



SALALE UNIVERSITY
POST GRADUATE STUDIES

**DETERMINANTS OF CREDIT REPAYMENT AND FERTILIZER USE
BY MEMBERS OF COOPERATIVES: THE CASE OF GIRAR JARSO
DISTRICT, NORTH SHEWA ZONE, OROMIA NATIONAL REGIONAL
STATE, ETHIOPIA**

MSc THESIS

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**Determinants of Credit Repayment and Fertilizer Use by Members of
Cooperatives: The Case of Girar Jarso District, North Shewa Zone, Oromia
National Regional State, Ethiopia**

A Thesis Submitted to the Department of Agricultural Economics

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SCIENCE IN AGRICULTURAL ECONOMICS**

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DEDICATION

I dedicate this thesis manuscript to my wife Enkenyelesh Getachew, my sister Addisalem Girma, Emebet Girma ,my brothers Abi Girma and Habtamu Girma who made great contributions to the success of my life.

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this thesis is my own work and that all sources of materials used for it have been duly acknowledged. The thesis has been submitted in partial fulfillment of the requirements for an M.Sc. in **Agricultural Economics** degree at Salale University and is deposited at the University's Library to be made available to borrowers under the rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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BIOGRAPHICAL SKETCH

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ACRONYMS AND ABBREVIATIONS

ADLI	Agricultural Development Led Industrialization
CBE	Commercial Bank of Ethiopia
CIA	Central Intelligence Agency
CSA	Central Statistics Authority
DBE	Development Bank of Ethiopia
FAO	Food and Agricultural organization
FCU	Farmers' Cooperative Union
FPC	Farmers Primary Cooperative
GDP	Gross Domestic Product-
GJDAO	Girar Jarso District Agricultural Office
GJDCPO	Girar Jarso District Cooperative Promotion Office
GTP	Growth and Transformation Plan
ICA	International Cooperative Alliance
MPC	Multi-Purpose Cooperative
NBE	National Bank of Ethiopia
NGO	Non-Government Organization
OLS	Ordinary least Squares
ROSCA	Rotating and non-Rotating Savings and Credit Association
SACCO	Saving and Credit Cooperative
SSA	Sub-Saharan Africa

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ABSTRACT

The study was aimed to determine factors affecting credit repayment and fertilizer use by members of cooperatives in Girar-Jarso district, North Shewa Zone, Oromia Regional State, Ethiopia. For data collection techniques, a two-stage sampling method were employed to collect primary data from 150 randomly selected households from four multi-purpose cooperatives. A semi- structured questionnaire was employed to collect primary data for the credit years of 2021/2022 from the sample respondents. For data analysis both descriptive statistics, and econometric model were employed. An econometric model known as Tobit model was used to analyze factors affecting fertilizer credit repayment rate and multiple linear regression model was used to identify factors affecting fertilizer use. The study shows that from the total sample households 22.67% were defaulters while 77.33% were non-defaulters. The result of two-limit tobit regression model revealed that family size, on farm income, non-farm income, total livestock ownership and saving were affecting fertilizer repayment rate positively and significantly at 5%, 1%, 1%, 10% and 5% significance level. respectively. Moreover, the result of multiple linear regression model showed that education level, family size, livestock owned, cultivated land affect fertilizer use significantly and positively at 5%, 10%, 1% and 1% respectively. Furthermore, age of the household affect fertilizer use significantly and negatively at 10% significance level. Finally, the study recommend expanding education, giving more attention on livestock raring, increasing awerness of household on non/off-farm income and encouraging saving service for the sampled household to improve fertilizer repayment and fertilizer use in the study area.

Keywords: Credit Repayment, Fertilizer, Girar Jarso District, Multiple Linear Regression, Two-limit Tobit

1. INTRODUCTION

1.1. Background of the Study

Agriculture is the main economic activity in Ethiopia, which provides employment opportunities to 83% of the labour force. The sector contributed 37.57% to the country's GDP and around 79% of the national export earnings was obtained from this sector (CSA, 2021). This shows that the performance of the entire economy of the country largely depends on the performance of agricultural growth and there is no other possible option other than modernizing the agriculture sector by using different inputs. Ethiopia, as a Least Developed Country (LDC), needs huge financial alternatives for rapid and sustainable development and improves the living standards of low-income small-holder farmers. Financial institutions ought to contribute to sustainable economic and financial systems development by offering access to credit for clients who are usually excluded from the formal banking system are ways of achieving increased agricultural productivity to reduce poverty in Ethiopia (Lopatta *et al.*, 2017). Fertilizer use is one instrument implemented as a means of raising production, yield and income of farm households. The core aim of most of the interventions was to sustainably improve cereal productivity through increased availability of improved seed, chemical fertilizer and better management practices (NPC, 2016).

Fertilizer is critical agricultural drivers, essential for growing crops that feed people around the world. The six biggest fertilizer producers in the world are Russia, mainland China, Canada, Morocco, the United States of America and Saudi Arabia. Collectively, those major suppliers

accounted for over half (52.6%) of globally exported fertilizers during 2021. These statistics indicate that the national level intensity of fertilizer use is still lower than the recommended rate of 200 kg per ha (100 kg of DAP and 100 kg of Urea) (Demeke *et al.*, 1998; Alem *et al.*, 2008; Fufa and Hassen 2005).

Close behind in second place were Asian exporters at 34.8% while 13.4% of international fertilizer shipments originated from North America. Another 13% was sent from exporters in Africa. Nitrogen (N) is the most used nutrient, and N fertilizer has long been a critical component of agriculture, currently accounting for over 50% of the world's food production (Elrys *et al.*, 2021; Dimkpa *et al.*, 2020 and Holden, 2018). (ough plentiful nitrogen gas (N₂) exists in the ambient air, crops can only take either ammonia (NH₃) or nitrogen oxides (NO_x) such as nitrate NO₃⁻ and nitrite NO₂⁻, which are the major components of nitrogen fertilizers (Wu *et al.*, 2021). As for different types of exported fertilizers, about four-fifths (80.4%) were nitrogen-based products. Potassium fertilizers represent 15.5% compared to phosphate fertilizers at 2.7%. Excluding those mineral or chemical fertilizer subcategories, the other fertilizer type is animal or vegetable fertilizers which accounted for the remaining 1.4% (Global Network Against Food Crisis, 2022).

The major source of fertilizer sales in Ethiopia has been urea and DAP. Since the 1960s and there has been no change in the composition of the used fertilizer in Ethiopian agriculture until the 2014/2015 cropping season. Due to the unbalanced use of fertilizer, the loss in soil fertility is also significant in Ethiopia. Diammonium nitrate (DAP) has been gradually substituted by NPS in the past two years to meet the sulfur demand of most of the Ethiopian soils. Yet,

fertilizer use in the country is low. Only 30–40 percent of Ethiopian smallholders use fertilizer, and those who do apply on average only 37–40 kilogram per hectare (ha), significantly below recommended rates (Spielman *et al.*, 2013). The import quantity of fertilizer is increasing; mainly Diammonium nitrate, urea, and NPS (nitrogen phosphate fertilizer with sulfur) are imported into Ethiopia. Ensuring agricultural development is one of the vents through which developing countries can escape from the vicious circle of poverty. Agriculture plays a vital role in Africa’s future. The continent has most of the world’s arable land, and over half of the population is employed in the agricultural sector and it is the largest contributor to the total gross domestic product (GDP). Yet, still Africa is producing too little food and low value- added products, and productivity has been broadly low since the 1980s (Abebe *et al.*, 2022).

Cooperatives in Ethiopia play an active role in the fields of finance, input and output marketing, consumer goods, agro-processing, mechanization and many other social and economic activities. Despite the ups and downs experienced, the cooperative movement in Ethiopia has registered numerical growth over the past decade both in terms of membership and capital. However, membership is still much smaller when compared with the huge potential. According to the Federal Cooperative Agency (FCA, 2021), there are 131 unions and more than 92755 cooperatives in Ethiopia with 21,043,370 members (6,743,429 female and 14,299,941 male) and there are 21,328 primary saving and credit cooperatives and they have 5,384,559 members (3,122,454 female and 2,262,105 male). The savings and shares of these SACCOS is 18.54 billion ETB (\$ 425,687,860) (Patrick, 2018).

Credit is provided to eligible farmers largely on the basis of need and not ability to pay, and is typically guaranteed by the regional governments (Duru, 2016). This, of course, is likely to make the demand for fertilizer much more dependent on available cash flow to the farmers at the time the purchases are made or fertilizer is needed. Moreover, the poorest farmers usually lack the collateral in case of crop failure which in turn leads them to fail to repay their credits. On the contrary, wealthier farmers may have access to purchase inputs by themselves (Assa *et al.*, 2014). Furthermore, fertilizer credit repayment approaches at the time of harvesting; it helps farmers to repay their loans on time before they used their product for consumption or other purposes. On the other hand, during harvesting time market price for farm products especially for grain is relatively low. This is because; it is during January and February that most farmers sell their products to celebrate social ceremonies and also to repay different loans. Then farmers need extra time to procure the farm product until market price starts to rise (Gebre-Selassie & Bekele, 2010).

This research focuses on chemical fertilizers, which are becoming a significant limiting factor in crop production. In Girar Jarso District, many farmers are using fertilizer credit access from cooperatives found in their kebeles. From the loan given (for fertilizer) to the farmers, around 86.27% of birr is not repaid by the smallholder farmers in the study area. This indicates that the majority of the loan given to the farmers is not paid. Therefore, this study aimed to identify factors affecting fertilizer credit repayment and fertilizer use by members of cooperatives in Girar Jarso district, North Shewa Zone, Oromia Regional State, Ethiopia.

1.2. Statement of the Problems

In the subsistence agriculture sector, in low-income countries such as Ethiopia, where smallholder farming dominates the overall national economy, smallholder farmers face a severe shortage of financial resources to purchase productive agricultural inputs. The prices of inputs rise very rapidly every year and consequently, the hope of the subsistence farmers on financial institutions for credit has become substantially higher in the recent times. The phenomenon of default on borrowed funds is still one of the critical problems faced by financial institutions in developing countries in their attempt to expand their services and reach a large number of clients. Despite the contribution of MFIs in poverty reduction, job creation, and sustainable economic growth of both in a developed and developing nation, there are numerous challenges face in their activities. The government and MFIs work more cooperatively towards minimizing fiscal hindrances while innovating and expanding many alternatives for poor individuals to access credit (Tarekegn & Molla, 2018).

According to Agbahey *et al.* (2015), there are four major functions along the supply chain of fertilizer in Ethiopia: import planning and inventory control, import execution and domestic supply of fertilizer, marketing and distribution and final use. Import planning begins with the assessment of fertilizer demand. It is a bottom- up approach. At *kebele* (sub-district level), extension workers referred as Development Agents (DA) collect farmers' requirements. The estimates by the development agent and cooperatives are reconciled by the woreda (district) bureau offices and then sent to the zonal offices. The zonal offices aggregate woreda-level data and then send the estimates to the Bureau of Agriculture and Rural Development (BoARD).

Loan defaults continue to be a major challenge that confronts financial institutions in developing countries and this impedes their potential role in sustainable development (Baidoo *et al.*, 2020). The loan repayment problem discourages rural finance institutions from encouraging and extending credit (Melese &Asfaw, 2020). If the loan funds in an economy are not repaid, the recovery of the funds is reduced by the amount of classified loans which may lead to economic stagnation. The central problem of the poor performance of financial institutions in Ethiopia is the high rate of non-repayment of loans (Reta, 2011). There are various types of informal organizations in Ethiopia (Worku, 2000). These include private sector rotating saving and credit groups such as Iddir and Iqqub that are initiated and organized by the people themselves, under the premise of financial relations based on reciprocity. In Ethiopia Iddir, Mahebers, Eqqqub, Debo, elders' group, women's association, money lenders, friends and relatives, pawnbrokers, money keepers and tradesman are the most important informal organizations. The top five largest MFIs (Amhara Credit & Saving Institute, Dedebit Credit & Saving Institute, Oromia Credit & Saving Institute, Omo Credit & Saving Institute and Addis Credit and Savings Institute) constitute 83.8 percent of the total capital, 93.7 percent of the savings, 89.8 percent of the credit and 90.4 percent of the total assets of the MFIs (Worku, 2000).

In Ethiopia, the trend of loan recovery performance in the financial industry showed that, loans collected decreased from 40.6% to 20.6% (Kebede, 2018). This indicates that the customers' profitability has decreased that hampering their paying back ability. Therefore, a thorough investigation of various aspects of loan defaulting is important for both the policy

makers and the lending institutions. There were many studies conducted on factors affecting loan repayment and repayment performance in Ethiopia (Garomsa, 2017; Abu *et al.*, 2017; Ume *et al.*, 2018; Abera & Asfaw, 2019). However, the results of the studies are different and debatable among different researchers in different study areas. The results showed that there is inconsistency regarding factors affecting the loan repayment performance of small-holder farmers. Moreover, the previous study only focused on factors affecting loan repayment and did not indicate factors affecting fertilizer loan repayment.

In Girar Jarso district around 11,885 qt of NPS and 12,352.5 qt of Urea were used in the year 2022, which is by far below the potential of the district (with blank recommendation one quintal NPS and one quintal urea should be used for an hectare of land). This is due to shortage and late delivery of these inputs increase in input price, weak credit and extension services, low efficiency of the role of cooperatives in the distribution and marketing of inputs and absence of timely input credit repayment (GJDADO, 2022). The multipurpose cooperatives found in the district are extending credit facilities to farming households in order to narrow the gap between the capital required and the capital that the households possess, for the improvement of agricultural technologies that would increase production and productivity. On average, an amount of birr 4,726,980.08 was disbursed for input (fertilizer) purchase in the past three years (2018/19-2020/21) and birr 2,352,819.45 remains unpaid in the study area which shows low percentage rate credit repayment.

So far, there is no empirical study that shows factors affecting fertilizer credit repayment by members of cooperatives in the district. Accordingly, there is a knowledge gap related to

credit repayment in the study area. This initiated the researcher to conduct a study on this issue to get recent scientific results and bridge the prevailing information gap by providing empirical evidence on the status and factors affecting fertilizer credit repayment. Thus, this study was carried out to identify factors affecting fertilizer credit repayment and fertilizer use by members of cooperatives in Girar-Jarso District, North Shewa Zone, Oromia Regional State, Ethiopia.

1.3. Research Questions

The present study attempts to answer the following key research questions:

1. What are the status of fertilizer credit repayment of the smallholder farmers look like in the study area?
2. What are the factors affecting the fertilizer use of the farmers in the study area?

1.4. Objectives of the Study

1.4.1. General objective

The general objective of the study was to assess factors affecting fertilizer credit repayment and fertilizer use by member of cooperatives in Girar- Jarso district, North Shewa zone, Oromia region, Ethiopia

1.4.2. Specific objectives

The specific objectives of the study were: -

- To identify factors affecting fertilizer credit repayment of the smallholder farmers in the study area
- To identify factors affecting the fertilizer use of the farmers in the study area

1.5. Significance of the Study

The information generated from this study was useful in the formulation of appropriate policies in the area of credit services and input marketing activities through cooperatives to promote farm households' input utilization and credit repayment thereby shaping the development of smallholder's agriculture. Furthermore, the analysis and identification of factors affecting utilization of inputs is vital in the process of promoting improved input use and enhancing food production as well as food security in the region. This study also provides base line information for further research work and development activities that will benefit the smallholder farmers in the study area. Agricultural cooperatives have been organized in order to render economic benefits to farmers. They are supposed to increase the efficiency of the marketing system and promote agricultural development in the rural sector of the country's economy. Hence, analyzing the benefits and challenges of improved input supply through cooperatives helped policy makers to know which factors to target to improve the livelihood of poor farmers.

1.6. Scope and Limitation of the Study

This study was limited to Girar-Jarso Woreda of MPCs and the study was focused only to fertilizer credit obtained from MPCs as it has wide coverage and diversified purpose with a good number of beneficiaries. Moreover, the study was limited itself to short term credit that was distributed for agricultural production only. Also, it considers a cross-sectional data and it does not attempt to look into the inter-temporal variations that might occur with regard to loan repayment capacity. Since a one-year cross-sectional data could not reveal the overall credit system, the study mainly focused on credit of 2021/2022 production year. Regarding the limitation, due to the fact that most of the households do not keep records, the accuracy of most of the data collected depends on individual's ability to recall. However, it disbelieved that the data would provide a useful basis of information for identifying the important factors that affect stallholders' credit repayment performance, fertilizer use and making suggestions to correct these problems.

1.7. Organization of the Thesis

This thesis document was organized in to five main parts. The first part includes background of the study, statement of the problem, research questions, and objectives, significance of the study, scope and limitation of the study. The second part of this thesis is literature review which includes theoretical review, empirical review and conceptual framework of the study. The third section of this thesis includes research methodology, whereas, the fourth parts include result and discussion. The fifth section contains conclusion and recommendation.

2. LITERATURE REVIEW

2.1. Theoretical Review

2.1.1. Concept and definition of credit

Credit: Beckman and Foster (1969) defined credit as the power or ability to obtain goods or services in exchange for a promise to pay for them later. In other words, it is the power or ability to obtain money, through the borrowing process, in return for a promise to repay the obligation in the future. The Concise McGraw-Hill Dictionary of Modern Economics defines credit as an exchange of goods and services for a promise of the future payment. It also indicates that credit is necessary in a dynamic economy because of the time that elapses between the production of a good and its ultimate sale and consumption and credit bridges this gap. The risk in extending credit is the probability that future payment by the borrower will not be made (Ackah & Vuvor, 2010). Futurity is thus a basic characteristic of credit and risk is necessarily associated with the time element. Regarding financial institutions, there are private and governmental organizations, which serve the purpose of accumulating funds from savers and channeling them to individuals, households and businesses, needing credit. Financial institutions are composed of deposit-type institutions-bank and non-bank-contractual saving institutions, personal and business financial companies, government and quasi-government agencies, and miscellaneous lenders. Formal financial institutions can be defined as institutions that are regulated by central bank's supervisory authorities for licensing and credit policy implementation. Formal loans are those disbursed by financial institutions that are set up legally and engaged in the provision of credit and mobilization of savings.

In the Ethiopian context, these institutions are regulated and controlled by the National Bank of Ethiopia (NBE). On the contrary, informal loans are those provided by individuals, organizations and institutions that operate outside the legal banking system and control of the National Bank. According to Bekele (1995), informal credit sources are categorized as commercial (those who lend money on short-term basis to obtain profit) and non-commercial (lenders that generally include friends, relatives and neighbors). Mutual help associations include Idir, Ikub, modern cooperatives, NGOs, etc. Informal finance is the one that comprises of all lawful but unregulated activities, such as rotating and non-rotating savings and credit associations (ROSCAs), moneylenders and money collectors and other providers of retail financial services. Default is defined as failure to pay a debt or a loan at the right time. On the contrary, non-default is defined as payment of a debt or a loan at the right time. Hunte (1996) defined credit worthy (synonymous to non-defaulter) borrowers as those who satisfy the entire loan contract conditions and repay their loans without ever going into arrears. Non-credit worthy (defaulters), as opposed to non-defaulters, are those who breach their loan contracts and have repayment problems.

Credit repayment:-The time that a borrower or debt holder has to repay his debt or loan, the minimum payment that has to be made in a period or penalties levied for late payment (Graw-Hill Dictionary).In the study loan repayment refers to the period which member borrowers repay their agricultural input loan to their cooperatives.

Cooperative:-The International Cooperatives alliance (ICA) defined cooperatives in 1995 as a cooperative is an autonomous association of persons united voluntarily to meet their common

economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise (Karakas, 2019).

Agricultural Multi-Purpose Cooperative Societies:-Multipurpose cooperatives unlike single purpose cooperative undertake diversified activities. Multipurpose cooperatives, which functions on the basis of a fully integrated framework of activities, planned according to members requirements identified at the grass root level, taking the socio-economic life of the farmer members in its totality (Badiru *et al.*, 2016).

Default and non-default:- Default is defined as failure to pay a debt or a credit at the right time. On the contrary, non-default is defined as payment of a debt or a loan at the right time. Hunte (1996) defined credit worthy (synonymous to non-defaulter) borrowers as those who satisfy the entire loan contract conditions and repay their loans without ever going into arrears. Non-credit worthy (defaulters), as opposed to non-defaulters, is those who breach their loan contracts and have repayment problems.

Agricultural input credit:-Agricultural input credit refers to short term credits extend to farmers for purchase of agricultural inputs like fertilizer, chemicals, seed etc (Badiru *et al.*, 2016).

2.1.2. The need for credit

Access to capital in the form of either accumulated savings or a capital market is necessary in financing the adoption of many new agricultural technologies (Feder *et al.*, 1985). The

importance of credit facilities to smallholders of less developed countries has been underlined by several authors (Adams and Graham, 1981; FAO, 1996; Gonzalez-Vega, 1977 Pischke, 1980).

According to Patro and Nanda (2014) credit is important for development. It capitalizes farmers and entrepreneurs to undertake new investments or adopt new technologies. It helps smooth consumption by providing working capital and reduces poverty in the process. Both formal and informal lenders are active in rural credit market. Collateral-free lending, proximity, timely delivery and flexibility in loan transactions are some of the attractive features of informal credit. However, informal finance may not be as conducive to development as formal finance because; (i) it is expensive; (ii) it is short-term and largely used for consumption; and (iii) it is not generally large enough to spur investment and growth.

Recent theoretical and empirical work in economics has established that credit markets in developing countries work inefficiently due to a number of market imperfections. The literature cites a number of market imperfections which lead some potential borrowers to be rationed out of the credit market. These imperfections include: (1) interest rate ceilings usually imposed by the government; (2) monopoly power in credit markets often exercised by informal lenders; (3) large transaction costs incurred by borrowers in applying for loans; and (4) moral hazard problems. In many cases a number of these imperfections combine to ration farmers out of the loan market (Jeremy, 2004).

Foder (1985) stated that credit is Important in every development program; this is particularly true for rural development because, so long as sufficient credit is not provided to the development programs of poor sections of the society, the goal of development cannot be achieved. Access to capital in the form of either accumulated savings or a capital market is necessary in financing the adoption of new agricultural technologies. Studies undertaken in Ethiopia show that credit provision to small farmers increases their productivity and improves their standard of living. For instance, Assefa (1987) reported the need for the expansion of rural credit to all areas of the country. Likewise, Berhanu (1993) and Getachew (1993) pointed out the need for agricultural credit to increase productivity and accelerate adoption rates. Generally, credit removes a financial constraint and helps accelerate the adoption of new technologies, increases productivity, and improves national and personal incomes. In addition, it constitutes an integral part of the process of commercialization of the rural economy and a convenient means of redressing rural poverty (MOA, 1995).

2.1.3. Agricultural credit in developing countries

Fertilizer consumption in developing countries is closely linked with access to input credit. Up to 70 90% of the annual fertilizer sales in these countries is on credit bases as compared to less than 30% in the developed nations (FAO, 1995). Among other measures, unless otherwise input credit is made available for farmers, the low level of fertilizer consumption will not be improved as required. In developing countries there are a number of credit sources. Government banks (commercial and Agricultural), farmer cooperatives, credit and saving institutions, fertilizer retailers etc. are among the major ones. Though, public banks are the main sources of credit in many of the developing countries, unfortunately, in the greater

number of cases, small farmers do not have easy access direct to bank credit as they lack land titles or other acceptable collateral. In the eye of banks, loans to small holders are too risky and costly to supervise (Zemen, 2005). Thus, banks to serve the small holders would have to lend to farmers cooperatives, rurally based micro credit and saving institution, fertilizer traders etc. since, these institutions are rurally based, they have the potential to reach small farmers that do not have access to the formal financial institutions (FAO, 1995).

2.1.4. Importance of cooperatives for agricultural input credit delivery

Kelly (2005) explained the importance of farmers' association for an effective delivery of vital services in rural areas. Accordingly, the demand for fertilizer in Sub Saharan Africa as collective action has the capacity to reduce farm-level transaction costs for potential input suppliers and output buyers. Belay (1998) expressed about financial institutions like Development Bank of Ethiopia (DBE) and Commercial Bank of Ethiopia (CBE) that need collateral and legal group formation for loan processing could reduce administration cost with existence of cooperatives. Given the Bank's existing working conditions, it is much difficult and almost impossible to reach the numerous geographically dispersed farm households individually, thereby he recommended the demand for credit should be accompanied with volunteer group formation so that loan application, processing, acquisition and repayment can be simple and effective. The same author suggested that, in order to qualify for credit service, farmers' cooperatives should be registered under cooperatives law. Capable management, adequate record keeping, reliable market for farm products and efficiency in lending and collection performances are some of the areas of consideration for measuring the viability of cooperatives.

2.2. Analytical Review

Most of the studies conducted in modeling the determinants of credit repayment used dichotomous discrete choice models (Logit and Probit) where the dependent variable is a dummy that takes a value of zero or one depending on whether or not borrowers are defaulted. However, there are possible losses of information if a binary variable is used as the dependent variable. In addition, binomial models, explain only the probability that an individual made a certain choice (i.e. defaulted or has not defaulted) and they fail to take in to account the degree of credit recovery. The linear probability model (LPM), even though computationally and conceptually simpler and easier than the binary choice models, it depends on the use of ordinary least squares (OLS) approach. Application of OLS to censored model however, inherently produces heteroscedastic disturbance term and as a result, the standard deviations of the estimates are biased. These inadequacies are minimized with the use of the Tobit model (Greene, 2000).

There are several occasions where the variable to be modeled is limited in its range. Because of the restrictions put on the values taken by the regress and, such models can be called limited dependent variable regression models. There are three types of regression models under the limited dependent variables models. These are Censored or Tobit regression, truncated regression and sample selected regression models. Inferring the characteristics of a population from a sample drawn from a restricted part of the population is known as truncation. A truncated distribution is the part of untruncated distribution that is above or below some specified value (Greene, 2000). Whereas a sample in which information on the regress and is

available only for some observation is known as censored sample. The use of Tobit models to study censored and limited dependent variables has become increasingly common in applied social science research for the past two decades (Smith and Brame, 2003).

In this study the value of the dependent variable is repayment ratio that has been computed as the ratio of amount of loan repaid to the total amount borrowed from formal sources of credit. Thus, the value of the dependent variable ranges between 0 and 1 and a two-limit Tobit model has been chosen as a more appropriate econometric model.

2.3. Empirical Review

2.3.1. Empirical review from outside Ethiopia

Aryal *et al.*(2021) study factors affecting farmers' use of organic and inorganic fertilizers in South Asia. Using data from 2528 households across the Indo-Gangetic Plains in India, Nepal, and Bangladesh, the study examines the factors affecting farmers' use of organic and inorganic fertilizers for the two most important cereal crops – rice and wheat. Together, these crops provide the bulk of calories consumed in the region. As nitrogen (N) fertilizer is the major source of global warming and other environmental effects, they also examine the factors contributing to its overuse. They applied multiple regression models to understand the factors influencing the use of inorganic fertilizer, Heckman models to understand the likelihood and intensity of organic fertilizer (manure) use, and a probit model to examine the over-use of N fertilizer. The results indicate that various socio-economic and geographical factors influence the use of organic and inorganic fertilizers in rice and wheat. Across the study sites, N fertilizer over-use is the highest in Haryana (India) and the lowest in Nepal. Across all

locations, farmers reported a decline in manure application, concomitant with a lack of awareness of the principles of appropriate fertilizer management that can limit environmental externalities. Educational programs highlighting measures to improving nutrient-use-efficiency and reducing the negative externalities of N fertilizer over-use are proposed to address these problems.

Waithaka *et al.*(2007) study factors influencing fertilizer and manure use at the farm level, 253 farm households in Vihiga district of western Kenya were sampled. A pair of Tobit models was used to relate amounts of manure and fertilizer used to household variables. The results indicate that the use of both manure and fertilizer reciprocally influence each other and are strongly influenced by household factors, and also imply that manure and fertilizer uses are endogenous. Policy changes are required to (1) reduce the burden on farming alone in rural areas; (2) promote the use of higher-cost, higher-value inputs such as fertilizers; (3) improve access to input and output markets; and (4) encourage farmer education so as to promote sustainable soil fertility management. Improved understanding of the biophysical and socioeconomic environment of smallholder systems can help target sustainable soil fertility interventions more appropriately.

Abimbola (2020) investigated the factors affecting loan repayment rate among Microfinance Banks (MFBs) in South West Nigeria. Specifically, the effect of socioeconomic factors on loan repayment rate was examined and the effect of MFBs characteristics on loan repayment performance was analyzed. Purposive sampling method was used to select 20 credit officers and 124 respondents who are customers of the four selected MFBs for more than five years. Data were obtained through well- structured questionnaires and analysis was done using

descriptive statistics and regression analysis technique. Findings showed that three of the socio-economic variables which are age, educational level and average monthly income of the respondents significantly influence loan repayment rate. However, the coefficients of gender and household type, though positive did not exert significant effect on loan repayment rate. Furthermore, results revealed that MFBs characteristics in terms of loan size, interest rates, repayment mode and period have significant effect on loan repayment performance.

Gobena & Debebe (2018) examined factors influencing repayment performance of agricultural loan: Evidence from Boloso Bombe Woreda, Wolaita Zone, Ethiopia. From primary surveyed data, a Probit model was used to analyze the result. We observed that farm production, training, size of farmland; male household head, married head, interest rate and the loan duration are strongly correlating with agricultural loan repayment. Inadequate agricultural funds, much expenditure on farm competition and improper interference of the third party in the decision of loan approval are the constraints associated with agricultural loan.

Sangwa *et al.* (2020) studied on repayment risk associated with microfinance institution (MFI) lending in India. While identifying the determinants of loan delinquency, it divulges features that tend to create repayment differences between the low- and high-income client households. Primary data of 498 households collected from two Indian states are analyzed using descriptive statistics and logistic regression. The study examines the role of household characteristics, loan characteristics, moral hazard features, and the regional attributes in loan delinquency behavior. The findings ascertain that the households having low incomes, high indebtedness and greater loan diversion, and experiencing high costs of borrowing are prone to greater default probabilities. Contrarily, those having higher financial literacy with a feeling of

social cohesiveness and joint liability are likely to be less delinquent. Absence of MFI supervision is a critical factor for loan delinquency. However, MFIs' biases against poverty lending are possibly over-emphasized. With proper supervision and measures to check unproductive loan utilization, the repayment propensity is likely to improve.

Yiga (2018) conducted a study on repayment performance of smallholder farmer revolving state-credit in Luwero District, Uganda. Using Tobit regression and descriptive statistical analysis, the study inquired into repayment performance of one state-provided credit – the Integrated Support to Farmer Groups (ISFG). Structured questionnaires were developed, pre-tested and then used to collect data from 153 beneficiaries. Respondents were sampled by purposive and then multi-stage random technique. The respondents were; male dominated, aged 45 years and with formal education level of seven years. Repayment of the ISFG significantly depended on; the distance of the beneficiary from the sub-county, the period taken by the farmed enterprises to mature, beneficiary education level and credit use experience, amount to be repaid and returns to the credit.

Werema and Opanga (2016) analyzed the factors affecting loan repayment performances in Microfinance Institutions (MFIs) with a case study of (Promotion of Rural Initiatives and Development Enterprises) PRIDE Arusha, Tanzania. The study used both quantitative and qualitative techniques to investigate factors affecting loan repayment performances. The findings show those clients' characteristics (age, household size, gender and level of education), nature of business (business type, business stability and income level) and loan characteristics (repayment period, repayment mode, and repayment amount) were among the factors that influenced borrowers in repaying their loans. Lack of business knowledge was

another factor mentioned by clients which leads to low productivity hence failure to have enough fund to repay their loans. The study further revealed that there was a significant relationship between loan repayment performances with clients' businesses challenges, loan diversification to other non-income activities, and other outside factors such market imperfections, higher interest charges, drought, among others.

2.3.2. Empirical review from Ethiopia

Leake(2018) study factors influencing application of fertilizer by smallholder Farmers of Northern Ethiopia. Tobit model was used to analyze factors influencing use of fertilizer econometrically. A total of twelve explanatory variables were included in the model. From the result of the analysis six variables (family size, sex of household head, distance from market, perception of household about cost of fertilizer, access to credit facility and total land size) were found to be the significant factor affecting the use of fertilizer by smallholder farmers. Implication of results of this study is that any development intervention through improved agricultural technologies should consider the aforementioned socioeconomic characteristics and determinants of adoption for success.

Mideksa *etal.*(2020) analyze determinants of fertilizer use using a survey data collected from 174 randomly selected maize producers in NonoBenja District, Ethiopia. Results show that the sampled respondents on average applied 142.8 kg/ha inorganic fertilizer (NPS+Urea) which is only 71.5% of the recommended rate. Age of household head, farm income, and use of input credit affected the probability of fertilizer use positively. Education level of household head,

livestock holding and frequency of contact with extension agent positively influenced both the probability and intensity of fertilizer use whereas perception on cost of production influenced both the use and intensity of use negatively. Off-farm income positively influenced the intensity of fertilizer use. Farmers applying the recommended and above the recommended rates of inorganic fertilizer in maize production were more profitable than those applying lower than the recommended rates.

Andualem and Ebrahim (2020) examine factors affecting loan repayment rate from Amhara Credit and Saving Institutions (ACSI) among smallholder farmers in Habru district, Ethiopia. In this study, both primary and secondary data sources were used. The study employed a combination of multi-stage purposive and stratified sampling techniques in the selection of 384 borrowers from small-holder farmers in the study area. The Tobit model result found that a total of 10 out of the total 15 explanatory variables involved in the model were found to be statistically significant. According to the result demographic factors (age and household size), socio-economic factors (educational level, land size, livestock size, non-farm income, purpose of borrowing), and institutional factors (road distance, contact with development agents, training received on loan use) were among the factors that influenced loan repayment rate of small-holder borrowers in the study area. Education level, land size, livestock size in TLU, non-farm income, purpose of borrowing, contact with agricultural extension agents, and training received on loan use were found to determine loan repayment rate of borrowers positively and significantly, while age, family size, and road distance were found negatively and significantly determine loan repayment rate in the study area.

Tefera (2020) done a study on factors that affect borrower's ability to repay loan in case of Oromia saving and credit institution in Bale Robe. The study used both primary and secondary data. Primary data was collected by using open ended question and closed ended questioner for the institutions employees and customers. Secondary data was gathered from the annual report of institution. The collected data was analyzed by using descriptive methods, and present it by using like percentage and table form. Abuye & Mohammed (2022) conducted a study with the aim of analyzing the factors that influence micro-finance loan repayment practice using primary data collected through self-administered questionnaire. Fentahun (2019), analyzed determinants of loan repayment performance of smallholder farmers in a special reference Assosa woreda. Purposive sampling technique was used to select sample *kebeles*. For the study a total of 1571 households' credit users and from these 94 households were selected randomly followed by probability proportional sample from Assosa woreda. Both primary and secondary data were collected for this study.

Biruk (2017) examined determinants of smallholder farmer's loan repayment performance in Assosa district, Western Ethiopia. The study used both Purposive and simple random sampling technique in order to select sampled *kebeles* and households, respectively. Hence, from 111 household credit users in the district, 94 households were selected randomly followed by probability proportional sample from Assosa district. Moreover, Biruk (2017) conducted research to identify borrowers, institutional and loan factors that affect loan default rate of smallholder farmers in Wogera Woreda Amahara National Regional State. To achieve this objective, primary data were collected from a sample of formal credit borrower farmers in the Woreda through a structured questionnaire. A total of 206 farm households' cases were

included in the final analysis. Logit model was used to identify and analyze the effect of explanatory variables on the dependent variable. A total of fourteen explanatory variables were included in the regression. Out of these, seven variables were found to be significant in terms of the probability of defaulting. The variables that have a significant relationship with formal credit users' loan default rate are: saving habit, other sources of income, fertilizer use, sector, loan diversion, loan supervision, and repayment period. The rest of the explanatory variables, namely age, sex, education level, family size, dependency ratio, irrigation use and loan size, had no significant effect on the probability of defaulting.

Abebe (2011) examined factors influencing timely credit repayment and input use (especially fertilizer) by smallholder farmers in Ada district of East Shewa zone. Data for the study were collected both from primary and secondary sources during 2009. A two-stage random sampling procedure was adapted to select five agricultural cooperatives and a total of 130 sample respondents from the district. Descriptive and inferential statistics were used to describe socio-economic and institutional characteristics of the respondents which revealed that there is significant mean difference regarding age, family size, cultivated land size, number of livestock owned, on-farm income, amount of fertilizer used and saving habits. Tobit model was employed to identify factors influencing loan repayment performance of the households. The result of the model showed that family size, livestock ownership, on-farm income, non-farm income and saving habit were the statistically significant factors influencing timely loan repayment performance positively.

2.4. Conceptual Framework of the Study

Credit decisions of different inputs across space and time are influenced by different factors and their associations. Factors such as, socioeconomic, institutional and demographic factors determine the probability of credit repayment and fertilizer use (Figure 1). It is obvious that different studies have been conducted to look into the direction and magnitude of the influence of different factors on farmers' credit repayment of agricultural input (fertilizer) and its use in the study area.

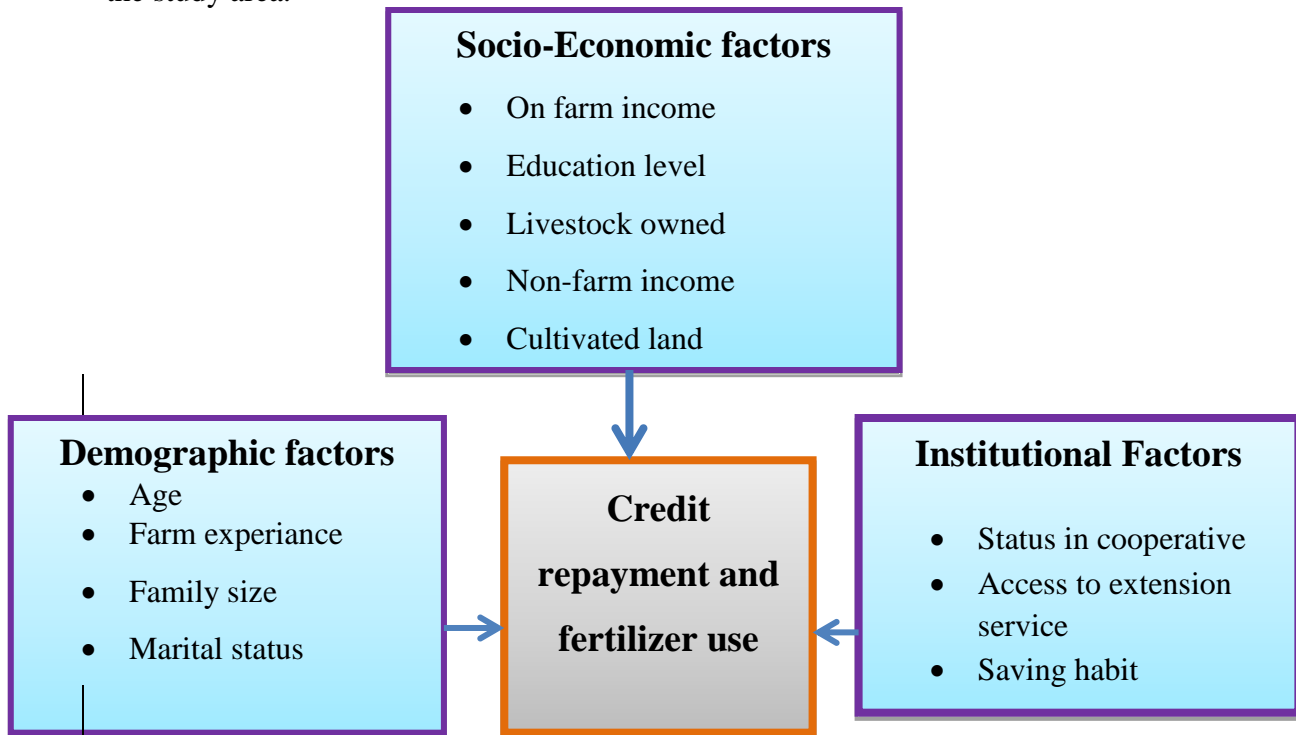


Figure 1: Conceptual framework
Source: Based on different literature review(2023)

3. RESEARCH METHODOLOGY

3.1. Description of the Study Area

The study was conducted in the Girar Jarso district in the North Shewa zone, Oromia Region State, Ethiopia. It is geographically located at latitude $8^{\circ}54''$ to $10^{\circ}23''$ N and $37^{\circ}56''$ to $39^{\circ}24''$ E 112 km northeast of Addis Ababa and bordered on the south by Yaya Gulale on the west by Degem, and on the east by the Debre Libanos districts and on the North by Amhara Regional state (Figure 2). Girar-Jarso is composed of 17 *kebeles* and one town administration. The area of the district is about 49,435 hectares. About 59% of the land is allocated for crop production. The climate condition of the district is about 52% Dega, 41% Woyna, Dega and 7% is Kola. The district receives 793- 1443 mm annual rainfall from May to October and temperature 10°C - 32°C . The main livelihoods of the population are agriculture mixed-farming system. The farming calendar of the district is from April to January. Rain-fed agriculture is its main crop production system. The agro-climatic conditions of the district are conducive to the production of various types of crops. The major crops grown in the districts are barely, wheat, teff, oat, bean, cow pea, field pea, haricot bean and maize. Wheat occupied the largest cultivated area out of the crops grown in the district. The livestock reared are cows, oxen, horse, donkey, sheep and goats including poultry. The total rural population of Girar Jarso district is 99,653 of which 51,027 are male and 48,626 are female. The total number of households in the district is 12,049 with an average family size of 5.6 persons (GJWAO, 2022).

The district has potential crop production due to suitable climatic conditions and good infrastructure. In the Girar Jarso district, there were 14 multi-purpose agricultural cooperatives. Moreover, they had 7,981 members (4405 male and 576 female) in 2022. The total capital of the cooperatives was birr 2,059,557.015. The cooperatives provide fertilizer, improved seeds and other farm inputs to farmers. One of the fascinating attributes of agricultural cooperatives is extending input in credit. They also market farm produce, especially teff and wheat. The number of MPCs provision of fertilizer credit for cooperative members increased from 2018-2022 years from 2143-3215 farmers (GJWAO, 2023).

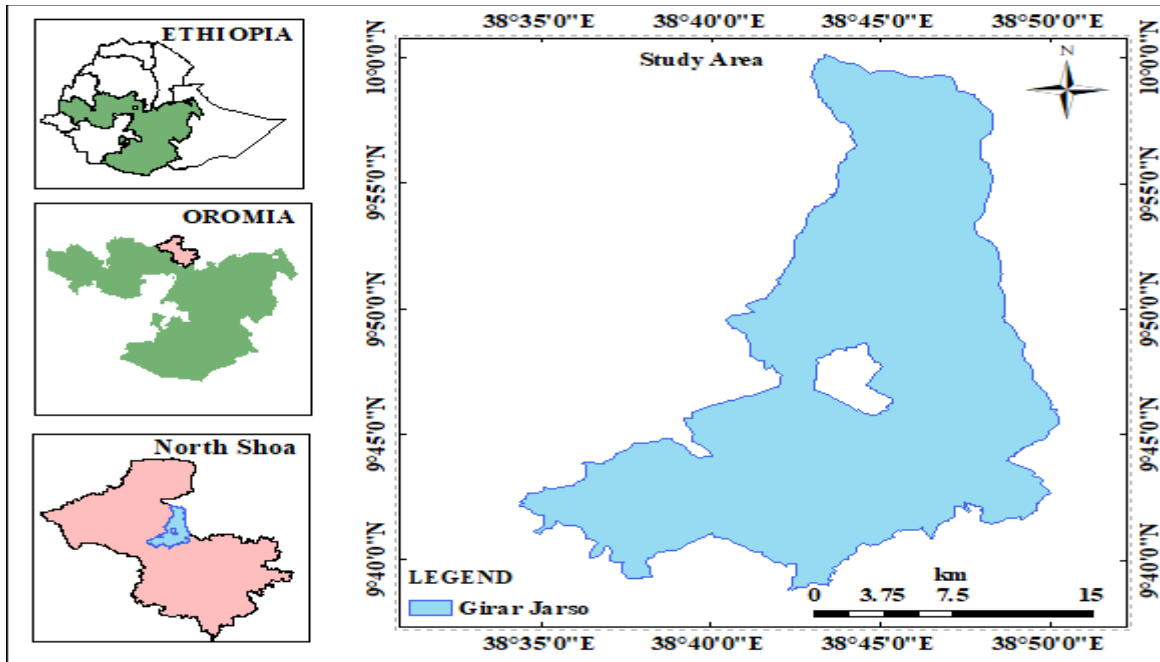


Figure 1. Map of the study area
Source: GIS (2023)

3.2. Sampling Techniques and Sample Size Determination

A two-stage random sampling method was used to select the sample respondents. In the first stage, from 14 primary cooperatives found in the district (having 7,981 farmer members) four MPCs cooperatives were selected randomly from the sampling frame obtained from the Girar-Jarso District Cooperative Promotion Office (GJCPO). In the second stage out of four primary cooperatives 150 sample farmers were selected randomly from the lists of respective cooperatives taking input in credit in the 2022 cropping calendar using probability proportional to size (Table 1).

Table 1. Sample cooperatives and sample respondents

No.	Sample cooperatives	Total number of borrowed	Sample respondents
1	GendaGuda	918	36
2	IyataDanisa	803	31
3	Warxu	1083	43
4	Ilamu	1008	40
	Total	3812	150

Source: GJCPO(2023)

The sample size was estimated using a formula developed by Yamane (1967) specified in equation 1.

$$n = \frac{N}{1 + N(e)^2} = \frac{3812}{1 + 3812(0.08)^2} = 150 \quad (1)$$

Where; n = Sample size

N= Total number of members borrowed fertilizer credit in the sampled cooperatives

e = margin of error (8%) .

3.3. Data Sources and Techniques of Data Collection

Data for this study was collected both from primary and secondary sources. Secondary data was collected from published and unpublished documents, reports, maps, statistical data, and bulletin and audit reports. Secondary data was also collected from different governmental and non-governmental offices found in the district, zonal, and regional offices. A the semi-structured questionnaire includes open-ended questions, so that both quantitative and qualitative information can be gathered was employed to collect primary data for the credit years of 2021/2022 from the sample respondents. Before conducting the actual interview, the questionnaire was pre-tested. The pre-test was administered to member farmers in the cooperatives who were not included in the sample respondents. Considering the pre-test information, some amendments were made to the questionnaire before it was administered. Enumerators were recruited and trained on the details of the interviewing techniques and the contents of the questionnaire. Five enumerators, four of whom are degree holders in plant science and with a degree in cooperative science having experience in data collection were recruited and trained. Continuous supervision was made to reduce errors during data collection and to correct possible errors right on the spot.

3.4. Methods of Data Analysis

3.4.1. Descriptive statistics

Descriptive statistics such as mean, standard deviations and percentages were computed to analyze the collected data. Moreover, differences between defaulters and non-defaulters with respect to the selected variables were tested using t-test and χ^2 - test.

3.4.2. Econometric model

An econometric model known as the tobit model was used to analyze factors affecting fertilizer credit repayment rate. This model is also recognized as a censored regression model in the sense that a sample in which information on the regress and (dependent variable) is available only for some observations is known as a censored sample (Greene, 2000).

The Tobit model was selected because the fertilizer credit repayment rate, which is the dependent variable, is continuous and censored. In this study the value of the dependent variable is the repayment ratio which is computed as the ratio of the amount of loan repaid to the total amount borrowed. Thus, the value of the dependent variable ranges between 0 and 1 and a two-limit Tobit model which is based on maximum likelihood technique was used as a more appropriate econometric model based on (Herranz, 2017) and Gujarati (2004). The structural equation of the Tobit model is given as:

$$Y^* = \beta X_i + \varepsilon : \varepsilon \sim N(0, \delta^2) \quad (2)$$

Denoting Y_i as the observed dependent (censored) variable

$$Y_i = \left\{ \begin{array}{l} \text{Lif } Y^* \leq L \\ Y^* = \beta X_i + \varepsilon \text{ if } L < Y^* < U \\ \text{Uif } Y^* \geq U \end{array} \right\} \quad (3)$$

Where

Y_i = the observed dependent variable, in our case fertilizer credit repayment ratio

Y_i^* = the latent variable (unobserved for values smaller than 0 and greater than 1)

X_i = is a vector of independent variables that influence repayment rate.

β_i = vector of unknown parameters associated with the independent variables to be estimated.

ϵ_i = Residuals that are normally distributed with mean zero and a constant variance.

$i = 1, 2 \dots n$ (n is the number of observations).

L = lower limit, U = upper limit

By using the two-limit Tobit model, the repayment rate was regressed on the various factors hypothesized to influence fertilizer credit repayment rate in the study area.

The log likelihood function for the general two-limit Tobit model can be given as follow:

$$\begin{aligned} \mathbf{L} = & \frac{1}{2} \sum j \epsilon C w_j \left[\left(\frac{y^i - x\beta}{\sigma} \right)^2 + \log 2\pi\sigma^2 \right] + \sum j \epsilon L w_j \log \Phi \left(\frac{y^l j - x\beta}{\sigma} \right) + \sum j \epsilon R w_j \log [1 - \\ & \Phi \left(\frac{y^{Ri} - x\beta}{\sigma} \right)] + \sum j \epsilon I w_j \log \Phi \left[\left(\frac{y^{2j} - x\beta}{\sigma} \right) - \Phi \left(\frac{y^{1j} - x\beta}{\sigma} \right) \right] \end{aligned} \quad (4)$$

Where C 's are point observations, L 's are left censored observations, R 's are right-censored observations, and I 's are intervals. And Φ is the standard cumulative normal distribution, and the w_j is the normalized weight of the j^{th} observation.

The Tobit coefficients do not directly give the marginal effects of the associated independent variables on the dependent variable. But their signs show the direction of change in the marginal intensity of credit recovery as the respective explanatory variable change (Amemiya, 1984; Goodwin, 1992; Maddala, 1992).

Based on McDonald and Moffit (1980), The Tobit model has an advantage in that its coefficients can be further disaggregated to determine the effect of a change in the i^{th} variable as follows:

1. The change in the probability of repaying the credit as an independent variable X_i changes is:

$$\frac{\partial \Phi(\delta)}{\partial X_i} = \Phi(\delta) \frac{\beta_i}{\sigma} \quad (5)$$

The change in intensity of credit recovery with respect to a change in an explanatory variable among non-complete defaulters is:

$$\frac{\partial E(Y_i/U > Y_i > L, X)}{\partial X_i} = \beta_i \left[1 + \frac{\delta_L \Phi(\delta_L) - \delta_U \Phi(\delta_U)}{\Phi(\delta_U) - \Phi(\delta_L)} - \left[\frac{\Phi(\delta_L) - \Phi(\delta_U)}{\Phi(\delta_U) - \Phi(\delta_L)} \right]^2 \right] \quad (6)$$

2. The marginal effect of an explanatory variable on the expected value of the dependent Variable is:

$$\frac{\partial E(Y/X_i)}{\partial X} = \beta_i (\Phi(\delta_U) - \Phi(\delta_L)) \quad (7)$$

Where:

X_i = explanatory variables

$\Phi(\delta)$ = the cumulative normal distribution

$\delta = \frac{\beta_i X_i}{\sigma}$ = the Z-score for the area under the normal curve

β_i = a vector of Tobit maximum likelihood estimates

σ =the standard error of the error term.

$$\delta_L = \frac{L - \beta X_i}{\sigma}, \delta_U = \frac{U - \beta X_i}{\sigma}$$

L and U are threshold values (L=0 and U=1)

Φ and ϕ are probability density and cumulative density functions of the standard normal distribution, respectively.

The second objective was analyzed by using multiple linear regression. Amount of fertilizer used by sampled household head is a continuous dependent variable of the model that was measured in quintal. The appropriate econometric technique to deal with the continuous dependent variable is using multiple linear regression models and it was the most familiar statistical models used to analyze the data. It is a general statistical technique through which one can analyze the relationship between a continuous dependent variable and a set of dummy/categorical/continuous independent variables (Alexopoulos, 2010). Multiple linear regression models are given as follows;

$$Y = \beta_0 + \beta_1 X_1 + \dots + \beta_{12} X_{12} + \varepsilon$$

Where the dependent variable was Y, the amount of fertilizer used by sample household and X_1 - X_{12} represents independent variables affecting amount of fertilizer use by sample household. The parameters $\beta_1 - \beta_{12}$ are the regression coefficients associated with independent variables (X_1 - X_{12}) respectively and ε is the random error component reflecting the difference between the observed and fitted linear relationship.

3.5. Definition, Measurement and Hypothesis of the Study Variables

Based on the literature reviewed and discussion held with stakeholders, the explanatory variables selected for this study were broadly categorized under demographic, socioeconomic, and institutional factors. In what follows, a brief explanation of the explanatory variables selected for this study and their likely influence on loan repayment performance is presented below.

Dependent variables

Credit Repayment: (CREDITREP): The dependent variable for this study is the proportion of credit repaid during the specified repayment period. This was calculated as the ratio of the total amount credit repaid to the total amount of due. Its value ranges between 0 and 1. Those borrower farmers who did not repay any amount of money they borrowed are considered as complete defaulters (i.e., the value of the repayment ratio in this case is zero). On the other hand, those farmers who repaid the money they borrowed within the stated time are considered as non-defaulters(Oyebanji, 2017).

Fertilizer Use:It is another dependent variable which refers to the amount of chemical fertilizer used by respondents during the cropping season. It is a continuous variable which is measured by quintal(Qt)..

Independent variables

Age of the household head (AGE): It is defined as the number of years the respondent household since birth until the survey was conducted. It is a continuous variable measured by years. Through time household heads acquire experience in the farming business and/or credit use. Moreover, older borrowers may accumulate more wealth than younger ones. However, if they have insufficient labor within their households, older household heads in rural areas are at a disadvantaged position economically in undertaking the heavy physical labor required in agriculture. Each additional unit increase in age after some point would thus add less to household income leading to low credit repayment performance. Therefore, the expected effect of age on loan repayment could be positive or negative (Owusu, 2017). Regarding to the study area, it was hypothesized to affect the loan repayment and fertilizer use positively.

Marital status (MARSTA): It is represented by 1 if the respondent is married, 2 if the household is single, 3 if the household is divorce and 4 if widow. It is assumed that married households can handle and manage their overall livelihood (social duties and farm activities) better than households who divorce, widowed, or single, that enabled them to produce more and generate more income. Therefore, married households repay their loan and use more fertilizer than divorce, widow and single households.

Education level of the household head (EDUCLVL): This is a continuous variable measured by level of educational attainment. Education may enable farmers to be more aware of the importance of formal loan and hence may reduce willful default. Education increases capacity of farmers to utilize technologies (Steven, 2018). Therefore, education is expected to affect loan repayment and fertilizer use positively.

Family size (FAMSIZE): It refers to The number of family members residing with the respondent. It a continuous variable which is measured in Man-equivalent. The larger the family members, the more the labor force available for production purpose. Therefore, there is a possibility to have more alternative sources of income to overcome credit risks. Based on this, families with sufficient labor-force would be expected to low probability of defaulting. On the contrary, since food requirements increase with the number of adult equivalent in the family, most of produce is used for consumption as number of family members relatively increase. It is expected that family size decrease loan repayment performance of farmers (Zemen, 2005). Therefore, the coefficient of this variable may appear with positive effect on credit repayment performance and fertilizer use of household.

Non-farm income (NONFARM): This is defined as the amount of income generated from activities other than crop and livestock productions. These include: petty trading, casual work, homemade drinks, handicraft (weaving, blacksmith, tannery) etc. These additional sources of income would back the farmers up to settle debt even during bad harvesting seasons and when repayment period and agricultural prices are inversely related. Most probably, repayment starts immediately after a peak harvesting time when prices of agricultural products fall sharply. During this time, farmers who practice non-farm activities can easily repay their loan on time than those who don't involved in non-farm income. Therefore, non-farm income is a very important source of cash for farm households especially to purchase inputs and repay their credits (Reardon *et al.*, 1999). It is assumed that the variable has a positive impact on credit repayment and fertilizer use.

On-farm income (ONFARM): It is defined as the total income generated from crops and livestock activities measured in Birr during a particular year. The higher the on-farm income, the greater the repayment capacity of the farmers and the higher the probability to be non-defaulter and vice versa. The cash generated from these activities could back up the farmers' income to settle their debt even during bad harvesting seasons and when repayment period coincides with low agricultural prices (Simachew and Hassen, 2020). Therefore, the coefficient of this variable is expected to affect loan repayment and fertilizer use positively.

Cultivated land (CULTLAND): It refers to the total cultivated land holding of the household. It is argued that farmers with large farm size have better chance of earning more income which in turn enables him/ her to use inputs and repay credits (Rasool *et al.*, 2020). This variable is hypothesized to have positive impact on credit repayment and fertilizer use.

Number of livestock owned (LIVSTNO): This variable is defined in terms of Tropical Livestock Unit (TLU) and may serve as a proxy for the capacity to bear risks of using credit. Livestock may also serve as a proxy for oxen ownership, which is important for farm operations (Kariyasa, 2011). It is expected that this variable have a positive influence on loan repayment performance and fertilizer use.

Access to extension service (EXTSER): This is a dummy variable, which takes a value 1 if the household receives extension service and 0 otherwise. It is hypothesized that this variable

positively influences credit repayment(Owusu, 2017). Regarding to the study area, this variable is hypothesized to have positive impact on credit repayment and fertilizer use

Status in the cooperative (COOPSTA): This is a dummy variable which takes a value of 1 if the respondent is an elected committee and 0 otherwise. It is assumed that farmers who worked as an elected committee member have better repayment status than other members (Karakas, 2019). This variable is hypothesized to have positive impact on credit repayment and fertilizer use

Saving habit (SAVING): This is a dummy variable that is represented by 1 if the respondent has saving and 0 otherwise. Farmers usually save from their proceeds for consumption smoothing purposes throughout the year, accumulation of wealth, and for contingency purposes in case of bad harvest or accident. Saving enables farmers to easily fulfill the contract entered when prices of agricultural products are not conducive. The more the amount of savings, the greater the capacity to repay input credit (Papias and Ganesan, 2009). Therefore, it is hypothesized that this variable positively influences credit repayment and fertilizer use.

Farm Experience(FARMEXPRNCE): It is a continuous variable and refers to the total years that the household participated on agricultural activities, which is measured in years. Having more experience and knowledge on agricultural production methods, post-harvest handling of agricultural products, agronomic practices and management of natural resources increase the

ability to repay loan and fertilizer use (Steven,2018). Therefore, it was hypothesized that this variable positively influences credit repayment and fertilizer use.

Table 2.Variables hypothesized on credit repayment and fertilizer use

Variables	Description	Type and measurement	Hypothesis
Dependent variables			
Loan repayment rate	Ratio of loan repaid	Index (0 up to 1)	
Fertilizer use	Amount of fertilizer used	Continuous (Qt)	
Independent variables			
LAND	Cultivated land	Continuous (hectars)	+ve
SH	Saving Habit	Dummy has saving 1, otherwis 0	+ve
SC	Status in the cooperatives	Dummy elected=1, otherwise 0	+ve
EDUH	Education of household head	continuous (grade completed)	+ve
AGE	Age of the household head	continuous (years)	+ve
MARSTA	Marital status	Categorical (1=married,2=single,3=divorced 4=widow)	+ve
FSH	Family size	continuous (Man equaivalent)	+ve
AEXTS	Access to extension service	Dummy (1=got extension servic e,0 otherwise)	+ve
ONFARM	On farm income	Continuous (Birr)	+ve
NONFARM	Non-farm income	Continuous (Birr)	
FARMEXPRNCE	Farm experience of the sampled hhs	Continuous(years)	+ve

Source: Own definition based on literature review (2023)

4. RESULTS AND DISCUSSIONS

This chapter presents the results from the descriptive and econometric analysis. The descriptive analysis made use of tools such as mean, percentages and standard deviation. In addition, the t-and chi-square statistics were employed to compare defaulters and non-defaulters' groups with respect to some explanatory variables. An econometric analysis was carried out to identify the most important factors that affect loan repayment performance and fertilizer use and to measure the relative importance of significant explanatory variables on loan repayment performance and fertilizer use.

4.1. Descriptive and Inferential Statistics

The demographic, socio-economic and institutional characteristics of the respondents such as age, marital status, family size, level of education, cultivated land, number of livestock owned, health condition of the household, fertility status of the soil, status in the cooperative, saving behavior of the respondents and other variables related to timely credit repayment (defaulters and non-defaulters) and inputs use were analysed using descriptive statistics.

4.1.1. Household characteristics

Age of the household head

The age of the sample respondents ranged from 28-76 years with a mean of 48.55 years and a standard deviation of 15.48. The average age of non-defaulters was 52.42 years, while that of defaulters was 45.28 years. Therefore, the survey results show that the mean difference between non-defaulters and defaulters with regard to age was statistically significant at 10%

significance level (Table 3). This revealed that, non-defaulters are more aged than defaulters implying that through time household heads acquire experience in the farming business or credit service use. Moreover, older borrowers may accumulate more wealth than younger ones.

Table 3. Distribution of the sample households by age

Characteristics	Non-defaulters (N=116)		Defaulters (N=34)		T-value	Total sample (N=150)	
	Mean	Std.Dev	Mean	Std.Dev		Mean	Std.Dev
Age (years)	52.42	16.35	45.28	8.89	1.92*	48.55	15.48
Maximum		76		76			76
Minimum		28		32			28

*Significant at 10% probability level; N=Number of respondents;
Sources: own computation, 2023

Family size of the respondents

The family size of the respondents ranged from 2 up to 11 persons, with an average family size of 5.97 and a standard deviation of 2.08. The average family size in the sample was higher than the average family size of the region's average family size of 5 persons (CSA, 2007). The average family size of the non-defaulters and defaulters was 6.81 and 4.88 with standard deviations of 2.22 and 1.89, respectively. Moreover, the family size between the two groups was statistically significant at 1% (Table 4). The average number of the active labor force (man-equivalent) for the whole sample, non-defaulters and defaulters was 5.14 and 3.88, respectively. This also shows that the difference between non-defaulters and defaulters regarding active labor was statistically significant at 10%. If this result is compared with the

average family size (5.97) on average 74, of the family members are actively engaged in an economic activity. The larger the family members, the more the labor force available for production purposes.

Table 4. Characteristics of the sample households by family size

Characteristics	Non-defaulters (N=116)		Defaulters (N=34)		T-value	Total sample (N=150)	
	Mean	Std.Dev	Mean	Std.Dev		Mean	Std.Dev
Familysize (ME))	6.81	2.22	4.88	1.89	2.94***	5.97	2.48
Active labor (number)	5.14	1.96	3.88	1.88		4.64	1.86
Dependent labor (number)	1.68	1.24	1.54	0.94		1.84	1.18

*Significant at 10% probability level

N=Number of respondents

Sources: Own computation, 2023

Note: Active labor is age group lying between 15 to 64 years

Marital status of the household

With regard to the marital status, from the total sample respondents 84.00%, 6.00%, 5.33% and 4.66% were married, single, divorced and widowed, respectively. The marital status of non-defaulters was 84.00%, 6.03%, 4.31% and 5.17% are married, single, divorced and widow, respectively while for the defaulters it is 79.41%, 11.76%, 8.82% and 5.88%, respectively are shown in Table 5. However, the percentage difference between the two groups was found to be insignificant.

Table 5. Distribution of the sample households by maritus status

Variables	Non-defaulters (N=116)		Defaulters (N=34)		χ^2 -value	Total sample (N=150)	
	N	Percent	N	Percent		N	Percent
Marital status-							
married	98	84.48	27	79.41	1.25	126	84.00
Single	7	6.03	4	11.76		9	6.00
divorce	5	4.31	3	8.82		8	5.33
Widow	6	5.17	2	5.88		7	4.66

N=Number of respondents

Sources: Own computation, 2023

4.1.2. Economic characteristics of the household

The cultivated land size (owned and rented) of sample households varies between 0.5 to 12.5 hectares with an average holding of 2.96 hectares and a standard deviation of 2.23. The average size of cultivated land for non-defaulters was 3.14 with a standard deviation of 2.42, while that of defaulters was 2.26 with standard deviation of 0.98. Statistically, there was a significant difference between non-defaulters and defaulters at 10% related to the size of cultivated land (Table 6).

Table 6. Land holding differentials between sample farmers

Characteristics	Non-defaulters (N=116)		Defaulters (N=34)		T-value	Total sample (N=150)	
	Mean	Std.Dev	Mean	Std.Dev		Mean	Std.Dev
Cultivated land size (ha)	3.64	2.51	2.28	0.98	1.86*	2.92	2.27
Maximum	0.5			0.5		0.5	
Minimum	12.7			4.85		12.7	

*Significant at 10% probability level

Sources: own computation, 2023

Farmers in the study area undertake both crop and livestock production activities. Though the holding size varied among the sample households and between non-defaulters and defaulters, all of the sampled respondents owned livestock. The most commonly reared livestock in the study area are cattle, sheep and goats, equines and poultry. Oxen is the most important source of drought power in the study area. The minimum and maximum number of livestock in TLU maintained by the sample respondents were 3 and 24 respectively. It was found that non-defaulters had an average of 11.48 TLU, while defaulters had 8.33 TLU with a standard deviation of 4.74 and 2.88, respectively. Moreover, the mean difference between the two groups was statistically significant at 1% (Table 7). Within the type of livestock possessed by households in the study area, the mean differences between defaulters and non-defaulters were found to be statistically significant for oxen, equines, goats and chickens.

In the 2014 production year, the average income earned from these sources was Birr 16,833.94. The analysis shows that non-defaulters had an average income of Birr 18,368.38, while defaulters had an average income of Birr 10,696.15. The difference in mean income between defaulters and non-defaulters was statistically significant at a probability level of less

than 1% (Table 7). This suggests that households with higher on-farm incomes have a greater repayment capacity and a higher likelihood of being non-defaulters. Non-defaulters had an average non-farm income of Birr 2417.53, while defaulters had an average non-farm income of Birr 1423.6 (Table 7).

The results of the survey, which was conducted with 150 respondents, indicate that all of the sample households used chemical fertilizer for their cultivation in the main cropping season of 2014. The data shows that non-defaulters and defaulters utilized an average of 3.87 quintals and 2.45 quintals of fertilizer, respectively, which was found to be statistically significant at a 1% and 5% significance level (Table 7). The survey also revealed that fertilizer utilization varied widely among the respondents, ranging from a minimum of 1 quintal to a maximum of 22.75 quintals. Non-defaulters had a fertilizer utilization range of 22.01 to 1, while defaulters had a range of 8.77 to 1. These findings suggest that there were significant differences in the use of fertilizer between the two groups at a 10% probability level. However, it is worth noting that fertilizer application rates were generally far below the recommended rates of 100 kg of DAP and 100 kg of Urea per hectare.

Table 7. Distribution of livestock holding, on-farm, non-farm and fertilizer use

Variables	Non-defaulters (N=116)		Defaulters (N=34)		T-value	Total sample (N=150)	
	Mean	Std.Dev	Mean	Std.Dev		Mean	Std.Dev
TLU	11.48	4.74	8.33	2.88	3.15***	10.37	4.61
Cattle	5.65	1.87	4.17	1.75		4.72	1.95
Oxen	8	1.81	2.55	1.23		3.03	1.80
Equine	4	1.43	0.37	0.67		1.12	1.27
Sheep	5	1.48	1.86	1.43		2.43	1.53
Goat	0.54	1.32	0.18	0.65		0.57	1.28
Chicken	1.91	1.73	1.17	2.08		1.74	1.87
On-farm income (Birr)	19457.8	11537.8	10897.3	6037.3	3.65***	17621.7	11045.61
Non-farm income (Birr)	2417.53	3902.5	1423.6	2891.2		1621.3	3028.25
Fertilizer (quintal)	3.87	3.91	2.45	1.73	1.91*	3.98	3.75
Maximum	22.75		8.77			22.01	
Minimum	1		1			1	

*** and * Significant at 1% and 5% level

N=Number of respondents

Sources: Survey results, 2023

4.1.3. Social and institutional characters

The respondents in the survey had an average educational level of 4.31 years of schooling, with a standard deviation of 3.87. The analysis shows that non-defaulters had a mean educational level of 4.12 years, with a standard deviation of 3.87, while defaulters had a mean educational level of 3.88 years, with a standard deviation of 2.88. However, the results suggest that there is no statistically significant difference between non-defaulters and defaulters in

terms of educational level (Table 8). The results of the survey indicated that 72% of the respondents have got enough knowledge about cooperatives and credit systems from extension agents, while 28% did not have any training or education from extension agents regarding credit. Group wise, 72.4% of the non-defaulters and 58.2% of the defaulters reported that they had extension contact. However, the chi-square value reveals that the difference between the two groups was insignificant (Table 8).

The ability to save refers to how much households save for future use. A survey found that 36% of households in the sample saved money in different banks for the future. Among non-defaulters, 36.2% had savings, while only 11.8% of defaulters had savings. The difference in saving behavior between defaulters and non-defaulters is significant at a 1% significance level, indicating that those who save more are more likely to repay input credit. This result suggests that the amount of savings is directly related to the ability to repay loans. Table 8 shows that, from defaulters 22.9% of households in the sample saved money in different banks for the future. The minimum and maximum amounts of defaulted money were 250 Birr and 2457 Birr, respectively.

Table 8. Distribution of socio-economic and institutional factors

Variables	Non-defaulters (N=116)		Defaulters (N=34)		T-value	Total sample (N=150)	
	Mean	Std.Dev	Mean	Std.Dev		Mean	Std.Dev
Education level	4.12	3.87	3.88	2.88	0.31	4.31	3.87
Maximum	13		8			13	
Minimum	0		0			0	
Extension	N	Percent	N	Percent	Chi ² -value	N	Percent
Yes	84	72.4	20	58.2		108	72
No	32	27.6	14	41.2		42	28
Cooperative status					0.85		
Elected	21	18.1	8	23.5		24	16
Not elected	95	81.9	26	76.5		126	84
Saving habit					12.55***		
Yes	42	36.2	4	11.8		54	36
No	74	63.8	30	88.2		96	64
Amount of money defaulted in Birr (N=34)			1407	308.67			
Maximum			2457				
Minimum			250				

*** and * Significant at 1% and 5% level

N=Number of respondents

Sources: Survey results, 2023

4.1.4. Benefits and Challenges of Inputs Marketing through Cooperatives

Cooperatives are established with the purpose of creating a collective capacity that cannot be achieved individually. The formation of farmers' cooperatives aims to address the issues faced by members regarding input and produce marketing. The challenges faced by the input marketing activity are multifaceted and include both marketing-related issues and

organizational challenges within cooperatives. One of the major challenges identified by members is the increasing number of defaulters, which makes it difficult for primary cooperatives to obtain input credit from banks without government collateral. The majority of cooperatives do not fully repay their loans in a timely manner, and in the survey, 20% of the 150 sampled members were found to be defaulters who did not repay their loans on time. Table 9 provides information on the amount defaulted by sample cooperatives from 2009-2014.

The second major challenge identified is that all of the sample primary cooperatives have an accumulated default that has been carried over since 2009-2014. Because of a lack of a clear delivery system, poor record-keeping, and weak monitoring systems, these debts have become nothing more than figures that are counted each year under the name of primary cooperatives, making it difficult to recover. Additionally, the primary cooperatives lack professional managers, and instead rely on honorary committees who do not have the necessary time or efficiency to identify and follow up with each loan taker to ensure that the credit is used for the intended purpose and repaid in a timely manner. Furthermore, the absence of timely repayment by the executive committee itself, preferential treatment for relatives and neighbors, and a lack of initiative for legal action against defaulters are some of the major problems that arise from the absence of strong follow-up on credit disbursed to members.

The success of agricultural technology in the region is heavily dependent on favorable weather conditions, and while natural calamities are not a common cause of defaults, their occurrence can have long-lasting repercussions. Some members of the survey identified this phenomenon as a cause for the failures of timely input credit return. For example, during the sample survey

interview, 73% of respondents who produced wheat in the cropping season of 2008 mentioned a significant reduction in wheat production due to the occurrence of frost.

The final challenge mentioned by respondents is the ever-increasing price of inputs, such as fertilizers, improved seeds, and chemicals, which are imported from abroad with foreign currency and are therefore subject to international market fluctuations. Over the last 2-3 years, the prices of these inputs have more than doubled, leading to reduced demand and ultimately resulting in the application of inputs far below the recommended level.

Table 9. Sample cooperatives loan repayment status for the year 2009-2014

Sample cooperative s	2009- 2013				2014			
	Credit(Birr)	Repaid(Birr)	Remaining balance (Birr)	% of defau credit	Credit(Birr)	Repaid(Birr)	Remainin g Balance (Birr)	% of defau credit
Ganda Guda	2,183,209.31	2,172,214.90	10,994.41	0.50	608,427.59	608,427.59	0.00	0.00
Iyata Danisa	2,076,670.10	1,878,477.90	198,192.20	9.54	557,957.80	476,236.11	81,721.69	14.65
Warxu	3,452,372.85	3,348,171.20	104,201.65	3.02	573,912.48	472,255.52	101,656.96	17.71
Ilamu	2,951,961.95	2,257,232.55	694,729.40	23.53	486,453.55	348,409.72	138,043.83	28.38
Total	10,664,214.21	9,656,096.55	1,008,117.66	-4.50	2,226,751.42	1,905,328.94	321,422.48	-14.82

Source: Own survey data, 2023

4.2. Results of the Econometric Model

4.2.1. Tobit model

Checking for multicollinearity among the hypothesized explanatory variables is crucial before using the Tobit model.

Multicollinearity occurs when one or more independent variables are linear combinations of each other. This issue can lead to estimated regression coefficients having incorrect signs and smaller t-ratios, which can result in erroneous conclusions. Two commonly used measures to assess multicollinearity are the Variance Inflation Factor (VIF), used for continuous explanatory variables, and contingency coefficients for dummy variables. According to Gujarati (2003), VIF can be defined as:

$$VIF_i = \frac{1}{1 - R_i^2}$$

Where VIF_i , variance of inflation factor and R_i^2 is the square of multiple correlation coefficient between X_i and the other explanatory variables. The larger the value of VIF_i the more collinear the variables X_i . As the rule of thumb, if the VIF of a rule of thumb, if the VIF of a variable exceeds 10, there is a multicollinearity problem. The VIF values are presented in Table 10.

Table 10. Variance of inflation factor for the continuous explanatory variables

Variable	Variance Inflation Factor (VIF)
Age	1.107
Educlvl	1.185
Famsize	1.214
Cultland	3.831
Livstno	4.316
Nonfarm	1.120
Onfarm	3.403
Farmexpernce	4.25

Source: Model output (2023)

4.2.2. Determinants of fertilizer credit repayment in the study area

Table 11 and 12 presents the estimated results, considering a total of 12 explanatory variables. Out of these, five variables were found to be statistically significant. These variables include family size (FAMSIZE), on-farm income (ONFARM), non-farm income (NONFARM), number of livestock owned (LIVSTNO), and saving (SAVING).

All of these significant variables had a positive coefficient, indicating a significant positive impact on credit repayment performance. Analyzing Table 12, it becomes apparent that the significant explanatory variables do not have an equal impact on loan repayment performance. It is therefore important to discuss the effects of these variables individually.

Family size (FAMSIZE): As anticipated, family size had a positive and significant influence on the loan repayment performance of households (significant at 5%). Each additional labor force member increased the probability of being a non-defaulter by 3.30 percent (Table 12). Furthermore, a unit increase in labor force corresponded to a 0.030 increase in the loan repayment rate for the entire sample, and a 0.0391 increase for non-complete defaulters (Table 13). This finding suggests that households with larger family sizes have access to more labor force for productive purposes, leading to a lower likelihood of default. This findings was contradicted by the study Steiner *et al.* (2009) found the family size to be related negatively to annual savings magnitude. As the members' family size increases, the ability to save was decreased.

On-farm income (ONFARM): This variable is another economic factor that significantly and positively affected loan repayment performance, with a 1 percent probability level. A one Birr increases in on-farm income resulted in a 0.00002 percent increase in the probability of being a non-defaulter (Table 12). Additionally, each additional unit of on-farm income led to a 2.21e-05 increase in loan repayment performance among all respondents and a 2.2e-05 increase among non-complete defaulters (Table 13). This suggests that borrowers who earn higher incomes from their farming activities prioritize loan repayment and settle their debts in a timely manner (Zemen, 2005).

Non-farm activities (NONFARM): This variable, which represents income generated from non-farm sources, also had a positive and significant impact on loan repayment performance for smallholder farmers, at a 1 percent probability level. Non-farm activities served as additional income sources for smallholders, enabling them to repay their loans even during unfavorable harvest seasons or when agricultural prices were low. A one Birr increase in non-farm income led to a 1.9E-05 percent increase in the probability of being a non-defaulter. On average, it increased the rate of loan repayment by 1.67E-05 among all respondents and by 1.96E-05 among defaulters (Table 13). The result is agreed with the study of Werema and Opanga (2016) who found the positive and significant effect non-farm activities of household on loan repayment.

Total livestock ownership (LIVSTNO): This variable had a significant positive influence on the loan repayment performance of respondent households, at a 1 percent probability level. An increase of one Tropical Livestock Unit (TLU) resulted in a 6.96 percent increase in the probability of being a non-defaulter (Table 13). Each additional unit of livestock increased the loan repayment performance by factors of 0.0696 among respondents and by 0.0831 among non-complete defaulters (Table 13). This suggests that livestock serve as a source of cash in rural areas and act as a safeguard against crop failures. Farmers with more livestock are better able to repay their loans even in the event of crop loss due to natural disasters. The result is supported by the finding of Andualem and Ebrahim (2020).

Saving (SAVING): The saving behavior of the households significantly and positively influenced loan repayment performance, with a 5 percent probability level. Households that developed a habit of saving increased their loan repayment performance by 0.1310 factors

among all respondents and by 0.1566 factors among non-complete defaulters (Table 12). The study is supported by the result of Abebe (2011).

Table 11. Maximum likelihood estimates of the Two-limit Tobit model

Explanatory Variables	Estimated Coefficients	Std. Err.	T-ratio	Change in probability
AGE	0.0072	0.0096	0.75	0.0013
MARSTA	-0.0241	0.4467	-0.05	-0.0042
EDUCLVL	-0.0324	0.0362	-0.89	-0.00324
FAMSIZE	0.1861**	0.0842	2.21	0.0372
NONFARM	8.3E-04***	3.04E-05	2.75	1.9E-05
ONFARM	1.2E-04***	3.4E-05	3.61	2.4E-05
LIVSTNO	0.4914***	0.1524	3.22	0.0041
CULTLAND	0.0423	0.0434	0.97	0.0084
FARMEXPRNCE	0.0062	0.0074	0.84	0.0012
EXTSER	-0.1875	0.3014	-0.62	-0.0386
COOPSTA	-0.2286	0.5662	-0.4	-0.0403
SAVING	0.6779**	0.3101	2.19	0.1543
CONSTANT	-1.5004	0.7225	-2.08	
Number of observations	= 150			
Log likelihood function	= -67.98			
Threshold values for the model:	Lower= 0, Upper= 1			
$\sigma = 1.0113$				
***, and ** represent level of significance at 1%, and 5% respectively				

Source: Own computation, 2023

Table 12. Marginal effect of independent variables

Effect of change in independent variable on dependent variable				
Explanatory variables	Change for observations at lower limit	Change for observations at upper limit	Change for non-complete defaulters	Change for all observations
AGE	0.0019	0.0014	0.0018	0.0015
MARSTA	-0.0049	-0.0032	-0.0044	-0.0034
EDUCLVL	-0.0063	-0.0042	-0.0058	-0.0047
FAMSIZE	0.0414	0.0303	0.0391	0.0330
NONFARM	2.09E-05	1.59E-05	1.96E-05	1.67E-05
ONFARM	2.3E-05	2E-05	2.2E-05	2.21E-05
LIVSTNO	0.0882	0.0643	0.0831	0.0696
CULTLAND	0.0087	0.0060	0.0081	0.0066
FARMEXPRNCE	0.0203	0.0344	0.0422	0.0541
EXTSER	-0.0437	-0.0319	-0.0412	-0.0345
COOPSTA	-0.0490	-0.0358	-0.0461	-0.0386
SAVING	0.1661	0.1215	0.1566	0.1310

Source: Model result (2023)

4.2.3. Factors affecting the fertilizer use of the farmers in the study area

The study aimed to identify the factors influencing the utilization of chemical fertilizer among farm households, as it is a critical factor affecting crop production. The survey results revealed that all respondent households had used chemical fertilizer supplied by primary cooperatives during the 2021/22 season, although the application rate was significantly below the recommended rate of 100 kilograms per hectare for DAP and 100 kilograms per hectare for UREA. The regression analysis was conducted using Stata, a statistical software. Table 13 presents the variables included in the analysis.

The results of the multiple regression analysis revealed that age, educational status, family size, cultivated land, number of livestock owned, and saving money significantly influenced fertilizer use among the respondents (Table 13). The effects of these significant variables on the dependent variable are discussed below.

Age (AGE): This variable had a negative and significant influence on fertilizer use (significant at a 10% significance level). According to Table 15, a one-unit increase in age led to a decrease in fertilizer use by 0.015 quintals, all else being equal. This suggests that as individuals age, their contribution to household production and income may diminish, resulting in lower fertilizer use. The result is contradict with the finding of Mideksa *etal.*(2020).

Education level (EDUCLVL): As expected, education level had a positive influence on fertilizer use (significant at a 5% significance level). As indicated in Table 15, a one-year increase in schooling led to an increase in fertilizer use by 0.052 quintals, all else being equal. This implies that higher levels of education, which enhance access to information and understanding of the benefits of fertilizer use (improved technology), positively affect fertilizer utilization. The result is agreed with the finding of Uddin *et al.*(2021) who found the positive and significant effect of education on fertilizer use of households.

Family size (FAMSIZE): Family size positively influenced fertilizer use (significant at a 10% level). Each additional unit of family labor increased fertilizer use by 0.121 quintals, all else being equal. This suggests that households with a larger number of family members find fertilizer use more attractive, likely due to the availability of additional labor force. The

finding is similar with the result of Mideksa *etal.*(2020) who found the positive effect of family size on fertilizer use.

Cultivated land (CULTLAND): Cultivated land had a positive and significant influence on fertilizer use (significant at a 1% level). Households with larger cultivated land used more inputs, including fertilizer. Holding other factors constant, a one-hectare increase in land cultivated led to a 1.694 quintal increase in fertilizer use, all else being equal. The finding is similar with the result of Leake (2018).

Saving (SAVING): As expected, the saving behavior of the household respondents had a positive and significant influence on fertilizer use at a 1% significance level (Table 13). The ability to save increased fertilizer use by 0.782 quintals, all else being equal. This suggests that households with a saving habit allocate more resources to fertilizer utilization. The finding is similar with the result of Abebe (2011) who found the positive effect of saving habit on fertilizer use.

Table 13. Output of the multiple linear regression model of fertilizer use analysis

Variables	β	Std. Err.	t-ratio	P> t
AGE	-0.015*	0.0085	-1.76	0.085
MARSTA	0.476	0.451	1.05	0.274
EDUC	0.052**	0.034	1.51	0.035
FAMSIZE	0.121*	0.0708	1.71	0.09
NONFARM	1.48E-04	1.4E-04	1.07	0.287
ONFARM	4.93E-05	2.5E-05	1.94	0.055
CULTLAND	1.694***	0.126	13.42	0.000
FARMEXPRNCE	0.206	0.447	0.46	0.812
LIVSTNO	-0.016	0.051	-0.31	0.755
EXTEN	0.112	0.274	0.40	0.702
COOPSTA	-0.552	0.493	-1.12	0.267
SAVING	0.782***	0.274	2.85	0.009
(Constant)	-2.049	0.807	-2.54	0.012

***, ** and * represent level of significance at 1%, 5% and 10% respectively $R^2 = 89.2\%$ Adj. $R^2 = 87.6\%$

Source: Model result (2023)

5. SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. Summary and Conclusion

This study was carried out in the Girar-Jarso district, North Shewa zone, Oromia region, Ethiopia, which has a high potential for fertilizer credit including repayment by members of cooperatives. The study examined factors affecting fertilizer credit repayment by members of cooperatives over the study area with the objectives of measuring the status of fertilizer credit repayment of the smallholder farmers in the study area and identifying factors affecting fertilizer credit repayment of the farmers in the study area.

In the first stage, from 14 primary cooperatives found in the district (having 7,981 farmer members) four MPCs cooperatives were selected randomly from the sampling frame obtained from the Girar-Jarso District Cooperative Promotion Office (GJCPO). In the second stage out of four primary cooperatives 150 sample farmers were selected randomly from the lists of respective cooperatives taking input in credit in the 2022 cropping calendar using probability proportional to size. A structured questionnaire was employed to collect primary data for the credit years of 2021/2022 from the sample respondents. Five enumerators, four of whom are degree holders in plant science and with a degree in cooperative science having experience in data collection were recruited and trained. Descriptive statistics such as mean, standard deviations and percentages were computed to analyze the collected data. An econometric model known as the Tobit model was used to analyze factors affecting fertilizer credit repayment rate.

The result revealed that the average age of non-defaulters was 52.42 years, while that of defaulters was 45.28 years. Therefore, the survey results show that the mean difference between non-defaulters and defaulters with regard to age was statistically significant at 10% significance level. The average family size of the non-defaulters and defaulters was 6.81 and 4.88 with standard deviations of 2.22 and 1.89, respectively. The average number of active labor force (man-equivalent) for the whole sample, non-defaulters and defaulters was 5.14 and 3.88, respectively. This also shows that the difference between non-defaulters and defaulters regarding active labor was statistically significant at 10%. The marital status of non-defaulters was 84.00%, 6.03%, 4.31% and 5.17% are married, single, divorced and widow, respectively while for the defaulters it is 79.41%, 11.76%, 8.82% and 5.88%, respectively. The minimum and maximum number of livestock in TLU maintained by the sample respondents were 3 and 24 respectively. It was found that non-defaulters had an average of 11.48 TLU, while defaulters had 8.33 TLU with a standard deviation of 4.74 and 2.88, respectively. In the 2014 production year, the average income earned from these sources was Birr 16,833.94. The analysis shows that non-defaulters had an average income of Birr 18,368.38, while defaulters had an average income of Birr 10,696.15.

The results of the survey indicated that 72% of the respondents had got enough knowledge about cooperatives and credit systems from extension agents, while 28% did not have any training or education from extension agents regarding credit. Group wise, 72.4% of the non-defaulters and 58.2% of the defaulters reported that they had extension contact. The majority of cooperatives do not fully repay their loans in a timely manner, and in the survey, 20% of the 150 sampled members were found to be defaulters who did not repay their loans on time.

These variables include family size (FAMSIZE), on-farm income (ONFARM), non-farm income (NONFARM), number of livestock owned (LIVSTNO), and saving (SAVING) had a significant and positive estimated coefficient on the research study. Total livestock ownership (LIVSTNO): This variable had a significant positive influence on the loan repayment performance of respondent households, at a 10 percent probability level. An increase of one tropical livestock unit (TLU) resulted in a 7.75 percent increase in the probability of being a non-defaulter.

5.2. Recommendations

Based on the findings and conclusions of the study, the following recommendations were forwarded to the bodies of the potential factors affecting fertilizer credit repayment by members of cooperatives over the study area.

According to the study's findings, livestock are valuable assets for farmers, as they contribute to improved repayment performance and the ability to purchase necessary inputs. Additionally, the research indicated that farmers who engage in non-farm activities earn higher incomes, enabling them to settle their debts promptly and make down payments for purchasing inputs. The study emphasized the significance of savings habits and credit facilitation in economic development, as they encourage individuals to engage in economic activities that foster self-reliance. Savings and credit schemes have the potential to enhance the productivity of impoverished farmers, particularly those heading households, with cooperatives playing a crucial role in agricultural production if properly managed, particularly

in countries like Ethiopia. Furthermore, the study revealed a positive and significant correlation between the educational level of the household head and farmers' use of inputs, such as fertilizer. This suggests that to effectively utilize improved technologies, it is essential to prioritize the educational advancement of farmers through adult education, training programs, and the expansion of primary education. The current study examined the factors that influence fertilizer credit repayment among cooperative members. As a result, the researcher recommends that future studies explore diverse and suitable adaptation management strategies, as well as prioritize the enhancement of the active labor force's capabilities through education and training. These measures are crucial for boosting productivity and would provide valuable insights for the study area.

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7. APPENDICES

Appendix table 1: Conversion factor used to calculate man and adult equivalent.

Age group (years)	Man Equivalent(ME)		Adult Equivalent(AE)	
	Male	female	Male	Female
<10	0	0	0.6	0.6
11-13	0.2	0.2	0.9	0.8
14-16	0.5	0.4	1	0.75
17-50	1	0.8	1	0.75
>50	0.7	0.5	1	0.75

Source: Storck (1991 as cited in Wassie, 2014).

Appendix 2: Conversion factors used to estimate Tropical Livestock Unit equivalents.

Animal category	TLU	Animal category	TLU
Cow and oxen	1	Sheep and goat young	0.06
Bull	1	Horse and mule	1.1
Calf	0.25	Donkey (young)	0.35
Heifer	0.75	Donkey (adult)	0.7
Sheep and goat(adult)	0.13	chicken	0.013

Source: Storck (1991 as cited in Wassie, 2014).

SALALE UNIVERSITY

SCHOOL OF GRADUATE STUDIES

Survey Questionnaires to be filled by Sample Household Heads

My name is Dereje Girma Eba. I am writing a thesis entitled “*Determinants of fertilizer credit repayment by members of cooperatives: -A Study of Girar Jarso Woreda Rural Households*” in partial fulfilment of MSc in Agricultural Economics. Confidently this research has a significant contribution in an effort to reduce the factors affecting fertilizer credit repayment for smallholder farmers of Girar Jarso District. Therefore, your valid contribution by giving accurate information is highly valuable in achieving the objective of this research. The information we will collect from you will serve only the academic purpose and it will be kept confidential. Thus, please feel free to convey the required information honestly.

General information

Identification Number (code _____)

Name of the District _____

Name of the cooperative _____

Name of enumerator _____

Signature of the enumerator _____

Date of interview _____

I- Household characteristics

1. Age_____ (years)

2. Gender

a) Male b) Female

3. Marital Status

a) Married b) Single c) Divorced d) Widowed

4. Educational level _____ (in grade)

5. What is your family size? Male_____ Female _____ Total_____

II- socio-economic factors

6. What is economic status of your family?

a) Economically dependent_____ (in number)

b) Economically active _____ (in number)

7. What are the main sources of your income in order of importance?

a) Sale of grains _____%

b) Sale of livestock_____%

c) Sale of vegetables _____%

d) Others /Specify_____ (_____) %

8. Did the household involve in any off/non-farm activities in 2014/15 E.C.?

a) Yes b) No

9. If yes, in what type of activity?

a) Petty trade (poultry & egg, milk & milk products, hides & skins, crop residue, honey)

b) Casual work

c) Handicraft) Others /Specify_____

10. What was the estimated amount of income for the year?

a) From farm production _____ birr

b) From off-farm (if any) _____birr

c) Total income (a + b) _____birr

11. How much is your cultivable land size in hectares (own land)? _____

12. Did the household rented in /shared in someone land?

a) Yes b) No

13. If the answer to question no 13 is yes, what was the size of the cultivable land rented in/

Sharedin (ha)

_____ And _____

14. If the answer to question no 13 is yes, what was/ were the reason (s) for renting in/shared in?

- a. Availability of fertilizer and other farm inputs
- b. Because of land shortage
- c. Because of the extra labor I had
- d. Others/ specify _____

15. If the answer to question no 13 is yes, the type of agreement is

- a) In birr b) In grain

16. If it was in birr, how much it was? _____Birr/ha

17. If it was in grain, how much quintal and what type of grain it

Was? _____birr per hectare

18. Have you rented out/shared out land to other farmers?

- a) Yes b) No

19. If the answer to question no 19 is yes, what was the size of the cultivated land rented out/

Shared out? _____ And _____(ha)

20. If the answer to question no 19 is yes, what was the reason for renting out/ sharing out?

a) Shortage of money to buy fertilizer and other inputs b) Disabled

c) Shortage of oxen) Others (specify)_____

21. If the answer to question no 19 is yes, the type of agreement is

a) In birr b) In grain

22. If it was in birr, how much is it? _____Birr/ha

23. If it was in grain, how much quintal and what type of grain it

Was? _____qt. per hectare

24. How many oxen do you have for drought purpose? _____

25. How many livestock do you have?

26. Do you use agricultural inputs for your cultivation for the past three years?

a) Yes b) No

27. Who was the supplier of the inputs you utilized in the past three cropping seasons?

a) Cooperatives b) Private companies c) Others (specify)_____

28. How did you pay for procuring these inputs?

a. Down payment with _____ %

b. 100 percent cash purchase

c. On 100 percent credit base

d. Other (specify) _____

29. If it is on credit which institution provides you?

a. Cooperatives b) Micro Finance Institutions c) Others (Specify)

30. If the input was supplied by cooperatives was it

a. the quantity demanded? a) Yes b) No

b. the desired quality? a) Yes b) No

C. timely supplied? a) Yes b) No

d. supplied at the right distribution center? a) Yes b) No

e. At fair price? a) Yes b) No

31. Was your application of the inputs as per the recommendation?

a) Yes b) No

32. If the answer to question no 25 is no, what are the reasons?

a. Its affordability b) Shortage of supply c) Lack of credit

d. Others (specify)_____

33. What was the price of your produce?

a. Better price b) Fair price c) Unfair price

34. Did you get education/ training from the cooperative in 2013/2014 E.C.?

a) Yes b) No

35. If Yes, on what points it gave you education/ training?

a) The benefits of the cooperative

b) The need of the members commitment to the cooperative

c) The principles of the cooperative

d) Others/specify_____

III. Organizational and institutional factors

36- Are there credit institutions at your disposal? 1. Yes 0. No

37- If your answer is yes, what is the name of credit institution?_____

38- Are you ever used credit from the organization? 1. Yes 0. No

39.1 If your answer is yes, how frequently you are using credit from the institution?

1- Once per a year 2- twice per a year 3- others specify_____

39.2 What is the type of credit you obtained? 1. in cash 2. In-kind

40 What problem you are encountered related to input credit?

41- What is your suggestion for efficient input credit service in the future?

42. Is there a storage facility nearby to store agricultural inputs? 1. Yes 0. No

43.1. If your answer is yes, what is its contribution to your farming activity?

1. To get inputs timely 2. To minimize transport cost 3. Others specify_____

43.2. If your answer is no, how much time do you spent to reach to the nearest input distribution

Center? _____

43.3 does the distance has negative effect on you in using agricultural inputs? 1. Yes 0. No

43.4 If your answer is yes, what do you suggest to improve the service? _____

44 Is there a service cooperative in your area? 1. Yes 0. No

45.1 If your answer is yes, are you a member of a service cooperative? 1. Yes, 2. No

45.2 If your answer is yes, what service do you get from the service cooperative?

1. Input credit 2. Crop Marketing 3. Credit and saving 4. Others specify_____

46 If the service cooperative works on input distribution, being as a member what are the problems encountered during distribution, and what is your suggestion to improve service delivery.

47.1 problems encountered_____

47.2 suggested solutions _____

48 If your answer for question 31 is no, what possibilities you have, to get services from a service cooperative? _____

49. Did you have any contact with a Development agent in your area? 1. Yes 0. No

50. If yes, frequency of contact? 5. Once in a week 4. Once in two weeks 3. Once in three weeks

2. Once in a month 1. Rarely 0.never

51. If no, why? 1. No DA nearby 2. No need for service 3 . Others (specify)

52. What types of service most of the time you are getting from DAs?

1. Technical support 2.Theoretical information 3. Input Supply 4. Experience sharing

5. Others specify_____.

53. Are you ever participated in extension training? 1. Yes 0. No

54. If yes, in what area of extension training you have participated? _____

55.Do you save? a, Yes b,No