results and findings, the study concludes that private commercial banks' credit risk is indeed influenced by bank specific and macroeconomic variables.

5.3. Recommendations

Based on the findings of the study, the following suggestions were recommended:

- The study disclosed that capital adequacy ratio had a negative and significant effect on credit risk of commercial banks. The Capital Adequacy Ratio (CAR) plays a pivotal role in regulating a bank's credit risk and overall financial stability. However, an overly high capital adequacy ratio can potentially yield negative effects on a bank's credit risk. Therefore, commercial banks should implement a risk-adjusted capital allocation strategy. This entails tailoring the allocation of capital based on the specific and varying levels of risk within the bank's lending portfolio. By aligning the allocation of capital with the inherent risk of assets, banks can optimize their CAR to support credit growth without compromising financial stability. They should also regularly assess and reassess the capital adequacy framework to ensure that it strikes an optimal balance between prudential capital buffers and credit expansion. By actively monitoring the impact of CAR on credit risk, banks can adapt their risk models and capital strategies to align with evolving economic environments.
- The regression result also revealed that GDP had a negative and significant effect on credit risk. Fluctuations in GDP can have a substantial impact on a bank's credit risk, particularly during economic downturns. Therefore, banks should adopt a macro-prudential risk analysis approach to assess the wider economic backdrop in which the bank operates. By closely monitoring GDP trends and broader economic indicators, banks can preemptively identify potential shifts in credit quality and risk profiles, enabling proactive risk management measures. They should also emphasize diversification in loan portfolios across different industry sectors and customer segments to reduce the concentration of credit risk associated with specific industries or economic sectors, thereby insulating the bank from a disproportionate impact of GDP fluctuations on credit quality.
- The lending interest rate negatively and significantly impacts a bank's credit risk, as it influences borrower behavior and payment performance. Therefore, banks should leverage advanced credit scoring techniques that account for varying interest rate scenarios. Implement robust credit scoring models that dynamically consider interest rate changes to assess borrower creditworthiness and potential risks associated with fluctuating interest

rates. They should also utilize interest rate hedging strategies and risk mitigation mechanisms to counteract the negative effects of interest rate volatility on credit risk. Hedging instruments and risk management tools can help hedge against the adverse impact of interest rate fluctuations on loan portfolios.

- The study result also established that loan growth had a negative and statistically significant effect on credit risk. The growth in loan portfolios can present systemic challenges to a bank's credit risk if not managed effectively. To mitigate the negative effects of rapid loan growth, banks should implement rigorous credit risk analysis to assess the quality of the growing loan portfolio. Regularly monitor the composition of loans, borrower creditworthiness, and loan-to-value ratios to proactively identify potential vulnerabilities and manage risks associated with rapid loan portfolio expansion. They should also emphasize the diversification of loan exposures across diverse industries, customer segments, and geographic regions. Diversification reduces the concentration of credit risk, mitigating the negative impact of extensive loan growth on the bank's overall credit risk profile.
- Finally, the study found that inflation had positive effect on banks credit risk. While inflation may generally be associated with potential negative effects on credit risk, it can also present certain opportunities for banks to effectively manage credit risk. Therefore, during inflationary periods, banks should reevaluate their loan portfolios to assess potential positive impacts on asset quality. Inflation can lead to the appreciation of certain asset classes, potentially reducing credit risk associated with these assets. They should also conduct comprehensive sectoral analysis to identify industries that are well-positioned to benefit from inflation. Banks can leverage this understanding to make more informed lending decisions, selecting sectors that are less vulnerable to inflationary pressures, thus reducing credit risk exposure.

5.4. Further Research

This study did include five bank specific variables (return on equity, capital adequacy ratio, liquidity, size, and loan growth) and three macroeconomic variables (GDP, Inflation, and Lending rate) to examine their influence on private commercial banks' credit risk. The study excluded state-owned banks. Therefore, this study recommends that another study should be done to augment the

findings in this study; it therefore recommends that future research should be directed towards validating the results of this study by conducting a similar research on the factors affecting the credit risk of micro-finance institutions in Ethiopia. Further, the study recommends further study to be conducted to compare the effect of these variables on private banks and state-owned banks.

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Annex

Appendix –1: Tests for the Heteroskedasticity Test: ARCH

Heteroskedasticity Test: ARCH

F-statistic	2.301413	Prob. F(1,146)	0.1128
Obs*R-squared	2.421522	Prob. Chi-Square(1)	0.1276

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 12/11/23 Time: 18:54

Sample (adjusted): 2 156

Included observations: 148 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.123758	1.562852	2.638610	0.0098
RESID^2(-1)	0.049321	0.105957	0.457973	0.6532

R-squared	0.024661	Mean dependent var	4.339842
Adjusted R-squared	0.014656	S.D. dependent var	13.12353
S.E. of regression	13.19883	Akaike info criterion	8.165838
Sum squared resid	17941.42	Schwarz criterion	8.221052
Log likelihood	68.32461	Hannan-Quinn criter.	8.187622
F-statistic	2.304243	Durbin-Watson stat	1.995748
Prob(F-statistic)	0.362915		

Appendix -2 Breusch-Godfrey Serial Correlation LM Test:

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.578421	Prob. F(1,143)	0.0923
Obs*R-squared	6.630802	Prob. Chi-Square(1)	0.0741

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 12/11/23 Time: 18:55

Sample: 1 156

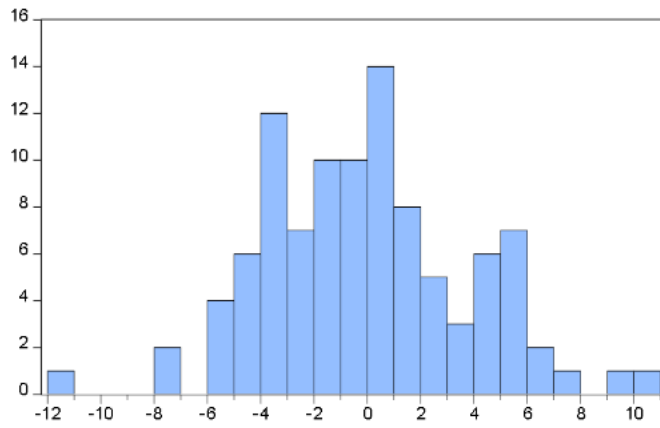
Included observations: 155

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.739636	2.671906	0.151520	0.3343
ROE	0.001152	0.000792	-1.454880	0.1498
CAR	-0.091846	0.234166	-0.391223	0.5645
Lending Rate	0.000863	0.053421	0.015432	0.2916
Liquidity	2.646691	1.568520	1.687382	0.0926
GDP	0.548566	0.424886	1.291089	0.2015
INF	2.716183	1.521925	1.473550	0.1367
SIZE	-0.007321	0.045613	-0.162345	0.1712
Loan Growth	0.060123	0.074321	0.013484	0.1832
RESID(-1)	0.243899	0.151924	2.220815	0.0385

R-squared	0.045725	Mean dependent var	-3.92E-15
Adjusted R-squared	-0.028634	S.D. dependent var	0.455450
S.E. of regression	0.461925	Akaike info criterion	1.372826
Sum squared resid	16.42984	Schwarz criterion	1.575394
Log likelihood	-50.65870	Hannan-Quinn criter.	1.454257
F-statistic	0.614922	Durbin-Watson stat	1.754537
Prob(F-statistic)	0.717694		

Appendix -3 Normality Test



Series: Standardized Residuals
Sample 2010 2022
Observations 156

Mean	1.892001
Median	1.624989
Maximum	8.830813
Minimum	0.057650
Std. Dev.	1.337172
Skewness	0.195267
Kurtosis	3.215705
Jarque-Bera	0.829355
Probability	0.660553

Appendix – 4: Tests for Model Selection (Random Effect versus Fixed Effect Models):

Hausman specification test

Correlated Random Effects - Hausman Test

Equation: Untitled

Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	2.862232	8	0.7507

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
ROE	-0.052616	-0.065676	0.000780	0.6401
CAR	0.018884	0.047285	0.000480	0.1951
Lending Rate	0.800281	0.883077	0.003063	0.1347
Liquidity	-0.136643	-0.157864	0.000411	0.2949
GDP	-0.041029	-0.044720	0.000133	0.7486

Period random effects test equation:

Dependent Variable: Credit Risk

Method: Panel Least Squares

Date: 12/11/23 Time: 19:31

Sample: 2010 2022

Periods included: 13

Cross-sections included: 12

Total panel (balanced) observations: 156

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.648037	2.348005	1.553675	0.1243
ROE	-0.052616	0.109885	-0.478834	0.6334
CAR	0.018884	0.029272	0.645132	0.5207
Lending Rate	0.800281	0.100901	7.931327	0.0000
Liquidity	-0.136643	0.059453	-2.298338	0.0242
GDP	-0.041029	0.024938	-1.645247	0.1039
Inflation	0.491104	0.710740	0.690976	0.4916
Size	0.037503	0.125806	0.298101	0.7664
Loan Growth	0.109179	0.095456	1.143761	0.2582

Effects Specification

Period fixed (dummy variables)

R-squared	0.722863	Mean dependent var	4.276492
Adjusted R-squared	0.641875	S.D. dependent var	3.324175
S.E. of regression	2.128573	Akaike info criterion	4.194439
Sum squared resid	267.3898	Schwarz criterion	5.127340
Log likelihood	-199.9386	Hannan-Quinn criter.	4.569300
F-statistic	12.19670	Durbin-Watson stat	1.667258
Prob(F-statistic)	0.000000		

Appendix – 5: Regression Results

Dependent Variable: CREDITRISK
 Method: Panel EGLS (Cross-section random effects)
 Date: 12/11/23 Time: 16:28
 Sample: 2010 2022
 Periods included: 13
 Cross-sections included: 12
 Total panel (unbalanced) observations: 155
 Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROE	-0.065676	0.106275	-0.617980	0.1382
CAR	-0.121009	0.049612	-2.439096	0.0159
Lending Rate	-0.133077	0.084367	-9.46713	0.0000
Liquidity	0.008311	0.009173	0.906000	0.3664
GDP	-0.034720	0.022119	-2.021767	0.0363
Inflation	0.153075	0.238909	1.059293	0.0424
Size	0.114677	0.097618	1.174751	0.2420
Loan Growth	-0.010189	0.002998	-3.398495	0.0009
C	-1.676830	2.695384	-0.622112	0.5355

Effects Specification		S.D.	Rho
Period random		0.000000	0.0000
Idiosyncratic random		2.335532	1.0000

Weighted Statistics			
R-squared	0.712935	Mean dependent var	4.476492
Adjusted R-squared	0.645500	S.D. dependent var	3.324175
S.E. of regression	2.188054	Sum squared resid	411.7317
F-statistic	22.16342	Durbin-Watson stat	1.973299
Prob(F-statistic)	0.000000		

Appendix 6: List of Private Commercial Banks in Ethiopia

No.	Bank Name	Year of Establishment
1	Nib Bank S.C	1999
2	Abay Bank S.C	2010
3	Addis International Bank S.C	2011
4	Awash Bank S.C	1994
5	Bank of Abyssinia S.C	1996
6	Berhan Bank S.C	2010
7	Bunna Bank S.C	2009
8	Cooperative Bank of Oromia S.C	2005
9	Dashen Bank S.C	1995
10	Debub Global Bank S.C	2012
11	Enat Bank S.C	2013
12	Lion International Bank S.C	2006
13	Oromia International Bank S.C	2008
14	Hibret Bank S.C	1998
15	Wegagen Bank S.C	1997
16	Zemen Bank S.C	2009
17	ZamZam Bank S.C	2021
18	Hijra Bank S.C	2021
19	Siinqee Bank S.C	2021
20	Shabelle Bank S.C	2021
21	Amhara Bank S.C	2021
22	Ahadu Bank S.C	2022
23	Goh Betch Bank SC	2021
24	Tsedey Bank S.C	2022
25	Tsehay Bank S.C	2022
26	Gadaa Bank SC	2023
27	Omo Bank S.C	2023
28	Siket Bank S.C	2022
29	Rammis Bank S.C	2022
30	Sidama Bank S.C	2022