



COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR FOOD SECURITY STUDIES

EFFECT OF CREDIT ON AGRICULTURAL
COMMERCIALIZATION AND HOUSEHOLD FOOD SECURITY: EVIDENCE
FROM DUGDA WOREDA, EAST SHOA ZONE, OROMIA, ETHIOPIA

BY: PETROS TESFAYE

ADDIS ABABA, ETHIOPIA
NOVEMBER, 2022



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PETROS TESHAYE

THESIS ADVISER

SOLOMON TSEHAY (PH.D.)

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MENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN
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ADDIS ABABA, ETHIOPIA

NOVEMBER, 2022

DECLARATION

I, **Petros Tesfaye**, do hereby declare to Addis Ababa University School of Graduate Studies that this thesis is a product of my original research work, and it has not been submitted to any other university for any academic degree. Materials and information other than my own are dually acknowledged.

Name: **Petros Tesfaye**

Signature: _____

Date of Submission: Nov, 2022

Supervisor's approval

This is to certify that the above declaration made by the candidate is correct to the best of my knowledge as an advisor.

Approved by: _____
Thesis Advisor Signature Date

Approval Sheet
ADDIS ABABA UNIVERSITY
COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR FOOD SECURITY STUDIES

As supervisors/co-advisers of the thesis, we certify that we have read and evaluated the thesis prepared by **Petros Tesfaye** Entitled ‘Effect of Credit on Agricultural Commercialization and Household Food Security: Evidence from Dugda Woreda, Oromia, East Shoa zone, Ethiopia’ and recommend Open Defense as fulfilling the requirement for the degree of **Master of Science Degree in Food Security and Development.**

.....
Name, Major Advisor	Signature & Date
.....
Name, Co-advisor	Signature & Date

As members of the Examining Board of the Thesis-Open Defense, we certify that we have read and evaluated the thesis prepared by **Petros Tesfaye** Entitled ‘Effect of Credit on Agricultural Commercialization and Household Food Security: Evidence from Dugda Woreda East Shoa, Oromia, Ethiopia and recommend that it is acceptable as thesis required for the degree of Master of Science Degree in Food Security and Development Studies.

.....
Name, Chairman	Signature & Date
.....
Name, Internal Examiner	Signature & Date
.....
Name, External Examiner	Signature & Date

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ACRONYMS

ATE	Average Treatment Effect
ATTE	Average Treatment Effect for Treatment
CGS	Credit Guarantee Systems
CM	Caliper Matching
CSA	Central Statistical Authority
ENTER	Endogenous Treatment Effect Regression
ETB	Ethiopia Birr
FAO	Food and Agriculture Organization
FCS	Food Consumption Score
GCF	Gross Capital Formation
GDP	Gross domestic product
HFIAS	Household Food Insecurity Access Scale
HH	Households
IDPs	Internal Displaced Person
IGAD	Intergovernmental Authority for Development
KBM	Kernel-Based Matching
MFI	Micron Finance Institutions
NBE	National Bank of Ethiopia
NEPAD	New Partnership for Africa's Development
NGO	Non-governmental organization
NNM	Neighborhood Matching
OLS	Ordinary Least Square
PSM	Propensity Score Matching
SAO	Seasonal Agricultural Operations
SSA	Sub-Saharan Africa

TLU Tropical Livestock Unit

USAID United States Agency for International Development

USD United States Dollar

WB World Bank

WFP World Food Programs

ZTBL Zarai Taraqiati Bank Limited

Abstract

Food insecurity and malnutrition affect people in all regions, across the worldwide. According to FAO report 9.7% of the global population affected by severe levels of food insecurity. In addition, the report of the WFP shows the most of world population showing to severe food insecurity except in Northern America and Europe. This study focused on examining and investigating the effect of credit on agricultural commercialization and household food security in the Dugda woreda, East Shoa Zone, Oromia, Ethiopia. We used a cross-sectional data with a sample size of 370 households selected randomly from the lists of commercial commodity producers of four kebeles. The result of the food consumption score (FCS) indicates that poor consumption is 6% of households, 32% borderline, and 62% acceptable score. The household food insecurity access scale (HFIAS) shows that 59% of households are food secure, and 41 % have mild food insecure. The logistic regression and propensity score matching (PSM) show access to credit and commerce negatively influences having poor and borderline food consumption score while it has positively influenced on having acceptable food consumption score. As well as, the result shows access to credit, agricultural commercialization, and holding livestock increases the probability of being food secure while it decreases the probability of being mildly food insecure. These variables were statistically significant at 1 %. The PSM show those households that access credit have about 33. 89% higher food security compared to that non-credit access, and similarly, a farmer who access credit their sale is 2,152.62 birrs higher than noncredit users' households. The above implication farm commercialization after the availability of credit improved the smallholders' income by nearly 2,153 birrs, thereby enhancing their spending on food items as revealed significant at 5%. Therefore, access to credit and agricultural commercialization has a positive impact on household food security status.

Keywords: Credit, Agricultural Commercialization, FCS, HFIAS, PSM

CHAPTER ONE: INTRODUCTION

1.1 Background of Study

Food insecurity and malnutrition affect people in all regions, across the worldwide. According to FAO report 9.7% of the global population affected by severe levels of food insecurity. And also, the report of the WFP shows the most of world population showing to severe food insecurity except in Northern America and Europe. This report indicates 746 million face food insecurity from a part of the world population; 16% of the world population, more than 1.25 billion people has faced moderate level food insecurity. In the Caribbean increased from 22.9% to 31.7% between 2014 and 2019; because of a sharp increase in South America (FAO, 2020).

Countries and governments around the world, and particularly in Africa, were always focused on transformation of agriculture to market-oriented production for generating foreign currency, minimizing food insecurity and malnutrition. This process impacts household income, consumption patterns, and the nutritional level of households (Braun, 1995). Ethiopia has also a great type of climate zone, nearest to Middle East Africa, and soil types that enable it to grow a diversity of horticultural crops (Gebissa et al., 2021).

Credit can be transforming agricultural facilities and control marketing stability. And also, the credit increases the consumption of the smallholder farmers, helps the income transfer, and removes the inequalities of income among citizens. Access to various types of financial services is a significant challenge for smallholders, who constitute the enormous majority of farmers in Ethiopia (Deresse et al., 2018).

In Dugda Woreda agricultural commercial production is mostly irrigation commodities; Maize, Wheat, Papaya, Tomato, Onion, vegetables cabbage, cucumber, Capsicum, and Green Beans. Most products are distributed to Addis Ababa and surrounding cities which increases the nutritious consumption of households (USAID, 2021). In the past decade, Agricultural commercialization highly expanded in the Dugda woreda. As a result of the investments in irrigation infrastructure and the diversification and commercialization of rain-fed farmers the irrigated area in Dugda woreda has increased rapidly during the last ten years (Miller et al., 2012). This study presents effect of credit on agricultural commercialization and household food security in the case of the Dugda woreda, East Shoa zone, Oromia, Ethiopia.

1.2 Statement of the Problem

Ethiopia is the least developing countries affected by food deficit. Currently in Ethiopia 5.4 million people are supported by the assistance of WFP. Those people suffering from drought and floods, internally displaced peoples, refugees, and malnourished children and women. The life-saving assistance provided by WFP across conflict-affected is as Afar, Amhara, Oromia, and Tigray Northern a part of Ethiopia (WFP, 2022).

In order to reduce this chronic problem of food deficit government of Ethiopia has focused on boosting agriculture for enhanced productivity and decreasing the food insecurity problem at households, and national levels. Dugda woreda is well known by production of commercial goods. The feeder of the capital city of Ethiopia; export to Djibouti. But currently, the price of pesticides, seeds, and other agricultural input is highly increased. Due to a lack of working capital, the farmers sell their land to other investors and may wait until rain. Align to this throughout harvesting time the market price fluctuated and the middlemen exploiting the farmer's benefits and during high rain damaged the crop or fruit and vegetables. The absence of crop, fruit, and vegetable insurances and agricultural banks target the smallholder farmer credit (Tara, 2014).

Many studies have been conducted over the past year on the effect of credit on agricultural commercialization and household food security (Omankhanlen (2013); Nasir et al. (2004); IZA (2020); Hussain et al. (2012)). The lack of agricultural credit to finance agrarian investment presents an acute problem in mechanizing our agricultural produce. A rise in agricultural credits increases farming productivity through its profound impact on smallholding production. And also, observes the effect of credit on agricultural commercialization and household food security as insights of smallholders.

However, these studies focused on macro evidences in Pakistan only, linked with credit, agricultural commercialization and household food security and for current study this is geographical gap. There is no research that has been conducted so far linking credit, agricultural commercialization, and household food security using theses variables except study made in Pakistan. This study was aim to assess the effects of credit on agricultural commercialization and household food security in Dugda woreda, east Shoa zone, Oromia, Ethiopia.

1.3 Objectives of Study

1.3.1 General Objectives

The general objective of the study would be to examine, and analysis the effect of credit on agricultural commercialization and food security status of households between credit users and non-credit users in case of Dugda woreda, east Shoa zone, Oromia, Ethiopia.

1.3.2 Specific objectives of the study are to

- Examine the effects of credit on the commercialization of agricultural commodity
- Investigate the effects of credit and commercialization on household food security
- Analysis of the household food security status

1.4 Hypothesis

- Access to credit would expect to have negative impact on the probability of being food security.
- Households who access to land and credit are less likely to face food insecure, so access to land and credit was expect to have negative impact on the probability of being food insecure.
- Agricultural commercialization would expect to have negative impact on the probability of being food insecure.

1.5 Scope of the Study

Due to food insecurity affects throughout the world particularly all different parts of Ethiopian regions, the study would be delimited only on the Dugda woreda, east, Shoa zone, Oromia, Ethiopia.

1.6 Significance of Study

This study provides information on the effect of credit on agricultural commercialization and household food security. The study providing the valuable information is eagerly expected to favorably receive significant input that helps for key suppliers of credit portfolio. And come up with key recommendations that help in efficiently delivering required credit to progressively increase the woreda production and efficient utilization for local consumption. And overall bring about food security in the specific area. The specific information typically generated in this em-

pirical study could adequately support an enormous number of responsible concerns including national and international research institutions, economic development parties, active traders, financial sectors, executive producers, effective policymakers, extension service providers, a responsible government, and non-governmental organizations.

1.7 Limitation of Study

While conducting the research the researchers encountered with the following problems as limitation. Such as: absence of recorded data regarding the study. Unwillingness to respondents provides adequate data.

1.8 Organization of the Thesis

This study was organized into five chapters; the first chapter included the background the study, statement of the problem, objective of the study, significance of the study, scope of the study, limitation and organization of the study. The second chapter contained review literature; the third chapter would be incorporated methodology of the study. The fourth chapter devote to data discussion and analysis. The fifth chapter presents the finding conclusion and recommendation

CHAPTER TWO: RELATED LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Agricultural Credit to Farmers

Before 1970s credit delivery intervention to advance development in third world countries focused on building agricultural lending institution, the effort however, failed short of expectation. Nevertheless, the initiative continued write the experience and expertise shared from the developed country. In this regard the Ethiopia had tried to pass their former African and Asian countries. Similarly, the America experience before world war second strongly influenced expended to the rest of the world using the United State donor agencies as a means to promote credit institution (The Layer, 2006).

The emphasis of all the financial services was agricultural credit to farmers for investment and input to promote agricultural production. Their credit wants to those who can show exploitable resource and the same approach to agricultural development credit were promoted in the 1960s and 1970s in Ethiopia. The agricultural development bank of Ethiopian established in the 1950 with this mind. Nevertheless, by early 1970s, the earlier rural credit approach started to fail in it, attempt to stimulate grass root agrarian productivity. Food shortage and famine overlook the million agrarian productivity enhancement of agricultural credit. It becomes increasing apparent that all was not well in many agricultural credit program, loan recovery difficulties, weak lending institution and heavy dependency on subsidy plagued the effort side by side with rural and urban poverty increase. This leads rural and urban increased poverty (Tsegaye, 2006).

2.2 Food security and Commercialization

From a food system focus, agroecology provides management options in terms of commercialization and consumption through the promotion of short food chains and healthy diets (Pimbert *et al.*, 2018; Loconto *et al.*, 2019). Commercially oriented farmers have more diverse diets than non-commercial oriented ones because they can easily purchase other foods to supplement their own production. Commercialization has a robust and positive effect on household food security. It significantly increases household dietary diversity and reduces the number of coping strategies adopted during food shortages (Dennis *et al.*, 2022).

2.3 Food Security Theories

Based on the improvement of food security ideas and problems to link with the development agenda, many theories, mechanisms, systems, rules, principles, or approaches give rich information on different features such as how and at what level should its analysis, study, investigation, and measurement is undertaken (Muro *et al.*, 2012).

2.3.1 Income Based Approach

It has brought a radical shift from food availability at the macro level to income at the micro level. Now, food insecurity is indirectly expected as a sub-category of poverty, often referred to as "food poverty", representing the absence of sufficient income necessary to buy the amount of food required at the given circumstances. A related issue of the income-based system as claimed that it requires making numerous assumptions to logically change expenditure to food security. That means, to change from income or expenses to food through the price per unit information: formerly from food to calorie through equivalence benches and finally, from calorie availability to food security or insecurity depending on the given threshold (Muro *et al.*, 2012).

2.3.2 Entitlement Approach

The groups that frequently face direct entitlement are food producers and those who are exposed to trade or indirect entitlement failures are producers of commodities. Sufficient food per capita at a national level can only be a necessary circumstance but not an appropriate condition for food security. Therefore, doing a food security assessment widening the information by integrating variables related to people's endowments such as productive and non-productive assets, intangible resources like education and social capital as well as information on wage and other prices of food and non-food items. Based on this framework, food security assessment conducted at the micro-level, and both at an individual and household level can be unit of the analysis. This method is also valued for its capacity to offer information on the future vulnerability to food insecurity because it considers a full set of assets or resources (Muro *et al.*, 2012).

2.3.3 Sustainability Livelihoods Approach

Sustainable Livelihood Framework is a general approach to the analysis of development problems like poverty and food security. The attention on livelihood started within the 1980s by Chambers 1983 who brought the basic elements of this method with attention to rural development and poverty. The sustainable livelihood framework is the more comprehensive or inclusive

method as it encompasses the main shelters of other methods like basic needs and entitlement methods or approaches. It emphasizes both gaining the living or necessities of life like basic needs approach and on means of securing living as the case in entitlement approach. The framework allows an assessment of food security at the micro household and community level, which usually used a unit of analysis (Muro *et al.*, 2012).

2.4 Agricultural Credit nexus to Household Food Security

Definition: Agriculture credit can increase food production which ensures food security. The widely accepted definition of food security given by the Food and Agriculture Organization (FAO) also emphasizes the accessibility and availability of food for everyone and everywhere. Abundant production ensures the availability of food which further leads to low prices (economic access i.e., accessibility) because of excessive supply (Asghar *et al.*, 2018).

Definition: Agricultural Household: - a household is considered an agricultural household when at least one member of the household is engaged in growing crops and/or raising livestock in private or in combination with others (CSA, 2021).

2.4.1 The Role Agriculture Credit

Agricultural credit is one of the most crucial inputs in all agricultural development programs. For a long time, the major source of agricultural credit was private moneylenders. But this source of credit was inadequate, highly expensive, and exploitative. To curtail this, a multi-agency approach consisting of cooperatives, commercial banks, and regional rural banks credit has been adopted to provide cheaper, timely, and adequate credit to farmers. The financial requirements of the Indian farmers are for,

Buying agricultural inputs like seeds, fertilizers, plant protection chemicals, feed and fodder for cattle, etc.

Supporting their families in those years when the crops have not been good.

Buying additional land, to make improvements on the existing land, clear old debt, and purchase costly agricultural machinery. Increasing farm efficiency as against limiting resources and hiring of irrigation water-lifting devices, labor and machinery (Devi *et al.*, 2012).

2.4.2 Type of Agricultural Credit

2.4.2.1. Based on Maturity agricultural credit classified into three

Short-term loans: These loans are to be repaid within a period of 6 to 18 months. All crop loans are said to be short-term loans, but the length of the repayment period varies according to the duration of the crop. The farmers require this type of credit to meet the expenses of the ongoing agricultural operations on the farm like sowing, fertilizer application, plant protection measures, payment of wages to casual laborers, etc. The borrower is supposed to repay the loan from the sale proceeds of the crops raised.

Medium-term loans: Here the repayment period varies from 18 months to 5 years. These loans are required by the farmers for bringing about some improvements on his farm by way of purchasing implements, electric motors, milch cattle, sheep, and goat, etc. The relatively long period of repayment of these loans are due to their partially-liquidating nature.

Long term loans: These loans fall due for repayment over a long time ranging from 5 years to more than 20 years or even more. These loans together with medium terms loans are called investment loans or term loans. These loans are meant for permanent improvements like levelling and reclamation of land, construction of farm buildings, purchase of tractors, rising of orchards, etc. Since these activities require large capital, a longer period is required to repay these loans due to their non - liquidating nature (Subba *et al.*, 2010).

2.4.2.2 Based on purpose agricultural credit classified into four

Production loans: These loans refer to the credit given to the farmers for crop production and are intended to increase the production of crops. They are also called seasonal agricultural operations (SAO) loans or short-term loans or crop loans. These loans are repayable within a period ranging from 6 to 18 months in lump sum.

Investment loans: These are loans given for the purchase of equipment the productivity of which is distributed over more than one year. Loans are given for tractors, pump sets, tube wells, etc.

Marketing loans: These loans are meant to help the farmers in overcoming the distress sales and to market the product in a better way. Regulated markets and commercial banks, based on the warehouse receipt are lending in the form of marketing loans by advancing 75 percent of the val-

ue of the produce. These loans help the farmers to clear off their debts and dispose of the produce at remunerative prices.

Consumption loans: Any loan advanced for some purpose other than production is broadly categorized as a consumption loan. These loans seem to be unproductive but indirectly assist in the more productive use of the crop loans i.e., without diverting them to other purposes (Tendulkar, 1983).

2.4.2.3. Classification of Agricultural Lender

Institutional credit: Here are loans are advanced by the institutional agencies like cooperatives, commercial banks. For instances: cooperative loans and commercial bank loans.

Non-institutional credit: Here the individual persons was lending the loans for instances loans given by professional and agricultural money lenders, traders, commission agents, relatives, friends, etc. (Pal *et al.*, 2014).

2.4.2.4 Borrower's classification

The credit is also classified on the basis of type of borrower. This classification has equity considerations.

- Based on the business activity like farmers, dairy farmers, poultry farmers, pisciculture farmers, rural artisans etc.
- Based on size of the farm: agricultural laborer's, marginal farmers, small farmers, medium farmers, large farmers, and based on location hill farmers or tribal farmers (Huirne, 1996).

2.5. Developing Countries Food Security Nexus to the Credit facility

In developing countries, the issue of food scarcity, poverty, and hunger is expanding with time. Governments of developing countries are putting efforts to raise agricultural productivity by giving allowance to the farmer (Mellor, 2001). Thus, access to credit facilities enables farmers to satisfy their cash desires encouraged by the agricultural production cycle and consumption requirements (FAO, 2013).

The government of India wants to double farmers' income in different ways so these agencies are providing financial assistance for farmers. Primary Agricultural Credit Societies, Cooperative Bank, and land development Banks provide credit to the weaker segment of the society at cheap-

er rates for enabling them in the mainstream of the society as well as for handling different operational processes of agricultural aspects (Beniwal *et al.*,2021).

2.6 Empirical Study

According to the results of the 2020/21(2013 E.C) large and medium scale commercial farms sample survey, the total area covered by grain crops was found to be 671,093.47 hectares (98.500% of the total country-level temporary crops covered land area), from which a total of 14,125,163.50 of production, (91.811% of the total country-level production of temporary crops) was obtained during 2021 (CSA,2021).Hence, market participation can play a significant role in reducing food poverty, thus ensuring food security (Kirimi *et al.*, 2013).An innovative way being used by some governments to increase agricultural loans by commercial banks is by partnering via risk-sharing and credit guarantee schemes (NEPAD, 2021).

The household food security while from the eight demand side factors, five farm experiences, participation in off-farm activities, annual farm income, market distance, and livestock holdings was associated with food security levels (Mulugeta, 2018).

The farm size, government subsidies, type of mechanization, and monthly expenses had an influence on commercialization. Again, the age of respondents, their marital status, level of education, farm size, and number of laborers employed, mechanization type, and the level of commercialization was the determinants of food security in Limpopo Province, South Africa (Isaac *et al.*, 2017).

The study showed that about 68% of the smallholder farmers were food secure households. Smallholder farmer commercialization affects the food security level of smallholder farmers (Nasir *et al.*, 2017).

Nevertheless, household income improved significantly, showing a nearly 70% rise. Subsequently, improved income together with enhanced on-farm food production resulted in an almost 20% rise in households' calorie intake. The finding of Hussain *et al.* (2012) shows that the proportion of food-secure households with caloric intake above the national standards of 2350kcal/day/AE increased by 23 %.

Agricultural credit is financial terms that bring up loans and other types of credit extended for agriculture purposes. Under capitalism, agricultural credit is a type of investment or loan capital in agriculture which is an important economic connection between the city and the countryside. Agricultural credit uses to develop agriculture and raise the standard of living of the rural popu-

lation. The availability of institutional credit can also help farmers in facilitating farm productivity enhancement which was led to higher income and better living. Jan and Naqvi *et al.* (2012) emphasized the need to involve the small common farmers in the comfortable credit distribution circle and Zarai Taraqati Bank Limited (ZTBL) is the biggest contributor in providing credit to farmers in Pakistan (Ahmed *et al.*, 2007)

2.7 Food Security Indicators

The food consumption score (FCS) is a composite score capturing the intensity and dietary diversity of food consumption as well as the relative nutritional importance of different food groups. Following WFP (2014) the score is built using data on the household's consumption of nine food groups (staple grains and tubers, pulses, vegetables, fruits, meat and fish, dairy, oil, and sugar) during the past 7 days.

Measuring food security is a complex and difficult task, that requires careful planning and analysis in order to avoid wrong or misleading conclusions. There are various types of food security indicators used by development practitioners, academicians, policymakers etc. However, the most widely used indicators to assess the food security status of households are: a. **Food Consumption Score (FCS)**: it is proxy indicator for current HH food access based on dietary diversity number of individual foods consumed over a reference period, food frequency number of days in the past week that a specific food item has been consumed and nutritional importance food groups are weighted to reflect their nutritional importance, b. **Expenditure**: Household expenditure information is uses as a proxy of purchasing power. Understanding household expenditures provides an insight into how households allocate scarce resources and give priority to competing needs. In order to categorize a household as food secure or not, the food security analysts have classified households into four general types.

1. **Food secure** -Households that show no or minimal evidence of food insecurity.
2. **Food insecure without hunger** -Food insecurity is evident in household members' concerns about adequacy of the household food supply and in adjustments to household food management, including reduced quality of food and increased unusual coping patterns. Little or no reduction in members' food intake reported.
3. **Food insecure with hunger (Moderate)** -Food intake for adults in the household reduced to an extent that implies, adults have repeatedly experienced the physical sensation of hunger.

4. **Food insecure with hunger (Severe)**- At this level, all households with children have reduced the children's food intake to an extent indicating that the children have experienced hunger. For some other households with children, this already has occurred at an earlier stage of severity. Adults in household with and without children have repeatedly experienced a more extensive reduction of foodstuff intake.

2.8 Literature gap

The reviewed theoretical and empirical literatures show most of the study focused on macro evidences linked with credit, agricultural commercialization and household food security. There is no research that has been conducted so far linking credit, agricultural commercialization, and household food security at micro level. But this study has tried to assess the effects of credit on agricultural commercialization and household food security particularly in Dugda woreda. For this reason, the study is need. It is contribution to fill the literature gap regarding on food security linked with these variable effects commercialization, credit at micro level.

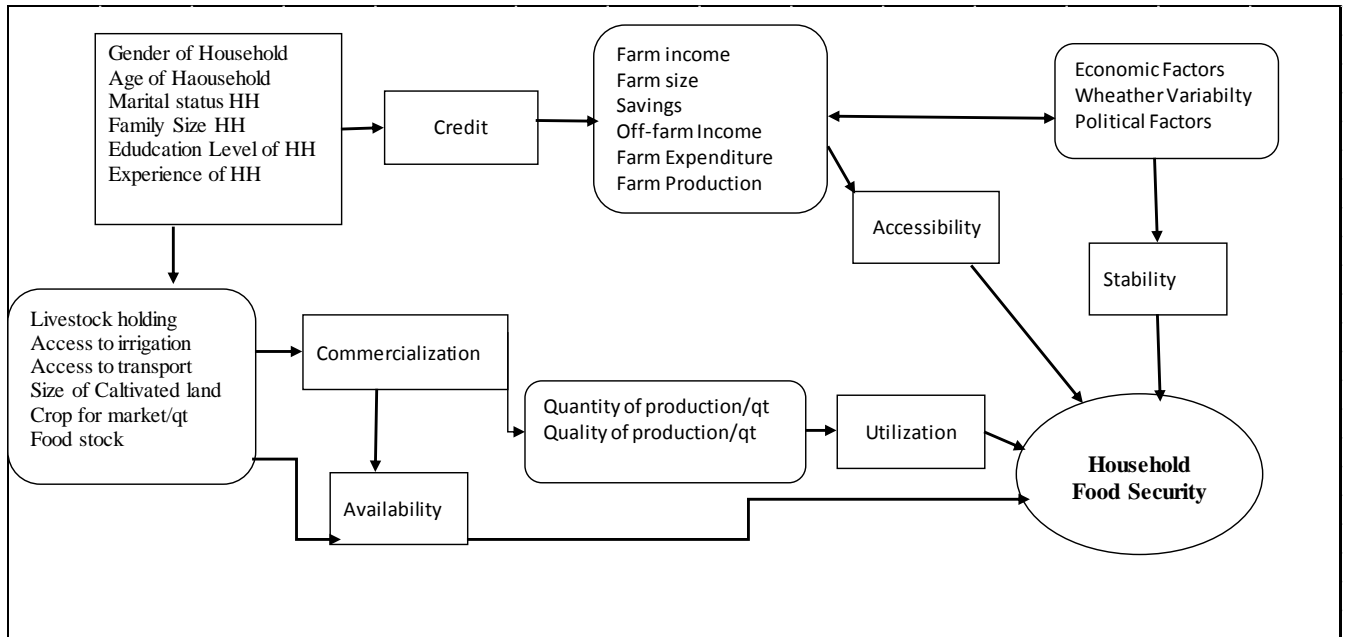
2.9 Conceptual Framework

In light of the empirical reviews presented above, food shortage and famine overlook the million agrarian productivity enhancement of agricultural credit. It becomes increasing apparent that all was not well in many agricultural credit program, loan recovery difficulties, weak lending institution and heavy dependency on subsidy plagued the effort side by side with rural and urban poverty increase food security is the function of income-based approach, entitlement approach and sustainability livelihoods approach which determines access to food. It has brought a radical shift from food availability at the macro level to income at the micro level. Food security cannot be attained without access to food. Based on this framework, food security assessment conducted at the micro-level, and both at an individual and household level can be unit of the analysis. Sustainable livelihood framework is a general approach to the analysis of development problems like poverty and food security.

In order to address credit, agricultural commercialization for enhance food security in the Dugda woreda. Although agricultural commercialization is one of the constraints of access to food, access to credit alone cannot guarantee food security unless credit for end used of commercialization commodity production.

Several factors, which affect the food security conceptualized as below framework. Food security is not affected by a single variable. But rather interaction of the empirical results described from the following inters connection with four pillar of food security. Availability there is reliable and consistent source of quality food, accessibility people have sufficient resources to produce and/or purchase food, utilization people have the knowledge and basic sanitary conditions to choose, prepare, and distribute food in a way that results in good nutrition, stability people's ability to access and utilize food that remains stable and sustained over time (FAO, 2002). The determinants of the food security like gender of household, age of household, marital status, family size, education level and farm experience and farm income, savings, off-farm income, farm expenditure and farm production, livestock holding, access to irrigation, access to transport, size of cultivated land, crop for market/qt and food stock. This study assesses the effects of credit on agricultural commercialization on household food security particularly in Dugda woreda.

Figure 1. Conceptual framework



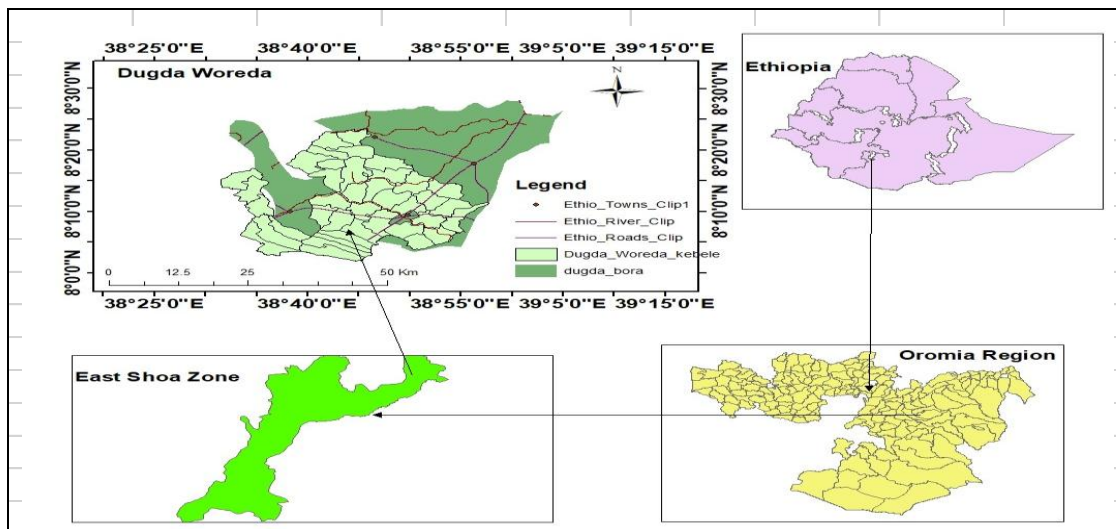
CHAPTER THREE: RESEARCH METHODS AND MATERIALS

3.1. Description of the Study Area

3.1.1 Location

Dugda is one of the 10th woredas in the East Shoa zone in Oromia Regional state of Ethiopia. It was part of the former woreda of Dugda Bora that was divided between Bora and Dugda woredas. Part of the Eastern Shoa Zone located in the Great Rift Valley; Dugda is bordered on the southeast by Lake Ziway, on the south by Adami Tullu Jido Kombolcha, on the west by the Southern Nations, Nationalities, and Peoples Region, on the north by Bora woreda, and on the east by (Ziway Dugda District) Arsi Zone.

Figure 2. Map of study area



Source GIS, 2022

3.1.2 Population

Currently, Dugda woreda has thirty-six rural kebeles and three kebele in Meki town, of a total population of 220,842 about 113,085 (51.20 %) and 107,757 (48.80%) of the woreda's population are males and females respectively. This historical fact naturally implies that the massive population of the established Dugda woreda population that is characterized by high fertility and an extraordinary abundance of the labor force (CSA, 2021).

3.2 Biophysical Condition

3.2.1 Topography and Drainage of the study area

The topography of the study area lies within sub-tropical agroclimatic zone. Its land escape is characterized by flat topped plain, valley and mountain. The soils are fine textured dominated by sandy, sandy loam and clay loam content that has good drainage capacity, which is suitable for irrigation and rain fed crop production. The aggregate area of Dugda woreda is yielded in the rift valley and Lake Basin. Meki River flows in to Lake Ziway. Its credible sources are streams that start from the fertile Gurage highlands and its intended destination in common is the Lake Ziway. As the river plays quite a vital role in the promotion of irrigated agricultural practices along its proper course in Dugda. The Awash forms the boundary of the woreda with Bora Woreda in the north and its valuable contribution for the economic development of small-scale irrigated agriculture in Dugda is substantial. Considered lake Dembel is one of the important rift valley lakes Covers 1,500 (15km) ha of land. The lake has flat swampy margins on all sides except in south and south east. It's provided for by a number of streams, the most important of which represent the Meki River, which drains part of west is land, Katar River, which drains from the East Arsi Mountains to the east and also seasonal inflow to the lake. The lake naturally has catchments 7,025 km² and its overspill is typically carried to Lake Abjata by Bulbula River (Agricultural Office of Dugad).

3.2.2 Climate

Agroecological, the woreda lies between dry naturally lowland 86.2 % and mid-highland 13.8 % of the woreda landmass with average annual Temperature varying between 30°C-22°C (Maximum & Minimum) in various months. The ecological coverage of the area is proportionally, about 55% you take care of the land area the woreda falls under is usually called lowland, and the rest 45% there is constituted by midland

3.2.3 Vegetation Covers

The greatest proportion (62,585 Hectares or 65.23 %) of the woreda area is devoted to cultivation land. the typical vegetation is highly distributed through human intervention. There are 414.4 hectares of land typically occupied by forest in the area. The vital typical vegetation of the historic woreda typically includes woodland and Savannah of junipers and variety of vegetation followed by subtropical grassland located at different pocket areas of the woreda. In the present

climate, however, they are degraded and converted into different land uses. The areas around the lake have been fled with only patches of ruminant wood and bushlands. The dominant tree species in common is Acacia.

3.3 Livelihood System

3.3.1 Agriculture

Agricultural is the backbone of the woredas. It is sharing large portion of livelihood of the population within the woredas. Based on the information obtained from woreda office, about 55,280 hectares of land is under agricultural production is dependent on rain fed. From the total agricultural area, the irrigation potential for the Lake Ziway catchment is estimated to be 13,300 ha in 18 in rural area kebele. Out of these, 82% (10,880 ha) have been developed under traditional and modern small-scale irrigation. The water sources for small-scale irrigation schemes are River, Lake and Groundwater which allow up to three cropping each year, mainly high value crops. Despite this fact the woreda is potentially rich particularly for farming practice. Its agro-climatic condition is dominated by subtropical which is suitable for the production of Cereal Crops. But meager and erratic rainfall distribution has been occurring in the woreda does impact on agriculture. However, it is characterized by lack of access to modern technology, market, low productivity, dependency on rainfall and lack of irrigation practice, etc. in the woreda mixed farming system is dominants. As a result, the livelihood of the rural people is dependent on crop farming, irrigated agriculture and livestock rearing. In addition to this, fishery is being practiced by the number of farmers who have access to Lake Ziway (Agricultural Office of Dugda).

3.3.1.1 Crop Production

3.3.1.1.1 Rainfed production

Rainfed Crop production of the woreda is limited to ‘meher’ season. And the annual range of rainfall at Dugda and its surrounding is 700-800 mm which c characterized by high variability and unpredictability. The rainfall pattern is bimodal. The “Belg “rainy season begins in March and ends in May while the “meher,” season begins in June and ends in September. The major types produced Dugda woreda includes maize, wheat, and teff. From the cereals and all crops produced by farmers farming Maize, wheat and teff do account 55%, 30%, and 15% respectively. And also, occupied the largest cultivated area of the woreda land under crops, and also, they're employed as the staple crops of the woreda. There are enough markets for agricultural outputs, especially from around Dugda woreda. As it is retailed in proximity to the significant

markets (Addis Ababa, Adama, Shashemene, and Hawassa) connected with an excellent high-way asphalted road (Agricultural Office of Dugda).

Table1. Production yields and cultivated area by rainfed major three crops

Year	Crop type	Land /ha	Production in quantal	Percentage
2013 E.C	Maize	19,484	1,165,143.20	55
	Wheat	18,778	644,041.50	30
	Teff	17,018	311,650	15
Total		55,280	2,120,834.70	100

Source: Dugda Woreda Agricultural Office

3.3.1.1.2 Irrigated Crop and Vegetable Production

Dugda woreda has enough water resources potential and flat land escape which is available for irrigation activities. In the area, modern and traditional irrigation systems have long been practiced in the catchment area of Meki River and around Lake Ziway by employing a furrow irrigation system. Few landholders are engaged in irrigated agriculture using water from lake Ziway, groundwater, and the Meki River. While the others rent out their holdings to private farmers who use their own diesel generators to pump out the water from the water sources. And most of the farmers in the woreda are rain-dependent. Leading horticultural crops produced around the Dugda area are Onions, Tomatoes, Cabbage, Maize, Wheat, Papaya, cucumber, Capsicum, Aubergine, Green Beans, and pepper. From the irrigated crops produced by peasant farming, Papaya, Tomatoes and Onion do account for 52%, 34% and 14% respectively in the 2013 E.C. currently from the aggregate potential area of land, 744 hectares was irrigated through the modern and traditional system, and 1,333,084 quintals of production was obtained 2013 E.C

Table 2. Production yields and cultivated area by major three commercial crops

Year	Crop type	Land /ha	Production in quantal	Percentage
2013 E.C	Papaya	600	694,544	52
	Tomato	93	456,190	34
	Onion	51	182,350	14
Total		744	1,333,084	100

Source: Dugda Woreda Agricultural Office

3.3.1.2 Livestock

Dugda woreda, rural populations have a great interdependence on livestock and make livestock provides a substantial contribution to the rural economy. The majority of rural agriculture, transport, and income sources are directly or indirectly linked to it. The woreda has diversified farm animal population. In terms of livestock inhabitants: - cattle (307742), and goats (92679), sheep (82797), poultry (229068), donkey (23264), horse (6390), and mule (2645). Extension programs for the development of dairy and cattle farms were not adapted to the rural sector.

Table 3. Number of Livestock in the Dugda Woreda

Year	Cattle	Goat	Sheep	Poultry	Donkey	Horse	Mule	Total
2014 E.C	307742	92679	82797	229068	23264	6390	2645	721321

Source: Dugda Woreda Agri cultural Office

3.4 Research Design

The objectives of the study used determine the research designs. As it is clearly indicated in chapter one the specific objective is all about examining the effect of credit on agricultural commercialization and household food security. Therefore, in order to analyze the existing situation under consideration. On the other hand, the study was used quantities research design and creates data structures and information that allow the effect relationships between two or more decision variables (Hair et al., 2006). The study also used a cross sectional survey because the data was collected at one point in a time to compare the factor effect of credit on agricultural commercialization and household food security. Structures and information that was allow the effect relationships between two or more decision variables (Hair et al, 2006).

3.5 Research Approach

This study was used mixed research approach. The collection of quantities and qualitative data minimizing the demerit by combination of both approaches to answer the research question (Klassen et al., 2012). Quantitative method of research approach is study involving analysis of data and information that are descriptive in nature and qualified (Sekaran, 2001). The quantitative data was collected and analyzed in order to elaborate the quantitative results obtained in the analysis.

3.6 Methods of Data Collection and Source of Data

The study was utilized both primary and secondary data sources. Primary data was collected from sample respondents by using a structured interview schedule. Before data collection, the questionnaire was tested on some farmers to evaluate the appropriateness of the design, clarity, and interpretation of the questions, the relevance of the questions, to make sure important issues have not been left out, and to estimate the time required for an interview. Training was given to enumerators regarding the objectives of the study and particularly on the detailed contents of the questionnaire. The secondary data on the population size of the study areas, lists of commercial commodity producers and traders, agroclimatic condition of the study area, and trader's financial report was taken from unpublished documents of zonal and woreda agricultural and natural resource offices, and trade and industry office of the woreda.

3.7 Sample Size and Sampling Procedures

Random sampling technique was used to select commercial commodity-producing Kebeles and sample farm households. In the first stage, with the consultation of woreda agricultural experts and an integrated farming system and credit agents, commercial producing kebeles was selected purposively based on the level of production. In the second stage, from the selected rural kebeles, four kebeles (Wolda Kelina, Bekele Girisa, Shubi Gamo, and Wolda Mokedela) was selected randomly. In the 3rd stage, from the total commercial commodity producer household heads was selected randomly based on probability proportional to population size. Dugda woreda agricultural office report shows that the producers of the commercial commodity were 10,057 from this Males=8,909 and Females =148.

The Yamane (1967) was simplified by Israel (2002), was used to determine the required sample

$$\text{Size. } n_0 = \frac{N}{1+N(e)^2} = \frac{10057}{1+10057(.05)^2} \sim \mathbf{385}$$

$$n = \frac{n_0}{\frac{1+(n_0-1)}{N}} = \frac{385}{\frac{1+(385-1)}{10057}} = 371$$

Where; n_0 = sample size

N = total number of commercial commodity producers in Dugda woreda

e = level of precision

Where;

Therefore, the sample size of the study was 371 households. So, 371 households were selected randomly from the lists of commercial commodity producers in the kebeles administration. Hence, based on proportional to the total household size of the selected kebeles, the sample size of each kebele was determined.

In addition to farm households, traders were selected purposively based on their size. By preparing a checklist of cooperatives, wholesalers, retailers, and supporting actors was interviewed in the study area.

3.8 Ethical consideration

The confidentiality of the respondents was carefully protected throughout the data collection process. Respondents were anonymous during the interview and discussion. Data analysis excludes confidential identities.

3.9 Food Security Model Analyses

3.9.1 Food Consumption Score (FCS) Analysis

Food Consumption Score (FCS) was used in this study to collect information on participants' dietary diversity with a 7-day recall period in order to supplement the information to be collected from HFIAS. Given that it takes into account dietary variety and frequency as well as the relative nutritional significance of various food types, it is a more complex predictor of the food security status of a household. Using a standard questionnaire, the following 9 food groups was assessed for food security and nutrition diversity to determine the food composition score 1, Maize, maize porridge, rice, sorghum, millet, pasta, bread, and other cereals, cassava, potatoes, and sweet potatoes other tubers, plantains 2, Beans, peas, groundnuts, and cashew nuts 3, Vegetables, leaves 4, Fruits 5, beef, goat, poultry, eggs and fish 6, milk, yogurt and another diary 7, sugar and honey 8, Oils, fats and butter 9, Spices, tea, coffee, salt, fish, small amounts of milk for tea (INDDEX,2018).

The intake rates are added together and multiplied by the standardized food group weight to derive the FCS. By using the WFP's suggested cut-offs to the food consumption score, households can then be categorized as having "poor," "borderline," or "acceptable" food consumption (WFP, 2014). The WFP, the range of the cut-off point is (0-28) poor, (28.5- 42) Borderline food secured, and >42 Acceptable.

3.9.2 Household Food Insecurity Access Scale (HFIAS) Analysis

In order to determine how households with and without credit utilization can affect their access to food, one of the study's goals is to determine their level of food security. According to Coates et al. (2007), the foundation of the HFIAS is the premise that food insecurity (access) results in predictable behaviors and responses that can be recorded, quantified, and summed up on a scale. Given that the study examines how credit affects agricultural commercialization and family food security, it was pertinent to employ the HFIAS to gauge those populations' access to food security.

The HFIAS consists of two categories of connected questions. The first question type is referred to as an "occurrence question," and it inquires as to whether a certain circumstance connected to the feeling of food insecurity ever occurred during the course of the previous four weeks (30 days). Every occurrence question has three components: the stem (timeframe for recollection), the question body (refers to a particular activity or attitude), and two response alternatives (0 = no, 1 = yes). The second sort of inquiry is referred to as a frequency of occurrence question, and it asks how frequently a stated condition happened over the course of the previous four weeks (30 days). The respondent is asked how frequently the condition mentioned in the previous occurrence question occurred in the four weeks prior to each question about frequency of occurrence. Three response choices are provided, with (1 = rarely, 2 = sometimes, and 3 = often).

Each household's access category for food insecurity was divided into four categories: food security, moderate food insecurity, and severe food insecurity, as stated below. It was used to assess the households of credit users' access category for food insecurity (access component) and was statistically examined.

The following formula is used to determine each household's access category for food insecurity:

HFIA category of Food Secure = 1 if $[(\beta_{1a}=0 \text{ or } \beta_{1a}=1) \text{ and } \beta_{2}=0 \text{ and } \beta_{3}=0 \text{ and } \beta_{4}=0 \text{ and } \beta_{5}=0 \text{ and } \beta_{6}=0 \text{ and } \beta_{7}=0 \text{ and } \beta_{8}=0 \text{ and } \beta_{9}=0]$

HFIA category of Mildly Food Insecure Access = 2 if $[(\beta_{1a}=2 \text{ or } \beta_{1a}=3 \text{ or } \beta_{2a}=1 \text{ or } \beta_{2a}=2 \text{ or } \beta_{2a}=3 \text{ or } \beta_{3a}=1 \text{ or } \beta_{4a}=1) \text{ and } \beta_{5}=0 \text{ and } \beta_{6}=0 \text{ and } \beta_{7}=0 \text{ and } \beta_{8}=0 \text{ and } \beta_{9}=0]$

HFIA category of Moderately Food Insecure Access = 3 if $[(\beta_{3a}=2 \text{ or } \beta_{3a}=3 \text{ or } \beta_{4a}=2 \text{ or } \beta_{4a}=3 \text{ or } \beta_{5a}=1 \text{ or } \beta_{5a}=2 \text{ or } \beta_{6a}=1 \text{ or } \beta_{6a}=2) \text{ and } \beta_{7}=0 \text{ and } \beta_{8}=0 \text{ and } \beta_{9}=0]$

HFIA category of severely food insecure Access = 4 if $[\beta_{5a}=3 \text{ or } \beta_{6a}=3 \text{ or } \beta_{7a}=1 \text{ or } \beta_{7a}=2 \text{ or } \beta_{7a}=3 \text{ or } \beta_{8a}=1 \text{ or } \beta_{8a}=2 \text{ or } \beta_{8a}=3 \text{ or } \beta_{9a}=1 \text{ or } \beta_{9a}=2 \text{ or } \beta_{9a}=3]$

Where, β_1 = Occurrence question and β_{1a} = Frequency question

3.10 Method of data analysis

Descriptive statistics and econometric models were used to analyze the effect of credit on agricultural commercialization and household food security. Computation of descriptive statistics and data analysis employed using Stata version 16.0.

3.10.1 Descriptive and Inferential statistics analysis

In order to compare and contrast several categories of sample units with respect to the intended characters, as well as to summarize data that was received from sample respondents, descriptive statistics including mean, standard deviation, and frequency of appearance was used. It served as an explanation for the socio-economic and demographic dynamics of household features. Using the t-test (age, education, farm size, farm income, credit amount, tropical livestock unit, farm expenditure of households), and chi-square (χ^2) test (sex and marital status of households, member of cooperatives, and source of credit) the variables that was thought to have an effect of credit on agricultural commercialization and household food security examined to determine if they were statistically significant or not.

The two groups of users and non-users were compared using the t-test to determine whether the mean value of continuous variables was significant. The chi-square (χ^2) test was used to examine putative discrete (dummy) explanatory factors.

3.10.2 Econometric models

Econometric models were used to analyze the effect of credit on agricultural commercialization and household food security.

3.10.2.1 Household Food Security Status

The dependent variable is household food security which has two outcomes; either the household is food secured or food insecure. Arbitrary values 0 and 1 can be assigned for the food insecure and food secured households respectively. To study qualitative response regression models and binary response models such as logit models are best suited for analysis. The study was used the logit model for its simplicity in this model.

The dependent variable of a logit model takes a binary response. That means $Y_i = 1$ if household is food secured and $Y_i = 0$ if household food insecure

To fix ideas, consider the following

$$Y_i = \beta_0 + \beta_1 X_{i1} + \dots + \beta_n X_{in} + \varepsilon_i \dots \dots \dots (1)$$

Where Y_i is dependent variables and dual response of $Y_i = 1$ if the household is food secured and $Y_i = 0$ if the household is food insecure, β is the vector of parameter and X_i is the vector of explanatory variable that include personal characteristics such as educational level of household head, sex of household and household characteristics such as household size, marital status of household head. Explanatory variable also includes occupation of household head, household access to land, access to commerce, household access to credit and number of livestock. The educational level and marital status of household heads are all expected to have negative influence on household being poor (vulnerable to food insecure). Households' head access to land, access credit and a higher income can also reduce the probability of household being food insecure. They are factors that negatively influence the dependent variable. Access to credit is theoretically expected to reduce food insecure through cash investment in productive activities and also smoothing consumption. The aged household head is perceived to be less productive and consequently the household is expected to be chronically poor. The probability that the event was occurring given X_i , is $pr(Y_i = 1/X_i)$. Now if p_i = probability the $y_i = 1$ (household is food secured) and $(1-p_i)$ is the probability that $y_i = 0$ (household is food insecure), the variable y_i has the following probability distribution:

$$Y_i \text{-----} p_i \text{ (Probability)}$$

$$Y_i(0) \text{-----} (1 - p_i) \text{-----} (a)$$

$$Y_i(1) \text{-----} (p_i) \text{-----} (b)$$

Total=1

$$P_i = \Pr(Y_i = 1/X_i) = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \dots + \beta_i X_{ii} \text{-----} (2)$$

Where $y = 1$ means the household is food Secured.

$$P_i = \Pr(Y_i = 1/X_i) = \frac{1}{1 + e^{(\beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \dots + \beta_i X_{ii})}} \text{-----} (3)$$

$P_i = \frac{1}{1 + e^{-z_i}} = \frac{e^{z_i}}{1 + e^{z_i}}$, where, $z_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \dots + \beta_i X_{ii}$ is the probabilities of being food secure in which X_i are explanatory variable.

If P_i is the probability of being food secured household, then $(1-P_i)$ was the probability of food insecure household.

$$1 - P_i = \frac{1}{1 + e^{(\beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \dots + \beta_i X_{ii})}} \text{.therefore we can write as:}$$

$$\frac{1}{1+e^{z_i}} = \frac{p_i}{1+p_i} = \frac{1+p_i e^{-z_i}}{1+e^{-z_i}} = e^{z_i}$$

Where $z_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} \dots \dots \dots + \beta_i X_{ii}$, then $\frac{p_i}{1+p_i}$ are simply the odds in favor of being food secured.

The probability that household was food secured to the probability that is food insecure. The above equation can be written in linear form by taking the natural logarithm as:

$$L_i = \ln\left(\frac{p_i}{1-p_i}\right) = \ln(e^{z_i}) = Z_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} \dots \dots \dots + \beta_i X_{ii}$$

Where; L is the log of then odds ratio $\left(\frac{p_i}{1-p_i}\right)$, is not only linear in x, but also linear in the parameters. L is called logit and hence the name logit model for models in the above equation. ε_i = the stochastic term. Also, since the above equation

$Z_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} \dots \dots \dots + \beta_i X_{ii} + u_i$ from the above model let us substitute Z_i with DFS (dummy of Food security) as the dependent variable.

$$\text{DFS} = \beta_0 + \beta_1(\text{sex}) + \beta_2(\text{Famsize}) + \beta_3(\text{Age}) + \beta_4(\text{Edu}) + \beta_5(\text{LivHo}) + \beta_6(\text{IRRas}) + \beta_7(\text{CrA}) + \beta_8(\text{Sizl}) + \beta_9(\text{Mars}) + \varepsilon_i$$

Where DFS= dummy of food security, ε_i is error term, β_0 is constant and β 's are coefficients.

3.10.2.2 Effects of Credit on Commercialization of Agricultural Commodity

In estimating the credit effect on commercialization of agricultural commodity, the OLS model is applicable if and only if all the households participate in the marketing of the commercial commodity. If the probability of credit is to be analyzed only, probit and logit models can adequately address the issue (Gujarati, 2011).

Following Greene (2012) Gujarati (2011), linear regression model can be specified as the following;

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots + \beta_k X_{ki} + U_i$$

Where; Y = quantity of commercial goods supplied to the market

X = a vector of the explanatory variable (the effect of credit on commercialization)

β_1 = is intercept

β_2 to β_k = are regression coefficients or regression parameters

U = is known as a random, or stochastic, error term. The subscript i denotes the i^{th} observation.

3.10.2.3 Effects of Credit on Household Food Security

The independent variable is credit, and dependent variable is household food security. The two outcomes; either the smallholder farmer is treated and untreated group. Arbitrary values 0 and 1 can be assigned for treated group (access to credit) and untreated group (not access to credit) of households respectively. For a dummy dependent variable, qualitative response regression model which often known as probability model was applied. To study qualitative response regression models, binary response models such as logit models are best suited for analysis. The study was used the propensity score matching (PSM) model for its simplicity in this research and effect of credit on household food security status. This is addressed by estimating the average treatment effect of credit on food security. The basic idea is to match each participant with an otherwise identical nonparticipant (the comparator) based on observed pretreatment characteristics (Haughton *et al.*, 2011).

The treatment specified as follows:

$$Y_i = \beta_0 + \beta_1 X_i + \dots + \beta_n X_{ni} + \varepsilon_i \quad (1)$$

Where Y_i is a binary variable and representing household access to credit or not dual response of $Y_i=1$ if the household is treated group (access to credit) and $Y_i=0$ if the household is untreated group (not access credit), β stands for a vector of coefficients to be estimated while ε captures a vector of random unobserved factors affecting the choice of the credit access and not credit access group and X_i is asset of covariates relevant in the choice of commercial goods producing smallholder farmers; the vector of explanatory variable that include personal characteristics such as educational level, farmer experiences, family size, age, land size, sex of household and marital status of household head.

The PSM generates a variable known as the propensity score, which is the probability or tendency that a smallholder's access to credit or not access to credit commercial farmer participant area.

The propensity score ($P(x)$) is written as:

$$P(x) = Pr (T = 1/X = x) \text{ -----}(2)$$

The generated propensity score can usually be used to create matched samples, uniform subgroups, and weight for balancing characteristics between farmers, and variable for controlling or adjusting the data (Guo *et al.*, 2009).

Assumption: $0 < P (T=1/X) < 1$, if it the not access to credit,

$$P_i^* \left(T = \frac{1}{T} = 1 \right) = P_i^* \left(\frac{X}{T} = 0 \right) \text{ if } P_i^* > 0, 0 \text{ otherwise}$$

The effect of participation on food security outcomes was estimated using the three most commonly adopted matching methods (nearest neighborhood matching (NNM), kernel-based matching (KBM) and caliper matching (CM)) in the literature (Awotide *et al.* 2015). Endogenous Treatment Effect Regression (ENTER): Assumption

$$Y_1 = Y_1\beta_1 + \varepsilon_1, \dots \dots \dots (3)$$

$$Y_0 = \beta_0 + \varepsilon_0, \dots \dots \dots (4)$$

$$T_i^* = Y_T Z_T + \varepsilon_T \dots \dots \dots (5)$$

Equations (3) and (4) are the two potential outcomes equations in the two possible states (participants and controls) of the credit access and not access credit.

$T(Z) = 1(T_i^*(Z) \geq 0) = 1(X_Y + \varepsilon_D \geq 0) \dots \dots \dots (6)$, where $T(Z) = 1$ if the access credit and $T(Z) = 0$ if not access credit.

$Y_i = TY_1 + (1 - T)Y_0 \dots \dots \dots (7)$ The probability of credit accessing or not access credit and the probability of household food secured and food insecure.

The effect of credit on household food security expressed as follow:

$$Y_i = Y - Y_0 \dots \dots \dots (8)$$

3.11. Hypothesis and Definitions of Variables

3.11.1 Dependent variables

Food security is the ability to provide enough for a healthy and active lifestyle. Food security is measured as a household level concept that refers to certain, sufficient, or acceptable availability of utilization of food (getting food three times per day but for those who are not three times and below are food insecure households). This variable takes a value 1 if the household is food secured and 2 otherwise.

Access to credit (CREDACC): It is a dummy variable that taking a value of 1 if a household head has access to credit service and 0 otherwise. Farmers who use credit may produce more output; this might be due to use of credit provide for farm households to spend in input market that boost yield and thus leading to more marketable surplus. Likewise, use of credit eases liquidity constraints of households that contribute to market-oriented production. Access to credit

has positive and significant influence on volume of wheat supply (Tadele *et al.*, 2016). Credit access was hypothesized to affect amount of food security positively.

3.11.2 Independent Variables

Sex is a dummy variable referring to whether the household head is male or female. It takes value 1 if the household head is male and 0 otherwise.

Marital status (MS): This variable is categorical which has shown whether the household head is single, married, and divorced. It determines the households of food insecurity status.

Land size: Land size is a continuous variable that refers to a total of farmland owned by the household and measured in a hectare. The household with more hectare of farmland were food secured than those with less or no farmlands.

Education is referring to promoting awareness of the possible advantages of modernizing agriculture through technological inputs and increase households' income, the opportunity to get credit which in turn enhances household supply.

Source of income: It is a continuous variable measured in monetary value (ETB). The major sources of transitory food insecurity are year-to-year variations in international food prices, foreign exchange earnings, domestic food production, and household incomes and it is measured by number.

Distance to the nearest market (DMRKT): It is a continuous variable and measured in walking time in minutes from nearest market the household used to sell their rice produce. The farther away a household is from the market, the more difficult and costlier it would be to get involved. Engida (2017) found that distance from the nearest market had negative and significant influence on the market supply of coffee. Sultan (2016) reported that distance from the closest market place positively and significantly affected accessing millers/processors market outlet as compared with accessing assembler market outlet of wheat. It also affected wholesaler market outlet negatively and significantly. Hence, distance from nearest market is hypothesized to affect amount of commercial goods sold negatively and market positively or negatively.

Cooperative Membership (COMSHIP): It is a dummy variable that taking a value of 1 if a household head is a member of agricultural cooperatives and 0 otherwise. Being a member of a cooperative farm household can easily access agricultural inputs (like: improved seed, fertilizers and herbicides) that required for crop production. Better access to agricultural input helps the

farmer to produce and sell more output. Membership in cooperative can also contribute towards reduced transaction costs and strengthen farmers bargaining power through networking and provision of up-to-date information to members. Therefore, the result reveals being a member in cooperatives increases the likelihood of choosing urban traders' outlet (Shewaye, 2016). Therefore, cooperative membership is hypothesized to affect amount of commercial goods sold positively and market positively or negatively.

Farming Experience (FARMEX): It is a continuous variable measured by number of years of experience the households have in commercial commodity farming at the time of interview. Farmers with longer production experience are expected to be more knowledgeable and have good weather forecasting ability, this improves the productivity and quantity of output sold. (Efa *et al.*, 2018) reported that the farming experience has a positively and negatively affected tomato farmer's market outlet choice of wholesaler and consumer outlet. Tomato producers who have more years of experience prefer to sell their products in larger volume than those who have less years of experience. The experienced farmers choose wholesaler because the buyers may buy the products in large, which reduces the transportation cost of the producers. However, farmers who involved in tomato production recently have less chance to get the customer to sell his/her products together (Tadesse, 2011). Therefore, farming experience is hypothesized to influence the quantity of commercial goods sold positively and market positively or negatively.

Commercial goods (CG): It is continuous variable, which is, price given for the commodity with different market outlets per quintal. This makes the supply to be directly related with a price offered. Study by Sultan (2016) revealed that price offered by wheat market outlet per kilogram significantly and negatively affected accessing cooperative wheat market outlet as compared with accessing assembler wheat market outlet. Therefore, current market price of commercial goods is hypothesized to affect market of producers either positively or negatively.

Total livestock holding: This refers to the total number of livestock measured in tropical livestock units. A household livestock ownership in TLU is calculated by multiplying the number of each type of animal by an appropriate conversion factor and then summing up. Livestock is an important source of income, food and drought power for crop cultivation in Ethiopian agriculture. More livestock holding is expected to increase the probability of participation in small scale irrigation. Livestock may also serve as a proxy for oxen ownership, which is important for farm operations. In this study it is hypothesized that higher TLU was positive influence on the partici-

pation in commercial goods production and the level of income, particularly by the owner of more oxen, leading to the ability to plough more land on time, thereby achieving crop yields and earning higher income. Therefore, it has a positively impact on household food security (Desale, 2008).

Table 4: Summary of variables definition, measurement and hypothesis for Agri cultural commercialization.

Variables	Category	Measurement	Expected effect on Agri -commerce
SEXHH	Dummy	1 if male, 0 otherwise	+
EDUHH	Continues	Years of schooling	+
FARMS	Continues	Hectare	+
FARMEX	Continues	Number of years	+
COMSHIP	Dummy	1 if member, 0 otherwise	+
CREDACC	Dummy	1 if has access, 0 otherwise	+

Table 5: Summary of variables definition, measurement and hypothesis for commercial goods producers

Variables	Category	Measurement	Expected effect on HHFS
SEXHH	Dummy	1 if male, 0 otherwise	+
EDHH	Continues	Years of schooling	+
LAND SIZE	Continues	Hectare	+
FARMEX	Continues	Number of years	+
TLU	Continues	Livestock number	+/-
DMRKT	Continues	Minutes' walk	+/-
COMSHIP	Dummy	1 if member, 0 otherwise	+/-
CG	Continues	ETH Birr/quintal	+/-
FCS	Scale of food security	1=poor,2= border line,3=acceptable	+/-

CHAPTER FOUR: RESULT AND DISCUSSION

This chapter presents the main results and discussions of the study. It is divided into three subsections. The first subsection describes the socioeconomic and demographic characteristics of the sample respondents with respect to identified explanatory variables using descriptive and inferential statistics notably, chi-square and t-test. The second subsection presents household's food security status and dietary diversity assessed using food consumption score and Household food insecurity access scale. The third subsection presents PSM and ordered logistic regression on the effect of credit access on household food security and agricultural commercialization. The study was distributed 397 questionnaires, and collected 370 valid questionnaires. The analysis of data was made by using STATA 16 software.

4.1. Results of Descriptive Statistics for Households' Characteristics

The descriptive statistics shows the socioeconomic and demographic compositions. The sample respondents were composed of both male and female household heads. These samples users of credit and non-users of credit, member of cooperatives, sources of credit which was assumed to have either negative or positive effects on food security and dietary diversity of households. It was found that 86% of the total sample households are male-headed while 14% are female-headed households. Out of 185 credit user households, 18% are female-headed and the remaining 82% are male-headed. The corresponding figure (185) for non-credit-users is 90% and 10% by male and female-household heads respectively. From these credit users are member cooperatives 174 (94%) and 11(6%) credit users are not members of cooperatives. The survey result revealed that (185) 50 % credit users. Out of 185 respondents, 98 (53%) are noncredit users and members of cooperatives and 87(47%) noncredit users and nonmembers of cooperatives respectively. The mains source of credit are cooperatives (127) 69 % and Banks (4) 2%, MFIs (50) 27%, and from relatives or friends (4) 2% respectively. The finding result shows 50% of credit users, and the rest 50 % of the non-credit-users respectively.

Table 6. Distribution of sample users, non-users and total samples for dummy variables*Source: Own Survey, (2022)*

Variables	Values	Cr-Users (185)		Non-Cr users (185)		Total sample(n)	
		Frequency	%	Frequency	%	Frequency	%
Sex of household head	Male	151	82	166	90	317	86
	Female	34	18	19	10	53	14
Member cooperatives	Yes	174	94	98	53	272	74
	No	11	6	87	47	98	26
Credit sources	Cooperatives	127	69	0	0	127	34
	Banks	4	2	0	0	4	1
	MFIs	50	27	0	0	50	14
	Friends	4	2	0	0	4	1
	Nonaccess credit	0	0	185	100	185	50

The WFP (2014) suggested cut-offs to the food consumption score, households can then be categorized as having "poor," "borderline," or "acceptable" food consumption. Accordingly, the result shows credit user's food security status shows 3% poor, 4% borderline, and 93% acceptable. The noncredit users 10% poor, 60% borderline, and 30% acceptable. It indicates for total sample households' food access based on dietary diversity number of individual foods consumed over a reference period in the past week that a specific food item has been consumed and nutritional importance food groups are weighted to reflect their poor consumption 6% of household, 32% borderline and the 62% Acceptable.

Table 7. Distribution of sample users, non-users and total samples for FCS

FCS	Cr-Users (185)		Non-Cr users (185)		Total sample(n)		χ^2
	Frequency	%	Frequency	%	Frequency	%	
Poor	5	3	19	10	24	6	311.5810***
Borderline	8	4	110	60	118	32	
Acceptable	172	93	56	30	228	62	

Note: '***' represent statistically significant at 1%

Source: Own Survey, (2022)

The HFIAS sort of inquiry is referred to as a frequency of occurrence question, and it asks how frequently a stated condition happened over the course of the previous thirty 30 days. The respondent is asked how frequently the condition mentioned in the previous occurrence question occurred in the four weeks prior to each question about frequency of occurrence. The household food insecurity access scale (HFIAS) categories result shows that credit users 89% food secured and 20% mildly food secured. And also, noncredit users 29% food secured and 71% mildly food secured. The total result reveal that 59% households' food secure and 41% mildly food insecure access.

Table 8. Distribution of sample users, non-users and total samples for HFIAS

Category of HFIAS	Cr-Users (185)		Non-Cr users (185)		Total sample(n)		χ^2
	Frequency	%	Frequency	%	Frequency	%	
Food Secure	165	89	53	29	218	59	
Mildly Food insecure	20	11	132	71	152	41	38.366** *

Note: '***' represent statistically significant at 1%; Source: Own Survey, (2022)

The chi-square test was used to determine the significant relationship between discrete (dummy) explanatory variables of credit users' food security status, and non-credit users' food security status. There is a significant relationship between sex of household heads and access to credit $\chi^2(1) = 0.0034$; $p = 0.00 < 0.05$. There is a statically significant relationship between marital status and access to credit $\chi^2(1) = 6.2866$; $p = 0.00 < 0.05$. The chi-square test revealed that there is a statistically significant difference between access to credit and cooperative members at $\chi^2(1) = 90.10$; $p = 0.00 < 0.05$. There is a significant relationship between access to credit and sources of credit significant at $\chi^2(1) = 370$; $p = 0.00 < 0.05$. Therefore, these explanatory variables are significant at 1% (***) or ($p = 0.000$) level of significance.

Table: 9. the chi-square test for dummy variables

Variables	Values	Credit users %	Noncredit-users %	Total	%	χ^2 Value		
Sex of household head	Male	151	82	166	90	317	86	0.0034***
	Female	34	18	19	10	53	14	
Marital status of household	Married	179	97	175	95	354	96	6.2866***
	Divorced	4	2	4	2	8	2	
	Widowed	2	1	6	3	8	2	
Member cooperatives	Yes	174	94	98	53	272	74	90.10***
	No	11	6	87	47	98	26	
Source of credit	Cooperative	127	69	0	0	127	34	370***
	MFI	50	27	0	0	50	14	
	Friends	4	2	0	0	4	1	
	Banks	4	2	0	0	4	1	
	Noncredit access	0	0	185	100	185	50	

Source: Own Survey, (2022)

Note: '***' represent statistically significant at 1%

T-test was used to determine the significance of the mean value of continuous variables of the two groups of credit users, and non-credit users. The study was used as the explanatory variables age of household, education level of households, family size of households, farm experiences, farm income, and credit amount in birr, farm expenditure, fertilizer and commerce (agricultural commercial goods sold in birr).

The mean age of the household heads of the sampled respondents is 45.43 years. The mean age of credit users and noncredit users are 45.11 and 45.8 years respectively. The t-test for this varia-

ble indicates that there is no significant mean difference in age distribution of household head between credit users and noncredit users. The average schooling years of the total sample is 7.99, while the figures for credit users and noncredit users are 4.79 and 7.58 years respectively. The t-test shows that there is no statistically significant mean difference in educational level between credit users' households and noncredit user's households. The average number family size of the total sample is 5.58, while the figures for credit users and noncredit users' family sizes are 5.67 and 5.47 respectively. The t-test shows that there is no statistically significant mean difference in family size between credit users' households and noncredit user's households. The average land holding of the sampled household is 1.81 hectare. The mean land holding for credit users is 1.3ha and the corresponding figure for the non- credit users' households are 1.03 ha. These figures are greater than smaller average of national figure, which is 1.2ha (CSA, 2021) indicating the presence of relatively high land holdings in the study area. The analytical question revealed that the major means of land acquisition was through land inheritance in the study area. The t-test revealed that the mean difference in size of cultivated land between credit users and non- credit users is statistically significant at 1% level of significance.

The average years of farm experience for credit users and non- credit users are 18.73 and 18.45 respectively and that of the total sample is 7.88-year experiences. The t-test shows that there is no statistically significant mean difference in farm experiences between credit users' households and noncredit user's households.

The average number of farm income in birr for credit users and non- credit users are 4,829.72 birr and 2,909.69 birr respectively and that of the total sample is 1,563.46 birr. The mean difference of households' farm income between credit users and noncredit users is found to be statistically significant at 1% level of significance.

The average credit amount 162,173.00 birr and non- credit users zero mean and the total sample is 86,550.30 birr respectively. The mean difference of credit amount in birr income between credit users and noncredit users is found to be statistically significant at 1% level of significance.

The average amount of farm expenditure credit users 669,369.00 birr, and non- credit users 342,312.10 birr respectively and that of the total sample is 516,860.00 birr. The mean difference of expenditure amount in birr between credit users and noncredit users is found to be statistically significant at 1% level of significance.

The average livestock holding of the total sample was 3.92 TLU. The mean livestock holding of credit users was 3.97 TLU while that of the non-users was 3.867 TLU. The t-test shows that there is no statistically significant mean difference in livestock holding between credit users' households and noncredit user's households. Livestock number was converted to tropical livestock unit based on (Desale, 2008).

The average fertilizer credit users 3,680.30kg and non- credit users 2,880.93 kg, and that of the total sample is 3,307.55kg respectively. The mean difference of fertilizer amount in birr between credit users and noncredit users is found to be statistically significant at 1% level of significance. This shows the fertilizers one of the basic inputs for the production of commercial goods for both credit users and noncredit users respectively.

The average amount of birr sold from agricultural commodity (commerce) the total sampled mean is 3,934.4 in birr. The mean commerce for credit users is 4,829.72 and the corresponding figure for the non- credit users' households are 2,909.62 in birr. The t-test revealed that the mean difference of agricultural commodity between credit users and non- credit users is statistically significant at 1% level of significance.

The mean distance of the sample households' residence from the market is 7.747km. The mean distance of the credit users' households from the market is 7.737km while the corresponding figure for non-users is 7.757km. The t-test result shows that mean difference in distance from the market credit users and noncredit users is statistically significant at 1% level of significance. Therefore, the result shows that farm size, farm income, credit amount, farm expenditure, fertilizer, commerce and distance to the market $p=0.000$ (***) and less than $p=0.05$ value significant at 1% level of significant $\chi^2(1)$.

Table 10: The t-test for mean difference of continuous variables

Variables	Non-Credit users (185)		Credit users (185)		Total Sample		
	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	T-test
Age of household	45.8	10.414	45.11	8.43	45.431	9.4	0.7014
Education	7.58	3.46	4.79	2.81	7.99	7.49	-1.265
Family size	5.468	1.981	5.672	1.768	5.577	1.87	-1.046
Farm size	1.029	0.659	1.314	0.721	1.181	0.71	-3.956***
Farm experiences	18.451	7.205	18.727	7.131	18.598	7.867	-0.3706
Farm income	2909.69	1367.96	4829.72	1108.79	3934.4	1563.46	-14.922***
Credit amount	0	0	162173	223740.3	86550.3	182253	-9.5320***
Farm expenditure	342312.1	110752.6	669369	141738.6	516860	207583	-24.508***
Total TLU	3.87	1.47	3.972	1.243	3.924	3.786	-0.7361
Fertilizer	2880.925	1847.473	3680.3	2019.616	3307.55	1979.35	-3.9567***
Commerce	2909.62	104.004	4829.72	78.798	3934.4	1563.46	-14.922***
Distance to market	7.757	2.578	7.737	2.592	7.747	2.592	0.0735***

Note: *** represent statistically significant at 1% significance level

Source: Computed from own survey data, (2022)

4.2. Results of Econometric Model

The study used logit regression model for estimation household food security and food insecurity status. These are food consumption score analysis and additionally, the effect of credit access on household food security and agricultural commercialization using PSM (propensity matching score) at the study area. The results under each part are discussed as follows.

4.2.1. Analysis of the Household Food Security Status

4.2.1.1. Determinants of Food Consumption Score (FCS)

The logistic regression model estimation results show that twelve explanatory variables affect the endogenous variables. These explanatory variables are sex of household, household head, age of household, marital status of households, educational level of household, farm experience, access to credit, distance from the market, total TLU (tropical livestock unit), and commerce (aggregate of the agricultural commodity sold in birr) respectively. These variables were statistically significant at (***) 1 %, and (**) 5% respectively. The result shows that from twenty variables four of them have significance in determining the dietary diversity of households. These variables are credit access, and commerce. Access of credit negatively influences having poor and borderline food consumption score while it positively influences having acceptable food consumption score. The study result shows that access to credit decreases the probability of having borderline food consumption score by -0.05495 and $p=0.012$, while it increases the probability of having acceptable food consumption score by 0.831176 and $p=0.000$. The access to credit has a negative effect on the probability of credit users being poor food consumption at a (**) 5%, and boarder

line (***) 1% significance level respectively. The previous studies access to credit services positively affected household food security status (Awotide *et al.*, 2015). Commerce negatively influences having poor and borderline food consumption score while it positively influences having acceptable food consumption score. The study result shows that commerce decreases the probability of having borderline food consumption score by $-4.00E-06$ and $p=0.023$ and 0.00022 ; $p=.000$. While it increases the probability of having acceptable food consumption score by 0.000226 and $p=.000$. The commerce effect has a negative on the probability of commercial goods producers being poor food consumption at a (***) 1%, and boarder line (***) 1% significance level respectively.

Commercially oriented farmers have more diverse diets than non-commercial oriented ones because they can easily purchase other foods to supplement their own production. Commercialization has a robust and positive effect on household food security. It significantly increases household dietary diversity and reduces the number of coping strategies adopted during food shortages (Dennis *et al.*, 2022).

Table 11. Distribution table for household food (FCS)

FCS	Coef.	Std. Err.	Z	P> z
Poor food (Consumption)				
HHGENDER	-0.00085	0.001663	-0.51	0.609
HHHEAD	0.002923	0.002251	1.3	0.194
AGEHH	1.11E-05	9.08E-05	0.12	0.903
HHMS	-0.00021	0.000905	-0.24	0.814
FARMSIZEINHECTARE	0.000349	0.001008	0.35	0.73
HHEDU	-0.0004	0.000334	-1.2	0.231
FARMEXP	-0.00015	0.000123	-1.25	0.212
ACCESSCRDT	-0.05495	0.021981	-2.5	0.012***
MEMBERCOP	-0.00138	0.002146	-0.65	0.519
DISTFROMMRKT	1.89E-05	0.0003	0.06	0.95
TOTALTLU	-5.1E-05	0.000506	-0.1	0.92
COMMERCE	-4.00E-06	1.76E-06	-2.27	0.023***
Borderline food (Consumption)				
HHGENDER	-0.04714	0.088954	-0.53	0.596
HHHEAD	0.161909	0.104588	1.55	0.122
AGEHH	0.000616	0.005003	0.12	0.902
HHMS	-0.01181	0.050726	-0.23	0.816
FARMSIZEINHECTARE	0.019315	0.055036	0.35	0.726
HHEDU	-0.02215	0.015565	-1.42	0.155
FARMEXP	-0.00853	0.005562	-1.53	0.125
ACCESSCRDT	-0.77623	0.04947	-15.69	.000**
MEMBERCOP	-0.07081	0.094322	-0.75	0.453

DISTFROMMRKT	0.001049	0.016618	0.06	0.95
TOTALTLU	-0.0028	0.027967	-0.1	0.92
COMMERCE	-0.00022	4.38E-05	-5.06	.000***
Acceptable food (consumption)				
HHGENDER	0.04799	0.090568	0.53	0.596
HHHEAD	-0.16483	0.106377	-1.55	0.121
AGEHH	-0.00063	0.005094	-0.12	0.902
HHMS	0.012021	0.051626	0.23	0.816
FARMSIZEINHECTARE	-0.01966	0.056031	-0.35	0.726
HHEDU	0.022555	0.015841	1.42	0.154
FARMEXP	0.00868	0.005662	1.53	0.125
ACCESSCRDT	0.831176	0.0525	15.83	.000***
MEMBERCOP	0.072196	0.096369	0.75	0.454
DISTFROMMRKT	-0.00107	0.016918	-0.06	0.95
totalTLU	0.00285	0.028472	0.1	0.92
commerce	0.000226	4.39E-05	5.14	.000***

Note: ***: refers to significance at 1% level

Source: Own survey, STATA 14.2 output (2022)

4.2.1.2 Determinants of Household Food Insecurity Access Scale (HFAS)

The result shows access to credit influences the probability of credit users being mildly food insecure at a 1% significance level. Thus, origin decreases the probability of being mildly food insecure at -0.08047 and $p=0.024$. This result conforms to the findings of a previous study showing that origin access to credit showed a negative correlation (Zama *et al.*, 2018). In the stage of moderate food, insecurity access to credit has a positive influence on credit user households being food secure at a 1% significance level and it has a positive influence on credit users being mildly food insecure and moderately food insecure. Therefore, access to credit increases the probability of being food secure while it decreases the probability of being mildly food insecure. The changes increased the probability of being food secure by 0.080466; $p=0.024$. In the current study, a household's access to credit was significantly associated with household food insecurity and it is one of the factors affecting food security status in research areas which is consistent with other studies that small farmers or household noncredit users are more likely to experience food insecurity, a finding consistent with previous studies access to credit services positively affected household food security status (Muleta *et al.*, 2021).

The total TLU has a negative effect on the probability of being mildly food insecure at a 1% significance level. Thus, decreases the probability of being moderately food insecure at -0.00424; $p=0.037$. The tropical livestock unit, has a negatively effect on the probability of food in secured, significant at 1% level of significance. The commerce (total agricultural goods sold in birr) hurts

the probability of commercial goods producers being mildly food insecure at a 5% significance level. Thus, decreases the probability of being mildly food insecure at $-2.67E-08$; $p=0.002$. The commerce (total agricultural goods sold in birr) has a negative effect on the probability of commercial goods producers' decrease being mildly food insecure at a 1% significance level. Commerce's a positive influence on food secure commercial goods produced while it showed a negative relationship with mildly and moderately food insecure households at a 1% significance level being food secure by $2.67E-08$; $p=0.002$. This result is in conformity with the findings of a previous study showing that can determine the food security status of households (Tarasuk *et al.*, 2018).

Table 12. Distribution table for household food insecurity access scale (HFIAS)

HFIAS	Coef.	Std. Err.	Z	P> z
Food Secure				
HHGENDER	0.017554	0.027497	0.64	0.523
HHHEAD	0.000157	0.02889	0.01	0.996
AGEHH	-1.4E-05	0.001086	-0.01	0.99
HHMS	0.001604	0.012335	0.13	0.897
FARMSIZEINHECTARE	-0.01433	0.016094	-0.89	0.373
HHEDU	0.00419	0.003105	1.35	0.177
FARMEXP	0.001666	0.001314	1.27	0.205
ACCESSCRDT	-0.08047	0.035749	-2.25	0.024***
MEMBERCOP	-0.05854	0.022173	-2.64	0.008***
DISTFROMMRKT	0.005985	0.003782	1.58	0.114
COMMERCE	2.67E-08	8.81E-09	3.03	0.002***
TOTALTLU	-0.00424	0.00203	-2.09	0.037***
Mildly Food Insecure				
HHGENDER	-0.01755	0.027497	-0.64	0.523
HHHEAD	-0.00016	0.02889	-0.01	0.996
AGEHH	1.43E-05	0.001086	0.01	0.99
HHMS	-0.0016	0.012335	-0.13	0.897
FARMSIZEINHECTARE	0.01433	0.016093	0.89	0.373
HHEDU	-0.00419	0.003105	-1.35	0.177
FARMEXP	-0.00167	0.001314	-1.27	0.205

ACCESSCRDT	0.080466	0.035746	2.25	0.024***
MEMBERCOP	0.05854	0.022173	2.64	0.008***
DISTFROMMRKT	-0.00599	0.003783	-1.58	0.114
COMMERCE	-2.67E-08	8.81E-09	-3.03	0.002***
TOTALTLU	0.004241	0.00203	2.09	0.037***

Note: ***: refers to significance at 1% level

Source: own STATA 16 output (2022)

4.2.1. Effects of Credit on the agricultural commercialization and Household Food Security

The correlation between access to credit and household food security, agricultural commercialization is theoretically complex and there are further empirical pitfalls regarding the impact evaluation problem. In this study the effect of credit access was estimated on the food security and agricultural commercialization based on cross-sectional data available. A propensity score matching technique was used to address the research questions. The credit access differential impact on household food security and agricultural commercialization was estimated using the propensity score matching (PSM) as revealed in the table 9 and significant at 5% (**). The over-all matching estimates show that access to credit has a positive and significant effect on household food security and significant effect on agricultural commercialization. The PSM show that household who access credit have about 33.89% higher foods secure compared to the non-credit access, and similarly, a farmer (household) who access credit their sale is 2152.62 birr higher than noncredit user's households.

Overall farm commercialization after the availability of credit improved the smallholders' income by nearly birr 2153, thereby enhancing their spending on food items. Adoption of commercial farming practices provided them the opportunity to fill the nutritional gaps. Agricultural credit uses to develop agriculture and raise the standard of living of the rural population. The availability of institutional credit can also help farmers (households) in facilitating farm productivity enhancement which was led to higher income and better living. Jan and Naqvi *et al.* (2016) emphasized the need to involve the small common farmers in the comfortable credit distribution circle and Zarai Taraqati Bank Limited (ZTBL) is the biggest contributor in providing credit to farmers in Pakistan (Ahmed *et al.*, 2007) and Commercialization has a robust and positive effect on household food security. It significantly in-creases household dietary diversity and reduces the number of coping strategies adopted during food shortages (Dennis *et al.*, 2022).

Table: 13. The effect of credit access on household food security and Agricultural commercialization using PSM (propensity matching score)

Estimates		access to credit			
Variable	Sample	Treated	Controls	Difference	T-stat
food security					
Sum FCS	Unmatched	65.614	32.344	33.27	26.5
	ATT	65.614	31.725	33.89***	26.93
Total livestock					
Total TLU	Unmatched	3.972	3.87	0.10367	0.74
	ATT	3.972	4.09	-0.1208	-0.51
Agricultural commercialization					
Commerce	Unmatched	4829.7	2909.7	1920.0	14.92
	ATT	4829.7	2677.1	2152.62***	11.26
Farm income					
Farmicm	Unmatched	4830	2909.7	1920.0	14.92
	ATT	4830	2677.1	2153***	11.26

Note *** indicates Significant at the 1% level.

The PSM graph indicates the existence of a good overlap between the propensity scores of treatment and comparison respondents. From 370 respondents in the pooled sample 185 and 185 treatment and comparison respondents are on common support, respectively.

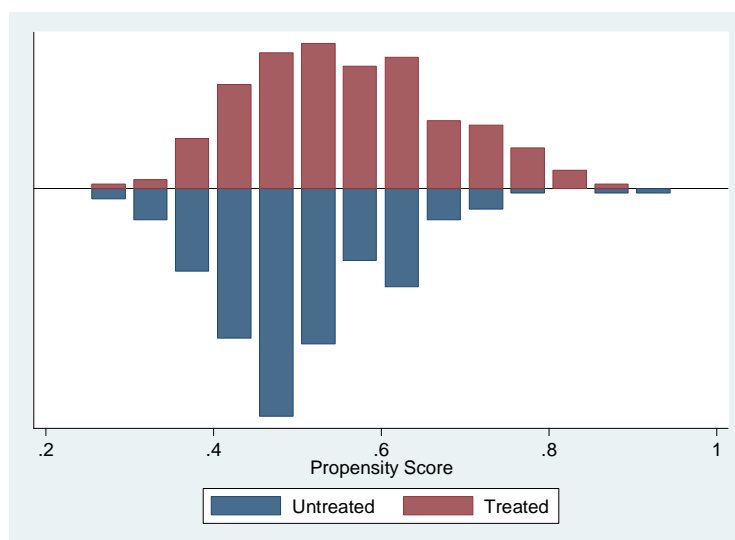


Figure .3. Histogram of estimated PSM between participants (treated) and nonparticipants (untreated) of credit users' households and noncredit users' households respectively.

Source: Own survey, 2022.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

They focused on the effects of credit on the commercialization of agricultural commodity; investigate the effects of credit and commercialization on household food security and analysis of the household food security status. The study was used mixed approach both quantitative and qualitative. The descriptive result reveals that 86% of the total sample households are male-headed while 14% are female-headed households. The result of food consumption score (FCS) indicates that poor consumption 6% of household, 32% borderline and the 62% acceptable. The t-test revealed that the mean of continuous variables shows $p=0.000$ and less than $p=0.05$ value significant at a 1% level of significance. Overall farm commercialization after the availability of credit improved the smallholders' income by nearly birr 2153, thereby enhancing their spending on food items. The researcher recapitulates the access to credit and agricultural commercialization has positively impact on household food security status.

5.2 Recommendations

The following recommendations have been forwarded based on the results of the research. In general, the study recommends that the ministry of finance and economic development policy of Ethiopia, which gives prime attention to smallholder farmers, should be integrated with ministry of agricultural of Ethiopia align with the procedure and lending policies to ensure the food security of smallholder households. The results of the study recommend the following specific areas of interventions: The results show access to credit increases the probability of being food secure while it decreases the probability of being mildly food insecure and moderately food insecure. The government or should be facilitating the uncollateralized loan for smallholders' farmers. Based on worthiness of the agricultural producer productive; and using emergency response by of digital supply of farm inputs and agriculture technology as credit. The government should provide credit by the minimum interest rate to farmers because more than 80% livelihood of the households. The government should the established Agricultural bank like Egypt, India and China because it is the driving force for smallholder farms. The over-all matching estimates show that access to credit and agricultural commercialization has a positive and significant effect on household food security. The concerned body /sectors should well organize the structure of market for supplier. Then, also minimize the farmers benefit exploitation of brokers and the commerce income increase simultaneously food security increase.

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APPENDIX
COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR FOOD SECURITY STUDIES

Dear respondent,

I am an MSc student conducting research entitled "**Effect of Credit on Agricultural Commercialization and Household Food Security: Evidence from Dugda Woreda**"

The objective of this research is to analyze, Examine, and investigate the effect of Credit on Agricultural Commercialization and Agricultural Commercial commodity producers' Household Food Security status in Dugda Woredas and forward possible solutions to overcome the threat. Regarding questionnaire items presented to you, there was no right or wrong answers. However, the result of this research was released and made known only after the exploration, identification, investigation, description, and production of an analysis result of the research work is completed based on a scientific approach.

Dear Participant,

All that is expected from you is to read each survey questionnaire item critically, understand it and answer or indicate your degree of agreement or disagreement truthfully and honestly that reflects your belief. Therefore, please give your answers to all items in the questionnaire. Be aware that you are participating in this study voluntarily. If for some reason, you want not to participate or to withdraw, you may do so at any time. Your participation in the study and your answers are unidentified and your identity was not be known by anyone. Only the study was having access to the completed questionnaire items. Your responses were used only for study and research purposes. Do not write your name on the questionnaire.

Thank you very much for your voluntary participation in the success of this academic endeavor!

Sincerely!

Petros Tesfaye, MSc Candidate

Email: petrostesfaye7@gmail.com

Mobile: +251-913-25-31-74

QUESTIONNAIRE

HH Sector.: _____ Enumerator's Name: _____
 Woreda: _____ Kebele: _____ Date: _____

A.1. Personal and demographic information of the households

Name of the Respondent: _____ Gender: Male _____ Female _____
 Respondent is the household head? 1) Yes 2) No,
 if No, Relationship with household head _____
 Age of the Respondent: _____ Age of the household head: _____
 Household Members: _____ Total earning hands: _____
 Education level of household head in year's _____
 Maximum level of education attained in the household _____
 Decision making regarding food purchase/consumption: Household head (Male) _____
 Spouse (Female) _____

Sr.No	Tenancy Status	Land Size
1	Owner	Owned area (Hectare)
		Rented in the area (Hectare)
2	Tenant	Rented out area (Hectare)
		Rented in the area (Hectare)

To whom you sell your products 1. Direct sell, 2. To a collector, 3. To Wholesaler,
 3. Retailer
 Farmexperiences in years _____, Nonfarm experiences in years _____

A.2 Food Consumption score

No	Food items	Food groups	A	B	FCS
		How many days, in the last 7 days, have you eaten the following food Items?	Number of times 0-7	Weight	Food Consumption Score calculation(A*B=FCS)
1	Maize, maize porridge, rice, sorghum ,millet pasta, bread and other cereals Cassava, potatoes and sweet potatoes, other tubers, plantains	Main staples		2	
2	Beans, Peas, groundnuts and cashew nuts	Pulses		3	
3	Vegetables, leaves	Vegetables		1	
4	Fruits	Fruits		1	
5	Beef, goat, poultry, eggs and fish	Meat and Fish		4	
6	Milkyogurt and other diary	Milk		4	
7	Sugar and sugar products, honey	Sugar		0.5	
8	Oils, fats and butter	Oil		0.5	
9	Spices, tea, coffee, salt, fish power, small amounts of milk for tea	Condiments		0	

A .3. Household food insecurity questions

Food access information

Household Food Insecurity Access Scale (HFIAS) questions

No	Questions	Responses	Code
1	In the past four weeks, did you worry that your household would not have enough food?	0=No (skip to Q2) 1=Yes	
1.a	How often did this happen?	1=Rarely (once or twice in the past four weeks) 2=Sometimes (three to ten times in the past four weeks) 3=Often (more than ten times in the past four weeks)	
2.	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0=No (skip to Q3) 1=Yes	

2.a	How often did this happen?	1=Rarely (once or twice in the past four weeks) 2=Sometimes (three to ten times in the past four weeks) 3=Often (more than ten times in the past four weeks)	
3.	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0=No (skip to Q4) 1=Yes	
3.a	How often did this happen?	1=Rarely (once or twice in the past four weeks) 2=Sometimes (three to ten times in the past four weeks) 3=Often (more than ten times in the past four weeks)	
4.	In the past four weeks, did you or any member have to eat some foods that you really did not want to eat because of lack of resources to obtain other types of food?	0=No (skip to Q5) 1=Yes	
4.a	How often did this happen?	1=Rarely (once or twice in the past four weeks) 2=Sometimes (three to ten times in the past four weeks) 3=Often (more than ten times in the past four weeks)	
5.	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0=No (skip to Q6) 1=Yes	
5.a	How often did this happen?	1=Rarely (once or twice in the past four weeks) 2=Sometimes (three to ten times in the past four weeks) 3=Often (more than ten times in the past four weeks)	
6.	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0=No (skip to Q7) 1=Yes	
6.a	How often did this happen?	1=Rarely (once or twice in the past four weeks) 2=Sometimes (three to ten times in the past four weeks) 3=Often (more than ten times in the past four weeks)	
7.	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of re-	0=No (skip to Q8) 1=Yes	

	sources to get food?		
7.a	How often did this happen?	1=Rarely (once or twice in the past four weeks) 2=Sometimes (three to ten times in the past four weeks) 3=Often (more than ten times in the past four weeks)	
8.	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0=No (skip to Q9) 1=Yes	
8.a	How often did this happen?	1=Rarely (once or twice in the past four weeks) 2=Sometimes (three to ten times in the past four weeks) 3=Often (more than ten times in the past four weeks)	
9.	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0=No (questionnaire is finished) 1=Yes	
9.a	How often did this happen?	1=Rarely (once or twice in the past four weeks) 2=Sometimes (three to ten times in the past four weeks) 3=Often (more than ten times in the past four weeks)	

A.4. Income and expenditure data.

A.4.1 Source of Income Farm income in birr, _____ Off-farm income in birr _____

A.4.2 Household Expenditures

Farm Expenditures in birr _____

Non-farm expenditure in birr _____

A.4.3. Farm Production, Expenditure, and Income Data

Q.A.4.3.1. Which crops have you grown in the last 12 months? (Tick all that apply)

a. Wheat, b. Barley, c. Rice, b. Fruit, d. Maize, f. Vegetables

Q.A.4.3.2 Farm Production

Crop Items	Land Size		Fertilizer in Kg	Preharvest Labour	Postharvest Labour	Total production in Kg	Total sells in Kg	On consumption in Kg
	Irrigated Land	Non-irrigated Land						
Wheat								
Maize								
Fruit								
Papaya								
Vegetable								
Tomato								
Onion								

Q.A.4.3.3. Please mention the expenditures on Labor/family labour

Wage = In cash _____ In birr per person per day

In Kind _____ Kg. per person per day

Land Rent = (if applicable) ----- (for a year) for _____ acres

Labor used for	Number of persons	Number of days	If different rates for Commercial goods or other crops
Sowing			
Spray			

Q.A.4.3.4. Please mention the expenditures on livestock

Livestock	Numbers of animals at the time of interview)	Feed (In birr per month)	Medicine (In birr per months)	Other expenditures (In birr) (tools, fence replacements)
Goats				
Buffalo				
Cow				
Oxen				
Chickens				
Horses/donkeys				
Other				

Q.A.5. Please provide information about any loan taken during the last 12 months

Loan Taken Yes No

Personal Loan amount in Birr _____,

Agricultural Credit amount in Birr _____, Non-farm Term Loan amount in birr _____

Membership of Cooperatives Yes No

Amount of Credit from Cooperatives in birr _____

Amount of credit membership taken from informal sector 1=Iquab, 2=Idir, 3=Other (Specify) _____

Did you get credit for agricultural input purchase Yes No?

From whom did you get this credit? Sources 1= Friends/relatives, 2= Seller, 3= Cooperative, 4= Bank/, Micro finance Institution, 5= Others (specify) _____ Interest rate _____

What was the amount of the credit for the purchase of these inputs? In Birr _____

What is the maturity of the Credit? 1= < 1Year Short Term loan, 2= >1 & <5 years Medium Term Loan, 3= >5 Year Long Term Loan

Did you obtain some of the agricultural inputs in the form of a gift or donation?

What was the principal source of this gift/ donation? 1=Other household, 2=State, 3=NGO, 4=Agricultural cooperative, 5=Collective, 6=Project, 7=Other (specify) _____

What did you or any other household member request the loan for? Choose all that apply
 1=Purchase of Food, 2=Purchase of other goods, 3= Purchase inputs for business,
 4=Purchase inputs for agriculture, 5= Other (Specify)_____

Q.A.6. Please mention; the production, consumption, and sold livestock during the last 12 months

Livestock income	Production (Kg for Milk and Numbers for Meat and dozen	Home Consumption (Kg for Milk and Numbers for Meat and dozens for eggs	Sold in markets
Milk	Quantity	Quantity	Prices In birr
Goat/Sheep			
Cow			
Meat			
Goat			
Sheep			
Cow			
Oxen			
Chickens Meat			
Eggs (Dozens)			
Others			

(*) means 'skip if landless'

A.7. Information about accessibility to input and output markets

Q.7.1. Please mention the distance to the nearest markets from your home/farm etc.

Sr.No	Distance to nearest	Distance in Kilometers (Km)	Transportation Const (1 time) in birr	Transportation Cost (Last 12 months) In birr
1	Tarred Road			
2	Seed and Fertilizer Market			
3	Pesticides Market			
4	Output Market (Mandi) your you sell your farm produce			
5	Utility Store			
6	Market Center			
7	Shop from where you purchase foodstuff for home use daily			

Q 5.2. To whom to sell the products 1= Direct Sell, 2= Wholesale, 3= Retailers,
 4= Collectors, 5= Cooperatives

Q.7.2. Do you have easy access and are satisfied with the extension services of the Dugda woreda Agricultural Department? Yes No

If Yes: to what extent

1=Dissatisfied, =Less Satisfied, 3=Satisfied

If No; what are the reasons

- i)
- ii)

Q.5.3. Do you have credit access? Yes No

If No; what are the reasons?

i)

ii)

Q.5.4. Do you have electricity access at your farm? Yes No

Q.7.5. Do you think the extension workers influence your sales decisions? Positive Negative

Q.5.6. Do you think cooperative societies influence your sales decisions? Positive Negative

Q.7.7. Do you have access to market information? Yes No

If Yes; to what extent 1=Negligible,2=Very less,3=less,4=Enough,5=Full

i)

ii)

Appendix 2

Overall Matching Test

. pstest,graph both

Variable	Unmatched Matched	Mean		%bias	%reduct bias	t-test		V(T)/ V(C)
		Treated	Control			t	p> t	
HHEDU	U	7.9899	7.578	13.1		1.27	0.207	0.66*
	M	7.9899	8.0455	-1.8	86.5	-0.17	0.863	0.62*
AgeHH	U	45.111	45.798	-7.2		-0.70	0.483	0.65*
	M	45.111	44.586	5.5	23.5	0.59	0.555	0.83
Familysize	U	5.6717	5.4682	10.8		1.05	0.296	0.80
	M	5.6717	5.7576	-4.6	57.8	-0.42	0.675	0.61*
Farmsizeinhectare	U	1.3144	1.0289	41.3		3.96	0.000	1.20
	M	1.3144	1.3396	-3.7	91.2	-0.35	0.727	1.01
farmexp	U	18.727	18.451	3.9		0.37	0.711	0.98
	M	18.727	17.955	10.8	-179.6	1.07	0.287	0.95
DistanceFromThemarketinkm	U	7.7374	7.7572	-0.8		-0.07	0.941	1.02
	M	7.7374	7.4747	10.1	-1222.9	1.02	0.307	1.09
HHhead	U	1.1717	1.1098	17.8		1.70	0.090	1.45*
	M	1.1717	1.1364	10.2	42.9	0.97	0.331	1.21

* if variance ratio outside [0.76; 1.32] for U and [0.76; 1.32] for M

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Unmatched	0.042	21.39	0.003	13.6	10.8	49.0*	1.24	43
Matched	0.009	5.11	0.646	6.7	5.5	22.7	1.64	29