ANALYSIS OF SMALLHOLDER FARMER'S PARTICIPATION IN PRODUCTION AND MARKETING OF COFFEE: THE CASE OF LIMMU KOSSA WOREDA, JIMMA ZONE OF OROMIA REGIONAL STATE

A RESEARCH THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF JIMMA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN DEVELOPMENT ECONOMICS

BY:

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JIMMA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

JUNE, 2021

JIMMA, ETHIOPIA

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CERTIFICATE

This is to certify that the thesis entitled "Analysis of Smallholder Farmers Participation in Production and Marketing of Coffee; The Case of Coffee in Limmu Kossa District, Jimma Zone of Oromia Regional State. Partial fulfillment of the requirements for the degree of Masters of Science in Development economics, the Graduate Program of the Department/School of Business and Economics, and has been carried out by Tamerat Abate Id. No WM0079/12, under my/our supervision. To the best of my knowledge, is an original work and not submitted earlier for any degree either at this University or any other University.

Therefore I/we recommend that the student has fulfilled the requirements and hence hereby can submit the thesis proposal to the department.

Name of major/main advisor	Signature	Date
Fikadu Gutu (ass. Prof.),	_____	_____
Name of co-advisor	Signature	Date
Esubalew Ayalew ,	_____	_____

DECLARATION

I, Tamerat Abate, declare that this thesis entitled "Analysis of Smallholder Farmers Participation in Production and Marketing of Coffee; The Case of Coffee in Limmu Kossa District, Jimma Zone of Oromia Regional State" is outcome of my own effort and study and that all sources of materials used for the study have been duly acknowledged.

To the best of my knowledge, this study has not been submitted for any degree in this University or any other University. It is offered for the partial fulfillment of the degree of Master of Science in Development Economics (MSc).

By: Tamerat Abate Date: 12/06/2021 Signature: _____

ACKNOWLEDGEMENTS

Above all, I would like to forward my deepest gratitude to almighty God for helping me to accomplish my will. No word of thanks and gratitude is sufficient to appreciate them have done for me. By their decree, this paper came out as a result of the contribution and support of many individuals whom I am greatly indebted to.

I really want to express my greatest thanks to my advisor Ato Fikadu Gutu for his patience and constructive advice throughout the development of this thesis without which this paper would have been lost. Besides, my special gratitude goes to my Co-advisor Mr. Esubalew Ayalew for his remarkable advices and encouragements throughout the course of the study.

Lastly, I would like to thank my family and friends: for their support and love throughout the year

ACRONYMS/ABRIVATIONS

LKAO-limmu Kossa Woreda Agricultural Office**.**

JZARDO-Jimma Zone Agriculture and Rural Development Office

CSA - Central statistical Agency

ECX-Ethiopian Commodity Exchange

GDP - Gross Domestic Product

GTP - Growth and Transformation Plan

Ha – Hectare

MY-Mid Year

HH – Household

MOARD-Ministry of Agriculture and Rural Development

FDRE-Federal Democratic Republic of Ethiopia

USDA-United States Department of Agriculture

ICO-International Coffee Organization

OLS - Ordinary Least Square

CC- Contingency Coefficient

PAs -Peasant Associations

USAID - United States Agency for International Development

MOFED- Ministry Of Finance and Economic Development

PAERT -Policy Analysis and Economic Research Team

PLCTC- Primary Level Coffee Transaction Centers

SNNPR - South Nation Nationalities and People Regional state

VAT- Value Add Tax

VIF- Variance Inflator Factor

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ABSTRACT

Agriculture in Ethiopia remains the key sector that provides lion share foreign exchange earnings and the largest labor force employer. Out of total agricultural output about 95% was covered by smallholder agriculture sub-sector. However, a number of factors limit farmers from participating in coffee production and marketing. The main objective of this paper was to identify household specific factors determining coffee production and marketing in Limmu kossa woreda. A cross-sectional quantitative study was conducted in a sampled population by taking 228 sample sizes using systematic sampling method, out of these selected households 170 were male headed, and the remaining 58 were female headed. According to the study 135 households were coffee producers and the rest 93 households were non- producers. The mean age of sampled household heads was 46.5 years; the maximum and minimum age for household heads were 81 and 18. Almost all of the respondents own their own land; the farm size of respondents varies from 0.1 to 9 hectare and the average farm size was found to be 2.41 hectare. 67% of coffee producers used traditional coffee seed and only 33% of coffee producers used improved coffee seed. On average, coffee producers generated income birr 17629.17 from sale of coffee in year 2019/2020.To examine the determinants of farmers' decision to participate in the production activity and level of participation, Double hurdle model were used. In the first stage of double hurdle model, probit regression was used to examine farmers' decision to participate in production. In the second stage of double hurdle model truncated regression were used to analyze level of participation and income generation from sell of coffee. The study indicated that farm size, active family labor, access to credit, availability of family food, and traveling time to the nearest market significantly explain the decision to produce coffee. On other hand, only number of working family members, and land size determine the level of coffee production participation considerably. Furthermore, the study verified that in addition to the quantity of coffee marketed, market price, selling time, travelling time from the nearest market and market information significantly determines the level of income earned from coffee sale. The implication is that livelihood improvement could be assisted through better participation of farmers in coffee production and marketing in the area.

Key Words: *double hurdle model, smallholder farming, coffee, production, marketing*

CHAPTER ONE
INTRODUCTION

1.1Background of the Study

Agriculture is abroad term for everything that goes in to practice of cultivating soil, producing crops and raising the livestock and in varying degrees the preparation and marketing of the resulting products. (Merriam Webster 2021). Agriculture remains the backbone of the economy of most developing countries. Typically, it is the largest source of employment; often two-thirds or more of the population are dependent for its livelihood on farming. The labor-intensive character of the sector reduces its contribution to the gross domestic product, but its contribution nevertheless ranges between 20 and 60 percent in most developing countries. Agricultural exports are the principal sources of foreign exchange earnings *(*Fethi Omer, Dr. K.Venugopal, Guday Abeje Mossie and Haimanote Belay. 2016*)*

Cash cropping is the production of crops solely for cash rather than food, in contrast to a situation where farmers grow crops for food and sell surpluses (Anderman,T,Remans 2014). Several studies in Africa have shown increased commercialization to be associated with an increase in household income, and this include Zimbabwe, Ethiopia, South Africa and Nigeria (Cockburn,J.j; Goshu D;kassa, H.C; vanden Berg 2014). Income from cash crop production provides cash so that food becomes economically accessible to those households not directly producing their own food. However, the income pathway to food security may not be linear, as the income may be used for other household non-food expenditures. Some studies have found cash cropping negatively associated with food crop productivity, as the former compete with the latter in smallholder production where land is a limited resource (Carletto, C; Corral, P, Guelfi 2017).

Coffee is one of the most known cash crops which is a major source of income for millions of smallholder farmers worldwide and is a significant source of export earnings to many nations. In Africa, coffee is mainly produced in Ethiopia, Uganda, Côte d'Ivoire, Kenya, Tanzania, Cameroon, Democratic Republic Congo, Rwanda, Guinea, and Burundi. Ethiopia is the top coffee producer in Africa (ICO, 2018). In these countries, coffee is the major commodity that supports the majority of rural households.

Smallholder and family farming agriculture remain to be the key and leading sector in overall economic development of many developing countries in the world (Quan, 2011). According to (Geremew, 2014), in addition to producing staple crops for domestic markets; smallholder farmers produce large shares of traditional exports in these countries. This shows how the economy of many developing countries still reliant on smallholder-based agriculture.

Market participation in rural households is an important strategy for poverty alleviation and food security (Geremew, 2015). It refers to the markets actors‟ decision on whether to be involved or not in the flow of products from producers to end users (Yaynabeba, 2013). Majority of smallholder farmers in rural areas are trapped in a vicious circle of poverty characterized, inter alia, by low economic returns due to low market participation. Increased market participation by the poor has been found to be vital as a means of breaking from the traditional semi-subsistence farming and a key factor to lifting rural households from poverty. However smallholder farmers still face various problems including the lack of enhanced participation in marketing channels, very limited access to short-term financing and reliable commodity market information (; Mhando et al., 2013; Liquate & Venkatakrishnan, 2014). There are differences of opinion on the amount of farm size for coffee production area by smallholders. More than 90 percent of coffee produced in the country comes from smallholder farmers, and the rest 10 percent is from medium and large scale producers (USDA, 2016). The majority of production is on the small garden field and on average less than 2 hectares with yields remaining low at around 0.7 - 0.8 metric tons per hectare (USDA, 2016). Coffee is produced in different production systems that include forest, semi-forest, garden, and a modern plantation.

Coffee is one of the highest valued commodities in international trade, with annual export revenues worth around $10 billion on average, and annual retail sales of approximately $50 billion. It is a highly labor-intensive industry employing an estimated 100 million people in over 60 developing countries, where it is often a vital source of export revenues and income to producers, many of whom are smallholder. The dependence in coffee is greatest in Africa, where there are some 25 coffee exporting countries (ICO, 2018).

Ethiopia’s coffee production in 2018/19 was estimated at 7.25 million 60-kilo bags and recorded 7.40 million bags of 60 –kilo gram bags. 150,000, 60- kilo bags more than USDA and post estimate. This situation is due to favorable weather conditions, low disease and pest pressure,

enough rainfall in coffee growing areas of the regions and better extension services in some coffee growing areas. All coffee production is rain fed; thus, precipitation is the most important production factor. Small land holder farmers produce 95 percent of Ethiopia's coffee in varied environments, including forest, semi-forest, garden, and plantation coffee. Under the government's second Growth & Transformation Plan (GTP II), MY19/20 production is predicted to come in at 1.1 million metric tons. Coffee productivity is also projected to increase from 0.75 tons/ hectare in 2014/15 to 1.1 tons per hectare by 2019/20. Total production is projected to increase from 420 thousand tons in 2014/15 to 1103 thousand tons by 2019/20 (Coffee Annual Report 2019).

Ethiopia is the largest producer of coffee in Sub-Saharan Africa, about 15 million people directly or indirectly deriving their livelihoods from coffee and is the fifth largest coffee producer in the world next to Brazil, Vietnam, Colombia, and Indonesia (Alemayehu.b, 2018). Ethiopia is origin of coffee and produces mostly Arabica coffee. It has economic, environmental as well as social significance to the country. At the moment Coffee is growing through at the country, but, largely in two regions of the country namely: Oromia and Southern Nations, Nationalities and People Regions (SNNPR).Jimma is one of the zones of the Ethiopia region of oromia.

Jimma Zone is one of coffee growing zones in the Oromia Regional State, which has a total area of 1,093,268 hectares of land (JZARDO, 2008). Currently, the total area of land covered by coffee in the zone is about 105,140 hectares, which includes small-scale farmers' holdings as well as state and private owned plantations. Out of the 40–55 thousand tons of coffee annually produced in the Zone (JZARDO, 2008), about 28-35 thousand tons is sent to the central market, while the remaining is locally consumed (Alemayehu et al., 2008). Now a day, Jimma Zone covers a total of 21% of the export share of the country and 43% of the export share of the Oromia Region (JZARDO, 2008).

Coffee is the major cash crop of the Zone, which is produced in the eight woredas namely, Gomma, Manna, Gera, Limmu Kossa, Limmu Seka, Seka Chokorsa, Kersa and Dedo, which serves as a major means of cash income for the livelihood of coffee farming families (JZARDO, 2008). According to the report from the same source, 30-45 % of the people in Jimma Zone are directly or indirectly benefited from the coffee industry.

1.2 Statement of the Problem

Ethiopia remains the largest producer of coffee in Africa and is the fifth largest coffee producer in the world next to Brazil, Vietnam, Colombia and Indonesia, contributing to about 4.2% of the total world coffee production (ICO, 2018). Coffee is one of the leading traded commodities on the global market in both volume and value (Zewdu, 2016). For the last several years its relative predominance in the export sector is decreasing because of increased contribution of other agricultural products like horticulture and floriculture. Consequently, only a little over 27% percent of the total exports earnings is contributed by coffee during the year of 2018/19 (USDA, 2020). The trend for the last several years shows that the share of coffee in foreign exchange earnings will further decline. Coffee also contributes for sizeable amount of government tax revenue. It seems that Ethiopia will, to some certain extent, continue to rely on this item for its export earnings in the coming future.

Limmu Kossa is one of coffee growing Woredas in the Jimma zone of oromia Regional State, which has a total area of more than 12,672 hectares of coffee land (LKAO, 2020). Currently, the total area of land covered by small holder households is about 6217 hectares. The numbers of household farmers in coffee producing Kebeles is more than 22860. But the total numbers of participant house hold farmers are only about 12801 in numbers. According to Limmu Kossaa Agricultural office (LKAO) annual report (2019/2020) the capability of coffee production was 9,504 tons per year. However, the achieved productivity of coffee was around six thousand tons per year which shows us the level of productivity was far below from available potential. (LKAO, 2020)

Despite its importance as cash crop and major export item in Ethiopia the production and controlling systems affects the amount of production and productivity that decreases income of farmers (Kifle, 2015).According to Alemseged (2013),factors reducing coffee production in Ethiopia were weak farm management systems, the agronomic practice are traditional, extension services provided to smallholder farmers are inadequate, lack of the necessary technical skills and knowledge in using agricultural technologies, poor extension and credit services, low rate of technological adoption and poor infrastructure.

Different researches indicate that there is huge potential to grow coffee in the country and there is high market demand at local and international levels (Habtamu Deribe 2019) and (Fethi Omer1, Dr. K.Venugopal, Guday Abeje Mossie, Haimanote Belay Alemayehu 2016).

In Limmu Kossa woreda, there are suitable agronomic conditions and large land size for growing coffee. Despite the available potentials and opportunities, farmers are not participating in coffee production and marketing in this area. This indicates that there are external and internal (household specific) factors that constrain some households from participation, (Laurent Bossolasco, 2017). In addition, the extent to which the participant farmers participate varies significantly and the overall participation is unmatched with the available potential. Similarly, producer farmers' face a number of marketing problems, which influences the income these farmers could derive from coffee sale. Due to these factors, smallholder farmers in Limmu Kossa woreda are differently responding to the available potential and thus obtain different welfare benefits from the available opportunities, (Samuel Diro, Beza Erko and Demelash Teferi 2019).

In general as mentioned in the above paragraphs, there is a weak performance of smallholder farmers in the participation of production and marketing of coffee in the study area. Then this paper will try to identify, those internal and external factors that affects smallholder households in the participation of production and marking of coffee.

The existing studies conducted by (Alemayehu,2010, PAERT,2008 andAnwar,2010) more concerned on performance of the coffee export sector in Ethiopia, technical efficiency of coffee producers using stochastic frontier analysis, constraints and dissemination of improved coffee varieties, coffee production, utilization and marketing in Ethiopia. But in this study the researcher additionally used variables such as experience of farmers in coffee production, food sufficiency for the whole year and coffee selling time to fill the variable gaps because these variables are directly or indirectly related with choice of decision of smallholder households either to produce coffee or other crops. If farmers produce food crops sufficiently, or if they are able to provide enough food for their family the whole year, then they will participate in production of cash crops like coffee or others in order to get income. But if farmers are not able to provide enough food for their family, the probability to participate in production of cash crops will decreases because of their desire to produce enough food for their family. Those variables also help to decide the extent for participation in production and marketing of coffee.

Most of previous studies used Logit and Tobit models. According to (Wooldridge, 2002), logit and tobit models are not perfectly convenient to assess the participation decision and level of participation, because Logit model analyze only decision to participate in the activities or not and Tobit model estimate the participation decision and level of participation in coffee production determined by the same variables and the same sign. The present researcher used double hurdle model with probit and truncated regression to better address the research problem.

Studies conducted on coffee production and marketing in Ethiopia (Kendra, 2009, Samual&Eva, 2008, and Abu, 2012) have considered the common coffee production related problems, ignoring factors affecting production participation decisions at individual household levels. This study examines factors affecting production and marketing participation decisions at individual household levels.

Finally as much as the researchers' knowledge there was no research found with the title analysis of small holder farmers participation in production and marketing of coffee in limmu kosssa woreda.

1.3 Objective of the study

1.3.1 General Objective

The general objective of this study is to analyze factors that influence smallholder farmers' participation decisions in production and marketing of Coffee in the study area.

1.3.2 Specific objectives of the study

- To analyze determinants of participation decision of smallholder farmers' in Coffee production
- To identify factors determining household's level of Coffee production
- To analyze factors affecting and explaining in marketing of coffee in the study area

1.4 Significance of the study

Smallholder farming is necessarily powerful in various ways in different countries and for different types of economic activities (Quan, 2011). In addition to providing cash crops for domestic and international markets, smallholder farmers also produce large shares of traditional export crops. Coffee is one of the Ethiopian export crops and is the major cash crop cultivated by

smallholder's in selective areas of the country such as in Limmu Kossa Wereda, even though it is not as such compared to the available potential and opportunities. At the end of the day, this study will have a major contribution in identifying the determinants that are currently be considered as challenges for smallholder farmers to participate in production and marketing of coffee in the study area.

The information generated might help a number of organizations including research and development organizations, extension service providers, governmental and non-government organizations to assess their activities and redesign their mode of operations and ultimately influence the design and implementation of policies and strategies.

Finally it could also assist various actors in finding and evaluating new ways to improve households' participation in production and marketing of coffee.

1.5 Scope and limitation of the study

It would have been ideal to conduct the thesis throughout from all coffee growing areas. However due to time and budget limitations, the scope of this study will delimited only in Limu Kossa woreda working on 228 smallholder households. In addition, due to the remoteness of the study area, lack of transportation assesses to study destination and communication with respondent farmers was two major problems in conducting the study. But every challenge will be treated to complete this paper.

1.6. Hypothesis of the Study:

- Farmers' participation in coffee production has positive correlation with farmers own farm size.
- Level of coffee production participation is positively correlated with credit access, number of active family labor, and other related variables.
- Income generation from coffee sale has positive correlation with quantity of coffee marketed

1.7 Organization of the Thesis

This thesis contains five chapters. The first chapter displays the overview of the study which consists of an introductory part, identifies statement of the problem, objective and significance of the study. Following the introductory chapter, chapter two is devoted to asses both theoretical and empirical literature review. Presentation of the research methodology and description of the study area is the subject of the third chapter. Chapter four is about reporting, summarizing of results and discussion of both descriptive and inferential statistics. Chapter five is all about conclusion and recommendation.

CHAPTER TWO
LITERATURE REVIEW

2. Introduction

This chapter reviews some relevant theoretical and empirical literature review regarding smallholder cash cropping. First, section 2.1 reviews the theoretical issue of smallholder farmer's cash cropping in developing countries context. Then in the next sections (section 2.2. and 2.3), we presents some relevant empirical literatures on factors affecting smallholder cash crop production and marketing participations in these counties. Section 2.4 highlights some recent statistics on coffee production and marketing in Ethiopia. Finally, 2.5 highlight of empirical literature reviews.

2.1 The Issue of Smallholder Farmers Cash Cropping in Developing Countries

In almost all developing countries, when any one talks about agriculture, the issue of smallholder commercialization comes forth. And one of the common forms in which smallholder commercialization occurs in these countries is through production of cash crops in addition to staple crops. A cash crop is a crop that is primarily produced for market and largely sold, thus generating income for the farming households (Maxwell and Fernando, 1989; Poulton et al., 2001; Lukanu et al., 2004). In theory, it is generally conceivable that the basic motivation of cash crop is higher returns to used resources for its production. In this regard, many recorded literatures reflect the importance of cash cropping in developing countries as it can be defined in terms of land use, employment, output, income or export at household, village, regional or national levels (Maxwell and Fernando, 1989; Von Braun and Kennedy, 1994, Poulton et al., 2001).

Despite these arguments, many household level studies show the complementary nature of food and cash crop productions at household levels (Maxwell and Fernando, 1989; Von Braun and Kennedy, 1994, Poulton et al., 2001; Schneider and K.Gugerty, 2011). Their argument bases itself on the income and financial linkages between the two types of crops. Maxwell and Fernando (1989) argued that income from cash crops might be used either to purchase food crops from a market, which permits allocating most household resources to cash crop production, or to purchase external inputs for the production of food crops that enhance food crop productivity.

According to Maxwell and Fernando (1989), cash cropping necessarily never associated with declining of food production at either the household or national levels (Maxwell and Fernando, 1989). Similarly, Poulton et al., 2001; argue that although food and cash crop productions often seen as mutually exclusive alternatives, increased cash crop production need not reduce food production at household levels. They reason out this that, income from cash cropping may enable households to invest in lumpy assets such as animal traction and helps to use more modern production inputs such as fertilizers and others that increases productivity of the food production. The study presented by Von Braun and Kennedy (1994) also suggests that households participation in cash cropping need not reduce own food production or nutritional status.

In general, the bodies of literature suggest that, increased productions of crops for markets are both an inevitable feature of rural development and essential in the counties where agricultural sector was believed to support the general economic development in these countries. This part of literature evidences the accompanying greater productivity and higher household incomes as a sign of such development benefit from cash crop production by smallholder farmers. This evidence suggests that in many cases small-scale cash cropping is both technically and economically efficient (Maxwell and Fernando, 1989). Poulton et al. (2006) argue that, in general, traditional export cash crops can make a significant contribution to poverty reduction when there is broad based participation by farmers in an area, labor-intensive production processes, and potential positive linkages to staple crop productivity in cash crop production.

Furthermore, many different studies indicate that, in sub-Saharan Africa, cash cropping remains the most important income sources for farmers and governments (through exports). In this regard, Chauvin (2012) suggested that cash crops are the major source of export revenue for a large number of Sub-Saharan African countries and the livelihood basis for millions of rural households who grow those crops (Chauvin, 2012). The author recommended that poor farmers in the cash crop sector should stand a better chance to rise out of poverty on the back of export market prices which normally bring better returns (ibid).

In line with this, Poulton et al. (2001) have listed some trends which will encourage the move toward cash cropping across a wide range of developing countries. For example, the increasing high demands for cash (e.g. for schooling, health, high cost of production inputs, etc.) encourage participation of smallholder farmers in cash cropping for those whom crop sales are the major

source of income. In addition, these authors argues that, the exchange rate policy (e.g. real devaluation) of a county make production of internationally tradable crops relatively more profitable than production of crops sold only on local markets, hence enhances smallholder cash crop production participations in those countries. Furthermore, Poulton et al (2001) suggested that long-term changes in the relative prices (on international markets) encourages those households who grow these crops for cash and may result in greater market-orientation of rural households. This indicates that, cash cropping contributes to growth through production linkage effects; in which it permit diversification away from the subsistence farming to somewhat market-oriented behaviors (Maxwell and Fernando, 1989).

In summary, the main lesson that we learnt from these recorded literature is that, at least in theory, production of cash crops may enable farm households to obtain more income that they could obtain by devoting the same household resources to staple crops. In addition these theoretical ligatures suggest that, cash crops are the main source of export revenue for many developing countries. This is also true in Ethiopian case, since Ethiopian export is primarily agricultural commodities. And many reports and facts indicate that, these crops are basically produced by smallholder agriculture sub-sector. Thus, it is important to analyze the status of smallholder farmers in production and marketing participation of export potential cash crops, based on the available theory. Here the main effort is not to analyze the issue by considering these smallholders as they are specialized in cash cropping, rather we focus on analyzing the issue by considering as these farmers can produce the two crops simultaneously by well management of household resources. Of course, production of some cash crops may entirely depend on agro-ecological conditions. This also requires special focus and we accounted for the issue in this study. With these theoretical establishments, we turn to focus on factors affecting smallholder farmers to participate in production of these crops.

2.2 Factors affecting smallholder cash crop production participations

This section reviews some empirical relevant literatures on smallholder farmers' participation in cash crop production and marketing. We start with the available literatures on different cash crops production participation observed in different countries and then we go to review of specific literature on coffee production and marking in Ethiopian case.

Govereh & Jayne (2003), in their study of cotton production in Zimbabwe observed that the most critical determinants of smallholder decision to produce cotton in Zimbabwe include farmer education levels, distance from the nearest buyer, and the early clearance of the tsetse fly. Their result also revealed that traction equipment and draft power were among the key determinants of households' ability to diversify into cotton production in the country (Govereh & Jayne, 2003).

(Olwande and Mathenge, 2012) demonstrated that private asset accumulation is a prerequisite for smallholders' graduation from subsistence production. The author suggests that one avenue for farmers to accumulate private assets is to enter into cash cropping. And investment in public infrastructure such as roads, and information communication facilities are the major determinants of participating in cash crop productions (Cadot et al., 2006).

Jayne (1994) argues that high costs related to purchasing food on the market make cash crop production unattractive, despite higher returns of cash crops on the farm. The author suggests so that, it is economically unviable to replace food crop production with cash crop production in this cases. Thus, according to the author food security condition is the one possible factor in limiting smallholder farmers to produce any cash crops.

Similarly, Boughton et al (2007) argued that the main challenge and constraint factor for smallholder farmers' to participate in cash crop production is the low productivity in food crop production and its market failure. According to these authors, as farmers have access to secure their food demand they are most likely to participate in production of market-oriented cash crops (Boughton et al., 2007).

According to Lukanu et al (2004), it is generally expected that farmer's decision to cultivate a given cash crop can be influenced by factors including household characteristics; economic factors (including the crop profitability and market availability); institutional factors (e.g. availability of extension, inputs and credit services); and environmental factors that involve the crop's compatibility to existing climate, soil, disease and pest conditions (Lukanu et al., 2004).

Aysheshm (2007) assessed a sesame value chain analysis in Metema Wereda and verified that lack of improved variety seed that properly fits the woreda agro ecology and lack of agro-chemicals supply at the right time and at fair prices constrained sesame production in Metema. In addition, according to Aysheshm, water logging problems has a contributing factor for the

reduction of output, yield and thus marketed supply of sesame in the area as well as other cash crops. Furthermore, his findings indicates that sesame marketing has been constrained by diverse factors such as shortage of modern inputs, shortage of capital, lack of timely and accurate market information, and poor quality of packing materials as a few of the inherent problems in the field.

Abdurahman (2005) study the determinants of the elasticity of coffee supply using both cross sectional and time series data from Hararghe high lands. He collected cross sectional data from 60 households residing in two peasant associations of the Hararghe zone. His study found a short run price elasticity coefficient of 0.6, which in line with the argument that individual crop price elasticity is larger because farmers can shift their variable in puts between different crops more easily. On the other hand, he also found that availability of consumer goods has a positive impact on the supply of coffee. In his estimation, he found that the sign of all the parameters to be consistent with his prior expectations except the coefficients for the coffee in the parallel market.

Teshome (2009) studied the determinants of coffee export supply by taking coffee arrival as dependent variable. The study uses time series data collected from different institutions mainly from national bank of Ethiopia. He employs vector autoregressive and vector error correction model .The study includes world price of coffee, producer price and rain fail, credit access, extension service, Gross Domestic product and real exchange rates as the explanatory variables of the model. The major findings of the study indicates that world price and producer price of coffee affects coffee production negatively their price elasticity was -1.62 and 0.69 respectively. The impact of rain fall is significant in both short run and long run .However, credit access and extension service are insignificant in the long run but significant in the short run .The study also indicates gross domestic product and real exchange rate does not have any impact on the export supply of coffee. Finally he recommends that providing of credit access and extension service at each woreda for coffee farmers are supposed to prove significant effect on export supply of coffee.

2.3 Factors affecting market participation of smallholder farmers

Market participation of smallholder farmers is affected by numerous factors, including socioeconomic factors, institutional factors, market factors and external factors such as political stability of the nation, natural disaster and calamities. These factors could have negative and positive effects, which could either improve or cause a decline in the welfare of the actors.

Social-economic factors include: age, gender, education, experience, household size and land size.

Age of the household head may have a negative or positive impact on market participation. The positive impact resulting from the fact that older farmers may take their decision more easily than the young farmers, because the older people might have accumulated capital or a long term relationship with their clients or might have preferential access to credit due to their age, availability of land, or family size (Adegbola and Gardebroek, 2017).

The age impact negatively in that young people might have a longer planning horizon and might be willing to take risks (Zegeye *et al*., 2016). The older households tend to have more dependants causing more consumption, hence lowering marketable surplus (Ehui *et al*., 2009).

The gender of the head of the household has a significant impact in the market participation decision. Male headed household are expected to have a positive impact on market participation because they are of resource endowed than their counterpart female. Jagwe *et al*. (2010) found that, female headed households are more negatively affected by the transaction costs of searching for buyers, contracting and enforcing a sale transaction as opposed to the male headed households. Likewise, female headed household is more likely to be resource constrained hence affecting production of marketable surplus (Guiterrez, 2003).

Education has a positive effect on market participation because it enhances the skill and ability to utilize better on market information, which may in turn reduces marketing costs and make it more profitable to participate in the market. The household size explains the family labor supply for production and household consumption levels (Jeoffery-sigei., 2018). Positive sign insinuates that a larger household provides cheaper labor and produce more output in absolute terms such that the proportion sold remains higher than the proportion consumed. A negative sign on the other hand means that a larger household is likely to consume more output, leaving smaller and decreasing proportion for sale. Key *et al*. (2016) postulated that land holding is directly linked to the ability to produce a marketable surplus. This can be explained by the fact that a farmer produces more output when the land is larger than when it is small.

Institutional factors like membership in the group, extension service, and infrastructure have an influence on market participation. Poor infrastructure has a negative effect on market participation because the majority of smallholder farmers in developing countries is located in remote areas with poor infrastructure and often fail to participate in the market due to the high transaction cost involved (Goetz, 1992; Makhura *et al*., 2001; Key *et al*., 2002). Membership to the group has both positive and negative impact on market participants. It positively impacts on market participation because it increases household‟s access to information vital to production and marketing decisions (Olwande and Mathenge, 2012). On the other hand, it can negatively impact market participation in case disagreement emerges among group members, distorting marketing decision. Extension service is expected to impact positively on market participation because it is through extension services that farmers are able to acquire better skill and knowledge on marketing.

Physical resource endowments like ownership of transport and communication equipment's have an impact on market participants. Ownership of communication equipment's such as mobiles, radios and televisions have a positive impact on the market participation by facilitating marketing information to the farmers. Ownership of transport equipment such as bicycles, motorcycles and truck have a positive impact on market participation by reducing the cost of transporting output from the farm to the market (Key *et al*., 2016).

Market factors have been found to positively and negatively influence market participation. Jari (2009) stated that availability of market information boosts confidence of household who are willing to participate in the market. Poor access to market information result in information-related problem, namely moral hazard and adverse selection which in turn increase transaction costs and hence discourages participation in the market by some farmers (Fatchamp and Hill, 2005; Shiferaw *et al*., 2009). Distance from the farm to point of sale, and market information were found in a couple of studies to be a major constraint to intensity of market participation (Goetz, 1992; Montshwe, 2006; Bahta and Bauer, 2007; Omiti *et al*., 2009). Price factor positively influences market participation. Alene *et al*. (2008) argue that output price is an incentive for sellers to supply more in the market.

2.4 Coffee Production and Marketing in Ethiopia

2.4.1 Coffee production in Ethiopia

Coffee is Ethiopia's largest export crop, (Petit, 2007). Ethiopia produces only Arabica coffee which is considered as superior to Robusta coffee due to its fine aroma, strong body, and pleasant acidity (Zewdu, 2016). The country produces premium quality Arabica coffee in Africa and is the third largest producer in the world (ICO, 2014). A quarter of the total population of Ethiopia is directly or indirectly dependent on the income they generate from growing coffee for their livelihood (Zewdu, 2016). The coffee production sector in Ethiopia is being supported by both Regional and Federal Governments (Berhanu, 2017). The country has enormous potential to become the leading coffee producer in the world, (Gole, 2015), primarily because of quality characteristics of the coffee (Alemseged, 2012). The Ethiopian coffee is characterized by its rich in aroma and flavor makes it desirable for blending with coffee from other countries. The change in consumer behavior and the increasing consumption of high-quality coffee is an opportunity for the coffee producing countries like Ethiopia. Improving coffee quality is a key prospect for increasing coffee exports and may be a good strategy to get better prices for the coffee (Kassaye, 2017). According to Herhaus (2014), Ethiopia is known for producing the finest Arabica coffee to the world market.

According to (USAID, 2010) Coffee production systems in Ethiopia generally categorized into four areas i.e. forest coffee, semi - forest coffee, garden coffee, and plantation coffee. Forest coffee is a wild coffee grown under the shade of natural forest trees and it does not have a defined owner. Semi-forest coffee farming is a system where farmers select forest trees to let sufficient sunlight to the coffee trees and to provide adequate shade. A farmer who prunes and weeds the forest area once a year claims to be the owner of the semi forest coffee. Garden coffee normally found in the vicinity (near) of a farmer's residence. It normally fertilized with organic material and usually intercropped with other crops. The government or private investors for export purposes plant Plantation coffee. Fertilizers and herbicides usually used in the coffee plantation farming system.

As (Sentayhu, 2013) Forest coffee accounts 10%, Semi forest coffee accounts 30%, Garden coffee accounts 50 % and Plantation coffees accounts 10% and according to (Taye, 2013) the forest coffee production accounts 8-10%, semi-forest coffee accounts 30-35%, garden coffee accounts 50-55% and Plantation coffee accounts 5-8% of its total production respectively. Ethiopia Small-scale holdings equal to or greater than 95% of total coffee production. According to (Alemseged&Getaneh, 2013) Ethiopia is the world's fifth largest coffee producer and Africa's top producer, with estimated coffee production of more than 450,000 tons and marketable supply of 334,000 metric tons in farm year 2012/13. Half of the coffee produced consumed locally and the country leads the African Continent in domestic consumption. It has been used income generation for that about 20 percent of the populations, directly or indirectly, depend for a living on coffee production and trading.

As (Anwar, 2010) coffee is the most important crop in the national economy of Ethiopia and the leading export commodity. Ethiopia is well known not only for being the home of Arabica coffee, but also for it is very fine quality coffee acclaimed for its smell and flavor characteristics. Ethiopia encompasses a potential opportunity to increase coffee production. It is endowed with suitable elevation, temperature, and soil fertility, indigenous quality planting materials, and sufficient rainfall in coffee growing belts of the country. Coffee is a shade loving tree. Forest coffee yield is low as considered to garden and semi-forest coffee because resource owner belongs to communal and poor management.

Table 2.1 Status of GTP II Coffee Production Targets (1,000 Metric Tons)

MY	2015/16	2016/17	2017/18	2018/19	2019/20
GTP II Target	504	605	726	871	1,103
Production	391	417	423	438	444
% Achieved	78	69	58	49	40

Source: GTP II plan, Official USDA/ post estimates for MY 15/16-19/20

2.4.2 Coffee Consumption in Ethiopia

According to ToraBäckman (2009), fair trade is a trading initiative based on equity that claims to contribute to development by increasing farmers' profits and empowerment in communities.

Ethiopia has grown coffee for a thousand years, is heavily dependent on export of coffee beans, and has recently started to export Fair trade certified coffee.

Coffee plays an important role in traditional and cultural gatherings. Ethiopians drink it during virtually all social occasions such as family gathering, festivities and times of mourning. Coffee consumption in MY 19/20 is forecasted at 3.35 million bags (approximately 201 metric tons) an increase of 75,000 bags from MY 18/19 post estimate. Coffee Consumption for MY18/19 is expected to increase slightly to 3.27 million bags (196.2 metric tons). This trend runs contrary to the government's attempt to lower domestic coffee consumption in order to have more beans for export. This official estimate is slightly above post and USDA estimate. The main reasons for the consumption increase are exportable-grade coffee entering the informal domestic market to take advantage of strong local prices and the increase of small roadside coffee stalls in and around major towns as income generating schemes for young, unemployed women. These shops serve coffee in the traditional sit-down fashion and have become popular among consumers. These informal stalls pay neither VAT nor exorbitant rental costs, making their cost of serving coffee relatively lower and more competitive than the regular coffee shops. Ethiopians drink more coffee than any other African country (USDA 2019).

2.4.3 Coffee Trade in Ethiopia

According to ToraBäckman (2009), fair trade is a trading initiative based on equity that claims to contribute to development by increasing farmers' profits and empowerment in communities. Ethiopia has grown coffee for a thousand years, is heavily dependent on export of coffee beans, and has recently started to export Fair trade certified coffee.

The Ethiopia Commodity Exchange (ECX) was established in 2008 to reduce price volatility and incentivize farmers to plant coffee. However, the lack of traceability at the ECX did not meet consumers' demand for traceable, farmer-specific or organic certified coffees. To address traceability issues, starting 30 April 2017 exporters with valid export license of for the marketing year can sell directly to international buyers, under the condition that the coffee loaded trucks must be sold within three days of arriving at the processing warehouses in the capital. If the coffee remains unsold after three days, they will be forced to sell on the existing ECX platform, but with traceability intact. The other major change is that farmers may sell beans directly to the roaster without entering to the Ethiopian Coffee Exchange platform. Coffee is the most

important foreign currency earner for Ethiopia. In addition to ensuring the volume and quality of coffee exports, exporters must properly manage the contracts. While most exporters assist the economy by supplying quality coffee to the international market, the government is also taking strict actions against those who fail to comply with their contracts. In March of 2019 alone 81 coffee exporters have been banned from trading with the Ethiopian Commodity Exchange (ECX) because they defaulted on their contracts. Ethiopia has more than 400 coffee exporters, 395 coffee farmers who directly export coffee, and over 30 import-export companies who export coffee and use the foreign currency to import other materials like vehicles and construction inputs. Ethiopia exports coffee to over 60 countries. Based on the coffee export data in 2017/18, the principal export markets for Ethiopian coffee were: Germany (22 %), Saudi Arabia (16 %), United States of America (11%), Belgium (7 %), Sudan (6 %) and Italy (5 %) (Coffee Annual Report, 2019).

2.4.4 Coffee marketing in Ethiopia.

According to Ministry of Trade (2012), there are three coffee marketing chains in Ethiopia that gives options for the producers to supply their product in to the market. These are primary level, Ethiopian Commodity Exchange and international coffee market chains.

- Primary Level Coffee Transaction Centers (PLCTC).

Located near to coffee farms where coffee farmers and suppliers buy and sell coffee. Farmers can take their product to the primary market in order to sell for suppliers (Aqrabis) and primary cooperatives. Now days there are about 1903 primary coffee marketing coffee marketing centers in the country (UKEssays. 2018)

- Ethiopian Commodity Exchange (ECX).

This is the secondary level of the chain where coffee is transacted. If farmers have more than 30 bags of coffee they can directly supply the coffee to the ECX. The functions of ECX are to receive all arrival coffee from suppliers, producers and cooperatives; undertake arrival coffee liquoring; grading and warehouse service; carry out coffee exchange between suppliers and exporters; and submission of sold coffee to exporters. There are currently ECX warehouses located at 8 different places of the country which are Dire Dawa, Hawasa, Dilla, wolayita sodo,

Bonga, Jimma, Bedele and Gimbi. Trading is carried out by open outcry at the ECX in Addis Ababa.

- International Coffee Market

The third level where Ethiopian coffee transacts takes place. In this level, the Exporters sell coffee to importers. In Ethiopia, only the citizens export green coffee. According to (Tenkir 2016) Coffee improvement opportunities related to market growth of specialty coffee industry and wide range of market options, diverse coffee consumers preference, modern marketing system, trade marking and licensing initiative, natural resource richest Arabica coffee gene pool, diverse agro ecology with unique quality profile, associations Active role cooperatives coop, Proclamation updates on coffee quality and marketing systems. We can export coffee to the international market in three ways. The first is producers supply their coffee though primary market suppliers (Aqrabis) or directly supply to ECX and exporters buy from Aqrabis at ECX, and then sell to the international market. The second is producers supply coffee to their primary cooperatives at primary coffee transaction centers, primary cooperatives to cooperative unions, cooperative unions directly sell to international market. The last way is producers directly supply to international market.

2.5 Empirical Literature

2.5.1. Determinants of Farmers' Participation in Production and Marketing of coffee.

Cadot(2006) demonstrated that private asset accumulation is a prerequisite for smallholders' graduation from subsistence production. The author suggests that one possibility for farmers to accumulate private assets is to enter into cash cropping. And investment in public infrastructure such as roads, and information communication facilities are the major determinants of participating in coffee productions.

Fethi. Omer and Dr.K.venugopal (2016) argues that high costs related to purchasing food on the market make cash crop such as coffee production unattractive, despite higher returns of cash crops on the farm. The authors suggests so that, it is economically unviable to replace food crop production with cash crop production in this cases. Thus, according to the author food

security condition is the one possible factor in limiting smallholder farmers to produce any cash crops, coffee. Similarly, Boughton et al (2007) argued that the main challenge and constraint factor for farmers' to participate in coffee production is the low productivity in food crop production and its market failure. According to these authors, as farmers have access to secure their food demand they are most likely to participate in production of market-oriented crops.

It is generally expected that farmer's decision to cultivate a given coffee can be influenced by factors including household characteristics; economic factors (including the crop profitability and market availability); institutional factors (e.g. availability of extension, inputs and credit services); and environmental factors that involve the crop's compatibility to existing climate, soil, disease and pest conditions (Lukanu et al., 2004).

Tamiru Derese (2016) studied the determinants of coffee export supply by taking coffee arrival as dependent variable. The study uses time series data collected from different institutions mainly from national bank of Ethiopia. He employs vector autoregressive and vector error correction model .The study includes world price of coffee, producer price and rain fail, credit access, extension service, Gross Domestic product and real exchange rates as the explanatory variables of the model. The major findings of the study indicates that world price and producer price of coffee affects coffee production negatively their price elasticity was -1.62 and 0.69 respectively. The impact of rain fall is significant in both short run and long run .However, credit access and extension service are insignificant in the long run but significant in the short run .The study also indicates gross domestic product and real exchange rate does not have any impact on the export supply of coffee. Finally he recommends that providing of credit access and extension service at each woreda for coffee farmers are supposed to prove significant effect on export supply of coffee.

Marcia (2006) studied about four countries production of coffee the data shows that the average coffee yield in Vietnam (2733kgs per ha), Guatemala (970 kgs per ha), Honduras (627 kgs per ha) and Nicaragua (452 kgs per ha). These differences observed in coffee yield can be attributed to three factors (1) the types of coffee that is cultivated by Central American countries (primarily Arabica) and Vietnam (primarily Robusta); (2) organic vs.

conventional production; and (3) differences in input use and tree age. Technical efficiency scores indicate that the mean technical efficiency score for all is 0.72, which implies that the production, on average, is about 28% below the frontier. This means that a considerable amount of output, on average, was missed due to technical inefficiency or that inputs were not at their optimal levels. The technical efficiency estimates varied from 8%-92%. Results from the inefficiency model reports that small farm size was a reason for inefficiency in coffee production. In addition, it was found that labor and organic fertilizer were factors for inefficiency, implying that, more used of this input the less technically efficient farmers are. However these variables were not significantly different from zero. All parameter estimates have the expected signs. Labor, tree age, pesticide, chemical and organic fertilizer all are positively correlated with yield. According to Marcia (2006), the elasticity of yield with respect to labor is 0.33. This means a 1% increase in the level of labor is associated with a 0.33% increase in yield. In addition, the contribution of pesticide to yield is 0.07, indicating that a 1% increase in the amount of pesticide is correlated with a 0.07% increase in yield. Furthermore, the contribution of chemical fertilizer to yield is 0.09. This means that a 1% increase in the amount of chemical fertilizer is correlated with a 0.09% increase in yield. These input elasticity's show that yield is sensitive to changes in Input levels for labor, pesticide, and chemical fertilizer. This suggests changes in input prices could affect yield by changing the incentives for input levels.

In general, the bodies of literature suggest that, increased productions of crops for markets are both an inevitable feature of rural development and essential in the countries where agricultural sector was believed to support the general economic development in these countries. This part of literature evidences the accompanying greater productivity and higher household incomes as a sign of such development benefit from coffee production by farmers. This evidence suggests that in many cases small-scale coffee cropping is both technically and economically efficient.

Here, in this thesis I was more focus on house hold level of farmers to show the determinants which are obstacle to the farmers to decide production participation of coffee, to increase level of coffee production participation and especially the marketing in

the study area. The researcher was not depending much on secondary data rather depends on cross sectional primary data. In addition, the researcher used double hurdle econometrics model and including additional explanatory variables to address the determining factors of farmers' decision to coffee production, extent of coffee production participation and marketing in Limmu Kossa Woreda.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter describes specific procedures that the researcher anticipates adopting for his thesis. In other words, this section succinctly articulates specific procedures for addressing the research problem. This chapter introduces the study area, research design, and methodology of our research.

3.1 Description of the Study Area.

The study area Limmu kossa woreda is found in Jimma zone of oromia regional state and it's located in northwest direction 75km far from jimma town and 410 km distance from Addis Ababa. The woreda is one of the most coffee producing woreda in Jimma zone. The woreda is geographically located between 70 50' to 80 36' North and 360 44' to 370 29' East (ORG, 2003). The total surface area of the district is 1355 km2. Agro-climatic condition of the district comprises of highland (25%), midland (65%) and lowland (10%) with annual rain fall varying between 1200 to 2000 mm and altitude ranging between 1450 to 1950 meters above sea level while annual temperature is 10oC to 25oc (MOARD, 2018).

Limmu Kossa is bordered on the south by kersa on the southwest by mana, on the west by Gomma, on the northwest by Didessa River which separates it from the Buno Bedele zone, on the north by limmu sekka. Limmu Genet is the administrative town for Limmu kossa wordea (Jimma zone Agricultural and Rural development Office 2008). Based on the figures published by the central statistical agency in 2005, this woreda has an estimated total population of 254,911, of whom128770 are men and 126,141 are women; 19,932 or 7.82% of its population are urban dwellers (CSA 2005) but according to agricultural survey result done by Central Statistical Agency jimma branch 2019, the current population is estimated to be 387,694. The average land holding size per house hold is 2.39 hectare out of which 24.6% is covered with annual crops.

A survey of the land in this woreda shows that 34.7% arable or cultivable, 20% pasture, 39.7% forest and the remaining 15.4% are considered degraded or built-up areas. Fruit, coffee and sugar canes are important cash crops produced by this woreda (MOARD, 2018).

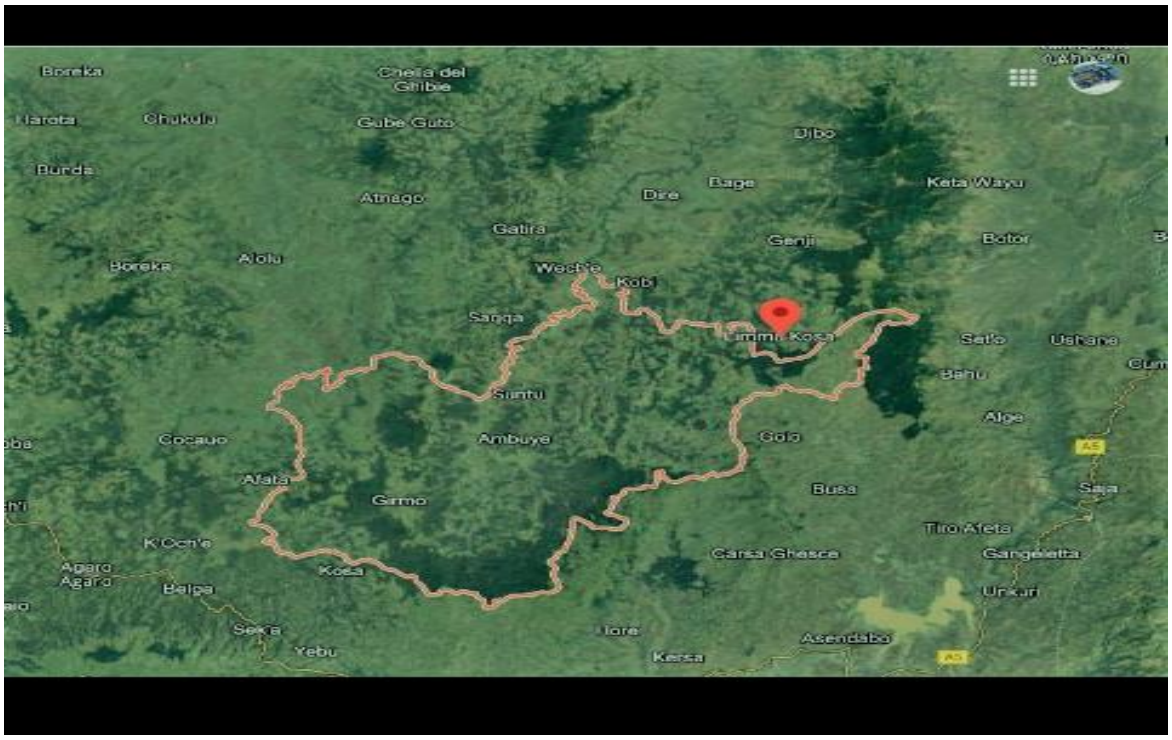

Figure 3. 1 Map of Limmu Kossa Woreda (Google Map)

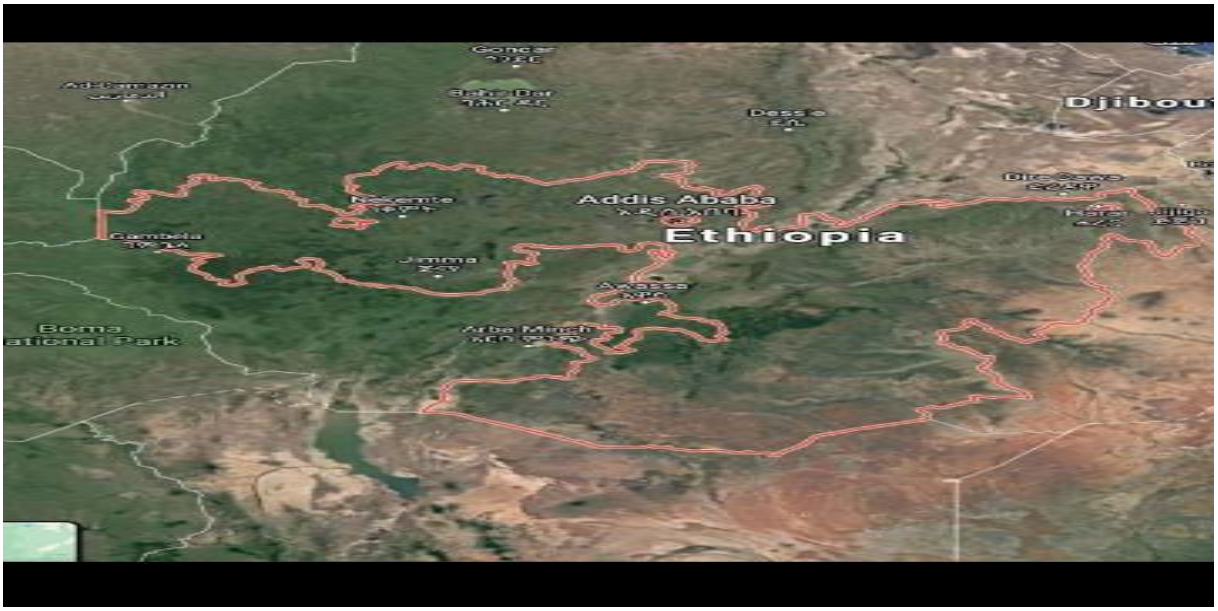

Figure 3.2 Map of Oromia Regional State (Google Map)

3.2 Data Type and Source.

To obtain information on the socio economic condition of the households in the woreda Primary data was collected through structured questionnaires. The households were interviewed by using structured questionnaires. The data were both quantitative and qualitative types. The factors that

contribute to farmer's demands to participate in production were analyzed by using qualitative methods. Quantitative research methods are used to measure demographic characteristics (age distribution, family size) and others. Therefore both quantitative research method and qualitative research methods are jointly used for this research.

3.3 Population of the Study

Populations were defines statistically as the study of all subjects having certain common characteristics that are being studied. It is the collection of units or elements under investigation which consist of specified type of objects over a given space and time the woreda has currently 44 Kebles and from these kebeles 30 kebeles are coffee producers (LKWAO, 2020). Out of those 30 coffee producing kebeles; 5 kebeles are selected using simple random sampling. The populations of this research are the number of households in these five coffee producer kebeles.

3.4 Sampling design

3.4.1 Selection of the study sites

The study was conducted in Limmu kossa, Jimma Zone in Oromiya Regional State, Ethiopia. This Wereda was purposefully selected based on conditions of its agro-ecological suitability for the selected crop (coffee). To select representative study sites within the Wereda, use of administrative units will be necessary. And the smallest administrative unit in the Wereda is locally called Ganda, which means Peasant Association (PAs) or Kebele. The selection of these Kebeles was approached based on their agro-ecological locations. Because of time and financial constraints reaching all coffee producer kebeles of Limmu Kossa is practically impossible. The 30 coffee producing kebeles are located at the same climatic condition (mid land or woynadega) agro ecological zone of the woreda. To select the representative kebeles, we used simple random sample selection method and five kebeles out of thirty will be selected.

3.4.2 Selection of respondents

To identify the representative household heads, list of households from each kebele Agricultural and Development Office was used as sample frame and sampling points are selected by using systematic random sampling method.

3.4.3 Sample Size

The sample is determined using the minimum sample size formulae of Fowler (2001) cited by Meneyahel (2015) given by the following formula.

$n_0 = \frac{z^2 pq}{e^2}$ ---------- (3.1)

Where = n_0 required return sample size according to Cochran's (1977) formula

e= the level of risk the researcher is willing to take that true margin of error may exceed the acceptable margin of error 0.06^2.

z = standard error associated with the chosen level of confidence 94 percent (1.88).

P=sample proportion in a population house hold participation in coffee production and house hold with non-participating in coffee production

Based on the above formula, the sample size becomes:

Table 3.1.Sample size of each Kebele

No	Name of Kebele	Total house hold in the Kebele	Participants of coffee production	Non Participants
1	Chako	814 Households	492	322
2	Mendera	756 Households	420	336
3	Tenebo Lalo	827 Households	478	349
4	Dora Gabena	946 Households	522	424
5	Mito Gundib	693 Households	384	309
Total		4036 Households	2296	1740

P=$\frac{2296}{4036}$ = 0.57 and q=1-0.57=0.43

n_0 =$\frac{1.88^2}{0.06^2}$*0.57*.43=240

The sample will be determined by the following formula:

$$n=\begin{cases} n_o & if \quad \frac{n_o}{N}<5\% \\ \frac{n_o}{1+\frac{n_o}{N}} & if \quad \frac{n_o}{N} \geq 5\% \end{cases}$$

Then since $n_o > 5\%$ we use $n=\frac{n_0}{1+\frac{n_0}{N}}$

This sample size then can be adjusted to final sample size by considering the total target population of the study area. Therefore, Cochran's (1977) formula should be used to calculate the final sample size by considering the total target population (Glenn, 2013). These calculations are as follows

$n= \frac{n_o}{1+\frac{n_o}{N}}$---------- (3.2)

Where, N= total number of the target population of the study area, n_0= required return sample size according to Cochran's (1977) formula=240, and n= the final sample size.

The total sample size for the study areas becomes: $n= \frac{240}{1+\frac{240}{4036}} = 228$

3.5 Model Specification

3.5.1. Method of Data Analysis and Respective Empirical Models.

Different methods can be employed to analyze farm household decision problem. One approach to analyze the issue is to use the well-known Tobit model. However, Tobit model assumes that both the decision to participate in activity and the level of participation are determined by the same variables and with the same sign (Wooldridge, 2002). That is, according to Tobit model, the decision to participate in production of a certain crop and the intensity of production participation are jointly determined and influenced by the same parameters. This is the main limitation of the Tobit model in which it restricts variables and coefficients in the two decisions (production participation and the level of participation decisions) to the same sign (Wooldridge, 2002). That is why recent empirical studies have shown the inadequacy of the Tobit model in cross-sectional analysis, stressing the relevance of alternative approaches. The appropriate approach is to use the double-hurdle model. This model assumes farmers faced with two hurdles in any agricultural decision making processes (Cragg, 1971; Sanchez, 2005; R.Humphreys,

2010). Accordingly, the decision to participate in an activity is made first and then the decision regarding the level of participation in the activity follows. In this study, thus, double-hurdle model was chosen because it allows for the distinction between the determinants of production participation and the level of participation in coffee production through two separate stages. This model estimation procedure involves running a probit regression to identify factors affecting the decision to participate in the activity using all sample population in the first stage, and a truncated regression model on the participating households to analyze the extent of participation, in the second stage. In our case, we will apply the first stage of double hurdle model to examine the factors determining the decision to participate in coffee production and it is analyzed by the means of probit regression.

According to Burke (2009), double hurdle model is useful because it allows a subset of the data to pile-up at some value without causing bias in estimating the determinants of the continuous dependent variable in the second stage, hence you can obtain all the data in the remaining sample for the participants (Burke, 2009).Thus, in double hurdle model, there are no restrictions regarding the elements of explanatory variables in each decision stages. That means it is possible to separately analyze the determinants of production participation decision and the level of participation decisions. Due to this separablity, the estimates of production decisions can be obtained by a means of probit regression and that of the level of production participation decision can be analyzed by use of a truncated regression. The log-likelihood function for the double hurdle model that nests a probi tmodel and a truncated regression model is given following Cragg, (1971) by:

$$\log L=\sum_0 ln[1-\Phi(x_{1i}^{i}\,\alpha_1)(\frac{x_{2i}^{*}}{\delta}\alpha_2)] +\sum_+ ln[\Phi(x_{1i}^{i}\,\alpha_1)\frac{1}{\delta}\,\emptyset(\frac{y_i-x_{2i}^{*}}{\delta}\alpha_2)]\text{---------}(3.3)$$

Where “0” indicates over the zero observations in the sample, while “+” indicates summation over positive observation, logL represents log likelihood function Φ and ∅ refer to the standard normal probability and density function respectively, x^*_{1i} and x^*_{2i} represents independent variables for the probit model and the truncated model respectively, y_i is dependent variable, α_1, and $\alpha_2$are parameters to be estimated for each model is the variance of error terms. .The first portion is the log likelihood for a probit, while the second portion is the log-likelihood for a truncated regression, with truncation at zero value of the continuous dependent variable in the

second stage (the amount of coffee produced in the survey year, in our case). A hypothesis test for the double hurdle model against the Tobit model was examined.

The likelihood ratio test statistics r =-2[$\ln L_T$ - ($\ln L_p$ + $\ln L_{TR}$)] ~ X^2 k ---------- (3.4)

Where LT is the likelihood for Tobit model; LP is the likelihood for the Probit model; LTR is the likelihood for the truncated regressions model; and k is the number of independent variables in the equations.

If the test hypothesis is written as, Ho $\lambda=:\frac{\beta}{\alpha}$ and H1 $\lambda\neq:\frac{\beta}{\alpha}$, Ho is rejected on a pre-specified significance level, provided $\mathbf{r>X^2k}$, confirming the superiority of the double hurdle specification over the Tobit model .In such a cause, the decision to state a positive value for farmers participation in production and the level of participation in production(Greene 2003).

Based on the above backgrounds, the linear probit model can be specified as follows:
$\boldsymbol{y^*=\beta_1 x_i + \varepsilon_i}$
Y=1 if y^*>0 and Y=0 if other wise

$$P(Y=1) = \boldsymbol{\beta_0 + \beta_1 x_i + \varepsilon_i} \text{---------- (3.5)}$$

Where Y is the probability of an individual farm household to participate in coffee production, βi is the vector of parameters will be estimated, Xi is the vector of explanatory variables expected to influence the participation decision probability and is the error term. Probit model specifies the functional relationship between the probability of participating in an activity (coffee production in our case) and the list of various explanatory variables thought to influence the participation decision. These factors can be either continuous or discrete explanatory variables. Therefore, the reduced functional relationship between the binary dependent variable (producing coffee or not) and a list of explanatory variables for the empirical analysis of the current study can be specified as follows using basic probit model specification.

Pr(PRODPART(y)=1)=
$\boldsymbol{\beta_0}$**+**$\boldsymbol{\beta_1}$**(sex)+**$\boldsymbol{\beta_2}$ $(\boldsymbol{age})$ **+**$\boldsymbol{\beta_3}$**(ednlvl)+** $\boldsymbol{\beta_4}$**(activemem)+** $\boldsymbol{\beta_5}$**(landsize)+** $\boldsymbol{\beta_6}$**(accesscredit)+** $\boldsymbol{\beta_7}$**(nonfarm)+** $\boldsymbol{\beta_8}$**(foodsuff)+** $\boldsymbol{\beta_9}$**(extnservice)+** $\boldsymbol{\beta_{10}}$**(nearmarket)+** $\boldsymbol{\varepsilon_i}$**----------(3.6)**

Where Pr - is the probability at which an individual household participate in coffee production represent by (PRODPART=1) and (PRODPART= 0) otherwise.

The dependent variable PRODPART=1 if a household participates in coffee production and PRODPART=0, if not

The explanatory variables, x_1=sex of household head, x_2= age of household head, x_3=education level of household head x_4= number of working family member, x_5= land size of household, x_6= access to credit service of household, x_7= participation in non-farm activity, x_8= food sufficiency of households all over the year, x_9= access to extension service of households, x_{10} = distance to the nearest market.

$\boldsymbol{\beta_i}$ `s – Are the regression parameters, $\boldsymbol{\varepsilon_i}$is the error term .The regression parameters estimated by maximum likelihood technique.

As noted in Wooldridge (2002), the estimated coefficients from probit regression give the signs of the partial effects of each *Xi* on the response probability (dependent variable). For the continuous explanatory variables, these marginal effects give partial effects of these variables at the sample means. While for the discrete or categorical variables, the marginal effects are used to calculate percentage changes in the dependent variable when the variable shifts from zero to one, ceteris paribus (Newman et al., 2003)

In the second stage of double-hurdle model the researcher examined factors affecting the level of coffee production, conditional on participation decision, which implemented using the truncated regression analysis. Thus, it involves the truncated regression that can

$$\mathbf{Q^* = \beta_0 + \beta_1 z_i + u_i}$$

Q= Q* if Q* > 0 and **y=1**

Otherwise Q=0,

From this, we can specify the reduced form of the truncation model as:

$$Q = \mathbf{\beta_0 + \beta_1 z_i + u_i} \text{ ---------- } \mathbf{(3.7)}$$

Where Q - the observed quantity of coffee produced, Q* is the latent variable which indicates the level of coffee production is greater than zero, βi is the vector of parameters to be estimate, Zi- is

the vector of exogenous explanatory variables and U_i is the error term. The empirical model used in this study assumes that the total quantity of coffee produced in the survey production year (2019/2020) is a linear function of continuous and dummy explanatory variables and is specified as follows:

$$Q = \boldsymbol{\beta_0}+\boldsymbol{\beta_1}\textbf{(sex)} + \boldsymbol{\beta_2}\textbf{ (ednlvl)} + \boldsymbol{\beta_3}\textbf{ (landSize)} + \boldsymbol{\beta_4}\textbf{ (activememb)} + \boldsymbol{\beta_5}\textbf{ (accescredit)} + \boldsymbol{\beta_6}\textbf{ (pastexp)} U_i \textbf{ ---------- (3.8)}$$

Where

The dependent variable (Q) – is the quantity of coffee produced in 2019/2020 production year.

The explanatory variables,

x_1=sex of household head, due to cultural influences and gender related issues if a household head is male, there will be positive relationship with intensity of production.

x_2= education level of household head, producers with higher levels of education tend to have greater access to production and market information; there is positive association between education level and level of production.

x_3= land size of household, the researcher expects that a household who holds a greater farm land are more likely to produce coffee and allocates a significant size for its production. Farm size positively affects farmer's level of coffee production.

x_4= number of working family member, family labor is the main source of labor and it is expected that there will be positive relation level of production participation.

x_5= access to credit service of household, farmers who have adequate access to credit service are expected to increase their production.

x_6= past experience, Participation of farmers in coffee production during last production years is expected to positively affect farmer`s level of participation in coffee production as it enhances their experience.

$\boldsymbol{\beta}_i$ `s – are the regression parameters, U_i is the error term.

Finally, the third objective of the present study can be achieved by defining the amount of income earned from coffee sale as a linear function of continuous and binary explanatory variables. The intention here is to identify important factors that determine households' income which is generated from coffee sale in this area. This can be analyzed by using the truncated regression model, because the dependent variable in this case has many observations at zero. And as noted in Pindyck and Rubenfeld (1991), analyzing such problems using an OLS method would yield biased and inconsistent results (ibid). Due to this we might force to exclude non producer farmers from the analysis, because the value of dependent variable (the amount of income earned from coffee sale) is zero for non-producer farmers. Therefore, by using the truncated regression model, we can account for these zero observations; hence this model provides a more accurate estimation (Wooldridge, 2002). Thus, the truncated regression model is chosen and takes the following specification:

$$y^{*} = \beta_0 + \boldsymbol{\beta}_i \boldsymbol{w}_i + \boldsymbol{v}_i$$

$y_i = y_i^{*}$ if $y_i^{*} > 0$ or 0 otherwise

$$y_i = \beta_0 + \boldsymbol{\beta}_i \boldsymbol{w}_i + \boldsymbol{v}_i \text{----------(3.9)}$$

Where Yi* is the unobserved latent variable; Yi is the actual observed outcome (the level of income generated from coffee sale); βi is the vector of parameters, W_i is the vector of explanatory variables and V is the error term.

The empirical model assumes that total farm income earn by a farm household from agricultural product sales is a linear function of continuous and discrete independent variables and is specified as follows:

$$yi = \beta_0 + \beta_1(\text{nearmarket}) + \beta_2(\text{qtymarketd}) + \beta_3(\text{Time of coffee sells}) + \beta_4(\text{mrktinfo}) + \beta_5(\text{coffeeprice}) + V_i \text{----------(3.10)}$$

Where Yi– is the household income generated from coffee sales (INCOME)

The explanatory variables, x_1= distance to the nearest market, x_2= quantity marketed in quintal, x_3=selling time of coffee after harvesting x_4= access to market information of households, x_5= price gained from coffee sales.

βi's – are the parameters and Vi-error terms.

3.4. Statistical and Specification Tests

Before executing the final model regressions, all the hypothesized explanatory variables will be checked for the existence of statistical problems such as multicollinearity problems. Basically, multicollinearity may arise due to a linear relationship among explanatory variables and the problem is that, it might cause the estimated regression coefficients to have wrong signs, smaller t-ratios for many of the variables in the regression and high R^2 value. Besides, it causes large variance and standard error with a wide confidence interval. Hence, it is quite difficult to estimate accurately the effect of each variable (Gujarati, 2004;Woodridge, 2002).

There are different methods suggested to detect the existence of multicollinearity problem between the model explanatory variables. Among these methods, variance – inflating factor (VIF) technique is commonly used and is also employed in the present study to detect multicollinearity problem among continuous explanatory variables (Gujarati, 2004). In Gujarati (2004) it was defined that VIF shows how the variance of an estimator is inflated by the presence of multicollinearity.

According to Gujarati (2004), the larger the value of VIF indicates the more co linearity among one or more model explanatory variables. As a rule of thumb, if the VIF of a variable exceeds 10, which will happen if a multiple R-square exceeds 0.90, that variable is said be highly collinear (Gujarati, 2004).

VIF=$\frac{1}{1-r_{xz}^2}$ ---------- (3.11) where r^2 is coefficient of determination between variables x and z.

With zero correlation between variables x and z, VIF equals 1. A value of VIF greater than 10 indicates the problem of multicolinearity.

Alternatively, we can use the inverse of VIF (1/VIF) called Tolerance as a measure of multicollinearity. The closer is tolerance of one explanatory variable (Xi) to zero, the greater the degree of co linearity of that variable with the other regressors. On the other hand, the closer tolerance of Xi is to 1, the greater the evidence that Xi is not collinear with the other regressors (Gujarati, 2004).

Similarly, contingency coefficient (CC) method was used to detect the degree of association among dummy explanatory variables (Healy, 1984). According to Healy (1984), the discrete/dummy variables are said to be collinear if the value of contingency coefficient (CC) is greater than 0.75.Mathematically:

$$\mathbf{CC}=\sqrt{\frac{X^2}{n+X^2}}\text{---------- (3.12)}$$

Where

CC-is contingency coefficient n- is sample size X^2-is chi-square value

Finally, the double hurdle model can be tested against the Tobit model using a standard likelihood ratio test, as the Tobit model is nested in the double hurdle model (Humphreys, 2010). To do so, let LLDH is the log likelihood value from the double hurdle model (which is the sum of log likelihood values from Probit and Truncated regressions) and LLT is the log likelihood value from the Tobit model. Then the likelihood ratio test can be carried out as follows: LR = -2 (LLDH - LLT) and the test statistic has a X^2 distribution with degrees of freedom.

Variable Description and their Expected Signs

Dependent variables

Production participation decisions (prdnpatcpn)

This is a binary dependent variable taking value "1" if the farmers participate in coffee production and "0" otherwise.

Amount of coffee produced in cropping season (coffeeprod)

This is a continuous dependent variable and measure in terms of quintal. The researcher used this variable as dependent variable to analyze factors that influence the extent to which farmers decide to produce coffee (the level of production participation, based on the decision to produce the crop) by using truncated regression.

Income generated from sale of coffee (totalinc)

This variable is a continuous dependent variable to analyze factors that determine the income farmers generate from sale of coffee. This allows the researcher to identify those factors that explain the marketing of the coffee in the study area.

Independent variables

Total farm size in hectare (landsize)

Land is one of the major and the key asset for rural household farmers everywhere. Thus, the decision made by any household is basically and highly influenced by their land holding size. Thus, the researcher expects that a household who holds a greater farm land are more likely to participate in coffee and allocates a significant size for its production. Farm size positively affects farmer's participation in coffee production.

Sex of household head (sex)

This is a discrete variable that takes a value of "1" if the household head is male and "0", otherwise. In this study, due to cultural influences and gender related issues, it is assumed that male household heads have more exposure and access to information and new interventions than female household heads, which might enable them to participate in production of coffee. Thus, male household head expected to participate more than female household heads.

Age of household head (age)

This is a continuous variable and defined as the number of years of household head age. In this study it is assumed that as age increases farmers would acquire knowledge and experience through continuous learning which help them to actively participating in production of market-

oriented cash crops. Thus, in this study this variable will use as a proxy for farmers experience in farming.

Educational level of household head (ednlvl)

It is generally recognized that education equips individuals with the necessary knowledge of how to make living. Thus, for the purpose of this study, we believe that those who are literate and have at least some education are better able to make the transition to cash crops. This is so because it is believed that producers with higher levels of education tend to have greater access to production and market information, hence expected to produce market-oriented cash crops.

Number of active family labor (activemember)

Family labor is a continuous variable referring to farmer's access to family labor. We consider a family labor as active if it can participate in the household agricultural activity. Thus, this variable is expected to positively affect the decision probability to produce coffee and its quantity. This is because coffee is a labor intensive crop, thus requires high labor and in these rural areas there is no employed labor. Thus, family labor is the main source of labor and it has positive effect on both farmer's participation and level of production participation.

Access to Credit (accescredit)

Credit access is a dummy variable, which takes value 1 if farmers have access to credit service and 0 otherwise. Since production of any cash crop requires capital which is scarce to most smallholder farmers, it importantly explains farmers' decision to produce coffee. Coffee especially requires sufficient finance throughout its production processes, farmers who have adequate access to credit service are expected to produce market oriented cash crops like coffee.

Food sufficiency for the whole year (foodsuff)

Smallholder farmers in developing countries are always prone to participate in production of cash crops if they could produce more family foods only. This is because these farmers first want to secure foods for their family. Thus, if farmers have potential and experience in producing sufficient family food for the whole year, such farmers are more likely to participate in production of cash crops such as coffee in the study area.

Household's access to off-farm activities (nonfarm)

Off-farm activity is a dummy variable indicating farmer's access to it. If farmers have access to alternative works to farm income sources they are less likely to participate in coffee production. On the other hand, since coffee production requires high working capital it is argued that farmers, who have access to non-farm activities and generate additional income, are likely to produce high value cash crops such as coffee. Therefore, the impact of this variable on farmers' decision in coffee production participation is inconclusive.

Access to extension service centers (accesscredit)

Access to extension service is a dummy variable, which takes value 1 if farmers have access extension service and 0 otherwise. Proximity to such service center is expected to enable regular contacts with agricultural experts, hence motivate to produce coffee.

Traveling time to the nearest market place (nearmrkt)

This is a continuous variable represented by walking time (in hour) from home to the nearest market place. Closeness to market centers may motivate farmers to produce market-oriented crops as it provides easy access to inputs, transport facilities and price externalities. Therefore, closeness to market place is expected to be positively correlated with farmer's participation in coffee production.

Farmer's experience on coffee production (pastexp)

This is a discrete variable used to account for farmers' experience in coffee production. Participation of farmers in coffee production during last production years is expected to positively affect farmer`s level of participation in coffee production as it enhances their experience.

Access to market information (marketinfo)

This is a dummy variable taking value 1 if farmers have access to price information by any means, and 0 otherwise. Market information highly influences commodity production, and hence has a significant impact on income earning. Therefore, it is hypothesized that access to price information positively affects the income earn from coffee sale in the study area.

The quantity of coffee marketed (qtymrktd)

This is a continuous variable referring the amount of coffee marketed in the specified year measured in quintal. Quantity marketed is one of the major and key factors in determining the amount of income received by farmers. Even, sometimes this alone determines the amount of income generated from agricultural sale. However, in this study the researcher assume that this variable alone cannot be considered as the determinant of income farmers are receiving from coffee sale, because there are also other factors that determine their income. Whatever the case, the researcher expected positive and significant result for this particular variable.

Market price of coffee (mrktprice)

Own price of coffee is continuous variable and expected to be positively related with income obtained from coffee and farmers production participation as well. It is because farmers' supply of coffee and their participation on production will depend on its price.

Time of selling (immidiate, onmnth, twomnth,)

This is also a categorical variables indicating the time in which farmers sell their produce. These categorical variables allow us to understand the role of time in which farmers sell in explaining the price they charge and hence income they earn. Thus, the researcher expected that these variables explain the income farmers earn from coffee sale.

Table 3.2 The description and expected sign of farmer`s participation in production and marketing of coffee cash crop.

NO	Variable Name	Description of Variables	Measurement	Expected sign
1	Total farm size(landsize)	Household total land hold size	Continuous variable , measured in hectare	+
2	Sex of house hold (sex)	Household head of a farming	Discrete variable and measured as (1= male headed household, and 0	+

		family	otherwise)	
3	Age (age)	Age of the household	Continuous variable, measured in years	+
4	Education(edcnlvl)	House hold level of education	Continuous variable, measured in education level	+
5	Active family labor(activefam)	Number of active family labor	Continuous variable, measured in number	+
6	Access to credit (accescredit)	Access to credit market	Dummy variable, measured as(1=access to credit, and 0 otherwise)	+
7	Food sufficiency (foodsuf)	Availability of family food for the whole year	Dummy variable, measured as(1=available family food produce, and 0 otherwise)	+
8	Off-farm activity(nonfarm)	Household`s access to off-farm activity	Dummy variables and measured as(1= farmers participation in off farm business and 0 otherwise)	-/+
9	Access to extension service(extnsrvice)	Access to extension services	Dummy variable measured (1=yes, 2=no)	–
10	Farmer's experience on coffee produ (pastexp)	experience on coffee production	Dummy variable and measured as(1= produce coffee last two years 0 otherwise)	+
11	Traveling time to the market(nearmrkt)	Traveling time to the nearest market	Continuous variable measured in minute	–
12	Access to information(mrktinfo)	Access to market information	Dummy variable measured as(1=farmers have market price information and 0 otherwise)	+
14	Quantity of coffee	The quantity of	Continuous variable measured in	+

	marketed(qtymrktd)	coffee marketed	quintal	
15	Market price (coffeprice)	Market price of coffee	Continuous variable measured in ET Birr	+
16	Time of selling (immediate Onemnth twomnth)	Time of selling	Dummy variable measured as(1=immidiate,2=onemnth, 3=two mnth,)	_

CHAPTER FOUR
RESULTS AND DISCUSSIONS

This chapter presents and discusses main findings of the study. Determinants of smallholders' decisions to participate in coffee production, the extent of production participation and the marketing issue of the crop in the study area will be presented and discussed.

4.1. Descriptive Results

4.1.1. Socio-demographic characteristics of households

Totally, 228 household heads were considered in this study. From selected households 135 (59%) were coffee producers and the remaining 93(41%) households were non-producers. Out of this 58 (25.44%) households were female headed and 170 (74.56%) were male headed. The mean age of the sampled household head was about 46.5 years; the maximum age and minimum age for household heads were 81 and 18 respectively. The average family size for coffee producers was about 6.7 persons per household, and about 3.7 persons per household for non-producer farmers. Table 4.1.1 presents summary statistics of sampled household's demographic characteristics in terms of the two sample groups.

Table 4.1.1: Demographic characteristics of households

	Producer				**Non producer**			
Varibes	Obs	Mean	Min	Max	Obs	Mean	Min	Max
Total HH size	135	6.7	3	14	93	3.7	1	9
Active family	135	4.6	3	11	93	2.08	1	5

Source: survey result, 2021

The mean number of active family labor is higher for coffee producers (4.6) and lower for non-producers (2.08).

Educational status of the household head is also an important element in smallholder economic activities. The survey result revealed that 52.19 percent of the sampled farmers never attended schooling, while 47.81 percent were literate at different levels of schooling. Among the literate farmers, majorities (about 25%) of them attended schooling below grade five and none of these farmers have attended above grade eight. Table 4.1.2 presents full information on different educational levels of sampled farmers.

Table 4.1.2: Educational level of sampled households

	Producer		Non producer		Total	
Edn level	Ferqcy	percent	Ferqcy	percent	Ferqcy	Percent
No education	73	32.08	46	20.18	119	52.19
Primary (1-4)	32	14.08	25	23.3	57	25
Primary (5-8)	26	11.40	21	9.21	47	20.6
Secondary (9-12)	4	1.75	1	0.44	5	2.19
Above 12th	0	0	0	0	0	0

Source: own survey result, 2021

4.1.2: Land ownership status of the respondents in hectare

Own survey result indicates that about 100% of respondents own their own land. The farm size of farmers varies from 0.1 to 9 hectare and the average farm size was found to be 2.41 hectare.

Table 4.1.3 Land ownership of respondents (ha)

	Producer				Non producer			
Varibes	Obs	Mean	Min	Max	Obs	Mean	Min	Max
land ownership	135	3.26	0.27	11.5	93	1.17	0.11	3.9

Source: survey result, 2021

Table 4.1.3 indicates that the mean land ownership for coffee producers was 3.26 ha which is much greater than the mean land ownership of non-coffee producers 0.88ha. The maximum land ownership for coffee producers was 11.5 hectare and 3.9 hectare for non-producers. This table

depicts that coffee producers own larger land size than non-producers, indicating may be smaller land size inhibits diversification of crops in the area.

4.1.3. Type of coffee seed used for plantation

Type and variety of coffee seed can highly influence the productivity of coffee and figure 4.1 indicated that in the study area, majority (67%) of coffee producers used traditional coffee seed. Only 33% of the respondent used improved coffee seed. From these finding we can say that average productivity of coffee was below the estimated potential because of majority of coffee producers used traditional coffee seed.

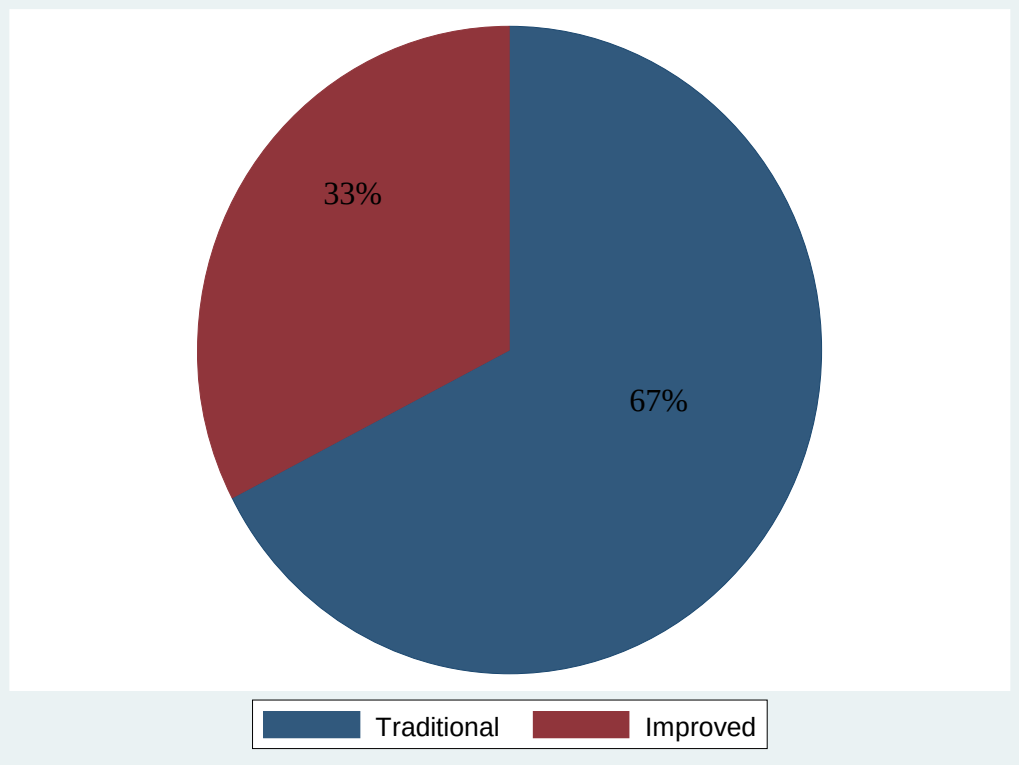

Figure 4.1 Type of coffee seed used by coffee producers

4.1.4. Livestock ownership of households.

Livestock is one of the major assets for farmers. And it is one way of indicating farmer's level of wealth in some areas of Ethiopia, since the number of livestock owned by each household is considered as the indicator of living standards in rural areas. Especially, in a mixed farming system the contribution of livestock to crop production is great. For example, livestock in the

study area (Limmu Kossa) can be used as an alternative source of income, for food, as a means of transportation and serve as a store of wealth. Oxen are the major livestock resource used in any crop production. These two resources are considered as the main influential variables in decision of farmers to produce and to what extent they can participate in any agricultural production.

Table 4.1.4 Oxen and Donkey ownership of respondents (%)

	Producer		**Non producer**		**Total**	
Number	Oxen	Donkey	Oxen	Donkey	Oxen	Donkey
0	0(%)	18.86(%)	14.91(%)	25(%)	14.91(%)	43.86(%)
1	16.23(%)	35.96(%)	24.56(%)	14.04(%)	40.79(%)	50(%)
2	30.26(%)	4.39(%)	1.32(%)	1.75(%)	31.58(%)	6.14(%)
3	4.82(%)	0(%)	0(%)	0(%)	4.82(%)	0(%)
>4	7.89(%)	0(%)	0(%)	0(%)	7.89(%)	0(%)

Source: survey result, 2021

As we can observe from table 4.1.4, 0% of coffee producers, 14.91 percent of non-coffee producers and 14.91% of the whole sampled farmers have no any oxen. Similarly, 18.86% of coffee producers, 25% of non-coffee producers, and 43.86% of the overall sampled households own no any donkey. In addition, according to the survey result, about 16.23% and 35.96% of coffee producers owns only one ox and donkey, respectively. Similarly, 24.56% and 14.04% of non-coffee producers own only one ox and donkey, respectively. This survey result also revealed that, on average, about 40.79% and 50% of the total sampled households owns only one ox and donkey respectively. Further, 30.26%, 4.82% ,7.89% of coffee producers own two, three and above four oxen respectively. However, only about 1.32% of non-coffee producers own two oxen and none of them were owned three and above four oxen.

4.1.5. Income sources of households

The survey data revealed that the major source of income for the farmers is on-farm activities (both from crop and livestock production). 26% of the respondents reported involvement in non-farm activities to generate some additional income. For the majority (70%) crop production was produced to generate income. Maize, chat and coffee are the main sources. On average,

farmers generated income birr 17629.17 from sale of coffee in year 2019/2020. On the other hand 14.9% of respondents were employed as seasonal and permanent laborers in large investments like Horizon Plantation and other private coffee producer companies.

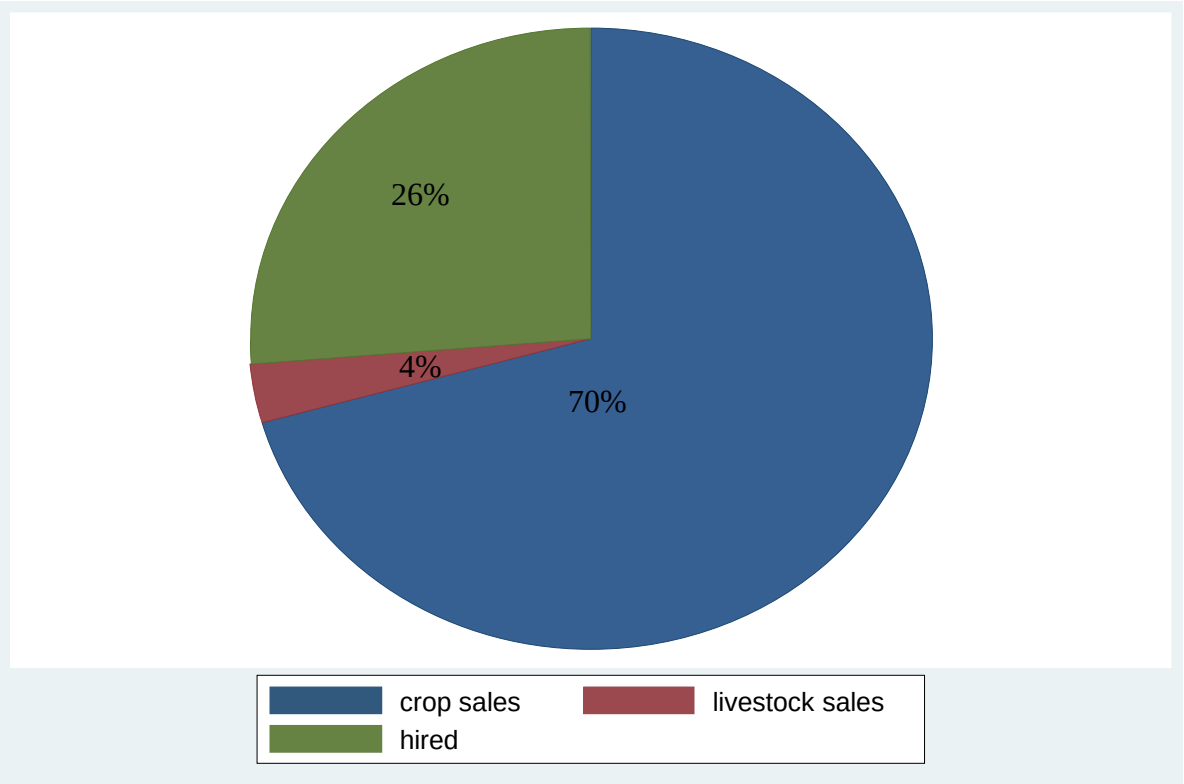

Figure 4.2 Pie Chart for Income of respondents

Source: survey result, 2021

The other possible source of cash for rural household is credit. Accordingly we asked the farmers if they have access to credit from any rural institution. From total of the respondents (exactly 32.5%) replied that they have access to credit. The remaining 67.5% answered they have no access to any credit.

4.1.6. Coffee Marketing Practices in Limmu Kosssa Woreda

The majority (99.9%) of coffee producer exchange coffee in market and about 69% sell directly to traders or purchasers at nearby markets. About 26% of coffee producers sold their produce through local collectors and the rest 5% sold their coffee sold to cooperatives.

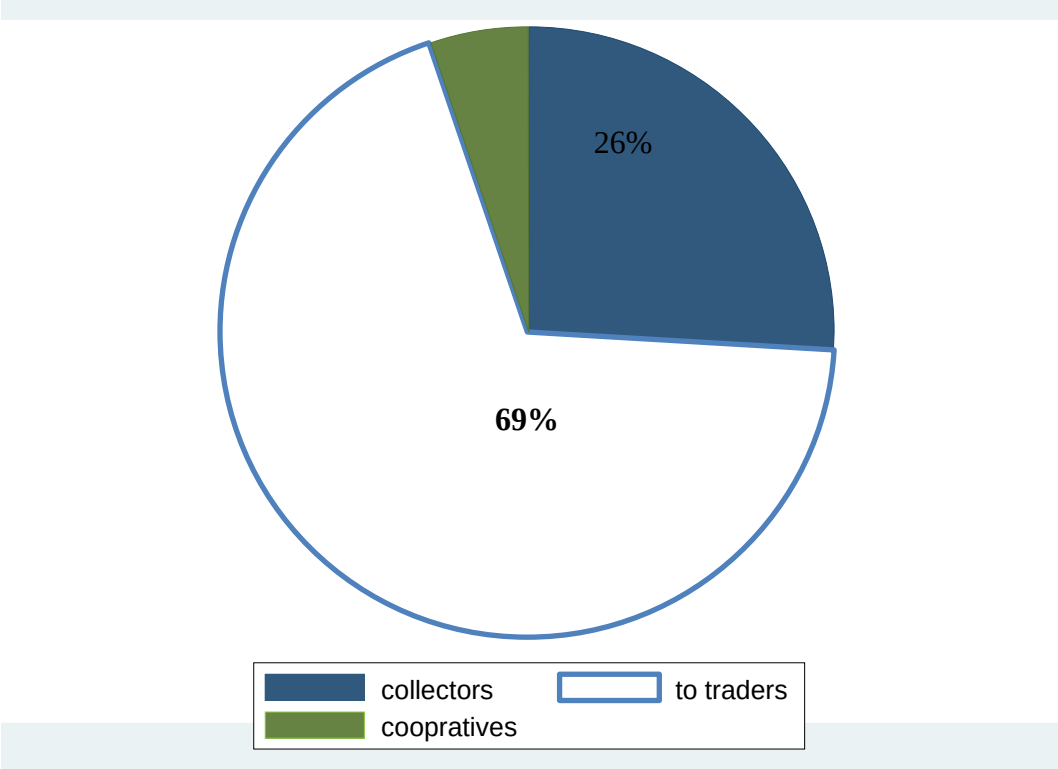

Fig 4.3 sales type of coffee producers

Source: survey result, 2021

Most farmers 54% sold their coffee produce immediately after harvest, 33% sell their produce one month later after harvest, and the remaining 13% sell two month after harvest. The reason they present is that coffee seed lost its weight and quality if it is stored at home longer and they have no well managed cemented places. Thus, they prefer to sell immediately after harvest (Table 4.1.5). The respondents also complained about existence of serious problems at market place at the time of selling their produce.

Table 4.1.5 Time of selling coffee

Sales period After harvest	ferqcy	percent	Cumm freq
immidiatly	73	54.07	54.07
after one month	45	33.33	87.41
after two month	17	12.59	100.00
Total	135	100.00	

Source: own survey result, 2021

4.1.7. Institutional Issues on Coffee Production in Lmmu Kossa Woreda

Among the institutional issues, membership status of farmers in rural cooperatives, access to different technical advisory services and access to any contractual opportunities with different bodies in production/marketing of agricultural products were assessed (Figure 4.4).

Results of the survey revealed that about 38.12 percent of the respondents were a member of local cooperatives. This percent show us large number of respondent farmers was not members of local cooperatives the reason may be lack of awareness of cooperatives. In addition, different necessary technical advisory services from agricultural extensions are also important and required by rural farmers. In this regard farmers are expecting more services from these institutions. One very important issue they raised is the problem of different diseases affecting different crops such as Coffee, maize, chat and sorghum. They are looking for immediate solutions for the problems attacking these crops.

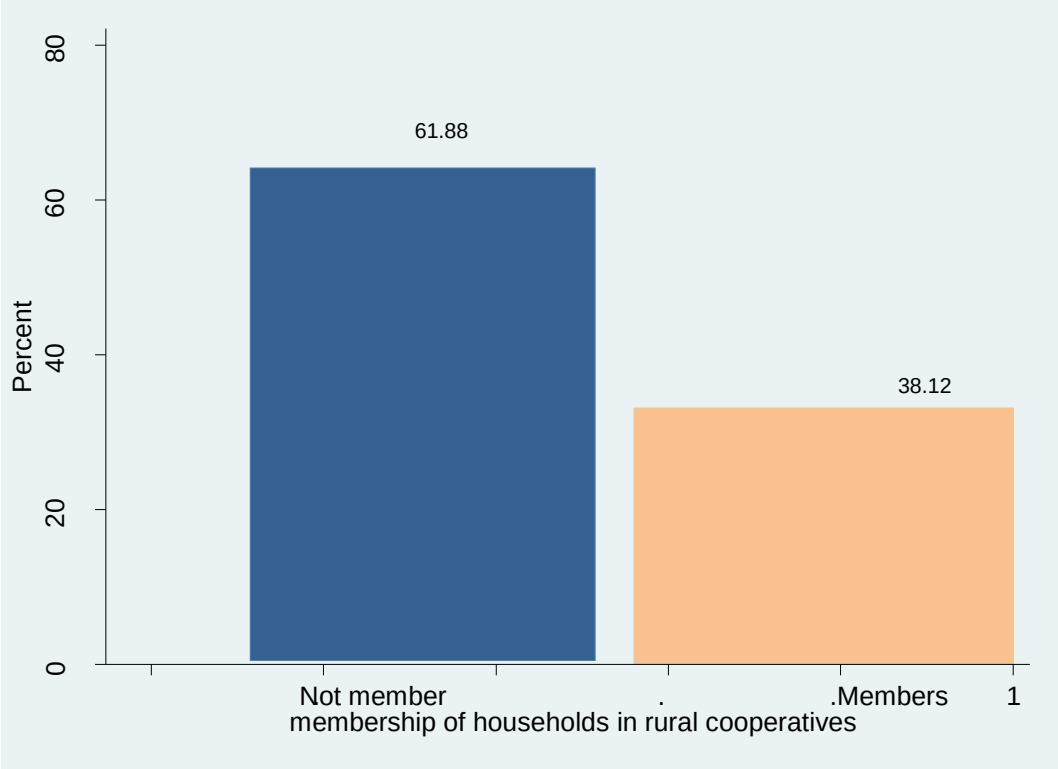

Figure 4.4 Farmers membership states of cooperatives

4.2. Econometric Results

4.2.1. Production Participation (Probit-regression)

In this section, we analyze factors affecting farmers' participation decision in coffee production. To analyze the problem we employed the probit regression and ten explanatory variables (four continuous and six discrete), were hypothesized to influence the probability of participation decisions and included in the analysis. However, prior to running the final regression analysis, both continuous and discrete explanatory variables need to be checked for existence of multi collinearity using Variance Inflating Factor (VIF) and the contingency coefficient (CC) methods respectively. Accordingly, as can be seen from the results presented in Appendix 2 and 3, our test result suggests that, there is no serious multicollinearity problem in our model, since there is no strong association among the hypothesized explanatory variables. Therefore, all of the proposed potential explanatory variables were included in the final probit regression. Other diagnostic tests like omitted variable test using ramsey test, model adequacy checking was done

before conducting probit model (Appendix 3 and 4) in ramsey RESET test we accept the null hypothesis and there is no omitted variable in the model and as showed in (appendix 4) using Hosmer-lemeshow 98% of the model (probit) fits the data .

The probit model regression was carried out and the result is presented in Table 4.2.1. From the regression result, the joint significance of the explanatory variables were tested by using the Wald test with a null hypothesis of coefficients of all explanatory variables included in the models are equal to zero. The Wald test, which follows $\chi 2$ distribution with 10 degrees of freedom (*DF*), is about 72.84. From $\chi 2$ distribution table with 10 *df* the critical value is 18.31 at 5 % level of significance. This implies that the joint null hypothesis of all slope coefficients of explanatory variables are equal to zero is rejected see table 4.2.1. Thus, the overall significance of the model is good (i. e. Explanatory variables have some joint effect on farmers participation in production). The estimated probability greater than chi-square value (Prob> chi-square = 0.0000), suggests that all the model parameters are jointly significant in explaining the dependent variable at less than 1and 5 percent significance level.

Significant explanatory variables from probit regression:

Out of the included regressors, the coefficients of five variables were found to have a significant impact on the likelihood of participating in the production of coffee in the study area. According to Wooldridge (2002), the probit regression coefficient gives signs of the partial effects of each explanatory variable on the response probability of the dependent variable.

Household's landholding size (landsize):

The estimated coefficient result for this variable was found to be positive, reflecting positive effect on producing coffee. This result implies that farmers, who have more farm size, are most likely to produce coffee, keeping the effects of other variables constant. In other hand, it indicates as households' farm size increases, the probability to produce coffee increases, ceteris paribus. This result is expected since land is one of the basic

factors of production in any agricultural activities, including cash productions. This is supported by the obtained statistically significant coefficient at less than 1 percent probability level, which confirms the logical association between producing any cash crop and the level of farm size owned by smallholder farmers. The study by Nguyen Hung Anh and Wolfgang Bokelmann(2019) and Geremew (2012) suggests that land is an important factor in influencing farmer's decision to produce any cash crop, hence support the finding of the current study.

Number of active family labour (activemember):

The estimated result also shows that, having more working family member increases the probability of producing coffee. The positive and significant coefficient obtained for this variable confirms that, existence of higher number of working family labour encourages the production of coffee as a cash crop. The result is expected since family labour is the major source of labour force in the area, hence those households who have access to more family labour are likely to produce more quantity of coffee. The reason is that labour markets are lacking in this area but coffee production from land preparation to its harvest requires labour. For example, coffee harvesting is a very critical activity which should be completed at a short period of time; otherwise if it dropped to land insects and associated problems can damages and decrease quality of the crop within a short day and also if coffee bean is picked within specified time the tree leaf of the coffee tree will dry which has negative impact on future production. This suggests that labour is among the critical variable in influencing decisions of households to produce coffee. The findings by Mr. Deresse Dalango Dawana1; Dr. Wondaferhu Mulugeta and Mr. Tesfaye Melaku(2018) and Sorsa, D. (2009) support the finding of the present study.

Access to credit (CREDIT):

The obtained result for this variable confirms that access to credit service significantly influences the likelihood of producing coffee. The estimates show that, farmers who have access to credit are more likely to produce coffee than their counterparts, ceteris paribus. The plausible explanation is that, access to credit enables smallholder farmers to finance purchase of inputs and other production equipment's, hence encourage farmers to produce

a given cash crop like coffee. Thus, as credit becomes more available for farmers, they are more likely to produce market oriented crops. The findings by Mustefa Bati, Alemu Ayele and Raja Kumar Parabathina (2017), Immink and Alarcon (1993); and Lerman (2004) support the finding of the current study by arguing for agricultural credit as it plays a vital role in the process of smallholder commercialization.

Table 4.2.1: Factors affecting coffee production participation (Probit regression)

Probit Regression					**Number of Observation = 228**		
					Wald $chi^2(10)$ = 72.84		
					Prob > chi^2 = 0.0000		
Log pseudolikelihood = -36.926015					Pseudo R^2 = 0.7604		
Variables	dy/dx	Std. Error	Z	p[z]	[95%	C.I.]	x-bar
sex	.1446853	.10674	1.36	0.175	-.06453	.353901	.745614
age	-.0006981	.00347	-0.20	0.840	-.007493	.006097	46.5307
ednlvl	-.0072563	.03035	-0.24	0.811	-.066736	.052224	1.72807
active~r	.0846922	.03571	2.37	0.018**	.014696	.154689	3.5614
landsize	.1242476	.03747	3.32	0.001***	.050817	.197678	2.4145
accesc~t	.2318828	.11821	1.96	0.050**	.000194	.463571	.574561
nonfrm~t	-.1135938	.08116	-1.40	0.162	-.272656	.045468	.657895
foodsuff	.2494616	.12713	1.96	0.050**	.000284	.498639	.570175
extnser~	.0245512	.05163	0.48	0.634	-.076643	.125746	.504386
nearmrkt	-.2845252	.1419	-2.01	0.045**	-.562647	-.006403	.915351

** Significance at 5%, ***significance at 1%,

Source: own survey, 2021

Availability of family food (FOOD):

Our regression result also reveals that, availability of family food for the whole year has a substantial effect on increasing the probability of producing coffee in the study area, keeping the value of other variables constant. The plausible explanation is that as farmers have good experiences and ability to produce the family food for the whole year, their likelihood to participate in the production of high value cash crops like coffee is higher under ceteris paribus assumption. In other words, this is to mean households who can produce family food for the whole year are more likely to produce coffee than those farmers who cannot produce the family food for the whole year. This is informed by the

obtained coefficient result for this variable with positive sign and statistically significant at five percent significance level. The study by Tenkir (2016) and G.Lukanu et al (2004) verified that household food availability is one among the factors that affects farmers' decision to cultivate a given cash crop, hence supports the current finding.

Distance to nearest market (nearmrkt):

Evidence from the probit regression result also indicates that the actual distance of households' home from near market significantly influences the probability decision to produce coffee in the study area, which is statistically significant at less than 5 percent probability level. The estimated coefficient for this variable shows that there is a negative correlation between distance from nearest market to households' home and the likelihood of producing coffee. This result suggests that farmers require nearby market and other to actively participate in production of market oriented crops, thus those farmers who live near market are more likely to participate in production of the considered crop, ceteris paribus. The study by Engida Gebre (2020) suggests that distance to the nearest market is an important factor in influencing farmer's decision to produce any cash crop and verified that there is a negative relation-ship between distance to the nearest market and farmers decision in participation of cash crops, hence support the finding of the current study.

4.2.2. Factors Determining the Extent of Coffee Production

Participation in Limmu kossa

This section focuses on factors determining the extent of farmers' coffee production participation, conditional on decision to produce coffee. Truncated regression is used in this case, which is the second stage of the double-hurdle model, to analyze the problem. However, before running the final regression, it is necessary to check for existence of statistical problems such as multicollinearity. In this regard, we employed the Contingency Coefficient (CC) method for discrete regressors. These test results are presented in Appendix 5.

According to Gujarati (2004), Contingency Coefficient (CC) test uses a correlation coefficient of 0.75 as its tolerable critical value in which CC value more than 0.75 indicates

collinearity problem. The test estimates show that there is no serious correlation among the proposed explanatory variables. We used the corrected – robust z-ratio since we suspect heteroskedasticity problem, which is commonly arise in a cross sectional data. As noted in Verbeek (2004) if we use the robust standard error, the resulting test statistics are appropriate, whether or not the errors have a constant variance.

A model specification error can occur when one or more relevant variables are omitted from the model or one or more irrelevant variables are included in the model .It can substantially affect the estimate of regression coefficients .more over the model specification errors were checked by **linktest** ,the **test** of **hat** and **hatsq**were 0.000 and 0.000 respectively which are significant. This is to say that the linktest has failed to reject the hypothesis that the model is specified correctly. There, fore it seems to us that we do not have a specification error (Appendix 6)

One of the significant variables in influencing the level of coffee production participation in the study area is the number of active working family members (activemember). This variable has an important impact on the extent of farmers' coffee production participation and the result was significant at less than 1 percent probability level. This positive and significant obtained coefficient reveals the importance of family labor in the intensity of coffee production participation as well as the decision to produce crop. The possible explanation is that as we have said in the above section (probit analysis), coffee production is labor intensive and in rural areas where labor markets are non-existed or lacking, family labor is the key and the only source of farming labor. Thus, access to more family labor significantly influences farmers' participation decision in any agricultural activity and determines the level of participation in those activities The study by Anne Bastin and Nicola Matteucci (2007) indicated that in specific house hold as a number of working member increases then the level of participation in cash crops will also increases and there is direct relationship between number of active working member in a family and level of production of cash crops, hence it supports the finding of the current study.

In line with this, we found similar result from the probit regression, in which this variable significantly and positively influences households' decision probability in coffee production participation. This shows the importance of working family labor to participate in production of coffee as a cash crop in the study area.

Household's landholding size (landsize) is the second significant variable which had positive coefficients. Truncated regression result implies that farmers, who have more farm size, are most likely to produce coffee, keeping the effects of other variables constant. In other hand, it indicates as households' farm size increases, the level of coffee produce increases. This result is expected since land is one of the basic factors of production in any agricultural activities, including coffee productions. This is supported by the obtained statistically significant coefficient at less than 1 percent probability level, which confirms the logical association between producing any cash crop and the level of farm size owned by smallholder farmers.

Table 4.2.2: Determinants of the extent of Coffee production participation

Truncated Regression					**Number of Observation = 135**		
					Wald chi2(6) = 19.25		
					Prob > chi2 = 0.0000		
Log pseudolikelihood = -293.22129					Prob > chi^2 = 0.0038		
Variables	dy/dx	Std. Error	Z	p[z]	[95%	C.I.]	x-bar
sex	-.063340	1.0671	-0.06	0.953	-2.15481	2.02813	.73333
ednlvl	.0678249	.56928	0.12	0.905	-1.04794	1.1835	1.7111
landsize	2.140593	.68938	3.11	0.002***	.789428	3.4917	3.2686
active~r	1.011002	.27003	3.74	0.000***	.481754	1.5402	4.5778
accesc~t	-.654851	1.16418	0.56	0.574	-2.93661	1.6269	.83704
pastex~e	.5403872	1.75207	0.31	0.758	-2.8936	3.97437	.955556

***, ** shows significance of the coefficients at 1% and 5% levels, respectively

Source: own survey, 2021

Past experience and education level have positive coefficients but insignificant impact on level of coffee production the reason may be the education level of household heads is low due to these and other unexplained factors, level of coffee production participation was significantly affected on other variables.

4.2.3. Factors Affecting Coffee Marketing in Limmu kossa

This section focuses on factors explaining marketing of coffee by smallholder farmers in limmu kossa. The objective is to analyze factors that affect marketing of coffee, by taking the amount of income generated by sampled households as a dependent variable. We can run

our model and analyze the problem, given that all the proposed regressors are uncorrelated with the error term, assuming all regressors are exogenous. However, as we have done in the previous sections, we should carry out statistical tests for the proposed regressors before using these variables in the final estimation. Accordingly, we carried out tests of multicollinearity (both for continuous and discrete variables) by applying VIF and contingency coefficient (CC) techniques. As one can observe, we obtained from both Appendix 7 and Appendix 8 that, there is no serious linear correlation among the proposed explanatory variables, which can cause a multicollinearity problems. Therefore, all the proposed variables were included in the final regression. We used the corrected – robust z-ratio since we suspect heteroskedasticity problem, which is commonly arise in a cross sectional data. As noted in Verbeek (2004) if we use the robust standard error, the resulting test statistics are appropriate, whether or not the errors have a constant variance. For omitted variable and Model adequacy checking see Appendix 9, 10. After all, seven variables entered the final regression and the estimated coefficients of these variables are reported in the Table 4.2.3. Out of the included explanatory variables, five (5) variables were found with statistically significant coefficients. Out of these significant variables, the coefficients off our variables were found with positive signs, implying direct correlation of these variables with the dependent variable. In contrast four significant variables were found to have a negative signs, indicating the inverse relationship between these regressors and the dependent variable.

The first significant variable in determining the income earned from coffee sale was traveling time to the nearest market "nearmrkt" which represents traveling time to the nearest market place. Negative sign coefficient was obtained for this variable from the regression result, giving evidence that show the income earned from coffee has inversely affected by the longer walking hour from households home to the nearest market place they sale their coffee produce. This implies longer travelling time negatively affects smallholder farmer's income. The outcome is expected because, long traveling time from market centers affects the price of the crop, hence producer farmers prefer to sale at local area to local traders at lower prices. In addition, long traveling time from market is one of the transaction cost related problems, which is common in rural areas where access to transportations is nonexistence, the problem is serious. Thus, the actual time between farmers' home and the nearest market place is

one of the determinant factors in influencing the amount of income earned from coffee sale in the study area, other things being constant.

The study by Samuel Diro, Beza Erko, Efrem Asfaw and Misganaw Anteneh(2019) suggests that distance to the nearest market can play a crucial role in determining farmers income gained from selling of cash crops, hence supports the current finding.

We also obtained result that confirms direct relationship between income generated and access to market information. The positive and significant coefficient obtained for this variable, highlights the evidence that show access to market information and the received income are positively correlated.

The result is also statistically significant at less than 1 percent significance level. The study by Samuel Diro, Beza Erko, Efrem Asfaw and Misganaw Anteneh(2019) suggests that market information also significantly affects farmers income gained from selling of cash crops, hence supports the current finding.

On the hand quantity of coffee marketed (qtymrktd) has a positive and significant effect on the derived income from coffee sale in the study area. This outcome is expected and logical, since there is positive relationship between quantity supplied and income generated. This result indicates that, the amount of coffee marketed is one among the major factors determining the amount of income earned from coffee sale in the study area.

Table 4.2.3: Factors affecting income earned from coffee sale

Probit Regression					**Number of Observation = 135**	
					Wald chi2(7) = 37.57	
					Prob > chi2 = 0.000	
Log pseudolikelihood = -5.8447523					Pseudo R^2 = 0.889	
Variables	dy/dx	Std. Error	Z	p[z]	[95%	C.I.]
nearmrkt	-3.48288	1.244415	-2.80	0.005***	-5.921887	-1.0438
qtymrkt	2.845317	.6211797	4.58	0.000 ***	1.627827	4.06280
Time of selling						
immidiat	-1.086838	.9781074	-1.11	0.266	-3.003894	.83021
onmnth	-1.568053	1.197082	-1.31	0.190	-3.914292	.77818
twomnth	2.410801	.9107283	2.65	0.008***	.6258064	4.1957
mktkinfo	3.641764	1.103106	3.30	0.001 ***	1.479715	5.8038
coffeprice	.3464749	.0978724	3.54	0.000***	.1546485	.538301
cons	-28.70206	8.127889	-3.53	0.000	-44.63243	-12.771

***, ** shows significance of the coefficients at 1% and 5% levels, respectively

Source: own survey result, 2021

Furthermore, the estimated coefficients for dummy variables indicating coffee selling periods **(**immidiate, onmnth) shows the inverse correlation between selling coffee in latter months after harvest and the income earned. But the variable (twomnth) had positive relation with income of farmers which is gained from sales of coffee. These are dummy variables we constructed to identify how the difference in coffee selling time can affect the income of farmers which could be derived from the sale. Accordingly, we constructed four dummy variables including: immidiate (to refer farmers have sold their coffee produce immediately after harvest), onmnth (to refer farmers have sold their produce one month later after harvest), twomnth (which represent farmers waits for two months after harvest and sold their coffee produce).

In this case, the first variable (immidiate) was considered as the reference dummy variable for comparison purpose and the rest of two dummy variables were included in the model regression. The variable onmnth has negative correlation with income of farmers which gained from coffee sale but it is insignificant at both 1 and 5 level of significance.

The variable twomnth is positively related with income of coffee sale which shows that those farmers who stored their coffee for two or more months, they were gained better price than those who sold their coffee immediately and one month after harvesting.

The study by Teshale Dhuguma (2018) indicated that selling time of coffee after harvesting significantly affects income gained from coffee. He concluded that selling time is inversely related with income gained from coffee, but he claimed that most of the farmers are suffering with storage related problems due to storing their coffee at home longer and they have no well managed cemented places. His finding supports the variable twomonth of the current study.

CHAPTER FIVE
CONCLUSIONS AND RECOMMENDATION

5.1. Conclusions

Coffee is the major cash crop for smallholders in Limmu Kossaa. And there is a potential arable land for further production in the Wereda. The production technique was still dominated by traditional means like oxen and other traditional equipment's. Lack of improved seed, lack of awareness about the importance of coffee in the area and lack of knowledge and capacity to use fertilizer for coffee production are the other major factors resulting in low productivity of the crop in the study area. This discourages farmers to produce coffee, despite the available potential and opportunities.

In addition, from the probit model regression, we observed that number of active family labour, the size of farmland owned, family food availability and access to credit service influences the decision probability of farmers to produce coffee in the study area, positively and significantly. We also obtained that, access to credit service increases the likelihood of farmers to produce coffee and its impact was found to be statistically significant. This result suggests that, household specific characteristics and asset endowments are the major determining factors for smallholder farmers to produce coffee in the study area. Individual household specific factors matters for different level participation status of smallholder farmers in coffee production in the area, which results them in differently responding to the available potential and opportunities. In addition, access to rural credit service was found to be a significant factor, in participation decision but insignificant in determining the level of coffee production participation in the study area.

In addition, households land holding size and number of active family member significantly influences coffee production participating (both decision to produce and how much to produce) in the study area. This is because coffee production is labour intensive, and land is the major factor for production .hence these two variables were found to be the major determinant factors both in decision to produce the crop and the extent of production participation. These two variables are also household specific factors in determining farmers' participation status in coffee production in the study area.

Furthermore, from the probit regression result, we highlighted that although the income farmers generate from coffee sale increases with the amount of coffee marketed, the relationship was found to be not a one-to-one. That is, in addition to the quantity of coffee marketed, other factors explain and determine significantly the amount of income earned from coffee sale in the study area. Accordingly variables such as market price of coffee produce, the usual selling time, market information and travelling time to the nearest market were found to be the major and the significant ones. One possible conclusion from this result is that, time at which farmers will sale their coffee produce matter in generating better income from coffee. Thus, it is better for farmers to sell their coffee produce before two months after harvest, the survey result reveals. Market price was also found to be an important factor in securing better income from coffee sells for smallholders. This is because coffee is one of the international crops in which its price is linked to international markets; hence market price is necessary and significantly determines the level of income farmers derives.

5.2. Recommendation

Coffee as usual maintains its role as important agricultural export commodity for Ethiopia. However, its production is significantly dominated by smallholder farmers and is limited to selected areas in the country due to limited availability of agro-ecological zones for its production and productivity. Therefore, to promote and encourage farmers in production of this cash crop, a number of improvements are required. According to CSA (2019) in Ethiopia there was a potential to produce 1.1 tons per hectare but actually 764863.16 hectare of land was allocated for coffee production and 494574.36 tones were obtained with average productivity of 0.64 tons per hectare which is very below from the potential. Based on the findings of the study, the following points need to be considered as possible recommendations. Sampled farmers complained about lack of improved coffee seed varieties in the area. In this regard, farmers require immediate intervention and support. Therefore, providing improved coffee variety that properly fit the agro-ecology of Limmu Kossa is one possible solution. In addition, sampled farmers have also complained about lack of awareness and capacity to use fertilizer for coffee production. Therefore, building smallholder farmers' knowledge on fertilizer application and improve fertilizer supply for coffee production is essential. Lack of improved cultivars, unavailability of improved production technologies,

physiological problems like die back and minimum or no use of agricultural inputs by small holder is also important factors for low coffee yield. Moreover, Ethiopian coffee is inferior in yield to other producers, which is mainly because of backward cultivation and harvesting system.

Furthermore, the findings of this study suggests that institutional services like extension service and credits are the key factors in influencing both farmers decision to participate in coffee production. This is so because coffee production entails high working capital throughout its production processes. Thus adequate availability of credit service can help to facilitate farmers to participate in its production and to produce a significant amount. Broadening and expanding sources of such institutional service is another possible recommendation from the present study, if active participation of smallholder farmers is required in coffee production and marketing in the study area. And as coffee is a smallholder crop; which is produced by a number of farmers at very remote and hardly transported places, infrastructure investments are also needed and recommended to encourage farmers in production of such high value-export potentials crops in the country.

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APPENDICES

APPENDIX1. Survey Questionnaire

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Purpose: This questionnaire is prepared to collect data pertaining to analysis of smallholder farmer's participation in production and marketing of export potential crops the case of coffee in Limmu kossa woreda jimma zone of oromia regional state. It will provide a major input for my master's thesis and it is purely conducted for academic purposes. Therefore, the respondent is kindly requested to provide his/her valid responses to the sets of questions included in the questionnaires. All your responses remain confidential.

I thank you in advance for your cooperation.

Woreda _____

Kebele_____

Date of interview----------

A. Household Head Demographic Characteristics

1. Sex: Male Female

2. Age (in years) 18-25 ☐ 25-32 ☐ 32-39 ☐ 39-46 ☐ 46-53 ☐ above 53

3. Educational level of household head (in years of schooling) _____

Better to categorize level of education as:

No formal education/no schooling ☐ Primary education (1 -8grades) ☐ Secondary education (9-12 grades) ☐ College's diploma ☐ University degree& above) ☐

4. Number of total family members _____

5. Number of active household members aged between 15 and 64 years fulltime on farm activity _____

Year			
Age	0-15	15-64	65 and above
Number of active family members			
Number of non-active family members			

6. Is your family labor adequate for farm activities? 1= Yes 2 = No

7. Total amount of hired labor for the production year (2011/12) ----------

8. Total land holding size (in hectare) _____

9. Land size suitable for Coffee production _____ (in hectare)

B. Source of Household Income

1. From where did you get income you used to cover all family expenditures?

Crop sales ☐ Livestock sales ☐ Remittances ☐ Aid ☐ hired ☐

Others, please specify (if any)_____

2. What is the major crop you grow currently?

4. Livestock ownership

Livestock	Cows	Oxen	Donkey	Mules	Sheep	Goats	Poultry	Heifers
No Owned								

3. If you get income from sale of crop productions, which crop type you used to sell in the market most of the time?

1= food crops 2 = cereals 3 = vegetables 4= cash crops 5=fruits

4. What are the 3 major crop produced for market (cash crops) you grow in your area? 1= _____ _____ 2=_____3=_____

5. Would you list these according to your level of production participation?

1st=_____ 2nd =_____ 3rd =_____

6. Are you a member of any rural cooperatives? Yes ☐ No ☐

7. Do you have access to credit/loan? Yes ☐ No ☐

8. Do you participate in non-farm income generating activities? Yes ☐ No ☐

9. Do you produce sufficient food for your family for the whole year? Yes ☐ No ☐

10. Do you have an access to extension services? Yes ☐ No ☐

11. Traveling time from home to nearby markets _____ (in hour)

12. Did you receive advisory services on coffee production? Yes ☐ No ☐

13. Did you have any past experience in production of coffee? Yes ☐ No ☐

14. What direction had the farm gate price of coffee shown in these two years?

Increased ☐ Decreased ☐ Remain the same ☐

15. Did you participate in the production of coffee in 2011/2012 (E.C) cropping season?

Yes ☐ No ☐

16. Land size allocated for coffee _____ (in hectare)

17. Which means of land preparation methods you used for coffee production:-

1= Own oxen ☐ 2 = Rented oxen ☐ 3= Tractor ☐ 4 = Traditional instruments ☐

18. Type of coffee (bean) seed used:

Traditional ☐ Improved ☐

19. From where did you get the coffee (bean) seed?

Own production ☐ Nearby Market ☐ Cooperatives☐ Agricultural offices☐

Other (specify_____)

20. Did you use fertilizer for coffee production? **Yes** ☐ **No** ☐

21. If your answer to question #20 is" No", what is the reason?

No need ☐ Not available ☐ No potential to purchase ☐ Others (specify_____)

22. If your answer to question #15 is "No", what are the main reasons that limit you from production of coffee?

No	Possible reasons	1=serious problem	2=Minor problem

1	Decreased productivity of coffee from year to Year		
2	Lack of improved coffee seeds		
3	Shortage of land		
4	Fear of market related problems		
5	Lack of awareness about its importance		
6	Fear of food shortages		

C. Marketing Aspects:

1. Quantity of coffee produced in 2013 E.C _____ (in quintal)

2. Quantity of coffee marketed _____ (in quintal)

3. Quantity of coffee consumed _____ (in quintal)

4. Period of selling coffee:

Immediately after harvest ☐ After a month ☐ After two months ☐

After three months/later ☐

5. How did you sale your coffee produce?

Directly to the purchaser/traders ☐ Through brokers ☐ Farmer unions ☐ Others ☐

6. Where did you sell mostly your coffee produce? Local buyers (collectors) ☐

Cooperatives ☐Traders at primary market ☐

7. From whom you get better price? Local collectors' ☐ Cooperatives ☐

Traders at primary market ☐ Others (specify_____)

8. Who set your selling price?

Yourself ☐ Market ☐ Buyers ☐ Negotiations ☐ Other _____

9. Did you know the nearby market price before you transport to your coffee to market?

Yes ☐ No ☐

11. What is the price of coffee per Kilogram at nearby market? _____

12. Do you have a transport access to the nearest market? **Yes** ☐**No** ☐

13. How did you transport your coffee produce from home to market places?

Head/back loading ☐ Pack animals ☐ Vehicles ☐ Other_____

14. Do you have access to market information? Yes ☐ No ☐

15. From where did you get market information?

Local traders ☐ Neighbor cooperatives ☐Media ☐Other_____

16. What is the amount of total income you earned from coffee produce?

17. What is the farm gate price of coffee per kilogram last year-2012 E.C? _____ (in birr)

20. What is your prediction about the coming year coffee price? Increase ☐ Decrease ☐ Remain constant ☐ No idea ☐

21. If you have any comment please list here: _____

Appendix 2:

VIF test result for continuous explanatory variables (production participation)

Variable	VIF	1/VIF
activemember	2.94	0.340487
age	2.66	0.375852
landsize	1.61	0.619339
nearmrkt	1.03	0.967137
Mean VIF |	2.06	

Appendix 3: Contingency Coefficient test (for discrete explanatory variables)

Correlation matrix of coefficients of regress model

e(V)	sex	ednlvl	accesc~t	nonfrm~t	foodstuff	exnser~e	_cons
sex	1.0000						
ednlvl	-0.1847	1.0000					
accescredit	0.1433	-0.0235	1.0000				
nonfrmacvt	-0.0135	0.1489	-0.0840	1.0000			
foodsuff	0.0239	0.0761	-0.5642	0.1717	1.0000		
exnservice	-0.1744	0.0746	-0.5345	0.1938	-0.0243	1.0000	
_cons	-0.3846	-0.5725	-0.0891	-0.5730	-0.2597	-0.1241	1.0000

Source: own survey result, 2021

Appendix 3: Omitted variable test

Ramsey RESET test using powers of the fitted values of prdnpatcpn

Ho: model has no omitted variables

F(3, 214) = 19.29

Prob > F = 0.0000

Source: own survey result, 2021

Appendix 4 Model adequacy checking

probit model for prdnpatcpn, goodness-of-fit test

(Table collapsed on quantiles of estimated probabilities)

number of observations	=	228
number of groups	=	6
Hosmer-Lemeshow chi2(4)	=	0.42
Prob > chi2	=	0.9811

Source: own survey result, 2021

Appendix 5 Contingency Coefficient test result for discrete regressors (Level of Participation)

eq1						sigma
e(V)	sex	ednlvl	accesc~t	pastex~e	_cons	_cons
sex	1.0000					
ednlvl	-0.0448	1.0000				
accescredit	0.1187	0.1177	1.0000			
pastexpria~e	-0.0233	0.1812	-0.0629	1.0000		
_cons	-0.1953	-0.6076	-0.6928	-0.2297	1.0000	
sigma _cons	0.0775	0.3862	0.6858	0.0362	-0.0704	0.7618	1.0000

Source: own survey result, 2021

Appendix 6 Functional Misspecification Test

Linktest

Truncated regression

Limit: lower =	-inf	Number of obs = =	135
upper =	+inf	Wald chi2(2) =	243.40
Log likelihood = -319.37219		Prob > chi2 =	0.0000

qtyprod	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
_hat	.334111	.0637999	5.24	0.000	.2090656	.4591565
_hatsq	.0304508	.0054711	5.57	0.000	.0197277	.0411739
_cons	3.393758	.2511078	13.52	0.000	2.901595	3.88592
sigma	2.5774	.1568555	16.43	0.000	2.269969	2.884831

Source: own survey result, 2021

Appendix 7. VIF test result for continuous regressors (Income Generation)

Variable	VIF	1/VIF
qtymrktd	1.01	0.987850
nearmrkt	1.01	0.988798
coffeeprice	1.00	0.998761
Mean VIF	1.01	

Source: own survey result, 2021

Appendix 8: Contingency coefficient test for discrete regressor variables (Income Generation)

Correlation matrix of coefficients of regress model

e(V)	onmnth	twomnth	mktkno~e	_cons
onmnth	1.0000			
twomnth	-0.5484	1.0000		
mktknowldge	-0.1373	0.0026	1.0000	
_cons	-0.1941	-0.3794	-0.6336	1.0000

Source: own survey result, 2021

Appendix 9: Omitted variable test

Ramsey RESET test using powers of the fitted values of totalinc

Ho: model has no omitted variables

F(3, 124) = 1.05

Prob > F = 0.3749

Appendix 10: Model adequacy checking

Probit model for totalinc, goodness-of-fit test

(Table collapsed on quantiles of estimated probabilities)

(There are only 6 distinct quantiles because of ties)

number of observations = 135

number of groups = 6

Hosmer-Lemeshow chi2(4) = 0.10

Prob > chi2 = 0.9987