DETERMINANTS OF CREDIT RISK MANAGMENT OF COMMERCIAL BANKS IN ETHIOPIA

The Research Paper Submitted to Department of Accounting and Finance for The Partial Fulfillment of the Requirement for (BA) Degree in Accounting and Finance.

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Statement of Declaration

I Adane Assefa, have carried out independently a research work entitled *" **determinants of credit risk management: in cases of commercial banks of Ethiopia** "* in partial fulfillment of the requirement of BA Degree in Accounting and Finance with the guidance and support of the research advisor. I do hereby declare that this research paper is my original work and that it has not been submitted by any other person for an award of degree in this or any other university/institution.

Submitted by:

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Approved By:

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Approval Sheet

This is to certify that the paper prepared by Adane Assefa, entitled: ***determinants of credit risk management: in cases of commercial banks of Ethiopia*** and submitted in partial fulfillment of the requirements for the Bachelor degree in Accounting and Finance complies with the regulations of the University and meets the accepted standards with respect to originality and quality. Approved by:

Advisor: Mr. Demelash (MSc) Signature_____ Date _____

Examiner: Signature _____ Date_____

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Abstract

This study empirically examines determinants of credit risk of commercial banks in Ethiopia and interprets the result by relating with theories, related empirical reviews and the regulation. the study used balanced panel model in examine the regression model and collected the secondary data from purposively selected 10 commercial banks out of 17 commercial banks currently operating in Ethiopia covering the 10-year period 2009 to 2018 and National Bank of Ethiopia annual. Accordingly, model selection was done by Hausman test to determine the most suitable model to be used in this study and the result showed that Random Effect Model become appropriate. The study used one dependent variable credit risk (CR), five independent variables that are inflation (INF), GDP, capital adequacy(CAR), Bank size(BS), loan to deposit ratio (LTD) and profitability (ROA). The result of the study showed that, inflation and profitability has a negative and in significant influence on the credit risk. GDP, capital adequacy, Bank size, loan to deposit ratio (LTD shows positive and significant relationship with credit risk of commercial banks in Ethiopia. The study recommends that commercial banks managers employ a more flexible approach to dealing with the macroeconomic factors: such as with inflation, an increase in the loan loss provision was recommended when there was low inflation and a decrease in loan loss provision in cases of high inflation rate. The empirical result showed that the lagged nonperforming assets (credit risk) had a strong and statistically significant positive influence on the current non-performing assets (credit risk). The study reveals that both macroeconomic, and bank specific factors play crucial role in determining the credit risk of the commercial banking sector in Ethiopia.

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List of Abbreviations and Acronyms Used

AIB Awash Bank S.C

BCBS Basel Committee on Banking Supervision

BOA Bank of Abyssinia S.C

BS Bank size

CAR Capital adequacy ratio

CBE Commercial Bank of EthiopiaIX

CBO Cooperative Bank of Oromia S.C

CRM Credit Risk Management

CRM Credit risk management

DB Dashen Bank S.C.

GDP Growth domestic product

INF Inflation rate

LAG Loan to advance growth

LIB Lion International Bank S.C

NBE National Bank of Ethiopia

NIB Nib International Bank S.C

ROA Return on Asset

UB United Bank S.C

WB Wegagen Bank S.C

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

Credit risk management in a financial institution starts with the establishment of sound lending principles and an efficient framework for managing the risk. Policies, industry specific standards and guidelines, together with risk concentration limits are designed under the supervision of risk management committee (Giesecke, 2004). These policies, standards and procedures also govern how credit risk is measured, monitored, reported and controlled. As market conditions change rapidly, adequacy and effectiveness of internal controls should be reviewed at least quarterly (Machiraju, 2003).

The diversity of the business and economic conditions has led to the development of highly sophisticated tools and models to measure the exposure of a financial institutions credit risk. In case of an individual loan portfolio, the probability of default, loss given default or credit rationing are the most commonly used ones to measure the exposure to credit risk. The invention of various credit scoring models that use observed loan applicant's characteristics either to calculate a score representing the applicant's probability of default or to sort borrowers into different risk classes bring the ability to address credit risk on a new level (Richard, 2011).

Credit risk is an investors risk of loss arising from a borrower who does not make payments as promised. Such an event called a default. Another term for credit risk is default risk (Brown and Moles, 2012). Investor losses include lost principal and interest, decreased cash flow, and increased collection costs, which arise in a number of circumstances: consumer does not make a payment due on a mortgage loan, credit card, line of credit, or other loan, a business does not

make a payment due on a mortgage, credit card, line of credit, or other loan, a business or consumer does not pay a trade invoice when due, a business does not pay an employees earned wages when due, a business or government bond issuer does not make a payment on a coupon or principal payment when due, an insolvent insurance company does not pay a policy obligation, an insolvent bank won't return funds to a depositor, and a government grant bankruptcy protection to an insolvent consumer or business.

Adequately managing credit risk in financial institutions (FIs) is critical for the survival and growth of the FIs. In the case of banks, the issue of credit is of even of greater concern because of the higher levels of perceived risks resulting from some of the characteristics of clients and business conditions that they find themselves in. They also provide loans, credit and payment services such as checking accounts, money orders and cashier's checks. Banks also may offer investment and insurance products and a wide whole range of other financial services, which they were once prohibited from selling (Perro, &Ruoff, 2001).

Credit risk management is a structured approach to managing uncertainties through risk assessment, developing strategies to manage it and mitigation of risk using managerial resources. The strategies include transferring to another party, avoiding the risk, reducing the negative effects of the risk, and accepting some or all of the consequences of a particular risk. The objective of risk management is to reduce the effects of different kinds of risks related to a pre-selected domain to the level accepted by society. It may refer to numerous types of threats caused by environment, technology, humans, organizations and politics. The purpose of this study is to understand the determinants of credit risk management of commercial banks in Ethiopia.

1.2 Statement of the problem

Issues of credit risk gained increasing attention in the world. Poor credit risk management was contributing to banks failure. It is critical issue for every bank to manage credit. Many countries are suffering from non-performing loan in which banks are unable to get profit out of loans. An increased exposure to credit risk reduces bank profitability (Kayode, Obamuyi, Owoputi, Ademola Adeyef, 2015). Increasing amount of non-performing loans in the credit portfolio is unfavorable to banks in achieving their objectives. Non-performing loan is the percentage of loan values that are not serviced for three months and above (Ahmad and Ariff, 2007).

Poor risk management lead to the accumulation of non-performing loan under which the generated profit is note eroded through loan provision but also soundness, safety and stability of bank While Effective Credit risk management improve Credit performance through establishing appropriate Credit risk environment, maintaining Credit limit at acceptable level, undertaking sound Credit granting process, proper monitoring and controlling credit risk as well as optimizing risk-return of the bank. Therefore, it is important to examine Credit risk management system and practice of Ethiopian Commercial banks to initiate top-level management and regulatory bodies to take policy measure toward maintaining adverse effect of Credit function (Richard, 2011).

Based on the above idea, this study was attempt to examine the determinant of credit risk management of commercial banks in Ethiopia. This is because as indicated above, several scholars and the survey result of National Bank of Ethiopia (NBE) in (2010), such as, even though commercial banking system in Ethiopia has been witnessing a significant expansion over the past ten years than before however banking industry still Underdeveloped: in this regards the

study were reveal lack of credit risk management practice were one of the major challenging factor of the sector. The survey believes that such growth should be matched with strong credit risk management practices. Accordingly, this research believes that to tackle credit risk management practice of commercial banks an academic study should focus on the area.

Hence, as far as the researcher knowledge, from the importance of sector for the development of the country, little studies were done to examine determents of credit risk of commercial banks in Ethiopia by Tilahun & Rafisa (2014) investigated only bank specific determinants of credit risk management in Ethiopian commercial banks during the period 2007 to 2011, such credit growth, bank size, operating inefficiency, ownership, profitability, capital adequacy, and bank liquidity. The regression results revealed that credit growth and bank size have negative and statistically significant impact on credit risk. Whereas, operating inefficiency and ownership have positive and statistically significant impact on credit risk. Finally, the results indicate that profitability, capital adequacy and bank liquidity have negative but statistically insignificant relationship with credit risk.

Tsegaye & Nigatu (2016), investigate only the macroeconomic and bank specific factors in Ethiopia commercial banks during the period 2003 to 2009 such as leverage, operating inefficiency, loan growth, ownership, loan to deposit ratio, GDP, Inflation and market interest Rate The study showed that leverage, operating inefficiency, loan growth, ownership and loan to deposit ratio are significant determinants of credit risk of Ethiopian commercial banks in the test period. The empirical finding of the study also showed an existence of a clear difference on credit risk level between government and private owned commercial banks.

Recently there are attempts being made to see the determinant of credit risk on the commercial banks in Ethiopia, as there are high loan provision expenses though declining, which is above the standard. According to the study conducted by Tsegaye & Nigatu (2016) on determinates of

credit risk of commercial banks in Ethiopia, the credit risk level of Ethiopia was 7.08%, which is very high relative to the international standard 2% risk level of commercial banks. This indicates that still it needs further investigation on the factors of credit risk of commercial banks in Ethiopia

Thus, due to the severity of credit risk problem and absence of empirical studies in Ethiopia commercial banks relating to this topic incorporating crucial microeconomic factors, collectively what motivate the researcher to examine determinants of credit risk management 0f commercial banks in Ethiopia by considering both the macroeconomic, and bank specific determinants.

1.3 Objective of the study

1.3.1 General Objective

The general objective of this research is to examine determinants of credit risk management of commercial banks in Ethiopia.

1.3.2 Specific Objectives

In order to achieve the general objective stated above, the specific objective of the research is to examine the determinants of credit risk of the bank.

1. To identify the effect of GDP growth rate on credit risk management in Commercial Banks in Ethiopia.
2. To examine the effect of capital adequacy on credit risk management of Commercial banks in Ethiopia.
3. To discover the effect of bank size on credit risk management of commercial banks in Ethiopia.

4. To identify the effect of loan to deposit ratio on credit risk management of commercial banks in Ethiopia.
5. To examine the effect of profitability on credit risk management of commercial banks in Ethiopia.
6. To investigate the effect of inflation rate on credit risk management of commercial banks in Ethiopia.

1.4 Research Hypothesis

The purpose of this study was to examine the determinants of credit risk managements of commercial banks in Ethiopia. The empirical studies made around the world demonstrate various outcomes on determinants of credit risk of the financial sectors.

The hypotheses of this study were formulated by referring the existing theories and past empirical studies that have been conducted on the determinants of commercial banks. In this section the researcher developed testable hypotheses to examine the relationship between Macroeconomic, and bank specific determinants of credit risk management of commercial banks in Ethiopia.

The hypotheses of this particular study were intended to grasp the determinants of credit risk management of commercial banks quantitatively through structured review of documents. In line with the broad objective of this study would be the following six hypotheses were formulating.

H1. Return on Asset (ROA) has positive and statically significant effect on credit risk

H2. Capital Adequacy (CAP) has negatively significant effect on the credit risk management on commercial banks in Ethiopia.

H3. There is positive and significant relationship between Bank size and Credit Risk

H4. There is positive and significant relationship between Loan to deposit ratio and Credit Risk

H5. Inflation rate (INF) has positive and significant effect on credit risk

H6.GDP has a positive effect on credit risk

1.5 Significance of the Study

The finding of this study would have an importance for different stakeholders such as National Bank of Ethiopia, Commercial Banks of Ethiopia, and commercial Bank managements and for other researchers in the area.

For example, for National bank of Ethiopia, since the investigation has policy implication, the finding of this study might be used as an input in the future during the preparation of regulatory standards regarding the lending policies and credit risk minimization procedures of commercial banks of Ethiopia. Investors: Investors could be interested in such studies in order to protect their investment.

Management: Administration could be interested in identifying factors of success and failure to take the necessary actions to improve the quality of the loans and decide the right decisions. The study also provides them with understanding of activities that will increase their loan performance by mitigating the risk factors of credit.

Generally, this study was great contribution to the existing knowledge gap in the sector and could give information about the factors that cause credit risk in commercial banks and their impact on financial performance of the company, industries and economic growth of the country as a whole.

1.6 Scope and delimitation of the study

This study delimited in scope of delimited commercial banks, issues that would be discussed as well as panel data. Accordingly, the study limit this study the commercial banks found in Ethiopia namely, Commercial bank Ethiopia Awash international bank, bank of Abyssinia, United bank, Nib Bank, wegagen and Dashen from medium large asset groups of a bank and Lion bank, Cooperative Bank of Oromia and Oromia international bank from small peer groups, based on their total asset. The study also specified in the issue was discussed such as, internal (specific) factors, that could arise from the banks strategies, capacity, competitiveness and macroeconomic factors that can affect the banks activities such as, inflation and GDP. The study was considered penal data from (2009-2018).

1.7. Organization of the paper

This research paper is organized in to five chapters. The first chapter consists of the introduction, statement of the problem, research objective, research hypothesis, significance, and scope of the study. The second chapter deals with review of related literatures. Issues like, conceptual/frameworks of credit risk. The third chapter contained the methodology part. This part of the study offers fundamental assumptions used in the study with special emphasis on research design, research approaches, sampling, and sample size determination, methods of data collection and analysis (empirical model). Chapter four also contain analysis, discussion and results and in the last chapter the conclusions and recommendation was presented as per the empirical findings discuses and analysis

CHAPTER TWO

LITERATURE REVIEW

2.1. Theoretical Literature

2.1.1 Meaning of Credit Risk

Credit risk refers to the probability of loss due to a borrower's failure to make payments on any type of debt. Credit risk management is the practice of mitigating losses by understanding the adequacy of a bank's capital and loan loss reserves at any given time – a process that has long been a challenge for financial institutions.

The global financial crisis – and the credit crunch that followed – put credit risk management into the regulatory spotlight. As a result, regulators began to demand more transparency. They wanted to know that a bank has thorough knowledge of customers and their associated credit risk. And new Basel III regulations will create an even bigger regulatory burden for banks.Altman, Edward I(1997)

2.1.2 Sources of Credit Risk

There are main source of credit risk include, limited institutional capacity, inappropriate credit policies, volatile interest rates, poor management, inappropriate laws, ineffective control processes. Poor loan underwriting, laxity in credit assessment. poor lending practices. poor project supervision, evaluation and management; untimely loan disbursement diversion of funds.

Tekle (2011), in his study discussed the reasons behind the problem of loan recover may vary for different financial institutions as it depends upon the respective nature of loans and summarized some of the causes loan defaults as he retrieved from as improper selection of an enterprise deficient analysis of project viability, inadequacy of collateral security equitable mortgage against loan, unrealistic terms and schedule of repayment, lack of follow-up measure and default due tuner. Calamities.

2.1.3 Components of credit risk in bank:

Santomeros (1997), in their study he forwarded the credit risk in a bank's loan portfolio consists of three components; first, Transaction risk focuses on the volatility in credit quality and earnings resulting from how the bank underwrites individual loan transactions. Second. Intrinsic Risk focuses on the risk inherent in certain lines of business and loans to certain industries. Third credit risk is the aggregation of transaction and intrinsic risk within the portfolio and may result from loans to one borrower or one industry, geographic area, or lines of business. Banks must define acceptable portfolios concentrations for each of these aggregations. Portfolio diversification achieves an important objective.

2.1.4 Credit Risk Exposures in Banks

Baset (1999a) reports that for most banks, loans are the largest and most obvious source of credit Risk; however, throughout the activities of a bank, which include in the banking book as well as the trading book, and both on and of the balance sheet, there are also other sources other source of credit risk. The possible sources of credit risk for most banks are:

2.1.4.1. On-Balance Sheet Exposures

1**. Loans**; Credit risk is the predominant risk in bank loans. Since the default risk is usually present to some degrees in all loans (Saunders and Comet, 2006), the individual loan and loan portfolio management is undoubtedly crucial in banks' credit risk management.

2. **Debt Securities**; besides lending, credit risk also exists in banks' traditional area of debt securities investing. Debt securities are debt instruments in the form of bonds, notes, certificates of deposits, etc. which are issued by governments, quasi-government bodies or large corporations to raise capital.

2.1.4.2. Off-Balance Sheet Exposures

Some of the off-balance sheet credit exposures are: Guarantees and Acceptances: it is an undertaking from the bank which ensures that the liabilities of a debtor will be met, while a banker’s acceptance is an obligation by a bank to pay the face value of a bill of exchange on maturity (Basel 1986). It is mentioned by guarantees and acceptances are obligations to stand behind a third party, they should be treated as direct credit substitutes, whose credit risk is equivalent to that of a loan to the ultimate borrower or to the drawer of the instrument.

2.1.5 General Principles of Sound Credit Risk Management in Banking

Reviewing the general principles of credit risk management can provide a clearer picture on how bank carry out their credit risk management, despite of the specific approaches that may differ among different banking sectors.

2.1.5.1. Establishing an Appropriate Credit Risk Environment

A credit risk strategy should clarify the types of credit the bank is willing to grant and its target markets as well as the required characteristics of its credit portfolio. According to Saunders

(2003). these strategies should reflect the bank's tolerance for risk and the level of profitability the bank expects to achieve for incurring various credit risks. Again, Boating's (2004) study shows that the credit risk strategy of a bank should give recognition to the goals of credit quality and earnings.

2.1.5.2. Operating under a Sound Credit Granting Process

The Basel Committee (2000 2001) asserts that in order to maintain a sound credit portfolio, a bank must have an established formal transaction evaluation and approval process for the granting of credit. These three Cs are:

Character This refers to the borrower's personal characteristics such as honesty, willingness and commitment to pay debt. Borrowers who demonstrate high level of integrity and commitment to repay their debts are considered favorable for credit.

Capacity This also refers to borrower’s ability to contain and service debt judging from the successor otherwise of the venture into which the credit facility is employed. Borrowers who exhibit successful business performance over a reasonable past period are also considered favorable for credit facility.

Capital. This refers to the financial condition of the borrower. Where the borrower has a Reasonable amount of financial assets in excess of his financial liabilities, such a borrower is considered favorable for credit facility.

2.1.6 Credit Risk Management Process

Credit risk management process is a set of outlined activities aimed at managing credit risk. They are risk Identification, measurement, assessment, control and monitor. The first step is to identify the risk involved in the credit process, and then risk is measured by evaluating the consequence

if it is not well managed. After the evaluation phase, the risk is the then assessed to know the impact, the likelihood of occurrence, and possibility for it to be controlled. The control and monitoring phase then comes in. these phase are not distinct like the other three. In the control phase, measures which can be used to avoid, reduce, prevent or eliminate the risk. The monitoring phase is used to make a constant check so that all processes or activities which have been put in place for the risk management process are well implemented for desired results to be gotten and in case of any distortions, corrections are then made.

Credit risk management process should cover the entire credit cycle starting from the origination of the credit in a financial institution's books to the point the credit is extinguished from the books (Bank of Mauritius, 2003).

2.1.7 Credit Risk Measurement

Measuring risk is always a crucial part in risk management process, and as suggested by Fabozzi 2006). Quantifying credit risk can be complicated due to the lack of sufficient historical data, the diversity of involved borrowers and the variety in default causes. In the following, the three categories of methods for bank credit risk measurement; credit rating, credit scoring and credit modeling explained.

2.1.7.1Credit Risk Rating

A credit rating is for assessing the creditworthiness of an individual or corporation to predict the probability of default, which is based on the financial history and current assets and liabilities the subject. As mentioned by the Federal Resere (1998). Credit risk ratings may reflect not only likelihood or severity of loss but also the variability of loss over time. For banks, both the internal credit rating and the external one are involved in their credit risk assessment.

2.1.7.2Credit Scoring Systems

Credit scoring approaches, as stated by Reto (2003), can be found in virtually all types of credit analysis and share the same concept with credit ratings. A credit scoring system determines points each per identified factor, which are combined to predict the loss probability and the recovery rate. According to Aluman and Saunders (1998), there are two types of accounting based Credit-Scoring system in banks-univariate and multivariate.

2.1.8 Tools of Credit Risk Management

Raghavans (2003) the instruments and tools, which credit risk management is carried out through. Exposure Ceiling which linked to Capital Funds say 15% for individual borrower entity, 40%for a group with additional 10% for infrastructure projects undertaken by the group of the Capital Funds of the bank. Review/Renewal is a Multi-Tier Credit Approving Authority, delegation of powers, higher delegated powers for better-rated customers; discriminatory time schedule for review/renewal based on risk rating, etc. are formulated. And Risk Rating Model: Set up comprehensive risk scoring system to Rating migration is to be mapped to estimate the expected loss. Risk based scientific pricing to Link loan pricing to expected loss. High-risk category borrowers are to be priced high.2.1.8.1 Further Performances for Alleviating Credit Risks Banks use a number of techniques to mitigate the credit risks to which they are exposed.

2.2 Determinants of credit risk management

In most of the literatures, there are two way and sometimes three ways of classifying the determinants of bank performance Arifin and salina (2009) cited in (Al-Tamimi, 2010; Aburime, 2005), for instance classified the determinant factors into two: bank specific (internal) and macroeconomic variables. The internal factors are individual bank characteristics which affect

the bank's performance. These factors are basically influenced by the internal decisions of management and board on risk management practices

2.2.1 Dependent Variables

2.2.1 Credit Risk Management

Credit assessment activity is the most important safeguard to ensure the underlying quality of the credit being granted and is considered an essential element of credit risk management. Though the quality of credit availed and its collectability highly depends on the level of prudence exercised on the assessment, evaluation and approval (Wendim agegn, 2012). Credit assessment includes every activity involved in lending including receiving of the application, customer selection and screening, credit analysis and approval process, repayment monitoring, credit information delinqu1ency and portfolio management. Whereas Credit follow-up is an integral part of the loan administration system of the Bank. It is a strong tool to assure the quality of loans and advances (Habtamu, 2015). its measurement is

CR= Provision for Loan Loss/Total loans

2.2.2 Independent Variables

Independent variables are explanatory variables that explain the dependent variables. Independent variables included in this study are indictors of bank specific risk indicators; return on asset, capital adequacy ratio (CAR), natural logarithm of Bank asset ratio (BAS), Loan Growth Ratio (LGR), Economic Gross of the country (GDPR), Inflation Rate (INFR). Majority of these variables are modified and adopted from previously done studies based on the extent of their effect on risk management practice on financial performance; whereas one of these

variable, that is Bank assets size ratio is added from the researcher sown perception for this study.

2.2.3 Bank specific/Internal factors

The internal factors are bank specific variables, which influence the performance of banks. They are termed as micro or bank-specific determinants of performance. The internal determinates originate from bank accounts (financial statements). They are factors that are influence by the banks management decisions and policy objectives. Shareholder and managerial decisions and activities can directly influence these characteristics; hence they also differ from bank to bank (Athanasoglou, 2005 and Fredrick, 2010). In this study such internal factors of performance included capital adequacy ratio (CAP), profitability (ROA), size of bank in terms of logarithm total assets (SIZE), and Loan and advance growth (LA). Accordingly, the study identified both dependent and independent variables. Below the definition of the dependent and independent variables discussed.

2.2.3.1 Profitability

Comptroller's Handbook (1998), states that lending is the principal business activity for most commercial banks. The loan portfolio is typically the largest asset and the predominate source of revenue. As such, it is one of the greatest sources of risk to a bank's safety and soundness. Since loans are illiquid assets, increase in the amount of loans means decrease bank solvency. According to Pilbeam (2005, p. 42), in practice the amount of liquidity held by banks is heavily influenced by loan demand that is the bases for loan growth

$$ROA = \frac{\text{Total profit before tax}}{\text{Total assets}}$$

2.2.3.2 Bank size (BAS)

Total assets of the bank measures bank size. In most of the literature, the total assets of the banks are as a proxy for bank size. However, since total assets collapsed the dependent variable in the model (CRM) it would be appropriate to take natural logarithm before including in the model to be consistent with other ratios. Among the factors identified, bank size identified as significantly affecting the performance of banks. The effect of a banks size on performance not settled in the literature because of this, the expected sign is ambiguous. Increase in size can lead to decreasing or increase profits for banks due to the situation (Ani et.al 2012). Like previous studies, this research also uses log of total asset to measure the size to the private commercial banks. The expected sign was positive and calculated as follows

Bank size = natural logarithm of total asset (BAS)

2.2.3.3 Capital Adequacy Ratio (CAPR)

Capital adequacy refers to the sufficiency of funds available to absorb losses to protect depositors, creditors, etc. in the interest of maintaining financial system stability. As per Basel 16 Committee on Banking Supervision (BCBS 2004) revised framework and NBE requirement (NBE directive no SBB/9/95) capital adequacy is measured by the ratio of regulatory capital to risk-weighted assets and accordingly a minimum of 8% is required. However, the proxy for capital adequacy measurement used in this study was the ratio of total equity to total asset.

$$\text{CAR} = \frac{\text{Total capital}}{\text{Total asset}}$$

2.2.3.4 Loan to deposit ratio

One of the most important roles of banks is to offer loans to borrowers and loans serves as the main source of earnings for commercial banks. In different words, loans are the highest yielding asset on banks' balance sheet. According to Abreu and Mendes (2002) the more the banks offer loans the more they do generate revenue and more profit they make. Therefore, loans should positively affect profitability as the bank is working vigilantly and not taking excessive risk.

$$LTD = \frac{\text{Total deposit}}{\text{Total loan}}$$

2.2.4 Macroeconomic/external factors

External factors are bank macroeconomic variable, which are not related to bank risk management practice observed direct but reflect economic and legal environment that affects the operation and profitability of banks. External determinants of bank profitability are factors that are beyond the control of a bank's management like interest rate policy, GDP, inflation, political instability and policy stability (YesoufImmani 2014). In this study, the study considers the effect of GDP and Inflation on (CRM).

2.2.4.1 Growth rate of Economy (GDP)

Growth rate of Economy (GDP) is among the most commonly used macroeconomic indicators, as it is a measure of total economic activity within an economy. The GDP per capita growth is expecting to have a positive impact on banks' profitability, according to the well-documented literature on the association between economic growth and financial sector performance.

GDP= annual GDP growth rates

2.2.4.2 Inflation Rate (INF)

The effect of inflation on credit risk depends on how inflation affects both salaries and the other operating costs of the bank. The study of Perry (1992) suggests that inflation impacts bank profitability whether it is fully anticipated or not. If the inflation rate is fully anticipated by the bank's management, the bank can adjust interest rates appropriately to increase revenues faster than costs, which should have a positive impact on profitability. However, Ethiopian Private commercial banks can't adjacent interest rate based at individual level, as result the following hypothesis is drawn.

INF = annual inflation rate

2.3 Empirical Literatures review on Determinants of Credit Risk Management

There are many studies that have been conducted so far in determinants of credit risk management of commercial banks in Ethiopia. Their results have shown that, credit risk of commercial banks are determined by internal or external or both factors. Hence, the following section presents the empirical evidence on the determinants of credit risk management of commercial banks in Ethiopia.

Maxwell S. & Agness K. 2016 cited as Aver's (2008) cited by conducted an empirical analysis of credit risk factors affecting Slovenian banking system and Results of the study confirm that unemployment rate, interest rates and stock market index were critical in influencing credit risk. Gadise (2014) cited as Louzis et al. (2010) conduct study to examine the determinants of NPLs in the Greek financial sector using fixed effect model from 2003-2009 periods. The variables included were ROA, ROE, solvency ratio, loan to deposit ratio, inefficiency, credit growth,

lending rate and size, GDP growth rate, unemployment rate and lending rates. The finding reveals that loan to deposit ratio, solvency ratio and credit growth has no significant effect on NPLs. However, ROA and ROE has negative significant effect whereas inflation and lending rate has positive significant effect on NPLs. It justifies that performance and inefficiency measures may serve as proxies of management quality.

Muasya (2013) investigated the relationship between credit risk management practices and loans losses a study on commercial banks in Kenya. Descriptive research design was utilized in this study as it aimed to see if there is a relationship between credit risk management practices and loan portfolio losses in commercial banks in Kenya. However, only thirtysix (36) of the respondent commercial banks completed the questionnaire. The data was then analyzed and the findings presented using tables giving descriptive statistics including frequencies, mean and percentages. It was concluded that credit risk management practices are common among most of the commercial banks in Kenya and that management of these commercial banks appreciated government legislation relating to credit risk management through the introduction of the credit sharing information Act, and that there is a significant negative relationship between credit risk management practices and loans losses in commercial banks in Kenya.

Maxwell S. & Agness K. (2016) conducted analysis of the factors leading to rising credit risk in the Zimbabwe banking sector. The objective of the study was to ascertain the impact of macroeconomic, industry and bank specific factors on rising credit risk in in Zimbabwe. The results revealed that the most significant factors leading to credit risk in the Zimbabwean banking sector were macroeconomic and bank specific factors. The industry factors did not show a significant influence on the rising credit risk.

Kasana & Naveed (2016,) conducted the study to investigate the determinants of credit risk (CR) of commercial banks in Pakistan from a sample of 26 commercial banks covering panel data

period 2007-2013 using OLS regression model by considering macro and bank specific variables that has been used in the study. Macro variable includes GDP growth (GDPGR) and growth in interest rate(IRGR), while the bank specific variable consists capital adequacy ratio(CAR), growth in advances(ADVNGR), operation inefficiency(OPINF), loan to depots ratio(LD), loan loss provision (LLP) and size of the bank. The dependent variable of the study was credit risk (CR) which is measured as the ratio of nonperforming loan to total loan. Panel data model such as, fixed affect model and random affect models were used to conduct detail panel data analysis. The robustness of the results will be statistically checked through Hausman specification test. Messai & Jouini (2013) investigate the non-performing loan in three different countries (Italy, Greece and Spain) used the data of periods from 2004 -2008, because these countries face the financial crises in 2008. The study used both bank specific and macroeconomic variables to find out the NPLs in these countries. The macroeconomic variables were the rate of growth of (GDP), unemployment rate and real interest rate and banks specific were the return on assets, the change in loans and the loan loss reserves to total loans ratio (LLR/TL). The study employed panel data model to investigate the relationship between explanatory and dependent variable. GDP and profitability have completely negative relation with NPLs and have positive relation with unemployment rate, the loan loss reserves to total loans and the real interest rate.

Tilahun & Rafisa (2014) explained the factors that are associated with credit risk with the reference of Ethiopian Banks from period 2007 -2011, used the quantitative approaches in ten commercial banks. This study used the banks specific variables to investigate the credit risk in commercial banks like credit growth, size, ownership, operating efficiency, capital adequacy and liquidity. Housman test was used to select between fixed effect and random effect model and OLS technique was used to check the result, ownership and operating efficiency have positive relation with credit risk profitability, capital adequacy and bank liquidity have negative but statistically insignificant relationship with credit risk

Tsegaye & Nigatu, (2016) conducted the study to investigate the factors that affect credit risk of Ethiopian commercial banks. It covers a time period from 2003 to 2009. Macroeconomic and bank specific credit risk factors were investigated using fixed effect panel data model. The credit risk of the sampled bank was 7.08% for the test period. It was higher than its international limit which is 2%. The study showed that leverage, operating inefficiency, loan growth, ownership and loan to deposit ratio are significant determinants of credit risk of Ethiopian commercial banks in the test period. The empirical finding of the study also showed an existence of a clear difference on credit risk level between government and private owned commercial banks. Particularly government owned banks should devise ways to lower their credit risk since they are found to be riskier than private ones. Generally, in this study bank specific variables have more significant effect than macroeconomic variables. So, bank managers and policy makers should deal with bank specific factors effectively.

2.4. Summary of Review Literature and Literature Gap

The literature review that are discussed so far showed that, banks credit risk is determined by macroeconomic, and bank specific factors. The empirical evidence shows that, favorable macroeconomic conditions, such as sustained economic growth, low unemployment and interest rates, tend to be associated with a better quality of bank loans. The studies in general show that the association between real GDP growth, inflation, real interest rate, unemployment rate, financial sector development, and competition. On the other hand, bank specific factors like, bank size, financial performance, operational efficiency, rapid loan growth, ownership type, income diversification, risk assessment, capital adequacy, loan to deposit ratio and monitoring are found to be having significance on the occurrence of credit risk of commercial banks.

However, most of the literatures that are discussed so far focused on studies that were conducted in counties far away from Ethiopia both in financially and economically structure and developed in their economies (such as Spanish, Greek, Italian, Indian, Chinese, Malaysian, and Indonesia).

Consequently, the Banking sectors in most developing economies like Ethiopia still received inadequate attention in the literature.

In the context of Ethiopia, the related study conducted by Tsegaye & Nigatu, (2016) investigated the Macroeconomic and bank specific credit risk factors that affect credit risk of Ethiopian commercial banks during the period from 2003 to 2009 by ignorance of all industry factors such as financial sector development, competition, government regulation and the likes. Furthermore, Tilahun & Rafisa (2014) and Atakelt & Veni (2015) conducted their studies on determinants of credit risk only by considering bank specific factors that are associated with credit risk with the reference of Ethiopian Banks. Considering the various risk faced by bank, the National Bank of Ethiopia (NBE).

In general, the lack of sufficient research on the determinants of credit risk management in the context of Ethiopia banking sector and the existence of knowledge gap in the area initiate this study. Hence, the purpose of this study is to investigate the determinants of credit risk management in Ethiopian commercial banking sector by utilizing an econometrics model so as to estimate both the macroeconomic, and bank specific determinants of credit Risk management.
This chapter provides so many evidences which identify the major determinants of bank loans particularly Credit risk. In case, some studies are conducted on particular country and the others on panel of countries. Hence many researchers have conducted a lot of study on determinants credit risk due to its significance for the bank's failure. In case, the study starts reviewing empirical related literatures from the study made across countries/them based single countries study and also review of previous studies on Ethiopia.

There are a plenty of variables that affect credit risk of banking sectors. In this study, the study focus on macroeconomic and bank specific determinants of Credit Risk management of commercial banks in Ethiopia Bank specific variables like, capital adequacy, return on asset,

Bank Size, and loan Growth. Macroeconomic variable like GDP, and inflation. The preceding researcher used panel regression model and used both secondary and primary source of data to determine credit risk. To fill these gaps this study was used different variables that are not touched by different preceding researchers, used time series fixed regression model and only secondary data used. The variables that can be address in this study is bank size, loan growth, capital adequacy, return on equity and management efficiency as an explanatory variables of credit risk in commercial bank of Ethiopia.

2.5 Conceptual Framework of the Study

According to (Svinicki, 2010) conceptual framework is defined as an interconnected set of ideas (Theories) about how a particular phenomenon functions or is related to its parts. In this study on The basis of theoretical, empirical literatures, and the hypotheses that developed from the literature part and the regression model of the study, the following conceptual frame work was developed

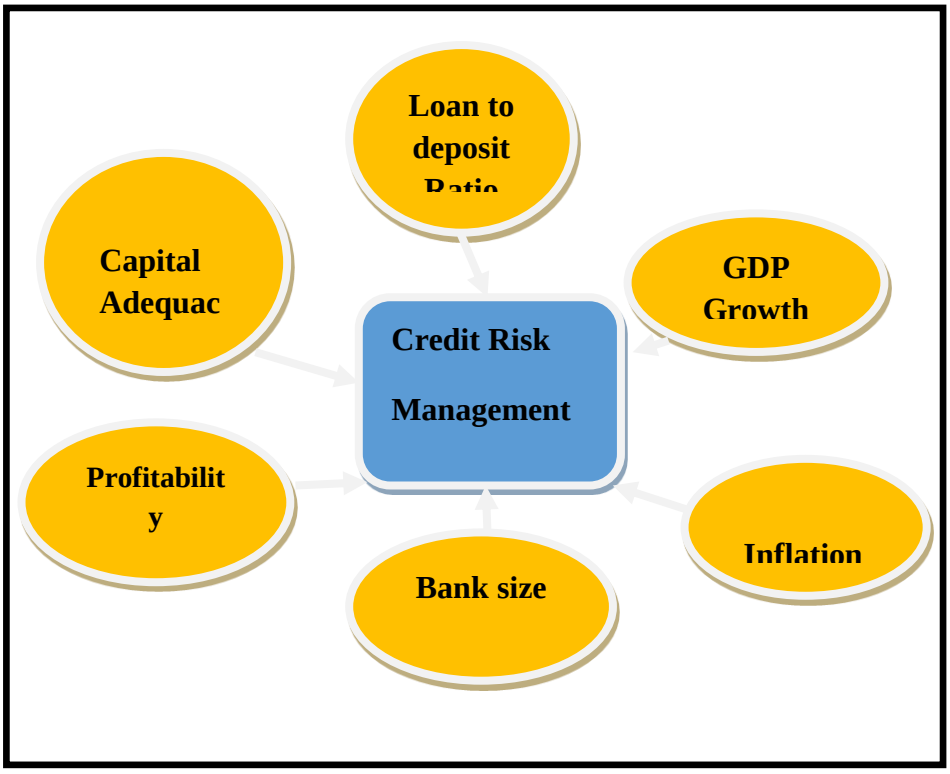


Figure 1. Conceptual Framework of the model of the study

CHAPTER THREE

Research Methodology and Design

3. Introduction

Under this chapter is to provide brief outline of the broad objectives of the study and the underlying principle of research methodology and the choice of the appropriate research method for the study. The chapter is arranged as follow: methodology of the study, research approach, research design, data type and sources, population, data collection, variables specifications and methods of data presentation are list as follows.

3.1 Research Design

Research design is the set of methods and procedures used in collecting and analyzing measures of the variables specified in the problem research. according to Creswell, John W. (2014). There are many type of research design; descriptive, explanatory, correlation, semi-experimental, experimental, review and meta-analytic. This study was used explanatory research design, because exploratory research design is seeking to generate a posteriori hypothesis by examining a data-set and looking for potential relations between variables Creswell, John W. (2014). Based on this credit risk can be affected by several determinant variables of credit areas. Based on this the study designed to describe the collected penal data (2009 - 2018) trend analysis and descriptive methods using percentage ratio as well as cause effect relation also tested using correlation and regression analysis.

3.2 Research Approach

this study was used different ways of approaching the problem. According to Creswell (2009), there are three approaches of research design; quantitative, qualitative and mixed. The following discussions briefly presents the basic features of these research approaches. Quantitative research is a means for testing objective theories by examining the relationship among variables. whereas, qualitative research approach is a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem with intent of developing a theory or pattern inductively). Finally, mixed methods approach is an approach in which the researchers emphasize the research problem and use all approaches available to understand the problem (Creswell, 2009).

3.3 Data Type and Sources

The study was used secondary data type in order to address the objective of the study; secondary data is used because mostly primary data are not objectively measurable. In addition to this, secondary data are easily accessible, relatively inexpensive, and quickly obtainable (Malhotra, 1996). The secondary data will be collected from internal and external sources. The internal sources will be collected from audited annual financial statements of the selected commercial banks and the external sources from National bank of Ethiopia (NBE). for the 10 years' data from 2009 to 2018.

3.4 Study Population

All operational commercial banks in Ethiopia will be taken as this study population. As stated before currently there are 16 operational private commercial banks in Ethiopia. According to NBE annual report (2016), Ethiopia consists of 18 Commercial banks. Commercial Bank of Ethiopia (CBE), Development Bank of Ethiopia(DBE), Dashen Bank S.C (DB), Awash

International Bank S.C (AIB), Wogagen 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 OromiaS.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), Abay Bank(AB),Addis International Bank(ADIB),Debub Global Bank(DGB) and Enat Bank (EB). Since the study analyses more depend on the secondary data obtained from NBE annual Report.

3.5 Sampling Techniques and sample size

From the target population, sample was selected based on purposive Sampling method, which is a non- probability-sampling procedure that ensures to achieve a certain goal that the study wants to address. Sampling design the population of the study was all commercial banks registered by NBE. There are 18 banks operating in the Ethiopian banking sectors. In this study, two criteria are used to determine the study sample. The first criterion is the nature of the bank. In the study, only commercial banks registered by NBE and under operation in the country currently are included. The main reason to include only commercial banks is to ensure that the econometric estimations are robust; it is preferable to work on a homogeneous sample. Availability of data is the second criteria, to this the study consider only banks that have data for the years 2009 to 2018. Therefore, based on the above two criteria only ten banks were included in the study from the total banks operating in the Ethiopian banking sectors. The ten commercial banks included in the study are, Awash International Bank (AIB), Bank of Abyssinia, commercial bank of Ethiopia (CBE), Oromia international bank(OIB), Dashen Bank (DB), Nib International Bank (NIB), United Bank (UB), Wegagen Bank (WB) Cooperative Bank of Oromia (CBO) and Lion International Bank S.C (LIB).

3.6 Methods of Data Analysis

Data analysis section of this study Would be mainly based on computation of financial ratio data's (risk management practice indicators) of the selected commercial banks. Moreover, the researcher compute ratios with the help of Microsoft spread sheet from balance sheet and income statements of commercial banks from 2009-2018 of the selected indicators; then processed through eview8 of. Furthermore, processed data interpreted through descriptive statistical analysis, trend analysis, and correlation and regression analysis. It means that this section provides the descriptive analysis of the panel data and variables for the study in collaboration with some important test such as normality, multicollinarity, parameter stability of data, describes magnitude of risk indicators and performance trend, discusses the correlation analysis between dependent and independent variables, deals the results of the linear regression and data analysis that constitute the main findings of this study.

3.7 Model Specification

The aim of this study was to examine the determinants of credit risk management of commercial banks in Ethiopia. Similar to the most noticeable previous research works conducted on credit risk of financial sectors, this study used credit risk (the ratio of Provision for doubtful loan to total loan) as dependent variables whereas Real Gross Domestic product growth rate (GDP), Inflation(INF), Loan to deposit ratio(LTD), Capital adequacy(CAR)and Return on Asset (ROA) as explanatory variables. These variables are chosen since they are widely existent for the commercial bank in Ethiopia.

According to Brooks (2008), the objective of many econometric model-building exercises is to build a statistically adequate empirical model which satisfies the assumptions of the CLRM. It is very easy to generalize the simple model to one with k repressors (independent variables).

$Yi = \beta 0 + \beta 1 X1i + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots + \beta_k X_{kt} + \varepsilon i,\ i = (1, 2 \ldots t).$

So the variables X_{2t} X_{3t}. . . X_{kt} are a set of k − 1 explanatory variables which are thought to influence y, and the coefficient estimates β0,β1, β2. . . βk are the parameters which quantify the effect of each of these explanatory variables on y.

The model expresses credit risk as a function of a vector of bank level characteristics, industry variables and macroeconomic indicators:

$Yi,t = \alpha i + \Sigma \beta XFj,i,t + \Sigma \delta XIj,i,t + \Sigma \theta XMj,i,t + \varepsilon i,t$

Where $Y_{i,t}$ represents credit risk, measured by the ratio of Provision For Doubtful Debts to total loans of banks referred to in this paper as CR;

X^F represents a vector of bank level characteristics,

X^I represents industry characteristics

X^M represents macroeconomic indicators including inflation volatility; α_i represents bank specific unobserved heterogeneity and $\varepsilon_{i,t}$ is the error term.

The study employs the panel data model summarized as below:

$Yit = \alpha i + \delta t + \beta Xjit + \varepsilon it + \eta it$

Where α represents cross sectional heterogeneous effect which is time invariant, δ time variant effect but cross-sectionally invariant, X_{jit} is a vector of explanatory variables, i represents the number of Banks, j is the number of explanatory variables and t represents time period, measured in years, ε is the unobserved time specific effect and η is the idiosyncratic error term.

Accordingly, to test effect of the determinants on credit risk of commercial banks in Ethiopia, the researcher estimated a linear regression model in the following form.

$$\mathbf{CR_{it} = \beta 0 + \beta_1 (INF)_{it} + \beta_2 (CAR)_{it} + \beta_3 (GDP)_{it} + \beta_4 (LTD)_{it} + \beta_5 (ROA)_{it} + \beta_6 (Bs) + \varepsilon_{it}}$$

Source: developed by researcher mainly based on Garr, (2013) where:

CR= Credit risk

INF= Annual Inflation Rate

CAR = Capital Adequacy Ratio

GDP= Growth Domestic product

LTD= Loan to deposit ratio

ROA= Return on asset

BS= Bank Size

Є =is the error component for company i at time t assumed to have mean zero E [Є it] = 0 β0= Constant

β= 1, 2, 3…6 are parameters to be estimate; i = sample bank i = 1. . . 7; and t = the index of time periods and t = 0. . . 14

3.7.1. Model Selection

C. Brook, (2008) panel data is advised for situation often arises in financial modeling are we have data containing both time series and cross-sectional elements.

Panel regression model was used to examine the impact of the explanatory variables Inflation, Growth domestic product, Capital adequacy, Bank size, loan to deposit ratio and return on asset, on credit risk management of commercial banks in Ethiopia was panel data regression model.

There are broadly two classes of panel estimator approaches that can be employed in financial research: fixed effects models and random effects models.

The appropriate test would be used to decide whether fixed effect or random effect model is appropriate with Housman Specification Test. Thus, Hausman Specification Test identifies whether fixe effects or random-effect model is most appropriate.

The hypothesis for the model selection test was formulate as follow;

H_0: Random effects model is appropriate.

H_1: Fixed effects model is appropriate.

$\alpha = 0.05$

Decision Rule: Reject H_0 if P value is less than significant level 0.05. Otherwise, do not reject H_0

CHAPTER FOUR

DATA ANALAYSIS AND INTERPRTATION

4.INTRODUCTION

In the previous chapter the research design employed in this study is presented and discussed in detail. The purpose of this chapter is to present results and analysis of data involved in this study. Accordingly, the descriptive statistics of all the variables used in this study and the results of hypothesis testing i.e. the estimated parameters of the regression equation, their significance, the connection between the independent variables and dependent variable according to the sign and the value of the parameters for the regression model are presented and discussed in detail.

4.1. Descriptive Statistics

Table 1, below represent a summary of the descriptive statistics of the dependent and independent variables ten commercial banks in Ethiopia from the year 2009 to 20018 with a total of 100 observations. The table shows the mean, minimum, maximum, standard deviation and number of observations for the dependent variable banks' credit risk (CR) and independent variables. Return on asset(ROA),Ioan to deposit ratio (LDR),Capital adequacy(CAR),bank sise(BS),GDP and INF.

Table1 summery of descriptive statics for dependent and independent variable

	CR	CAR	BS	GDP	INF	LTD	ROA
Mean	0.252631	0.182831	4.099657	0.160560	0.325060	0.590859	0.044333
Median	0.254300	0.126282	4.045653	0.147000	0.057500	0.585894	0.033142
Maximum	0.697600	0.821196	8.204571	0.341000	3.085600	0.890000	0.360700
Minimum	0.000000	-0.017884	2.506505	-0.093000	-0.809000	0.411530	-0.019315
Std. Dev.	0.137060	0.214411	0.722238	0.120129	1.055917	0.090105	0.049598
Observation	100	100	100	100	100	100	100

Source: - annual report of sample commercial banks computed using E-views 8

As indicated in the table, credit risk which is measured by the ratio of provision for doubtful loans to total loans of commercial banks of Ethiopia was reached on average 25% of the total loans per year and maximum of 69.7%. This indicates that, from the total loans that commercial banks disbursed, an average of 25% were being default or uncollected over the period of 2009 to 2018. The lowest credit risk ratio that commercial banks experienced over the sample period was 0 % un stable to this study. On the other extreme, the highest provision to doubtful loans ratio of commercial banks was 69% which was in excess of the requirement 5% set by Nation Bank of Ethiopia. According to Ethiopian context, the banking sectors are required to maintain the ratio of NPLs (credit risk rate) at least below 5% (NBE, 2008). But the average value of the ratio of provision for doubtful loans to total loans of the commercial banks also shows that it is above the maximum tolerable rate 5% set by Nation Bank of Ethiopia. The difference between the minimum 0% and the maximum 69% of credit risk indicate the margin that provision for doubtful loans ratio of commercial banks ranged over the sample period. The standard deviation (0.137060) of credit risk also shows

the existence of the difference among commercial banks in Ethiopia in terms their loan recovering capacity from the average. From bank specific independent variables, as stated in the above table, table 1, from the total of observations 100 over the sample period of 2009 to 20018, the Return on Asset which proxy of profitability of the commercial banks in Ethiopia have an average of 0.044333, with a minimum of-0.019315 and a maximum of 0.3607. That means during the period under consideration sampled Ethiopian commercial banks earned an average of 0.0443 cents of profit after tax for a single Birr invested in their assets. The negative sign of Return on Asset indicates the existence of negative net income in commercial banks of Ethiopia due to the different conditions that decreased the bank's profitability during the sample period. The standard deviation of Return on Asset was also indicated that the 0.049598 deviations in profit from the mean in commercial banks in Ethiopia. Another interesting observation was that the loan to deposit ratio of banks which indicated by the range between 0.8900 and 0.4115. The standard deviation shows there is 0.090105 disparity among Ethiopian commercial banks in terms of their loan to deposit ratio. Regarding the independent variables of the model there are some interesting statistics that have to be mentioned. The macroeconomic variable employed in this study the annual inflation rate as measured by (Inflation Rate at time t - Inflation Rate at time t-1) /Inflation Rate at time t-1. In this study inflation showed highest standard deviation (1.055917), which means, it was the most deviated variable from its mean compared to other variables used in this study, which had an average value of 0.325060 with a maximum of 3.085600. and a minimum of -0.809000. This implies that inflation rate in Ethiopia during the study period remains somewhat unstable. On the other hand, the mean of the growth domestic's products of Ethiopian commercial banks was 0.16056 with a standard deviation of 0.12. The standard deviation of ROA was the lowest of all the variables used in this study. This indicates that the ROA of Ethiopian commercial banks was Low stable over the sample period. Regarding

the industry specific variables considered in this study, Capital adequacy ratio(CAR) had a mean of 0.182831 with a maximum value 0.821196 and a minimum of -0. 017884.The standard deviation which was 0.214411.

4.2. Correlation Analysis

Correlation measures the degree of linear association between variables. Values of the correlation coefficient are always ranged between +1 and -1. A correlation coefficient of +1 indicates that the existence of a perfect positive association between the two variables, while a correlation coefficient of -1 indicates perfect negative association. A correlation coefficient of zero, on the other hand, indicates the absence of relationship (association) between two variables (Brooks, 2008). The table below shows the correlation matrix among dependent and independent variables.

Table 2. Correlation analysis of variables

Variables	CR	CAR	BS	GDP	INF	LTD	ROA
CR	1.000000						
CAR	-0.083456	1.000000					
BS	0.825790	-0.337194	1.000000				
GDP	0.012351	-0.016281	-0.163870	1.000000			
INF	-0.155092	-0.001513	-0.100448	-0.087313	1.000000		
LTD	-0.000495	0.284791	-0.165272	-0.029463	-0.114260	1.000000	
ROA	-0.079079	-0.089521	0.086720	-0.195217	-0.149337	0.104305	1.000000

Source: - Annual Report of Sample Commercial Banks Computed Using E-views 8

The correlation result in Table 3 shows Capital adequacy, Loan to Deposit Ratio, inflation and Profitability has negative correlation with credit risk of commercial Banks in Ethiopia. It refers that when Capital adequacy, Loan to Deposit Ratio, and return on Asset increases the credit risk of commercial banks in Ethiopia will be go down. However, Bank size and GDP have positive

relationship with credit risk. If BS and GDP increases similarly the credit risk of commercial banks in Ethiopia increase.

4.3. Regression Model Tests

4.3.1. Model Selection (Random Effect versus Fixed Effect Models)

As explained in chapter three according to (C. Brook, 2008) panel data is advised for situation often arises in financial modeling where we have data containing both time series and cross sectional elements. Econometrics model used to examine the impact the explanatory variables Inflation, Gdp, capital adequacy, Bank size, loan to deposit ratio and return on asset, on credit risk of commercial banks in Ethiopia was panel data regression model.

There are broadly two classes of panel estimator approaches that can be employed in financial research:

A. **fixed effects models and**

B. **random effects models.**

The appropriate test used to decide whether fixed effect or random effect model is appropriate was Hausman Specification Test. Thus, Hausman Specification Test identifies whether fixedeffects or random-effect model is most appropriate.

To conduct a Hausman test the number of cross section should be greater than the number of coefficients to be estimated. Thus, to determine whether the fixed effects or the Random effect model is appropriate for this study the Hausman specification test was recommended by (C.Brooks 2008) and others. The hypothesis for the model selection test was formulated as follow; H_0: Random effects model is appropriate.

H_1: Fixed effects model is appropriate.

$\alpha = 0.05$

Decision Rule: Reject H_0 if P value is less than significant level 0.05. Otherwise, do not reject H_0 As noted by Gujarati (2004) and C.Brook(2008), fixed effect model is most appropriate when null hypothesis is rejected whereas random effect is appropriate when null hypothesis is not rejected.

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	12.938138	6	0.0440

4.3.2 Discussion of Regression Results

This section discusses in detail the analysis of the results for each explanatory variable and their importance in determining NPLs in Ethiopian commercial banks. The model developed for this study was: $CR= \beta o + \beta 1(ROA)_{it} + \beta 2(BS)_{it} + \beta 3(CAR)_{it} + \beta 4(LTD)_{it} + \beta 5(GDP)_{it} + \beta 6(INF)$. The definition of all individual variables included in the above equation is discussed in the methodology part of the study. The regression result for this model is as follow.

Dependent Variable: CR

Method: Panel Least Squares

Date: 01/04/21 Time: 23:35

Sample: 2009 2018

Periods included: 10

Cross-sections included: 10

Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CAR	-1.285061	0.392422	-3.274689	0.0015
C	-0.307172	0.107907	-2.846628	0.0056
BS	0.172401	0.015348	11.23254	0.0000
GDP	0.146098	0.053275	2.742332	0.0075
INF	-0.006682	0.006054	-1.103625	0.2729
LTD	0.143098	0.084516	1.693161	0.0941
ROA	-0.403058	0.149636	-2.693591	0.0085

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.839969	Mean dependent var	0.252631
Adjusted R-squared	0.811392	S.D. dependent var	0.137060
S.E. of regression	0.059524	Akaike info criterion	-2.659231
Sum squared resid	0.297620	Schwarz criterion	-2.242404
Log likelihood	148.9615	Hannan-Quinn criter.	-2.490533

F-statistic	29.39320	Durbin-Watson stat	1.665248
Prob(F-statistic)	0.000000		

Source eveiew 8 2021

The estimation results reported above depicted that, The R-squared and Adjusted R-squared values of 0.839969 and 0.811392 respectively is an indication that the model is a good fit. This means more than 83.9% of variations in CR of Ethiopian commercial banks were explained by independent variables included in the model. However, the remaining 16.1% changes in CR of Ethiopian commercial banks are caused by other factors that are not included in the model. Furthermore, the F-statistic was 29.39 and the probability of not rejecting the null hypothesis that there is no statistically significant relationship existing between the dependent variable (CR) and the independent variables, is Prob(F statistic) 0.000000 indicates that the overall model is highly significant at 1% and that all the independent variables are jointly significant in causing variation in non-performing loans.

4.2.3 Return on Asset (ROA) and Credit risk(CR)

The regression result of fixed effect model in the above table is consistent with the hypothesis developed by the researcher. The study hypothesized that there is a negative association between ROA and CR of banks. The hypothesis, the estimated coefficients and test statistics of ROA was -0.403058 and -2.693591 respectively. This reveals negative and statistically insignificant impact of ROA on the levels of CR and implies that for one unit change in bank profitability measured in terms of ROA, had resulted unit change on the level of CR in the same direction. Unlike the study made by Boudriga *et al*.(2009) and Makri *et al.*(2014) where aggregate country data was used, and Selma and Jouini(2013) where particular country data was used, the results of this

study confirms the finding of Swamy(2012) and, Ahmad and Bashir(2013)where single country data was considered. Thus, results of this study examined negative insignificant effect of bank profitability measured in terms of ROA on the levels of CRs of commercial banks in Ethiopia. The main reason for this negative impact of ROA on the levels of CR salted from bank management's inefficiency on asset utilization and also poor loan quality in the Ethiopia. Thus, the finding implies that commercial banks in Ethiopia are less incentive for return gained from assets and also to provide loans.

4.2.4 Capital Adequacy Ratio (CAR) and Credit risk(CR)

Regarding capital adequacy ratio that determines the risk taking behavior of banks, this study identifies statistically insignificant and negative impact of capital adequacy ratio on CRs Thus, regression result of fixed effect model in the above table is consistent with the hypothesis developed in this study. The study hypothesized that there is negative association between CAR and CR of banks. This negative sign indicates a indirect relationship between capital adequacy ratio and CR Thus, it implies that for one unit change in the bank's capital adequacy ratio, keeping other thing constant had resulted -0.307172 unit changes on the levels of CR in the same direction. The result of this finding is consistent with the study of Hyun and Zhang (2012) where particular country data was used and Makri *et al.* (2014) where aggregate country data was used. Unlike the study made by Boudriga *et al. (*2009), and Djiogap and Ngomsi (2012) where aggregate country data was used and, Shingjerji (2013) and Swamy (2012) where particular country data was used, the result of this finding confirms significant negative effect of CAR on the levels of CR of commercial banks in Ethiopia by supporting the arguments that state well capitalized banks are better able to resist the levels of risk. This implies commercial banks in Ethiopia are less the incentives to take riskier loan activities due to highly regulated nature of the institution in the country. Thus, negative impact of CAR on CR is due to effective regulatory

pressures by NBE on capital adequacy ratio of banks and also bank management's efficient utilization of its capital to absorb CR.

4.2.5 Loan to Deposit ratio (LTD) and Credit risk(CR)

It examines bank liquidity by measuring the fund that a bank has utilized in to loan from collected deposit. The coefficient signs of loan to deposit ratio shows that there is a positive relationship between banks non-performing loans and loan to deposit ratio. Loan to deposit ratio had positive Coefficient value (0.143098) and statistically significant (p-value = 0.0441) at 5% significant level. The result is in line with the research hypothesis which is based on the argument that when banks' lending increase as compared to the deposits the level of CR also increase. Because at the time of low loans to deposits ratio in order to earn more banks start lending even to the low quality borrowers and do not follow the standard loan allocation practices, which leads to the growth in CR. Therefore, the result implies that every one percent change (increase or decrease) in bank's loan to deposit ratio keeping the other thing constant has a resultant change on the Credit risk in the same direction. The result is show there is a positive relationship between loan to deposit ratio and Credit risk. Therefore; - Loan to deposit ratio had positive and statistically significant relationship between banks Credit risk and loan to deposit ratio. On Ethiopian commercial banks.

4.2.6 Growth domestic's products (GDP) and Credit risk(CR)

The coefficient signs of real GDP growth rate show that, economic growth has a positive impact on the growth of CR. Unexpectedly the current econometric analysis suggest that real GDP growth is not the main driver of non-performing loan ratio in Ethiopia banking industry. The result also suggests that GDP growth rate is not the most important determinant factor for Ethiopia commercial banks CR So, (i.e. there is positive and insignificant relationship between GDP and banks Credit risk). Opposite to the current coefficient sign of GDP, Quagliarello

(2007) found that business cycle affects the CR ratio for a large panel of Italian banks over the period 1985 to 2002. Furthermore, Salas and Saurian (2002) estimated a significant negative contemporaneous effect of GDP growth on the CRs ratio and inferred the quick transmission of macroeconomic developments on the ability of economic agents to service their loans. Growth domestic's products (GDP) have a positive and significant relationship between GDP and Bank credit risk). The coefficient signs of real GDP growth rate show that 0.146098 and also the research hypothesis was positive relationship between Growth domestic's products (GDP) and Credit risk in commercial banks of Ethiopia.

4.2.7 Inflation Rate (INF) and Credit risk(CR)

Theories argue that inflation rate and Credit risk have Negative relationship. Since market frictions lead to the rationing of credit, credit rationing becomes more severe as inflation rises. As a result, the financial sector makes fewer loans, resource allocation is less efficient, and intermediary activity diminishes with adverse implications for capital/long term investment. Though the magnitude of the coefficient of correlation between inflation and Credit risk low, the sign is negative (-0.006682); unexpected rise in inflation under cyclical downturns is likely to negatively affect the performance of the banking sector and recovery of loans to private operators and investors. In the extreme case, hyper-inflation may erode banks assets and equity and weaken banks position through the interest rate channel (Piloiu.A et. al.2013). Therefore, even if the finding is insignificant (-0.006682) the result disclosed that inflation rate has negative relationship with Credit risk(CR). So, Inflation rate is not important determinants of CR in Ethiopia commercial banks.

4.2.8 Banks Size (BS) and Credit risk(CR)

The result of this study found that bank size had a positive and statistically significant impact on Credit risk of Ethiopian commercial banks. The regression result of the model indicates that

banks size had positive and statistically significant impact on Credit risk which is the same to the hypothesis of banks size has negative and significant impact on CRs of commercial bank. This positive sign of the coefficient indicates a direct relationship between bank size and Credit risk and the results of the study supports the above "too big to accept theories. The result of the study reveals that, being other variables constant, a one unit change on bank size had resulted in a 0.172401 units change on Credit risk of Ethiopian commercial bank in the same direction. In generally, the result reveals that banks Credit risk decreases with the size of the banks size measured by natural logarithm of total asset in which small sized banks may hold a buffer of liquid asset. Thus, the hypothesis: banks size has positive and significant impact on banks size was accepted. The descriptive statistics for dependent and independent variables are presented below. For both dependent and independent variables value of minimum, maximum, mean and standard deviation are presented. The dependent variable is Credit risk and measured by impaired loan (bad loan) to total loan. The remaining are independent variables such as: profitability, capital adequacy ratio, loan to deposit ratio, bank size, gross domestic product and inflation rate.

I. The errors have zero mean (E(ut) = 0)

Since a constant term is included in the researcher study regression equation, according to C. Brooks (2008) and Gujirati(2004), if a constant term is included in the regression equation, the errors have zero mean assumption will never be violated.

II Test for heteroskedasticity assumption (var(ut) = σ2 <∞)

As indicated by Brooks (2008), this assumption requires that the variance of the errors to be constant. If the errors do not have a constant variance, it is said that the assumption of homoscedasticity has been violated. This violation is termed as heteroscedasticity. In this study test was used to test for

existence of heteroscedasticity across the range of explanatory variables. To test for the presence of heteroscedasticity, the popular Harvey test was employed (Brooks 2008).

The hypotheses used for this test was

H0: The variance of the error is homoscedasticity
H1: The variance of the error is heteroscedasticity
$\alpha = 0.05$

Decision Rule: Reject the null hypothesis (H_0) if p-value is less than significance level.

Otherwise, do not reject H_0.

table 5,Heteroskedasticity Test: Harvey

F-statistic	0.898843	Prob. F(6,93)	0.4993
Obs*R-squared	5.481135	Prob. Chi-Square(6)	0.4837
Scaled explained SS	4.543553	Prob. Chi-Square(6)	0.5035

Source: - annual report of sample commercial Banks in Ethiopia computed using E-views 8
As shown in table 5, all versions of the white test statistic (F-statistic, Obs*R-squared and Scaled explained SS) gave the same conclusion that there was no evidence for the presence of homoscedasticity in this particular study since the p-values for all versions of the test statistic were in Less of 0.05. Accordingly, the null hypothecs that the variance of the errors is constant (homoscedasticity) should be rejected.

III. Test for autocorrelation assumption ($cov(u_i, u_j) = 0$ for $i \neq j$

As mentioned in the previous chapter to empirically analyze the determinants of credit risk in commercial banks in Ethiopia, 100 observations and six explanatory variables excluding intercept term were used in the model.

The study use Durbin-Watson (DW) test for the existence of autocorrelation.

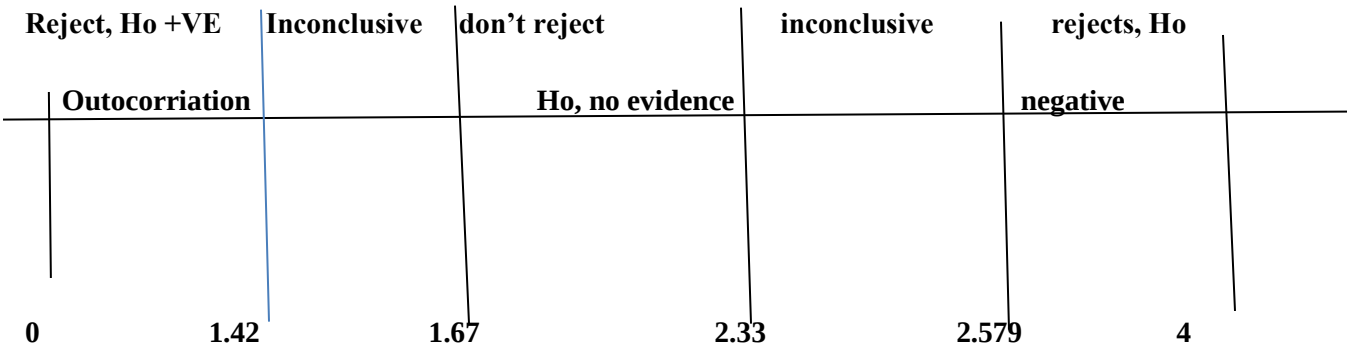
Table 6. Autocorrelation Test: Durbin Watson

Effects Specification			
Cross-section fixed (dummy variables)			
R-squared	0.839969	Mean dependent var	0.252631
Adjusted R-squared	0.811392	S.D. dependent var	0.137060
Sum squared resid	0.297620		
F-statistic	29.39320	Durbin-Watson stat	1.665248
Prob(F-statistic)	0.000000		

Source: - annual report of sample commercial Banks in Ethiopia computed using E-views 8

Accordingly, the relevant critical values for 100 observations and 6 repressors in Durbin-Watson test statistic table have shown an upper critical value (dU) is 1.670 and a lower critical value (dL) of 1.421 which is an intermediate region where the null hypothesis of no autocorrelation can neither be rejected nor not rejected.

Figure 2. Rejection and non-rejection regions for Durbin-Watson Test



According to (Brooks, 2008) the figure shows as Durbin-Watson has 2 critical values: an upper critical value (dU=1.67) and a lower critical value (dL=1.421).

The values of 4 - dU = 4-1.670=2.33 and 4-Dl=4-1421=2.579 According to Durbin-Waston test(DW) in the region between dU and 4-dU no evidence of autocorrelation. According to Brooks (2008) the null hypothesis is rejected and the existence of positive autocorrelation presumed if DW is less than the lower critical value; the null hypothesis is rejected and the existence of negative autocorrelation presumed if DW is greater than 4 minus the lower critical value (dL); the null hypothesis is not rejected and no significant residual autocorrelation is presumed if DW is between the upper(dU) and 4 minus the upper limits. Hence the values of 4 - dU = 4-1.67=2.33.

As shown in table 4.5, the Durbin-Watson test statistic of this study=1.6652 which is between dU=1.670 and 4-dU=2.33 was clearly between the upper limit (1.67) and 4-dU=2.33 and so null hypothesis not rejected. That means no evidence of autocorrelation.

IV. Test of normality (ut ~N(0, σ2)

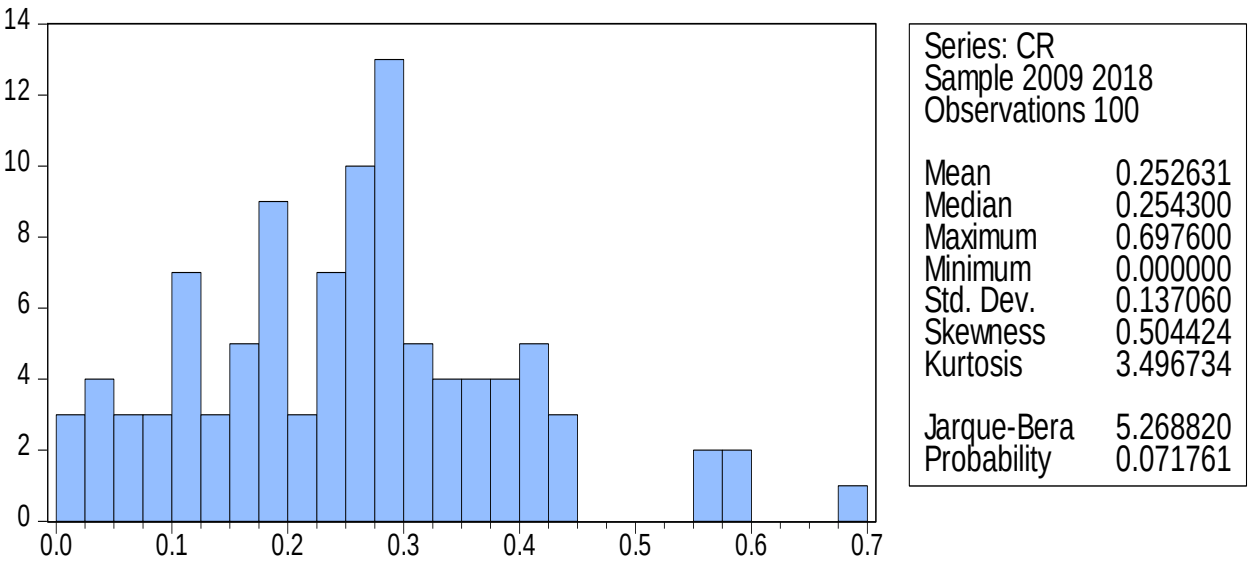
According to (Brooks,2008) One of the most commonly applied tests for normality is the Bera-Jarque test. Bera--Jarque uses the property of a normally distributed random variable that the entire distribution is described by the first two moments the mean and the variance. The standardized third and fourth moments of a distribution are known as its skewness and kurtosis. Skewness measures the extent to which a distribution is not symmetric about its mean value and kurtosis measures how fat the tails of the distribution are. A normal distribution is not skewed and is defined to have a coefficient of kurtosis of 3 and a it will thus have a coefficient of excess kurtosis of zero. That means if the residuals are normally distributed, the graph should be bellshaped and the Bera-Jarque statistic would be significant. This means that Jarque Bera formalizes this by testing the residuals for normality and testing whether the coefficient of skeweness and kurtosis are ≈ 0 and ≈ 3 respectively. According to (Brooks,2008) if the residuals are normally distributed, the Bera--Jarque statistic would not be significant. This means that the p-value given at the bottom of the normality test screen should be bigger than 0.05 to not reject the null of normality at the 5% level.

The hypothesis for the normality test was formulated as:

H_0: Error term is normally distributed

H_1: Error term is not normally distributed $\alpha = 0.05$

Decision Rule: Reject H_0 if p-value of JB tests less than significance level. Otherwise, do not reject Ho.



V. Test for multicollinearity

As explained by Brooks (2008) the term Multicolinearity indicates the existence of exact linear association among some or all explanatory variables in the regression model. In normal scenario, the correlation between explanatory variables will be non-zero, although this will generally be relatively benign in the sense that a small degree of association between explanatory variables will almost always occur but will not cause too much loss of precision. But, a problem occurs when the explanatory variables are very highly correlated with each other, and this problem is known as multicollinearity. It is possible to distinguish between two classes of multicollinearity: perfect multicollinearity and near multicollinearity.

Perfect multicollinearity occurs when there is an exact relationship between two or more variables. In this case, it is not possible to estimate all of the coefficients in the model. Perfect multicollinearity will usually be observed only when the same explanatory variable is inadvertently used twice in a regression. When independent variables are multicollinear there is

overlapping or sharing of predictive power. Thus, if multicolinearity is perfect, the regression coefficients of the independent variables are indeterminate and their standard errors are immeasurable (Gujarati, 2004).

Gadise(2014) cited as (Theodros, 2011) when explanatory variables are highly correlated with one another, they share the same information. Thus, the multicolinearity problem reduces the individual explanatory variables' predictive power. That is none of the predictor variables may contribute uniquely and significantly to the prediction model after the other independent variables is included.

Multicollinearity problems exists when the correlation coefficient among explanatory variables should be greater than 0.75 (Malhotra, 2007). However, Brooks (2008) mentioned that if the correlation coefficient along with the independent variables is 0.8 and above, multicollinearity problems will be existed

According to Gujarati,(2004) "Multicollinearity violates no regression assumptions. Unbiased, consistent estimates will occur, and their standard errors will be correctly estimated. The only effect of multicollinearity is to make it hard to get coefficient estimates with small standard error. But having a small number of observations also has that effect, as does having independent variables with small variances.

Table 8. Correlation Matrix between independent variables

Variables	CR	CAR	BS	GDP	INF	LTD	ROA
CR	1.000000						
CAR	-0.083456	1.000000					
BS	0.825790	-0.337194	1.000000				
GDP	0.012351	-0.016281	-0.163870	1.000000			
INF	-0.155092	-0.001513	-0.100448	-0.087313	1.000000		
LTD	-0.000495	0.284791	-0.165272	-0.029463	-0.114260	1.000000	
ROA	-0.079079	-0.089521	0.086720	-0.195217	-0.149337	0.104305	1.000000

Source: - Annual Report of Sample Commercial Banks Computed Using E-views 8

Table1.4. Summary of actual and expected signs of explanatory variables on the dependent Variables.

Explanatory variables	Hypothesized impact on Credit risk	Actual impacts
Loan to deposit ratio	Positive & Sig	Positive & Sig
Return on asset	Positive & Sig	Negative & Ins.
Capital adequacy ratio	Negative & Sig	Positive & Sig
Banks size	Positive & Sig	Positive & Sig
Gross Domestic Product	Positive & Sig	Positive & Sig
Inflation Rate	Negative & Sig	Negative & Sig

CHAPTER FIVE

5.Conclusion and Recommendation

The previous chapter presented the results and the findings discussion, while this chapter organized in two section: conclusion and recommendations based on the findings of the study.

5.1 Conclusion

Credit risk can affect the ability of banks to play their role in economic development. The fast increase in CR not only increased banks' vulnerability to further shocks but also limited their lending operations with broader repercussions for economic activity. The current study attempted to a certain determinant of CRs. As well as to investigate a Credit risk and verify the effectiveness of common determinants of commercial banks and how they affect the level of Credit risk in Ethiopia commercial banks. Six variables (four bank specific and tow macro-economic determinants/variables) affecting the commercial banks CRs. were chosen and analyzed. The panel data was used for the sample of ten (10) commercial banks in Ethiopia from 2009 to 2018. Data was presented by using descriptive statistics. The balanced correlation and regression analysis for Credit risk was conducted. The model was tested for the multiples linear regression model assumptions. The model fulfills assumptions of the LRM. Fixed effect

model/FEM was used based on convenience. Six factors affecting banks' loan and advance were chosen and analyzed. From the list of possible explanatory variables, only four of them proved to be statistically significant. The results of models enable us to make following conclusions. With respect to the bank specific variables, the study finds that from four bank specific variables two of them (Capital adequacy ratio and loan to deposit ratio) were statistically significant and important factors that affect the level of CRs in Ethiopia commercial banks. From macroeconomic variable the study also find evidence for a significant and positive relationship between GDP and Credit risk. From mentioned variables inflation rate have a very strong impact on CR. Result also shows that the impact of inflation rate on CR is instantaneous. The empirical results, however, reveals that GDP and inflation rate are important determinants of CR they were not an important determinant of CRs in Ethiopia commercial banks. Generally; Based on the above finding it can be concluded that Ethiopian Commercial Banks are showing a good performance on avoiding CR. Credit risk of Ethiopian commercial Banks are highly affected by macroeconomic factors like growth domestic product and inflation rate and also growth domestic product is found to be the most significant Variable which explains the variation of Cr in ECBs. This is because the country's economy is more fluctuated. Loan to deposit, Capital adequacy is found to be a significant variable in explaining the variability of CR in ECBs among the bank specific variables. From the bank specific variables ROA and Bank size are founded to be insignificant in explaining the variation of CRs of ECBs.

5.3 Recommendations

Based on the findings of the study the following possible recommendations were forwarded:

- Ethiopian commercial banks should be considering the performance of the real economy when extending loans.

- The government should be reducing the strains to the general economy in order to facilitate economic growth but also to enhance the minimization of Cr
- The government as well as other stakeholders in the economy should acknowledge the threat that Credit risk pose not only to the banking sector but also to the general economy.
- The government must take into account that Cr can contribute to the collapse of the banking sector and to the entire economy.
- Furthermore, the government should implement policies that take into account of Cr.
- The result of this study more specifically indicates that the government should come up with strategies aimed at reducing the impact of inflation rate, growth domestic products in commercial banks of Ethiopia.
- Finally; -the study sought to investigate the determinants of Cr in Ethiopian commercial banks. However, the variables used in the econometrics model did not include all factors that can affect Cr of Ethiopian commercial banks.
- Thus, the future researcher should incorporate external factors such as regulatory environment (loan loss provisions), money supply, unemployment rate and corporate governance.
- It is also recommended for future researchers to study the determinants of Cr in different economic sectors.

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Appendix

Raw data 1

year	COMP	Cr	ROA	BS	CAR	LTD	GDP	INF
2009	AIB	0.2901	0.0314	3.8077	0.1168	0.5467	0.256	0.2719
2010	AIB	0.1789	0.0442	3.9001	0.1184	0.5152	0.341	1.573
2011	AIB	0.1510	0.0499	4.0050	0.1293	0.5148	0.191	0.003
2012	AIB	0.1934	0.0445	4.0769	0.1349	0.5980	-0.093	0.106

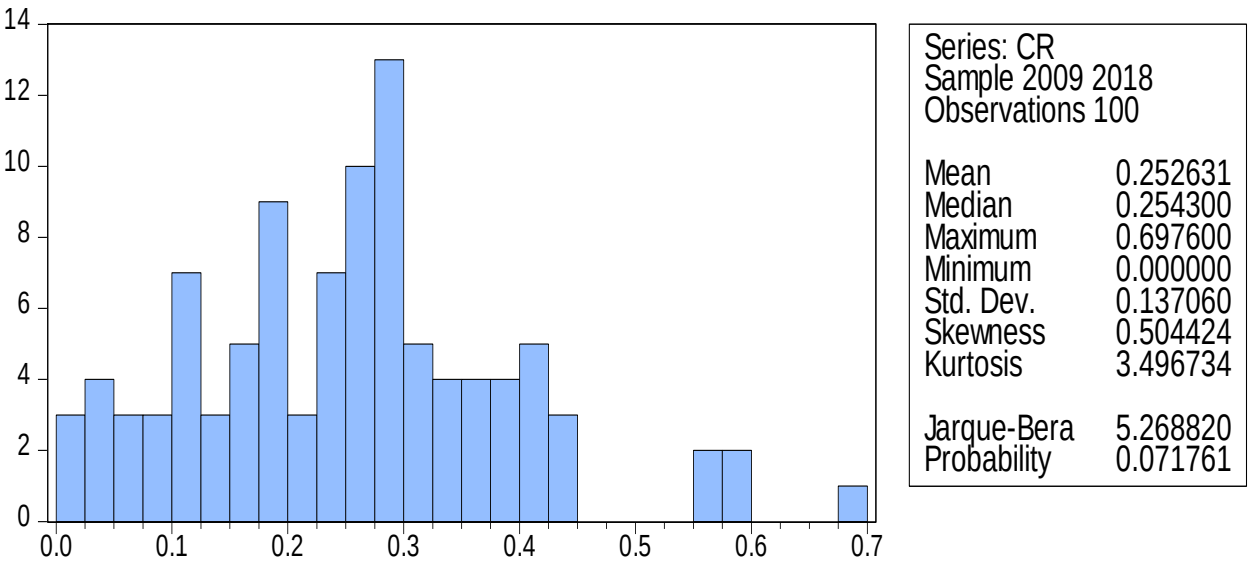
2013	AIB	0.2983	0.0439	4.1720	0.1354	0.6146	0.05	3.0856
2014	AIB	0.3159	0.0414	4.3017	0.1261	0.6101	0.329	0.109
2015	AIB	0.3546	0.0361	4.3778	0.1295	0.6740	0.087	0.073
2016	AIB	0.4121	0.0333	4.4714	0.1289	0.6767	0.147	0.106
2017	AIB	0.4213	0.0280	4.6230	0.1111	0.7380	0.147	0.3662
2018	AIB	0.4132	0.0477	4.7425	0.0881	0.7146	0.113	0.158
2009	BOA	0.2295	0.0266	3.7385	0.0948	0.6028	0.256	0.2719
2010	BOA	0.2112	0.0312	3.7979	0.0932	0.6136	0.341	1.573
2011	BOA	0.1900	0.0354	3.8620	0.0908	0.5458	0.191	0.003
2012	BOA	0.2363	0.0351	3.9159	0.1100	0.5756	-0.093	0.106
2013	BOA	0.2363	0.0284	4.0056	0.1093	0.5534	0.051	3.0856
2014	BOA	0.2243	0.0465	4.0522	0.1356	0.5564	0.329	0.109
2015	BOA	0.1945	0.0275	4.1357	0.1325	0.5311	0.087	0.073
2016	BOA	0.1943	0.0278	4.2260	0.1262	0.5876	0.147	0.061
2017	BOA	0.2321	0.0260	4.4035	0.1147	0.6728	0.147	0.3662
2018	BOA	0.2763	0.0345	4.5049	0.1327	0.6975	0.113	0.028
2009	CBE	0.4321	0.0323	4.7739	0.0848	0.4807	0.256	0.2719
2010	CBE	0.3876	0.0265	4.8703	0.0749	0.4395	0.341	1.573
2011	CBE	0.3954	0.0251	5.0579	0.0548	0.4243	0.191	0.181
2012	CBE	0.3765	0.0342	5.2009	0.0486	0.5345	-0.093	0.054
2013	CBE	0.4215	0.0310	5.2947	0.0459	0.4695	0.051	3.0856
2014	CBE	0.5623	0.0278	5.3809	0.0446	0.4538	0.329	-0.274
2015	CBE	0.6976	0.0835	8.2046	0.0806	0.5972	0.087	-0.666
2016	CBE	0.5764	0.0216	5.5842	0.0386	0.4778	0.147	-0.083
2017	CBE	0.5823	0.0178	5.6903	0.0909	0.4115	0.147	0.3662

2018	CBE	0.5721	0.0123	6.0000	0.0647	0.4461	0.113	-0.282
2009	CBO	0.0452	0.0028	2.6274	0.8143	0.8630	0.256	0.2719
2010	CBO	0.1021	0.0180	2.8312	0.8212	0.6580	0.341	1.573
2011	CBO	0.1012	0.0221	3.0099	0.8077	0.7560	0.191	-0.809
2012	CBO	0.0391	0.0331	3.2475	0.8028	0.5260	-0.093	-0.041
2013	CBO	0.1637	0.0401	3.3981	0.8027	0.4120	0.051	3.0856
2014	CBO	0.3615	0.0494	3.5648	0.8051	0.4900	0.329	-0.274
2015	CBO	0.3345	0.0332	3.8155	0.8001	0.4700	0.087	-0.666
2016	CBO	0.3467	0.0032	3.8664	0.7964	0.6700	0.147	-0.083
2017	CBO	0.4363	0.0181	4.0593	0.8024	0.8900	0.147	0.3662
2018	CBO	0.4210	0.0184	4.0264	0.7922	0.7100	0.113	-0.282
2009	DB	0.1365	0.0362	3.9882	0.0934	0.5617	0.256	0.2719
2010	DB	0.1425	0.0371	4.0918	0.0909	0.4977	0.341	1.573
2011	DB	0.1706	0.0430	4.1661	0.0953	0.5251	0.191	-0.809
2012	DB	0.1945	0.0510	4.2435	0.1043	0.5776	-0.093	-0.041
2013	DB	0.1777	0.0412	4.2955	0.1036	0.5591	0.051	3.0856
2014	DB	0.2453	0.0436	4.3417	0.1183	0.5333	0.329	-0.274
2015	DB	0.2574	0.0389	4.3938	0.1181	0.5818	0.087	-0.666
2016	DB	0.2910	0.0333	4.4560	0.1175	0.5578	0.147	-0.083
2017	DB	0.2643	0.0239	4.5394	0.1153	0.6509	0.147	0.3662
2018	DB	0.2981	0.0299	4.6573	0.1291	0.6471	0.113	-0.282
2009	LIB	0.0279	0.0398	2.9788	0.2013	0.6682	0.256	0.2719
2010	LIB	0.0457	0.0345	3.1347	0.1773	0.5739	0.341	0.573
2011	LIB	0.0032	0.0276	3.2572	0.1952	0.5213	0.051	3.0856
2012	LIB	0.0653	0.0351	3.3915	0.1793	0.5589	0.329	-0.274

2013	LIB	0.0742	0.0412	3.4687	0.1842	0.6259	0.087	-0.666
2014	LIB	0.0823	0.0295	3.5579	0.1738	0.5736	0.147	-0.083
2015	LIB	0.2873	0.0318	3.7678	0.1403	0.6350	0.147	0.3662
2016	LIB	0.2762	0.0206	3.9095	0.1318	0.6795	0.113	-0.282
2017	LIB	0.2628	0.0281	4.0404	0.1320	0.6252	0.113	-0.282
2018	LIB	0.3621	0.0387	4.1559	0.1263	0.6335	0.191	-0.809
2009	NIB	0.2339	0.0459	3.6818	0.1516	0.6736	0.256	0.2719
2010	NIB	0.2213	0.0389	3.7760	0.1535	0.6169	0.341	0.573
2011	NIB	0.1534	0.0412	3.8520	0.1646	0.5364	0.191	-0.809
2012	NIB	0.1784	0.0272	3.9178	0.1846	0.6353	-0.093	-0.041
2013	NIB	0.1976	0.0251	3.9612	0.1822	0.6826	0.051	3.0856
2014	NIB	0.2754	0.0795	4.0313	0.1828	0.6825	0.329	-0.274
2015	NIB	0.2643	0.0795	4.1224	0.1642	0.7053	0.087	-0.666
2016	NIB	0.2853	0.0775	4.1995	0.1591	0.6047	0.147	-0.083
2017	NIB	0.3134	0.0370	4.3226	0.1405	0.6525	0.147	0.3662
2018	OIB	0.3213	0.0467	4.4263	0.1267	0.6244	0.113	-0.282
2009	OIB	0.0019	-0.0193	2.5065	-0.017	0.6141	0.256	0.2719
2010	OIB	0.0000	0.0267	3.0487	0.0107	0.4495	0.341	0.573
2011	OIB	0.1112	0.0289	3.2927	0.0089	0.4336	0.051	-0.809
2012	OIB	0.1101	0.0209	3.4452	0.0048	0.4816	0.329	-0.041
2013	OIB	0.1052	0.0200	3.5923	0.0035	0.5315	0.087	3.0856
2014	OIB	0.0996	0.0306	3.7890	0.0039	0.5059	0.147	-0.274
2015	OIB	0.2695	0.0275	3.9793	0.0026	0.6456	0.147	-0.666
2016	OIB	0.3175	0.0213	4.0524	0.0017	0.5526	0.113	-0.083
2017	OIB	0.3421	0.0209	4.2120	0.0012	0.5349	0.147	0.3662

2018	OIB	0.2972	0.0191	4.3012	0.0014	0.5438	0.113	-0.282
2009	UB	0.1670	0.0446	3.6676	0.1118	0.5952	0.256	0.2719
2010	UB	0.2887	0.0331	3.7706	0.1081	0.5532	0.341	0.573
2011	UB	0.2545	0.0340	3.8879	0.1167	0.5402	0.191	-0.809
2012	UB	0.0567	0.3607	3.9438	0.1254	0.6046	-0.093	-0.041
2013	UB	0.1256	0.0228	3.9990	0.1204	0.5842	0.05	3.0856
2014	UB	0.2535	0.0181	4.0747	0.1326	0.5693	0.329	-0.274
2015	UB	0.1083	0.2144	4.1572	0.1174	0.5811	0.087	-0.666
2016	UB	0.2711	0.2143	4.2373	0.1200	0.6546	0.147	-0.083
2017	UB	0.3421	0.1948	4.3405	0.1149	0.7268	0.147	0.3662
2018	UB	0.3657	0.0276	4.4476	0.1054	0.6443	0.113	-0.282
2009	WB	0.1231	0.0611	3.7091	0.1634	0.5666	0.191	0.2719
2010	WB	0.0853	0.0396	3.7591	0.1832	0.6306	-0.093	0.573
2011	WB	0.2521	0.0454	3.9064	0.1659	0.4885	0.051	-0.809
2012	WB	0.3213	0.0243	3.9215	0.1922	0.6192	0.329	-0.041
2013	WB	0.2894	0.0224	4.0168	0.1761	0.6212	0.087	3.0856
2014	WB	0.2431	0.0167	4.0509	0.1907	0.5492	0.147	-0.274
2015	WB	0.2755	0.1910	4.1371	0.1761	0.6151	0.147	-0.666
2016	WB	0.2541	0.1366	4.2092	0.1733	0.6775	0.113	-0.083
2017	WB	0.4264	0.0264	4.3212	0.1602	0.7301	0.256	0.3662
2018	WB	0.3876	0.0357	4.4376	0.1397	0.7210	0.341	-0.282

Appendix 2



Source eveiw 8 2021

APPENEAX 3

Dependent Variable: CR

Method: Panel Least Squares

Date: 01/04/21 Time: 23:35

Sample: 2009 2018

Periods included: 10

Cross-sections included: 10

Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CAR	-1.285061	0.392422	-3.274689	0.0015
C	-0.307172	0.107907	-2.846628	0.0056
BS	0.172401	0.015348	11.23254	0.0000
GDP	0.146098	0.053275	2.742332	0.0075
INF	-0.006682	0.006054	-1.103625	0.2729
LTD	0.143098	0.084516	1.693161	0.0941
ROA	-0.403058	0.149636	-2.693591	0.0085

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.839969	Mean dependent var	0.252631
Adjusted R-squared	0.811392	S.D. dependent var	0.137060
S.E. of regression	0.059524	Akaike info criterion	-2.659231
Sum squared resid	0.297620	Schwarz criterion	-2.242404

Log likelihood	148.9615	Hannan-Quinn criter.	-2.490533
F-statistic	29.39320	Durbin-Watson stat	1.665248
Prob(F-statistic)	0.000000		

Source eveiw 8 2021

APENDAX 4

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	12.938138	6	0.0440

APPENDAX5

Variables	CR	CAR	BS	GDP	INF	LTD	ROA
CR	1.000000						
CAR	-0.083456	1.000000					
BS	0.825790	-0.337194	1.000000				
GDP	0.012351	-0.016281	-0.163870	1.000000			
INF	-0.155092	-0.001513	-0.100448	-0.087313	1.000000		
LTD	-0.000495	0.284791	-0.165272	-0.029463	-0.114260	1.000000	
ROA	-0.079079	-0.089521	0.086720	-0.195217	-0.149337	0.104305	1.000000

APPENDAX6

	CR	CAR	BS	GDP	INF	LTD	ROA
Mean	0.252631	0.182831	4.099657	0.160560	0.325060	0.590859	0.044333
Median	0.254300	0.126282	4.045653	0.147000	0.057500	0.585894	0.033142
Maximum	0.697600	0.821196	8.204571	0.341000	3.085600	0.890000	0.360700
Minimum	0.000000	-0.017884	2.506505	-0.093000	-0.809000	0.411530	-0.019315
Std. Dev.	0.137060	0.214411	0.722238	0.120129	1.055917	0.090105	0.049598
Observation	100	100	100	100	100	100	100