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Determinants of Credit Risk in Ethiopian Microfinance Institutions

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BAHIR DAR UNIVERSITY

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DETERMINANTS OF CREDIT RISK IN ETHIOPIAN MICROFINANCE INSTITUTIONS

BY -EDLAMU ALEMIE

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A THESIS PAPER SUBMITTED TO

DEPARTMENT OF ACCOUNTING AND FINANCE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF SCIENCE IN ACCOUNTING &FINANCE

BY

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JULY, 2022

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Declaration

This is to certify that the thesis entitled "Determinants of credit risk in Ethiopian microfinance institutions", submitted in partial fulfillment of the requirements for the Master of science in Accounting and Finance of Department of Accounting and Finance, Bahir Dar University, is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been duly acknowledged.

Edlamu Alemie	_____	**July 2022**
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APPROVAL OF THESIS FOR DEFENSE

I hereby certify that I have supervised, read and evaluated this thesis titled "**Determinants of credit risk in Ethiopian microfinance institutions**" prepared by Edlamu Alemie under my guidance. I recommend the thesis be submitted for oral defense.

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APPROVAL OF THESIS FOR DEFENSE RESULT

We hereby certify that we have examined this thesis entitled "**Determinants of Credit Risk in Ethiopian Microfinance Institutions**" by Edlamu Alemie. We recommend that ___is approved for the degree of "Master of Science (MSC) in Accounting and Finance.

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Abstract

Credit risk is the financial risk arising from a microfinance institution's dependence on another party (counterparty) to perform an obligation as agreed. Credit risk management and control are so critical for microfinance firms to remain competitive and appealing. As a result, the primary goal of this study was to empirically investigate the determinants of credit risk in Ethiopian microfinance firms. A fixed effect regression model was used in the investigation. Thirteen microfinance institutions were taken as a sample. The researcher used a purposive sampling technique to select those Thirteen microfinance institutions. The data covered from the period 2012-2020 were used for analysis. The data was collected from national banks of Ethiopia, the association of Ethiopian microfinance institutions and world bank data. A Balanced longitudinal/panel secondary dataset were used in this study. Also, Explanatory research design, quantitative research approach and positivism paradigm were employed to examine the effect of explanatory variables (profitability, operating efficiency, leverage, loan growth, liquidity, capital adequacy, age, firms' size, GDP growth rate, broad money supply (M2), lending rate, Inflation rate and Unemployment rate) on the dependent variable (credit risk). The major findings of the study revealed that Loan growth rate, Return on Asset and Liquidity had a negative and statistically significant effect on credit risk. Whereas, leverage and size had a positive and statistically significant effect on credit risk. All the rest of the explanatory variables, were statistically insignificant in explaining credit risk of Ethiopian microfinance institutions under the study period. Thus, Loan growth rate, Leverage, size, return on asset and Liquidity are the most powerful variables for variation in credit risk among microfinance institutions in Ethiopia.

Key words: Determinants, credit risk, microfinance institutions, and Ethiopia

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Abbreviations and Acronyms

ACSI- Amhara Credit and Saving Institution

ADCSI-Addis Credit and Saving Institution

AEMFI-Association of Ethiopian Microfinance Institution

AVFS-Africa Village Financial Service

CR-Credit Risk

DECSI- Dedebit Credit and Saving Institution

MFI-Microfinance Institution

NBE- National Bank of Ethiopia

OCSSCO- Oromia Credit and Saving Share Company

PAR- Portfolio at Risk

ROA- Return on Asset

CHAPTER ONE-INTRODUCTION OF THE STUDY

Introduction

This chapter includes the following; background of the study, statement of the problem and continued with the research hypothesis, objective of the study, significance of the study, scope of the study, limitation of study and organization of the paper.

1.1 Background of the Study

Ethiopia is the second most populous country in Africa next to Nigeria, with a population of about 115 million people in 2020; from these around 79% of the population resides in rural areas (Worldometer, 2022). And it is widely recognized that the exclusion of the poorest borrowers, particularly in rural areas, from the financial banking system is one of the main obstacles to sustainable development and poverty reduction. In fact, for rural poor living in riskier environments and lacking in assets, formal wage jobs and limited credit history, it is almost impossible to obtain credit from the formal banking system as lending to them has become very risky and very costly . The failures of formal banks in the rural sector, particularly the poor repayment rates of agricultural state banks that had provided subsidized loans to rural farmers, have led to innovative credit institutions that are microfinance institutions. This type of organization has become an increasingly popular vehicle that can alleviate poverty by providing small, unsecured loans to poor clients (Ibtissem and Bouri, 2013).

Financial institutions (FIs) are very important in any economy as they can mobilize savings and loans for productive investment and facilitate capital flows to different sectors of the economy, thereby stimulating investment and increasing productivity (Richard, 2011). Among formal financial institutions, MFIs provide savings and microcredit to small and medium-sized enterprises (SMEs) and farmers. In this regard, there are major gaps in terms of geographic coverage, types of financial service products, and viability requirements to access credit for investment, working capital for large companies, or start-up loans for farmers. In addition, young people face difficulties in accessing start-up loans from the formal financial institutions due to a lack of collateral and financial literacy education. In general, the lack of diversified financial

products and the limited geographic coverage of formal financial institutions combined with difficulties in accessing skill training, farm inputs and markets exacerbate youth unemployment in rural and urban areas (Morka and Wamatu, 2020).

To overcome these challenges, Microfinance institutions (MFIs) have served a large number of clients (breadth of outreach) and at the same time ensure coverage for those living with high relative poverty levels (depth of outreach) with financial services needed for both consumption and enterprise development (Abdulai and Tewari, 2017). In doing so, MFIs face various risks that can be categorized into five: Strategic risk, Credit risk (CR), Liquidity risk, Interest rate risk & Operational risk (NBE, 2010).

These risks have varying effects on the performance of MFIs. When compared to others, the extent and degree of loss generated by CR are significant enough to create failures. This is evidenced not only by a consistent growth of credit risk (CR) as measured by PAR>30, but also by the percentage which is greater than the world average (AEMFI, 2021).Since loan portfolios are the most important asset of the lending institutions, the value of the loan portfolio depends not only on the interest rates earned on loans, but also on the probability of interest and principal being paid. Lending is the main business activity of all MFIs. The loan portfolio is typically the largest asset and the predominant source of income. As such, it is one of the greatest sources of risk to the safety and soundness of an MFI. Whether due to lax credit standards, poor portfolio risk management or economic weakness, problems in the loan portfolio have historically been the main cause of losses and defaults for MFIs. Effective loan portfolio management is fundamental to the safety and soundness of a microfinance institution (Jansson, 2003).

Hence, it is better to know the factors that determine credit risk in order to manage credit risk in Microfinance Institutions. Due to this fact, different researches were conducted in this area. Majority of the researches were conducted using primary data to assess incidences of credit default by surveying of borrower's opinion, and they didn't address determinants of credit risk by using firm-specific and macroeconomic variable. However, few researches were conducted on the determinants of credit risk on the side of the microfinance institutions using secondary data, Such as; Rono (2020); Tehulu & Abegaz (2016); Tilahun (2015); Adugna (2014) and Tapano (2012), and their results were inconsistent towards the effect of Inflation, size of the

firm, ROA, operating efficiency, loan growth, lending rate, capital adequacy, Leverage, age and liquidity on credit risk. In general, the inconsistency (except variables like lending rate which was done by a single researcher) of findings among Ethiopian researchers may be the result of difference in sample, data collection period or it may be the degree of care given among them. And also, the inconsistency of findings compared to researchers abroad may be the result of difference in countries economic policy in addition to the above-mentioned causes. The reason to conduct this study is therefore to examine factors affecting the credit risk of Ethiopian microfinance institutions by increasing the number of observations, this is to alleviate the ambiguity towards their effects on credit risk of Ethiopian MFIs and by adding new variables such as; GDP growth rate, Unemployment rate and broad money supply. Additionally, all of the aforementioned researches were conducted before the year 2015 G.C. So, this research is believed to represent the current credit risk determinant factors in Ethiopian microfinance institutions.

1.2 Statement of the Problem

Credit risk is the financial risk that arises from a microfinance institution's dependence on another party (counterparty) to fulfill an obligation as agreed. It is the risk to income or capital due to borrowers defaulting on and not repaying the loan obligation. Credit risk includes both income losses resulting from MFIs' inability to collect expected interest income and capital losses resulting from loan defaults (NBE, 2010).

In 2020, the 33 MFIs in Ethiopia delivered loans to 5.1 million clients. The three largest MFIs; namely OMO (27.4%), ACSI (25.5%) and OCSSCO (21%) accounted for 74% of all borrowers. Unexpectedly, the large peer group MFIs accounted for 99% of total clients, while the remaining MFIs accounted only for 1 % of the total borrowers. From this analysis, one can say that Ethiopia microfinance industry market is almost monopolized by the largest four MFIs; ACSI, OMO, OCSSCO and DECSI in all outreach indicators. Which means the industry's performance is highly depend on the performance of these institutions. Any negative performance (risk) happened to one of these institutions can significantly affect the whole performance of the industry (AEMFI, 2021).

In 2017, Ethiopian microfinance institutions credit risk as measured by PAR>30 was an average of 3.5%. However, Degaf MFI maintain relatively poor portfolio quality with PAR>30 days of 14.28% (AEMFI, 2018). This weak portfolio was evidenced by the PAR value which is higher than the industry’s average. Also, in 2019, PAR>30 days was an average of 6.06%. However, Debo and AVFS maintain relatively poor portfolio quality, with an average PAR>30 days of 24.89% and 19.18% respectively. The result of Debo and AVFS were widely far from the industries average (AEMFI, 2020).

The latest value in 2020 was an average of 10.8%. However, afar and AVFS MFI maintain relatively poor portfolio quality, with an average PAR>30 days of 23% and 35.58% respectively. In contrast, Latin America and South Asia reported PAR of 4.5% and 0.7% respectively (AEMFI, 2021). This shows, credit risk in Ethiopian microfinance institution is recently increased at increasing rate and those points tell us credit risk in Ethiopian microfinance institutions is higher when it is compared to a peer microfinance institution abroad.

According to AEMFI (2018), although the PAR varies from region to region, a PAR ratio that goes above 8% (or a Total Risk Ratio beyond 10%) should be a cause for worry, because unlike loans of commercial banks, most loans are not backed by bankable collaterals. When we see Ethiopian MFIs credit risk in 2020 it is greater than the above benchmark. This indicates that credit risk is a serious issue in Ethiopia. Therefore, effective loan portfolio management is fundamental to the safety and soundness of a microfinance institution.

Managing credit risk isn't possible without knowing and controlling the factors influencing it. In literature, there are several variables that are claimed to be determinants of credit risk. The result of the study undertaken in our country as well as outside Ethiopian related to the topic revealed that Microfinance credit risk can be influenced by distinctive variables such as Inflation, lending rate, size of the firm, ROA, operating efficiency, leverage, loan growth, Capital Adequacy, age and liquidity.

According to the research conducted by Adugna (2014); Tilahun (2015) inflation had a positive and statistically insignificant impact on the credit risk of Microfinance institutions in Ethiopia. In contrast, the research conducted by Rono (2020) shows that, inflation have a negative and insignificant and impact on credit risk of Microfinance institutions. The Size of MFIs had a negative and statistically significant effect on credit risk, the result was evidenced by the findings of Tehulu & Abegaz (2016)**;** Tilahun (2015); Adugna (2014); Tapano (2012). Incontrast, Kassa (2018) revealed that, size had a positive and significant effect on credit risk.

Based on the findings of Tehulu & Abegaz (2016); Adugna (2014) profitability has a negative and statistically significant effect on credit risk of Microfinance institutions. In contrast, Tilahun (2015) showed that, ROA has a positive and statistically significant impact on credit risk. Further Ganic' (2014), found that a positive but statistically insignificant effect of ROA on credit risk.

According to Tilahun (2015) Operating efficiency had a statistically insignificant impact on credit risk. Whereas, Tehulu & Abegaz (2016); Tapano (2012) showed that, operating efficiency has a negative and statistically significant impact on credit risk of Microfinance Institutions. The study conducted by Tehulu & Abegaz (2016), found a positive & insignificant impact of leverage on credit risk, while Adugna (2014) shows that, a positive & statistically significant

impact of leverage on the credit risk of microfinance institutions. Whereas, Tapano (2012), shows that leverage has a negative and significant effect on Credit risk. Further, based on the findings of Tehulu & Abegaz (2016), liquidity has no effect on the credit risk of Microfinance institutions. In contrast, Adugna (2014); Tapano (2012) shows that, liquidity has a positive and significant effect on credit risk.

The research conducted by Adugna (2014), revealed that, age of Microfinance institution has a positive and significant effect on credit risk. Whereas, Tehulu & Abegaz (2016) shows that, age didn't have an impact on credit risk. Moreover, Based on the findings Tilahun (2015), capital adequacy has a negative and significant impact on credit risk of MFIs. In contrast Tapano (2012) found a stastically insginficant impact of Capital Adequacy on Credit risk of MFIs. Finally, Tilahun (2015) found a negative and insignificant impact of lending rate on credit risk, while he found a postive and stastistically insignificant impact of loan growth on credit risk of MFIs.whereas, Ganic' (2014) found negative and statistically significant effect of credit growth on credit risk.

As the researcher mentioned above, prior researchers mainly focused on common factors. Such as: Inflation, lending rate, size of the firm, ROA, operating efficiency, leverage, loan growth, capital adequacy, age and liquidity and they got different results for the same variable (except variable lending rate). In order to fill this literature gap, the researcher motivated to undertake research by increasing the number of observations.

In this study, the effect of Inflation, size of the firm, profitability, operating efficiency, leverage, age, capital adequacy and liquidity were examined again in order to alleviate the ambiguity towards their effects on credit risk of Ethiopian Microfinance Institutions. Additionally, this paper examined lending rate again to verify their pervious results. Furthermore, unlike the previous researchers, this study examined the effect of Gross domestic product, Unemployment and money supply on credit risk of Ethiopian Microfinance Institutions for the first time and the study period is unique from the previous researchers except the year from 2012 - 2014.

1.3 Objectives of the Study

1.3.1 General Objective

The main objective of this study is to examine determinants of credit risk in Ethiopian microfinance institutions.

1.3.2 Specific Objectives

The following are specific objective of the study

1. To investigate the effect of macroeconomic variables (such as; GDP growth rate, broad money supply (M2), lending rate, Inflation rate and Unemployment rate) on credit risk of microfinance institutions.
2. To examine the effect of MFIs specific variables (such as: profitability, operating efficiency, leverage, loan growth, liquidity, age, Capital adequacy and firms' size) on credit risk of microfinance institutions.

1.4 Research Hypothesis

H1: GDP growth has a significant impact on credit risk of Ethiopian MFIs.

H2: Inflation rate has a significant impact on credit risk on Ethiopian MFIs.

H3: money supply has a significant impact on credit risk of Ethiopian MFIs.

H4: unemployment rate has a significant impact on credit risk of Ethiopian MFIs.

H5: Lending rate has a significant impact on credit risk of Ethiopian MFIs.

H6: ROA has a significant impact on credit risk of Ethiopian MFIs.

H7: operating efficiency has a significant impact on credit risk of Ethiopian MFIs.

H8: Liquidity has a significant impact on credit risk of Ethiopian MFIs.

H9: Firms' Size has a significant impact on Credit risk of Ethiopian MFIs.

H10: Age has a significant impact on with credit risk of Ethiopian MFIs.

H11: loan growth has significant impact on credit risk of Ethiopian MFIs.

H12: leverage has a significant impact on credit risk of Ethiopian MFIs.

H13: capital adequacy ratio has a significant impact on credit risk of Ethiopian MFIs.

1.5. Significance of the Study

The outcomes and recommendations of the research will help Ethiopian microfinance institutions to manage their credit risk by giving them an insight on what factors influence it and identify which variable is the most important one. The findings of this study can also be used in the development of regulatory standards with regards to central bank's lending policies. Finally, the study benefit researchers, analysts and academicians who wish to conduct further studies and increase the body of knowledge on the impact of firm-specific and macroeconomic variables on MFI credit risk in Ethiopia and particularly in the developing economy at large and future credit researchers can use this information to understand what has been done and build on it for new or comparative studies.

1.6. Scope/Delimitation of the Study

The scope of this study was limited to examine the determinants of credit risk in Ethiopian microfinance institutions using nine years' panel data from the period 2012 to 2020 only. The reason for this is to obtain a sufficient number of observations without affecting the number of microfinance institutions included in the study. To this end, this study was limited to examine the macro and MFIs specific variables that affect credit risk (such as; GDP growth rate, broad money supply (M2), lending rate, Inflation rate, Unemployment rate, profitability, operating efficiency, leverage, loan growth, capital adequacy, liquidity, age and firms' size).

1.7. Limitation of the study

Although the study was well conducted, it is not free from some constraints. At the initial stage of the paper there were fourteen explanatory variables. However, during the investigation the variable productivity was excluded from the study because there was no sufficient data that suits for balanced panel data set. Likewise, at the beginning of the paper fifteen MFIs were selected purposively, but from those two-microfinance institution namely: Somali and One MFIs were excluded from the study because of inadequate data for balanced panel data.

1.8. Organization of the Paper

This study has five chapters. The first chapter focus on the introductory parts; such as background of the study, statement of the problem, objective of the study, hypothesis, significance of the study, scope, limitation of the study, and organization of the study. The second chapter deals with review of related theoretical and empirical literatures. The third chapter deals with research methodology; which includes research paradigm, research design, types and sources of data, methods of data collection and techniques, target groups and sampling design and methods of data analysis. The fourth chapter contains data presentation, analysis and interpretation. Finally, the last chapter concerned with conclusions drawn and recommendations forwarded by the researcher.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

Introduction

This chapter consists of the theoretical and empirical parts of related literature. In the theoretical review part, the theories that state the credit risk, such as; theory of financial exclusion, portfolio theory and the theory of asymmetric information have been discussed. The empirical literature part discusses past studies that were conducted in the area of factors determining credit risk. In this part, the variables that were included, the methodology that was used to undertake the study, and the results of the studied under review have been discussed. This chapter ends by discussing factors that determine credit risk and by presenting the conceptual framework of the study.

2.1. Overview about Microfinance Institution

2.1.1. Definition and Necessitate for Microfinance Institutions

The definition of microfinance institutions proposed by some authors and organizations seems to differ from each other. However, the essence of the definition is usually the same; in microfinance is a category of financial services aimed at individuals and small businesses who do not have access to traditional banking and related services. Microfinance increases household income and enables them to increase their savings and investment capacity. Therefore, microfinance plays an important role at the economic level, as it allows low-income people to obtain small loans to participate effectively in the local economy and achieve financial stability that gives them more autonomy. Microfinance is the provision of a wide range of financial services, such as deposits, loans, payment services, money transfers and insurance, to poor and low-income households and their micro-enterprises. It encompasses a variety of financial activities that facilitate micro-enterprises and help low-income households and the poor to self-develop and raise living standards. It can be called as a special type of banking sector service which addresses financially excluded population, generate employment opportunities and fulfill needs (Zeb *et al.*, 2021). MFIs also offer savings and microloans to small and medium-sized enterprises (SMEs) and farmers. In this regard, there are major gaps in terms of geographic coverage, types of financial service products, and viability requirements to access credit for investment, working capital for large companies, or start-up loans for farmers. In addition, young people face difficulties in accessing start-up loans from the formal financial institutions due to a

lack of collateral and financial literacy education. In general, the lack of diversified financial products and the limited geographic coverage of formal financial institutions combined with difficulties in accessing skill training, farm inputs and markets exacerbate youth unemployment in rural and urban areas (Morka and Wamatu, 2020).

Limited access to financial services is one of the main problems hampering rural livelihood development (Wijesiri, Yaron and Meoli, 2017). The problem is particularly acute in developing countries like Ethiopia for two main reasons. First, most of the country's conventional banks are concentrated in urban areas, while more than 80% of the population lives in rural areas. Second, whenever available, the conventional banking sector systematically excludes the rural poor due to higher appraisal, monitoring and enforcement costs (Wassie, Kusakari and Sumimoto, 2019).

In addition, most poor people are excluded because of their socioeconomic status and because they cannot meet the requirements of a formal banking institution (FINCA, 2020). The failures of formal banks in the rural sector, particularly the poor repayment rates of agricultural state banks that had provided subsidized loans to rural farmers, have led to innovative credit institutions that are microfinance institutions. This type of organization has become an increasingly popular vehicle that can alleviate poverty by providing small, unsecured loans to poor clients (Ibtissem and Bouri, 2013).

2.1.2. The Development of Microfinance Institutions in Ethiopia

In Ethiopia microfinance institutions were first established by Proclamation No. 40/1996. The development of MFIs in Ethiopia now has a legal basis as the government proclamation paved the way for their establishment. As a result, various MFIs were legally registered and started providing microfinance services. Spread across rural and urban areas, MFIs provide legitimate deposit services to the public with powers to draw and accept bills of exchange and manage funds for microfinance companies. The average age of the Ethiopian microfinance institution is 14 years. However, it has experienced rapid growth and is aggressively striving to achieve large and broad geographic coverage. Dominance of state-backed MFIs, focuses on rural households, offers both credit and savings services and emphasizes sustainability (AEMFI, 2021).

According to NBE (2022) there are 41 microfinance institutions which are registered and operated in Ethiopia. In 2020, the performance of thirty-four MFIs in Ethiopia (which are member of the AEMFI), have a total capital of close to 88 billion Ethiopian birr (ETB) and serving around 5.1 million clients in all parts of Ethiopia. the conventional service provided by MFIs include collecting saving, providing group and individual loans, micro leasing activities , micro insurance and domestic money transfer service (AEMFI, 2021).

2.1.3. Risks Associated with Ethiopian Microfinance Institution

According to NBE (2010), Risk-taking is an inherent element and an integral part of financial services in general and microfinance in particular, and profits are indeed partly the reward of successful risk-taking in business. On the other hand, excessive and poorly managed risks can lead to losses, thereby jeopardizing the safety and soundness of microfinance institutions and the safety of microfinance institutions' depositors. As a result, microfinance institutions may miss their social and financial goals. This implies that proactive risk management is essential for the long-term sustainability of microfinance institutions (MFIS). Based on this, NBE identified five common types of risks in Ethiopian microfinance institutions; these are Strategic risk, Credit risk, Liquidity risk, Interest rate risk and Operational risk. Each is explained as follows;

- **Strategic risk**: refers to the potential negative impact on a microfinance institution’s earnings and capital that can arise in circumstances where decisions taken by the organization or the manner in which business strategies are executed result in losses or missed opportunities for the organization to remain relevant in the marketplace as a viable and profitable business entity, and It relates to a microfinance institution’s ability to effectively, efficiently and prudently respond to business opportunities in a manner that reflects a strong vision and the ability to employ the resources necessary to achieve organizational goals in a lucrative and long-term way. One of the most underestimated and underestimated risks within MFIs is the risk of having an inadequate structure or body to make effective decisions (which is the governance risk, which is one of the critical strategic risks.
- **Credit risk;** is the financial Risk arising from a microfinance institution's dependence on another party (counterparty) to perform an obligation as agreed. It is the risk to income or capital due to borrowers defaulting on and not repaying the loan obligation. Credit risk

includes both income losses resulting from MFIs' inability to collect expected interest income and capital losses resulting from loan defaults. Microfinance institutions need to manage the credit risk inherent in the entire portfolio as well as the risk of individual loans or transactions. In addition, microfinance institutions should be aware that credit risk does not exist in isolation from other risks, but is closely intertwined with these risks. Credit risk is measured by portfolio at risk (PAR), which is calculated by dividing the Outstanding balance of all loans with arrears Over 30 days, plus all renegotiated (or restructured) loans (Renegotiated or restructured loans are loans where the borrower has repayment difficulties and a revised payment schedule is made so that the MFI is able to recover a loan that would otherwise go unpaid. These loans therefore present a risk to the lending institution), by the outstanding gross loan portfolio. The data used for this indicator is calculated at a specific point in time. PAR can be specified for different time increments, e.g., PAR30, PAR60, PAR90 or PAR180, which represent the balance of loans with arrears over 30, 60, 90 or 180 days respectively. PAR30 is used as the best rating of credit risk measurement in microfinance (AEMFI, 2020).

- **Liquidity risk**; is the risk of not being able to meet commitments, repayments and withdrawals at the right time and in the right place. The purpose of liquidity management is to ensure that each microfinance institution can fully meet its contractual obligations.
- **Interest rate risk**; is the exposure of microfinance institutions to adverse interest rate movements. taking this risk is a normal part of the business of microfinance institutions and can be an important source of profitability and shareholder value. however, a bit much interest rate risk can give rise to a significant threat to microfinance institutions' earnings and capital base. changes in interest rates affect the earnings of microfinance institutions by changing their net interest income and the level of other interest-sensitive income and operating expenses.
- **Operational risk**; is the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events or unforeseen catastrophes. It includes the exposure to loss resulting from the failure of a manual or automated system to process, produce or analyze transactions in an accurate, timely and secure manner. Operational risk therefore is imbedded in all of the microfinance institution's operations, including those supporting the management of other risks.

2.2. Theoretical Review

In this section the theory of financial exclusion, modern portfolio theory and the theory of asymmetric information are presented.

2.2.1. The Theory of Financial Exclusion

Financial exclusion is the lack of access for certain consumers to adequate, inexpensive, fair and safe financial products and services from mainstream providers. Financial exclusion becomes a bigger problem in the Community when it affects consumers on low incomes and/or those people in financial difficulties. Financial exclusion can be observed at the individual, family or household level, but can also be highly concentrated in suburbs or regions and sometimes in ethnic minorities within a suburb or region. Financial exclusion can also apply to individual small businesses, NFPs and other collaborative ventures (Choudhury and Bagchi, 2016).

Generally, it is widely recognized that the exclusion of the poorest borrowers, particularly in rural areas, from the financial banking system is one of the main obstacles to sustainable development and poverty reduction. Indeed, it is nearly impossible for rural poor individuals who live in riskier areas, lack assets collateral, a regular wage employment, and have a limited credit history to receive credit from the conventional banking system since lending to them has become extremely dangerous and expensive. The failures of formal banks in the rural sector, particularly the poor repayment rates of agricultural state banks that had provided subsidized loans to rural farmers, have led to innovative credit institutions that are microfinance institutions. This type of organization has become an increasingly popular vehicle that can alleviate poverty by providing small, unsecured loans to poor clients (Ibtissem and Bouri, 2013).

The relevance of this theory to this research area is that, when majority of the people exclude from the formal banking system, they alternatively rely on microfinance institution to satisfy their financial needs without securing collateral and this will increase the likelihood of default risk.

2.2.2. Portfolio Theory

The history of modern portfolio management (also known as modern portfolio theory (MPT)), originates with the seminal academic work of Markowitz. MPT introduced the concept of risk-

return tradeoffs, asset return correlations, portfolio selection, and investment optimization. Using these concepts MPT is a prescriptive rather than descriptive theory that offers a solution for investors by showing what is the best combination of available assets in a portfolio to maximize the expected total return for a given amount of risk, or alternatively in to minimize portfolio risk at a given level of expected return. An asset's risk is measured as the variance of that asset's return, where the variance is a measure of how returns can deviate from their expected value. The portfolio's return variance is thus the sum of the square of the fraction held in a given asset (weight) times the asset's return variation over all assets (Beyhaghi and Hawley, 2013).

There are a number of critical underlying assumptions of MPT about the behavior of individuals, which are typically and usually implicitly also made about institutional behavior, whatever the problems with that linkage. Some of these assumptions are also taken by the efficient market hypothesis (EMH). First, that the investor is rational. The rational investor assumption ("homo economics," i.e., utility maximization and calculation) serves as the foundation for the EMH, which is itself accepted by MPT. The EMH assumes, in turn, that information is symmetric, (all actors have equal and timely access to all relevant information); information is comprehended, digested, and therefore becomes "knowledge," and that such knowledge is promptly used (Beyhaghi and Hawley, 2013).

The theory was found to suitable in this study since it provides the basis for assessment of vector of risk such as interest and inflation rates that can impact on management of assets which in this case the portfolio of loans in MFIs. This theory applies in this study in that, loan performance can be influenced by vector of risks such as interest and inflation rate.

2.2.3. Theory of Information Asymmetry

Economists have long debated what to do when information is imperfect. The basis of early neoclassical assumptions presented information as perfect. This thinking was used in the various models and scenarios that these economists would use to display a structured representation of the real world. Perfect information is a situation in which every acting economic actor fully understands the consequences of his actions. This can happen during any form of transaction, either money or barter. The agent has reflected and outlined how this will affect himself, those around him, his future well-being, and even the environment. The information about the thing

being purchased or bartered for is understood by the economic actor. Both actors truly understand all of the properties connected with the object. This will eventually lead to a market pricing equilibrium. A market failure occurs when anything interferes with this process (Merrill, 2017).

The disparity between what the vendor knows and what the buyer knows is referred to as information asymmetry. Information asymmetry in contract theory is the study of decisions in transactions where one party has more or better information than the other. This can create a power imbalance, resulting in the transaction causing a market failure. Adverse selection, moral hazard, and information monopoly are examples of failures. For the purpose of this work, we will focus mainly on the principal-agent perspective, using supporting views form the firm and aggregate level (Merrill, 2017).

This knowledge imbalance causes difficulties with adverse selection and moral hazard. These latter ones begin with a circumstance marked by information asymmetry. The difference between these two similar concepts is temporal. Adverse Selection assumes a situation before signing the contract. This is to make the choice between goods or agents that remain the same after signing a contract but do not reveal their true nature after signing. In fact, after signing such a contract, moral hazard arises. This situation is characterized by the agents being able to change their behavior after signing the contract. As a result, the insurer is required to take the necessary measures to counteract these two phenomena of negative selection and moral hazard, which can affect the company's productivity (Feki, 2016).

The theory is relevant to this study because eradication of information asymmetry improves management of credit risk and reduces credit risk. Any hidden or classified information held by either the financial institutions or the borrowers affect management of loan portfolio. Therefore, the processes of appraisal of loans need to be done in a diligent manner through either loan or credit officer. The knowledge generated in this study intends to minimize information asymmetry as far as variables that have impact on credit risk are concerned.

2.3. Empirical Review

This section provides the relevant empirical review related to credit risks which were conducted in different countries across the world and particularly Ethiopia in focus. It also presents factors that determine credit risk of MFIs with supportive theoretical and empirical evidence. The end of this section contains description of variables which are used in the study, summary of knowledge gap and conceptual framework.

Accordingly, Majority of the researches in Ethiopia and abroad were conducted using primary data to assess incidences of credit default by surveying of borrower's opinion and they didn't addressed determinants of credit risk by using firm specific and macroeconomic variable. However, few researches were conducted on the determinants of credit risk on the side of the microfinance institutions using secondary data. And due to, the shortage of empirical work directly related to determinant of credit risk in microfinance institution, this study examined related literatures both from banks and microfinance perspective as follows;

2.3.1. Empirical Reviews outside Africa

Foglia (2022) investigated the influence of macroeconomics determinants on non-performing loans (NPLs) in the Italian banking system. The empirical evidence shows that gross domestic product and government debt have a negative impact on NPLs. On the other hand, they find that the unemployment rate and domestic creditworthiness positively affect impaired loans. Moreover, Zheng, Bhowmik and Sarker (2020), analyzed industry-specific and macroeconomic determinants of non-performing loans. Among the industry-specific drivers, bank loan growth, net operating profit, and deposit rates all have a statistically significant negative influence on NPLs, whereas bank liquidity and lending rates have a substantial positive impact on NPLs. Among the macroeconomic factors, GDP growth and unemployment show a negative relationship with NPLs. Domestic credit and exchange rates, on the other hand, have a considerable positive relationship with NPLs. Likewise, Mustafa and Ali (2019) conducted a research to analyze macroeconomic factors influence on Non-performing loans: the case of commercial banks in Malaysia. The findings suggests that GDP growth and unemployment are correlated with NPL fluctuations in the long and short run. On the other hand, Inflation has no

correlation. More specifically, GDP growth has a negative association with NPLs, but the unemployment rate has a positive relationship with NPLs.

Effendi and Yuniarti (2018) also analyzed the effect of macroeconomic variables, namely GDP, Inflation and Unemployment on the credit risk of Islamic banking of Indonesia. The results of panel data regression suggest that GDP and unemployment rate have a significant negative impact on the credit risk of Islamic banking in Indonesia. At the same time, inflation has a negative but statistically insignificant impact on the credit risk of Indonesia's Islamic banking system. Moreover, Morakinyo and Sibanda (2016) also investigated the major factors that affect non-performing loans in the MINT (Mexico, Indonesia, Nigeria and Turkey) economies. It uses static panel data and dynamic panel model analyses. While the return on assets, liquidity ratio and capital adequacy ratio show a negative and significant relationship with non-performing loans, nominal exchange rate, money supply growth rate, total bank credit and lending rate show positive and very significant relationships with non-performing loans. Further, Mazreku *et al.* (2018) also investigated determinants of the level of non-performing loans in commercial banks of transition countries. The study found that GDP growth had the strongest (inverse) relationship with non-performing loans. Inflation also showed a significantly negative relationship with non-performing loans while Unemployment showed a significant positive relationship with NPLs, in line with prior findings, further underscoring the importance of domestic economic conditions for NPLs.

Pei (2019) also studied bank's credit risk and its determinants: a study on bank of ayudhya in Thailand. This study employed multiple regression analysis from the year 2013 to 2017. Among these ratios, the operating ratio and GDP growth rate have high negative correlated to credit risk. It indicates that if the operating ratio or GDP growth rate increase, the credit risk of the bank will decrease. Meanwhile, the inflation rate and policy interest rate are positive correlated to credit. Further, Pasha, Bastanzad and Hossein (2016) also examined the impact of macroeconomic indicators on the non-performing loans in the case of Iran. The results show that the impact of real money on banks' non-performing loans is positive and significant. The coefficients of the other variables (including the ratio of each bank making loans to total deposits, the ratio of each bank making loans to total loans, and GDP would also be positively significant. The real interest rate has had a negative-significant impact on NPLs. Ganic' (2014), also conducted a study to examine the influence of bank-specific determinants on the realization of credit risk in the

portfolio of commercial banks in Bosnia and Herzegovina (B&H). The empirical results suggest that there was a significant relationship between credit risk and the following variables: [Inefficiency (IE), Profitability (ROE), Credit Growth (CG) and Deposit Rate (DR), while the variables Solvency (SR), Ratio of loans to deposits (LTD), market power (MP), profitability (ROA) and reserve ratio (RR)] are not statistically significant with respect to credit risk. To this end, Lu (2013) further analyzed Credit risk determinants based on empirical evidence from Chinese commercial banks. The empirical results indicate that the inflation rate and the provision for loan losses for the credit risk of Chinese commercial banks are clearly positive, on the other hand, the market interest rate, exchange rate, unemployment rate, bank size, regulatory capital and bank management show efficiency a significantly negative relationship between banks' credit risk. However, the real GDP growth rate does not have a significant impact on credit risk in China's commercial banking market.

2.3.2. Empirical Reviews in Other African Countries

Rono (2020), Conducted a study to examine macroeconomic factors and non-performing loan among deposit taking microfinance institutions in Kenya. The findings have indicated inflation, interest rate and unemployment rate affect non-performing loan negatively. In addition, exchange rate was found to have statistically positive effect on non-performing loans. On the other hand, GDP was reported to have an insignificant effect on NPL. Also, in the same country Atem (2017), also conducted an investigation into factors affecting non-performing loans: a case study of KCB bank in Kenya and the study found that interest rate significantly affects non-performing loans, while loan size, bank size, gender and age had no significant impact on non-performing loans in KCB-Bank. Further, Salem, Labidi and Mansour (2020), explored the most important determinants of friction in the Tunisian credit market using a multivariate Vector Error Correction Model. The regression results show a negative and important relationship between economic growth and Non-Performing Loans (NPL) ratio, which is very robust during the political crisis of 2011. The non-performing loan ratio is positively associated to the money market interest rate and the money supply. Finally, Mpofu and Nikolaidou (2018) also investigated the macroeconomic determinants of credit risk in the banking system of 22 Sub-Saharan African economies. The finding depicts that an increase in real GDP growth rate had a statistically and economically significant effect in reducing the ratio of non-performing loans to

total gross loans. Furthermore, inflation rate, domestic credit to private sector by banks as a percent of GDP, trade openness all have positive and significant impact on NPLs.

2.3.3. Empirical Reviews in Ethiopia

Abebe (2021), examined the determinants of non-performing loans in Ethiopian commercial banks based on panel data analysis. This study found that inflation rate has a negative significant effect on non-performing loans, but loan growth, lending rate and operational efficiency have a positive and significant effect on non-performing loans. Moreover, Kitila, Lemi and Sultan (2019) also investigated the determinants of credit risk in the case of selected commercial banks in Ethiopia. The result indicated that predictor variables like efficiency ratio, return on equity and bank size have statistically significant positive effects on the dependent variable (credit risk). Further, the study revealed that capital adequacy had statistically significant negative impact in predicting the dependent variable (credit risk). However, predictor variables like return on asset, leverage and loan to deposit ratio didn't make any statistically significant effect on credit risk.

Tole, Jabir and Wolde (2019), examined Determinates of Credit Risk in Ethiopian Commercial Banks. To analyze the data, a fixed effect ordinary list square model was applied. And it was found that Loan deposit ratio and size have positive impact. The result of the study further indicated that a negative and significance effect of GDPR and loan growth on the level of assets quality in Ethiopian baking industry. Likewise, Kassa (2018), did study on factors affecting non-performing loan in the case of Ethiopian commercial banks. The regression analysis result showed that the determinant variables Bank Size, GDP, Liquidity and profitability are positive and significant relationship with NPLs, and also exchange rate, inflation rate, loan growth and lending rate are a negative and significant relationship with NPLs. Further, Mekuria (2017), also examined the determinants of credit risk of Ethiopian commercial banks. The result of the study showed that inflation has a positive and significant impact on credit risk. The development of the financial sector also shows a positive and significant relationship with the credit risk of commercial banks in Ethiopia. In addition, the study found that there is a significant and negative inverse relationship between competition (CON), LDR and profitability with the credit risk of commercial banks in Ethiopia.

Tamiru (2017) also did study to examine the determinant of non-performing loan in Ethiopian private commercial banks: with emphasis on manufacturing sector. The result of the study revealed that business profit margin, deposit interest rate, loan growth rate, loan to deposit ratio, credit monitoring and follow-up and nature of business statistically significant relationship with banks' NPLs. On the other hand, variables like exchange rate and inflation rate were found to be statistically insignificant.

Tehulu and Abegaz (2016) also examined the determinants of credit risk management of microfinance institutions in Ethiopia. The regression result has shown that portfolio size, return on investment and operational efficiency have negative and significant effects on credit risk. However, productivity, liquidity, debt and age have no bearing on credit risk. Therefore, portfolio size, return on investment and operational efficiency are the important variables responsible for the differences in credit risk among microfinance institutions in Ethiopia. Likewise, Tilahun (2015) also investigated the determinants of credit risk in microfinance institutions in case of selected Ethiopian microfinance institutions. The Fixed effects technique has been applied to find out the most significant variables from considered firm specific and macroeconomics variable. The regression results show that, loan growth, capital adequacy size of micro finance institution and microfinance profitability has significant effects on non-performing loan of microfinance institution. On the other hand, leading rate, operating inefficiency and inflation don't have statically significant effects on Ethiopian microfinance non-performing loan.

Tehulu and Olana (2014), examined the bank-specific determinants of credit risk in commercial banks in Ethiopia. The regression results showed that loan growth and bank size have a negative and statistically significant impact on credit risk. In contrast, operational inefficiency and ownership have positive and statistically significant effects on credit risk. Finally, the results indicate that profitability, capital adequacy and bank liquidity are negatively but not statistically significantly related to credit risk. In the same year Adugna (2014), analyzed the determinants of microfinance institutions loan portfolios quality: empirical evidence from Ethiopia and based on random effects generalized least squares and the pooled ordinary least squares (OLS), the study finds an institution size (LnTA) is negatively and significantly influences LLR and WOR. Operating expense (OPPEXP) has a negative significant relationship with LLR, PAR-30days and

WOR. Age of the MFIs has a positive significant relationship with PAR-90days. Percentage of women borrowers (WOMBOR) has a positive significant impact on PAR-30days. Deposit to loans (DTL) positively and significantly influences LLR and WOR. Gross loan portfolio/ total asset (GLP/TA) has a negative significant impact on LLR and WOR. Voluntary savings (LnVOLSAV) has a negative significant relationship with LLR, PAR-90days and WOR. The regression results also show that Return on equity (ROE) has a negative significant relationship with LLR, PAR-30days, PAR-90days and WOR. Change in growth national income (CH-GNI) negatively and significantly influences PAR-30days and PAR-90days. The study finds insignificant results on inflation and leverage.

Finally, Tapano (2012) did study to analyze determinants and management of credit risk in microfinance institutions: empirical study on selected MFIs in Ethiopia and the finding suggests that five variables i.e., loan to deposit ratio, average loan per borrower, total assets, leverage, and management efficiency are significantly affecting the credit risk, and their credit risk arises from different aspects that can be seen from three perspective i.e., external and internal factors, borrowers and lenders characteristics, and firm and loan characteristics.

2.4. Summary of Literature and Knowledge Gap

Depend on the above theoretical and empirical review; credit risk is the major problem for all financial institution in general and Ethiopian financial institutions in particular. Although the above empirical literatures are from a banks and microfinance perspective, this study focuses on the determinants of credit risk in Ethiopian microfinance institution. So, the summary of literatures and knowledge gaps are from a microfinance perspective.

The result of different researchers revealed that Microfinance credit risk can be influenced by distinctive variables such as Inflation, lending rate, size of the firm, ROA, operating efficiency, leverage, loan growth, Capital Adequacy, age and liquidity.

According to the research conducted by Adugna (2014); Tilahun (2015) inflation had a positive and statistically insignificant impact on the credit risk of Microfinance institutions in Ethiopia. In contrast, the research conducted by Rono (2020) shows that, inflation have a negative and insignificant and impact on credit risk of Microfinance institutions. Moreover, Tehulu & Abegaz

(2016)**;** Tilahun (2015); Adugna (2014); Tapano (2012) stated that, size of microfinance institution has a negative and significant effect on microfinance institutions credit risk. Whereas, Kassa (2018) revealed that, size had a positive and significant effect on credit risk. Also, Tehulu & Abegaz (2016); Adugna (2014) profitability has a negative and statistically significant effect on credit risk of Microfinance institutions. In contrast, Tilahun (2015) showed that, ROA has a positive and statistically significant impact on credit risk. Further Ganic' (2014), found that a positive but statistically insignificant effect of ROA on credit risk. Further, Tilahun (2015) revaled that, Operating efficiency had a statistically insignificant impact on credit risk. Whereas, Tehulu & Abegaz (2016); Tapano (2012) showed that, operating efficiency has a negative and statistically significant impact on credit risk of Microfinance Institutions.

The study conducted by Tehulu & Abegaz (2016), found positive & insignificant impact of leverage on credit risk while, Adugna (2014) shows that, a positive & statistically significant impact of leverage on the credit risk of microfinance institutions. Whereas, Tapano (2012) shows that leverage has a negative and significant effect on Credit risk. Also, based on the findings of Tehulu & Abegaz (2016) liquidity has no effect on the credit risk of Microfinance institution. In contrast, Adugna (2014); Tapano (2012) shows that, liquidity has a positive and significant effect on credit risk.

The research conducted by Adugna (2014) revealed that, age of Microfinance institution has a positive and significant effect on credit risk. Whereas, Tehulu & Abegaz (2016) shows that, age didn't have an impact on credit risk. Moreover, based on the findings Tilahun (2015) capital adequacy has a negative and significant impact on credit risk of MFIs. In contrast Tapano (2012) found a stastically insginficant impact of Capital Adequacy on Credit risk of MFIs.

Finally, Tilahun (2015) found a negative and insignificant impact of lending rate on credit risk, while he found a postive and stastistically insignificant impact of loan growth on credit risk of MFIs.whereas Ganic' (2014) found negative and statistically significant effect of credit growth on credit risk.

In general, both macroeconomic and microeconomic factors are believed to be the determinants of credit risk in Ethiopian microfinance institutions and there is inconsistence of findings among literature.

In order to fill this literature gap, the researcher motivated to undertake research in this particular area by increasing the number of observations and by adding new additional variables.

2.5. Determinant Factors of Credit Risk in Ethiopian Microfinance Institutions

A. GDP Growth Rate

According to the Bureau of Economic Analysis (BEA), Gross Domestic Product (GDP) is the value of goods and services produced by the country's economy minus the value of goods and services used up in production. GDP is also the sum of personal consumption expenditure, private gross domestic investment, net exports of goods and services, and government consumption (Dynan and Sheiner, 2018).

Various empirical evidences confirm that an increase in GDP growth rate negatively affects credit risk. According to Foglia (2022); Salem, Labidi and Mansour (2020); Tole, Jabir and Wolde (2019); Zheng, Bhowmik and Sarker (2020); Mustafa and Ali (2019); Pei (2019); (Mpofu and Nikolaidou (2018); Effendi and Yuniarti (2018); Mazreku *et al.* (2018) found that when gross domestic product increases it would reduce credit risk by a significant amount. This is evidenced by improved financial conditions for businesses and households imply a reduction in NPLs as they are able to repay their debts. However, Rono (2020), found a negative and statistically insignificant effect of GDP on credit risk. Therefore, it is expected to have negative impact on credit risk. Based on the above empirical review the following hypothesis has been developed.

H1: GDP growth has a negative and significant impact on credit risk of Ethiopian microfinance institutions.

B. Inflation Rate

Inflation refers to an overall increase in the Consumer Price Index (CPI), which is a weighted average of the prices of various goods. The group of commodities that make up the index depends on which are considered representative of a common consumption basket. Therefore,

depending on the country and the consumption habits of most of the population, the index will comprise different goods. Some commodities may see a price decrease while others may increase, so the total value of the CPI depends on the weight of each commodity in relation to the total basket. Annual inflation is the percentage change in CPI compared to the same month last year (Inflation-Indicator, 2022).

According to Kassa (2018); Effendi and Yuniarti (2018); Mazreku et al. (2018) inflation rate had a significant negative effect on the level of credit risk and This is due to the fact that, during inflationary periods the real value of payments that borrower has to settle their obligations to credit institutions falls. In contrast, Pei (2019); Mpofu and Nikolaidou (2018); Mekuria (2017); Lu (2013) found that inflation had a positive and significant effect on credit risk and this is evidenced by the Higher the inflation rate , the higher will be the cost of business which ultimately may result less return from the business and low capacity to repay loans. Further Adugna (2014); Tilahun (2015) revealed that inflation had a positive and statistically insignificant impact on the credit risk while Rono (2020) shows that, inflation have a negative and insignificant and impact on credit risk . Therefore, inflation rate is expected to have a positive impact on credit risk. Based on the above empirical review the following hypothesis has been developed.

H2: Inflation rate has a significant impact on credit risk on Ethiopian microfinance institution.

C. Money Supply

Traditionally, money supply is defined in the narrower and broader sense. Margin money (M1) is a measure of the money supply intended primarily for transactions. It consists of cash held by the public, traveler's checks, demand deposits and other checkable deposits. Broad money (M2) is a measure of domestic money, which includes M1 plus quasi-money (savings and time deposits), overnight repurchase transactions, and personal balances in money market accounts. Basically, M2 includes money that can be used for spending (M1) as well as items that can be quickly converted into M1. NBE takes the broader definition of money or M2 as money supply (NBE, 2009).

According to Salem, Labidi and Mansour (2020); Morakinyo and Sibanda (2016); Pasha, Bastanzad and Hossein (2016) money supply had a positive and significant effect on credit risk.

Their ideas were evidenced by the increase of money supply leads to higher liquidity; as a result, this pushes financial institutions to grant more credit which increases the likelihood of credit risk. Therefore, money supply is expected to have a positive impact on credit risk. Based on the above empirical review the following hypothesis has been developed.

H3: money supply has a significant impact on credit risk of Ethiopian microfinance institutions.

D. Unemployment Rate

According to Seth, John and Dalhatu (2018), unemployment is a serious predicament confronted by most developed and developing nations which leads to economic and social issues. The economic problems of unemployment deny the nation tax revenues in the form of income taxes, wasting productive hours and more, while the social problems of unemployment deal with depression, lack of self-esteem and other vices like robbery, prostitution and many others (Adarkwa, 2017).

According to Foglia (2022); Mustafa and Ali (2019) ; Mazreku *et al.* (2018) unemployment rate positively and significantly affect credit risk. These results imply that the increase in unemployment has a large impact on the increase of non-performing loans to enterprises, as an increase in unemployment results in a decline of effective demand, negatively affecting production as a consequence. Subsequently, a significant decline in production would lead to decreased income for enterprises, influencing their capacity to meet their liabilities. Regarding households, unemployment has a negative impact on cash, as unemployed clients cannot fulfill their obligations to repay the loans, which results in an increase of non-performing loans (Kjosevski, Petkovski and Naumovska, 2019). In contrast Rono (2020) found a significant and negative impact of unemployment rate on credit risk. So, Unemployment is expected to have a positive impact on credit risk. Based on the above empirical review the following hypothesis has been developed.

H4: unemployment rate has a significant impact on credit risk of Ethiopian microfinance institutions.

E. Lending rate

Lending rates are one of the primary economic determinants of NPLs. It is the cost of borrowed funds. Based on the empirical evidence of Abebe (2021); Zheng, Bhowmik and Sarker (2020); Atem (2017); Morakinyo and Sibanda (2016) lending interest rate had a positive and significant effect on credit risk. In contrast, the research conducted by Rono (2020); Kassa (2018) found that lending interest rate had a significant and negative effect on credit risk. Finally, the study conducted by Tilahun (2015) revealed that lending interest rate had a negative but statistically insignificant effect on credit risk. So, lending rate is expected to have negative impact on credit risk. Based on the above empirical review the following hypothesis has been developed.

H5: Lending rate has a significant impact on credit risk of Ethiopian Microfinance Institution.

F. Return on Asset

As a measurement of profitability, ROA indicates how well an MFI uses all their assets. It is also measuring the profitability of the institutions which reflects both the profit margin and the efficiency of the institutions. ROA is computed by dividing net income (after taxes and excluding any grant or donations) by average assets. Unlike ROE, this ratio (net operating income less taxes as a percentage of assets) measure profitability regardless of the institution's underlying funding structure it does not discriminate against institutions that are funded primary through equity (AEMFI, 2018)**.**

According to Mekuria (2017); Tamiru (2017); Tehulu & Abegaz (2016); Adugna (2014); Morakinyo & Sibanda (2016) profitability had a negative and statistically significant and effect on credit risk. In contrast, Tilahun (2015) showed that, ROA has a positive and statistically significant impact on credit risk. Further, Tehulu and Olana (2014) found a negative and insignificant relationship between profitability and credit risk while Ganic' (2014) found that a positive but statistically insignificant effect of ROA on credit risk.. So, ROA is expected to have a negative impact on credit risk. Based on the above empirical review the following hypothesis has been developed.

H6: ROA has a significant impact on credit risk of Ethiopian microfinance institution.

G. Operating efficiency

Efficiency indicators take into account the cost of the input and/or the price of output. The operating expense ratio is calculated by dividing all expenses related to the operation of MFIs (including all the administrative and salary expense, depreciation and board fees) by the period average gross portfolio. However, extraordinary expenses are not included. This ratio provides the best the best indicator of the overall efficiency of a lending institution. For this reason, the ratio is also commonly referred to as the efficiency ratio. The lower the rate is, the higher its efficiency (AEMFI, 2018).

According to Abebe (2021); Kitila, Lemi and Sultan (2019); Tehulu and Olana (2014); operating ratio had a positive significant effect on credit risk. In contrast, Pei (2019); Tehulu & Abegaz (2016)**;** Tapano (2012); Ganic' (2014); Lu (2013) found a negative and significant effect of operating ratio's on credit risk. Further, Tilahun (2015) found a negative but statistically insignificant effect of operating efficiency on credit risk. Therefore, loan growth is expected to have a negative impact on credit risk. Based on the above empirical review the following hypothesis has been developed.

H7: operating efficiency has a significant impact on credit risk of Ethiopian microfinance Institutions

H. Liquidity

Loan to Deposit ratio (LDR) is used to assess a MFI's liquidity by comparing a MFI's total deposit to its total loans for the same period. The DLR is expressed as a percentage. If the ratio is too low, it means that the MFI's may not have enough liquidity to cover any unforeseen fund requirement. Conversely, if the ratio is too high, the MFI may not be earning as much as it could be (AEMFI, 2020).

According to Tole, Jabir and Wolde (2019); Zheng, Bhowmik and Sarker (2020); Kassa (2018); Tamiru (2017) ; Pasha, Bastanzad and Hossein (2016); Adugna (2014); Tapano (2012) liquidity had a positive and significant effect on credit risk. In contrast, Mekuria (2017); Morakinyo and Sibanda (2016) found a significant and negative effect of liquidity on credit risk. Tehulu and Olana (2014) also found an inverse and insignificant effect of liquidity on credit risk. Furthermore, Tehulu & Abegaz (2016) found that, liquidity didn't have effect on credit risk. So,

liquidity was expected to have negative impact on credit risk. Based on the above empirical review the following hypothesis has been developed.

H8: Liquidity has a significant impact on credit risk of Ethiopian microfinance institutions.

I. Size of MFI's

According to empirical studies such as, Tehulu & Abegaz (2016)**;** Tilahun (2015); Tehulu and Olana (2014)**;** Adugna (2014); Lu (2013); Tapano (2012) found the inverse and statistically significant effect of firm's size on credit risk. This implies that a high diversification of portfolio assets in large MFIs can cause a reduction in credit risk of MFIs in Ethiopia and it also shows that larger MFIs have better diversification opportunity than smaller MFIs. In contrast, the study conducted by Kitila, Lemi and Sultan (2019); Tole, Jabir and Wolde (2019); Kassa (2018) revealed that, size of MFI's had a positive and significant effect on credit risk. Natural logarithm of total assets has been used as a proxy for measuring institution size in most prior research. Therefore, size of MFI's was expected to have positive impact on credit risk. Based on the above empirical review the following hypothesis has been developed.

H9: Firms' Size has a significant impact on Credit risk of Ethiopian microfinance institution.

J. Age of MFI's

The average age of Ethiopian MFIs is 14 years. All matured MFIs in Ethiopia have huge amount of assets and good financial performance. However, some MFIs such as One/Letta (age 17) and AVFS (age 23) are still in smaller peer groups, though matured in age but not yet financially self-sufficient and their loan portfolio amount is small compared to their age (experience) (AEMFI, 2021)**.**

According to Atem (2017) age of firms didn't have a significant effect on credit risk. Further Tehulu & Abegaz (2016) revealed that age of MFIs didn't have effect on credit risk. And generally Natural logarithm of Age of firms has been used as a proxy for measuring institution age by these researchers. Therefore, age is expected to have negative impact on credit risk. Based on the above empirical review the following hypothesis has been developed.

H10: age has a significant impact on with credit risk of Ethiopian microfinance institutions.

K. Loan Growth

Loan growth is the increment in the amount of loans from time to time. Accordingly, different researchers were studied to know the effect of loan growth on credit risk of financial institutions.

So, based on Abebe (2021); Tilahun (2015); loan growth had a positive and significant and insignificant effect on credit risk respectively. In contrast, Tole, Jabir and Wolde (2019); Zheng, Bhowmik and Sarker (2020); Kassa (2018); Tamiru (2017); Ganic' (2014); Tehulu and Olana (2014) found a negative and significant effect of loan growth on credit risk. So, Loan growth is expected to have negative impact on credit risk, accordingly the following hypothesis has been developed.

H11: loan growth has significant impact on credit risk of Ethiopian micro finance institution.

L. Leverage

According to AEMFI (2021), Debt to equity ratio (DER) is used to evaluate a company's financial leverage and is calculated by dividing a company's total liabilities by its shareholders equity. The DER is an important metric used in corporate finance. It is a measure of the degree to which a company is financing its operation through debt versus wholly owned funds. More specifically it reflects the ability of shareholder equity to cover all outstanding debts in the event of business downturn.

In this regard different empirical evidence suggested that, leverage had effect on credit risk of financial institutions. Ghosh (2005); Adugna (2014) shows that a positive & statistically significant effect of leverage on credit risk. According to Tapano (2012) leverage had a negative and significant impact on credit risk. However, Adugna (2014) found an insignificant effect of leverage on credit risk. Further, Tehulu & Abegaz (2016) found a positive and statistically insignificant effect of leverage on credit risk. So, Leverage was expected to have positive impact on credit risk, accordingly the following hypothesis has been developed.

H12: leverage has a significant impact on credit risk of Ethiopian microfinance institutions.

M. Capital Adequacy

Different empirical evidence revealed that there is a strong statistical effect of capital adequacy on credit risk: Kitila, Lemi and Sultan (2019); Morakinyo and Sibanda (2016); Tilahun (2015) found statistically negative and significant effect of capital adequacy on credit risk. Finally, Tapano (2012); Tehulu and Olana (2014) also found a negative, But statistically insignificant effect of capital adequacy on credit risk. So, capital adequacy was expected to have a negative impact on credit risk. Based this empirical evidence the following hypothesis has been developed.

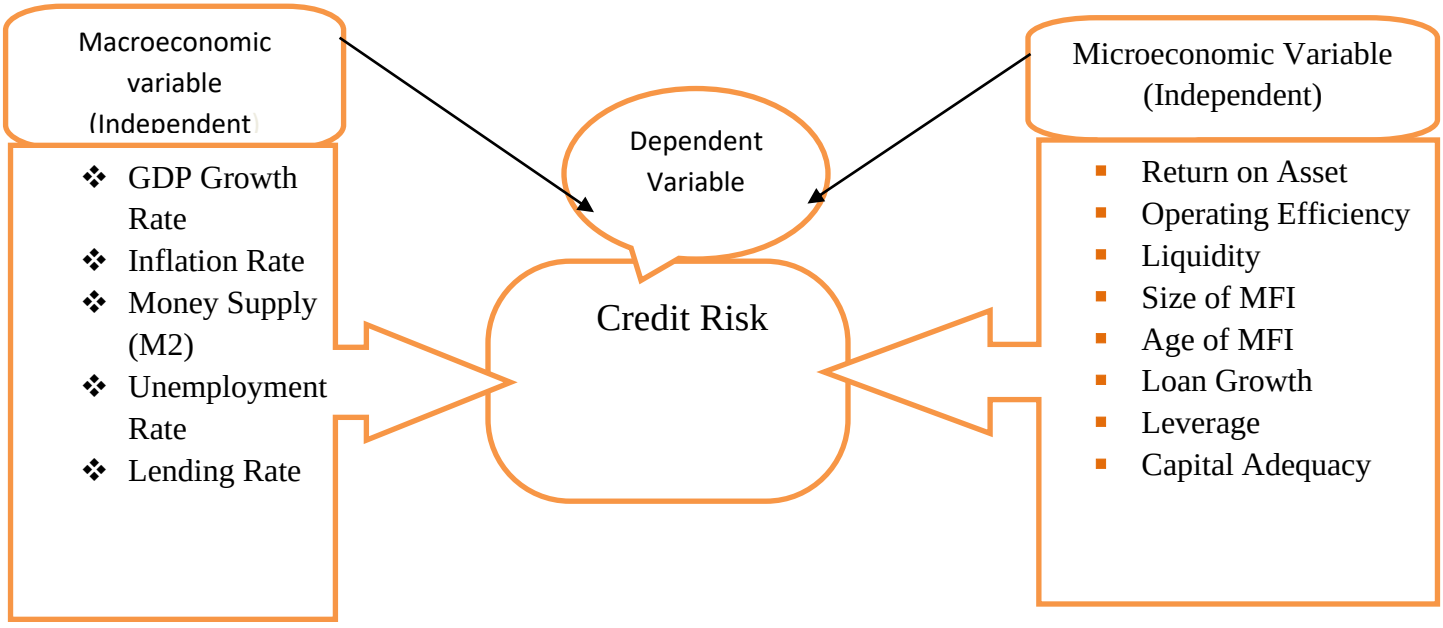
H13: capital adequacy ratio has a significant impact on credit risk of Ethiopian microfinance institutions.

2.6. Conceptual Framework

According to Regoniel (2015) , a conceptual framework represents the researcher's synthesis of the literature on how to explain a phenomenon. It maps out the actions required in the course of the study, given his previous knowledge of other researchers' point of view and his observations on the subject of research. Conceptual framework is a network of interlinked concepts that together provide a comprehensive understanding of a phenomenon (Jabareen, 2009).

In this study, the dependent variable credit risk while the independent variables are the determinants of credit risk. The study has thirteen independent factors determining the credit risk of Ethiopian Microfinance institutions. Those factors are GDP growth rate, Inflation rate, Money supply, Unemployment rate, lending rate, return on asset, operating efficiency, liquidity, size of MFI, age of MFI, loan growth, leverage and capital adequacy. The Conceptual framework of these variables is a guide to the research and shows how they determine credit risk of Ethiopian MFIs'. This conceptual frame work can be elaborate using the following diagram

Figure 2 1 conceptual framework



Source; - Author's own formulation from theoretical and empirical literature

CHAPTER THREE: RESEARCH METHODOLOGY

Introduction

The purpose of this chapter is to discuss the research methodology along with the detailed methods used in the study. It is divided into six major sections. The first section describes the study's research paradigm, which is followed by research approach, research design, data type and source, sample design, model and variable measurement and data analysis technique.

3.1. Research Paradigm

There are four knowledge claims or paradigm in research. Those are Positivism, Constructivism, Advocacy/participatory and Pragmatism. Positivism knowledge claim or philosophy holds a deterministic philosophy in which causes probably determine effects or outcomes. And according to this theory, there is a cause and effect relationship between the independent and dependent variables with an objective judgment (Creswell, 2014). As the main objective of this research is to examine the effect of macro and microfinance specific variables on credit risk of Ethiopian microfinance institutions, this study adopts a positivism paradigm.

3.2. Research Approach

According to Creswell (2014) there are three research approaches. Namely: qualitative research approach, quantitative research approach and mixed research approach. Qualitative research is a means of exploring and understanding the meaning that individuals or groups attach to a social or human problem. The research process involves emerging questions and procedures, data typically collected from the participants' environment, data analysis building inductively from details of general issues, and the researcher making interpretations of the meaning of the data. Quantitative research is a means of testing objective theories by examining the causal relationship between variables. These variables, in turn, can typically be measured on instruments so that numbered data can be analyzed using statistical methods. Mixed methods research is an investigative approach that combines or connects both qualitative and quantitative forms. As the main objective of this study is to examine the effect of macro and MFIs specific variables on credit risk of Ethiopian microfinance institutions, this study used quantitative research approach because it is helpful to test causal (cause and effect) relationship.

3.3. Research Design

Research designs are plans and the procedures for research that span the decisions from broad Assumptions to detailed methods of data collection and analysis (Creswell, 2014).

According to Srejesh, Mohapatra and Anusree (2014) there are three types of research design. Those are descriptive research design, exploratory research design and explanatory research design. Descriptive Research Design is the method of collecting information by asking a set of pre-formulated questions in a predetermined sequence in a structured questionnaire to a sample of individuals drawn. Exploratory research is used to identify the boundaries of the environment in which the problem, opportunity, or situation of interest is likely to be found, and to identify the hidden factors or variables found there that might be relevant to the research. Finally, the explanatory research design is used to identify the cause-and-effect relationship between variables. As the main objective of this paper is to examine the effect of macro-economic and microfinance specific variables on credit risk of Ethiopian microfinance institutions, this study employed explanatory (causal) research design.

3.4. Target Population

The target population for this study was all microfinance institutions which are established and operated in Ethiopia. According to NBE (2022), there are 41 MFIs which are in operation.

3.5. Sample Size and Sampling Techniques

This study had covered some microfinance institutions which are established and operate in Ethiopia and also have a minimum of nine years of financial data at the time of data collection on the selected variables.

According to Adams *et al.* (2007) , non-probability sample that conforms to certain criteria is called purposive sampling. Purposive sampling, also known as judgment sampling, is a method of selecting sample members solely on the basis of the researcher's knowledge and judgment. Since out of 41 microfinance institutions the following thirteen microfinance institutions were selected based on their data availability for balanced panel data set.

Table 3. 1 List of sampled Ethiopian microfinance institution

code	Name of MFIs	Operation started date	Sector
1	ACSI	1996 G.C.	MFI
2	OCSSCO	1996 G.C.	MFI
3	ADCSI	1996 G.C.	MFI
4	Omo	1996 G.C.	MFI
5	Agar	2003 G.C.	MFI
6	vision	1998 G.C.	MFI
7	Wassa	1999 G.C.	MFI
8	Bussa Gonofa	1998 G.C.	MFI
9	Dynamic	2008 G.C.	MFI
10	peace	1998 G.C.	MFI
11	Harbu	2004 G.C.	MFI
12	AVFS	1997 G.C.	MFI
13	Sidama	1996 G.C.	MFI

Source; Author's own Compilation using data from AEMFIs

3.6. Type and Source of Data

As per Kothari (2004) , researchers should keep in mind two types of data those are, primary and secondary data. The primary data are those which are collected for the first time, and thus happen to be original in nature. Secondary data, on the other hand, are those that have already been collected by someone. This study used secondary data because it allows the researcher to conduct his research objectively.

3.7. Method of Data Collection

Data was collected from NBE, Association of Ethiopian Microfinance Institutions (AEMFI) Bulletin and World Bank from the year 2012 to 2020 using document analysis.

3.8. Research Econometric Model

A quantitative methodology is used to analysis the significance of the identified variables. The econometric model which is employed for this study is based on the "Panel data" or "longitudinal" sets for which each MFIs' will be representing the "cross-section" while also be divisible through a timeline known as "time-series" (Wooldridge, 2016).Therefore, the basic

econometric regression model in this research to examine the determinants of credit risk and it can be written as follows:

$$Ynt=\beta0+\beta1X1nt+\beta2X2nt+\beta3X3nt+\cdots\beta nXnt+\varepsilon nt$$

Where;

Ynt: Dependent Variable in time t for MFn

β0: Constant term

β1to βn: Coefficient of independent variable

X1nt to Xn, nt: Independent variable in time t for MF i

εnt: Error term in time t for MF n

3.8.1. Variables and research models

3.8.1.1. Variables

The study has to types of variables; dependent variable (credit risk) and independent variables (Inflation, lending rate, size of the firm, ROA, operating efficiency, leverage, loan growth, capital adequacy, age, liquidity, GDP growth rate, unemployment rate and money supply).

Table 3. 2 Description of the variables and their expected Sign

Variable	symbol	Measurement	Expected sign
Credit risk	PAR- 30	PAR- 30 ratio	
Inflation rate	IFR	Consumer Price Index (CPI)	+
Lending rate	LNR	Lending interest rate	-
Firms size	SIZE	Natural logarithm of Gross loan portfolio SIZE	+
Return on asset	ROA	Net Income per Average Assets	-
Operating efficiency	OEF	Operating expense to loan portfolio	-
Leverage	LEV	Debt to equity ratio	+
Loan growth	LOG	annual percent change in total outstanding loans	-
Capital Adequacy	CAR	Capital to asset ratio	-
Age of MFIs	AGE	Natural logarithm of Age of MFIs	-
liquidity	LIQ	loan to deposit ratio	-
GDP growth	GDPr	Real GDP growth rate	-
Unemployment	UNR	Unemployment rate	+
Broad Money supply	BMS	M1 + time deposit	+

3.8.1.2. Specifications of Research Model

For the purpose of formalize the applicable hypotheses; the above mentioned variables need to be summarized into an econometric model and this research model is similar to the model used by Tilahun (2015); Lu (2013) . Therefore, the equation of the model to be used in this research can be summarized as follows

$PAR{>}30nt = \alpha + \beta1*IFRnt + \beta2*LNRnt + \beta3*SIZEnt + \beta4*ROAnt + \beta5*OEFnt + \beta6*LEVnt + \beta7*LOGnt + \beta8*CARnt + \beta9*AGEnt + \beta10*LIQnt + \beta11*GDPrnt + \beta12*UNRnt + \beta13*BMSnt + \varepsilon nt$

WHERE:

IFR-Inflation rate

LNR- Lending rate

SIZE-Size of MFIs

ROA-return on asset

OEF-operating efficiency

PROD-productivity

LOG-loan growth

CAR-Capital adequacy ratio

AGE-age of MFIs

LIQ-liquidity

GDPr-Gross domestic product growth rate

UNR-unemployment rate

BMS-broad money supply

n = 1…2…10 (MFI)

t = 1…2…10 years (2012---2020)

ε = the error term

3.9. Assumptions tested

- No autocorrelation between the errors, means a situation in which no identifiable relationship exists between the values of the error term
- No perfect multicollinearity between independent variables, means no explanatory variable can be written as a linear function of other explanatory variables.
- There is no heteroskedasticity problems, means the variance between the residual terms should be constant.

3.10. Method of Data Analysis

According to Richmond (2006) Data analysis can refer to a variety of specific procedures and methods. This involves goals; relationships; decision making; and ideas, in addition to working with the actual data itself. Simply put, data analysis includes ways of working with information (data) to support the work, goals and plans of your program or agency.

Both descriptive and inferential statistics were used to analyze the collected data. Multivariate Ordinary Least Square (OLS) regression technique was employed to determine the relationship between the multiple independent variables and the dependent variable. One regression equation was used to test the hypotheses constructed in relation to both macro-economic and MFI-specific determinants of credit risk. The collected panel data were regressed using STATA 16 statistical software and the regression outputs were analyzed. On top of this, MS Excel 2016 was also used to compute and feed convenient data into STATA. First, data were tested to ensure the validity of classical linear regression model (CLRM) assumptions. Second, tests of the hypotheses that were previously developed in chapter one & two were made based on the general estimated model which examined the relationship between the credit risk and its determinants for Ethiopian microfinance institutions.

CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

4. Introduction

This chapter deals with the results and discussion of the findings. The chapter has four sections. The first section presents a descriptive analysis of the study. The second section presents the choice between the fixed effect model and the random effect model. The third section of a chapter presents the diagnostics test results of multicollinearity, heteroscedasticity, autocorrelation, and normality. The last section is all about the discussion of regression results. The data was analyzed based on STATA version 16 software.

4.1. Descriptive Statistics

Descriptive statistics are used to describe the sample data of each variable in the study with a single value that represents the data's center, the largest and smallest data values. It is also used to determine how far the data deviates from the mean.

The dependent variable used in this study was credit risk and the independent variables were Inflation, lending rate, size of the firm, ROA, operating efficiency, leverage, loan growth, regulatory capital, age, liquidity, GDP growth rate and unemployment rate.

Table 4. 1 Summary of descriptive statistics

```
summarize PAR30 LGrate lev ROA size age liquidity CAR OEF gdprate IFR UNR BMS LNR
```

Variable	Obs	Mean	Std. Dev.	Min	Max
PAR30	117	.0482902	.0588407	.0004	.3558
LGrate	117	.3525233	.7425968	-.7195519	7.517401
lev	117	2.284174	2.048673	-10.54071	11.88495
ROA	117	.079923	.2101291	-1.493699	.4619846
size	117	5.497462	.9698666	2.651375	7.392195
age	117	1.207054	.1418767	.60206	1.380211
liquidity	117	2.372796	.9515335	.6185031	5.700749
CAR	117	.3421377	.1454927	-.1048229	.8598424
OEF	117	.191746	.2176275	.0159238	1.676945
gdprate	117	.0891111	.0137168	.061	.104
IFR	117	.1417778	.0804595	.074	.341
UNR	117	.0239333	.0030166	.0225	.0324
BMS	117	.2448519	.0445807	.170165	.302811
LNR	117	.1270222	.0085576	.1188	.143

Source: STATA 16 output result 2022

The above table was generated to give overall description about data used in the model and served as data screening tool to spot unreasonable figure.

As shown in Table 4.1 above, the mean value of Ethiopian Microfinance institutions' credit risk as measured by PAR>30 was 4.8 percent for the period from 2012-2020. This implies that, Ethiopian Microfinance Institutions were faced 4.8 percent of average credit risk during the given period of time. Further during those periods Ethiopian Microfinance Institutions' credit risk was fluctuated between 0.04 percent by Peace MFI in 2019 and 35.58 percent by AVFS MFI in 2020. To this end, the standard deviation for credit risk was 5.88 percent. This assures that there were high varieties or volatility of credit risk in Ethiopian Microfinance institutions during the study period. This is evidenced by a higher standard deviation than the mean value.

The mean value of Loan Growth rate was around 35.25 percent and there was a higher dispersion among loan growth rate. Because the standard deviation of loan growth rate was around 74.26 percent which was a higher variety. During the period Those MFIs recorded the minimum loan growth rate of -71.95 percent in 2012 and the maximum of 7.517 times in 2015 by dynamic MFIs. The minimum value in 2012 was because of the reduction of gross loan from Br.1,597,800 to Br. 448,100 and the maximum value in 2015 was because of a higher increment in gross loan amount from Br.510,270 million to Br. 4,346,200.

The average value of leverage was 2.2841 during the period of study. This implies that, during the period those MFIs institutions financed mostly by a debt rather than an equity participation. Or simply during the period those MFIs' debt was 2.2841 times their equity participation. The standard deviation of the period was 2.0486. This value tells us leverage had less volatility during the period under study. This was evidenced by the standard deviation was lower than its mean value. The minimum value during the period was -10.54 by Dynamic MFI in 2014 and the maximum value was 11.88 by Omo MFI in 2017. The main reason for the minimum value of -10.54 was in that period the company had a paid-up capital of 1,368,000; Retained earing of 1,457,780 and legal reserve of 9,200. So, the balance of capital became (98,580). as it was divided to the liability of the period which was 1,038,260, it would give the above negative value.

During the study period the average value of ROA was 7.99 percent and it was believed that there was a high fluctuation in those MFIs, this is because its mean value is less than standard deviation of the period which was 21.01 percent. The minimum value was -1.493(-149.3 percent) by Dynamic MFI in 2014 and the maximum value of 46.19 percent by Peace MFI in 2013.

The mean value of firms' size was 5.497 during the period between 2012-2020. The minimum value was 2.6513 by dynamic MFIs in 2012 and the maximum value was 7.3921 by ACSI in 2019. The mean deviates during the year by 0.969. So, firms' size had less verity's during the period because standard deviation was below the mean value.

The average value of MFIs age was 1.207 during the period under study. The minimum and maximum value was 0.602 and 1.380 respectively. The mean value deviates by 0.1418 during the period.

The average value of liquidity during the study period was 2.3727. This means during the period MFIs current Asset was 2.3727 times its current liability. The minimum value was 0.6185 by AVFS in 2020 and the maximum value was 5.7007 by Dynamic MFI in 2016. During the period liquidity was fluctuated in smaller amount because a standard deviation of 0.9515 is less than the mean value.

The average value of capital adequacy ratio was 0.3421 and the standard deviation of 0.1454 This indicates that there was little variation of each observation from its mean value of capital adequacy ratio. The minimum value was -0.1048 while the maximum value was 0.8598 by Dynamic MFIs in 2014 and 2015 respectively.

During the period of study, the mean value of Operating Efficiency was 0.1917 and the mean value deviates by 0.2176. The minimum vale was 0.0159 while the maximum value was 1.6769.

The mean value of GDP growth rate of Ethiopia was around 8.9 percent and the standard deviation for GDP growth rate was 1.34 percent, this implies that there was also little volatility of each observation of GDP growth rate from its mean value during 2012-2020. The minimum and maximum value of GDP growth rate for the last nine years was 6.1 % and 10.4% respectively.

The average value of Ethiopian Inflation rate during the study period was around 14.17% and the standard deviation for Inflation rate was around 8%, this confirms that there was also little volatility of each observation of inflation rate from its mean value during 2012-2020. The minimum and maximum value was 7.4 % and 34.1% respectively. This shows that there was some government control on inflation rate, so those MFIs was not significantly affected by it.
During the period under study the mean value of Ethiopian unemployment rate was around 2.39% and the standard deviation for unemployment was around 0.03%, this assures that there was little volatility of each observation of unemployment rate from its mean value. The minimum and maximum value was 2.25% and 3.24 % respectively.

Further, the mean value of broad money supply growth rate was around 24.48% and the standard deviation for broad money supply was around 4.45%, this shows there was less volatility during the period under study. The minimum and maximum value was around 17.01 % and 30.28 % respectively.

Finally, the average value of Lending Rate during the period under study was around 12.7% and the standard deviation of 0.85%, this tell us there was lower fluctuation in lending rate during the period and the minimum and maximum value was 11.88% and 14.3% respectively.

4.2. Correlation Matrix

Correlation is degree in which two or more variables are related to each other. The sample size is the basic component to decide whether or not the relationship coefficient is distinctive from zero/statistically critical. The values of the relationship coefficient are always between -1 and +1. A relationship coefficient of +1 demonstrates that the two factors are perfectly related in a positive linear form; whereas a relationship coefficient of -1 shows that two factors are perfectly related in a negative direction. A relationship coefficient of 0, on the other hand demonstrates that there's no direct relationship between two variables and the correlation between two variables measures the degree of linear association between them. If y and x are said to be correlated, it means that they are treated in a completely symmetrical manner (Brooks, 2014).

Table 4. 2 Correlation Matrix and their Significance Level of Correlation for Dependent Variable and Independent Variables (obs=117)

```
. pwcorr

             |    par30   lgrate      lev      roa     size      age liquid~y
-------------+---------------------------------------------------------------
       par30 |   1.0000
      lgrate |  -0.1021   1.0000
         lev |  -0.1607  -0.0774   1.0000
         roa |  -0.5611  -0.0449   0.3143   1.0000
        size |  -0.3841  -0.1121   0.5379   0.3627   1.0000
         age |  -0.1897  -0.2823   0.4214   0.4099   0.6651   1.0000
   liquidity |  -0.2546   0.4289  -0.2622   0.2825  -0.3622  -0.3356   1.0000
         car |  -0.0275   0.3871  -0.4547   0.2889  -0.4192  -0.3181   0.4618
         oef |   0.6386  -0.1475  -0.4597  -0.7715  -0.6512  -0.4635  -0.1467
     gdprate |  -0.3047   0.1570  -0.1033  -0.0062  -0.1576  -0.2811   0.0961
         ifr |   0.1760  -0.0841   0.0111  -0.0175  -0.0940  -0.1677   0.0322
         unr |   0.4085  -0.1421   0.0791  -0.0655   0.1560   0.2909  -0.1169
         bms |  -0.2826   0.0542  -0.0548   0.0605  -0.1595  -0.2820   0.0487
         lnr |   0.2592  -0.1440   0.1466   0.0140   0.2733   0.4751  -0.1700

             |       car      oef  gdprate      ifr      unr      bms      lnr
-------------+---------------------------------------------------------------
         car |   1.0000
         oef |  -0.1095   1.0000
     gdprate |   0.0578  -0.0008   1.0000
         ifr |  -0.0189   0.0469  -0.4435   1.0000
         unr |  -0.0972   0.0439  -0.7584   0.2520   1.0000
         bms |   0.0802  -0.0182   0.4749   0.1869  -0.6014   1.0000
         lnr |  -0.0746  -0.0648  -0.8000   0.0355   0.7191  -0.5419   1.0000
```

Source: STATA output result 2022

The correlation matrix within the above table 4.2. Shows a negative relationship between PAR>30 as a measurement of credit risk (dependent variable) and explanatory variables (loan growth rate, leverage, ROA, size, age, liquidity, capital adequacy ratio, GDP growth rate and broad money supply). On the other hand, there was a positive relationship between PAR>30 and inflation rate, lending rate and operating efficiency.

4.3. Model selection criteria (Random vs. Fixed effect model)

There are two commonly used models: Namely fixed effect model and random effect model.

Fixed effect model

When you only want to analyze the impact of variables that change over time, use fixed-effects (FE). Within an entity, FE investigates the relationship between predictor and outcome variables (country, person, company, etc.). Each entity has its own characteristics that may or may not influence the explanatory variables (Torres-reyna, 2007). The advantage of the fixed effects method is that it can overcome the effects of confounding variables without measuring them or even knowing actually what they are, as long as they are constant for a given period of time (Firebaugh, Warner and Massoglia, 2013).

Random effect model

Unlike the fixed effects model, the variation across entities in the random effects model is assumed to be random and uncorrelated with the predictor or independent variables included in the model. Random effects are based on the principle that the entity's error term is unrelated to the explanator, allowing time-invariant variables to function as explanatory variables. Individual characteristics that may or may not influence the predictor variables must be specified in random effects. The issue is that some variables may not be available, resulting in omitted variable bias in the model (Torres-reyna, 2007). To decide between fixed or random effect, a Hausman test was employed and where the null hypothesis is that the preferred model is random effects, vs. the alternative the fixed effects. If the probability value (p value) for Hausman test greater than alpha of 0.05, the Hausman test will be statistically insignificant, and the null hypothesis will be accepted in favor of the alternative. If not, Fixed effect model is appropriate.

Ho; random effect model is appropriate
H1; fixed effect model is appropriate

Table 4. 3 Hausman Test

```
Test:  Ho:  difference in coefficients not systematic

              chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       24.04
            Prob>chi2 =      0.0000
```

Source: STATA 16 output result 2022

Final Decision: As we can see from the above STATA output, the P-value is 0.0000 (The P-value is less than 5 percent); therefore, the null hypothesis is rejected. If the null hypothesis of random effect estimator is rejected, then we know that, the Fixed Effect Estimator is used to analyze the model of this research.

4.4. Data Testing

The most critical assumptions related to CLRM of panel data are tested in the following subsections. Normality, multicollinearity, heteroskedasticity, model specification tests,

autocorrelation and the like have been made to make the data available, give reliable results and make the model fit the data.

4.4.1. Test for average value of the error term is zero (E(ut)=0) assumption

The error term takes into account for the variation in the dependent variable in which the independent variables do not explain. Random chance should determine the values of the error term. The average value of the error term must equal zero for the model to be unbiased.

4.4.2. Test of Stationarity

Unit root tests are tests for stationarity in a time arrangement. A time arrangement has stationarity if a shift in time doesn't cause a change in the shape of the distribution; unit-roots are one cause for non-stationarity. Applications of panel unit root tests have become commonplace in empirical economics, yet there are ambiguities as how best to interpret the test results (Pesaran, 2012).In this study the researcher used Levin, Lin & Chu method to test whether there was unit root or not. As a rule of thumb, non-stationary data are unpredictable and cannot be predicted or modeled. Using non-stationary panel data results in an output that is spurious in a sense that there is a sign for the existence of a relationship between two variables where one does not exist.

4.4.2.1. Levin – Lin - Chu Test

Table 4. 4 Levin – Lin - Chu unit root – Test

```
Levin-Lin-Chu unit-root test for par30
------------------------------------------

Ho: Panels contain unit roots               Number of panels  =     13
Ha: Panels are stationary                   Number of periods =      9

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

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 Unadjusted t         -8.8027
 Adjusted t*          -6.1037        0.0000
------------------------------------------------------------------------------
```

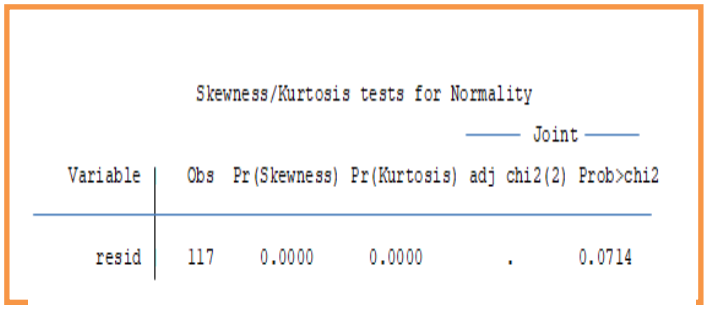
Source: STATA output results and researcher's computation.

As we can see from the above STATA output, the p-value is less than 5% level. Therefore, we reject the null hypothesis that the panel contains unit roots. Hence the panel data in this research is stationary and can be used for hypothesis testing.

4.4.3 Test of Normality

This study tested the other diagnostic test for CLRM assumption of normality. According to the assumption, disturbances are normally distributed. According to Brooks (2014), one of the most commonly applied tests for normality is the Jarque-Bera test. Jarque-Bera employs the property of a normally distributed random variable, which states that the entire distribution is defined by the first two moments, the mean and the variance. The standardized third and fourth moments of a distribution are skewness and kurtosis. Skewness is a measure of a distribution's symmetry around its mean value. A skewed distribution is not symmetric about its mean, whereas a normal distribution is.

Table 4. 5 skewness -kurtosis- test for normality



Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	Joint adj chi2(2)	Joint Prob>chi2
resid	117	0.0000	0.0000	.	0.0714

Source: STATA output results and researcher's computation

As we can see from the STATA output above, Jarque Bera test revealed P-Values of 0.0714 which is above 0.05 for both implying that we cannot reject the null hypothesis of normality. Hence, we once again confirm that the distribution of the residuals is normal.

4.4.4. Test of Multicollinearity

According to Brooks (2014) the absence of multicollinearity assumption says that the explanatory variables are not correlated with one another. If the explanatory variables have no relationship with one another, they are said to be orthogonal to one another. Adding or removing a variable from a regression equation would not change the values of the coefficients on the other variables if the explanatory variables were orthogonal to one another. A small degree of association between explanatory variables will almost always occur, but will not result in significant precision loss.

Table 4. 6 Variable Inflation Factor (VIF) Technique to Detect Multicollinearity

Variable	VIF	1/VIF
lnr	3.54	0.282663
gdprate	3.35	0.298352
unr	3.04	0.329321
lev	2.79	0.358737
size	2.47	0.404963
bms	2.20	0.454554
ifr	1.90	0.526909
roa	1.63	0.613084
age	1.53	0.655731
liquidity	1.51	0.663019
car	1.33	0.753223
lgrate	1.26	0.792983
oef	1.22	0.820867
Mean VIF	2.13	

Source: STATA output results and researcher's computation

According to Daoud (2017), in order to say no multicollinearity among explanatory variables variance inflation factor should be less than 10 and tolerance value should be greater than 0.1 or 10%. In principle, a VIF greater than 10 may suggest that the concerned variable is multi-collinear with others in the model and may need to be excluded from the model to overcome the severity of the problem. Hence, the VIF result in table 4.6, as none of the VIFs is 2.13 which suggests that there is no collinearity between the explanatory variables.

4.4.5. Test of Heteroskedasticity

The homoscedasticity assumption of the classical regression model states that, the variance of the unobserved error, u, conditional on the explanatory variables, is constant. Homoskedasticity fails whenever the variance of the unobserved factors changes across different segments of the population, where the segments are determined by the different values of the explanatory variables (Wooldridge, 2016). Even if there are numerous of methods to detect the existence of heteroscedasticity, the researcher used Breusch-Pagan/ Cook-Weisberg.

Ho: There is no heteroscedasticity in the model

H1: Ho is false

Table 4. 7 Breusch-Pagan/ Cook-Weisberg test for Heteroskedasticity

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of par30

         chi2(1)      =   160.77
         Prob > chi2  =   0.1063
```

Source: STATA output results and researcher's computation

As we can see from the above table 4.7, the p-value which is 0.1063 is insignificant, meaning it is greater than 0.05, and hence we do not reject the null hypothesis that this research's residuals are homoscedastic.

4.5. Test of Model Specification

In this study, Ramsey RESET test are used to detect omitted variables.

4.5.1. Ramsey RESET Test for Omitted Variables

RESET Ramsey proposed the RESET (Regression Specification Error Test) in 1969. This test is based on the null hypothesis, which states that "the model has no omitted variables." The test's intuition is that if non-linear combinations of the explanatory variables have any power to explain the response variable, the model is mis specified in the sense that the data generation process could be better approximated by a polynomial or another non-linear functional form.

Table 4. 8 RESET Test for Omitted Variables

```
Ramsey RESET test using powers of the fitted values of par30
       Ho: model has no omitted variables
                 F (3, 100) =      13.31
                  Prob > F =       0.2351
```

Source: STATA output results and researcher's computation

As we can see on table 4.8, the p-value is not less than 0.5. Hence, it is impossible to reject the null hypothesis and we can conclude that our model is fit; or there is no specification error in the data. It is safe to say that there is no omitted specification in data. To the best knowledge of the researcher all the variables included in the model were believed to be important as it was evidenced by different empirical results from both MFIs and commercial banks perspective. So, the researcher was not relayed only by the result of Ramsey test but also by those empirical evidences.

4.6. Test of Autocorrelation

According to Gujarati and Porter (2009) the assumption of no autocorrelation between the disturbances assumes that given any two X values, Xi and Xj (i≠j), the correlation between any two ui and uj(i≠j), is zero. According to Brooks (2014), the errors are assumed to be unrelated to one another, If the errors are not uncorrelated with one another, they are said to be auto correlated 'or serially correlated '. If the errors are correlated with one another, they are said to be autocorrelated. The Durbin Watson (DW) autocorrelation test was used to put this assumption to

the test. Durbin-Watson (DW) is a first order autocorrelation test, which looks for a relationship between an error and its immediately preceding value.

Table 4. 9 Durbin Watson (DW) test to check autocorrelation

```
. dwstat

Durbin-Watson d-statistic( 14,   117) =  2.471255
```

Source: STATA output results and researcher's computation

In general, DW test statistic values in the 1.5 to 2.5 range are accepted as normal. Values outside of this range, on the other hand, may be cause for concern. As we can see the above test, the obtained DW-statistics (2.4) ends up in the zone of no autocorrelation.

4.7. Regression Results and Analysis

In this section, the empirical results of the panel multiple linear regression model that determines credit risk (PAR>30) of Ethiopian Microfinance institutions have been discussed. The purpose of regression analysis in this study is to examine the importance of each independent variable in explaining the variation of credit risk of Ethiopian Microfinance institutions. The empirical data of the value of the variables are computed for nine consecutive years (2012 - 2020), using audited financial statements of the selected MFIs which was gathered from National bank of Ethiopia, AEMFIs and from the world bank. Therefore, the panel data computed by multivariate ordinary least square (OLS) regression is carried out in this study to provide a comprehensive analysis about the determinants of Credit risk in Ethiopian microfinance institutions. The STATA application version 16, was used here to run the multivariate regressions.

Section 4.4 is dedicated to discuss whether the regression model is unbiased or not by running test of classical linear regression model (CLRM) assumptions (normality, multicollinearity, heteroskedasticity, model specification) which suits to the employed panel data.

The linear regression model before estimation was:

$PAR{>}30nt = \alpha + \beta1*IFRnt + \beta2*LNRnt + \beta3*SIZEnt + \beta4*ROAnt + \beta5*OEFnt + \beta6*LEVnt + \beta7*LOGnt + \beta8*CARnt + \beta9*AGEnt + \beta10*LIQnt + \beta11*GDPrnt + \beta12*UNRnt + \beta13*BMSnt + \varepsilon nt$

Table 4. 10 The Panel Multiple Linear Model Regression Results

```
. reg par30 lgrate lev roa age size liquidity car oef gdprate ifr unr bms lnr

      Source |       SS           df       MS      Number of obs   =       117
-------------+----------------------------------   F(13, 103)      =     20.55
       Model |  .208317441        13  .016024419   Prob > F        =    0.0000
    Residual |  .080298842       103   .0007796   R-squared       =    0.7218
-------------+----------------------------------   Adj R-squared   =    0.6867
       Total |  .288616283       116  .002488071   Root MSE        =    .02792

------------------------------------------------------------------------------
       par30 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lgrate |  -.1349649    .049894    -2.71   0.008    -.2339178   -.036012
         lev |   .5393324   .0768838     7.01   0.000     .3868515   .6918133
         roa |  -.6607678   .2523806    -2.62   0.010    -1.161305  -.1602304
         age |  -.0591877   .0420046    -1.41   0.162    -.1424939   .0241184
        size |   .7282051   .1921227     3.79   0.000     .3471752   1.109235
   liquidity |  -.1078623   .0248226    -4.35   0.000    -.1570921  -.0586325
         car |  -.0088496   .0205295    -0.43   0.667     -.049565   .0318658
         oef |  -.0133695   .0131918    -1.01   0.313    -.0395323   .0127934
     gdprate |  -.0506886   .4867715    -0.10   0.917    -1.016085   .9147079
         ifr |  -.0039645   .0523948    -0.08   0.940    -.1078772   .0999481
         unr |    1.41098   1.556484     0.91   0.367    -1.675938   4.497899
         bms |   .0128899   .0866411     0.15   0.882    -.1589423   .1847221
         lnr |  -.8559209   .6673637    -1.28   0.203    -2.179479   .4676376
       _cons |   .2724446    .186782     1.46   0.148    -.0979934   .6428826
------------------------------------------------------------------------------
```

Source: STATA output results and researcher's computation

As shown in the above table 4.10: On the upper right, there are overall summaries of the 'robust' regression: the number of observations, the F test for the overall significance, R2 and the square root mean squared error of the residuals. The most important information is presented on the lower pane of the regression output. On the first column, we have the names of the dependent variable (PAR>30) and that of the explanatory variables (lgrate, lev, roa, age, size, liquidity, car, oef, gdp rate, ifr, unr, bms and lnr) and cons- is the constant term (intercept) of the regression. In the second column (Coef.), the values of the coefficients (α, β1, β2, β3, β4, β5, β6, β7, β8, β9, β10, β11, β12, β13) and error term (ε) are listed. The third column (Std.Err.) shows the standard errors that are related with coefficients. The fourth column (t) lists down the t-statistics used in testing whether a given coefficient is significantly different from zero. Further in the fifth column (P>|t|) shows the two-tailed p-values used in testing the null hypothesis making the

coefficient zero. To this end, the confidence interval for the coefficient is given in the last two columns.

The regression value and analyses of the upper right corner in table 4.10: are discussed as follows;

The result of R squared is 0.7218 which indicates that about 72.18 percent of the change of PAR>30 is explained by the determinants (lgrate, lev, roa, age, size, liquidity, car, oef, gdp rate, ifr, unr, bms and lnr). In other words, about 72.18 percent of the variability in the dependent variable is explained by the independent variables that are included in the model. However, the remaining 27.82% variation in Ethiopian MFIs credit risk as measured by PAR>30 was caused by other factors that were not included in the model. Hence, the p-value of F-statistics is zero, the null hypothesis was rejected and the model was significant, which enhanced the fitness of the model. In other words, all the independent variables were jointly significant in causing variation in Ethiopian MFIs credit risk. This shows that there was significant relationship between the dependent variable and explanatory variables. The adjusted R2 avoids the overestimation effect of including additional variables in the model.

When it comes to the first column of the lower lift side in table 4.10, it shows the beta coefficients and the result revealed that, the beta coefficient of lgrate, roa, age, liquidity, car, oef, gdp rate, ifr and lnr are negative while the beta coefficient of size, unr, lev and bms are said to be positive. Among those explanatory variables lgrate, lev, roa, size and liquidity are statistically significant at 1% level of significance.

Thus, based on the above regression output, the Panel linear regression model for this study could be written as follows:

$$PAR{>}30_{nt} = 0.2724 - 0.0039(IFR_{nt}) - 0.8559(LNR_{nt}) + 0.7282(SIZE_{nt}) - 0.06607(ROA_{nt}) -$$
$$\quad (0.186) \quad (0.052) \quad (0.667) \quad (0.192) \quad (0.252)$$
$$0.0133(OEF_{nt}) + 0.5393(LEV_{nt}) - 0.1349(LOG_{nt}) - 0.0133(CAR_{nt}) - 0.0591(AGE_{nt}) - 0.1078\,(LIQ_{nt})$$
$$(0.013) \quad (0.076) \quad (0.049) \quad (0.020) \quad (0.042) \quad (0.024)$$
$$-0.0506(GDPr_{nt}) + 1.4109(UNR_{nt}) + 0.0128(BMS_{nt}) + \varepsilon_{nt}$$
$$(0.0486) \quad (1.556) \quad (0.086)$$

4.7.1. Discussion of Results

In this section, the relationship between the dependent variable (credit risk) and explanatory variables were discussed as follows on the basis of the panel model regression result from this study and those results were evidenced by empirical literatures stated in chapter two. Due to lack of enough empirical studies in Microfinance institutions, this discussion also inferred from commercial banks to argue in support or against it.

A. GDP growth rate and Credit risk

From Research hypothesis one, a negative and significant impact of GDP growth rate on credit risk was expected. The regression results revealed that, the coefficient of real GDP growth and p-value was-0.0506 and 0.917 respectively. This shows that real GDP growth rate has negative and statistically insignificant effect credit risk of Ethiopian Microfinance institutions. From Microfinance perspective, this finding supports the result Rono (2020), who found a statistically insignificant effect of GDP growth on credit risk. From Commercial banks perspective This finding supports the results of Salem, Labidi and Mansour (2020); Tole, Jabir and Wolde (2019); Zheng, Bhowmik and Sarker (2020); Mustafa and Ali (2019); Pei (2019); Mpofu and Nikolaidou (2018); Effendi and Yuniarti (2018); Mazreku *et al.* (2018). But contradict with the significance level. The previous supported studies conclude that GDP growth rate has negative and significant impact on credit risk. But this study conclude that GDP growth rate has negative and insignificant impact on Credit risk. Therefore, in general, null hypothesis has been accepted and concluded that GDP growth rate had insignificant impact on Ethiopian Microfinance institutions credit risk. This study disproof the hypothesis developed in chapter one and two.

B. Inflation rate and Credit risk

The result in table 4.10, confirms that inflation rate has a negative and statistically insignificant effect on credit risk of Ethiopian microfinance institutions. From MFIs perspective, this result supports the arguments of Rono (2020) with both direction and significance. But it contradict with the result of Tilahun (2015) who found a positive and statistically insignificant effect of inflation on credit risk. From Commercial banks perspective this result was supported by the findings of Kassa (2018); Effendi and Yuniarti (2018); Mazreku et al. (2018) , but contradict with a statistically significance level. The previous supported studies in those commercial banks conclude that inflation rate had a significant negative effect on the level of credit risk. But this

study conclude that Inflation rate has a negative and statistically insignificant impact on credit risk. Therefore, the null hypothesis has been accepted and conclude that Inflation rate had insignificant impact on credit risk of Ethiopian MFIs.

This study disproof the hypothesis developed in chapter one & two which said, "inflation rate has statistically significant effect on credit risk of Ethiopian MFIs"

C. Money Supply and credit risk

The result in table 4.10, indicated that, broad money supply growth rate as a measurement of money supply has a positive and statistically insignificant effect on credit risk. Due to lack of empirical and theoretical literatures related to Microfinance institutions, the result is supported by findings from commercial banks. Accordingly, the research result is supported by the findings of Salem et al. (2020); Morakinyo & Sibanda (2016); Pasha, Bastanzad and Hossein (2016).but it contradict with signifcance level. The previous supported studies conclude that Money supply had positive and statistically significant effect on credit risk whereas this study conclude broad money supply had a positive but statistically insignificant impact on credit risk of Ethiopian MFIs.

This study disproof the hypothesis developed in chapter one & two which said, "Money supply has statistically significant effect on credit risk of Ethiopian MFIs"

D. Unemployment Rate and credit risk

The regression result in table 4.10, indicated that, unemployment rate has a positive but statistically insignificant effect on credit risk of Ethiopian MFIs. From Microfinance perspective This finding is supported by the result of Rono (2020) in both direction and significance level.

From Commercial banks perspective this finding is supported by Mustafa and Ali (2019) ; Mazreku et al. (2018). But it contradicts with significance level. Those previous supported studies conclude that unemployment rate had positive and statistically significant effect on credit risk whereas this study conclude unemployment had a positive but statistically insignificant impact on credit risk of Ethiopian MFIs.

This study therefore, disproof the hypothesis developed in chapter one & two which said, "unemployment has statistically significant effect on credit risk of Ethiopian MFIs"

E. Lending rate and credit risk

The regression table 4.10, shows that lending rate had a negative but statistically insignificant effect on credit risk of Ethiopian MFIs. From Microfinance Perspective, this result is supported by the findings of Tilahun (2015) in both direction and significance level whereas it is inconsistent with the findings of Rono (2020) tough their coefficient are negative. From Commercial Banks perspective the findings of the study is supported by Kassa (2018), but the significance level is contradict.

This study therefore, disproof the hypothesis developed in chapter one & two which said, "lending rate has statistically significant effect on credit risk of Ethiopian MFIs"

F. Return on Asset and Credit risk

As shown in table 4.10, ROA had negative and statistically significant effect on credit risk of Ethiopian Microfinance Institutions and from microfinance institutions perspective this result is supported by the findings of Tehulu & Abegaz (2016); Adugna (2014). Based on coefficient the finding of Tehulu and Olana (2014) support the study result , however it contradict because of siginficance level. The finding is against the result of Tilahun (2015)**.** The finding also supported by emprical results in commerical banks such as ; Mekuria (2017) . The researcher concludes that there is negative and statistically significant impact of ROA on credit risk in Ethiopian MFIs. This reveals negative and statistically significant impact of ROA on the levels of credit risk and implies that for 1% increase in MFIs profitability measured in terms of ROA, keeping the other thing constant had resulted 66.07 % reduction in the level of credit risk in Ethiopian microfinance institutions.

This study proofs the hypothesis developed in chapter one and two which said, "ROA has a significant impact on credit risk of Ethiopian MFIs."

G. **Operating efficiency and Credit risk**

The regression result of table 4.10, confirms negative and statistically insignificant effect of operating efficiency on credit risk of Ethiopian MFIs. The finding is supported by Tilahun (2015)**.** Further the findings of Tehulu & Abegaz (2016); Ganic' (2014) supported the direction or coefficient of the result, But it contradict in significance level. Finally, the finding is against the result of Tehulu and Olana (2014) in which operating ratio had a positive significant effect on

credit risk. This study concludes operating efficiency had a negative but statistically insignificant impact on credit risk of Ethiopian MFIs.

This study therefore, disproof the hypothesis developed in chapter one & two which said, "operating efficiency has a significant effect on credit risk of Ethiopian MFIs."

H. Liquidity and Credit risk

The regression result in table 4.10, revealed that liquidity has a negative and statistically significant effect on credit risk of Ethiopian MFIs. The beta coefficient of liquidity is -0.1078, clearly embodies that 1 unit increase in MFIs liquidity, keeping the other thing constant reduce 0.1078 unit of credit risk. This result is supported by the empirical studies in commercial banks such as; Mekuria (2017); Morakinyo and Sibanda (2016). Further, from MFIs emprical studies , the study result is supported by the findings of Tehulu and Olana (2014), but it contradict in significance level. Finally, the study result is against the result of Adugna (2014). The result of Adugna (2014) revealed that liquidity had a positive and statistically significant effect on credit risk of Ethiopian MFIs. In contrast, this study conclude that liquidity has a negative but statistically significant effect on credit risk of Ethiopian MFIs.

This study therefore, proofs the hypothesis developed in chapter one and two which said "liquidity has a significant effect on credit risk of Ethiopian MFIs."

I. Size of MFI's and credit risk

The regression result in table 4.10, confirms that size of MFI's as measured by logarithm of gross loan portfolio has a positive and statistically significant effect on credit risk of Ethiopian MFIs. a coefficient of 0.7282 indicate that assume other things constant, one unit increase in size cause 0.7282 unit increase in credit risk of Ethiopian MFIs. This finding suggests that diversification and effective monitoring measures increase MFIs size to cover unexpected events and reduce the chances of insolvency or it simply mean when MFIs size increase monitoring and controlling of it became difficult, this in turn leads to credit risk problem. The study result is against the findings of Tehulu & Abegaz (2016)**;** Tilahun (2015); Tehulu and Olana (2014)**;** Adugna (2014); Lu (2013). And from commercial banks the study result is supported by Kitila, Lemi and Sultan (2019); Tole, Jabir and Wolde (2019); Kassa (2018). To this end, this study conclude that size of MFIs has positive and statistically significant effect on credit risk of Ethiopian MFIs.

This study therefore, proofs the hypothesis developed in chapter one and two which said "size of MFIs has a significant effect on credit risk of Ethiopian MFIs."

J. Age of MFI's and credit risk

Based on Table 4.10, above, age of MFIs has negative but statistically insignificant effect on credit risk of Ethiopian MFIs. The significance level of this study is supported by the findings of Tehulu & Abegaz (2016). However, it contradicts in beta coefficient. This study concludes age of MFIs has negative but statistically insignificant effect on credit risk of Ethiopian MFIs.

This study therefore, disproof the hypothesis developed in chapter one and two which said "age of MFIs has a significant effect on credit risk of Ethiopian MFIs."

K. Loan Growth and credit risk

Table 4.10, confirms that, loan growth has a negative and statistically significant effect on credit risk of Ethiopian MFIs. A beta coefficient of -0.1349 indicates that assume other things constant, a one percent (1%) increases in loan leads to 13.49 percent reduction in the level of credit risk in Ethiopian MFIs. The result is supported by the findings of Tole, Jabir and Wolde (2019); Zheng, Bhowmik and Sarker (2020); Kassa (2018); Tamiru (2017); Ganic' (2014); Tehulu and Olana (2014). However the study result is against the result of Tilahun (2015). So, the study concludes there is a negative and statistically significant impact of loan growth on credit risk of Ethiopian MFIs.

This study therefore, proof the hypothesis developed in chapter one and two which said "Loan growth has a significant effect on credit risk of Ethiopian MFIs."

L. Leverage and Credit risk

As shown in table 4.10, leverage has a positive and significant effect on credit risk of Ethiopian MFIs. beta coefficient of 0.5393 indicate that assume other things constant, one unit increase in leverage cause 0.5393 unit increase in credit risk of Ethiopian MFIs. The study result is supported by the findings of Adugna (2014); Ghosh (2005). Further, the beta coefficient of the result is in line with the result of Tehulu & Abegaz (2016). However, the finding is against the result of Tapano (2012). The study conclude that leverage has positive and statistically significant effect on credit risk of Ethiopian MFIs.

This study therefore, proof the hypothesis developed in chapter one and two which said "leverage has a significant effect on credit risk of Ethiopian MFIs."

M. Capital Adequacy and credit risk

Based on table 4.10, of the regression result, capital adequacy ratio has negative but statistically insignificant effect on credit risk of Ethiopian MFIs. This result is supported by the findings of Tehulu and Olana (2014); Tapano (2012). Further , the beta coefficient of the study result is also similar to the result of Kitila, Lemi and Sultan (2019); Morakinyo and Sibanda (2016); Tilahun (2015).This study also conclude that capital adequacy ratio has a negative but statistically significant effect on credit risk. This study therefore, disproof the hypothesis developed in chapter one and two which said "capital adequacy ratio has a significant effect on credit risk of Ethiopian MFIs."

4.8. Summary of Findings

In this chapter the results of descriptive and inferential statistics were discussed. Several assumptions or diagnostic tests such as unit root test, model specification test, multicollinearity test, autocorrelation test and normality test were also performed to achieve the objectives of this study. The table below summarizes the expected results and actual or regression results as follows:

Table 4. 11 Summary of Expected results and Actual results

Variable	Expected sign and effect	Actual sign and effect
Credit risk		
Inflation rate	Positive & significant	Negative & insignificant
Lending rate	Negative & significant	Negative & insignificant
Firms size	Positive & significant	Positive & significant
Return on asset	Negative & significant	Negative & significant
Operating efficiency	Negative & significant	Negative & insignificant
Leverage	Positive & Significant	Positive & Significant
Loan growth	Negative & significant	Negative & significant
Capital Adequacy	Negative & significant	Negative & insignificant
Age of MFIs	Negative & significant	Negative & insignificant
liquidity	Negative & significant	Negative & significant
GDP growth	Negative & significant	Negative & insignificant
Unemployment	Positive & significant	Positive & insignificant
Broad Money supply	Positive & significant	Positive & insignificant

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5. Introduction

In the previous chapter, the results of the study were presented and discussed. This chapter deals with the conclusions and recommendations of the study based on the findings. Hence, section 5.1 presents the conclusions, section 5.2 presents the recommendations and Avenues for Future Research and Improvements provided in section 5.3.

5.1. Conclusion

Lending is the principal business activity for all MFIs. The loan portfolio is typically the most valuable asset and the primary source of revenue. As such, it is one of the greatest sources of risk to a MFI's safety and soundness. The loan portfolio's value is determined not only by the interest rates earned on loans, but also by the likelihood that interest and principal will be paid. Whether due to slack credit standards, poor portfolio risk management, or weakness in the economy, loan portfolio problems have historically been the major cause of MFIs losses and failures in general and Ethiopian microfinance institutions in particular. The severity of credit risk in Ethiopian microfinance institutions became an important concern in recent years.

The main objective of this study was to examine determinants of credit risk in Ethiopian microfinance institution for the period between 2012-2020. A balanced panel data of 13 microfinance institutions and 117 observations have been used for the analysis. The regression results revealed that 72.18 percent of the variation in the dependent variable (credit risk as measured by portfolio at risk> 30) is explained by the independent variables included in the model. However, their degree of significance is not the same. This means, those explanatory variables are good in explaining credit risk in Ethiopian microfinance institutions. In general, based on the regression analysis, the following conclusion has been provided:

- Based on the regression analysis variables such as: Loan growth rate, Leverage, size, return on asset and Liquidity have a statistically significant effect on credit risk of Ethiopian Microfinance institutions.

- Among those statistically significant variables Loan growth rate, Return on Asset and Liquidity have a beta coefficient of negative, whereas Leverage and Size of MFIs have coefficient of positive. This Coefficients tell us the direction(magnitude) of the explanatory variables in determining the dependent variable.
- Explanatory variables such as Age of MFIs, capital adequacy ratio, operating efficiency, GDP growth rate, inflation rate, unemployment rate, Lending rate and broad money supply are believed to be statistically insignificant in explaining credit risk of Ethiopian Microfinance Institutions during the period under study.
- Among those statistically insignificant explanatory variables; Age of MFIs, capital adequacy ratio, operating efficiency, GDP growth rate, Lending rate and Inflation rate have a beta coefficient of negative whereas Unemployment and broad money supply have a positive beta coefficient.
- Further, an increase in Loan growth rate, Return on Asset and Liquidity would reduce credit risk by a significant amount and vice-versa. In contrast, an increase in Leverage and Size of MFIs would also leads to an increase in credit risk of Ethiopian MFIs.
- Finally, as shown in R-square of the regression result the explanatory are good in explaining Credit risk of Ethiopian microfinance institutions. From those explanatory variables the researcher concludes that Loan growth rate, Leverage, size, return on asset and Liquidity are the most powerful variables in explaining credit risk of Ethiopian MFIs.

5.2. Recommendation

Based on the findings of the study; Loan growth rate, Leverage, size of MFIs, return on asset and Liquidity were the significant drivers of credit risk in Ethiopian MFIs. Hence, focusing and reengineering the institutions alongside these indicators could reduce the probability of credit risk in Ethiopian Microfinance Institutions. Let us see the possible recommendations on each statistically significant variables as follows:

- Ethiopian Microfinance institutions should increase the amount of loans delivered to its loan clients because when there is a loan growth in Ethiopian MFIs, credit risk is reduced by a significant amount. This is evidenced by When the amount of credit grows, the client's investment would increase likewise it leads to an increase in economies of scale. An increase in economies of scale means the loan clients are in an excellent position to repay their debts. To do so, the National Banks of Ethiopia should liberalize MFIs Directives on credit limits. However, microfinance institutions need to understand to whom they are granting credit. Therefore, prior to entering into any new credit relationship, a microfinance institution should become familiar with the borrower or counterparty and be confident that they are dealing with an individual or organization of sound repute and creditworthiness.
- Ethiopian MFIs should sustain their profitability in order to reduce the amount credit risk. This is evidenced by high ROA shows that the financial position of the MFIs is stable, and they are not interested in investing in risky loans. So, the possible risk from investing in risky asset will reduced. To this end, working more to increase return on asset ratio assists to reduce portfolios risk.
- Since leverage has a statistically significant effect on credit risk of Ethiopian Microfinance institutions, managers should manage and follow up their liability properly. When assessing the risk of leverage, the value of the company and its activities should also be considered. If a company borrows debt to modernize its operations, add new products to its product line, or expand its operations, the additional diversification would most likely cancel the extra risk from leverage. If not, this leads to the management of the organizations to worry about whether the organization is bankrupt or not. Likewise, low

attention would be given to the amount of loan given to its client. This in turn would increase the probability of default by the borrowers.

- Microfinance institutions should increase liquidity so as to minimize the credit risk problem. This is based on the idea that, when those microfinance institutions secure a stable amount of liquidity, they can settle their loan obligation and they can also lend the remaining amount to reduce idle asset on hand. Therefore, their loan clients can get additional funds to strengthen their earlier business, this in turn reduce the probability of default.
- The finding suggests an increase in MFIs size, increases MFIs size to cover unexpected events and reduce the chances of insolvency or it simply mean when MFIs size increase monitoring and controlling of it became difficult, this in turn leads to credit risk problem. So, Microfinance institutions first, they should diversity their business to different sector of the economy and they should also use efficient and smart employees to manage their diversified business.

5.3 Suggestions for further studies

This study examined both microfinance-specific and macroeconomic determinants of Ethiopian Microfinance institutions using selected variables from 2012 to 2020. Nonetheless, there are so many variables that were not involved in this study. Consequently, future researchers may be interested in validating the consistency of the result and provide supplementary results for this study by including other variables like GDP per capita, pubic debt, tax issues Moreover, the same study may be required on newly emerging microfinance institutions. The results obtained by piloting econometric examination can be used to project fundamental grounds of credit risk in the economy of Ethiopia. It will help policymakers in developing countries like Ethiopia to take enough measures to control credit risk or take precautions against it. The contribution of the current study puts light on future research. For example, future research could be conducted in developing and emerging economies like Ethiopia.

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Appendix I: The data used in the regression analysis

firm	ID	year	PAR>30	LG rate	lev	ROA	size	age	liquidity	CAR	OEF	gdp rate	IFR	UNR	BMS	LNR
acsi	1	2012	0.01	0.56558	2.57858	0.07901	6.4748	1.20412	1.66082	0.27944	0.06494	0.087	0.341	0.0228	0.30281	0.1188
acsi	1	2013	0.0073	0.43891	2.7493	0.07119	6.63283	1.23045	1.75278	0.26672	0.06687	0.099	0.135	0.0225	0.24242	0.1188
acsi	1	2014	0.006	0.22806	3.16676	0.06509	6.72205	1.25527	1.19484	0.23999	0.06622	0.103	0.081	0.0226	0.26532	0.1188
acsi	1	2015	0.0086	0.47951	3.34457	0.06163	6.89217	1.27875	1.21635	0.23017	0.06742	0.104	0.077	0.0227	0.24713	0.1188
acsi	1	2016	0.009	0.26027	3.39792	0.05839	6.99263	1.30103	1.11942	0.22738	0.09432	0.08	0.097	0.0229	0.19912	0.1275
acsi	1	2017	0.0034	0.22979	3.27852	0.05676	7.08246	1.32222	1.05362	0.23373	0.04185	0.101	0.074	0.023	0.28779	0.1275
acsi	1	2018	0.0169	0.46301	3.65086	0.05342	7.24771	1.34242	1.13638	0.21501	0.0878	0.077	0.146	0.0232	0.29153	0.135
acsi	1	2019	0.0304	0.39471	3.65261	0.0417	7.39219	1.36173	1.30942	0.21493	0.09771	0.09	0.126	0.0233	0.19739	0.135
acsi	1	2020	0.0559	-0.0994	3.13192	0.03447	7.34673	1.38021	1.22031	0.2284	0.11766	0.061	0.199	0.0324	0.17017	0.143
ocssco	2	2012	0.032	0.27415	2.68745	0.16701	6.22981	1.20412	1.69078	0.27119	0.08983	0.087	0.341	0.0228	0.30281	0.1188
ocssco	2	2013	0.0277	0.44047	2.98793	0.17018	6.38831	1.23045	1.65595	0.25076	0.08726	0.099	0.135	0.0225	0.24242	0.1188
ocssco	2	2014	0.0349	0.42292	4.11243	0.15724	6.5415	1.25527	1.51878	0.1956	0.06848	0.103	0.081	0.0226	0.26532	0.1188
ocssco	2	2015	0.032	0.05169	2.91884	0.18726	6.56338	1.27875	1.59295	0.25518	0.12536	0.104	0.077	0.0227	0.24713	0.1188
ocssco	2	2016	0.074	0.03433	2.4105	0.0574	6.57804	1.30103	1.55001	0.29321	0.12326	0.08	0.097	0.0229	0.19912	0.1275
ocssco	2	2017	0.0205	0.68026	3.55786	0.2221	6.80342	1.32222	1.71162	0.2194	0.08701	0.101	0.074	0.023	0.28779	0.1275
ocssco	2	2018	0.0217	0.39752	4.10231	0.19553	6.94878	1.34242	2.08248	0.19586	0.08146	0.077	0.146	0.0232	0.29153	0.135
ocssco	2	2019	0.0254	0.17591	4.46857	0.04765	7.01915	1.36173	2.17317	0.18286	0.08735	0.09	0.126	0.0233	0.19739	0.135
ocssco	2	2020	0.1491	0.11859	4.06448	0.02678	7.06782	1.38021	2.28464	0.19745	0.10953	0.061	0.199	0.0324	0.17017	0.143
adcsi	3	2012	0.025	0.19272	1.61637	0.03725	5.81522	1.07918	1.74665	0.38221	0.07415	0.087	0.341	0.0228	0.30281	0.1188
adcsi	3	2013	0.0298	0.45114	1.46271	0.08606	5.97693	1.11394	1.28493	0.40606	0.07509	0.099	0.135	0.0225	0.24242	0.1188
adcsi	3	2014	0.0294	0.68939	1.61782	0.09525	6.20466	1.14613	1.41154	0.382	0.06796	0.103	0.081	0.0226	0.26532	0.1188
adcsi	3	2015	0.0251	0.42229	1.60065	0.10782	6.35765	1.17609	1.76245	0.38452	0.07235	0.104	0.077	0.0227	0.24713	0.1188
adcsi	3	2016	0.0294	0.04113	1.55206	0.1457	6.37515	1.20412	1.63218	0.39184	0.06748	0.08	0.097	0.0229	0.19912	0.1275
adcsi	3	2017	0.0189	0.01825	2.01658	0.17861	6.38301	1.23045	1.28379	0.3315	0.07859	0.101	0.074	0.023	0.28779	0.1275
adcsi	3	2018	0.04665	0.11263	1.86155	0.19899	6.42936	1.25527	1.6745	0.34946	0.07422	0.077	0.146	0.0232	0.29153	0.135
adcsi	3	2019	0.0744	0.09093	2.03341	0.05882	6.46715	1.27875	1.68053	0.32966	0.07629	0.09	0.126	0.0233	0.19739	0.135
adcsi	3	2020	0.0926	0.60837	2.51759	0.04955	6.67354	1.30103	2.67258	0.28429	0.05363	0.061	0.199	0.0324	0.17017	0.143

omo	4	2012	0.094	0.44411	4.61514	0.01002	5.93231	1.20412	1.74466	0.17809	0.08439	0.087	0.341	0.0228	0.30281	0.1188
omo	4	2013	0.0173	0.49928	4.80978	0.03154	6.10819	1.23045	1.65242	0.17212	0.0748	0.099	0.135	0.0225	0.24242	0.1188
omo	4	2014	0.009	0.54234	5.83502	0.02865	6.29637	1.25527	1.70085	0.14631	0.08538	0.103	0.081	0.0226	0.26532	0.1188
omo	4	2015	0.0624	0.34078	5.85245	0.03394	6.42373	1.27875	1.79413	0.14593	0.08255	0.104	0.077	0.0227	0.24713	0.1188
omo	4	2016	0.021	0.1419	7.64688	0.02714	6.48136	1.30103	1.68649	0.11565	0.10332	0.08	0.097	0.0229	0.19912	0.1275
omo	4	2017	0.0382	0.22944	11.885	0.02445	6.57107	1.32222	1.41389	0.07761	0.10808	0.101	0.074	0.023	0.28779	0.1275
omo	4	2018	0.03185	0.49545	8.39593	0.02115	6.74584	1.34242	1.54974	0.10643	0.10354	0.077	0.146	0.0232	0.29153	0.135
omo	4	2019	0.0255	0.30956	4.20059	0.03597	6.86296	1.36173	1.84774	0.19229	0.08286	0.09	0.126	0.0233	0.19739	0.135
omo	4	2020	0.0666	-0.00853	4.8892	0.02349	6.85924	1.38021	1.66753	0.1698	0.09039	0.061	0.199	0.0324	0.17017	0.143
agar	5	2012	0.075	0.64921	2.36419	0.10671	4.499	0.95424	3.63576	0.29725	0.15222	0.087	0.341	0.0228	0.30281	0.1188
agar	5	2013	0.0543	0.59064	1.51568	0.11501	4.70057	1	2.97309	0.39751	0.13264	0.099	0.135	0.0225	0.24242	0.1188
agar	5	2014	0.0291	0.60303	1.55505	0.12964	4.90551	1.04139	3.8571	0.39138	0.1078	0.103	0.081	0.0226	0.26532	0.1188
agar	5	2015	0.0284	0.58489	1.36608	0.15313	5.10551	1.07918	4.50959	0.42264	0.1076	0.104	0.077	0.0227	0.24713	0.1188
agar	5	2016	0.024	0.45515	1.32389	0.14882	5.26842	1.11394	4.92858	0.43031	0.10569	0.08	0.097	0.0229	0.19912	0.1275
agar	5	2017	0.0063	0.34638	0.95915	0.13168	5.39758	1.14613	2.97303	0.51042	0.10855	0.101	0.074	0.023	0.28779	0.1275
agar	5	2018	0.0408	0.21906	0.85554	0.13107	5.48361	1.17609	3.77036	0.53893	0.12071	0.077	0.146	0.0232	0.29153	0.135
agar	5	2019	0.0753	0.20172	1.3273	0.08995	5.56341	1.20412	2.43327	0.42968	0.14615	0.09	0.126	0.0233	0.19739	0.135
agar	5	2020	0.2547	-0.21696	1.09907	0.09082	5.4572	1.23045	2.04792	0.4764	0.24448	0.061	0.199	0.0324	0.17017	0.143
Vision	6	2012	0.023	0.8169	1.09844	-0.01553	5.25409	1.14613	3.19111	0.47655	0.23515	0.087	0.341	0.0228	0.30281	0.1188
Vision	6	2013	0.0178	0.51043	1.06272	0.06585	5.43319	1.17609	2.92068	0.4848	0.22371	0.099	0.135	0.0225	0.24242	0.1188
Vision	6	2014	0.0658	0.00512	0.92253	0.08919	5.43541	1.20412	2.00357	0.52015	0.2819	0.103	0.081	0.0226	0.26532	0.1188
Vision	6	2015	0.0524	0.4347	0.83422	0.15576	5.59217	1.23045	2.10055	0.54519	0.2082	0.104	0.077	0.0227	0.24713	0.1188
Vision	6	2016	0.0658	0.2472	0.86388	0.2318	5.6881	1.25527	2.13073	0.53652	0.20983	0.08	0.097	0.0229	0.19912	0.1275
Vision	6	2017	0.0275	0.36297	0.95068	0.28346	5.82259	1.27875	2.09643	0.51264	0.18193	0.101	0.074	0.023	0.28779	0.1275
Vision	6	2018	0.0312	0.53918	1.52064	0.27818	6.00988	1.30103	2.14505	0.39672	0.1693	0.077	0.146	0.0232	0.29153	0.135
Vision	6	2019	0.0348	0.37962	1.7989	0.08495	6.14964	1.32222	2.12264	0.35728	0.18245	0.09	0.126	0.0233	0.19739	0.135
Vision	6	2020	0.0395	0.30398	1.90839	0.07232	6.26491	1.34242	2.40378	0.34383	0.18796	0.061	0.199	0.0324	0.17017	0.143

wassa	7	2012	0.013	0.35644	1.41037	0.22043	5.18009	1.11394	3.58555	0.41487	0.11619	0.087	0.341	0.0228	0.30281	0.1188
wassa	7	2013	0.0052	0.33351	2.14639	0.22547	5.30509	1.14613	3.22822	0.31782	0.13626	0.099	0.135	0.0225	0.24242	0.1188
wassa	7	2014	0.0071	0.26492	2.37179	0.23374	5.40715	1.17609	3.1185	0.29658	0.15088	0.103	0.081	0.0226	0.26532	0.1188
wassa	7	2015	0.0083	0.34824	3.25907	0.20336	5.53692	1.20412	4.20449	0.23479	0.13728	0.104	0.077	0.0227	0.24713	0.1188
wassa	7	2016	0.0073	0.14526	3.37427	0.18541	5.59583	1.23045	2.90242	0.22861	0.17037	0.08	0.097	0.0229	0.19912	0.1275
wassa	7	2017	0.0046	0.01296	2.71726	0.20489	5.60142	1.25527	2.45685	0.26902	0.18995	0.101	0.074	0.023	0.28779	0.1275
wassa	7	2018	0.0317	-0.02957	2.40923	0.2342	5.58838	1.27875	1.94324	0.29332	0.2044	0.077	0.146	0.0232	0.29153	0.135
wassa	7	2019	0.0588	0.60445	2.72896	0.02911	5.79371	1.30103	2.31681	0.26817	0.11431	0.09	0.126	0.0233	0.19739	0.135
wassa	7	2020	0.0571	0.10415	2.88445	0.0146	5.83674	1.32222	2.25029	0.25744	0.1882	0.061	0.199	0.0324	0.17017	0.143
Bussa G	8	2012	0.006	0.4269	1.15071	0.26268	5.03572	1.14613	5.45747	0.43805	0.16802	0.087	0.341	0.0228	0.30281	0.1188
Bussa G	8	2013	0.0044	0.47918	1.5494	0.24134	5.20574	1.17609	4.91444	0.35459	0.16139	0.099	0.135	0.0225	0.24242	0.1188
Bussa G	8	2014	0.008	0.40237	1.69462	0.24372	5.3526	1.20412	4.03216	0.34067	0.14396	0.103	0.081	0.0226	0.26532	0.1188
Bussa G	8	2015	0.0088	0.12067	1.80919	0.23185	5.40208	1.23045	3.11681	0.29525	0.16251	0.104	0.077	0.0227	0.24713	0.1188
Bussa G	8	2016	0.0081	0.1335	1.42911	0.04757	5.4565	1.25527	2.75959	0.36319	0.16374	0.08	0.097	0.0229	0.19912	0.1275
Bussa G	8	2017	0.0038	0.03796	1.34796	0.06259	5.47268	1.27875	2.51118	0.35735	0.13551	0.101	0.074	0.023	0.28779	0.1275
Bussa G	8	2018	0.0212	0.40645	1.86606	0.0469	5.6208	1.30103	2.27329	0.29033	0.14936	0.077	0.146	0.0232	0.29153	0.135
Bussa G	8	2019	0.0386	0.34661	2.43118	0.04233	5.75004	1.32222	2.24804	0.2405	0.1811	0.09	0.126	0.0233	0.19739	0.135
Bussa G	8	2020	0.0564	0.07496	2.24006	0.03143	5.78144	1.34242	2.3347	0.25579	0.21052	0.061	0.199	0.0324	0.17017	0.143
Dynamic	9	2012	0.1498	-0.71955	2.39282	-0.41572	2.65137	0.60206	1.06412	0.29474	1.05892	0.087	0.341	0.0228	0.30281	0.1188
Dynamic	9	2013	0.32	0.14684	1.85773	-0.85403	2.71088	0.69897	1.42829	0.35	1.21463	0.099	0.135	0.0225	0.24242	0.1188
Dynamic	9	2014	0.1979	-0.00706	-10.5407	-1.4937	2.7078	0.77815	1.63901	-0.10482	1.67695	0.103	0.081	0.0226	0.26532	0.1188
Dynamic	9	2015	0.0758	7.5174	0.163	-0.29757	3.63811	0.8451	5.03907	0.85984	0.24106	0.104	0.077	0.0227	0.24713	0.1188
Dynamic	9	2016	0.056	2.50476	0.33248	0.31153	4.18277	0.90309	5.70075	0.75047	0.13343	0.08	0.097	0.0229	0.19912	0.1275
Dynamic	9	2017	0.0261	0.8474	0.28746	0.14488	4.44933	0.95424	3.7268	0.77672	0.01592	0.101	0.074	0.023	0.28779	0.1275
Dynamic	9	2018	0.0367	0.43727	0.36587	0.11751	4.60687	1	2.86098	0.73213	0.17288	0.077	0.146	0.0232	0.29153	0.135
Dynamic	9	2019	0.0473	0.80451	0.63703	0.16596	4.86322	1.04139	2.31255	0.61086	0.14073	0.09	0.126	0.0233	0.19739	0.135
Dynamic	9	2020	0.0704	0.04225	0.65485	0.08597	4.8812	1.07918	2.06044	0.60429	0.21866	0.061	0.199	0.0324	0.17017	0.143

peace	10	2012	0.001	0.16569	1.21404	0.45848	4.71529	1.14613	3.49853	0.45166	0.16722	0.087	0.341	0.0228	0.30281	0.1188
peace	10	2013	0.0014	0.423	1.35911	0.46198	4.8685	1.17609	3.1627	0.42389	0.14691	0.099	0.135	0.0225	0.24242	0.1188
peace	10	2014	0.0013	0.11081	1.29156	0.45211	4.91414	1.20412	2.93807	0.43638	0.15779	0.103	0.081	0.0226	0.26532	0.1188
peace	10	2015	0.0011	0.10708	1.29394	0.44291	4.95832	1.23045	2.78607	0.43593	0.18569	0.104	0.077	0.0227	0.24713	0.1188
peace	10	2016	0.0013	0.00149	1.27293	0.23326	4.95896	1.25527	2.46263	0.43996	0.46048	0.08	0.097	0.0229	0.19912	0.1275
peace	10	2017	0.0009	0.28798	1.34378	0.2649	5.06887	1.27875	3.17182	0.42666	0.18808	0.101	0.074	0.023	0.28779	0.1275
peace	10	2018	0.00065	0.34261	1.99727	0.24447	5.19683	1.30103	2.23368	0.33364	0.20456	0.077	0.146	0.0232	0.29153	0.135
peace	10	2019	0.0004	0.48546	2.31852	0.06757	5.36869	1.32222	3.6405	0.30134	0.15426	0.09	0.126	0.0233	0.19739	0.135
peace	10	2020	0.0627	0.23684	2.87454	0.04152	5.461	1.34242	2.34558	0.2581	0.15085	0.061	0.199	0.0324	0.17017	0.143
Harbu	11	2012	0.033	0.59084	2.01714	0.00779	4.59859	0.90309	2.7811	0.33144	0.11541	0.087	0.341	0.0228	0.30281	0.1188
Harbu	11	2013	0.0836	0.11939	2.22128	0.00843	4.64757	0.95424	2.45395	0.31044	0.22664	0.099	0.135	0.0225	0.24242	0.1188
Harbu	11	2014	0.0492	-0.05627	1.89993	0.00941	4.62242	1	2.12223	0.34484	0.24792	0.103	0.081	0.0226	0.26532	0.1188
Harbu	11	2015	0.0421	0.10136	1.63691	-0.08282	4.66435	1.04139	2.4931	0.37923	0.2261	0.104	0.077	0.0227	0.24713	0.1188
Harbu	11	2016	0.0482	0.26753	2.34365	0.00555	4.76731	1.07918	2.48086	0.29907	0.26765	0.08	0.097	0.0229	0.19912	0.1275
Harbu	11	2017	0.0257	0.46989	3.49703	0.00914	4.93459	1.11394	2.41664	0.22237	0.19312	0.101	0.074	0.023	0.28779	0.1275
Harbu	11	2018	0.0333	0.54373	4.15814	0.03254	5.12316	1.14613	2.73758	0.19387	0.18929	0.077	0.146	0.0232	0.29153	0.135
Harbu	11	2019	0.0408	0.40941	4.94064	0.12811	5.2722	1.17609	2.96288	0.16833	0.18384	0.09	0.126	0.0233	0.19739	0.135
Harbu	11	2020	0.0357	0.21839	3.54725	0.09265	5.35799	1.20412	3.26808	0.21991	0.18519	0.061	0.199	0.0324	0.17017	0.143
AVFS	12	2012	0.095	0.04471	0.80679	0.1157	4.19154	1.17609	2.31448	0.55347	0.25022	0.087	0.341	0.0228	0.30281	0.1188
AVFS	12	2013	0.0437	-0.07268	1.24738	0.0831	4.15877	1.20412	2.47932	0.44496	0.32653	0.099	0.135	0.0225	0.24242	0.1188
AVFS	12	2014	0.036	0.16263	1.40271	0.02775	4.22421	1.23045	2.42519	0.4162	0.33775	0.103	0.081	0.0226	0.26532	0.1188
AVFS	12	2015	0.0391	0.07538	1.5036	0.0431	4.25577	1.25527	2.1245	0.39942	0.3205	0.104	0.077	0.0227	0.24713	0.1188
AVFS	12	2016	0.037	-0.00424	1.40155	0.01408	4.25393	1.27875	2.09248	0.4164	0.32519	0.08	0.097	0.0229	0.19912	0.1275
AVFS	12	2017	0.0304	-0.00367	0.86991	-0.06313	4.25233	1.30103	2.07276	0.53478	0.31293	0.101	0.074	0.023	0.28779	0.1275
AVFS	12	2018	0.1111	-0.09426	0.87291	0.03317	4.20934	1.32222	1.91598	0.53393	0.2714	0.077	0.146	0.0232	0.29153	0.135
AVFS	12	2019	0.1918	0.10814	1.40155	0.01583	4.25393	1.34242	2.09248	0.4164	0.32519	0.09	0.126	0.0233	0.19739	0.135
AVFS	12	2020	0.3558	-0.58732	3.60051	-0.13308	3.86955	1.36173	0.6185	0.21737	1.03184	0.061	0.199	0.0324	0.17017	0.143

sidama	13	2012	0.041	0.36587	2.78372	0.04976	4.71863	1.20412	1.83524	0.2643	0.18058	0.087	0.341	0.0228	0.30281	0.1188
sidama	13	2013	0.1215	0.55692	3.96125	0.04264	4.9109	1.23045	2.18756	0.20156	0.15623	0.099	0.135	0.0225	0.24242	0.1188
sidama	13	2014	0.0985	0.27416	2.01682	0.05482	5.01612	1.25527	2.19319	0.33148	0.14817	0.103	0.081	0.0226	0.26532	0.1188
sidama	13	2015	0.0103	0.11504	1.94356	0.05062	5.06341	1.27875	2.21458	0.33972	0.17153	0.104	0.077	0.0227	0.24713	0.1188
sidama	13	2016	0.0092	0.21531	2.38885	0.05573	5.1481	1.30103	1.64042	0.29509	0.14186	0.08	0.097	0.0229	0.19912	0.1275
sidama	13	2017	0.0471	0.33443	2.04152	0.07737	5.27339	1.32222	1.78215	0.32878	0.15917	0.101	0.074	0.023	0.28779	0.1275
sidama	13	2018	0.0574	0.32174	1.83358	0.08044	5.39454	1.34242	1.99545	0.35291	0.13747	0.077	0.146	0.0232	0.29153	0.135
sidama	13	2019	0.0676	0.22199	1.56879	0.0622	5.4816	1.36173	1.91116	0.38929	0.14985	0.09	0.126	0.0233	0.19739	0.135
sidama	13	2020	0.2191	0.03236	1.40864	0.04643	5.49544	1.38021	1.90544	0.41517	0.15411	0.061	0.199	0.0324	0.17017	0.143

Appendix II Diagnostic test and other output

- **Hausman Test**

```
Test:  Ho:  difference in coefficients not systematic

            chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                    =       24.04
          Prob>chi2 =      0.0000
```

- Levin – Lin - Chu unit root – Test

```
Levin-Lin-Chu unit-root test for par30
------------------------------------------

Ho: Panels contain unit roots               Number of panels  =      13
Ha: Panels are stationary                   Number of periods =       9

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

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 Unadjusted t         -8.8027
 Adjusted t*          -6.1037        0.0000
------------------------------------------------------------------------------
```

Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	Joint adj chi2(2)	Joint Prob>chi2
resid	117	0.0000	0.0000	.	0.0714

❖ **RESET Test for Omitted Variables**

Ramsey RESET test using powers of the fitted values of par30

Ho: model has no omitted variables

F (3, 100) = 13.31

Prob > F = 0.2351

❖ **Breusch-Pagan/ Cook-Weisberg test for Heteroskedasticity**

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of par30

chi2(1) = 160.77

Prob > chi2 = 0.1063

❖ **Variable Inflation Factor (VIF) Technique to Detect Multicollinearity**

Variable	VIF	1/VIF
lnr	3.54	0.282663
gdprate	3.35	0.298352
unr	3.04	0.329321
lev	2.79	0.358737
size	2.47	0.404963
bms	2.20	0.454554
ifr	1.90	0.526909
roa	1.63	0.613084
age	1.53	0.655731
liquidity	1.51	0.663019
car	1.33	0.753223
lgrate	1.26	0.792983
oef	1.22	0.820867
Mean VIF	2.13	