ADDIS ABABA UNIVERSITY SCHOOL OF GRADUATE STUDIES

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

THE EFFECT OF LOAN DEFAULT ON FINANCIAL PERFORMANCE OF COMMERCIAL BANKS IN ETHIOPIA

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A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Economics (International Economics)

By: RegassaYadete

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This is to certify that the thesis prepared by RegassaYadete, entitled with: THE EFFECT OF LOAN DEFAULT ON FINANCIAL PERFORMANCE OF COMMERCIAL BANKS IN ETHIOPIA, and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Economics (International Economics) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abstract

This study aimed to find out the effects of loan default on financial performance of commercial banks in Ethiopia. Using a panel data spanning over the period 2010 to 2020 on seventeen commercial banks operating in Ethiopia, we estimated the effect of loan default on commercial banks financial performances. The data was collected from National Bank of Ethiopia and financial statement of each bank. The analyses were done using summary statistics, trends and fixed effect regression model. The findings show that, on average, about 2% of banks loan resulted in default with a minimum of 0.2 percent to maximum of 8.8 percent whereas the average return on asset (financial performance) is improving by 2.85% in the commercial banks working in Ethiopia. The finding also shows that, loan default is decreasing as financial performance is increasing indicating improvements in both indicators since 2010. Moreover, the result from panel fixed effect regression model revealed that loan default is not statistically significantly affecting the financial performances of the commercial banks in Ethiopia. Nonetheless, other variables including bank size and bank efficiencies are statistically significantly improving the financial performances of commercial banks in Ethiopia. Hence, this study recommends that, commercial Banks operating in Ethiopia should continue minimizing their loan defaults by enduring the creditworthiness (ability of potential customer to repay the loan) to improve their performances while they continue improving banking size and banking efficiencies.

Keywords: ***Ethiopia, commercial banks, panel fixed effect, loan default, Return on asset***

Contents

List of Tables and Figures

List of Acronyms

NPL -Non-Performing Loan

FEM -Fixed Effect Model

REM- Random Effect Model

HT - Hausman Test

CAPM - The Capital Asset Pricing Model

ROA - Return on Asset

NonPLR - Nonperforming Loan Ratio

EffRat - Banking Efficiency Ratio

CAR - Capital Adequacy Ratio

LoDe – Loan to Deposit Ratio and

Bsize- Bank Size

CHAPTER ONE: INTRODUCTION

1.1.Background of the study

Banks are financial intermediaries in the economy. They accept funds from the surplus (depositors) and distribute to those who have funding gap (borrowers). It bridges savers and borrowers and open up opportunities for the two parties and thereby help entrepreneurs to enter to the market. However, contractual party (the borrower) will sometimes fail to meet its obligations in accordance with the contractual terms. In recent years, financial institutions have increased their focus on the significances of such failures on their financial performances (Gadzo et al, 2019).

The chance of failure (loan default) in the contractual party can either diversifiable and eliminated or un diversifiable and un-eliminated. If the failure is linked to the overall market system, then it cannot be eliminated by diversification; however, if it isn't linked to the overall market system but specific to each business, then it can be eliminated by diversification (Sayedi, 2014). Loan default is an internal risk, that, if commercial banks or any other financial institution want to minimize it, it can do so. Increases in loan default raise the marginal cost of debt and equity, which in turn increases the cost of funds for the financial institution and lower financial performances (Engle and Gizycki, 1999).

There has been a growing interest in both developed and developing nations on the effect of loan default on financial performances. It is argued that in small country like Ethiopia, the financial sector is still in the development phase; and banks revenue depends heavily on lending activities which is central to any banking organizations profit; this basically indicates that the occurrence of loan default will likely have significant influence on the profitability of banks (Mekasha,

2011).Others have also shown that improvements in loan default (Mulugeta, 2018), increasing banking size (Loan et al, 2018), improvement in banking efficiency (Ngunyu, 2013), and improving banking liquidity (Yameem, 2019) were some of the things to improve financial performances.

Despite the evidences how an outstanding loan increment by about 24.3 percent is surpassing one trillion Birr in 2020/21, banks loan collection showed only 1.5 percent increment in Ethiopia compared to a year before (NBE, 2021). The difference may have contributed to loan default. However, the accompanied effect of such loan default on financial performance has been less studied. Hence, this study aimed to find out the effect of loan default on financial performance of commercial banks in Ethiopia.

1.2. Statement of the problem

Bank loans work similarly to personal loans any one get from their friends, family, neighbors etc. After applying for credit, the bank will review the credit score, history and income of borrower to determine how much money wanted to borrow and what annual percentage rate qualify for borrower. Once the borrower received the loan, the borrower will pay it back in monthly or annual installments. Bank loan repayment terms may range from about months to several years. But at the end of loan maturity, the borrower should pay all principal and interest to the lenders (banks). However, the borrowers may sometimes fail to pay all the principals and interests leading to loan default. Such default is detrimental to the performance of lenders (Abaidoo and Oppong, 2017).

Non-performing loan (NPL) levels in numerous Euro zone countries surged dramatically during the financial crisis. Despite the fact that this is to be expected in a recession, NPL ratios are still

heightening years later. Bad credit can have a negative impact on banks' capital, profitability, and funding costs from a micro prudential standpoint. NPLs necessitate risk-weighted fines, which forces banks to set aside capital that is therefore unavailable for other uses. Second, high NPL levels indicate a significant number of non-income-generating assets, lowering profitability. Finally, because of the knowledge asymmetry on the quality of the loan book, these conditions might raise funding costs since investors want a higher risk premium (Gaudencio, 2019).

Financial organizations' ability to collect loans as efficiently and effectively as feasible is critical to their long-term viability. To put it another way, financial institutions must maintain excellent portfolio quality based on 100% payback, or at the very least low default, cost recovery, and efficient lending in order to be financially viable or sustainable. However, financial institutions have recently complained about a high rate of default by their clients, implying that most financial institutions are failing to meet the internationally accepted standard portfolio at risk of 3%, which is cause for concern because of the consequences on businesses, individuals, and the economy of the countries as a whole (Mbah &Wasum, 2019).

Despite the fact that, there are good theoretical considerations on the effect of loan default on commercial bank financial performance as mentioned in the literature (Nbe, 2021; Giza, 2015; Regan, 2017), the number of empirical studies on the impact of loan default on commercial bank profitability in Ethiopia was quite limited (Mekasha, 2011; Million, 2014). Many works in Ethiopian are also heavily centered on the Ethiopian Commercial Bank, which is the country's largest and most powerful bank, leaving the others aside (Mekasha, 2011; Mulugeta, 2013). Moreover, existing literature has gained growing evidence on determinants of loan default (Negera, 2012 and Zeleke, 2021) regardless of its effect on the financial performance.

The studies on the effect of loan default on financial performance were very limited and those studied on this topic are also inconclusive because the data they have used were significantly limited to either pure cross sectional or pure time series data. Besides, the data collected by each researcher are less representative, as they collected data from some banks classifying as biggest banks, smallest banks, etc., at the country level makes it impossible to generalize how the impact of loan risk varies across banks. For this reason, it is imperative to understand, the link between loan default as measured by nonperforming loan and financial performances using a more representative sampling and better quality data, to make suggestion for credit management and policy makers in this area. Hence the purpose of this study is to investigate the effect of loan default on financial performance of commercial banks in Ethiopia by combining both cross sectional and time series data which comprise panel data.

By integrating the above information, this study is designed to contribute to the literature on the effect of loan default, as measured by non-performing loan on financial performances (return on asset) in Ethiopia. The potential estimation problems, unlike the other studies, are addressed through panel regression model. The analysis takes the advantage of using the data collected from National bank of Ethiopia and commercial banks financial statement.

1.3. Objective of the study

The general objective of this study is to investigate the effect of loan default on financial performance (return on assets) of commercial banks in Ethiopia. Specifically, this study aims:

- To show the trends of loan default and financial performances in Ethiopia and
- To examine whether loan default is significantly affecting financial performance in Ethiopia

1.4. Research question

This study answers the following questions:

1. Does loan default and financial performance of commercial banks are improving in Ethiopia?
2. Are the relationship between loan default and financial performances of commercial banks in Ethiopia are significant?

1.5. Significance of the Study

This study is important for commercial bank loan risk managers and policy makers about loan risk in the Ethiopian banking system and its effect on financial performance. It also has a great importance for commercial banking firms in order to make adequate control over credit management system to make sustainable profit. Besides, it helps for other researchers who are interested in this area as a reference.

1.6. Scope and limitation of the study

This study focused on all commercial banks in Ethiopia established before 2020 and was in operation because of the fact that, the newly established banks such as Zemzem, Hidjira, Sinkee has no organized data yet and were less than one year since they begin operations. Again, this study limited panel data starting from 2010 to 2020 due to data availability. Finally, due to the nature of data, this study uses the quantitative research approach.

1.7. Organization of the Study

The rest of the Thesis is organized as follows: The second chapter deals with review of theoretical, conceptual framework and empirical literature. The third chapter deals with methodology of the study. The fourth chapter deals with results and discussion. The fifth chapter deals with conclusion and recommendation.

CHAPTER 2: REVIEW OF THEORTIUCAL LITREATURE AND EMPIRICAL EVIDENCES

This chapter summarizes the information from related literature. It reviews theories of the effects of loan default as well as empirical studies on the effect of loan default on the financial performance and developed the conceptual framework.

2.1. Theoretical review

According to the directive of the national bank of Ethiopia's licensing and supervision of banking business on asset classification and provisioning "defaulter means a borrower whose outstanding loan and advances has been classified as substandard, doubtful or loss and nonperforming loan means loan or advances whose credit quality has deteriorated such that full collection of principal and or interest rate in accordance with the contractual repayment terms of the loan or advance is in question." Moreover, the financial performance is measured by return on asset, measures the extent to which a business is able to generate profit (income) from use of business assets. Return on Assets = net income/total asset. It is defined as profit after tax divided by total asset; reflect how well bank managers are using the banks real investment resource to generate profit. It shows the profit earned per birr of assets and most importantly, reflects the management ability to utilize the bank's financial and real investment resources to generate profits (CFI, 2022).

The theoretical literature in this area linked the link between loan default and financial performance to the premises of information asymmetry, which is one of the tenants of the lemon theory propounded by Akerlof in 1970. According to Tupangiu (2017), information asymmetry depicts relationships where an agent holds information while another does not hold it. Thus, to the extent that one of the parties to the financing agreement has information more or less

accurate than another, the asymmetry of information appears to be a major constraint in the financing of a project. Banks, in their capacity as financial intermediary responsible for asset transformation need more information to assess the borrower before funds are channeled to them. From this backdrop, according to Akerlof (1970) the lemon theory postulates that given an inefficient Credit reference bureau system, it will culminate into the existence of information asymmetry between regulatory body and the banks as well as the customers of the banks and the management of the banks. Banks may find it difficult to distinguish credit worth borrowers from bad borrowers, which may result in adverse selection and moral hazards problems.

Bofondi and Gobbi (2003) posit that adverse selection and moral hazard have led to substantial build-up of NPLs of banks, which has eventually exposed them to high credit risk as well as operational risk. Derban et al. (2005) and Ahmed et al. (2006) suggested that borrowers be screened particularly by banking institutions in the form of credit assessment. From the perspective of operations of the banks, the lemon theory postulates that it might result in adverse selection on the part of the customers as well as the directors of the bank. The adverse selection from the perspective of managers will lead to operational problems and eventually affect the performance of the banks. Evidence from such literature showed that the relation between loan default and financial performances is linked to information asymmetry.

Berger and Deyoung (1997) banking profitability may also reflect the risk taking behavior of managers. Banks with high profitability are less pressured to revenue creation and thus less constrained to engage in risk credit offerings. At the same time, inefficient banks are more likely to experience high level of problem loans. Poor management can imply weak monitoring for both operating costs and credit quality of customers, which will include high levels of capital

losses. Under this bad management advances by Berger and DeYoung (1997), managers lack competencies to effectively assess and control risks incurred when lending to new customers.

2.2. Empirical Review

There are prior studies conducted in different countries which are related to the topic/problem of this study. In order to show the research gap and justify the importance of this study the following section presents review of the empirical evidence that have examined loan risks and profitability of commercial banks in two parts. The first part indicates the empirical literature in the other developing countries and the second part indicates the empirical findings in Ethiopia.

2.2.1. Other Developing Countries

Ndiago (2016) analyzed the effect of credit risk management practices on profitability of listed commercial banks at Nairobi Security Exchange in Tanzania using descriptive and purposive sampling method. They found that credit appraisal practices had a significant positive effect on profitability and that it explained 14.4% of the variations in profitability. The results also found that credit monitoring had a significant positive effect on profitability and that 47.8% of the variance in profitability. Similarly, Macharia (2012) studied the relationship between the level of non-performing loans and the financial performance of commercial banks in Kenya. The population of the study was all the financial performance of commercial banks in Kenya from 2005 to 2011. It was found that, the levels of non-performing loans significantly reduced with the profitability levels increasing significantly.

Alkhatib (2012) empirically examined the financial performance of five Palestinian commercial banks listed on Palestine securities exchange. Financial performance has been measured by using three indicators; Internal–based performance measured by Return on Assets, Market-based

performance measured by Tobin's Q model (Price / Book value of Equity) and Economic–based performance measured by Economic Value add. The study employed the correlation and multiple regression analysis of annual time series data from 2005-2010 to capture the impact of bank size, credit risk, operational efficiency and asset management on financial performance measured by the three indicators, and to create a good-fit regression model to predict the future financial performance of these banks. The finding show that operational efficiency and asset management individually have significant impact on ROA, when they used along with bank size and credit risk, they add significant effect on Tobin's Q and EVA.

Sufian and Chong (2008), look for the factors that influence the profitability of Philippines banking sector by using ROA as a dependent variable during the period 1990–2005. The empirical evidences suggest that all the bank specific determinant variables have a statistically significantly effect on bank performance. Among them size, credit risk, and overhead expensed are negatively affect the bank profitability, whereas non-interest income and capitalization have a positive impact on it.

Githaiga (2015) analyzed the effects of credit risk management practices on the performance of Financial Banking Institutions. The study attempted to establish if there exists any relationship between the credit risk management determinants by use of CAMEL indicators and financial performance of commercial banks in Kenya. The finding of the study concludes that Credit Risk has a strong negative relationship with financial performance. This indicates that poor credit risk or high non-performing loans to total assets related to poor bank performance.

Kenned (2016) assessed the effect of credit risk on financial performance of commercial banks in Kenya covering from 2005 and 2014. Credit risk was measured by capital to risk weighted

assets, asset quality, loan loss provision, loan and advance ratios and financial performance by return on equity (ROE). The study used the balance sheets components and financial ratios for 43 commercial banks in Kenya registered by year 2014. From their results credit risk has a negative and significant relationship with bank profitability. Poor asset quality or high non-performing loans to total asset is related to poor bank performance both in short run and long run.

2.2.2. Ethiopian Case

In the same way we have reviewed the empirical literature in Ethiopia. For instance, Temerat (2015) studied the effect of credit risk management on the performance of commercial banks in Ethiopia using secondary data from annual reports of the commercial banks and showed that there was a negative relationship between credit risk and performance of commercial banks in Ethiopia. Again, Mekasha (2011) examined credit risk management and its impact on performance on Ethiopian commercial Banks using quantitative research design and survey data. The estimation results showed that return on asset (ROA) and non-performing loan of the financial institution was significantly negatively related.

Mulugeta (2011) studied the relationship between credit risk and performance of commercial banks in Ethiopia using quantitative research approach on panel data from seven selected commercial banks covering eleven-year period (2001-2011). The findings of the study showed that non-performing loan had statistically significant negative relationship with ROA. In addition, Hailu (2016) investigated the impact of credit risk on profitability performance of selected public and private commercial banks of Ethiopia. Using secondary data from annual

reports of the selected public and private commercial banks of Ethiopia, he showed that there is a negative relationship between credit risk and performance of commercial banks in Ethiopia.

2.3. Evaluation of the literature in the context of this study

Similar to other developing countries, numerous empirical studies conducted the effect of loan default on performance of commercial banks in Ethiopia by Mekasha (2011),Temerat (2015) and Mulugeta (2013), as mentioned above. However, in their studies only selected sample in terms of big size such as commercial bank of Ethiopia and medium sized commercial banks have been used as a sample. Hence, they failed to disclose the literature gap by incorporating those small sized commercial banks in their samples. And again, the data they have used were almost outdated and the recent literature in this topic uses either purely cross section or purely time series data to estimate the effect of loan default on financial performances of commercial banks leaving it inconclusive. Therefore, this study tried to overcome such problems by including all small sized, medium sized and big sized commercial banks working in Ethiopia; and using panel data.

2.4. Approach of the study and Conceptual framework

The main objective of this study is to investigate the effect of Loan default (Credit risk) on financial performance of commercial banks in Ethiopia. Based on the objective of the study, the following conceptual model is framed. The bank performance measured by return on asset which can be affected loan default.

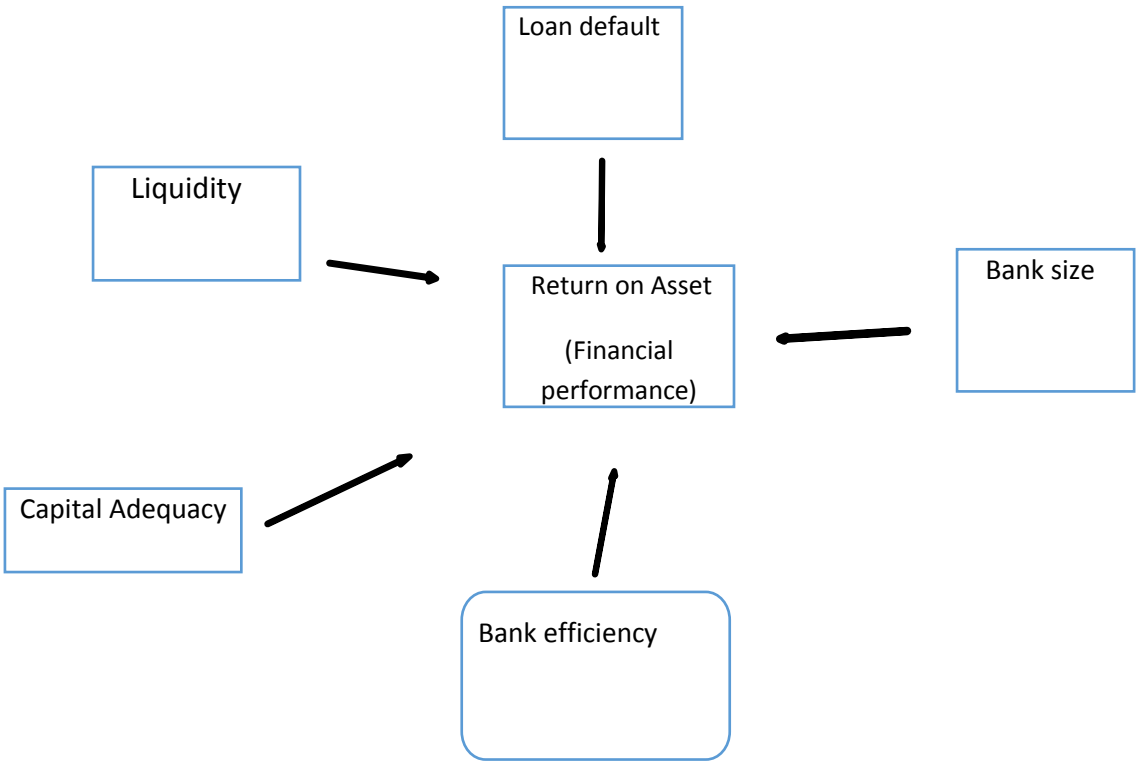

Figure 2.1 Conceptual framework of the relationship between financial performance and loan default

CHAPTER 3: RESEARCH METHDOLOGY

This chapter presents the approaches to be followed and applied for conducting this study. In this chapter, the researcher identified the techniques and procedures that would be applied in the collection, processing and analysis of the data. It specifically explained the data sources, study design and study approach, the study population and sample size determination, description of study variables, model specification and methods of data analysis.

3.1. Data sources and sample size

The panel data from 17 commercial banks in Ethiopia covering the period 2010 to 2020 were collected from National Bank of Ethiopia (NBE) and commercial banks financial statements. The variables used in the model contain information on bank performances, loan, total asset, total liability and other variables.

A panel data study design combines the attributes of cross-sectional (each commercial banks) and time series data (yearly). The advantage of panel data analysis is to overcome the problem of unobserved variable bias that are not changing over time and vary across individual; and to estimate reliable estimates of the parameters in the model obtained (Gujarati, 2004).

Due to absence of organized data for many banks on the select variables, the study has forced to restriction the period ranging from2010 to 2020. Hence, this study employed the data for seventeen banks over the period of eleven years comprising the total observation to 187. From the selected banks, around four banks (Abay, Enat, Addis International and Debub Global bank) have missing observation for some variables. This missing observation is due to data unavailability especially before 2012 for some variables. This could not affect our analysis, because, the missed observation wasn't systematic and again they are not significantly large.

3.2. Description of Study Variables

This study used several variables to find out the effect of loan default development on financial performances based on plenty of literature. Namely: Return on asset (ROA) as a measure of financial performances; non-performing loan ratio (NonPLR) as a measure of loan default; Bank size (Bsize) as a measure of financial size; Bank efficiency(EffRat), as measure of bank ability to manage its costs by non-interest income; bank liquidity (LoDe) as a measure of bank ability to pay for possible demand of depositor, and capital adequacy (CAR) as a measure of banks' ability to handle a certain amount of losses, before being at risk for becoming insolvent. All of these variables are continuous variables and their importance of including was briefly described here in after.

Prior works on loan default management and bank performance indicated that return on assets (ROA) was an important measurement used in the financial performance of banks (Girma, 2011; Agegnehu, 2013). It is used as a dependent variable in this study. The ROA refers to the financial returns gained compared to asset through loans, purchases of non-equity securities, and trade credits and other obligation. In addition to this, the data for the study drawn from the annual report of National bank of Ethiopia, which disclose information about the variable, which is important to measure the performance of the banks and computed as Return on Assets = net income/total asset. It is defined as profit after tax divided by total Asset which reflects how well bank managers are using the banks real investment resource to generate profit. It shows the profit earned per birr of assets and most importantly, reflects the management ability to utilize the bank's financial and real investment resources to generate profits.

An indicator of banking loan default, NPLR is used as core independent variables. It is expected to affect the financial performances negatively. Increases in financial risk such as loan default

raise the marginal cost of debt and equity, which in turn increases the cost of funds for the Bank and lower financial performances (Gizycki, 2001).

Bank size is also independent variable, measured by the natural logarithm of the total assets of a bank. It controls for cost difference and product and risk diversification according to the size of the institution if there are significant economies of scale (Akhavein, Berger & Humphrey, 1997). Large banks are likely to have an advantage of engaging in higher investment diversification than small banks. Since this diversification reduces risks and economies of scale lead to increase operational efficiency improving profitability (Rao &Tekeste, 2012 and Alper and Anbar, 2011). Hence, this variable is expected to have positive effect on financial performances.

Another important independent variable is liquidity, an indication for bank ability to pay in case of customer possible demand for short term. The liquidity expresses the degree to which a bank is capable of fulfilling its respective obligations. Banks makes money by mobilizing short-term deposits at lower interest rate, and lending or investing these funds in long-term at higher rates, so it is hazardous for banks mismatching their lending interest rate. Liquidity reflects the capacity of a bank to pay the debts on a short term and to cope with unexpected withdrawals of depositors. Liquidity is measured by loan to deposit ratio in this study. If the ratio is greater than one, it indicates that the loans disbursed are more than the deposits and vice-versa. This variable is also expected to have moderately positive effect after some threshold on financial performances. Usually, researcher has put threshold to 70 to 80% up to which it is positively affecting financial performances of the banks.

Finally, the variable capital adequacy ratio is taken as another control variable which indicates bank ability to protect depositors and to promote the stability of a country's financial system. It is

shown that, the higher the ratio of bank capital adequacy ratios, the higher the degree of protection money to depositors is. Hence, this variable is expected to have positive effect on return on asset.

Table 3.1 Description of variables

Variables	**Variables**	**Notations**	**Measure**	**Indicator**
Dependent Variable	Return on Asset	ROA	Net income before tax/Total Asset	Financial performances
Independent Variable	Loan default	NonPLR	Ratio of non-performing loan to total loan	Credit risk/loan default indicator
	Liquidity	LoDe	The ratio of loan to deposit ratio	Bank ability to pay in case of customer possible demand in short term
	Bank size	Bsize	Natural logarithmic of total bank assets	Industry size
	Bank efficiency Ratio	EffRat	Ratio of non-interest income to non-interest expense	Bank ability to manage its costs by non-interest income or efficiency in utilizing resources
	Capital Adequacy Ratio	CAR	Ratio of capital to asset	bank ability to protect depositors and to promote the stability of a country's financial system

3.3. Methods of Data Analysis

To achieve the broad research objective, this paper is primarily based on panel data. Thus, the collected panel data is analyzed using descriptive summary, trends, correlations and panel data regression models. Several estimation techniques have been used while using the panel data approach. In particular, the fixed effect and random effect models are the most widely used in the literature and they were used in this paper as well.

3.3.1. The Fixed Effect Model (FEM)

In the formulation of the fixed effect model, the intercept in the regression is allowed to differ among individual units in recognition of the fact that each cross-sectional unit might have some special characteristics of its own. That is, the model assumes that differences across units can be captured in differences in the constant term. The α_i is unobserved variable bias that capture unobserved heterogeneity. The model allows each cross-sectional unit to have a different intercept term though all slopes are the same, so that

$$Y_{it} = \delta X_{it} + \alpha_i + \epsilon_{it} \quad (1)$$

Where; α_i is sometimes called unknown intercept for each entity, Y_{it} is the dependent variables, X_{it} is independent variables, δ is the coefficient, ϵ_{it} is the error term, i and t is entity and time. The FEM is appropriate in situations where the individual specific effect might be correlated with one or more regressor (Green, 2003, Gujirati, 2003). Moreover, ϵ_{it} is iid over i and t.

3.3.2. Random Effect Model (REM)

The rationale of using random effects model is that, unlike the fixed effects model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. Moreover, random effects are whether the unobserved individual effect embodies elements that are correlated with the regressor in the model, not whether these effects are stochastic or not" [Green, 2008, p.183]. In random effect model time invariant variables (i.e. gender) can be included. In the fixed effects model these variables are absorbed by the intercept. The random effects model is:

$$Y_{it} = \beta_0 + \delta X_{it} + \alpha_i + \epsilon_{it} \quad (2)$$

Where: ϵ_{it} error term and all others are as explained under fixed effect. Random effects assume that the entity's error term is not correlated with the predictors which allows for time-invariant variables to play a role as explanatory variables. Random effect allows generalizing the inferences beyond the sample used in the model.

3.3.3. The Hausman Test (HT)

To decide between fixed or random effects we can run a Hausman test where the null hypothesis is that the preferred model is random effect vs. the alternative the preferred model is fixed effect. It basically tests whether the unique errors (α_i) are correlated with the regressor; the null hypothesis is they are not. If the probability of chi-square is less than 5% we reject the null hypothesis and use fixed effect model whereas if the probability is greater than 5% we fail to reject the null hypothesis and use random effect mode.

The model robustness should be checked based on the assumption required by fixed effect and random effect. These model basically assumed that, the data is from random sample; each explanatory variable in the model has to changes over time (for fixed effect model), and no perfect linear relationships exist among the explanatory variables; the variance of the differenced errors conditional on all explanatory variables should be constant or errors are homoscedastic. Similarly, the differences in the idiosyncratic errors are uncorrelated (conditional on all explanatory variables and α_i). This means the differenced errors should be serially uncorrelated. A more important thing is a reliability of this result, which should be explained by intra class correlation coefficient. These all should be tested in this study to make the output more reliable and error free. In this study, we mainly used cluster standard error, which is robust toward serial autocorrelation and heteroscedasticity of the variances.

3.4. Model Specification

The model specification follows the capital asset pricing model (CAPM). According to Ben McClure, no matter how much we diversify our investments, it's impossible to get rid of all the risk. As investors or bankers, it deserves a rate of return that compensates us for taking on risk. The capital asset pricing model (CAPM) helps us to calculate investment risk and what return on investment should expect. The capital asset pricing model was the work of financial economist (and, later, Nobel laureate in economics) William Sharpe. His model starts with the idea that individual investment or return of bank contains two types of risk: Systematic Risk - These are market risks that cannot be diversified away and unsystematic Risk - also known as "specific risk," this risk is specific to individual stocks or banks and can be diversified away as the bankers or investors increases diversification in his or her portfolio (Fama and French, 2004). The model generally assumes that the investor or banks maximize expected return given risk.

Return = f(risks)

In this paper, the risk is loan default which is indicated by non-performing loan. Based on the above theoretical model and following the literature reviewed in the previous chapter, we specified the econometric model for the effect of loan default on financial performances controlling for the other factors. It is increasingly difficult to expect loan to be returned fully with income it was expected to achieve. This is because; the contractual party (the borrower) will sometimes fail to meet its obligations in accordance with the agreed terms. Existence of such problems may lower the financial performances of commercial banks. Bearing this argument and following the model used by Alkhatib (2012), Sufian and Chong (2008) and Githaiga (2015) among the others, to examine the effect of loan defaulton banks performance in different

countries of the world, this study specified the effect of loan default as indicated by non-performing loan ratio on financial performance of commercial banks as follows:

$$ROA_{it} = \beta_0 + \beta_1 NonPLR_{it} + \beta_2 EffRat_{it} + \beta_3 Bsize_{it} + \beta_4 LoDe_{it} + \beta_5 CAR_{it} + \alpha_i + \epsilon_{it} \quad (3)$$

Where;

- → ROA is a return on asset which is manipulated by profit before tax / total asset
- → NonPLR is non-performing loan (ratio of nonperforming loan to total loan)
- → Bsize is Bank size
- → EffRat is efficiency ratio (bank efficiency)
- → LoDe is liquidity which the ratio of loan to deposit
- → CAR is capital to asset ratio
- → β_1, β_2, β_3, β_4 *and* β_5 are parameters to be estimated;
- → ϵ_{it} = is the error component for banki at time t assumed to have mean zero E [ϵ_{it}] =0 and constant
- → α_i is unobserved variable effect
- → i = commercial banks i = 1. . . 17; and
- → t = the index of time periods and t = 2010, 2014, 2015…….2020

CHAPTER 4: RESULT AND DISCUSSION

Under this section, we present results and discussions. First, data were explored using summary statistics and trends, then model results was presented using panel regression model along with its diagnosis, and finally the empirical results were discussed.

4.1. Data Exploration using Trends and Summary Statistics

Table 4.1 presented the summary statistics of the variables used in this study for seventeen commercial banks spanning over the period of 2010 to 2020, in Ethiopia. It explored the mean, the minimum, the maximum and the standard deviation of the variables. The units of variables are mixed. The variables such as return on asset (ROA), nonperforming loan ratio (NonPLR), banking efficiency (EffRat), capital adequacy ratio (CAR) and liquidity (LoDe) are in ratios; whereas, bank size (Bsize) is in the natural logarithmic form of an assets. The recent development of these variables is additionally presented by trends which are aggregated over the years in figure 4.1.

ROA variable indicates that, on average, the Ethiopian commercial banks are gaining about 2.85% of its total assets annually with the highest of 6.72 and lowest of -7.50%, over the period of 2010 to 2020. The average ROA indicates the profitability of the commercial banks in Ethiopia. This development in the bank profitability might have been accompanied by the low growth in nonperforming loan and improvements in bank size and efficiency. The summary statistics shows that about 2% of banks loan resulted in default with a minimum of 0.2 percent to maximum of 8.8 percent over this study period.

Moreover, the average efficiency ratio is about 102 percent, which is quite large, indicating the Ethiopian commercial banks' ability to cover its non-interest expense by its non-interest income. Finally, liquidity indicator, loan to deposit ratio, is indicating an average of about 62.4%. Capital adequacy ratio is also about 14.88 percent in the overall average. To further explain the existence of possible relationship among the above mentioned variables, their line trend was explored using Figure 4.1 below.

Table 4.1 Summary statistics for each variable

Variable		Mean	Std. Dev.	Min	Max	Observations
ROA	overall	2.85	1.27	-7.51	6.72	N = 177
	between		0.52	2.03	4.18	n = 17
	within		1.16	-6.68	5.64	T-bar = 10.42
Asset	overall	36413.30	105758.30	379.52	819278.80	N
	between		86928.40	2789.33	370151.80	n=17
	within		60693.01	-259551.60	485540.30	T-bar=10.18
NonPLR	overall	1.98	1.29	0.22	8.83	N = 173
	between		0.82	0.69	4.01	n = 17
	within		1.02	-0.47	7.12	T-bar = 10.18
EffRat	overall	101.76	48.98	11.51	283.08	N = 177
	between		23.98	78.28	174.73	n = 17
	within		42.77	0.75	236.99	T-bar = 10.42
LoDe	overall	62.44	10.03	39.72	91.46	N = 177
	between		6.18	44.71	72.11	n = 17
	within		7.98	39.87	92.23	T-bar = 10.42
CAR	overall	14.88	5.40	3.72	38.24	N = 177
	between		4.63	5.96	24.92	n = 17
	within		3.13	9.30	31.41	T-bar = 10.42

The values of some variables were large, whereas the others are very small. For instance, the value of ROA and NonPLR are almost below three whereas the value of EffRat, Bsize and LoDe are slightly large. Because of this reason drawing their trends on single axis hides the variables

with small values and makes the variables with large values only visible. To make them all visible we put some variables on the second axis (EffRat and LoDe) and the others on the first axis. This will not change the interpretation and needs a little cautious.

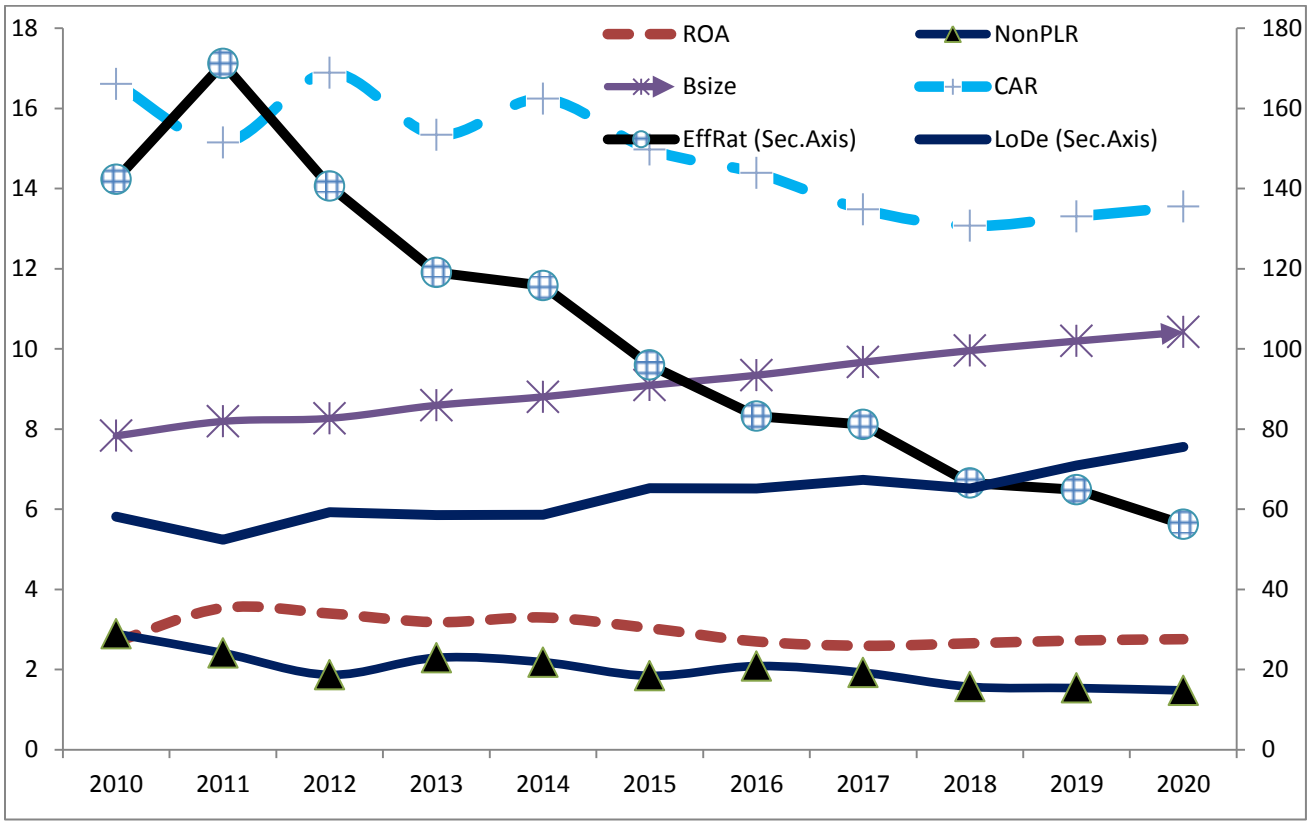

Fig 4.1 the trends developments of variables

The trends of all variables were all above zero, indicating improvements in the variables. The trends show decreasing trends of efficiency ratio. The reason for slowly decreasing of bank efficiency might have been due to the fact that, as the banking industries are growing, the noninterest expense is also growing similarly. Although efficiency ratio seems decreasing, the values are still in large percent. The trends also show that, the relationship between ROA and NonPLR seem exist. They seem indirectly related. When ROA is increasing, NonPLR is decreasing and vice versa. Figure 5 further shows the relationship between return on asset and non-performing loan ratio. Both of them seem improving. Improving in a sense that loan default

seems decreasing while return on asset seems increasing especially after 2017. However, the significance of this relationship is further explored under the empirical analysis.

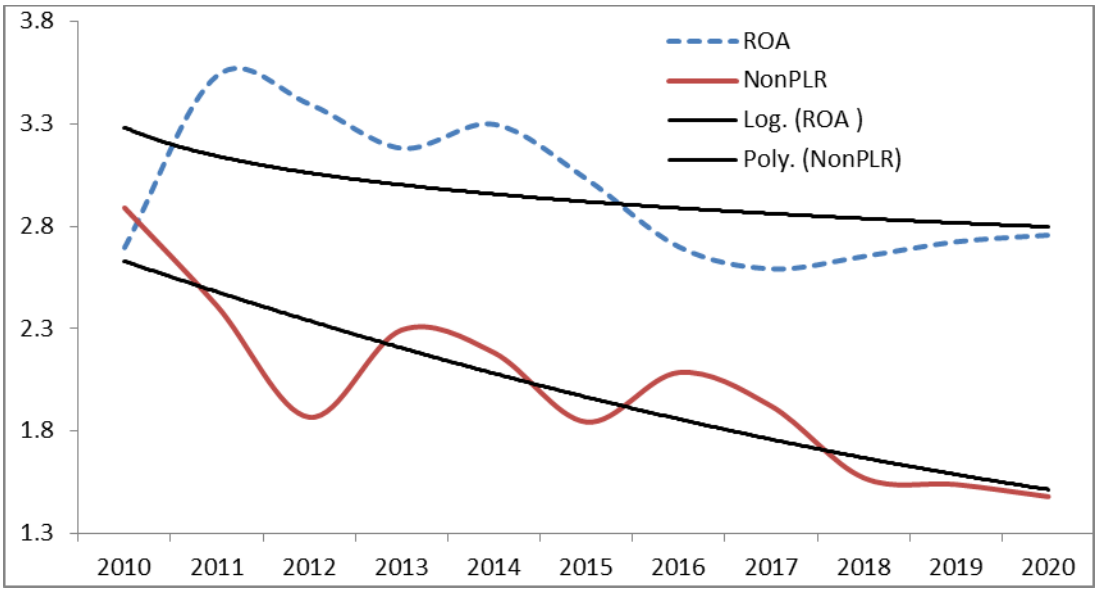

Fig 4.2 the trends showing the relations between ROA and NonPL

In general, it seems interesting to take into account the relationship in the above-mentioned variables, again some of their relationship with ROA is encouraging in both summary statistics and trends, as it clearly visualized in both trends and summary description of recent data. Specifically, the trend seems to show that the loan default and return on asset seems stable and indirectly related since 2010. Yet the descriptive analysis of both summary and trends does not indicate whether the relationship between loan default indicator (nonperforming loan) and financial performance indicator (return on asset) is significant. This argument is further explored under empirical findings in Table 4.4

The independent t-test was used to compare the differences between the loan default for public bank (commercial banks of Ethiopia) with other private banks (see the results in Table 4.9 in the appendix I). The result has shown that, the average loan default is significantly higher in public bank (Commercial Bank of Ethiopia) compared to private banks.

4.2. Model Estimation

Under this model estimation, we have tested for unit roots and panel Cointegration and then went on to the regression model.

4.2.1. Panel Unit root test

The fisher type unit root test based on augmented dickey fuller tests to test the hypothesis with Ho: All panels contain unit roots Vs Ha: At least one panel is stationary. The test has used different test statistic such as inverse chi-squared with degree freedom, inverse normal and inverse logit, and modified inverse chi-square. Fortunately, all these tests have resulted in the same conclusion for all six variables consistently to be stationary as presented in Table 4.2.

Table 4.2 Panel Unit root test: Fisher-type unit-root test based on augmented Dickey-Fuller tests

Variables	**The value of test statistics and p values**	**Inverse chi-squared(34)**	**Inverse normal**	**Inverse logit t(89)**	**Modified inv. chi-squared**
ROA	Test statistics	145.11	-8.12	-9.56	13.47
	p-values	0.00	0.00	0.00	0.00
Bsize	Test statistics	95.88	-3.41	-4.17	7.50
	p-values	0.00	0.00	0.00	0.00
EffRat	Test statistics	87.06	-5.14	-5.37	6.43
	p-values	0.00	0.00	0.00	0.00
LoDe	Test statistics	67.03	-3.80	-3.75	4.01
	p-values	0.00	0.00	0.00	0.00
NonPLR	Test statistics	125.84	-7.00	-8.12	11.14
	p-values	0.00	0.00	0.00	0.00
CAR	Test statistics	140.94	-7.66	-9.13	12.97
	p-values	0.00	0.00	0.00	0.00

4.2.2. Panel Cointegration Test

The Kao test for Cointegration tests the hypothesis Ho: No CointegrationVs Ha: All panels are cointegrated. The test has used different test statistic such as modified dickey fuller, augmented dickey fuller, unadjusted modified dickey fuller and unadjusted dickey fuller to test for the above mentioned hypothesis. Similarly, all these tests have resulted in the same conclusion that the variables have long run common trends (or cointegrated) at five percent significance level as it is presented in Table 4.3.

Table 4.3 Panel Cointegration test: Kao test for Cointegration

Ho: No Cointegration Ha: All panels are cointegrated	Number of panels = 17 Avg. number of periods = 8.18	
Cointegrating vector: Same		
Panel means: Included Time trend: Not included AR parameter: Same	Kernel: Bartlett Lags: 1.59 (Newey-West) Augmented lags: 1	
	Statistic	p-value
Modified Dickey-Fuller t	-3.37	0.00
Dickey-Fuller t	-5.04	0.00
Augmented Dickey-Fuller t	-4.19	0.00
Unadjusted modified Dickey-Fuller	-4.68	0.00
Unadjusted Dickey-Fuller t	-5.52	0.00

4.2.3. Result of Estimated Panel Regression

The following Table 4.5 presents the empirical results. For the outcome or response variable return on asset, this study presented a set of estimates following the strategy outlined under the methods. In the Table 4.5, we reported the effect of loan default on financial performance in commercial banks working in Ethiopia after controlling for banking size, banking efficiency, capital adequacy and banking liquidity status. The estimated and reported results were undergone different steps including diagnosis test. Moreover, instead of conventional standard error, this

result was used robust standard errors to allow for the correlation of observations within the banks, to account possible serial correlation and heteroscedasticity. The reported estimates are panel fixed effect model result and again for the simplicity of interpretation, we present the results in summary and also as estimated in Stata software package at the appendix.

Besides, the estimated outputs in Table 4.5 come after a set of estimation have been done. To decide between the random and fixed effect panel model, a Hausman test was applied. The test null hypothesis is that the preferred model is random effects (Green, 2008). It basically tests whether the unique errors (αi) specified in equation (1) are systematically correlated with the regressor (independent variable). Table 4.4 reported the result for Hausman test.

The Chi2 at the end of Table 4.4 is the results of Hausman test. This test has rejected the null hypothesis that "Ho: difference in coefficients not systematic" at 5% significance level. This indicates that, the fixed effect model is the preferred model to the random effect model. This confirms unmeasured bank characteristics such as staff health, ability of staff members or CEO, as well as preference heterogeneity correlation with loan default. This preferred fixed effect model is believed to remove the unobservable variables effect that is correlated with loan default provided that they are not varying over time.

Table 4.4 Hausman Test Result

	Coefficients ---- (b) (B) (b-B) sqrt(diag(V_b-V_B)) fixed random Difference S.E.
Bsize	.71.213 .49 .10
NonPLR	-.13 -.09 -.03 .008
EffRat	.03 .021.004 .001
LoDe	.01 .04 -.03 .006
CAR	-.01 -.02.009.02

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic
chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 16.09
Prob>chi2 = 0.0066

The estimated fixed effect regression is reported under the following Table 4.5. The first column shows estimate using conventional standard errors and the second column shows estimate using robust standard error clustered at bank level to account for possible correlation of variables with in banks. The difference between the two estimates is only on standard errors. The interpretation is however fully depending on the estimate using cluster standard error (Second column of Table 4.5). As indicated under Table 4.5 footnotes, "*" indicates at 5% significance level, "**" indicates at 1% significance level and "***" indicates at 0.1% significance level. The result seems to show negative and low statistically significant effect of loan default on financial performance of commercial banks in Ethiopia at 10 percent level of significance. The significance is not strong as it fails to be significant at planned 5% significance level. In fact, when conventional standard error is used, this variable is found to have significant effect at 5% significance level (see the original results in the Tables under Appendix I).

Table 4.5: Estimated Regression Output using Panel Fixed Effect Model

		(1)	(2)
		Dependent Variable→ROA	
		Estimate using Conventional standard error	Estimate using Clustered standard error
Independent Variables	Bank size	0.710***	0.710**
		(0.141)	(0.219)
	Loan default (NonPLR)	-0.127*	-0.127
		(0.062)	(0.067)
	Efficiency Ratio	0.025***	0.025***
		(0.002)	(0.005)
	Liquidity	0.007	0.007
		(0.011)	(0.011)
	Capital adequacy	-0.014	-0.014
		(0.031)	(0.031)
	_cons	-6.223***	-6.223**
		(1.576)	(2.079)
	N	173	173
	R2	0.563	0.563
	Rho	0.597	0.597
	AIC	403.002	401.002
	F	38.96 (p=0.00)	6.798 (p=0.00)

Standard errors in parentheses
*p< 0.05, **p< 0.01, ***p< 0.001

On the other hand, it shows that the variables such as banking size and banking efficiency ratio seem to have statistically significant effect on the financial performances of the commercial bank working in Ethiopia. And finally, the variables liquidity and capital adequacy ratio are found to have insignificant effect. Their implication and magnitudes of effect is further explored under discussion after diagnosis test has pursued to make sure that the estimated result is acceptable.

4.3. Model Diagnosis

One of the key assumptions for performing inference using the fixed effect approach to panel data models is the assumption of no serial correlation in the idiosyncratic errors, $\{u_{it}: t = 1, \ldots, T\}$. Heteroscedasticity can also be an issue. Fortunately, there are simple solutions for fully robust inference that is robust to arbitrary violations of the above mentioned assumption. The general approach to obtaining fully robust standard errors and test statistics is known as clustering. In this analysis, first, each explanatory variable correlation output shows existence of no perfect linear relationships among explanatory variables (Table 4.6). Second, robust standard error was used to account for not only serial correlation but also the heteroscedasticity of the variance. Hence, the variance of the demeaned errors, conditional on all explanatory variables, is expected constant. This ensures that the differenced errors are homoscedastic. Similarly, the demeaning in the idiosyncratic errors is uncorrelated (conditional on all explanatory variables and α_i). This means the demeaned errors are serially uncorrelated because it contained using robust standard errors. A more important thing is a variation explained by included explanatory variable in the result, which is explained by R^2 (see R-sq in Table 4.5). It shows a moderate (about 56 percent) variation in return on asset is explained by the variation in the included variables. Another important thing is a reliability of this result, which is explained by intra class correlation coefficient (see rho in Table 4.5). It shows a moderate (between 50 to 70 percent) reliability, extent to which correlation and measurements are replicated. In all cases, it found nothing to change the estimated results in the models of Table 4.5.

Table 4.6 Correlation Coefficients among variable used in this study

	ROA	Bsize	NonPLR	EffRat	LoDe	CAR
ROA	1					
Bsize	-0.02	1				
NonPLR	0.12	0.12	1			
EffRat	0.61	-0.28	0.30	1		
LoDe	-0.04	-0.02	-0.35	-0.43	1	
CAR	-0.07	-0.76	-0.28	0.017	0.32	1

4.4. Discussion

For the interpretation of the estimated coefficients, this study has relayed on the results in Table 4.5. In this table, the model fitted the results of fixed effect model for the effect of loan default on financial performance of commercial banks working in Ethiopia after controlling for other variables. Since all variables underwent some transformation, the estimated coefficients must be interpreted cautiously. An indicator for loan default is in ratio form. Similarly, returns on asset, banking efficiency, banking liquidity and capital adequacy are in the ratio form, whereas bank size is in natural logarithmic form. For this reason, the unit of interpretation is a percent on percent for each variable. Hence, for every one-unit increase in units of the significant variables, the ROE is expected to increase or decrease by approximately the percentage of corresponding coefficients. The variables whose p-value is less than 0.05 were considered statistically significant. The discussions of the findings are summarized in the following four points.

First, the loan default indicator, non-performing loan ratio, wasn't found to have strongly significant effect on financial performances of commercial banks working in Ethiopia at five percent significance level when robust standard error is used to account for possible serial correlation and heteroscedasticity. This variable was expected to have negative and again statistically significant effect on financial performances, although, the data we have used did not

revealed it. However, this indicator of loan default was found to have negative effect on banking performance in line with the theoretical argument that increase in the loan default increases the costs and then reduce financial performance of commercial banks in Ethiopia. The insignificance may be due to the fact that, the loan default in the commercial banks of Ethiopia is too low as it comprises of only about 2 percent of the total loan provided by the Ethiopian commercial banks. This negative effect was well documented in many literature (Mekasha, 2011; Mulugeta, 2013; Temerat, 2015 Kenned, 2016; Girma, 2011; Agegnehu, 2011; Hailu, 2016), although the statistical significance differs across the researches, the data used and the countries.

Second, among control variables, banking size is found to have positive and statistically significant effect to determine the financial performances. The BS, (coefficient=0.71), measures a banking size. Normally, increasing banking size will increase the financial performance, although its significance depends on how well the asset has been efficiently utilized. This finding show that banking size is positively and statistically significantly determining financial performance of commercial banks in Ethiopia at 5 percent significance level. Accordingly, a one percent increase in banking size will likely increases the financial performances of commercial banks in Ethiopia by about 0.76 percent, keeping other things constant. This finding was supported by Biplab K and Inder S (2018).

Third, another control variable, efficiency ratio is found to have positive and statistically significantly effect in determining the financial performances. This variable is calculated by the ratio of non-interest income to non-interest expense of each bank. It generally refers to the degree of a process to the level of success of processing within an organization, the cost effectiveness of a market, or the erosion of income by expense in each bank. Hence, the significantly growing efficiency ratio in the Ethiopia commercial banks is contributing positively

and significantly to financial performances at 5% percent significance level. Consequently, a one percent increase in efficiency ratio will likely increases financial performances by 0.03%, on average, keeping other things constant. This finding is also consistent with the finding in Kenya by Ngunyu (2013).

Fourth, the liquidity indicator is found to have positive and statistically insignificant effect in determining the financial performances. This variable is calculated by the ratio of loan to deposit ratio of each bank. Liquidity reflects the capacity of a bank to pay the debts on a short term and to cope with unexpected withdrawals of depositors. In order to tribute these obligations and in general to be able to provide liquidities, the bank must be liquid. Hence, the liquidity ratio in the Ethiopia commercial banks is contributing positively to financial performances. Although this finding fails to show its statistical significances, the direction of its effect is similar to the findings in the paper done by Demirgunes (2016) in the Turkish retail industry.

Finally, the capital adequacy ratio indicator is found to have negative and statistically insignificant effect in determining the financial performances. This variable is calculated by the ratio of capital to asset of each bank. It reflects bank ability to protect depositors and to promote the stability of a country's financial system in the long term. Hence, its negative effect indicates the Ethiopia commercial banks becoming more cautious about their long term protection of its customer. Although this finding fails to show its statistical significances, the direction of its effect is found similarly to the findings in the research done by Kamande (2016), but contradicts the research done by Shabani et al (2019).

In sum, the findings show that having strongly efficient banking and large banking size significantly improve financial performances of the commercial banks working in Ethiopia.

Again, although loan default (nonperforming loan) is reducing financial performances, the data we have used does not show it's statistically significance. Moreover, the average loan default is significantly higher in public bank (Commercial Bank of Ethiopia) compared to private banks.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The purpose of this study was to see the effect of loan default on the financial performance of commercial banks in Ethiopia. We explored this issue using the data collected from National Bank of Ethiopia and financial statement in each commercial bank. The collected data were explored first using summary statistics and trends and then the model is estimated using fixed effect panel regression model.

Our key findings are twofold. Firstly, having banking efficiency and having large banking size significantly improves the financial performances of the commercial banks working in Ethiopia. Secondly, although the loan default (nonperforming loan) is reducing financial performances of the commercial banks in Ethiopia, the effect is statistically less significant which may be linked to the low percentage of loan default in Ethiopian case. Whatever it is, loan default is reducing the financial performances of commercial banks in Ethiopia.

It is worth asking if these results are specific only to the case of Ethiopia commercial banks, or if they have broader application. We hope that the context under investigation is characteristic of the majority of the developing countries. The majority of developing countries experience the challenges in banking sectors performances. Whatsoever, loan default is contributing negatively to financial performances, although the significance was very small (statistically insignificant). So, this study area may serve as a case of how loan default development contributed to financial performances.

The drawback in this study is lack of long time data in Ethiopia context and observational nature of this study. This study used a data of only eleven years repeated for each commercial bank working in Ethiopia. It would be beneficial to pursue additional research in Ethiopia in order to set the most appropriate policies; much remains to be understood about the effect of loan default developments using intervention. Openly, more complete data would be recommended in order to further analyse the effect of loan default development on financial performances.

5.2. Recommendation

The findings clearly show that increasing banking size and efficient will significantly improve the financial performances of commercial banks in Ethiopia. Again, having lower loan default improves the financial performances of commercial banks, although the data we have used fail to show strong statistical significance. Hence, this study recommends that, commercial Banks operating in Ethiopia should minimize the loan default by determining creditworthiness of potential customer during their loan disbursement to improve their performances.

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Appendix I: Panel Fixed effect regression output using conventional and clustered standard error and t-test result

Table 4.7: Fixed Effect Regression Output Using Conventional Standard Error

```
Fixed-effects (within) regression               Number of obs      =       173
Group variable: BID                             Number of groups   =        17

R-sq:                                           Obs per group:
     within  = 0.5633                                         min =         5
     between = 0.1177                                         avg =      10.2
     overall = 0.2970                                         max =        11

                                                F(5,151)           =     38.96
corr(u_i, Xb)  = -0.6693                        Prob > F           =    0.0000
```

ROA	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Bsize	0.71	0.14	5.04	0.00	0.43	0.99
NonPLR	-0.13	0.06	-2.04	0.04	-0.25	-0.00
EffRat	0.03	0.00	12.64	0.00	0.02	0.03
LoDe	0.01	0.01	0.62	0.54	-0.01	0.03
CAR	-0.01	0.03	-0.45	0.65	-0.08	0.05
_cons	-6.22	1.58	-3.95	0.00	-9.34	-3.11
sigma_u	0.98					
sigma_e	0.98					
rho	0.60	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(16, 151) = 3.82                     Prob > F = 0.0000
```

Table 4.8: Fixed Effect Regression Output Using Clustered Standard Error

```
Fixed-effects (within) regression               Number of obs      =       173
Group variable: BID                             Number of groups   =        17

R-sq:                                           Obs per group:
     within  = 0.5633                                         min =         5
     between = 0.1177                                         avg =      10.2
     overall = 0.2970                                         max =        11

                                                F(5,16)            =      6.80
corr(u_i, Xb)  = -0.6693                        Prob > F           =    0.0014

                                         (Std. Err. adjusted for 17 clusters in BID)
------------------------------------------------------------------------------
             |               Robust
         ROA |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Bsize |        0.71       0.22     3.24   0.01        0.25        1.17
      NonPLR |       -0.13       0.07    -1.90   0.08       -0.27        0.01
      EffRat |        0.03       0.00     5.26   0.00        0.01        0.04
        LoDe |        0.01       0.01     0.58   0.57       -0.02        0.03
         CAR |       -0.01       0.03    -0.45   0.66       -0.08        0.05
       _cons |       -6.22       2.08    -2.99   0.01      -10.63       -1.82
-------------+----------------------------------------------------------------
     sigma_u |        0.98
     sigma_e |        0.98
         rho |        0.60   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Table 4.9: Result from Independent t test for comparing the ratio of NPL for Public Bank with Privates

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
CBE	11	3.177791	.2778133	.9214024	2.558784	3.796797
Oth	11	1.932349	.1303095	.4321876	1.642002	2.222697
combined	22	2.55507	.2022004	.9484039	2.134571	2.975569
diff		1.245441	.3068563		.6053504	1.885532

diff = mean(CBE) - mean(Oth) t = 4.0587
Ho: diff = 0 degrees of freedom = 20

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.9997 Pr(|T| > |t|) = 0.0006 Pr(T > t) = 0.0003