DETERMINANTS OF MICROFINANCE INSTITUTIONS LOAN PORTFOLIOS QUALITY: EMPIRICAL EVIDENCE FROM ETHIOPIA

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This is to certify that the thesis prepared by Sara Adugna, entitled: *Determinants of microfinance institutions l oan por tfolios qual ity: an e mpirical s tudy on E thiopian m icrofinance i nstitutions* and submitted in partial fulfillment of the requirements for the Degree of Master of Science (Accounting and Finance) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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LIST OF ACRONYMS.

ACSI	Amhara Credit and Savings Institution
ADCSI	Addis Credit and Savings Institution
AEMFI	Association of Ethiopian Microfinance Institution
CLRM	Classical Linear Regression Model
GLS	Generalized Least Square
OCSSO	Oromia Credit and Savings Institution Share.co
OLS	Ordinary Least Square
VIF	Variance Inflation Factor

ABSTRACT

This study examined determinants of loan portfolios quality, using panel data of fourteen (14) MFIs from the period 2003- 2012. The study employed four dependent variables as proxies for loan portfolios quality, namely: loan loss rate (LLR), portfolio at risk over 30-days (PAR-30days), portfolio at risk over 90-days (PAR-90days) and write-off ratio (WOR).This study is crucial from the fact that there is limited research on MFIs loan portfolios quality using quantitative approach in Ethiopia. Based on the pooled ordinary least squares (OLS) and random effects generalized least squares, 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 leverage and inflation. Since MFIs provide financial services to the poor people those who cannot provide collateral, thus they may highly face default risk when borrowers fail to repay their obligations as per the agreement. Accordingly, the findings of the study may have implications for MFIs and policy makers in that it provides hint on some important determinants of loan portfolios quality.

CHAPTER ONE

1. INTRODUCTION

1.1.Background of the Study

Microfinance is the provision of financial service to the poor people with very small business or business projects (Marzys, 2006). Only a small fraction of the world population has access to financial instruments because commercial banks consider the poor people as un-bankable due to their lack of collateral and information asymmetries.Most microfinance institutions do not require formal collateral, and instead base loan decisions on character, group solidarity, and past repayment history (Ruerd and Schers, 2007). Collateral, when pledged, may not be legally registered or may have little liquidation value. Thus, when loan portfolio quality suffers substantially, MFIs face far greater loan losses relative to the amounts outstanding than intermediaries that operate other types of portfolios secured with collateral. In the other way, the extent to which the loan would secure is based on the MFIs' screen, monitor and facilitate repayment activities. The more the MFIs properly analyze and approve loan has a significant impact on the loan repayment rate, which in turn brings back money to facilitate loan disbursement to other clients (Crabb and Keller, 2004).

There are a number of studies (Ledgerwood, 1999; Robinson, 2001; Khandker, 2003; Magnus, 2005; Woller and Schreiner, 2006) on the MF industry at international level because it has got the attention of academicians and practitioners as an innovative method of fighting poverty. Poverty is the main challenge and a fundamental issue of economic development in Ethiopia. The solutions to poverty are multifaceted as are its causes. Alleviation of poverty and promotion

of economic development can therefore be facilitated through providing credit to the poor (Melkamu, 2012). Moreover, most studies conducted were mainlyconcentrated on three key areas.The first area is impact assessment whether the provision of financial service has improved the lives of the poor in terms of economic, social and political indicators of poverty(Magnus, 2005). The second area is whether these financial service providers reach the poorest of the poor who is in need of financial services (Folake, 2005).The third is the issue of financial sustainability of MFIs(Okerenta et al., 2007).Nevertheless, it is limited in Ethiopia.

Currently, the Ethiopian microfinance institutions are playing crucial roles in improving the life of poor societies and economic development of the country as a whole. Accordingly, their loan outstanding is substantially increasing (589 million birr in 2003 to 7.15 billion birr in 2011, AEMFI performance analysis report, 2012). With this regard, the vital objective of MFIsis poverty alleviation. To do so, their loan portfolios should be secured, and can be collected in order to facilitate loan disbursement to other clients. As the loans provided are repaid on the contract date, the MFIs more reach poor people in finance, which may in turn to increase loan portfolios quality. Therefore, the study is intended to identify and analyze what drives loan portfolios quality of fourteen (14) Ethiopian microfinance institutions data set over 2003 – 2012 using panel regression models.

1.2. Statement of the problem

Nowadays, microfinance institutions are playing vital roles in economic development ofdeveloping countries.Khandker (2003) points out that the goals of microfinance institutions as development organizations are to service the financial needs of un-served or underserved markets as a means of meeting development objectives such as to create employment, reduce poverty, empower women or poor people, and encourage the development of new business. More specifically, three objectives of microfinance institutions are frequently cited: to create employment and income opportunities through the creation and expansion of microenterprises; to increase the productivity and income of vulnerable groups, especially women and the poor; and to reduce rural families' dependence on drought-prone crops through diversification of their income generating activities (World Bank, 2007). In short, micro finance institutions are expected to reduce poverty, which is considered as the most important development objective.

Most MFIs do not require formal collateral, and instead base loan decisions on character, group solidarity, and past repayment history. Collateral, when pledged, may not be legally registered or may have little liquidation value. Thus, when loan portfolio quality suffers substantially, MFIs face far greater loan losses relative to the amounts outstanding than intermediaries that operate other types of portfolios secured with collateral. If loans are not properly analyzed and approved to clients, there might be a significant adverse impact on the loan repayment rate (Crabb and Keller, 2004). According, a decrease in loan repayment loans has enormous effect on microfinance institutions operations. First, it leads to inappropriate valuation of assets and misallocation of resources. For example, an increase in loan portfolios at risk reduces assets. Loan loss rate also reduces net income. Second, it confines the MFIs financial capacity to reach

poor people in finance and then, distorts efficiency economic of the institutions. Finally, a lower repayment loan may in part contribute to financial distress because it leads to weak financial services.

Despite the increasing reliance on microfinance institutions to reduce poverty and life of poor people in Ethiopia, to my knowledge there is few research done related to determinants of MFIs loan portfolio quality. According to association of Ethiopian microfinance institutions performance analysis,non-performing loans as measured by portfolios at riskover 90 days was 12 percent of total outstanding in 2003, 17 percent in 2004 and 22 percent in 2009, which was the highest rate thatthe MFIs had recorded. The institutions had also recorded 5 percent of outstanding loans in 2012. These figures show that a significant amount of loan portfolios of MFIs were not collected as per the agreement and then reduce the quality of loan portfolios.Having well diversified loan portfolios is inefficient unless they are secured and repaid as per the agreement. Therefore, identifying and analyzing what drives loan portfolio quality is very essential as it helps to have healthy loans. In an attempt to fill this gap, the study analyzed 14 MFIs data set using panel regression models.

1.3. Objective of the study

1.3.1 General Objective

The main objective of the study is to examine the determinants of loan portfolios quality of microfinance institutions in Ethiopia.

1.3.2. Specific Objectives

In line with above stated main objective, the study aims at achieving the following specific objectives:

- To examine the effect of MFIs characteristics on loan portfolios quality.
- To examine the effect of macroeconomic factors (change in GNI per capita and inflation) on MFI loan portfolio quality.

1.4. Hypotheses of the study

In line with the main objective of the study, the researcher has developed the following hypotheses based on the theories and empirical studies discussed in literature related to MFIs loan portfolios quality.

HP1: There is a significant positive/ negative relationship between the size of MFIs and the MFIs loan portfolios quality.

HP2: There is a significant negative relationship between operating expense of MFIs and MFIs loan portfolios quality.

HP3: There is a significant positive relationship between age of MFIs and MFIs loan portfolios quality.

HP4: There is a significant negative relationship between the ratio of women borrowers and MFIs loan portfolios quality.

HP5: There is a significant negative relationship between leverage and MFIs loan portfolios quality.

HP6: There is a significant positive/ negative relationship between deposit to loan ratio and loan portfolios quality.

HP7: There is a significant positive/ negative relationship between gross loan portfolio to total asset ratio and MFIs loan portfolios quality.

HP8: There is a significant positive / negative relationship between voluntary savings and MFIs loan portfolios quality.

HP9: There is a positive / negative significant relationship between return on equity and MFIs loan portfolios quality.

HP10: There is a significant positive relationship between growth national income and MFIs loan portfolios quality.

HP11: There is a significant positive/ negative relationship between inflation and MFIs loan portfolios quality.

1.5. Significance of the Study

The findings of the study may serve as stepping-stone for other studies, which may focus on similar topics and issues related to the determinants of loan portfolios quality of microfinance institutions. It might also help those policy makers to support, encourage, and promote MFIs for poverty alleviation through maximizing loan portfolios quality and minimizing loanlosses relative to the amounts outstanding than intermediaries that operate other types of portfolios secured with collateral.

1.6. Scope of the Study

The area of the study is limited to the determinants of loan portfolios quality of MFIs in Ethiopia. The study only used quantitative variables which are measured numerically and thus, secondary data were needed. The study time period covers 2003 to 2012.

1.7. Limitation of the study

As with any other study, this study is subject to some limitations. First, the sample of MFIs was selected based on availability of data for the observation periods. This may introduce bias inherent with non- probability sampling method.The unavailability of yearly annual report for the year 2013 forced the researcher to exclude data's for this time period. Second**,** some variables like lending methodology, interest rate, financial depth are not included in the model. Finally, due to non-random sampling approach used, generalization of the findings would somewhat be limited.

1.8. Structure of the study

This study is organized into five chapters. Chapter one presents introductions of the study. The literature review part of the study is presented in chapter two. The review of the literature includes the theoretical review in the first section which is followed by the review of the previous studies related to the area and conclusion and knowledge gap finally. Chapter three presents the research methodology. The results and discussions of the study are presented in chapter four. Finally chapter five presents the conclusions and recommendations of the study.

CHAPTER TWO

2. REVIEW OF LITERATURES

2.1. Theoretical Review

2.1.1. What is a Microfinance Institution?

Different authors and organizations have defined Microfinance institutions in different ways. However the essence of the definitions are usually the same in which microfinance refer to the provision of financial services; primarily savings and credit to the poor and low income households that don't have access to commercial banks.

Arsyad (2005) and Legerwood (1999) defines it as the provision of financial services (generally saving and credit) to low income clients. Robinson (2001) defines it as small scale financial services primarily credit and saving provided to people who farm or fish or herd; who operate small enterprises or micro-enterprises where goods are produced, recycled, repaired or sold; who provide services; who work for wage and commission; who gain income from renting out small amount of land, vehicles, draft animals, or machinery tools; and other individual and groups at the local level of developing countries both rural and urban area.

But for this case the definition given by the MIX (Microfinance information exchange) is more appealing than the rest provided in the above paragraph.The MIX (Microfinance information exchange) defines the microfinance institutions as a variety of financial services that target low-income clients, particularly women. Since the clients of microfinance institutions have lower incomes and often have limited access to other financial services, microfinance products tend to be for smaller monetary amounts than traditional financial services. These services include loans,

savings, insurance, and remittances. Micro-loans are given for a variety of purposes, frequently for micro-enterprise development. The diversity of products and services offered reflects the fact that the financial needs of individuals, households, and enterprises can change significantly over time, especially for those who live in poverty. Because of these varied needs, and because of the industry's focus on the poor, microfinance institutions often use non-traditional methodologies, such as group lending or other forms of collateral not employed by the formal financial sector.

2.1.2. Characteristics of Microfinance.

Microfinance came into being from the appreciation that micro-entrepreneurs and some poorer clients can be ‘bankable’, that is, they can repay, both the principal and interest, on time and also make savings, provided financial services are tailored to suit their needs. Microfinance as a discipline has created financial products and services that together have enabled low-income people to become clients of a banking intermediary. The characteristics of microfinance products include (Murray.U&Boros.R, pp. 10-11, 2002).

- Little amounts of loans and savings.
- Short- terms loan (usually up to the term of one year).
- Payment schedules attribute frequent installments (or frequent deposits).
- Installments made up from both principal and interest, which amortized in course of time.
- Higher interest rates on credit (higher than commercial bank rates but lower than loan-shark rates), which reflect the labor-intensive work associated with making small loans and allowing the microfinance intermediary to become sustainable over time.

- Easy entrance to the microfinance intermediary saves the time and money of the client and permits the intermediary to have a better idea about the clients' financial and social status.
- No collateral is required contrary to formal banking practices. Instead of collateral, microfinance intermediaries use alternative methods, like, the assessments of clients' repayment potential by running cash flow analyses, which is based on the stream of cash flows, generated by the activities for which loans are taken.

2.1.3. Portfolio Theory

2.1.3.1. Risks in Portfolio

Maintaining quality portfolio is not that simple as it is exposed to different risk. A MFI must balance many different types of risk within its portfolio. Common risks include (Nara Hari.D,2007) :

Credit risk: This risk originates due to client's unwillingness or inability to repay their loans. Credit risk results in a deterioration of the MFI's portfolio, reduced revenues, and increased operating expenses. **Interest rate risk**: Any changes in the level of market interest rates during the term of a loan relates to interest rate risk. This risk originates from the mismatch of the maturities of the MFI's assets and liabilities. **Liquidity risk**: A MFI's difficulty in obtaining needed cash at a reasonable cost. The largest source of risk for any financial institution resides in its loan portfolio. The loan portfolio is by for a largest asset of the microfinance institution (MFI).

2.1.3.2. Markowitz's portfolio theory

The cornerstone of Markowitz's seminal 1952 theory, for which he was awarded a Nobel Prize in Economics in 1990, is the ability of investors to diversify away unsystematic risk by holding

portfolios consisting of a number of different shares. Markowitz's starting point is to construct what is known as the envelope curve. This represents the set of portfolio choices available to investors when investing in different combinations of risky assets (Brealey, 2003):

The Basics of Modern Portfolio Theory

The primary rule of MPT is the following dictum: For every level of expected risk, a portfolio can be constructed to achieve the highest expected return or, alternatively, for any given level of expected return, a portfolio can be constructed to have the lowest expected risk. Portfolios having these characteristics lie on or quite close to the Efficient Frontier. Under MPT an Efficient Frontier is constructed in expected risk/return space, where return is the expected return of the portfolio and risk is measured by the standard deviation or volatility of the portfolio.

Forecasting Returns.

The expected return of any portfolio can be forecast in a relatively straightforward manner: it is the weighted average of the expected returns of the assets in the portfolio, with the weights being the proportions of the individual assets' market values relative to the market value of the total portfolio.

Forecasting Risk.

The risk (standard deviation) of a portfolio, however, is not the weighted average of the expected standard deviations of the constituent assets. Risk goes beyond the individual standard deviations to encompass the inter-asset correlations or how each asset moves with every other asset in the portfolio. Because the portfolio is the appropriate level of analysis under the Rule, estimating the expected returns, standard deviations, and correlations for every asset in the portfolio are all reasonable duties of the fiduciary.

The Portfolio Effect.

The importance of asset return correlations is probably the most practical contribution of MPT and constitutes the portfolio effect. This effect means that the fiduciary cannot make portfolio decisions by viewing the risk and return characteristics of one asset or asset class in isolation but must take into account how this asset's return correlates with all the other assets in the portfolio.

Problems with the practical application of portfolio theory

There are problems associated with trying to apply portfolio theory in practice, some of which are as follows.It is unrealistic to assume that investors can borrow at the risk-free rate. Individuals and companies are not risk-free and will therefore not be able to borrow at the risk-free rate; they will be charged a premium to reflect their higher level of risk.

- There are problems with identifying the market portfolio as this requires knowledge of the risk and return of all risky investments and their corresponding correlation coefficients.
- Once the make-up of the market portfolio is identified it will be expensive to construct because of transaction costs. These costs will be prohibitive in the case of smaller investors.
- The composition of the market portfolio will change over time. This will be due to shifts both in the risk-free rate of return and in the envelope curve and hence the efficient frontier.

One way for smaller investors to overcome the problems mentioned above is by buying a stake in a large, diversified portfolio, for example by buying into unit trusts, investment trusts or *index* tracker funds

2.1.4. Terms and Definitions

According to Ledgerwood (1999), the performance of MFI is measured in many parameters.

This includes:

Portfolio Quality indicators: Portfolio quality ratios provide information on the percentage of non-earning assets, which in turn decrease the revenue and liquidity position of MFIs. Some of the measures used include the repayment rates, arrears rate, Portfolio at risk, delinquent borrowers, loan loss reserve ratio, and loan loss ratio.

Productivity ratio: Productivity refers to the volume of business that is generated (output) for a given resource or asset (input). Common measures of productivity include the number of active loans per credit officer, and average portfolio outstanding per credit officer.

Profitability in dicators: These indicators measure the MFI net income in relation to the structure of its balance sheet. Common measures include Return on Equity, Return on Assets, and Return on Business.

Leverage ratio: Leverage refers to the extent to which a MFI borrows money relative to its amount of equity. In other words, it answers the question of how many additional dollars can be mobilized from commercial sources for every dollar worth of funds owned by the MFI. The most widely used measure of leverage is the debt equity ratio.

Gross loan portfolio:- The outstanding principal balance of all of an MFI's outstanding loans, including current, delinquent, and restructured loans, but not loans that have been written off. It does not include interest receivable.

Portfolio at risk: - The value of all loans outstanding that have one or more installments of principal past due more than a certain number of days. This item includes the entire unpaid principal balance, including both past-due and future installments, but not accrued interest. It

also does not include loans that have been restructured or rescheduled. Portfolio at risk (PAR) is usually divided into categories according to the amount of time passed since the first missing principal installment.

Number of loans outstanding: - The numbers of loans that have been neither fully repaid nor written off and thus comprise part of the gross loan portfolio. For MFIs using a group-lending methodology, this term includes every individual who is responsible for repaying a portion of a group loan.

Value of loans written off: - The value of loans that have been recognized for accounting purposes as uncollectible. The process of recognizing an uncollectible loan is called a write-off or a charge-off. A write-off is an accounting procedure that removes the outstanding balance of the loan from the gross loan portfolio and from the loan-loss allowance. Thus the write-off does not affect the balance of the net loan portfolio, total assets, or any equity account, unless the loan-loss reserve was insufficient to cover the amount written off.

Loan Loss Rate:-We can carry out such a historical analysis of loan portfolio performance by calculating the loan loss rate. The loan loss rate refers to the amount of loans that has actually been written off during a specific period of time. These are explicit losses that an institution has acknowledged because there is no possibility to recover or enforce the loan.

Number of active borrowers: - The numbers of individuals who currently have an outstanding loan balance with the MFI or are primarily responsible for repaying any portion of the gross loan portfolio. This number should be based on the number of individual borrowers rather than the number of groups.

Number of active clients:-The number of individuals who are active borrowers, depositors, or both. Individuals who have multiple loans or accounts with an MFI should be counted as a single

client. Individuals who are not currently receiving any service directly from the MFI are not included, such as those with facilitated savings.

The loan portfolio is the primary income generating asset for an MFI1 and it is most commonly subject to material misstatements. Most MFI failures stem from the deterioration in the quality of the loan portfolio (Graham A, P.6, 2006).

2.2. Review of Empirical Studies

This section reviews the related empirical evidence on the factors affecting MFIs loan portfolios quality and identifies the research gap that the current study is intended to fill out partially.

Zeller (1998) examined the determinants of repayment performance for group lending in Madagascar using data from a random sample of 146 groups in 6 different lending programs. He found that group consisting of members facing homogenous risk exposure do not have higher repayment rates, but that repayment rates significantly improve when groups have some type of social cohesion, informal or not. Bhatt and Tang (2002) conducted a study to investigate the determinants of loan repayments in microcredit programs that applied the group lending approach, but took a different approach. Bhatt and Tang looked at the borrower's socio economic variables instead of the elements of group lending for their influence on loan repayment behavior. The borrower's socioeconomic variables included gender, educational level, household income and characteristics of the business (type of business, years in business, etc.). In their study, they found that a higher education level was significant and positively related to better repayment performance. Conversely, female borrowers, level of household income, type of business and borrower's experience had no significant effect on repayment behavior.Chaudhary and Ishafq (2003) examined the credit worthiness of 224 rural borrowers in Pakistan. Using

logistic regression, they found that borrowers with higher educational levels, involved in a non-farm business activity, who were using the loans for investment and were female, had a higher probability of repaying their loan. The study found that the subsidized interest rate level did not have a significant effect on repayment behavior among rural borrowers in Pakistan. They concluded that a subsidized interest rate was not the best way to ensure good repayment by borrowers.

Peter and Keller (2004) find that the ratio of women borrowers within the total clients has relationship with MFIs loan portfolio. They suggest that group lending can significantly improve repayments and therefore reduce risks in loan portfolios. Espallier (2009), study analyzed gender differences with respect to microfinance repayment rates using a large global dataset covering 350 microfinance institutions in 70 countries. The result revealed that more women clients are associated with lower portfolio at risk, lower write-offs and lower credit loss provisions. The study in general revealed that women are a better credit- risk for MFIs, as the effect were stronger for NGO's individual based lenders, finance plus providers and regulated MFIs.

Micha'el (2006), study attempted to identify some of the main factors that influence microfinance level loan repayment performance of the informal sector. Data for the study was collected through a structured interview, questionnaire and informal discussion in ten sub-cites of Addis Ababa. The results of the study indicated that the better repayment performance were strongly and directly associated with educational level of borrower, insufficiency of the loan granted and un-planned engagements in business activity do also reduce repayment performance. Beatrice (2012) investigated external factors (socio political instability, economic downturn, weather conditions inability to enforce); MFIs (corporate governance, loan process and procedures, default recovery methods.) and self- help group's specific factors (group governance,

members of screening process, default recovery methods). The study findings revealed that as there exists a positive and significant relationship between loan delinquency and MFIs specific factors. In addition self- help group's specific factors have a significant relationship to loan delinquency performance. Suraya et.al. (2012), investigated the determinants of loan repayment problems among microfinance borrowers in Tekun and Yum institutions in Malaysia. He noted that borrower's characteristics (age, gender, type of business involved and microcredit loan characteristics (mode of repayment amounts) are as the factors to microcredit loan repayment amounts problems, therefore result in risks in loan portfolio.

R.Srinivasan (2007) addressed the measurement of loan delinquency and default in microfinance institutions (MFIs) in India during 1998 to 2006 period. The paper concluded that the mature i.e. the rate after say a year of operations of MFI current collection rate, portfolio at risk number would not mislead and with improper loan loss provision net portfolio at risk will not reflect delinquency correctively, therefore concluded that the collection rate as useful for estimating delinquency. Romy (2007) analyzed also the impact of institutional characteristics on the default rates of non- profit MFIs. He stated that a focus on women borrowers, on institutional incorporation into the community, and on client led programing all lead to lower default rates and thus greater success.

Jackle (2013) analyzed micro and macro indicators of MFIs portfolio quality. He noted that PAR over 30 days is statistically significant driven by its own past trend, size of gross loan portfolio and how it grows, operational self- sufficiency, loss provisioning and write- off policy, amount of female borrowers and the degree of loan monitoring on the micro side and on macro side

indicators (inflation rate, the labor force participation rate and depth of financial system as important. Letenah (2009) find also that large and small MFIs are allocating more loan loss provision expense than the industry average and the related portfolio at risk is high for these MFIs and microfinance age correlated positively with efficiency and productivity.

Norhaziah and Mohad (2013) examined the loan repayment problems in microfinance programs in peninsular Malaysia using a total of 30 respondents with the MFI staffs and clients. The study result revealed that the factors affecting the ability of borrowers to repay their loans are business factors, borrower's attitude towards their loans, other debt burden, amount of loan received, business experience, business formality and family background. Finally, the researcher concluded that those factors result in risks in loan portfolios. Adayemo and Agbonlahor (2007), study provided empirical analysis of microcredit repayment in southwestern Nigeria, multi stage ratified random samplingprocedure was used to collect data from 200 members of MFIs in the study area. The study findings revealed that amount of loan borrowed, access to business information, and penalty for lateness to group meetings as significantly influence of their loan repayment performance.

Walter and Lilian (2013) investigated the causes of loan default in Trans Nzoia using a sample of 150 MFIs (100 MFI loan borrowers and 50 MFIs official loan borrowers). They find loan repayment default was a result of non- supervision of borrowers by MFIs, in adequate training of borrowers on utilization of loan funds before the received loans. The findings also revealed that most borrowers did not spend the loan amount on intended and agreed projects.

Fofack (2005) study analyzed casual and macroeconomic implication on loan default in sub-Saharan countries. The study used pseudo panel- based prediction models to test real exchange rate appreciation, net interest margins and real interest rate. The study result showed that, macroeconomic stability and economic growth are associated with a declining level of default; whereas average macroeconomic shocks coupled with higher cost of capital and lower interest margins are associated with a rising scope of nonperforming loans. John (2008) examined how performance, both financially and in terms of outreach of MFIs varies with changes in domestic economy of an institution. The data set used for this study was made available through the microfinance information exchange (MIX). The study includes 3258 separate observation from 77 different countries and from this 10 of the countries were included in the study during 1999 to 2006 period. The study finding revealed that there is no significant correlation with changes in any of the microfinance performance indicators and domestic GDP.

Ruerd and Schers (2007) find that MFI size exercises an opposite relationship on loan portfolio risk. In fact larger firms are subject to various investigations by financial analysts, regulators, external auditors and they relatively hire more qualified employees which in turn reduce the risks of loan. Gonzalez (2007) analyzed the impact of macroeconomic shocks on the quality of microfinance loan portfolios using quantitative research approach. The study result revealed that size of (the number of borrowers per staff member) and operating expense ratio have significant relationship with MFI loan portfolio quality as measured by portfolio at risk over 30-days and write-off ratio.

Bert et al. (2009) study on the impact of women borrowers on loan repayment in microfinance in Norway using 350 rated MFIs from 70 countries during 2001 to 2006 period. The study used

panel data regression techniques with the independent variables were the proportion of female borrowers and a wide variety of MFIs specific and institutional controls. The result indicated that more women clients as associated with lower portfolio at risk, lower write-offs and lower credit-loss provisions.

Anne Norgaard (2011) examined the factors that determine profitability of MFIs and the relationship between profitability and yield on gross profitability. The data used in the study was found through mix market and a sample of 879 MFIs was processed and analyzed to test two profitability models with return on assets and profit margins as the dependent variables. The study findings revealed that factors that statistically influenced profitability positively was the capital asset ratio, age (new) and gross loan portfolio, factors with a statistical negative influence were legal status (credit union), cost per borrower, and two other variables showed statistically significant but with opposite influences: operating expense over loan portfolio which had a positive influence, and a number of active borrowers, with a negative influence.Bayeh (2012), examined factors affecting financial sustainability of microfinance institutions in Ethiopia. The study followed a quantitative research approach using a balanced panel data set of 126 observations from 14 MFIs over period 2002-2010. The study revealed that microfinance breadth of outreach, depth of outreach, dependency ratio and cost per borrower affect the financial sustainability of microfinance institutions in Ethiopia; however the study revealed that capital structure and staff productivity has insignificant impact on financial sustainability.

Obsa (2012) examined the determinants of loan portfolios quality of MFIs in Ethiopia using a sample of 15 MFIs during 2003 to 2009 period. The results showed that a significant negative relationship between an institution size and LLP and PAR-30 days. Loan ratio (outstanding loans

to total assets) positively and significantly impacts PAR-30 days and WOR. The coefficient for the ratio of women borrower reveals a significant negative impact on LLP and WOR; the estimates also show a significant inverse relation between changes in total loan and the three indicators of MFIs loan portfolio risk: LLP, PAR -30 days and WOR. Operating expense ratio, the measure of efficiency is positively related to WOR .The study did not observe any significant relationship between macroeconomic factors (changes in gross national income per capital and Inflation) and MFIs portfolio risks indicators: LLP, PAR-30 days and WOR. More currently Tilahun (2013) investigate the determinants of financial sustainability of MFIs in east Africa were poverty is a serious problem and the regression results revealed that MFIs financial sustainability is positively and significantly driven by loans intensity and size.

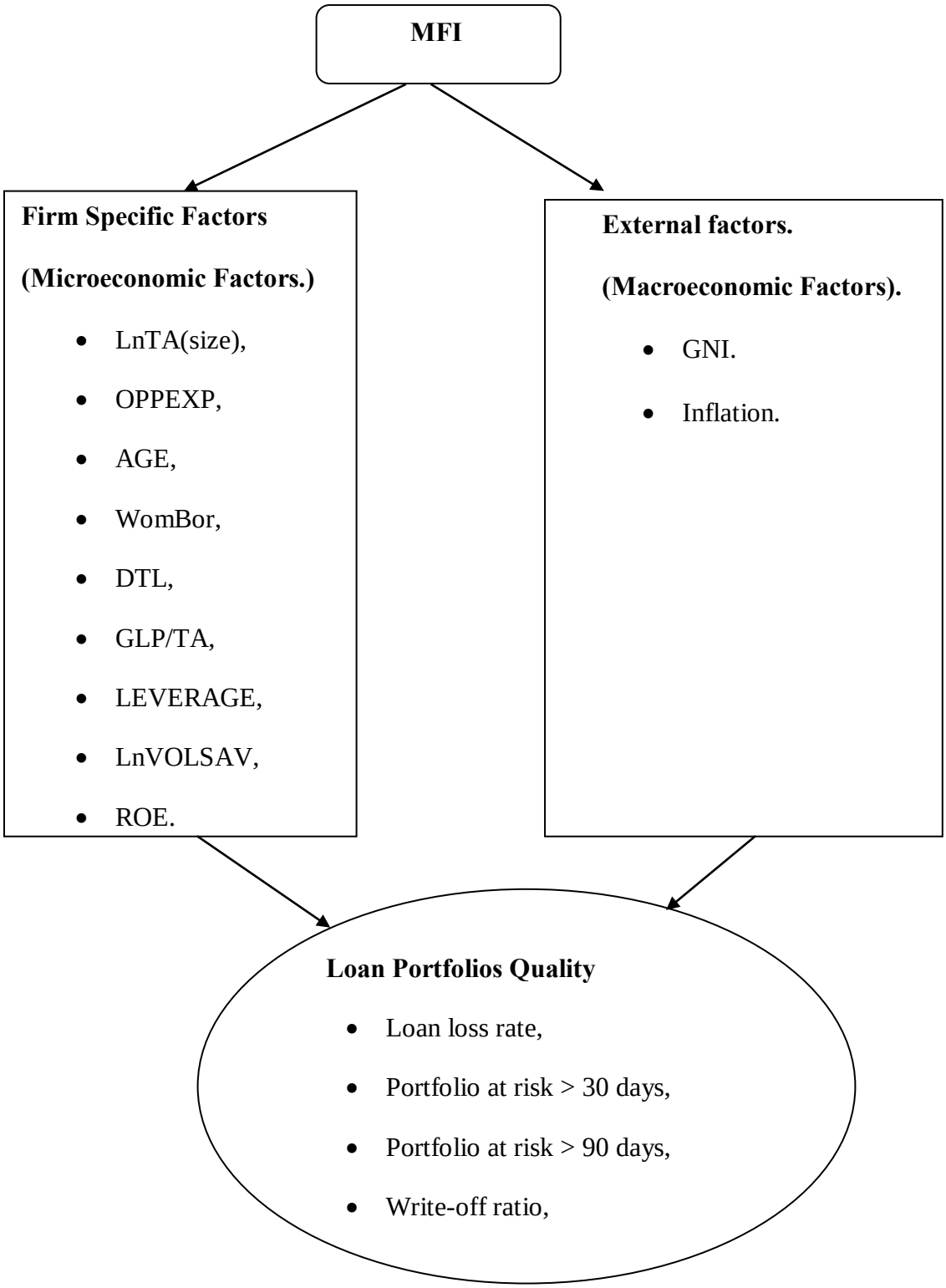
The empirical evidences on the relationship between leverage and portfolio risk is limited. Leverage measures the degree to which a MFI borrows money relative to its equity.Abdelghany (2005) finds that high leverage firms more likely to face portfolio risk as measured by loan loss provision. The most widely used measure of leverage is the debt to equity ratio. Changes in total loan ratio and outstanding loan ratio (percentage of loan portfolios to total assets) are also suggested as the major determinants of loan portfolios quality. Since these variables are pertained to default risk. Brownbrigde (1998) argue that high inflation makes loan appraisal more difficult because the viability of potential borrowers depends up on unpredictable growth in the overall inflationary rate. The study by Elizabeth (2009) revealed that MFIs with higher leverage (debt to equity ratio) ratios and strong profit margins tends to have stronger financial performance than firms with low debt to equity and weak profit margins, MFI size and expense ratio are inversely related to financial performance.

2.3. Identification of Knowledge Gap

The study is intended to identify major determinants of loan portfolios quality which are not included in previous studies (for example, Obsa,2012). He used three variables as proxies for loan portfolios quality (loan loss rate, portfolios at risk over 30 days and write off ratio).Independent variables: deposits to loans, voluntary saving and return on equity were overlooked in prior studies. Running the regression by including these variables would enhance the finding and fill the problem of missing important variables in previous studies.

In an attempt to fill this gap, the study intends to examine the determinants of microfinance institutions (MFIs) loan portfolios quality as measured by Loan loss rate (LLR), portfolio at risk over 30 days (PAR-30), portfolio at risk over 90 days (PAR-90) and write-off ratio (WOR). In general, the lack of sufficient research on the determinants of microfinance loan portfolios quality in the context of Ethiopia and the existence of knowledge gap in the area initiate this study.

2.4. Conceptual Framework of the Study.



CHAPTER THREE

3. RESEARCH METHODOLOGY

This section discusses the research methodology applied for the study, specifically, nature of data, sample and sampling techniques, method of data collection, method of data analysis, model specification and measuring variables.

3.1. The Nature of Data

This research is designed to examine the determinants of loan portfolios quality of microfinance institution in Ethiopia**.** The nature of the study is quantitative and it employs a panel data that is pooling of time series and cross sectional observations. There are important advantages to make full use of this rich structure. First, and perhaps most importantly, we can address a broader range of issues and tackle more complex problems with panel data than would be possible with pure time-series or pure cross-sectional data alone (Chris.B, p.487, 2008).Second, it is often of interest to examine how variables, or the relationships between them, change dynamically (over time). To do this using pure time-series data would often require a long run of data simply to get a sufficient number of observations to be able to conduct any meaningful hypothesis tests. However, by combining cross-sectional and time series data, one can increase the number of degrees of freedom, and thus the power of the test, by employing information on the dynamic behavior of a large number of entities at the same time. The additional variation introduced by combining the data in this way can also help to mitigate problems of multicollinearity that may arise if time series are modeled individually.Finally, as will become apparent below, by structuring the model in an appropriate way, we can remove the impact of certain forms of omitted variables bias in regression results (Chris.B, p.487, 2008).

3.2. Population, Sample and Sampling Techniques

3.2.1. Sample Frame

The sample frame is the list of total population. The sample frame in this study is all those Microfinance institutions (33 MFIs as of 2012) operating in the country (National Bank of Ethiopia, 2012).

3.2.2. Sample Size and Sampling Techniques

As the MFIs with the required data are limited, the researcher selects MFI with ten years financial data and excluded MFI with less than ten years operating life. Specifically, panel data of fourteen MFIs were selected.. This sampling technique is reasonably used because MFIs were selected in terms of financial data availability for ten years and the institutions with less than ten years operating life were excluded. The time period covered is from 2003 to 2012. As a result the study has 144 observations.

3.3. Data Source and Collection Methods

The study used only secondary data, which was collected from Association of Ethiopian Microfinance institutions (AEMFIs). The data on inflation and growth national income was taken from National Bank of Ethiopia.

3.4. Method of Data Analysis

The study used descriptive and inferential statistics for data analysis. Descriptive statistics for dependent variables and all independent variables is used to check whether there is a significant variation in the data set. A correlation statistics is also needed to observe the direction and magnitude of relations among variables. However, this method does not give assurance for causal relation between the dependent and independent variables. Inferential statistics is used to

test the hypotheses. The estimations are made using pooled ordinary least squares and random effect generalized least squares regression. The results are presented using tables.

3.5. Measuring Variables and Model specification

3.5.1. Dependent variables

The literature suggests indicators of portfolio quality (Gonzalez, 2007) i.e., portfolio at risk over 30 days, portfolio at risk over 90 days, loan loss provision ,write –off ratio and loan loss rate. The first two variables are assumed to measure portfolio at risk and the later three variables are deemed to measure default risk. Following this scenario, the study employed LLR, PAR-30 Days, PAR-90 Days and WOR as proxies for portfolio quality.

Loan Loss Rate (LLR)

Adjusted Write- offs, net of recoveries / Adjusted Average Gross Loan Portfolio. Loan loss ratio relate to the ratio of amount written off in a period to average portfolio outstanding. The loan loss rate is an indicator to measure un-recovered loans. It is an important indicator to measure portfolio quality. When compared with delinquency rate, the loan loss ratio helps to understand the quality of the portfolio (Nara Hari ,2007).

Portfolio at risk (PAR)

It is computed by dividing the outstanding balance of all loans with arrears over 30 days and all refinanced (restructured) loans, by the outstanding gross portfolio as of a certain date (Bulletin, 8, 2012). Since the ratio is often used to measure loans affected by arrears of more than 60, 90, 120 and 180 days, the number of days must be clearly stated (for example PAR -30 days). It

shows the portion of the portfolio that is “contaminated” by arrears and therefore at risk of not being repaid. As Jackle (2013) noted that PAR over 30 days is statistically significant driven by its own past trend, size of gross loan portfolio and how it grows, operational self- sufficiency, loss provisioning and write- off policy, amount of female borrowers and the degree of loan monitoring on the micro side and on macro side indicators (inflation rate, the labor force participation rate and depth of financial system as important.

Write-off Ratio (WOR)

It is computed as Value of Loans Written- Off / Average Gross Loan Portfolio. When the MFIs are sure that a loan is not going to be repaid, such loans are written off against the loan loss reserves made. In many cases, MFIs continue to show non recoverable loans as part of the portfolio as they do not have any write-off policy. This is not a good practice as their portfolio loses value over a period of time. A written off policy also help the MFIs to present accurate financial statements; it is always advisable to write-off of the loan which are not repaid over and above a period of one year. If they are received at a later stage this amount can be shown as other income (Nara Hari, 2007). The MFI should continue its efforts to recover the loans even though they are written off from the books. If they are received at the later stage, this amount can be shown as other income.

3.5.2.Independent Variables

Firm Size

In this study, firm size is defined as natural logarithm of total assets, the proxy for firm size. The size of MFIs implies possession of more resources, which are used to reach more poor people as well as enable the institution to be self- dependent. The empirical evidences have also shown the presence of positive impact on the size of MFIs in firm performance measured by different

aspects. The study by Letenah (2009), reported a positive impact of size on the profitability and sustainability of MFIs in Ethiopia. The results were in line with the results by Coleman (2007) that indicates firm size has a positive impact on yield on gross loan MFIs. In other studies by Ruerd and Schers(2007), Elizabeze (2009) and Crasmus (2013) size of MFIs is reversely related to the financial performance. Therefore, the researcher supposes that the MFI size will be positively/ negatively correlated with loan portfolios quality.

Operating expense ratio (OPPEXP)

The operating expense ratio is calculated by dividing all expenses related to the operation of MFI (including all the administrative and salary expenses, depreciation and board fees) by the average gross portfolio. Interest and provision expenses are not included. The ratio provides the best indicator of the overall efficiency of a lending institution. For this reason, the ratio is commonly referred to as the efficiency ratio. It measures the institutional cost of delivering loan services. Gonzaalez (2007) revealed that operating expense ratio have a negative significant relationship with MFI loan portfolio quality as measured by portfolio quality at risk over- 30 days and write-off ratio. In other study by Anne Norgaard (2011), operating expense positively influence profitability. In light of these findings, the researcher supposes that operating expense will negatively affect MFIs loan portfolios quality.

Age

The age of MFIs tells about the experiences acquired by the institution with operations, resource mobilization as well as market experience. The evidences provided by Coleman (2007) reported a positive impact on MFIs performance, as age increases the institutions expands and reaches more poor clients. The increase in the poor clients raises the repayment problems, which in turn results into higher default rates. Letenah (2009) found a positive impact of MFI age on efficiency

and productivity. Similarly, Elizabeth (2009) concluded that the older the MFI the better the financial performance. Anne Norgaard (2011) finding revealed that, a positive impact of age on MFI profitability. Claudio and Waelchi (2010) reports that performance gets worse with age since old age may make knowledge, abilities and skills obsolete and induce organizational decay. However, recent study by CrasmusFabin (2013) concluded that firm age have significant impact on microfinance performance efficiently and productivity. In this study analysis number of years since establishment, is used as the proxy for age. Consequently, the researcher supposes that the MFI age will affect positively the loan portfolio quality.

Percentage of women borrowers (WOMBOR)

According to the study by Peter & Keller (2004), the ratio of women borrowers is negatively related to MFIs loan portfolio. Bert.el.al (2009) study result indicates that more women clients are associated with lower portfolio risk, lower write- offs and lower credit-loss provisions. In study by Obsa (2012), the coefficient for the ratio of women borrower reveals a significant negative impact on LLP and WOR. Therefore, the researcher supposes that the MFIs percentage of women borrowers will negatively affect the loan portfolio quality.

Leverage (Debt to equity ratio)

The debt to equity ratio is calculated by dividing total liabilities to total equity. Total liabilities include everything the MFI owes to others, including deposits, borrowings, accounts payable and other liability accounts. Total equity is total assets less total liabilities. The debt to equity ratio is the simplest and best- known measure of capital adequacy because it measures the overall leverage of the institution. The debt to equity ratio is of particular on which MFI borrowers also influence how much debt it can safely assure. Abdelghany (2005) finds that highly leverage firms more likely to face portfolio risk as measured by loan loss provision.

Deposits to loan (DTL)

In this study, deposits to loans ratio is computed by dividing voluntary savings over the adjusted gross loan portfolio. The deposits to loans ratio is an important indicator for MFIs that mobilize deposits. For deposit- taking institutions, the deposits to loan ratio measures the portion of the MFIs portfolio funded by deposit (Association of Ethiopian Microfinance Institution Performance, 8, 2012).

Gross loan portfolio to total asset ratio (GLP/TA)

It is calculated by adjusted total liabilities over adjusted total equity.The outstanding principal balance of all of the MFI's outstanding loans include current, delinquent, and restructured loans, but not loans that have been written off. It does not include interest receivable. Although some regulated MFIs may be required to include the balance of interest accrued and receivable, the MFI should provide a note that gives breakdown between the sum of all principal payments outstanding and the sum of all interest accrued. Some MFIs choose to break down the components of the gross loanportfolio, which is frequently referred to as or loans outstanding (Association of Ethiopian Microfinance Institution Performance, 8, 2012).

Voluntary savings (LnVOLSAV)

Total value of voluntary savings involves demand deposit and time deposit accounts. This is not an obligatory part of accessing credit services, and is provided by MFIs to borrowers and non-borrowers. Voluntary saving is a lot easier to use than compulsory savings, but it is still not optimal (Ledgerwood, 1999). Voluntary savings are funds that individuals or organizations may voluntary save to meet emergency smooth, consumption and liquidity needs. Saving deposits enable households to build for the future and better prepare for unexpected emergencies.

Return on equity (ROE)

It is the net operating income less taxes as a percentage of total equity. The ratio indicates MFIs ability to build equity, which includes not only the return on the portfolio, but also all other revenue generated from investments in other operating activities.

Gross national income (GNI)

GNI per capita is gross national income divided by midyear population. John (2008) finding revealed that there is no significant relationship between GDP and performance of MFIs. This finding was in line with the finding by Obsa (2012) that the study did not observe any significant relationship between GNI per capita and MFIs portfolio risks indicators: LLP, PAR-30days and WOR.

Inflation

Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. Brownbrigde (1998) argue that high inflation makes loan appraisal more difficult because the viability of potential borrowers depends upon unpredictable growth in the overall inflationary rate.

.3.6. Model Specification

The literature suggests four indicators of portfolio quality (e.g., Gonzalez, 2007) i.e., portfolio at risk over 30 days, portfolio at risk over 90 days, loan loss rate and write –off ratio. Accordingly, the researcher used loan loss rate and write – off ratio as proxies for default risk;portfolios at risk over 30 days and portfolios at risk over 90 days as proxies for portfolios at risk. Therefore, four panel regression models were run.

$$LLR_{i,t} = \beta_0 + \beta_1 LnTA_{i,t} + \beta_2 OPPEXP_{i,t} + \beta_3 AGE_{i,t} + \beta_4 WomBor_{i,t} + \beta_5 DTL_{i,t} + \beta_6 (GLP/TA)_{i,t} + \beta_7 LEV_{i,t} + \beta_8 LnVOLSAV_{i,t} + \beta_9 ROE_{i,t} + \beta_{10} GH\text{-}GNI_{i,t} + \beta_{11} INFL_{i,t} + \varepsilon_{i,t} 1$$

$$PAR\text{-}30days_{i,t} = \beta_0 + \beta_1 LnTA_{i,t} + \beta_2 OPEXP_{i,t} + \beta_3 AGE_{i,t} + \beta_4 WomBor_{i,t} + \beta_5 DTL + \beta_6 (GLP/TA)_{i,t} + \beta_7 LEV_{i,t} + \beta_8 LnVOLSAV_{i,t} + \beta_9 ROE_{i,t} + \beta_{10} GH\text{-}GNI_{i,t} + \beta_{11} INFL_{i,t} + \varepsilon_{i,t} 2$$

$$PAR\text{-}90days_{i,t} = \beta_0 + \beta_1 LnTA_{i,t} + \beta_2 OPEXP_{i,t} + \beta_3 AGE_{i,t} + \beta_4 WomBor_{i,t} + \beta_5 DTL_{i,t} + \beta_6 (GLP/TA)_{i,t} + \beta_7 LEV_{i,t} + \beta_8 LnVOLSAV_{i,t} + \beta_9 ROE_{i,t} + \beta_{10} GH\text{-}GNI_{i,t} + \beta_{11} INFL_{i,t} + \varepsilon_{i,t} 3$$

$$WOR_{i,t} = \beta_0 + \beta_1 LnTA_{i,t} + \beta_2 OPEXP_{i,t} + \beta_3 AGE_{i,t} + \beta_4 WomBor_{i,t} + \beta_5 DTL_{i,t} + \beta_6 (GLP/TA)_{i,t} + \beta_7 LEV_{i,t} + \beta_8 LnVOLSAV_{i,t} + \beta_9 ROE_{i,t} + \beta_{10} GH\text{-}GNI_{i,t} + \beta_{11} INFL_{i,t} + \varepsilon_{i,t} 4$$

Where:

i = Microfinance index

t = Year index

LLR = Loan loss rate

PAR-30days = Portfolio at risk over 30 days

PAR-90 days = Portfolio at risk over 90 days

WOR = Write - off ratio

TA = Total assets

LnTA= Natural logarithm of total assets

OPPEXP = Total operating expenses

Age = Firm age

WomBor = Percentage of women borrower

DTL = Deposit to loan

GLP/ TA= Gross Loan portfolio divided by Total Assets

LEV = Leverage

LnVOLSAV = Natural logarithm of voluntary savings.

ROE = Return on equity

CH_GNI = Percentage change in Growth National Income per capital

INFL = General inflation rate

CHAPTER FOUR

4. RESULTS AND DISCUSSION

This chapter presents the results of the study organized into three sections. Section 4.1 presents the descriptive statistics. Section 4.2 presents the correlation analysis among the dependent and independent variables.Section 4.3 presents the regression results.

4.1. Descriptive Statistics

Table 1 presents descriptive statistics i.e. mean, standard deviation, minimum and maximum values of variables involved in the regression models. This was generated to give overall description about data used in the model and served as data screening tool to spot unreasonable figure. The mean of loan loss rate (*LLR*) is 4.489 percent, whereas the minimum, maximum and standard deviation are – 4.65, 37.31, and 7.328517, respectively. The standard deviation exceeds its mean value. This reveals that there was a significant variation among microfinance institutions over the observation periods on loan loss rate. *PAR-30*dayshas 5.882066 percent and 7.328517, respectively. There was also a significant variation on this variable across microfinance institutions and over observation periods. The maximum value is 37.31 and the minimum value is -4.65.

Table 1. Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
LLR	4.489	5.956	-4.65	26.3
PAR-30days	5.882	7.328	-4.65	37.31
PAR-90 days	3.739	4.334	.01	22
WOR	4.900	5.989	-.1	26.3
TA	396000000	817000000	2479546	5490000000
OPPEXP	9.392	5.372	1	26.78
AGE	9	3.116	3	15
WOMBOR	48.186	19.469	.54	110
DTL	26.408	35.844	.1	250
GLP/TA	69.912	24.133	.64	133
LEVERAGE	9.784	24.832	.2	122
VOLSAV	76600000	183000000	9872	1040000000
ROE	1.386	14.972	-50.8	27.5
CH-GNI	6.733	4.422	-4.81	11.02
INFLATION	17.378	12.539	3.26	44.39
Obs 144				
***Note**: TA and VOLSAV are the level of total assets and voluntary, respectively*				

Source: Stata output result for descriptive statistics.

The mean of *PAR-90 days* is 3.739, whereas the minimum, maximum and standard deviation are .01 percent, 22 percent and 4.334, respectively. The mean shows that on average, the sampled microfinance institutions had recorded 3.739 percent of portfolio at risk over 90 days over 2003 to 2012. It is low when compared to loan loss rate, portfolio at risk over 30 days and write –off ratio. Write off ratio (WOR) has mean value of 4.900 and 5.989 standard deviation. In comparison the mean, the standard is high which indicate existence of a significant variation on

this variable. The sampled microfinance institutions have birr 396,000,000 average total assets and birr 817,000,000 standard deviation. It implies that existence of significant gap of total assets among microfinance institutions over observation periods. The maximum total asset is birr 5,490,000,000 and the minimum is birr 2,479,546. The maximum value of operating expenses as deflated by total asset (*OPPEXP) i s* 26.78 percent and the minimum value is -.1 percent. Its mean value and standard deviation are 9.392 percent and 5.372 respectively.

The mean value of age is 9 years while the maximum age is 15 years and the minimum is 3 years. This implies that microfinance institutions have no long operation experience. On average, the firm has around 48 percent of women borrower i.e., ratio of women clients to total clients. This figure reflects how much the microfinance institutions emphasis on women in providing financial services to them. Thedeposits to loans ration (*DTL*) mean value is 26.408 percent whereas the minimum and the maximum are .1 and 250 percent, respectively. The mean of gross loan portfolios to total asset *(GLP / TA)* is 69.912. The mean value of gross loan portfolios to total asset is 69.912 percent, the minimum value is .64 percent and maximum is 133 percent. Leverage (debt to equity) has 9.784 mean, .2 minimum value and 122 maximum value. The maximum value indicates highly leverage microfinance institution and the minimum value shows low leverage. On average, the sampled microfinance institutions are not highly leveraged. The average of voluntary saving is birr 76,600,000. The minimum amount is birr 9,872 and the maximum is birr 1,040,000,000. The figures show a significant gap among the firms on voluntary savings. Return on assets (*ROA*), changes in gross national income (*CH-GNI*) and inflation means are 1.386, 6.733 and 17.378, respectively.

4.2 Correlation Coefficients

The correlations obviously show direction and strength of association between variables and it is a precondition to run regression, although correlations do not highly support whether there is a causal effect between variables or not because variables that are not theoretically correlated and have no causal effect might reveal significant association.

Table 2 presents correlation coefficients for all models in which loan loss rate (LLR), portfolios at risk over 30 days (PAR – 30 days), portfolios at risk over 90 days (PAR -90 days) and write –off ratio (WOR) are used as proxies for loan portfolios quality. The positive significant correlation among dependent variables argues that a firm with higher portfolio at risk over 30 days would have a high loan loss rate, portfolios at risk over 90 days and write-off ratio. Natural logarithm of total assets (LnTA) negatively and strongly related to all dependent variables (LLR, PAR – 30days, PAR-90days and write off ratio ($P< 0.01$). It implies the larger firms are more likely to reduce portfolios risk because they have more economics of scale, hiring qualified employees and strong control over its loan products.

As can be observed in Table 2, Age has a positive relationship ($P < 0.01$) with loan loss rate, portfolios at risk over 90 days and write-off ratio, indicating that the order MFI might relatively face portfolio risk than the young one. One of the reasons may be due to that the older MFI focus on expansion to reach more poor clients. As a result, increase on poor clients raises the repayment problems, which in turn results into higher default rates (Coleman (2007). Operating expense to total assets ratio (OPPEXP) negatively and significantly related to only portfolio at risk over 90 days. There is a positive and negative association between deposits to loan portfolios

(DTL) and portfolios at risk over 30 days ($P < 0.05$). Gross loan portfolio over total asset is negatively and significantly correlated to portfolios at risk over 90 days only.

The coefficient on natural logarithm of voluntary saving (LnVOLSAV) shows a positive and significant association with all dependent variables (LLR, PAR-30days, PAR -90 days and WOR). It indicates that a MFI with higher voluntary saving would more have portfolio risks. This is linked to diversification concept that a firm with voluntary saving may would have more diversified portfolios, which help to significantly reduces portfolios risk (Ledgerwood, 1999). Return on equity (ROE) significantly and strongly related to loan portfolios risk indicators (LLR, PAR -30days, PAR-90days and WOR). ROE is a proxy for firm profitability; therefore, firms that are more profitable would significantly reduce portfolios risk because they have a competitive advantage, relatively use available technology and strong systems related to loan products.

Table 2. Pearson Correlation coefficients

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.LLR	1														
2.PAR-30days	**0.597**	1													
3.PAR-30days	**0.329**	**0.44**	1												
4.WOR	**0.986**	**0.58**	**0.331**	1											
5.LnTA	**-0.34**	**-0.25**	**-0.23**	**-0.31**	1										
6.OPPEXP	0.073	0.072	0.*22*	0.018	**-0.69**	1									
7.AGE	**0.33**	-0.*23*	0.038	**-0.29**	**0.61**	-0.12	1								
8.WOMBOR	-0.04	-0.14	-0.06	-0.061	**-0.27**	**0.38**	-0.01	1							
9.DTL	0.09	*0.19*	0.13	0.113	*0.20*	*-0.20*	0.15	-0.06	1						
10.GLP/TA	-0.15	-0.13	*-0.19*	-0.12	0.07	**-0.25**	0.01	-0.11	0.08	1					
11.LEVERAGE	0.009	-0.02	-0.07	-0.01	-0.15	0.041	-0.03	0.09	**0.45**	0.07	1				
12.LnVOLSAV	**0.55**	**0.31**	**0.56**	**0.55**	**0.50**	**-0.37**	0.17	0.02	0.15	0.02	-0.03	1			
13.ROE	**-0.52**	**-0.62**	-0.*23*	**-0.47**	**0.43**	**-0.29**	**0.5**	0.08	**0.24**	*0.19*	0.11	0.24	1		
14.CH-GNI	-0.09	*-0.23*	-0.16	-0.11	0.15	-0.17	*0.19*	-0.10	0.04	0.028	0.04	0.03	0.11	1	
15.INFLATION	**-0.28**	-0.06	0.029	*-0.2*	0.16	-0.01	**0.32**	0.054	-0.12	0.07	0.02	0.05	**0.33**	-0.14	1

Note: a. **Bolds** denote significant at the 1% level b. Italics denote significant at the 5% level

From macroeconomic variables, changes in growth national income per capital(CH_GNI) has negative associate with only PAR -30 days, showing that the overall growth in economic conditions may provide reliable information to MFIs in providing financial services to low income group societies, which in turn reduce risk. There is a positive significant relationship between inflation and loan loss rate, write off ratio. Overall, the correlation coefficient among the independent variables is not sufficient to bias the result because multicollinearity is not a concern.

4.3. Estimation Method

The study employs a panel data that combines observations on cross- section and time series. Panel data approach has several advantages over cross- section and time series data set lonely. For instance, its estimation accounts for individual heterogeneity due to hidden factors, degree of freedom increases and colinearity among the independent variables are reduced. As a result, efficiency of estimates can be improved (Gujarati, 2004).

To fix on the panel regression models whether the random or fixed effects fit for the data, the Hausman specification test was run however; no models met the asymptotic of the test. Therefore, the researcher decided to select the estimation using the Breusch-Pagan Lagrangian multiplier test. The Breusch - Pagan Lagrangian multiplier test was used to fix on whether a random effect regression or ordinary least square (OLS) regression is appropriate. This method tests the null hypothesis that no significant difference across units (i.e., no panel effect). The results from the test reveal insignificant p- values 0.3393 and 0.21 for mode 1 and 4, respectively. Thus, the null hypothesis is accepted and the researcher concluded the pooled OLS regression is appropriate.

The test also shows significant p- values 0.0071 and 0.0248 for model 2 and 3. Accordingly, the estimations are made using the random effect Generalized Least Square (GLS) regression with cluster robust standard errors.

4.4. Testing OLS Assumptions

Multiple regressions are subject to several important assumptions of Classical Linear Regression Model (CLRM). Specially, multicollinearity, heteroscedasticity, autocorrelation and normal

distribution of residuals are the major assumptions. Accordingly, the researcher tests these four assumptions whether or not they are met in the models.

Hetroskedasiticity Test

This assumption was tested by Breusch-Pagan / Cook- Weisberg test. It tests the null hypothesis that variance is constant. If p- value shows insignificant ($p > 0.05$), the null hypothesis would be accepted and the variances are homogenous. In contrast, if the p- value is significant ($p < 0.05$), the null hypothesis would be rejected and it implies a heteroskedasticity concern.

Model 1

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of llr

chi2(1) = 12.65

Prob> chi2 = 0.0004

Model 2

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of par30days

chi2(1) = 43.46

Prob> chi2 = 0.0000

Model 3

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of par90days

chi2(1) = 39.90

Prob> chi2 = 0.0000

Model 4

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of wor

chi2(1) = 22.29

Prob> chi2 = 0.0000

Here, in the above 4 models, the null hypothesis was rejected because the p-value is strongly significant in each models, which indicates the existence of heteroskedasticity in the 4 models. To control for this problem, the models are adjusted with heteroskedasticity-robust standard errors (Stock, 2003). Similarly, the random effect GLS accounts for heteroskedasticity in the models; therefore, it provides efficient estimates (Cameron, 2009). Overall, the violation of this assumption is overcome.

Multicollinearity

The degree of multicollinerity among variables is measured based on variance inflation factors (VIF) suggested in the rule-of - thumb. As per this usual threshold, if the variance inflation factor

on each variable is less than ten and 1 / VIF exceed 0.1, multicollinerity is not a serious problem (Field 2009).

Table 3: Degree of Multicollinearity for Variables.

Variables	**VIF**	**1/VIF**
LnTA	5.07	0.197045
OPPEXP	3.28	0.305105
AGE	3.02	0.330725
INFLATION	2.15	0.464677
CH-GNI	1.90	0.526151
DTL	1.72	0.580713
ROE	1.59	0.629689
LnVOLSAV	1.44	0.695416
GLP/TA	1.43	0.698539
WOMBOR	1.28	0.781893
LEVERAGE	1.14	0.874501
MeanVIF	**2.18**	

A vif> 10 or 1/vif< 0.10 indicates trouble.

Here the variance inflation factor (VIF) for all variables is significantly less than 10 and the 1/VIF is significantly exceeds 0.1. Therefore, the researcher concluded that multicollinearity is not a serious concern.

Autocorrelation Test

The autocorrelation assumption is made of the CLRM's disturbance terms is that the covariance between the error terms over time is zero; it assumed that the errors are uncorrelated with one another. If the errors are not uncorrelated with one another, it would be stated that they are serially correlated (Brook, 2008). As a very conservative rule of thumb, values less than 1 or

greater than 3 are definitely cause for concern (Field, 2009). Table 4 shows DW test statistics for the autocorrelation test for the 4 models.

Table 4.Autocorrelation Test: Durbin Watson

Model	**Durbin Watson**
Model(1)	1.105572
Model(2)	1.559933
Model(3)	1.312507
Model(4)	1.458799

Here from the table 5, DW test statistics for model (1), model (2), model (3), and for model (4) value are between 1 and less than 3, which can be concluded using rule of thumb that the autocorrelation problem is not a series concern for the models.

Normal Distribution of Residuals

The Shapiro-wilk test was used to test the normality distribution of residual. It tests that the residuals are normally distributed. The tests display insignificant p-values (p-value > 0.05) on the four models, therefore the researcher conclude that residuals have a normal distribution pattern.

Table.5. Shapiro-Wilk test for normal data (Model 1)

Variable	Obs	W	V	z	Prob>z
Residual	82	0.97829	1.021	0.044	0.48245

Shapiro-Wilk test for normal data (Model 2)

Variable	Obs	W	V	z	Prob>z
Residual	104	0.97665	1.098	0.200	0.42080

Shapiro-Wilk test for normal data (Model 3)

Variable	Obs	W	V	z	Prob>z
Residual	104	0.97675	1.099	0.210	0.42090

Shapiro-Wilk test for normal data (Model 4)

Variable	Obs	W	V	z	Prob>z
Residual	73	0.97538	1.568	0.980	0.16353

4.5 Regression Results

Table 6 reports the regression results obtained from the four models in which LLR, PAR-30 days, PAR -90 days and WOR are used as dependent variables. Model 1 is significant at $F = 6.74, df = 11, p\text{- value} < 0.01$; Model 2 is significant at $Wald\ chi2 = 104.93, df = 11, p\text{-value} < 0.01$; Model 3 is significant at $Wald\ chi2(11),\ df = 11,\ p\text{-value} < 0.01$; and Model 4 is significant at $F = 6.82, df = 11, p\text{-value} < 0.01$. The independent variables explain 58.80 percent of changes in loan loss rate; 48.89 percent of changes in portfolios at risk over 30 days; 40.35 percent of changes in portfolios at risk over 90 days; and 63.76 percent of changes in write of ratio.

As can be seen in Table 6, natural logarithm of total assets (LnTA) the proxy for MFI size is negatively and significantly influences portfolios at risk over 30 days (PAR-30days), write off ratio(WOR) and loan loss rate(LLR) at ($P < 0.01$, 0.01 and 0.05), respectively. It implies that an institution size negatively influences portfolio risk. In fact, larger firms are subject to various investigations by financial analysts, regulators, external auditors and they relatively hire qualified employees, which in turn reduces the risk of loan (Zoubi and Al-Khazali, 2007). Ruerd and Schers (2007) also find that MFI size tends to reduce portfolio risk because larger MFIs appear though to be better able to diversify loan risks. As a result, this result suggests that larger MFIs tend to have lower portfolios at risk over 30 days, write off ratio and loan loss rate. A significant relationship is also observed between LnTA and portfolio at risk over 90 days> however, it is not statistically strong ($P < 0.1$).

Table 6: Regression Results

Dependent Variables: LLR, PAR-30 days, PAR-90 days, WOR								
Variable	***LLR (Model 1)***		***PAR-30 days (Model 2)***		***PAR-90 days (Model 3)***		***WOR (Model 4)***	
	β	**t-value**	**B**	**z-value**	**β**	**z-value**	**B**	**t-value**
Constant	36.949 (12.177)	3.03 (0.003)***	31.863 (6.819)	4.67 (0.000)***	18.232 (10.522)	1.73 (0.083)*	46.638 (11.195)	4.17 (0.000)***
LnTA	-1.279 (.605)	-2.11 (0.038)**	-1.291 (.494)	-2.61 (0.009)***	-.836 (.508)	-1.64 (0.100)*	-1.709 (.617)	-2.77 (0.007)***
OPPEXP	-.458 (.202)	-2.27 (0.026)**	(-.623) (.180)	-3.46 (0.001)***	-.032 (.134)	-0.23 (0.815)	-.610 (.156)	-3.90 (0.000)***
AGE	-.027 (.248)	-0.11 (0.913)	.157 (.250)	0.63 (0.530)	.758 (.243)	3.12 (0.0020)***	.074 (.294)	0.25 (0.802)
WOMBOR	.0105 (.024)	0.43 (0.667)	.063 (.035)	1.78 (0.074)*	-.013 (.037)	-0.34 (0.733)	-.002 (.028)	-0.08 (0.939)
DTL	.152 (.052)	2.95 (0.004)***	.072 (.032)	2.19 (0.028)**	.038 (.024)	1.55 (0.121)	.185 (.056)	3.33 (0.001)***

GLP/TA	-.044 (.022)	-1.99 (0.050)*	-.010 (.014)	-0.71 (0.475)	-.017 (.024)	-0.71 (0.481)	-.050 (.022)	-2.29 (0.025)**
LEVERAGE	.012 (.029)	0.40 (0.687)	.0362 (.021)	1.69 (0.092)*	-.002 (.007)	-0.30 (0.763)	.009 (.028)	0.33 (0.744)
LnVOLSAV	-.430 (.112)	-3.84 (0.000)***	-.093 (.269)	-0.35 (0.728)	-.253 (.099)	-2.55 (0.011)**	-.504 (.114)	-4.42 (0.000)***
ROE	-.159 (.043)	-3.69 (0.000)***	-.293 (.091)	-3.19 (0.001)***	-.069 (.039)	-1.77 (0.076)*	-.146 (.043)	-3.40 (0.001)***
CH-GNI	.040 (.148)	0.27 (0.784)	-.272 (.168)	-1.61 (0.106)	-.153 (.064)	-2.37 (0.018)**	.009 (.154)	0.06 (0.951)
INFLATION	.016 (.038)	0.43 (0.671)	.058 (.037)	1.57 (0.116)	.003 (.033)	0.10 (0.920)	.028 (.046)	0.61 (0.543)
	F(11 70) = 6.74 Prob> F = 0.0000 R- squared =.5880 Root MSE = 4.3613		R –squared = .4889 Wald chi2(11) =104.93 Prob> chi2 = 0.0000		R –squared =.4035 Wald chi2(11) =429.30 Prob>chi2 = 0.0000		F (11 61) = 6.82 Prob> F = 0.0000 R – squared = .6376 Root MSE= 4.1207	

Obs =144 Obs year 2003 -2012 MFIs = 14

Note: *Numbers in parentheses under the coefficient (β) and t-value or z -value ar e r obust standard errors and p-values, respectively. *, **, and *** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.*

The coefficient for operating expenses as measured by (operating expenses divided by total assets) shows a negative and significant influence on portfolios at risk over 30 days, write off ratio and loan loss ratio ($P < 0.01$, 0.01 and 0.05, respectively). The operating expenses ratio provides the best indicator of the overall efficiency of a lending institution and thus, it measures the institutional cost of delivering loan services. The result argues that the less efficient MFI more likely to reduce portfolios risk. Gonzalez (2007) provide also similar evidence that operating expense ratio have a negative and significant relationship with MFI loan portfolio quality as measured by portfolio quality at risk over- 30 days and write-off ratio. However, Obsa (2012) finds a positive relationship between operating expenses ratio and portfolios risk as measured by write off ratio. The study finds insignificant relationship between portfolios at risk over 90 days and operating expenses ratio.

Firm age has positive and significant impact on only portfolios at risk over 90 days ($p < 0.01$). The result suggests that MFIs with long operating life have more portfolios risks. This might be because of lack of strong procedures in screening, monitoring and collection of loan portfolios. When a firm engages in providing various loan products to its clients but with smooth polies and procedures, the firm might face problem to get back the money. In addition, the older Microfinance institutions may acquire knowledge and experience about the market, better operational strategies, financing sources, customer needs and have learned ways to overcome completion constraints in the market. Gonzalez (2007) argues that the older MFIs have more experience in screening, monitoring and collection practices than MFI at an infant level. This holds reliable if the MFI have strong policies and procedures (e.g, collateral) on loan portfolios. However, most of microfinance institutions provide financial services to low income group societies who do not provide qualified collateral. The evidences provided by Coleman (2007)

shows a positive impact between age and default rate in Microfinance institutions. He analyzed that as the age increases the institutions expands and reaches more poor clients. As a result, increase on poor clients raises the repayment problems, which in turn results into higher default rates.

As shown in Table 6, the coefficient for the ratio of women borrowers within the total borrowers (WOMBOR) shows a significant ($p< 0.1$) positive relationship with portfolios at risk over 30 days only. However, the sign is not statistically strong. Deposit to loan ratio (DTL) positively and significantly influences loan loss rate (LLR), write off ratio (WOR) and portfolios at risk over 30 days (PAR 30 days) at ($P < 0.01$, 0.01 and 0.05, respectively). High ratio of deposit to loan implies liability to the institution. In other ways, an institution with high deposits volume would have more capacity to provide financial services. Virtually, microfinance institutions engaged in accessing finance to micro and small enterprises. While providing loans, MFIs require the borrowers to save a specified amount of money (obligatory savings) on frequently basis. Accordingly, the borrowers should save some amount of money, which may limit their capacity to run the business as well. Therefore, obligatory saving at early stages may reduce the borrowers' investment capacity and thus, increase the probability of default risk. Usually a business incurs losses at the early stages of operation because of high amount of set up costs and marketing costs. The negative and significant coefficient on gross loan portfolios to total asset (GLP/TA) with loan loss rate (LLR) and write of ratio (WOR) argues that MFI with more diversified loan portfolios is lower likely to have portfolios risk. A MFI with high proportion of loan portfolio to its total assets is more likely to have lower loan portfolio risk because the magnitude of loans default decreases with the size of diversified portfolios.

Table 6 reveals that natural logarithm of voluntary savings (*LnVOLSAV)* negatively and significantly related to loan loss rate (LLR), write off ratio (WOR) and portfolios at risk over 90 days (PAR 90 days), meaning that an institution with higher amount of voluntary savings would more likely to reduce portfolios risks. This result is linked to loan portfolios diversification because if the MFI mobilizes a huge amount of voluntary savings, it would have more diversified portfolios, which help to significantly reduces portfolios risk (Ledgerwood, 1999). The result suggests that raising voluntary savings with diversification concept could appear as one mechanism to boost portfolios quality. Return on equity (ROE) has significant and negative impact on loan loss rate (LLR), portfolios at risk over 30 days (PAR 30 days) and write off ratio (WOR). It depicts that a MFI with higher return on equity ratio more tends to have lower portfolios risk. Since the return on equity is a proxy for profitability, therefore, a profitable MFI has capacity to reduce loan risks via hiring qualified employees, using the available technology, in designing an effective control over loan products and continuously follow up its clients. A portfolio at risk over 90 days (PAR 90 days) is also adversely related to return on equity but it is not statistically strong ($P < 0.1$).

As shown in Table 6, from macroeconomic variables, changes in gross national income per capital (CH_GNI) found that negatively and significantly affects portfolios at risk over 90 days (PAR 90 days) only ($P < 0.05$). This argues as gross national income increases, the risk of loan portfolios declines. This result is consistent to Gonzalez (2007) findings that when the overall economic conditions increase, MFIs portfolios risk could reduce. A stable and increase economic condition trend would help MFI to make reliable prediction about their loan. The study did not found significant coefficient on the ratio of women borrowers (WOMBOR), leverage and

inflation. Generally, on balance the hypotheses linked to LnTA, OPPEXP, Age, DTL, GLP/TA, LnVOLSAV, and ROE were accepted. Nevertheless, the hypotheses related to leverage and inflation were rejected and the hypothesis related to CH_GNI was some somewhat supported.

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1.SUMMARY AND CONCLUSIONS

This study examines determinants of MFIs loan portfolio quality as measured by loan loss rate (LLR), portfolio at risk over 30-days (PAR-30 days), Portfolio at risk over 90-days (PAR-30 days) and write- off ratio (WOR), using 10 years data of 14 Ethiopian microfinance institutions over the period 2003 to 2012. Based on the pooled ordinary least squares (OLS) and random effects generalized least squares, the study finds an institution size (LnTA) is negatively and significantly influences portfolios at risk over 30 days (PAR-30days), write off ratio(WOR) and loan loss rate(LLR) . It implies that large MFIs can operate at low costs due to scale and scope of economies advantages, possess a larger pool of qualified human capital and have a greater chance for strategic diversification. The result suggests that MFIs with long operating life have more portfolios risks. This might be because of lack of strong procedures in screening, monitoring and collection of loan portfolios.

Deposit to loan ratio (DLT) positively and significantly influences loan loss rate (LLR), write off ratio (WOR) and portfolios at risk over 30 days (PAR 30 days). High ratio of deposit to loan implies liability to the institution. In other ways, an institution with high deposits volume would have more capacity to provide financial services. While providing loans, MFIs require the borrowers to save a specified amount of money (obligatory savings) on frequently basis. Accordingly, the borrowers should save some amount of money, which may limit their capacity to run the business as well. The negative and significant coefficient on gross loan portfolios to total asset (GLP/TA) with loan loss rate (LLR) and write of ratio (WOR) argues the MFI

withmore diversified loan portfolios would less likely to have portfolios risk. The natural logarithm of voluntary savings (*LnVOLSAV) is* negatively and significantly related to loan loss rate (LLR), write off ratio (WOR) and portfolios at risk over 90 days (PAR 90 days), meaning that an institution with higher amount of voluntary savings would more likely to reduce portfolios risks. Return on equity (ROE) has significant and negative impact on loan loss rate (LLR), portfolios at risk over 30 days (PAR 30 days) and write off ratio (WOR). It depicts that a MFI with higher return on equity ratio more tends to have lower portfolios risk. Macroeconomic variables, changes in gross national income per capital (CH_GNI) found that negatively and significantly affects portfolios at risk over 90 days (PAR 90 days) only. This argues as gross national income increases, the risk of loan portfolios declines.

5.2.RECOMMENDATION

The major objective of microfinance institutions isthe provision of financial service to the poor people who have no financial service access from banks and cannot provide qualified collateral to get loans. Particulary the institutions empower women entrepreneurs in group by providing loans to them. To do so, the loan portfolios should be secured in order to reach more number of low income group societies in financial services. Unless the loans paid on the maturity or contract date, the institution could not make loan available to others. Accordingly, the institutions may face default risks. With this fact in mind, the researcher forwards the following recommendations based on the findings.

First, natural logarithm of the total assets found as important determinant portfolio quality of MFIs. The result shows that larger MFIs have more capacity to reduce the risk (Table 6, pp.47).

Therefore, the study recommends that the microfinance institutions should give considerable attention to their loan products as total assets increase to get the advantage of size to reduce the risk. The operating expenses ratio the proxy for efficiency appeared as important determinant. The lower ratio implies more efficiency and vice versa, but the regression result shows a positive sign means as the ratio gets up, the portfolios risk will rise (Table 6, pp.47). With this regard, the study recommends that the institution should take into attention to reduce operating expenses and see its effects on loan portfolios quality.

Second, the study found the strong effect of deposit to loan ratio and gross loan portfolios to total asset on loan portfoliosquality. Deposit to loan ratio shows positive coefficient suggesting that as the ratio increases, the risk would also increase. One of the reasons might me involuntary savings by the borrowers. Practically, a business incurs losses at the early stages because marketing cost would high; therefore, if the borrowers should save back a specified amount of money borrowed at an interval time, they may feel lack of enough capital to run their business as well and thus, in short period they will liquidate the business and fail to repay loan. Therefore, the MFIs should due enough emphasis while setting the amount and interval period for involuntary savings by borrowers. Gross loan portfolios to total assets reflect assets diversified which recommended in reducing loan risk. This is the advisable device in portfolios management so that MFIs could have a diversified their loan products which would significantly reduce risks.

Finally, natural logarithm of voluntary savings and return on equity also thought as major determinants of loan portfolios quality. Voluntary saving shows a negative coefficient arguing that having higher volume of voluntary savings could reduce the risk. Voluntary saving is

recommended to have diversified portfolios than involuntary savings (Ledgerwood, 1999). Based on this notion, the study recommends that MFI should work more on mobilizing voluntary savings which would in turn reduces loan risk via a diversification. The coefficient on the return equity is also hope giving to increase portfolios quality. Therefore, working more to increase return on equity ratio assists to reduce portfolios risk. Overall, macroeconomic variables (CH_GNI and inflation) were not found as major determinants but MFI should not ignore them.

There are important determinant variables suggested in literature but not included in the models of the study, for example, method of lending (group lending, individual lending), management related factors (internal control over loan products), technology, etc. Therefore, further study would use these variables and see their effects on portfolios quality.

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Appendix

Appendix 1: Variable Definition

LLR	Adjusted Write- offs, net of recoveries / Adjusted Average Gross Loan Portfolio.
PAR-30 days	Outstanding balance, Loans overdue > 30 days/ Adjusted Gross Loan Portfolio
PAR-90 days	Outstanding balance, Loans overdue > 90 days/ Adjusted Gross Loan Portfolio
WOR	It is computed as Value of Loans Written- Off / Average Gross Loan Portfolio.

Independent variables

LnTA	Latural logarithm of total assets , the proxy for firm size
OPPEXP	Total Operating Expenses / Total Assets
Age	Number of years since establishment, the proxy for age
WomBor	Percentage of women borrowers within the total clients

Deposit to Loans Ratio	voluntary savings over the adjusted gross loan portfolio
Gross Loan Portfolio to Total Asset Ratio	Adjusted total liabilities over adjusted total equity.
Leverage (LEV)	Debt to Equity Ratio
LnVOLSAV	Total value of voluntary savings, demand deposit and time deposit accounts
ROE	It is the net operating income less taxes as a percentage of total equity
CH-GNI	Gross national income divided by midyear population
INFLATION	Measured by the consumer price index

Test of Random Effects versus Pooled OLS

(a) Model 1.

Breusch and Pagan lagrangian multiplier test for random effects

llr[pid,t]=xb+u[pid]+ e [pid,t]

Estimated results:

	Varsd = sqrt(Var)	
llr	39.89507	6.316254
e	15.49049	3.935795
u	11.39262	3.375295

Test: var(u) = 0

Chibar 2(01) = 0.17

Prob>chibar 2 = 0.3393

(b) Model 2.

Breusch and Pagan lagrangian multiplier test for random effects

Par30days[pid,t]=xb+u[pid]+ e [pid,t]

Estimated results:

	Varsd = sqrt(Var)	
par30days	58.1812	7.62766
e	21.63323	4.651153
u	15.83924	3.979854

Test: var(u) = 0

Chibar 2(01) = 6.02

Prob>chibar 2 = 0.0071

(c) Model 3.

Breusch and Pagan lagrangian multiplier test for random effects

Par90days[pid,t]=xb+u[pid]+ e [pid,t]

Estimated results:

	Varsdsqrt(Var)	
par90days	18.34172	4.282723
e	10.10886	3.179443
u	3.236235	1.798954

Test: var(u) = 0

Chibar 2(01) = 3.86

Prob>chibar 2 = = 0.0248

(d) Model 4.

Breusch and Pagan lagrangian multiplier test for random effects

wor[pid,t]=xb+u[pid]+ e [pid,t]

Estimated results:

	Varsdsqrt(Var)	
wor	39.69443	6.300352
e	14.36655	3.790324
u	4.160908	2.03983

Test: var(u) = 0

Chibar 2(01) = 0.21

Prob>chibar 2 = 0.3225

Testing Assumptions of OLS

i. Heteroskedasticity Test

a. Model 1

hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of llr

chi2(1) = 12.65

Prob> chi2 = 0.0004

b. Model 2

hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of par30days

chi2(1) = 43.46

Prob> chi2 = 0.0000

c. Model 3

hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of par90days

chi2(1) = 39.90

Prob> chi2 = 0.0000

d. Model 4

hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of wor

chi2(1) = 22.29

Prob> chi2 = 0.0000

Table 5.Autocorrelation Test: Durbin Watson

Model	**Durbin Watson**
Model(1)	1.105572
Model(2)	1.559933
Model(3)	1.312507
Model(4)	1.458799

Normal Distribution of Residuals

Shapiro-Wilk test for normal data (Model 1)

Variable	Obs	W	V	Z	Prob>z
Residual	82	0.97829	1.021	0.044	0.48245

Shapiro-Wilk test for normal data (Model 2)

Variable	Obs	W	V	Z	Prob>z
Residual	104	0.97665	1.098	0.200	0.42080

Shapiro-Wilk test for normal data (Model 3)

Variable	Obs	W	V	Z	Prob>z
Residual	104	0.97675	1.099	0.210	0.42090

Shapiro-Wilk test for normal data (Model 4)

Variable	Obs	W	V	Z	Prob>z
Residual	73	0.97538	1.568	0.980	0.16353