RHEINISCHE FRIEDRICH – WILHELMS – UNIVERSITÄT BONN

FACULTY OF AGRICULTURE

MASTER THESIS

AS PART OF THE MASTER PROGRAMME

AGRICULTURE AND FOOD ECONOMICS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

„MASTER OF SCIENCE“

Off-farm Income and Smallholder Commercialization: Evidence from Ethiopian Rural Household Panel Data

SUBMITTED BY:

TESFAYE BERHANU WOLDEYOHANES

MATRICULATION NUMBER

2598623

SUBMITTED ON:

DECEMBER 23rd, 2013

Prof. Dr. THOMAS HECKELEI

Prof. Dr. YVES SURRY

Tesfaye Berhanu Woldeyohanes

_____ _____

Prof. Dr. Thomas Heckelei, Thesis Advisor Date

_____

Prof. Dr. Yves Surry, 2. Thesis Committee Member Date

_____

3. Thesis Committee Member Date

_____

Dean or President Universität Bonn, Date

Abstract

Transforming smallholder agriculture from subsistence production system to more market oriented production system is considered as an indispensable to insure food security and sustained economic growth in Ethiopia. Understanding factors that makes smallholder farmers subsistence oriented is essential to identify policy actions that will help to increase market orientation and smallholder welfare. This study uses panel data from Ethiopia to investigate how earnings from off-farm work affect smallholder output market participation and marketed surplus. The study also assessed the influence other household level factors in determining smallholder market integration. A farm household model under imperfect market condition is considered and a two-step decision making process is outlined. Household is supposed to decide, first, whether or not to participate in the market and then they decide how much to sell. The estimation is done using correlated random effect double hurdle model. We compute the conditional and unconditional marginal effects for the whole sample. Our empirical finding indicates off-farm income has no significant influence on household output market participation. However, conditional on positive market participation has been made each additional earnings from off-farm work has negative and significant effect on household market supply, holding other factors constant. Our empirical finding also indicates there is no evidence to support the hypothesis that off-farm income promotes smallholder commercialization by relaxing liquidity constraint to invest and raise productivity and marketable surplus. Moreover, our analysis shows that participation in off-farm employment is higher among household with smaller land holding, which can be considered relatively poor. Thus, they may use earnings from off-farm source for consumption smoothing than as liquidity source to invest in agricultural production. This may have policy implication that expanding higher earning rural enterprises through capacity building and human capital investment is vital to improve the returns to labor for off-farm work participating land-poor households during the economic transformation.

Key Words: commercialization, smallholder, market participation, panel data, off-farm income, CRE double hurdle model, Ethiopia

Table of Contents

List of Tables

Acknowledgements

My special gratitude goes to my supervisor, Prof. Dr. Thomas Heckelei for his invaluable and constructive comments on the manuscript starting from the proposal preparation. Second, I would like to thank my co-supervisor Prof. Dr. Yves Surry from the Swedish University of Agricultural Sciences. Prof. Yves's comment during summer school was quite constructive. I also benefited from Mr. Hugo Storm's constructive comment and kind support.

I gratefully acknowledge European Commission for awarding me Erasmus Mundus scholarship whose financial funding allowed me to study in Europe. I would like to thank all the coordinators of AFEPA program for their special support during my study period. My special thanks goes to Prof. Bruno Henry de Frahan , Mr. Henrich Brunke, Kristina Johansson, and Dr. Ralf Nolten, for their vital support in all practical matters that makes my life in Europe easy. My heartfelt thanks to all AFEPA Master Students, several other fellow students that I met at SLU, Uppsala University, University of Bonn and during summer schools for exchanging some thoughts and some of you for asking me "how is your work?", which meant a lot for me.

I am also thankful to my parents, Berhanu Birmaji and Beshadu Bedada for sending me to school and keeping me there with great encouragement and support. My sincere thanks go to my sister Alemitu Berhanu, without whose caring support it would not have been possible for me to achieve this academic success.

Finally, thanks to the Almighty God for providing me the courage, endurance and patience in accomplishing this piece of work and realizing my dream.

DEDICATION

Dedicated to my mother, Fantaye Mamo, for her irreplaceable love which remains with me forever although we are physically separated by unfortunate death.

List of Acronyms

AAU	Addis Ababa University
ADLI	Agricultural Development Led-Industrialization
AgSS	Agricultural Sample Survey of Central Statistical Agency
APE	Average Partial Effect
CAPE	Conditional Average Partial Effect
CRE	Correlated Random Effect
CSA	Central Statistical Agency of Ethiopia
DH	Double Hurdle
ERHS	Ethiopian Rural Household Survey
ESRC	Economic and Social Research Council
ETB	Ethiopian Birr (local currency)
FE	Fixed Effect
GDP	Gross Domestic Product
GTP	Growth and Transformation Plan
HCI	Household Commercialization Index
HH	Household
IFPRI	International Food Policy Research Institute
IMR	Inverse Mills Ratio
MLE	Maximum Likelihood Estimation
MoFED	Ministry of Finance and Economic Development of Ethiopia
NGOs	Non-Governmental Organizations
OLS	Ordinary Least Square
PADETS	Participatory, Demonstration and Training Extension System

PASDEP	Plan for Accelerated Sustainable Development to End Poverty
PRSP	Poverty Reduction Strategy Program
SIDA	Swedish International Development Agency
SNNP	Southern Nations Nationalities and People Region
TLU	Tropical Livestock Unit
UAPE	Unconditional Average Partial Effect
USAID	United States Agency for International Development
WB	World Bank

CHAPTER 1 - INTRODUCTION

1.1 General background

The economy of Ethiopia remains highly dependent on agriculture which is source of livelihood for 85 % of the population, contributes 90 % of total export earnings and 40 % to GDP (World Bank, 2007). Agricultural sector is dominated by smallholder farmers who produce about 90 % the total agricultural production on the average land holdings of 1 hectare per household (CSA, 2012). Despite such socio-economic contribution, the sector is characterized by its subsistence oriented production system with low level of productivity. Smallholder farmers produce at subsistence level due to lack of appropriate inputs and infrastructure to generate adequate surplus to market. Thus, transforming the smallholder agriculture from subsistence based production system to more market oriented production system is considered as an indispensable to insure food security and sustained economic growth in the country. Accordingly, the country has adopted commercialization of smallholder agriculture as a strategy for its economic transformation. Specifically, the government puts a strong emphasis to the intensification and commercialization of smallholder agriculture as means to achieve poverty reduction and food security which has been reflected in its development policy and strategies at different time.

Since early 1990s, several economic policies and programs have been designed and implemented in Ethiopia. In 1993, the government has put forward the development strategy called Agricultural Development Led Industrialization (ADLI). The main objective of this development strategy is to generate (i) a more supportive macroeconomic framework; (ii) liberalized markets for agricultural products; and (iii) a strong extension- and credit-led push for intensification of food staples production through the use of modern inputs, especially seed and fertilizer (MoPED, 1993). Transforming the productivity of the peasant agriculture and reconstructing the manufacturing (Industrial) sector, so that it makes extensive use of the country's natural and labor resources was the central aim of this plan (MoPED, 1993).

To make agriculture a growth engine for development through domestic economy and international trade, there has to be a progress in terms of market integration. Specifically, it necessitates more intensive farming and increasing the proportion of output produced for market

and correspondingly decreasing the degree of subsistence production. But, early government development strategies put less emphasis to smallholder commercialization. Nevertheless, the government has implemented an extension program known as Participatory, Demonstration and Training Extension System (PADTES) in 1995. The objective of this project was to help smallholder farmers in increasing their productivity through provision of credit for inputs, demonstration and dissemination information on major food crops and cash crops (Gebremedhin et al., 2006). Cooperatives were also part of this program to facilitate smallholder input and output market integration and promote provision of rural finance.

The government has prioritized commercialization of smallholder agriculture in the second five year (2005/06-2009/10) Poverty Reduction Strategy (PRS) called Plan for Accelerated and Sustainable Development to End Poverty (PASDEP). This initiative to accelerate agricultural growth has two main directions. The first one is to commercialize agriculture through intensified production of marketable products both by smallholder farmers and private investors for local as well as export market. And the second one is to ensure the growth of the non-farm private sector (MoFED, 2006). According to this plan, smallholder farmers will be benefited through increased availability and utilization of appropriate technologies, an effective and efficient service delivery system and, improving institutional competence and performance, formation of cooperatives and unions and the introduction and expansion of 'productive' safety-nets.

With this policy shift, in cooperation with favorable weather conditions, promising progress have been seen in increased aggregate agricultural production and export. For example, the National Bank of Ethiopia 2005/06 report indicates increased export market of pulses, oil seeds, meat and meat products, and live animals by 51%, 152%, 99% and 960%, respectively between 2003/04 and 2005/06 (Gebreselassie, 2007).

Maintaining agriculture as a major source of growth is also among the major pillars of the recently launched 'ambitious' five year (2011-2015) Growth and Transformation Plan (GTP). GTP has similar set of priorities focused on capacity building of smallholder farmers. In this strategic plan, strong support for intensified production of marketable commodities by smallholder and private sector both for domestic and international market is given priority the same as in the PASDEP (MoFED, 2010). According to this plan, the commercialization of

smallholder agriculture will continue to be the major source of agricultural growth and overall economic transformation of the country.

These documented government development and policy strategy clearly indicates the country adopted commercialization of smallholder agriculture as a strategy for its economic transformation. Some research findings (e.g. Gebremedhin et al., 2009) indicates basic institutional support service to smallholders that are crucial for this transformation process like extension, credit and input supply services are expanding to some extent. Nevertheless, different reports are not showing that integration of smallholder farmers in to market is progressing at the right pace and the larger proportion of total production is used for home consumption (CSA, 2012).

1.2 Smallholder commercialization in Ethiopia

According to Barrett (2008), majority of the population in East and Southern Africa remain disproportionately rural and engage in production of staple food grains mainly for subsistence than market oriented production He identified three core themes that characterizes food grain producers in these regions: First, many farmers are not net staple crop sellers, Second, net sales are positively associated with asset endowments and favorable geographic factors (access to market infrastructure and favorable agro ecological zone) and third, transactions costs exert considerable influence on crop marketing patterns. Staple grain sales are extremely concentrated in the hands of relatively few producers who are capitalized and located in favorable geography.

The food grain marketing situation in Ethiopia is not an exception. Using nationally representative data from rural Ethiopia, Pender and Alemu (2007) found that smallholder farmers in Ethiopia are either autarkic or net buyers of teff[1] and maize, the two most important food grains. These households are poorer in many aspects compared to the net sellers. However, some studies indicated wide variations in terms of grain market participation and volume sold across region and crop dimensions. For example, according to Hoekstra and Gebremedhin (2008) about 47–60% of the marketable cereals produced by smallholder farmers are sold. Study conducted by

[1] Teff (*Eragrostis tef*) is a grass like grain native to Ethiopia which is used to make a local bread called *Injrera (buddena).*

Gebreselassie and Sharp (2008) in selected teff growing areas in Ethiopia also indicated that sample households sold above 49% of their total output in value terms.

Cereals, pulses and oilseeds are the most widely grown grain crops by smallholder farmers in Ethiopia, both in terms of area coverage and quantity of production. They constituted the major food crops for the majority of country's population, serve as main income source at household level and also contribute to country's foreign currency earnings among others. Table 1.1 shows the proportion of output marketed for each of these crop categories in 2001/02 and 2011/12 crop year. According to agricultural sample survey 2001/02 by CSA, the larger proportion of crops produced were used for household consumption and only meager amount were sold. In 2001/02, close to 64 % of the grain production is destined for home consumption and only 20.4 % is marketed. In the same crop year, 15.7% of cereals, 21.6% oilseeds, and 53.8% pulses were marketed, while 66.9%, 61% and 33.9% of these crops were used for household consumption, respectively.

Table 1. 1 Crop utilization by households in 2001/02 and 2011/12, in percent

	2001/2002			2011/2012		
Crop Type	Own consumption	sale	others[2]	Own consumption	sale	others
Grains	63.7	20.4	15.9	62.03	19.84	18.14
Cereals	66.9	15.7	17.4	66.98	14.66	18.37
Oilseeds	61	21.6	17.4	34.87	50.04	15.09
Pulses	33.9	53.8	12.3	59.71	21.52	18.78

Source: CSA (2003, 2011), Ethiopian Agricultural Sample survey 2001/02 and 2011/12

The observed patterns in terms of crop utilization did not show any visible change ten years later in 2012/2012 cropping year. The use of aggregate grains and cereals that accounts for the largest proportion of crop production remains unchanged. The proportion of output marketed for cereal crops remained the same as in the year 2001/02, while marketed proportions for pulses (the second major important grain produced by smallholders) decreased substantially. The marketed

[2] Includes crops used for seed, in kind wage payment, animal feeds and other miscellaneous utilizations

proportion of total oilseeds production, however, has increased by more than half in the year 2011/12. Oilseeds are grown mainly to flavor food consumed at home and to earn some cash for smallholder farmers. It has given considerable attention in the commercialization strategy of smallholder farmers. In addition to grains, tree crops like coffee and chat[3], vegetables and root crops are also produced considerably by smallholder farmers. Coffee and chat, being cash crop by nature, are highly marketed.

In general, the crop utilization pattern reveals level of smallholder commercialization in Ethiopia is still at infancy stage and the majority of smallholder farmers produce primarily for subsistence. But there are wide variations within the country and across different crop categories.

1.3 Off-farm employment in rural Ethiopia

The role of rural off-farm employment in reducing poverty has been reviewed in literatures covering different developing countries (e.g., Woldenhanna and Oskam, 2001; Davis et al., 2009; Oseni and Winters, 2009; Bezu et al., 2012). Off-farm employment can be important sources of cash income to finance farm investment, mitigate risks by lowering income variability and consumption smoothing in case of food production shortfall (Reardon et al., 1994). Particularly, when agricultural credit for smallholder farmers is severely lacking, which is common in most countries of Sub-Saharan Africa, off-farm income generates important liquidity to finance input typically needed to increase productivity. For instance, Oseni and Winters (2009) found that rural households who have access to off-farm work in Nigeria used the income generated from this source to purchase inputs for crop production.

In Ethiopia, even though farming on own agricultural land is a major source of livelihood, rural household also engages in different off-farm employment driven by different push and pool factors (Woldenhanna and Oskam, 2001, van den Berg and Kumbi, 2006; Rijkers et al., 2008). Types of off-farm work that rural households in Ethiopia engage in can be categorized as wage employment and self-employment (Woldehanna and Oskam, 2001). Wage employment includes paid development work, wage work on others farm, professional wage work (e.g. lecturers),

[3] Chat is stimulant cash crop which is widely produced by smallholders mainly for domestic and export market. It is the second major agricultural export commodity of Ethiopia.

skilled non-farm (e.g. mechanics) and unskilled wage work (e.g. for public and private construction). The employers could be small and/or commercial farmers, NGOs, government organizations, urban dwellers, religious institution, and contractors. Self-employment could be milling, weaving, handicraft, trade in grain and livestock, collecting and selling firewood and selling local food and drinks. Returns to labor is higher for activities such as professional wage work; skilled wage employment and off-farm self-employment, but these are not easily affordable to the poor farm households due to entry barriers and off-farm job rationing (Reardon, 1997; Woldenhanna and Oskam, 2001).

According to Davis (2003) and Deininger et al. (2003), in Ethiopia, some 20 percent of rural income originates from off-farm sources. Study conducted by Woldehanna (2000) shows that off-farm income accounts for up to 35 percent of total farm household income in some parts of Ethiopia. Rijkers et al. (2008) also found non-farm enterprise makes considerable contributions to rural income and approximately 25% of all households in rural Ethiopia own one or more nonfarm enterprises. The author also indicated that only about 2% of households exclusively rely on nonfarm enterprises. Using the 1999 ERHS data, Beyene (2008) found that 43% of the total sample farm households were participated in self-employment activities, while 23.3% of the sample household reported that they participated in wage employment. According to this study, on average a farm household earn ETB 615.9 per annum from off-farm activity (Beyene, 2008). Based on household survey from four major regions in Ethiopia, Berhane et al. (2013) recently reported that 30% of the households either the head or other members in the household engaged in wage employment, while 24 % of the households engaged in non-farm business.

This indicates with increasing land and capital constraint, the role of rural off-farm employment is increasing from time to time. In spite of this fact, they are rarely covered by government policies and strategies. However, the PASDEP policy document does address diversification more concretely compared to the earlier PRSP. In this document, diversification in to off-farm income is considered as a tool to overcome food insecurity that helps to rely on farmers own resource and shift away from reliance on foreign food aid (MoFED, 2006).

1.4 Research problem

Agriculture is quite essential to spur economic growth, reduce mass poverty and enhance food security for most agriculture based low income countries (World Bank, 2007). However, using agriculture as growth engine will require some sort of transformation out of subsistence production system, that characterize most developing countries relying on agriculture, to more commercial oriented production system.

The agricultural sector in Ethiopia is highly dominated by smallholder farmers who produce about 90% of the total agricultural production on the average land holding of less than one hectare per household (CSA, 2011). Transforming the sector from such a subsistence production system to a high productivity and commercial oriented production system is an indispensable to insure food security and sustained economic growth. Recently, commercializing smallholder agriculture by promoting farmers to produce market oriented product instead of subsistence production has received a strong emphasis in government agricultural development and poverty reduction strategy (MoFED 2006, 2010). The government has been using different strategies like agricultural extension service and provision of institutional support services such as credit service and input supply to improve productivity and provision of market information through farmers' cooperatives to realize this transformation process. However, smallholder farmers in the country are still largely subsistent as they consume a significant fraction of the output and supplying only small fraction to market. For instance, according to AgSS of CSA 2011/12, more than 65% of the total cereal produced is kept for household consumption and only 14% is supplied to market (CSA, 2011).

Understanding factors that makes smallholders subsistence oriented is essential to identify factors that will help to increase commercial orientation of smallholder farmers. Previous studies on the determinants of smallholder commercialization in Ethiopia are either regional focusing on few crops ((Woldehanna, 2000; Gebreselassie and Sharp, 2007) or followed special project intervention to see if there is induced impact on smallholder commercialization (Gebremedhin and Hoekstra, 2008; Geberemedhin and Jaleta et al., 2010). Moreover, these studies have considered smallholder commercialization in its static form – measuring level of output and input market participation at a given point in time and relied on cross-sectional data analysis.

However, smallholder commercialization could be seen as a dynamic process as decision to participate and proportion of output sold could change due to changing circumstances over a period of time. So, panel data analysis to measure this change and identify factors that influence this change is important. Despite government policy intervention at different times to promote smallholder commercialization, to the best of my knowledge, no such study exists in the country.

At the early stage of agricultural commercialization, production of marketable surplus of staple food crops is the most common form of agricultural commercialization than exclusively producing cash crops for market (Pingali and Rosegrant 1995; Gebre-Ab 2006). This implies that it is essential to increase agricultural productivity and surplus production to link up smallholder farmers with output market. However, poor households are often constrained by lack of liquidity to finance the inputs typically needed for increased productivity. The problem is especially great when the agricultural credit is lacking or not accessible to poor (Carter, et al., 2004), and Ethiopia is not an exception. Under this situation, rural household's access to off-farm employment can be important source of cash income to relax the liquidity constraint they face and increase farm productivity (Reardon et al., 1994). This potential relationship between off-farm employment and smallholder investment in agricultural inputs have been tested empirically (Mathenge and Tschirley, 2008; Davis et al., 2009; Oseni and Winters, 2009). The results from these studies indicated there is some positive effect of off-farm income on agricultural production. For example, Oseni and Winters (2009) found that rural households who have access to off-farm work in Nigeria used the cash income from this source to purchase inputs for crop production.

The above studies and many others have made numerous contributions on the linkage of farm and off-farm employment and their contribution in poverty reduction. However, the nature of interaction between income from off-farm employment and smallholder commercialization has received little attention in the empirical work. More specifically, there exist minimal empirical literature on possible direction of relationship between off-farm income and smallholder commercialization at household level. At the macro level, the linkage between agricultural commercialization and off-farm employment can be explained though growth of linkages. That means advancement in agricultural commercialization creates rural off-farm employment opportunity for the poor (von Braun, 1994). Although this is very crucial for rural development,

information on the nature of interaction that could exist at the household level is more beneficial for the design of pro-poor public policies. Thus, empirical study to determine the direction of the relationship between off-farm employment and smallholder commercialization has important implications for public policy to support rural communities during the process of economic transformation. The result of this study will help policy makers to better understand the situation and explore policy options to rationally address it.

1.5 Objective of the study

The main objective of this study is to identify factors that influence smallholder output market participation and market supply. Specific attention is paid to the role off-farm income in the smallholder commercialization process. We have three specific objectives:

- To determine the direction of relationship between off-farm income and smallholder commercialization measured in terms of output market participation and market supply.
- To determine other factors that determines smallholder crop output market participation and market supply
- To assess the patterns and trend of smallholder commercialization in Ethiopia over the survey years.

1.6 Research Hypothesis

There are numerous factors that determine degree of smallholder commercialization at household level and aggregate level. This study tries to examine the nature of interaction between of off-farm income and smallholder commercialization at household level, controlling for other determinant factors.

There are two contrasting views regarding the effect of off-farm income on smallholder output market participation and intensity of sale. The first view is that off-farm income may increase commercial linkage of farmers indirectly through its effect on crop production. With limited availability of agricultural credit for smallholder farmers, productivity growth in the smallholder sector remains a big challenge. Under such circumstance, can income generated within the household like off-farm income can play important role to relax this liquidity constraint. Thus,

cash income from off-farm source can help liquidity constrained farmers to reduce their liquidity constraint so that they will intensify input use to increase crop productivity and marketable surplus. In addition to this, income from off-farm employment can be used to overcome production and marketing risks associated with the commercialization of agriculture (Von Braun et al., 1994). Hence, holding other factors constant an increase in off-farm income may lead to high probability of output market participation and output marketed surplus.

The second view is that holding other factors constant, an increase in off-farm income may decrease the probability of output market participation and quantity supplied. This is because an increase in off-farm income can have income effect that increases household's consumption demand for own production and other non-agricultural products. Consequently, household can use off-farm income as alternative financial source to purchase non-agricultural consumption goods and consume what they produce. In this case, market participation might be lower than what it could be otherwise. Therefore, the overall effect of off-farm income on smallholder commercialization is ambiguous and depends on whether the positive impact dominates the negative impact or vice versa.

To capture the ceteris paribus effect of off-farm income (key variable of interest), we need to control for other determinants smallholder commercialization. Explanatory variables that theoretically expected to affect smallholder commercialization were included based on literature review. The hypothesized impact of these control variables is discussed in detail in the section empirical model specification.

1.7 Limitations of this study

The data for the empirical analysis are taken from three rounds of ERHS panel data: round 4 (1997), round 5(1999) and round 6 (2004). The data for round 7 (2009) is already available for public use and attempts were made to include it so that the impact of recent changes in local and world economic situation could be seen. But, since there were no sufficient observations on crop sale for this round it is excluded from the analysis.

In measuring degree of commercialization at household level the proportion of households participated in output market as seller and total value of crop sold were used. However,

households may sell commodities that are not intentionally produced for market. In this case, using value of crop sold as an indicator of degree of commercialization may lead to wrong conclusions. Another related issue of concern is when there is a distress sale which implies crop sales by poor households right after harvest at a lower price because they are in a desperate need for cash. Where it is food that is being sold, the household may then be forced to buy back the same (or indeed a greater) quantity of food later in the year when the price is much higher. In this case, the crop sale may raise the total value of crop sold, but is in no way indicative of increasing household welfare.

Another alternative measurement is to use household market orientation index. Market orientation index which is based proportion of land allocated to more marketable crop could capture the household production decision whether given commodity is produced for consumption or market. In this study, an attempt was made to use this index in measuring degree of household commercialization. But, since households within the same village produce more or less similar crops, the market orientation index that have been computed did not show sufficient variation to perform empirical analysis. Therefore, market participation and aggregate value of crops sold by household were used as a proxy indicator to measure degree of commercialization at household level.

1.8 Thesis outline

The thesis has consists of six chapters including the introductory chapter that has been discussed. The remaining chapters are organized as follows: In the second chapter, previous works on smallholder commercialization will be discussed in detail. In this chapter pervious works on the determinants of off-farm employment and rural non-farm income will also be discussed. In chapter three, the theoretical framework which serves as a base for empirical analysis will be presented and empirical model will be specified. Econometric approach regarding model selection and estimation methods will be discussed in chapter four. Data used in this study and summary statistics of variables used in the empirical analysis will be presented in chapter five. In chapter six, the econometric results will be presented and discussed. Finally, conclusions and some policy implications will be presented in chapter seven.

CHAPTER 2 - LITERATURE REVIEW

2.1 Theoretical Literature

2.1.1 Concepts of smallholder commercialization

The concept of agricultural commercialization is broad, and has contributed to varying definitions and emphasis in the literature. A given farm household is considered as commercialized if it is producing significant amount of cash commodities, allocating larger proportion of its resource to more marketable crops or selling larger proportion of its agricultural production (Immink and Alarcon, 1993; Strasberg et al., 1999 and Govereh et al., 1999). However, the meaning of commercialization goes beyond supplying surplus products to market (Von Braun et al., 1994; Pingali and Rosegrant, 1995; Pingali, 1997). According to these authors, commercialization of agriculture looks at both the output and input side of production and marketing decision. On the output side, simply speaking cash crops could qualify as crops for sale. But, commercialization of agriculture cannot be defined merely based on whether or not cash crop is present to a certain extent in the crop production portfolio (Von Braun, 1994). Commercialization can also be possible with primarily staple cereals since they are frequently marketed to a considerable extent while the so called high value cash crops are retained for home consumption (Von Braun et al., 1994; Pingali and Rosegrant, 1995). On the input side, commercialization implies both traded and own produced inputs are valued based on their market values (Pingali and Rosegrant, 1995).

Literature on commercialization also highlights the importance attached to the profit motive within the farm business as an indicator of agricultural commercialization. According to Pingali and Rosegrant (1995) agricultural commercialization means product choice and input use decisions are based on the principle of profit maximization. This can be contrasted with risk minimization motive in subsistence production. Hence, the commonly accepted concept commercialization of agriculture is that commercialized farmers relies on market signal and comparative advantage in their production and marketing decision as opposed to that of subsistence farmers whose main interest is to satisfy own consumption requirement and sell

whatever surplus left (Pingali and Rosegrant, 1995; Jaleta et al., 2009). Gebremedhin and Hoekstra (2008) referred to the former as 'produce what you intend to sell' and the latter as 'sell surplus of what you produce'.

Smallholder commercialization is part of agricultural transformation process which passes through three main phases; subsistence, semi-commercial and fully commercial (Pingali and Rosegrant, 1995). The product mix, input use decision and objective of production differ at each phase of the commercialization.

In the subsistence phase, household generated non-traded inputs are used to produce diverse product mainly for self-sufficiency. Both traded and non-traded inputs are used to produce moderately specialized product with the objective of surplus generation at semi-commercial level. At fully commercialized phase, however, inputs are mainly obtained from markets, products are highly specialized and the main objective is profit maximization (Pingali and Rosegrant, 1995). When agriculture is fully commercialized non- agricultural sectors become source of higher proportion of output and employment resulting from economic growth, urbanization and withdrawal of labor from agricultural sector (Pingali and Rosgrant, 1995; Jaleta et al., 2009).

Table 2.1 Degree of market orientation in different phase of commercialization

Level of Market Orientation	**Farmer's Objective**	**Sources of inputs**	**Product mix**	**Household income sources**
Subsistence systems	Food self-sufficiency	Household generated (non-traded)	Wide range	Predominantly agricultural
Semi-commercial systems	Surplus generation	Mix of traded and non-traded inputs	Moderately specialized	Agricultural and non-agricultural
Commercial systems	Profit maximization	Predominantly traded inputs	Highly specialized	predominantly non-agricultural

Source: Pingali and Rosegrant (1995)

Therefore, smallholder commercialization passes through this process and may not imply an immediate move on to high value cash crop production (Gebremedhin and Hoekstra, 2008). It

includes the production of both marketable staple food crops and cash crops. According to Pingali et al. (2005) for many farmers, transition from substance to commercial staple crop production is more common than complete shift to specialized high value commodities. Production of marketable surplus of staple food crops over what is required for household consumption is the most common form of agricultural commercialization in peasant agriculture (Gebre-Ab, 2006). But it should be understood that as the level of commercial orientation increases through time, one observes mixed staple and cash crop production system replaced by specialized production of high value commodities (Pingali, 2005; Gebre-Ab, 2006)

2.1.2 Measurements of smallholder commercialization

Different measurement indicators have been used to measure the degree of commercialization at household level. A simple measurement of smallholder commercialization at household level is value of sales as a proportion of the total value of agricultural output (Gebre-Ab, 2006). Von Braun et al. (1994) have formulated three types of ratios that could be used to measure level of commercialization at household level. These ratios are formulated considering forms of commercialization and integration in to cash economy from at least from three different angles.

1a)

$$\text{Commercialization of agriculture (from output side)} = \frac{\text{Value of agricultural sale in market}}{\text{Agricultural production value}}$$

1b)

$$\text{Commercialization of agriculture (from input side)} = \frac{\text{Value of agricultural inputs acquired from market}}{\text{Agricultural production value}}$$

2)

$$\text{Commercialization of of rural economy} = \frac{\text{Value of goods and services acquired through market transactions}}{\text{Total Income}}$$

3)

$$\text{Degree of inegration in to the cash economy} = \frac{\text{Value of goods and services acquired through cash transactions}}{\text{Total Income}}$$

The first one is commercialization of agriculture both from input and output side and the ratio measures proportion of the value of agricultural sale and value of input acquired from market to the total agricultural production value. The second type of ratio measures commercialization of rural economy as a proportion of value of goods and services acquired through market transaction to total household income. Here there is an assumption that some in kind transaction like payment of food commodities for land and laborers may takes place. The third type is household degree of integration in to cash economy which is measured a proportion of value of goods and services acquired by cash to total income (Von Braun et al., 1994).

Another indicator of household's degree of commercialization is household commercialization index (HCI) that has been used by Govereh et al. (1999) and Strasberg et al. (1999). It is a ratio of the gross value of all crop sales per household per year to gross value of all crop production by the same household in the same year.

$$HCI_{it} = \left[\frac{\text{Gross Value of crop sale}_{it}}{\text{Gross value of all crop production}_{it}} \right] * 100$$

Where i denote household and t denote year

This index indicates to what extent a household crop production decision is oriented toward markets. A value of zero would signify a totally subsistence-oriented household; a household with an index value of 100 is completely commercialized (Govereh et al., 199). The advantage of this measure is that it considers commercialization in a continuum and avoids crude distinction

as “commercialized” and “non-commercialized’’ households. It also effectively brings even the substance food producers in to the center of discussion about commercialization.

There are other four approaches used in Gabre-Madhin et al. (2007) to measure the level of household commercialization. These includes sales-to-output and sales-to-income ratios, net and absolute market positions (either as a net buyer, net seller or autarkic/self-sufficient household), and income diversification or level of specialization in agricultural production written as follows.

$$\text{Sales - to - output ratio} = \left[\frac{\text{Gross Value of agricultural production HH}_i}{\text{Gross value of all agricultural production HH}_i} \right] * 100$$

$$\text{Total Sales - to - Income ratio} = \left[\frac{\text{Gross Value of total sales HH}_i}{\text{Gross value of all crop production HH}_i} \right] * 100$$

Net Market position

$$\%\ \text{of sale} = \left[\frac{\text{sales}}{\text{V stored at the begonning} + \text{V produced during the season}} \right] * 100$$

$$\%\ \text{of sale} = \left[\frac{\text{Purchase}}{\text{V stored at the begonning} + \text{V produced during the season}} \right] * 100$$

Where V refers to volume of commodities

Specialization Index (SI)

$$\%\ \text{of sale} = \left[\frac{\text{value of Purchased agricultura products not produced by household}_{\text{HHi}}}{\text{Gross value of agricultural production}_{\text{HHi}}} \right] * 100$$

According to Gabre-Madhin et al. (2007), the sales-to-output ratio measures the gross value of all agricultural sales by a household as a percentage of the total gross value of its agricultural production. This ratio is similar to what has been developed earlier (e.g. von Braun et al., 1994) as the percentage of agricultural output sold to total agricultural production. The total sales-to-income ratio is the ratio of the gross value of total sales to total income from crop production. In this index, income from crop production is assumed as a proxy to total household income,

ignoring income from livestock, and off- and non-farm sources. The market position of a household is evaluated using the ratio of volume of sales and volume of purchases to the total volume of stock: the sum of storage from the previous production year and production in the current year. Net market position is better indicative if there is "distress" sale, i.e. crop sales by households, quite often at lower price, right after harvest. The household may be forced to buy back the same (or indeed a greater) quantity later in the year when the price is much higher. In this case, indicators like percentage of crop sold to total agricultural production, is in no way good indicative of increasing household welfare. The specialization index is a measure of degree of specialization of farm households in their production to capture the benefits from comparative advantages: producing what they can efficiently produce and exchange for what they cannot. This index measures the proportion of the value of purchased agricultural products not produced by households to the gross value of agricultural production.

2.1.3 Rational for smallholder commercialization

The potential welfare gain of smallholder commercialization is based on the principle of comparative advantage. Farm household increases their income by producing crops which provides the highest returns to land and labor, and then use the cash to buy household consumption items, rather than be constrained to produce all the various goods that the household needs to consume (Pingali, 1997; Govereh et al., 1999). Timmer (1997) also pointed out that smallholder commercialization is significantly related with "higher productivity, greater specialization and higher incomes". In turn, an increased income gives way to improvement in food security, poverty reduction and economy-wide growth (Timmer, 1997 and Fafchamps, 2005).

Jaleta et al. (2009) categorized the possible welfare effect of smallholder commercialization as first order, second order and third order effects. The first order effect is its direct impact on household income and employment, while the second order effects include health and nutrition aspects usually contingent on the level of household income at a given level of commercialization. The third-order effect includes impact that goes beyond the household level like environmental and socio-economic impact. According to these authors, farmers can achieve higher gross margins from land and labor used for market oriented crops compared to crops for

subsistence, thereby increasing their incomes. But, farmers are not the only ones to benefit: under the right conditions, linkages in production and consumption should lead to extra jobs being created in the local rural economy, to benefit landless and marginal farmers unable to commercialize.

However, there is a frequent concern that the shift from subsistence to commercial crop production may have an adverse consequence by exposing households to volatile food market prices and food insecurity, particularly if the rural market is not well-integrated and higher marketing risks (Islam 1994; Govereh et al., 1999; Jaleta et al., 2009). If efficient markets do exist, then commercialization leads to separation of production from consumption, supporting food diversity and overall stability at household level (Bernard et al., 2007) and increased food security and improved allocative efficiency at macro level (Fafchamps, 1992 and Timmer, 1997). But if markets remain inefficient and transaction costs are high, smallholders may not able to exploit the potential advantage of commercialization.

Von Braun (1995) summarized a series of comparative studies of selected sites where farm household had switched from semi-subsistence staple food production with low levels of external inputs to production of more crops for sale in the market or to production with more purchased inputs. He found that commercialization plays a significant role in increasing incomes and stimulating rural growth, through improving employment opportunities; increasing agricultural rural productivity; direct income benefit for employees and employers; expanding food supply and potentially improving nutritional status. However, he is also cautions that, while commercialization by itself rarely has adverse consequences on household welfare, commercialization combined with failures of institutions, policies, or markets can be damaging. Finally, he concludes that in order to maximize potential benefits from agricultural commercialization and minimize damage: There must be government policies that facilitate the transition to commercialized agriculture in a manner that benefits the poor and does not simply replace subsistence-related production risks with new market and policy failure risks, may be even more devastating to the poor (Von Braun, 1995)

2.1.4 Determinants of smallholder commercialization

Market oriented production leads to welfare gains through specialization that build on comparative advantage, economies of scale and regular interactions and exchange based flow of ideas (Romer 1993, 1994). Although the net welfare gain from agricultural commercialization is universally accepted, smallholder farmers in low income countries are constrained by a number of factors in their quest to participate in exchange economy and materialize its potential welfare gains.

Factors that affect the decision of smallholder market participations may vary depending on local context but there are a numbers of common factors when it comes to low income countries (Barrett, 2008; Von Braun et al., 1994). In the literature, these factors are broadly categorized as external and internal factors[4] (von Braun, 1991; Pingali and Rosegrant, 1995; Jaleta et al., 2009). According to these authors, population growth and demographic change; technological change and development of new commodities; development of infrastructure and market institutions; macro-economic and trade policies are the major external forces that influence smallholder commercialization process. In addition to this, development of input and output markets, cultural and social factors affecting consumption preference, agro-climatic, production and market related risks are other external factors that could affect the commercialization at local level (Pender and Alemu, 2007). These factors influence commercialization through their effect on the condition of commodity supply and demand, output and input price, and transaction costs and risks faced by actors in agricultural production and marketing system.

Leavy and Poulton (2007), identified three critical conditions that have to be in place to promote agricultural commercialization that will benefit the larger proportion of smallholder producers. These are market access, access to staple food and asset accumulation. Although market access is crucial to smallholder commercialization, not all households have equal access to market due to transaction costs. According to these authors, rural infrastructural development, better market information, strengthening farmer organization and promoting contract farming plays important role in strengthening smallholder market access. Citing different case studies in different African

[4] In Von Braun et al (1991) exogenous and endogenous factors were considered as equivalent to external and internal factors, respectively from household's point of view.

countries, Leavy and Poulton (2007), documented success stories of smallholder farmers who have participated in contract farming and benefited from adoption of new production method, access to stable market and secure income.

The second critical condition for viability of agricultural commercialization, according to Leavy and Poulton (2007), is access to food markets and food production. Two main standards of literature that investigate the relationship between subsistence and commercial agricultural productions among smallholders are identified. The first standard of literature looks at the impact of commercial agricultural production on food security of those who have already engaged in it. There are some concerns that cash crop production can have negative impact on food security and nutrition of smallholder farmers. The argument for this is that farm household those invest in cash crop may sacrifice food security to do so. However, a summary of case studies by von Braun and Kennedy (1994) indicated that such adverse impacts are rare. According to this study, farmers who are adopting commercial crop or new technologies allocate considerably smaller share of their resource to food crops for own consumption. Nevertheless, they generally achieve higher productivity in their food crop production. Moreover, higher income as a result of adoption of new commercial crop or technology leads to higher calorie intake. The second standards of literature examines if household concerns about food security can be a constraint to smallholder commercialization. If food markets are unreliable, inefficient or highly volatile, it is argued that farm households will prioritize feeding themselves and hence will only cultivate very small quantities of crops intended for sale. In such situations, farm households are rational even if they could have earned better incomes by diversifying into cash crop production.

The third critical factor in smallholder commercialization that Leavy and Poulton (2007) identified is asset accumulation. Differences in asset holding are considered to be a big determinant of who respond to incentive to commercialize. One of the key assets for rural household is land holding. Jayne et al.(2003), also indicated small land holding under poorly developed food market keep poor households focused on the production of (often low value) staple food crops to achieve a given level of self-sufficiency. There is then less land available, if any at all, for production of higher value crops for market. Another form of asset accumulation is animal traction. According to Leavy and Poulton (2007), accumulation of animal traction can benefit farmers in two ways: by increasing their responsiveness to rains and through provision of

manure. Quick response to rains result in higher yields as it is the case with the use of manures which enhance soil fertility and thus yields of the farm household.

Smallholder farmers in most developing countries are heterogeneous by their asset holding position (World Bank, 2007). Lack of the key productive assets is greater in Sub-Saharan Africa. Farm size in this region is unsustainably small and falling due to population pressure and land degradation. Along with other constraint factors like negligible investment in irrigation, poor health and education are limiting the productivity and participation in market and other opportunities (World Bank, 2007).

According to Jaleta et al. (2009), asset holding plays important role as a determinant of smallholder commercialization through its impact on the production and consumption decision of households. When credit market for consumption is absent or not easily accessible to the poor, asset liquidation may be the only option available to household to smooth consumption. On the production side, asset holdings are essential for marketable surplus production particularly when markets for production factors and labor are completely missing or less functioning (Jaleta et al, 2009). Hence, smallholder farmers with high asset holdings deliver surpluses to food markets and share the benefit of expanding markets, whereas many others remain in substance farming mainly due to low asset holding.

Another barrier to market participation by resource-poor households is transaction costs (de Janvry et al., 1991; Sadoulet and de Janvry, 1995; Key et al., 2000). According to von Braun and Kennedy (1994), high transaction costs and risks related to production, markets, and employment are some of factors that keep smallholder farmers in Sub-Saharan Africa to be subsistence oriented. In the literature, transaction costs are classified in to two as proportional and fixed transaction costs (Key et al., 2000; Alene et al., 2008). Proportional or variable transaction costs are costs related to transferring outputs and inputs traded to market such as transport, time spent and storage. It is per unit cost of accessing market that raise the price effectively paid for inputs and lowers the price effectively received for outputs, thereby create price band within which for some households it is unprofitable to participate in market (Key et al., 2000; Alene et al., 2008). In most developing countries, smallholder farmers are located in a remote area far away from service providers and major consumers of farm products. Consequently, distance to market

exacerbated by poor access to infrastructure, assets and market information leads to too high transaction costs that completely hinder or limit smallholder market participation (Alene et al., 2008). Fixed transaction cost includes searching, negotiation and bargaining, and screening costs among others. These types of costs are invariant with the volume of transaction that takes place. This is because once the market has been obtained and contracts made with buyer, then the farmer can sell any amount without additional costs.

2.1.5 Off-farm income and its interaction with smallholder commercialization

Haggblade et al. (2007) described 'off-farm' income as income earned "off the owner's own farm". It includes wage employment in agriculture earned on other people's farms and nonfarm earnings from the owner's nonfarm enterprises or from nonfarm wage earnings. Thus, off-farm income simply is rural non-farm income and wage earnings in agriculture.

According to neoclassical farm household model, a farm household chooses to work either on farm or off-farm depending on the marginal value of labor in farm work and off-farm work (singh et al., 1986). In a perfect market system, individuals participate in off-farm activities as long as the marginal value of farm labor (reservation wage) is less than the off-farm wage they are offered (Becker, 1965; Gronau, 1973 cited in Woldehanna and Oskam, 2001). This implies poorer households have a strong incentive to participate in off-farm activities because they earn lower marginal value of farm labor (Woldehanna and Oskam, 2001).

Rural farm households diversify their income sources in to off-farm activities motivated by different factors. According to Reardon et al. (2001), decision by rural household to participate in off-farm activity can be influenced by incentives offered and household capacity. Some poor rural households may participate to take advantage of opportunities in the rural nonfarm economy, taking into account wage difference between the two sectors and the associated riskiness. Rising incomes and availability of off-farm employment are among the pull factors that increase the supply of off-farm labor. Others may be pushed into the nonfarm sector forced by lack of on-farm opportunities, for example, resulting from drought or small size of land holdings.

If off-farm options can be accessed easily, but credit markets are thin or missing, off-farm earnings can be a crucial means for overcoming working capital constraints in the farm investment (Woldehanna, 2000, Barrett and Reardon 2001; Oseni and Winters, 2009; Hernandez et al, 2010). There is, however, far less literature on how off-farm work participation and income from this source interacts with smallholder commercialization at household level. Some theoretical premise suggests that off-farm income could enhance smallholder commercialization via its farm investment effect (e.g. Woldehanna, 2000; Oseni and Winters, 2009). Income obtained from off-farm activities can provide liquidities for farm investment so that the productivity and production of marketable surplus increases which in turn increase the proportion of crop sale (Woldehanna, 2000, Oseni and Winters, 2009). This could happen if a household engages in higher earning wage or self-employment activities. In addition to this, because of high risk associated with commercialization, income from off-farm employment may assist farm households in consumption smoothing in a bad year (Evans and Ngau 1991; Reardon et al., 1994; Holden et al., 2004). This may help smallholder farmers to develop a willingness to move from "safety first" food cropping to risky cash cropping with a buffer of cash from nonfarm activities (Reardon et al., 1994). Hence, off-farm income can enhance smallholder commercialization process by providing liquidity for credit constrained farm households.

On the other hand, off-farm income can also have negative impact on smallholder commercialization (Woldehanna, 2000; Kan et al., 2006). The first argument is based on the notion that holding farm income constant, an increase in off-farm income can increase household's demand for both agricultural and non-agricultural consumption goods. Thus, farm household may use cash income received from off-farm employment to satisfy their cash demand for the purchase of non-agricultural consumption goods and consume what they produce and become self-sufficient. Hence, the marketed surplus might be lower than what it would be otherwise. Another argument for negative relationships between off-farm employment and smallholder commercialization is its potential competition with farm labor. According to Burger (1989), shifts in labor from farm to off-farm employment can sometimes lead to farm production inefficiency that could slowdown agricultural intensification and commercialization.

There exist minimal literature on possible interaction between off-farm work and smallholder commercialization. Woldehanna (2000) found that household's probability and level of food

purchase increase as off-farm income increases, whereas the probability of grain sales decreases. Based on cross-sectional data from selected tef growing areas in Ethiopia, Gebreselassie and Sharp (2007) have identified factors responsible for smallholder commercialization. They modeled quantity supplied to market (value of crop sold) as a linear function of different household level variables. They employed instrumental variable regression (2SLS) to estimate determinants of quantity supplied to market. Their finding indicates off-farm employment participation doesn't have any statistically significant impact on the quantity supplied. Whereas, the effect of off-farm income on the quantity supplied was negative and statistically significant. They also found total value of crop production has positive and a significant impact on households' degree of market participation as seller. However, this study was based cross sectional data obtained from tef growing households in specific areas in the country.

2.2 Empirical Literature

Under this section, I will discuss some approaches and empirical models employed in the study of agricultural commercialization their major findings.

2.2.1 Market participation under market failures

A market fails for a particular household when transaction cost through market exchange produces the gain that is below the cost of participation in the market (de Janvry et al., 1991). This implies market exists for a given commodity or factor, but the gains from market for a particular household may be below or above the cost. Thus, some households participate in the market while others will not. When a given commodities can be bought and sold by a household, the width of price band between the selling and buying price depend on various transaction costs that are largely household specific. Poor infrastructure, less competitive marketing systems, inadequate information system, shallow local market, and price risks leads to greater size of this band (de Janvry et al., 1991; key et al., 2000; Barrett, 2008). If the shadow price of a product or factor which the household produces and uses falls within this price band, trade will not occur: It is more preferable for a household to be self-sufficient in this product or factor (de Janvry et al. 1991). According to Sadoulet and de Janvry (1995), a frequent cause of market failure is limited access to working capital.

If perfect market condition for all product and factor market exists, then production and consumption decision of farm household can be modeled as being separable (Singh et al., 1986; Sadoulet and de Janvry, 1995). Household behaves as if production and consumption decisions were made separately and sequentially: Production problem solved prior to consumption problem and the optimal profit level achieved in the production decision enters the consumption decision (de Janvry et al., 1991). All commodities are tradable and all prices are exogenous.

Market failures for commodities and factors leads to non-separability production and consumption decisions, which account for the potential breakdown of agricultural commercialization strategies based on comparative advantage (Govereh et al., 1999). In non-separable farm household model, production and consumption decisions are made simultaneously (de Janvry, 1991). That means, not only the production decision that affects the consumption decisions but also the consumption decisions affect the production decisions. The two are linked through endogenous price, household shadow price, that equates the demand and supply for non-tradable.

2.2.2 Previous findings on determinants of smallholder commercialization

Recent empirical studies on smallholder market participation emphasize transaction costs and institutional factors in determining households' decisions on market participation (Goetz, 1992; Key et al., 2000; Alene et al., 2008). Goetz (1992) estimated a switching regression model of market participation and amount traded to grain market in Senegal – separating the decision of whether or not to participate in markets from the decision of how much to trade. He found that fixed transactions costs significantly and negatively affect smallholder's market participation. While better information stimulated, smallholder's market participation. He also decomposed the impact of a rise in the price of grains between entries of new sellers and increase in the sale of producers already in the market.

Elaborating the works by Goetz (1992), Key et al. (2000) also used household model that allows farmers to be net buyer, net seller or autarkic of each commodity depending on proportional and fixed transaction costs they face. They consider both fixed and proportional transaction costs. Fixed transaction costs are invariant with the volume traded, while proportional transactions proportionally increase with the volume traded as the name indicates. They solve the model

conditional on market participation, and drive indirect utility functions for each regime defined by a particular participation rule. Then, market participation is determined by comparing these indirect utilities for buying, selling and self-sufficient for particular commodity. Finally, they estimated the model using data consisting of Mexican corn producers and the results indicate that both fixed and proportional transactions costs play a significant role in explaining household behavior, with proportional transaction costs being more important in selling decisions

Alene et al. (2008) also followed Goetz's approach to estimate reduced form equations for market participation and output marketed surplus based on data from maize producer smallholders in Kenya. They estimated selectivity model for market participation and marketed surplus. Factors significantly and negatively influencing market participation included off-farm income, age of household head and distance from input market. Whereas land per capita, credit access and labor availability are found to have positive and significant influence on household output market participation.

Gebremedhin and Hoekstra (2008) have examined factors affecting decision to grow more marketable crops and proportions of these crops sold based on cross-sectional data from selected grain producing regions in Ethiopia. They estimated probit model to determine factors affecting probability of households' decision to grow grains meant for market and interval regression for proportions of these grain sold. They found hosts household level factors including household demographic characteristics, human capital, physical capital and distance to market to be significant in determining market orientation and probability of output market participation. Village level factors like population density, agricultural labor wage and rainfall have explained both market orientation and market participation of households. They found female headed households are less likely to grow market oriented crops. Household size was also found to have negative impact on household market orientation. Household endowments of land, labor and traction power explained market orientation positively and significantly (Gebremedhin and Hoekstra, 2008). They also found distance to the nearest market place has negative impact market orientation.

2.2.3 Determinants of off-farm employment

There are several research works on factors that influence households' decision to participate in different off-farm activities and income from these sources. For example, Man and Shady (2009) used logit model to look at off-farm participation determinants on a study made among 500 paddy farmers in Malaysia. They found household characteristics like household heads' age, gender, number of dependents and other income influenced households' likelihood to engage in off-farm activity. While impact of farm size and farmers education level were insignificant (Man and Shady, 2009). On the other hand, Mduma and Wobet (2005) in their study conducted in Tanzania, found education level, availability of land and access to economic center and credit as most determining factors of the numbers of household participated in particular rural local labor market and share of labor income of total cash income.

Amount of income earned from off-farm activity depends on whether the reason for household participation in off-farm activity is push factor or pull factor. Household could engage in off-farm activities attracted by wage rate, availability of labor, and access to capital to start own business. On the other hand they can be pushed in to off-farm activities due to lack of opportunities on the farm such as insufficient land holding, lack of access to credit, drought and so forth. Woldehanna (2000) in his study conducted in Northern Ethiopia, found household participation in off-farm employment and income from off-farm increases with market wage rate, livestock wealth, and family size, and decreases with non-labor income, farm assets, variable farm inputs, and area of land cultivated. Lemi (2006) also looked at factors that influence intensity of off-farm activity (share of off-farm income in total cash income) in rural Ethiopia based on 1994 and 1997 household survey data. He found, in 1994 having more land increased household off-farm intensity, whereas having more livestock lowered intensity

•

CHAPTER 3-THEORETICAL FRAMEWORK

In this chapter the theoretical model which serves as a base for the empirical analysis will be presented. Our theoretical model is based on non-separable farm household model. Non-separable farm household model first developed by Singh et al. (1986), has been employed frequently in solving problems related to the complex behavior of farm household model particularly under missing or imperfect markets (de Janvry et al., 1991; Sadoulet and de Janvry, 1995; Key et al., 2000; Barrett, 2008). The model described in this section is adopted mainly from the work of Key et al. (2000) and Barrett (2008).

3.1 Market participation choice and market supply

Empirical works on smallholder market participation and agricultural supply response are based on the assumption that market access is not uniform because of high transactions costs that farm household face in their marketing decision (Key et al., 2000; Barrett, 2008). High transaction cost may widen the price margin between the effective price paid by buyers and effective price received by sellers and ultimately determine households market positions (de Janvry et al. 1991; Sadoulet and de Janvry 1995; Key et al., 2000).

The theoretical framework in this study is based on a stylized farm household model under imperfect market conditions in line with Key et al. (2000). Market participation is considered as a choice variable in the model. Households are assumed to maximize utility with respect to consumption (c_i), production (q_i), input use (k_i), sales (s_i) and purchase (b_i) of each good $i = 1, 2, \quad ...N$. Goods consumed include self-produced agricultural commodities, other market commodities and leisure. Household produces agricultural goods (q_i) using land, labor and other variable inputs (k_i).

In the absence of transaction cost, households' problem is to maximize utility function (3.1) subject to the liquidity (3.2), commodity balance (3.3), production technology (3.4) and non-negativity (3.5) constraints.

$$Max\ U(c, z_u) \qquad (3.1)$$

Subject to

$$\sum_i p_i^m (s_i - b_i) - p_k k_i + W \geq 0 \qquad (3.2)$$

$$q_i - k_i + E_i - c_i + b_i - s_i \geq 0 \qquad (3.3)$$

$$G(q, k; z_q) = 0 \qquad (3.4)$$

$$q_i, c_i, k_i \geq 0 \qquad (3.5)$$

Where p_i^m denotes the market price, E_i is endowment of good *i*, *W* is exogenous off-farm income which could be earned or unearned and z_u and z_q represents household and production characteristics respectively. The cash constraint (3.2) states that all the purchases of household must be less than or equal to sales of any or all of *i* crops plus off-farm income and other net transfers. The commodity balance in the constraint equation (3.3) states that total quantities consumed, used for input and sold cannot exceed the production, endowment and purchased quantity of each good *i*. The production technology constraint (3.4) corresponds to a well-behaved production function that relates all the inputs to outputs. Equation (3.5) is non-negativity constraint.

Now if we consider that household faces crop and household specific transactions costs per units of quantity sold and bought, $\tau^c(Z, A, G, W)$. These involves both proportional and fixed transactions costs that may depend on household specific characteristics, *Z*, (e.g. educational attainment, age and gender) that might affect search costs, negotiation skill etc., public goods and services, *G*, (e.g. access to extension services for information on crop marketing strategies, road accessibility and distance to nearby market), household assets, *A*, and liquidity from off-farm income, *W*. With transactions costs, the cash constraint equation (2) can be written as follows.

$$\sum_i [(s_i (p_i^m - \delta_i \tau^c(Z, A, G, W)) - b_i (p_i^m + \gamma_i \tau^c(Z, A, G, W))] - p_k k_i + W \geq 0 \qquad (3.6)$$

δ_i takes value 1 for the seller households and 0 for autarkic households for each good *i*, while γ_i takes value 1 for buyer households and 0 for autarkic. The equation implies in the cases when

transactions costs involved, the price received by the seller farmer is the market price p_i^m decreased by the amount of transaction costs. Whereas, when buying goods, the household has to pay an additional transactions cost in addition to the market price for each unit bought. Buying and selling transaction costs are assumed to be different for the same household and the same commodity. The first order condition of the maximization problem of utility function will yield the reduced form output marketed supply, conditional on the market participation (Goetz, 1992; Key et al., 2000).

Output market participation:

$$Q_{si} = (p_i^m, \tau_i^{pc}, \tau_i^{fc}, z_u, z_q, E_i, W) \qquad (3.7)$$

Output marketed supply:

$$Q_{si} = (p_i^m - \tau_i^{pc}, z_q) \qquad (3.8)$$

Where τ_i^{pc} and τ_i^{fc} denotes proportional and fixed transaction costs, respectively. Equation (3.7) and (3.8) implies that participation in the market which is determined by discrete comparison of the expected utility form alternative marketing regime (i.e., participation vs autarky) it will be affected both by fixed and proportional transactions costs. However, for those who sell or buy output, the volume of output sold or bought is unaffected by the fixed transaction cost. Once the fixed cost of participation in the market is paid, the farmer can sell or buy any volume of output without any additional cost.

3.2 Reduced form and Marketed surplus

Based on the theoretical framework described above, and following the works of Strauss (1984) and later on by Goetz (1992) the reduced form of the underlying modeling frame work could be presented as follows:

$$x^q{}_{ij} = x^q(p, z_q) \qquad (3.9)$$

$$x^c{}_{ij} = x^c(p, [(A_i + p_n L(\mu) + f(p, z_q)], z_u) \qquad (3.10)$$

Where $x^{q}{}_{ij}$ is production of crop *j* by household *i;* $x^{c}{}_{ij}$ represents consumption of product *j* by household *i;* p are prices of goods; z_q denotes farm characteristics including fixed inputs and a vector of production technology; z_u is household characteristics affecting consumption; A_i is exogenous income sources in which off-farm income is embodied; p_n is labor price; L is total time available for on-farm, off-farm and leisure; μ is household characteristics determining total labor time and $f(.)$ is farm profit. Then following Strauss (1984) and Goetz (1992), the marketed surplus of commodity *j*, Q_{ij}^{m} can be calculated as total output produced less output consumed as follows:

$$Q_{ij}^{m} = x^{q}{}_{ij} - x^{c}{}_{ij} = x^{q}(.) - x^{c}(.) = f(p, A_i, \mu, z_q, z_u) = f(X_i) \qquad (3.11)$$

This equation (3.11) states that the marketed surplus for commodity *j* and household *i*, is expressed as a function of all exogenous variables related to the production and consumption decision of households. The theoretical restrictions of standard supply and demand functions do not apply to marketed supply. Moreover, one does not need to estimate the complete system of demand and supply of all products for marketed surplus as noted by Sadoulet and de Janvry (1995).

From the equations (3.7) and (3.8) we can further assume that both proportional and fixed transaction costs affect the market participation, while supply decision, conditional on market participation, only affected by the variable transaction cost. Thus, we can use fixed transaction costs to identify the probability of market participation as follows:

$$pr(market\ participation) = f_i(x_i, \tau_i^{fc}) \qquad (3.12)$$

3.3 Model specification

Our specification of empirical model is based on the theoretical framework summarized above. Accordingly, household market participation and output supply decision were estimated based on reduced form equations (3.7) and (3.8) to assess how off-farm income affect these decisions. Unlike some previous studies (Goetz, 1992; Key et al., 2000; Alene et al., 2008), the dependent variable in this study is aggregate value of sales. The main reason to use aggregate value of sale instead of quantity marketed (i.e. tone or kg's) is to make the most out of data, i.e. to use all the

available information in the data by including the aggregate of all crops produced and sold by households in a given period. In addition to this, due to substitution between crops, some exogenous variables may increase individual crop sales at the expense of other crops. Aggregating over multiple crops makes it impractical to work with quantities since different crops produced and sold cannot be aggregated directly. So use of values instead of quantities was made to solve this problem. Village level market prices for each crop during the respective survey period were used as implicit weight.

The selection of explanatory variables that we used in this study in addition to the key variable of interest, off-farm income, is based on various related empirical works (e.g. Alene et al., 2007; Boughton et al., 2007; Gebremedhin et al., 2009) and theoretical literature on the determinants of smallholder commercialization (von Braun, 1994 and Jaleta, 2009). Accordingly, household market participation decision and quantity supplied were specified as function of off-farm income; value of crop production; vector of household resource endowments; household and household head characteristics; vector of variables related to proportional and fixed transaction costs and regional dummies for agro-ecological difference between regions[5.]

Value of total crop production is included to the explanatory variables in the model. Due to food market imperfections in developing countries, production and consumption decisions of farm household are usually non-separable (Sadoulet and de Janvry, 1995). Particularly at the early stage of commercialization, surplus production of staple food crops is more common than production of cash crops exclusively for market. As a result most of the crops supplied to market are surplus products after satisfying household subsistence requirements. In such circumstances, increasing level production is expected to have positive impact on market participation and volume sold.

Under imperfect factor market, which is common in most developing countries, ownership of these factors matters for efficiency and productivity of agriculture (Sadoulet and de Janvry, 1995). Because modern capital is not very common in rural Ethiopia, three variables: plot of land owned, traction power (oxen owned) and Livestock ownership in Tropical Livestock Unit (TLU)

[5] Crop price is not included as right hand side variable, because the dependent variable is the aggregate value of all crops sold and it was difficult to come up with representative price at household level.

are included in the model to capture the effect of resource endowment. Land per capita is declining due to population growth and land degradation among others factors. Thus, land is expected to be an important limiting factor of production and households with relatively larger land holding may produce surplus for market. Hence, land is expected to have positive and significant impact on marketed surplus and participation decision. Livestock ownership may offer alternative cash income for households, thus we expect to have negative impact.

Among household characteristics, family size is expected to increase demand for domestic consumption requirements. Therefore, households with larger family size may allocate their resource to crops that are intended for home consumption and consequently become more subsistent oriented. On the other hand, family size may also reflect availability of labor endowment for farming and off-farm activity. This is more evident in developing countries where agriculture is predominantly dependent on family labor and larger family size means more hands for farming and off-farm activity. Thus, the overall impact of family size on output market participation is ambiguous. But, conditional on participation decision, larger family size is expected to have negative influence on intensity of sale.

Transaction costs are important determinants of market participation and volume traded by resource poor farmers. However, there are serious empirical challenges related to its measurement. First, when the transaction costs are too high to prevent exchanges to take place, then these costs cannot be observed since no transaction takes place. Second, even when transaction takes place, these costs cannot be easily recorded in a survey (Key et al., 2000). Even so, to circumvent any possible omitted variable bias we can use observable exogenous variables that are theoretically expected to explain these transaction costs. Hence, building on pervious empirical works (e.g. Alene et. al, 2008), variables such as distance to nearby markets; ownership of transport animals; age, gender and education of head of household and participation in extension program are considered in the explanatory variables.

By increasing travel time and transportation cost, distance to the nearby market is expected to have negative impact both on market participation and amount traded. So it is related to proportional transaction cost. Data on this variable is available at village level. For most rural Ethiopian households, the main means of transportation of inputs and outputs and also access to

nearby towns for information is by transport animals. Hence, ownership of transport animals is expected to have positive influence on market participation as well as quantity sold.

Access to communication/information networks essentially mitigates the fixed transactions costs and is thus likely to facilitate market participation only. Information variables meant to capture fixed transactions costs are education, age and gender of head of household and participation in extension program. A better educated head of household is assumed to have better skill, better access to information, capable of higher level of information processing and well- networked within the community. Therefore, it is expected to have positive influence on market participation. Age can be considered as an indicator of experience in farming, greater market contact and build trust that could enable them to trade at lower cost. Hence, an increase in age of household head may increase household market participation. Because of better capacity in farming and more access to information, male headed households are expected to be more market participant. Agricultural extension programs are expected to improve access to information by facilitating smallholder linkages with input and output markets. Thus, participation in the extension program is expected to have to have positive impact on household market participation through its impact on fixed transaction cost.

Household market participation in selling crop output modeled as two stage decision process: First, the household decides whether they should participate in the crop market as seller (M_{it}). In the second stage, conditional on the participation decision, they decide on the volume of crop products they sell ($V^{s}{}_{it}$). In these decision process, market participation decision depends on both fixed and proportional transactions cost, while supply decision conditional on market participation, only depends on proportional transaction costs. Therefore, the underlying model for household market participation and supply decision can be specified as follows;

$$M_{it} = f(W_{it}, Q_{it}, HH_{it}, A_{it}, TLU_{it}, DM_{it}, EO_{it}, EXTN_{it}, DR, v_{it}) \quad (3.13)$$

$$V^{s}{}_{it} = f(W_{it}, Q_{it}, FZ_{it}, A_{it}, TLU_{it}, DM_{it}, TA_{it}, DR, u_{it}) \quad (3.14)$$

Where

M_{it} : is household i[th] crop market participation as seller which takes value 1 if household sold any value in period t, zero otherwise.

W_{it} : is off-farm income,

HH_{it} : is a vector of household and household characteristics,

A_{it} : is area of land in terms of hectare owned by household in a given period t

TLU_{it} : is livestock owned by household in tropical livestock unit in a given period t

DM_{it} : is distance from nearby market in kilometer

TA_{it} : is number of transport animals owned by household

$EXTN_{it}$: is dummy for participation in extension program which takes on value 1 household participated in extension program in a given period 1

FZ_{it} : is household family size in a given period

DR: is a regional dummy to capture the difference in terms of agro-ecology between regions.

v_{it} and u_{it} are the idiosyncratic error terms associated with market participation and volume sold, respectivley

CHAPTER 4- ECONOMETRIC APPROACH

4.1 Model Selection

As mentioned earlier, some farm households may not participate in output market constrained by different factors, high fixed transaction costs for instance. In this situation, farmers may produce marketable product but prefer to be autarkic if the household shadow price lies between the mark-up selling and buying price due to high transaction costs in marketing (Key et al 2000; and Alene 2008). The value of crop sale is reported to be zero for those farm households who did not participate in crop market as seller. In this study, on average 32 % of the sample households have not participated in crop output market as seller. Therefore, any parameter estimation result based on linear regression model like ordinary least square (OLS) would be biased and inconsistence (Maddla, 1983)

Most previous empirical studies on smallholder commercialization have modeled output marketed supply or input demand as a two stage decision process. First household's decisions of whether or not participate in market, then the volume of transaction. They used either Heckman's (1976) sample selection model or its variants of double hurdle and switching regression models (e.g., Goetz, 1992; Boughton et al., 2007; Alene et al., 2008), while some other used the more restrictive Tobit model (e.g., Holloway et al., 2000; Gebremdehin et al., 2010).

4.1.1 Heckman's Sample Selection

In sample selection approach we deal with non-random samples that may arise as result of survey design, non-response on survey questions, sample attrition or the specific attributes of the variable being analyzed. A classic example is the work of Heckman (1979) that was based on female labor supply, where hours worked is observed only for those women who decided to participate in the labor force. If not taken in to account it is well known to lead to inconsistent estimation of the behavioral parameters of interest, because these are confounded with the parameters that determine the probability of entry in to the sample.

In sample selection problems, some part of the dependent variable is not observed as a result of the outcome of another variable. In this case, it is erroneous to infer a zero for non-participation and any estimation based on the selected sample would be biased unless we account for those agents who never participated or whose data is missing through the correction term. The Heckman two step approach deals with such a sample selection problem. In the first step, one estimate the binary Probit model of market participation; then in the second step, fits a regression for volume traded by ordinary least square (OLS), conditional on market participation (Wooldridge, 2002). From the first step Probit selection model, we can compute the selection term which is called Inverse Mill's Ratio (IMR) and include it as explanatory variable in the second step regression to correct for self-selection and obtain unbiased, consistent, and efficient estimators (Wooldridge, 2002).

It may seem justifiable that Heckman selection model would be used in this study because we have many farm households with zero sales value. However, Heckman selection model is designed for incidental truncation, where zeros are unobserved values (e.g., in the case of wage rate model where sample includes unemployed persons), which is not the case in this study. Therefore, corner solution model is more appropriate than selection model for this problem because, due to fixed transaction costs and other constraint factors, the zeros in the data reflect farmers optimal choice not to participate in market as crop seller than representing missing values.

4.1.2 Tobit Model

A Tobit estimator proposed by Tobin (1958) for corner solution model could be used to model the household's market supply decision. In this case, farm household's marketing problem is modeled just as one decision problem and therefore it assumes the decision to participate in crop market and volume of sale, conditional on participation are determined by the same process (variables). Moreover, in a Tobit model, partial effect of particular variable, x_j, on the probability that a farmer participate in crop market and on the expected value of quantity they sell, conditional on participation have the same signs (Wooldridge, 2002). This assumption is considered as fairly restrictive (Wooldridge, 2002; Ricker-Gilbert et al., 2011) especially when the factors that affect household market participation decision are different from factors that

affect the intensity of participation. For instance, fixed transaction costs may have an impact on household decision to participate, but not on the intensity of participation because any quantity can be sold once the fixed transaction cost is paid (key et al. 2000; Alene et al. 2008).

4.1.3 Double Hurdle Model

Double Hurdle model, also known as two tier model, is corner solution model in which zero values associated with non-participation are assumed to be outcome of rational choice (Wooldridge, 2002). The DH model is an extension of Tobit model which relaxes the restriction imposed by Tobit model by allowing different mechanisms to determine the discrete probability of participation and volume of transaction, conditional on participation. The DH model is more flexible and fits our problem than Tobit model because it allows for the fact that fixed transaction costs may affect a farmer's decision to participate in the crop market, but once the decision to participate has been made, fixed costs may not affect the quantity sold. The DH model also allows the same factor to affect participation and amount sold in different ways. Therefore, the DH model proposed by Cragg (1971) is implemented in this study.

In the first hurdle, farmers decide whether or not participate in the crop market, then conditional on the participation (y > 0), hurdle two considers volume of transaction. The double hurdle decision process can be formulated as follows:

Decision on participation:

$$y_{i1t}^{*} = \alpha' w_{it} + v_{it}$$

$$y_{i1t} = \begin{cases} 1 \text{ if } y_{i1t}^{*} > 0 \\ 0 \text{ otherwise} \end{cases} \qquad (4.1)$$

Decision on quantity of sell:

$$y^{*}_{i2t} = \beta' \mathrm{x}_{\mathrm{it}} + u_{it}$$

$$y_{it} = \begin{cases} \beta' \mathrm{x}_{\mathrm{it}} + u_{it} & \text{if } y_{i1t} = 1 \text{ and } y^{*}_{i2t} > 0 \\ 0 & \text{Otherwise} \end{cases} \qquad (4.2)$$

$$i = 1, 2, ..., N \qquad t = 1, 2, ..., T$$

Where, y^{*}_{i1t} is a latent (unobserved) participation indicator, indicating potential participation, y_{i1t}, that takes value 1 if y^{*}_{i1t} >0 and zero otherwise; y^{*}_{i2t} is a latent for value of crops sold, while y_{it} is the actual observed sales value if $y^{*}_{i2t} > 0$ and y_{i1t} =1. The discrete participation decision and amount sold conditional on participation decision are influenced by vectors of explanatory variables w_{it} and x_{it}, respectively, assumed to be exogenous (these vectors may or may not contain the same variables in the two hurdles). α and β are vectors of parameters to be estimated, v_{it} and u_{it} are idiosyncratic independent and normally distributed error terms related with participation decision and amount of sell.

The maximum likelihood estimator (MLE) in the hurdle 1 can be obtained from Probit estimator. Then, the maximum likelihood estimator (MLE) for hurdle 2 can be estimated from truncated normal regression model. Following cragg's (1971) original assumption on errors from hurdle 1 and hurdle 2 that assumes conditional on the explanatory variables they are independent, normally distributed and zero covariance between the two, the likelihood function becomes (Jones, 1989; Cragg, 1971; Burke, 2009):

$$L_i(y_{it} \mid w_{it}, x_{it}; \theta) = \prod_{y_{it}=0} \left[1 - \Phi(w_{it}\alpha / \sigma_v)\right] \Phi\left(x_{it}\beta / \sigma_u\right) \\ X \prod_{y_{it}>0} \Phi(w_{it}\alpha / \sigma_v) \Phi\left(x_{it}\beta / \sigma_u\right) \Phi \frac{1}{\sigma_u} \frac{\phi\left(y_{it} - x_{it}\beta\right) / \sigma_u}{\Phi\left(x_{it}\beta / \sigma_u\right)} \qquad (4.3)$$

Where ϕ and Φ are standard normal probability density and cumulative distribution functions, respectively; σ_v and σ_u are standard deviations of v_{it} and u_{it}, respectively. For the sake of simplicity, we will right σ_u as σ in the following discussion. The model in (4.3) can be estimated through maximum likelihood estimation.

From the likelihood function (4.3), we can notice that Tobit model is nested within the DH model because if everyone is assumed to participate in market, i.e. $\Phi(\alpha w_{it})$ =1 for $\forall i$, then the model reduces to Tobit model. The appropriateness of the DH against the Tobit estimator can be

evaluated using a likelihood ratio test. Assuming the independence of error terms, the likelihood of DH model is equivalent to the sum of likelihood from Probit model and likelihood from truncated normal regression. Accordingly the likelihood ratio test of Tobit restriction can be performed as follows.

$$LR\,static = -2\left[\ln L_T - \left(\ln L_P + \ln L_{TR}\right)\right] \qquad (4.4)$$

Where L_T the likelihood of Tobit is, L_P is likelihood of Probit and L_{TR} is likelihood of truncated regression. $LR\,static$ has a χ^2 distribution.

The actual equations estimated for the two hurdles are as shown below. Note that we use the same set of explanatory variables for the two hurdles, and separate parameters for the intercept, time trends, off-farm income (off_inc), total value of crop produced (val_prod_{it})age off household head (age_{it}), education of household head (edu_{it}), family size ($fams_{it}$), gender of household head ($male_{it}$), hectare of land owned ($land_{it}$), livestock owned (tlu_{it}), distance from the nearby market (d_mrkt_{it}), number of pack animal owned($pack\_anim_{it}$), dummy for participation in extension program ($extn_{it}$), dummy if household is located in Oromia Region (oro_i), Amhara Region (amh_i) and Southern Region ($south_i$). Since household's settlement across region does not change over time, the time index is excluded.

Participation:

$$\begin{aligned} mrkt\_part^{*}_{i1t} = {} & \alpha_0 + \alpha_1 off\_inc_{it} + \alpha_2 val\_prod_{it} + \alpha_3 age_{it} + \alpha_4 edu_{it} + \alpha_5 fams_{it} + \alpha_6 male_{it} \\ & + \alpha_7 land_{it} + \alpha_8 tlu_{it} + \alpha_9 d\_mrkt_{it} + \alpha_{10} pack\_anim_{it} + \alpha_{11} extn_{it} + \alpha_{12} oro_i + \alpha_{13} amh_i \\ & + \alpha_{14} south_i + \delta_1 t + \delta_2 t^2 + c_{1i} + v_{it} \end{aligned}$$

(4.5)

Sells decision:

$$\begin{aligned} val\_sale^{*}_{i1t} = {} & \beta_0 + \beta_1 off\_inc_{it} + \beta_2 val\_prod_{it} + \beta_3 age_{it} + \beta_4 edu_{it} + \beta_5 fams_{it} + \beta_6 male_{it} \\ & + \beta_7 land_{it} + \beta_8 tlu_{it} + \beta_9 d\_mrkt_{it} + \beta_{10} pack\_anim_{it} + \beta_{11} extn_{it} + \beta_{12} oro_i + \beta_{13} amh_i \\ & + \beta_{14} south_i + \eta_1 t + \eta_2 t^2 + c_{2i} + u_{it} \end{aligned}$$

(4.6)

Where c_{1i} is unobservable heterogeneity in the participation decision and c_{2i} account for unobserved heterogeneity in the crop sells decision.

4.2 Estimation method

A major advantage of panel data analysis is the ability to control for time invariant unobservable individual heterogeneity. The heterogeneity across individuals may arise, for example as a result of differences in preferences, endowments and attributes. These time invariant individual characteristics are commonly unobservable or difficult to measure due to its qualitative nature. To obtain unbiased and consistent estimates for our nonlinear panel model, the covariates must be independent of unobserved heterogeneity c_i 6. This is often a strong assumption, leading to biased coefficient estimates if not accounted for.

There are different approaches to deal with the individual heterogeneity. The use of Fixed Effect estimator is usually the most practical way to accomplish this, since it requires no assumption regarding the correlation between observed determinants (x_{it}) and unobserved heterogeneity (c_i). In FE estimator, we control for unobserved heterogeneity, c_i, by means of dummy variable approach, i.e. by introducing dummies for c_i of each observations and estimate along with other parameters. The problem, however, is that estimation of c_i along with other parameters introduces incidental parameters problem. Incidental parameters problem arise with maximum likelihood estimation of panel data models that treats unobserved effects as additional parameters to estimate, leading to inconsistent estimator when N tending to infinity and T is small and fixed (Wooldridge, 2002).

The use of correlated random effects (CRE) following Mundlak (1978) and Chamberlain (1984) is another approach to relax the assumption of independence between covariates and c_i. The CRE estimator, unlike the standard random effects, allows for the correlation between unobserved heterogeneity (c_i) and vector covariates across all time period (x_{it}) by assuming the correlation takes the form of: $c_i = \tau + \overline{X}_i \xi + a_i$, where $\overline{X}_i$ is time average for all time varying covariates in

[6] c_i represents the unobserved heterogeneity c_{1i} and c_{2i} in hurdle 1 and hurdle 2, respectively

equation (4.4) and (4.5) above. These variables have the same value for each household in every year but vary across household. τ and ξ are constants, a_i is error term for constant with normal distribution, $a_i \mid X_i \sim Normal\left(0, \sigma_a^2\right)$. In practice to implement CRE, we specify a model for the distribution of unobserved heterogeneity c_{1i} in equation (4.5) and c_{2i} in equation (4.6) as linear function of time average of time varying explanatory variables, $\overline{w}_{it}$ and $\overline{x}_{it}$, whereas τ is absorbed in to the intercept term.

The CRE approach has more benefit than the traditional random effect estimator in panel data analysis. First, by including the vector of time averaged explanatory variables we can control for time invariant unobserved heterogeneity as with fixed effects without encountering the incidental parameters problem in nonlinear models. Second, it allows measuring the effect of time invariant explanatory variables just as in traditional random effect estimator (Wooldridge, 2002, Ricker-Gilbert et al., 2010). Therefore, the DH model in equation (4.5) and (4.6) including the average of all time varying variables in the list of explanatory variable is estimated following Craggit procedure developed by Bruke (2009) in STATA 2012. Since in CRE estimator we simply transform the time constant unobservable heterogeneity into a function of observable time-constants, which is then substituted into the primary equations in the model, this has no effect on the likelihood shown in (4.3).

4.2.1 Estimation of Conditional and unconditional Marginal Effects

After estimating the CRE double hurdle model, we can do post estimation analysis on the partial effect of changes in the explanatory variables on the probability of being market participant and on conditional as well as unconditional expected value of crop sale. Following the procedure by Burke (2009), first the probability of being market participant is given by Probit model as:

$$P\left(y_{it1}^{*} > 0 \mid w_{it}\right) = \Phi(w\alpha) \qquad (4.7)$$

Form this, the partial effect on the probability of being market participant per unit change of explanatory variable (x_k) can be calculated as:

$$\frac{\partial P\left(y_{it1}^{*} > 0 \mid w_{it}\right)}{\partial x_k} = \alpha_k \phi(w\alpha) \tag{4.8}$$

If x_k is continuous variable and

$$\frac{\Delta P\left(y_{it1}^{*} > 0 \mid w_{it}\right)}{\Delta x_k} = \Phi(w\alpha^1) - \alpha_k \Phi(w\alpha^0) \tag{4.9}$$

If x_k binary variable

Where $w\alpha^1 = w_1\alpha_1 + ... + w_{k-1}\alpha_{k-1} + 1.\alpha_k$; $w\alpha^0 = w_1\alpha_1 + ... + w_{k-1}\alpha_{k-1} + 0.\alpha_k$

These numbers gives interesting information about which variables have influence on being market participant.

Second, the conditional expected value of y_i, given the household sold any crop (i.e. the household has passed both hurdle 1 and hurdle 2 and we observe positive sale) is calculated as:

$$E\left(y_{it} \mid y_{it} > 0, x_{it}\right) = x\beta + \sigma.\lambda\left(\frac{x\beta}{\sigma}\right) \tag{4.10}$$

Where $\lambda(c) = \frac{\phi(c)}{\Phi(c)}$ is inverse mills ratio (IMR). From (4.10), the partial effect for unit change in continuous variable on the conditional expected value becomes:

$$\frac{\partial E\left(y_{it} \mid y_{it} > 0, x_{it}\right)}{\partial x_k} = \beta_k \left[1 - \lambda\left(\frac{x\beta}{\sigma}\right).\left\{\frac{x\beta}{\sigma} + \lambda\left(\frac{x\beta}{\sigma}\right)\right\}\right] \tag{4.11}$$

And for binary explanatory variable the partial effect is calculated as:

$$\frac{\partial E\left(y_{it} \mid y_{it} > 0, x_{it}\right)}{\partial x_k} = \left(x\beta^1 + \sigma.\lambda\left(\frac{x\beta^1}{\sigma}\right)\right) - .\left(x\beta^0 + \sigma.\lambda\left(\frac{x\beta^0}{\sigma}\right)\right) \tag{4.12}$$

Where $x\beta^1 = x_1\beta_1 + ... + x_{k-1}\beta_{k-1} + 1.\beta_k$ and $x\beta^0 = x_1\beta_1 + ... + x_{k-1}\beta_{k-1} + 0.\beta_k$

Finally, the unconditional expected value can be calculated as:

$$E\left(y_{it} \mid x_{it}, w_{it}\right) = \Phi\left(w\alpha\right)\left(x\beta + \sigma.\lambda\left(\frac{x\beta}{\sigma}\right)\right) \tag{4.13}$$

Then the partial effect for continuous variable becomes:

$$\frac{\partial E(y_{it} \mid x_{it}, w_{it})}{\partial x_k} = \alpha_k \phi(w\alpha)\left(x\beta + \sigma.\lambda\left(\frac{x\beta}{\sigma}\right)\right) + \Phi(w\alpha)\beta_k\left[1 - \lambda\left(\frac{x\beta}{\sigma}\right)\left(\frac{x\beta}{\sigma} + \sigma.\lambda\left(\frac{x\beta}{\sigma}\right)\right)\right] \quad (4.14)$$

And for discrete variable

$$\frac{\partial E(y_{it} \mid x_{it}, w_{it})}{\partial x_k} = \Phi(w\alpha^1)\left(x\beta^1 + \sigma.\lambda\left(\frac{x\beta^1}{\sigma}\right)\right) - \Phi(w\alpha^0)\left(x\beta^0 + \sigma.\lambda\left(\frac{x\beta^0}{\sigma}\right)\right) \quad (4.15)$$

Where $x_k \in x_{it}, w_{it}$; $x\beta^1, x\beta^0, w\alpha^1$ and $w\alpha^0$ are as defined above.

From equation (4.14) one can notice that if x_k is influencing only the probability of market participation, then β_k =0 and subsequently the second term in this equation drops out. If it is the other way, i.e. if x_k affects only the second stage of the DH model, then α_k =0 and the first term in equation (4.14) drops. However, in either of the case, the marginal effect is still the function of parameters and explanatory variables from the two stage of DH model.

After estimating the partial effects for every observation in the data set, the average partial effect (APE) which is simply the average of all partial effects for each observation is obtained. The standard errors for APEs, which are used for inference, are obtained using delta method and bootstrapping following the procedure proposed by Bruke (2009).

Finally, it has to be noted that the above empirical approach may not capture a situation when there is reversal causality problem. There might be a case where increased income as a result of higher commercialization help farmers to overcome capital constraint and engage in own nonfarm business that would increase off-farm income. There might also be a feedback effect from market participation to total value of crop production if exposure to new ideas through trade (better knowledge diffusion through exchange) and incentive in the form of higher income

leads to change in production decision. But, as the decision on the amount to produce precedes that on the amount to sell, it is less likely that total value of crop sold determines total value of production in the same time period. Moreover, at the initial phase of commercialization where most farmers produce marketable staple food crop mainly for home consumption and supply residual to market, production decision based on market signal is less likely to happen. Yet, the estimation result should be seen as an attempt to show whether there is relation between the dependent variable and these two variables of interests – off-farm income and household total value of crop produced.

CHAPTER 5- DATA AND VARIABLE DESCRIBTION

5.1 Data type and source

One of the main problems encountered in the empirical analysis of agricultural commercialization was to find rich dataset that consist of relevant information on the variables that are considered in the model. This study used Ethiopian Rural Household survey (ERHS) which is unique longitudinal data and addressed topics such as household characteristics, agriculture and livestock production activities, marketing activity, as well as community level data. Besides, ERHS survey was conducted on a longitudinal basis and allows for controlling unobserved household heterogeneity. In this chapter the nature of data, the sampling procedures that have been used in the data collection and variables used in this study will be presented.

5.1.1 The Ethiopian Rural Household Survey

As mentioned in pervious section, this study is based on Ethiopian Rural Household Survey[7] (ERHS) panel data conducted in seven rounds from 1989 to 2009 covering households in a number of villages in rural Ethiopia. It is a unique longitudinal household survey data collected by Economics department of AAU, Ethiopia in collaboration with Oxford University, UK and International Food Policy Research Institute (IFPRI), USA. The financial assistance for data collection was provided by ESRC, SIDA, USAID, and the WB.

The survey was started in 1989 when IFPRI team visited 450 households in seven farming villages in Central and Southern Ethiopia (see Dercon and Hoddinot, 2004; von Braun and

[7]The data have been made available by the Economics Department of Addis Ababa University, Ethiopia, the Centre for the study of African Economies, University of Oxford and the International Food Policy Research Institute. Funding for data collection was provided by the Economic and Social Research Council (ESRC), the Swedish International Development Agency (SIDA) and the United States Agency for International Development (USAID); the preparation of the public release version of these data was supported, in part, by the World Bank. AAU, CSAE, IFPRI, ESRC, SIDA, USAID and the World Bank are not responsible for any errors in these data or for their use of interpretation. http://www.ifpri.org/dataset/ethiopian-rural-household-surveys-erhs accessed on 11/14/2012.

Yohannes, 1992). In 1994, the survey was expanded to 15 villages so as to cover the main agro-climatic zones and main farming systems in the country. Farming systems were considered as an important stratification basis in selecting villages. The sampling frame to select villages was based on their main agro-ecological zones and sub-zones and one to three villages per strata were selected. A household then proportionately and randomly selected after stratifying based on sex of household heads (Dercon and Hoddinot, 2004). In total, about 1477 households are covered in the 1994 survey. These households have been re-interviewed in the late 1994 as well as in 1995, 1997, 1999, 2004 and 2009. The households are from 15 peasant associations of four major regions of Ethiopia, i.e. Oromia, SNNP, Amhara, and Tigray. The data covered villages in almost all direction of the rural part of Ethiopia. However, pastoral areas were not included in the survey (due to their constant mobility and difficulty of accessing them), hence cannot be considered as fully representative of the entire rural Ethiopia.

For this study, the data is compiled from 1997, 1999[8] and 2004 survey rounds. The three survey rounds were selected because they contain sufficient observations on variables considered in this study. The sample attrition is low, with only 12.4 percent between 1994 and 2004 (or 1.3 per cent per year) (Dercon and Hoddinot, 2004). Limited access to land for cultivation in other areas could be one of the plausible reasons for low attrition rate. Finally we have a balanced panel data for 1,184 households.

In the survey, households were asked information about their participation in off-farm activities, income earned from off-farm activities both in cash and in kind payment[9], other farm activities like crop and livestock production, input use and crop selling activities. Data on input and output price were collected at the community level during each survey round. In this study, 2004 constant price was used to calculate the values of crop produced and sold by households.

[8] For the 1999 round, there are three additional villages that have been included and the sample sizes are expanded to 1685 households. But, these villages are excluded from 1999 round in this study and only villages common to previous rounds were considered.

[9] In kind payment was converted to cash payment based on the type of in kind commodity, unit of measurement and conversion factor.

5.2 Variable Description

In this section definitions and measurements of variables used in this study will be presented. Table 5.1 presents the summary statistics (for the pooled data) of all variables used in the econometric analysis. The dependent variable in the first stage of our model, market participation, is a dummy variable which takes value of 1 if household i sold any crop during survey round t. The pooled data contains 3552 farm households and of which 67.8% participated in crop market as seller.

Table 5.1 Definitions and summary statistics of variables used in the analysis (N=3552)

Variable description	Mean	Min.	Max.	SD
Dependent variables				
Market participation (=1 if sold any crop at time t)	0.679	0	1	0.467
Total value of crop sold (ETB)	1020.49	0	189607.6	4347.66
Explanatory variables				
Participation in off-farm employment(=1 if participated)	0.42	0	1	0.49
Off-farm income (ETB)	202.33	0	47027.78	1022.95
Age of household head (year)	48.62	15	105	15.20
Gender (=1 if head of household is male)	0.74	0	1	0.44
Education (= 1 if attend any level of primary school)	0.27	0	1	0.44
Family size (no)	5.71	1	26	2.63
Farm land size owned (ha)	1.47	0.05	9.88	1.26
Livestock owned (TLU)	3.05	0	58.3	3.24
Value of crop produced (ETB)	2170.00	0	255354.8	5874.02
Transport animals (=1 if household owned at least one)	0.407	0	1	0.49
Distance to the nearest market (km)	10.66	1	25	5.81
Involvement in extension program (=1 if participant)	0.11	0	1	0.310

Oromia (Dummy if household lives in Oromia region)	0.275	0	1	0.447
Amhara (Dummy if household lives in Amhara region)	0.323	0	1	0.468
SNNP (Dummy if household lives in SNNP region)	0.296	0	1	0.457

Source: own calculation based on 1997, 1999 and 2004 ERHS data

Total value of crops sold, which is the dependent variable in the second stage of our double hurdle model, is the aggregate value of all crops sold by household i during survey round t, weighted by village level price10 for each crop. In the survey, the quantity for each crop sold was reported in a local unit which is converted in to kilogram using conversion factor provided in the data. On average, household sells about Birr 1020.49 worth crop produce.

Participation in off-farm employment is a dummy variable that takes on value 1 if at least one member of the household participates in wage work or self-employment activities in a given survey round. The pooled data shows slightly above 41% of households participated in off-farm employment either as self-employee or wage worker. Off-farm income is amount of total earnings in ETB from wage work and/or self-employment activities. Payments are made either in cash or in kind which was converted to cash using conversion factor provided in the data. Average off-farm income for sample households is Birr 202.330 per household. Households who earn off-farm income at least ETB 500 constitutes less than 10% of the total sample households. This indicates, contribution of off-farm income to households' livelihood is quite smaller as compared to average income from crop production which amounts to ETB 2170.

Head of household's average age, measured in years, for the total sample household is 48.6. About 74% of households in the sample are male headed household. The average family size is 5.7 with household labor supply of 2.93 which also implies dependency ratio of 1.94. Education of household head is a dummy variable that takes value of 1 if a household head participated at least in any level of primary education. This is because majority of households were not attending any schooling and the number of household heads attending schooling above primary education is almost nil. Hence, in this study, head of household is considered as literate if he/she has enrolled in any level of primary education and able to read and write. Average land holding

[10] All monetary values are in 2004 constant price Ethiopian Birr (ETB); 1USD = 18.16 Ethiopian Birr in July 2013 (www.nbe.gov.et)

per household for the panel sample household is 1.47 hectare which is larger than the current national average land holding of 1 hectare per household. The amount of livestock owned by household during the survey period is measured by tropical livestock unit (TLU). The average livestock owned per household is 3.05 TLU, while 40.6 % of the sample household owned at least one transportation animals.

The average distance from village to the nearest market in kilometers is 10.6, ranging from a minimum of 1 km to 25 km. This indicates there are wide variations in terms of access to market close agricultural market. Agricultural extension programs are expected to improve access to information by facilitating smallholder linkages with input and output markets. The dummy variable for participation in extension program that take value 1 if household participated either in government or sasakawa Global 2000 extension program is included in the model. The pooled data indicates only slightly above 10% of the sample households participated in extension program during the three survey rounds. This might be due to the low level of public extension coverage until the late 1990s. For instance, when the government launched the extension program called Participatory Demonstration and Training Extension System (PADETS) in 1995, the number of participants in extension program where only 3200. The coverage was increased to 4.2 million in 2002 (Gebremedhin et al., 2006). It is expected that surplus production and the level of commercialization to be affected by agro-climatic and other geographical differences. Hence regional dummies for Oromia, Amhara and SNNP regional states is created and added to the explanatory variables. Tigray region is left out to be used as a reference in the analysis.

CHAPTER 6- RESULTS and DISCUSSIONS

6.1 Analyses of descriptive informations

6.1.1 Trends of market participation and marketed surplus

The mean and distribution of variables used in this study are presented in table A1, Appendix A over the three survey wave. The household data shows that compared to 1997 and 1999 , total value of crop produced and value of crop sold by sample households has increased in 2004 survey round. Proportion of sample household participated in output market increased from 66% in year 1997 to slightly above 72% in in the year 2004. The result also indicates that market participation and value of crop sold follows the same trend with total annual crop production. This may indicate the non-separable production and consumption decision by smallholder subsistence farmers. Because most of the time marketed crops are staple food grains, surplus production is marketed only after satisfying household consumption. The household commercialization index measured as a ratio of aggregate value of crop sold to value of all crop produced by household in a given year showed an increasing trend over the survey year. It was slightly above 29% in the year 1997 which has increased to more than 32 % and 35 % in the year 1999 and 2004, respectively. The result, though not conclusive by itself, suggests that smallholder commercialization in Ethiopia is moderate and progressing over the survey period.

Average participation in off-farm employment and off-farm income showed an increasing trend over the survey period. Nearly 29% of sample households participate in off-farm employment in 1997 survey round. This number has increased to 52 % and 44% of sample households in 1999 and 2004 survey rounds, respectively. Average off-farm income per household is larger in 1999 survey round, which is close to ETB 630 per household. Although there is an increasing trend from 1997 round to 1999 and 2004 rounds both in percentage participation and income from off-farm employment, we can observe that the income from off-farm source is quite small compared to the one obtained from annual crop production.

Average walking distance to the nearest market decreased from nearly 13 km in 1997 survey round to 8.5 km in 2004. Average participation in extension program increased from 6% to 11.5

% and 14.7% in 1999 and 2004 survey round, respectively The proportion of male headed households has decreased over the survey years. There is no visible change in the trends of average land holding per household over the survey periods.

6.1.2 Market participation and marketed surplus across land quintile

Differences in asset holdings are likely to be a big determinant of smallholder farmers in their response to the incentive to commercialize (Leavy and poulton, 2007). Land is a key asset for rural households and market for land is either missing or imperfect. Jayne et al. (2003), indicated that there is considerable and growing inequality in terms of landholding based on evidence from five east and southern African countries including Ethiopia. They also show positive correlation between income per capita and in land size Thus, land holding can be a used as proxy for wealth to see the pattern of response among land poor and non-poor households to incentive to commercialize.

Table A2 presents household crop market participation, asset holding status and other household characteristics per land size quintiles. Average land holding ranges from 0.32 hectares in the lowest land quintile to 3.5 hectares in the highest land quintile. As expected, average value of total crop production and value of crop sold for the sample household shows an increasing trend over the land quintile. Similarly, the percentage of market participant exhibits an increasing trend. Trend of household commercialization index (HCI) across land quintile is not clear. It increases when we go up from the lowest land quintile and decreased among households in upper quintile. Although this index has some advantage to measure extent of household market orientation in their crop production decision, it has also some drawbacks that may result in this uneven trend. On average, about 58% of the sample household in the lowest land quintile participated in crop market as a seller and sold crop produce that worth about ETB 350. For those in the highest land quintiles the average market participation and value of crop sold has increased to 63.6% and ETB 1828.38, respectively. This indicates lower rate of participation in output market and lower marketed surplus for households with smaller land holding compared to those who have larger land holding. This is could be due to the fact that households with smaller land per capita has to devote higher proportion of their land to staple food production to achieve a given level of food self-sufficiency There is then less land available for the production high value cash crop for market.

Participation of household in to off-farm work and income earned from this source shows a decreasing trend across land quintile. On average, about 46.6% of the sample household in the lowest land quintile participated in off-farm work and earned average income of ETB 217.35 (Table A2). This value has decreased to 37.6% and ETB 154.54, for participation and off-farm income earned, respectively for those in the highest land quintiles. This shows land poor households allocate more of their time in to off-farm activities and generate their livelihood. Moreover, due to entry barriers or startup cost to participate in high earning activities, poor households participate in low earning activities like wage work on others farm. van den Berg and Kumbi (2006) reported similar results that in Oromia region of Ethiopia, land poor households are pushed in to off-farm activities. Based on survey conducted in five African countries including Ethiopia, Jayne et al. (2003) also found that households with lower land per capita obtain higher share of their income from off-farm activity than households with larger land per capita, although the income from this source is insufficient to compensate for low land holdings in predominantly agricultural economy.

Regarding household characteristic, head of households in the highest land quintile are relatively older than those in the lowest land quintile. The average proportion of male headed households also shows an increasing trend across the land quintiles. This is important finding because it implies female headed households have relatively lower average land holding per household than their male headed household counterpart. Average proportion of household heads who attend at least any primary level school is smaller for households in the lowest and highest land quintile. Average family size, livestock and transport animals owned and participation in extension program shows an increasing trend as we go up across land quintile.

Mean comparison is made to see if market participants and non-participant households are distinguishable in terms of off-farm participation, asset holding and other household and household head characteristics. Results show that the two groups are not distinguishable in terms of proportion participation in off-farm activity and average off-farm income earned (Table 6.1) However, there is significant difference observed between the two groups with respect to value of crop produced, participation in extension program, walking distance to nearest market and household characteristics.

Table 6.1 Comparison of off-farm participation, household characteristics and asset holding by market participation status (N= 3552)

Variables	Market participant (n=2413)		Non-participant (n=1139)		Mean difference (Participant-Non-part.)
	Mean	SD	Mean	SD	
Off-farm participation (dummy)	0.419	0.493	0.414	0.493	0.005
Off-farm income (ETB)	206.585	23.786	193.306	18.059	13.279
Age of household head (years)	47.903	15.048	50.126	15.425	-2.222*
Male headed household	0.804	0.397	0.616	0.486	0.188*
Education of household head (dummy)	0.323	0.468	0.145	0.352	0.178*
Family size(no)	6.025	2.641	5.046	2.475	0.978*
Available family labor	3.065	1.518	2.648	1.522	0.4178*
Farm land owned(ha)	1.476	1.223	1.457	1.342	0.0195
Value of crop produced (ETB)	2777.428	7008.112	883.1566	1062.85	1894.271*
Transport animal owned(no)	0.6655	1.2383	1.137	1.824	-0.741*
Livestock owned(TLU)	0.617	1.262	0.959	1.584	-0.342
Distance to the nearest market(km)	10.491	5.921	11.026	50554	-0.534**
Involvement in extension program	0.131	0.338	0.057	0.233	0.074*

Note: ***, **, *indicates that the corresponding t-statistic for mean differences are significant at the 10%, 5%, and 1% levels, respectively

Source: own calculation based on 1997, 1999 and 2004 ERHS data

The average value of crop produced which is ETB 2777.428 is significantly higher for participant group compared to ETB 883.156 for non-participant. Participant group also seems to have better access to extension program and access to nearest agricultural market. Nearly 13% of sample households of market participant group involved in extension program, while only 5% of sample households for non-participant groups.

The result also depicts the market participant households are significantly distinguishable from non-participant in terms of household head and household characteristics. About 80% of sample households of the participant group are male headed compared to 60% for non-participant groups. The participant group is also headed relatively by younger and educated household head

and the difference is significant at 1% significance level. On average, 33% of the sample households in the participant group have household head that enrolled at least in primary education compared to 14.5% for non-participant household. This may indicate households headed by educated, younger and male farmer may have better capacity, batter access and processing skill of market information that have positive influence on market participation. Besides, market participant households have larger average family size and family labor available than non-participant households and the mean difference is significant at 1% significance level. Average transport animal owned by the participant households is lower than the non-participant group. This contradicts the hypothesis that ownership of transport animals positively correlate both with market participation and value of crop sold because pack animal is the only means of transportation for most rural Ethiopian households. There is no significant difference observed between the two groups in terms of livestock and farm land endowment.

In general the mean comparison of market participant and non-participant households suggest that the two groups are not distinguishable with respect to off-farm participation and off-farm income earned from this source Nevertheless, they are distinguishable in terms some household level characteristics that could have important implication for household market integration In the subsequent section of this chapter, a rigorous analytical model is estimated to verify whether these differences in mean comparison is maintained after controlling for all confounding factors.

Table A3 presents mean comparison between off-farm work participant and non-participant households for the whole panel. The result shows even though the two groups are not distinguishable in terms of market participation, total value of crop produced and amount of marketed surplus, measured in aggregate value of crop sold, are significantly larger for non-participant households. On average non-participant household sold amount of crop that worth ETB 1212 and significantly larger than the amount sold by off-farm work participant households which is ETB 752. Similarly, the non-participant household owned larger plots of land and more transport animals relative to off-farm participant households. The non-participant group has also older household head and the difference is statistically significant. The proportion of educated household head is larger for off-farm work participant group. The two groups are not different with respect to livestock ownership, distance from nearby market and involvement in extension program.

6.2 Econometric results and discussions

In this section, we discuss the results of correlated random effect double hurdle model as outlined in chapter four. As previously discussed in chapter four, the double hurdle model is an alternative to the tobit specification, thus tobit model is nested in double hurdle model. Therefore a likelihood ratio test is performed to check appropriateness of double hurdle model following the procedure in equation 4.4. The LR statistic comparing the two model is 1551.01 with probability value, (Prob > χ^2 = 0.000). The result reveals the null hypothesis that the farmer's market participation consists of just one decision can easily be rejected in favor of the double hurdle model.

6.2.1 Estimation result -CRE double-hurdle model

Maximum likelihood estimation result of CRE double-hurdle model for probability of output market participation and value of crop sold in ETB, conditional on positive participation is given in table B1, in Appendix B. The estimates show that off-farm income has no effect on likelihood of output market participation. Nevertheless, it influences the quantity of crop sold negatively and significantly conditional on the first stage decision being positive. Higher value of crop produced significantly increases the probability of output market participation. Being male headed household, more land and livestock ownership are related with higher probability of output market participation as seller. Farm households those in Oromia and Amhara region are more likely to participate in output market than those in Tigray region Households are more likely to participate in output market in the year 2004 than the previous year 1997 and 1999. Except participation in extension program, all other explanatory variables have expected sign, although they are not statistically significant

Conditional on the first stage decision being positive, off-farm income, total crop production and farm land owned positively and significantly influence the value of crop sold. By contrast, our result indicates farm households with more livestock sell less of their crop output, given they are participating in output market. Value of crop sold is higher for households in Oromia, Amhara and SNNP relative to those in Tigray region, given they are participating in output market. This might be due to interregional difference as regional dummies control for the agro-ecological

differences to some extent. Relatively there is higher marketed surplus in the 2004 wave than 1997 and 1999 waves, conditional on positive market participation decision in first stage.

6.2.2 Factors influencing probability of market participation and marketed surplus

After we get estimates from CRE double hurdle model, we calculate the marginal effect for each explanatory variable on the probability of market participation and intensity of crop sale. This section presents the results from this estimation and discuss in detail. The average particle effect on the probability of market participation is calculated at the sample average following the procedures outlined in section four. The coefficients APE are estimated using margin command in Stata and standard errors are obtained based on delta method approach and the results is displayed in Table 6.2 .

Table 6.2 CRE double-hurdle model – factors influencing probability of market participation and marketed surplus

Independent Variables	**Hurdle 1-Market participation decision**	**Hurdle 2 Value of crop sold Truncated normal regression**	
	APE [a]	CAPE [b]	UAPE [b]
Off-farm Income (ETB)	4.67e-06 (8.34e-06)	-0.0374*** (0.0219)	-0.0239 (0.0259)
Total value of crop produced (ETB)	0.00012* (0.00011)	0.2348* (0.0111)	0.2464* (.0259)
Age of household head (year)	-0.0019 (0.0015)	4.4903 (4.3924)	2.1394 (3.4726)
Gender (=1 if head of household is male)	0.0422 * (0.0123)	50.0583 (41.9111)	67.45** (35.541)
Education (=1 if head of household enrolled at least in any primary level)	0.0005 (0.0163)	31.6379 (41.9111)	23.93 (35.156)
Family size (no)	-0.0104** (0.0058)	-1.0578 (10.845)	-7.33 (12.874)
Farm land size owned (ha)	0.0125*** (0.0081)	85.2176* (21.0146)	78.722* (19.169)
Livestock owned (TLU)	0.0110** (0.0047)	-18.1791** (9.3915)	-6.4508 (10.949)
Transport animals (no)	0.0069 (0.009)	33.6540 (44.073)	19.99 (27.996)

Distance to the nearest market (km)	-0.0028 (0.0026)	-12.3957*** (7.1969)	-10.759*** (6.2075)
Involvement in extension program (=1 if participated)	-0.0226 (0.0222)	97.6040*** (44.073)	65.025 (47.703)
Oromia	0.1648* (0.0219)	2319.578* (487.56)	2515.01 (1582.712)
Amhara	0.0398*** (0.0221)	2440.622* (573.57)	1965.56 (1340.595)
SNNP	0.3636* (0.0193)	1958.441* (416.98)	2562.01*** (1358.365)
Round 1 (1997)	-0.0510** (0.0211)	-109.3392** (51.81)	-108.083** (43.489)
Round 2 (1999)	-0.0565* (0.0186)	-87.1881** (46.86347)	26.1543 (.40.0161)

Note: ***,** and * indicates significance at 10%, 5% and 1% level; Values in parenthesis are standard errors.

Source: own calculation based on 1997, 1999 and 2004 ERHS data

The marginal effect of explanatory variables on the value of crop sold can be made either conditionally on household's market participation decision in hurdle 1 or unconditionally for the entire sample. Conditional average partial effects (CAPE) and unconditional (overall) average partial effects (UAPE) for hurdle 2 are also estimated following the procedures in section four and the results are displayed in Table 6.2. The coefficients of CAPE and UAPE with their standard errors and p-values are obtained via bootstrapping at 100 replications after craggit command in Stata.

Effect of off-farm income on smallholder commercialization

The main focus of this study is to identify the potential relationship between off-farm income and smallholder commercialization, where smallholder commercialization is indicated by proportion of household participation in crop output market as seller and intensity of sale. The result in Table 6.2 indicates all the marginal effects coefficients for off-farm income is negative, even though statistically not significant except CAPE. CAPE is marginally significant at 10% significance level. This implies, holding other factors constant, an increase in off-farm earning has no influence on the probability of farmer's output market participation However, conditional on positive participation in the first stage, each additional income earned from off-farm work has

negative effect on household market supply. The economic effect indicates that on average each additional ETB 100 off-farm income earnings decreases the value of crop sold by ETB 3.75, all other factors being constant. The coefficient of UAPE indicates the overall influence of off-farm income on household market supply is not significant at any conventional significance level

The negative influence of off-farm income on household market supply conditional on positive participation decision is consistent with the notion that off-farm income slows down smallholder commercialization due to its income effect. Income effect arising from an increase in off-farm income may negatively influence marketed surplus by increasing household's consumption demand for own production.(Woldehanna, 2000). Moreover, if income from off-farm source is geared toward consumption instead investing in farm capital, then it competes with agriculture for labor and other resources that in turn lower production and marketable surplus. Research findings by Alene et al. (2008) and Omiti et al (2009) for Kenyan smallholder farmers also support this idea. This is more evident particularly if the poor is pushed in to off-farm activities due to small land holding and drought incidence, for instance. As we have seen previously, the results from our descriptive statistics also indicated participation in off-farm employment is higher among household with smaller land holding, which can be considered relatively poor. Some previous study from Ethiopia also supports this finding (Jayne et.al 2003).

In general, our empirical finding indicates there is no evidence to support the hypothesis that off-farm income promotes smallholder commercialization through capital investment e in agriculture and risk diversification. Perhaps participation in off-farm activities does help smallholder farmers to overcome liquidity constraints. Especially when agricultural growth is hampered by credit constraints, the additional resources can be used by farmers for the adoption of innovations and the purchase of input. Such positive effect off-farm income in providing liquidity to agriculture were recently shown by Oseni and Winters (2009) But, it depends on types of activity, amount of income earned and the way that liquidity is used. The policy implication of our finding is that expanding higher earning rural enterprises through capacity building and human capital investment is vital. This may help to improve the returns to labor for off-farm work participating land-poor households as Ethiopian smallholder commercialize

Other determinants of smallholder commercialization

The other objective of this study was to identify other factors that affect smallholder commercialization in Ethiopia Accordingly, based on the results from estimation of CRE double hurdle model; in this sub-section we will discuss the effect of other factors on probability of household market participation and value of crop sold.

Our result shows that degree of participation in crop market is influenced by value of crop produced, male household head, family size, livestock owned and landholding size, all with expected sign. Similarly, degree of market participation is significantly influenced by regional dummies and dummy for survey rounds. Higher value of crop produced is positively correlated with market participation and statistically significant at 1% level. The result indicates on average each additional ETB 1000 value of crop production makes a household about 10 percentage points more likely to participate in the output market, other factors held constant. Gender of household head significantly influences probability of participation at 1% significance level. On average, probability of output market participation is higher by 4 percentage points if the household is male-headed, other factors held constant. The result is consistent with our prior expectation that male headed household participate more in output market due to better capacity in farming and more access to information. Similar effects were found by Gebremedhin and Hoekstra (2008) that female headed households are less likely to produce more market oriented cereal crops in Ethiopia.

Each additional family member makes a household about 1 percentage point less likely to participate in output market which is marginally significant at 10% significance level, other factors being constant. This is most likely due to its effect on household consumption demand. One TLU more livestock results in 1 percentage point higher probability of market participation which is significant at 5% level. The magnitude of family size and livestock owned coefficients are relatively small, most likely because these two variables can influence market participation in both directions at the same time. Larger family size implies more consumption demand and at the same time it makes more family labor available for agricultural production. Similarly, more livestock provides traction power for agricultural production and at the same time it offers alternative financial income for household. Thus, the overall impact of these variables depends on whether the positive influence dominates the negative or vise-versa. Land size, which can be

considered as household's wealth, has positive and statistically significant (10% significance level) influence on the probability of market participation.

The coefficients of transport animals and distance to nearby markets, which are included to control for the effect of variable transaction costs, is not significant in the hurdle 1. But both of them have the prior expected sign. Similarly, our result indicates participation in extension program has no significant influence on the probability of market participation. This result contradicts our prior expectation of extension program's role in improving access for marketing information through smallholder linkages with input and output markets. Its insignificance in market might be related to the nature of services provided by extension program For instance; the extension service could be directed towards the provision of inputs and credit service and less of output marketing information. This may result in higher marketable surplus with little or no significant influence on fixed transaction cost which more important for market entry. The result may suggest the need for extension service to strength the marketing extension in addition to input and credit service supply

On average, probability of household market participation is higher by 16, 4 and 36 percentage points for households in Oromia, Amhara and SNNP region, respectively as compared to those in Tigray region. This result is statistically significant at 1% level for Oromia and SNNP and 10% for Amhara region. The probability of household market participation is lower by 5 percentage points in the survey round 1997 and 1999 compared to 2004.

Our results from hurdle 2 indicates that once the participation decision has been made, value of crop produced, size of farm land owned and participation in extension program positively and significantly influence value of crop sold. This is of course what we would expect a prior because increased production and more resource endowment increases marketable surplus. Given that positive participation decision has been made in hurdle 1, on average an increase in value of crop produced by ETB 100 increases the value of crop sold by 23.5 ETB, other factors being constant. The result is statistically significant at 1% level. The unconditional marginal effect (UAPE), capture the joint impact of a variable on the changes in the probability of market participation and in the level of marketed supply. It is more interesting and of practical importance as it combines both effects unconditionally. The UAPE for value of crop produced indicates that on average each ETB 100 of crop produced increases the value of crop sold by

ETB 24.6 and statistically significant at 1% level. This finding confirms the idea that most of the crops marketed by smallholders are surplus product after satisfying household subsistence requirement and increased production means more surpluses to sell

As we can see from the CAPE coefficients, the magnitude of effect on marketed surplus is stronger for extension participation followed by land size. While seemingly insignificant in determining the probability of market entry, participation in extension program increases the value of crop sold on average by 97.6 ETB, conditional on the participation decision has been made. The result is marginally significant at 10% significance level. This is perhaps because extension is one of the basic support services promoting smallholder food production. Its insignificance in market entry of smallholder might be related to the nature of services provided as previously discussed.

The economic effect of land size indicates that on average, each additional hectare of land increases the value of crop sold by ETB 85 conditional on participation decision has been made and is statistically significant at 1% level. UAPE coefficient for land holding size influence on the value of crop sold is estimated to be ETB 79 which is also statistically significant at 1% level. This result confirms that land is a key constraint input for rural household and land holding per capita is declining mainly because of rapidly growing population. Moreover, land market for smallholder farmers is nonexistent in Ethiopia as land is state property and farmers have only usufruct right. Our result is also consistent with what others found elsewhere in developing countries (e.g. Alene et al., 2008).

More livestock ownership and distance to the nearest market negatively and significantly affect how much values of crop a household sells once the participation decision has been made. The CAPE coefficient shows that one TLU more livestock on average reduces the value of crop sold by ETB 18, given the household is participating in crop market. It is statistically significant at 5% level. This is what we would expect a prior and support the idea that more livestock offers alternative financial income for household so that marketed surplus would be lower. Similar effect of livestock ownership on quantity of crop sold was found in Ethiopia by Gebremedhin et al. (2009). The overall influence of livestock ownership on the value of crop sold (UAPE) is not significant at any conventional significance level. Conditional on participation decision has been made; one km distance from nearest market on average decreases the value crop sold by 12 ETB,

whereas the overall effect is 10 ETB. Both are marginally significant at 10% level. The negative influence of distance from market also makes sense and supports the idea that infrastructure development strength smallholder's market integration by reducing marketing cost. It is interesting to note that variables that affect probability of market participation are not necessarily variables that affect intensity of participation.

Another interesting result is the unconditional marginal effect (UAPE) of gender of household head on value of crop sold. The result indicates being male headed household on average increases the value of crop sold by 67.5 ETB, other factors being constant. It is statistically significant at 5% significance level. By contrast, the coefficient of CAPE is not significant at any conventional significance level. This implies gender of household head influences household market entry and overall market supply, but not the volume sold once the participation decision has been made. This might be due to the cultural influence that male farmers have better access to information and well- networked within the community that helps them to trade at lower cost and participate more in output market than their female counterpart. This finding may suggest any policy action designed to strength smallholder market integration has to bring the gender aspect in the center of discussion so that equal participation of female farmers would be ensured.

Contrary to what we expected, conditional and unconditional influence of family size on the value of crop sold is not statistically significant, although it has negative sign as prior expected. Similarly, our empirical finding doesn't show any significant influence of education of household head and ownership of transport animals both on household market entry and marketed surplus. This might because majority of household head were not attending any schooling and the proportion of household heads attending schooling above primary education was quite small. Perhaps because 41 % of households in the panel data own transport animals, more of transport animals don't not have a separate influence on market participation and quantity of crop sold. .

Conditional on positive participation decision in the first stage, the marginal effects for regional dummies is positive and statistically significant at 1% level. The result also shows that magnitude of influence on value of crop sold is also quite stronger. This could be due to the fact that Oromia, Amhara and SNNP are located in ago-ecological zone which relatively for agricultural production. Our empirical finding also indicates dummies for survey rounds 1997

and 1999 are negative and statistically significant. Conditional on positive participation decision in first stage, compared to 2004 round the value of crop sold declines on average by 109 and 87 Ethiopian birr for the 1997 and 1999, respectively. These are statistically significant at 5% level. This finding confirms with the result we found the descriptive statistics and the trend may suggest that there is an improvement in terms of smallholder market integration

.

CHAPTER 7- CONCLUSIONS AND POLICY IMPLICATIONS

The economy of Ethiopia remains highly dependent on smallholder agriculture which is considered as an engine for economic growth and development of the country. Yet, the sector is characterized by its subsistence oriented production system with low level of productivity. Thus, transforming the smallholder agriculture from subsistence based production system to more market oriented production system is an indispensable to insure food security and sustained economic growth in the country. As a result, Ethiopia has adopted commercialization of smallholder agriculture as a strategy for its economic transformation as reflected in different rural and agricultural development policy agenda of the country. Indeed, understanding factors that makes smallholder farmer subsistence oriented is essential to identify policy actions that will help to improve market integration and welfare of smallholder farmers.

This study uses three waves of panel data from Ethiopian Rural Household Survey (ERHS) to assess trends of smallholder market integration and identify factors that influence household's output market participation and intensity of sale. Specific attention is paid to the linkage between off-farm income and household's output market participation as seller. This is important because, different study indicates there is a growing importance of rural off-farm employment in rural Ethiopia following rapid population growth and declining land per capita. Thus, understanding the direction of relationship between off-farm income and smallholder commercialization has important implications for public policy to support rural communities during the process of economic transformation.

Descriptive statistics was used to assess the level and trends of smallholder commercialization over the survey years considered in this study. We use a farm household model under imperfect market condition and a household's two-step decision making process was assumed. Farm household is supposed to decide, first, whether or not to participate in the market and then s/he decide how much to sell. Double hurdle model was employed because it is more flexible than Tobit model and allows the same factor to affect participation and amount sold in different ways. We use the correlated random effects procedure to control for correlation between time-constant unobserved heterogeneity and the covariates.

The results from our descriptive analysis revealed that there is a rising trend in terms of market participation and market supply. The household data shows compared to 1997 and 1999 , total value of crop produced and value of crop sold by sample households has increased in 2004 survey round. Proportion of sample households participated in output market increased from 66% in year 1997 to 72% in the year 2004. The household commercialization index (HCI) has also increased from 29% in the year 1997 to more than 32 % and 35 % in the year 1999 and 2004, respectively. The result, though not conclusive by itself, suggests that smallholder commercialization in Ethiopia is at its early stage, but there is improvement over the survey period.

We observe considerable difference in terms of household market participation and value of crop sold between households in the lowest land quintile and those in the highest land quintile. Household with large land holding size participate more in output market with higher marketed surplus. This could be due to the fact that households with smaller land per capita has to devote higher proportion of their land to staple food production to achieve a given level of food self-sufficiency. By contrast, we found that participation of household in to off-farm work and income earned from this source shows a decreasing trend across land quintile. This indicates land poor households allocate more of their time in to off-farm activities to generate their livelihood. The result is also consistent with Jayne et al. (2003) who found households with lower land per capita in Ethiopia obtain higher share of their income from off-farm activity relative to those with larger land holding.

Our empirical finding indicates off-farm income has no discernible influence on household output market participation Nevertheless, conditional on positive market participation has been made, each additional earnings from off-farm work has negative and significant effect on household market supply. Although the magnitude of economic effect on marketed surplus is small, it seems consistent with notion that off-farm income slows down smallholder commercialization due to its income effect. Indeed, our empirical finding indicates there is no evidence to support the hypothesis that off-farm income promotes smallholder commercialization by relaxing liquidity constraint to invest and raise productivity and marketable surplus. This might be due to the fact participation in off-farm activities by land poor households is due to lack of options not as a choice. They may participate in lower earning

activities such as wage work and their saving rate would be small. The policy implication of our finding is that expanding higher earning rural enterprises through capacity building and human capital investment is vital. This may help to improve the returns to labor for off-farm work participating land-poor households as Ethiopian smallholder commercialize.

The results from double hurdle model also show that increased crop production per household is found to be a major determinant of both household participation in crop market as a seller and also the extent of market participation. This finding indicates that most of the crops marketed by smallholders are surplus product after satisfying household subsistence requirement and increased production means more surpluses to sell. Gebremedhin et al (2009) also found the same effect of increased crop production on smallholder market integration. We found that extension program participation is insignificant in determining the probability of market entry. Nevertheless, it has positive influence on the value of crop sold conditional on the participation decision has been made. Similarly, our result indicates land holding has significant and positive influence on household market participation and value of crop sold. These effects altogether have wider policy implications to strengthen the linkage between smallholder household and output market. First, given the current small land holding system in Ethiopia, the possible option is intensification of agriculture by expanding and strengthening the institutional support services via extension program. Second, strength the marketing extension service and make them more easily and widely accessible.

We also found distance to the nearest market negatively and significantly affect how much values of crop a household sells once the participation decision has been made. This consistent with notion that household access to rural infrastructure is quite critical to link up with crop output markets by reducing marketing cost and need public policy attention. Our finding also indicates male headed household more participate in output market and the overall influence on value of crop sold is also positive. The implication is that any policy action designed to strength smallholder linkage to output market has to consider the gender aspect and empower female farmers.

References

Alene, A.D., Manyong, V.M., Omanya, G., Mignouna, H.D., Bokanga, M., Odhiambo, G., 2008. Smallholder market participation under transaction costs: Maize supply and fertilizer demand in Kenya. *Food Policy* 33: 318-328.

Barrett, C. 2008. Smallholder Market Participation: Concepts and Evidence from Eastern and Southern Africa . *Food Policy.*33(4), 299-317

Bernard, T., Eleni G. and Alemayehu, S.T. 2007. Smallholder's Commercialization through Cooperatives: A Diagnostic for Ethiopia. IFPRI Discussion Paper No. 00722.

Beyene, A.D. 2008. Determinants of off-farm participation decision of farm households in Ethiopia. *Agrekon: Agricultural Economics Research, Policy and Practice in Southern Africa* 47(1).

Bezu, Sosina & Barrett, Christopher B. & Holden, Stein T., 2012. Does the Nonfarm Economy Offer Pathways for Upward Mobility? Evidence from a Panel Data Study in Ethiopia,*World Developmentz* 40(8): 1634-1646.

Von Braun, J., Kennedy, E., Bouis.,H. 1990. Commercialization of smallholder agriculture: policy requirements for the malnourished poor. Food Policy report. IFPRI, Washington D.C.

von Braun, J. 1994. *Introduction*. In: von Braun, J., and E. Kennedy (eds.). Agricultural Commercialization, Economic Development, and Nutrition. Johns Hopkins University Press, Baltimore, MD, 3-8.

von Braun, J. 1994. Agricultural commercialization: impacts on income and nutrition and implications for policy. *Food Policy,* 20(3), pp. 187-202

Burke, W. J., 2009. Fitting and interpreting Cragg's tobit alternative using Stata. *Stata Journal* 8(4), 584-592.

Carter M, Waters E, Branch B, Ito L, and Ford C, 2004. "Rethinking Rural Finance." ASynthesis of the Paving the Way Forward For Rural Finance Conference, BASIS Collaborative Research Support Program, University of Wisconsin-Madison.

Chamberlain, G. 1984. Panel Data. In Handbook of Econometrics, vol. 2, ed. Z. Grilliches and M. D. Intriligator, 1247–1318. Amsterdam: North-Holland.

Chamberlin, J. 2008. It's a Small World After All: Defining Smallholder Agriculture in Ghana. IFPRI Discussion Paper No. 00823, November 2008. http://www.ifpri.org/pubs/dp/ifpridp00823.asp last accessed on 17.05.2013

. Cragg, J. G., 1971. Some statistical models for limited dependent variables with application to the demand for durable goods. *Econometrica* 39(5), 829-844.

CSA. 2011 'Report on area and production of major crops – Agricultural sample survey 2011/2012)' Central Statistics Authority, Addis Ababa.

Davis, B., Winters, P., Reardon T., and Stamoulis, K. 2009. Rural nonfarm employment and farming: Household-level linkages. *Agricultural Economics* 40 (March): 119-124.

Davis, J.R. 2003. The Rural Non-Farm Economy, Livelihoods, and Their Diversification: Issues and Options. Report prepared for Natural Resources Institute, Department for International Development, and World Bank. Chatham Maritime, Kent, UK: NRI

Deininger, K., S. Jin, B. Adenew, S. Gebre-Selassie, and B. Nega. 2003. Tenure Security and Land-Related Investment: Evidence from Ethiopia. World Bank Policy Research Paper 2991. Washington, DC: World Bank

de Janvry A., Fafchamps M. and Sadoulet, E. 1991. Peasant household behaviour with missing markets: Some paradoxes explained. *The Economic Journal* 101(409): 1400–1417.

de Janvry, A., Sadoulet, E., 2001. Income Strategies among Rural Households in Mexico: The Role of Off-farm Activities. *World Development* 29(3), 467-480.

Dercon, S., and Hoddinot, J., 2004. The Ethiopian Rural Household Surveys: Introduction. International Food Policy Research Institute (IFPRI), CD-ROM or www.ifpri.org.

Evans, H E., Ngau, P., 1991. Rural-Urban Relations, Household Income Diversification and Agricultural Productivity. *Development and Change* 22(3), 519-545.

Fafchamps M. 1992. Cash crop production, food price volatility, and rural market integration in the third world. American *Journal of Agricultural Economics* 74(l), 90–99.

Gebre-ab N. 2006. Commercialization of smallholder agriculture in Ethiopia. Ethiopian Development Research Institute, Notes and Papers Series No. 3. Addis Ababa, Ethiopia.

Gebremedhin, B., Jaleta, M., Hoekstra, D., 2009. Smallholder, Institutional Service, and Commercial Transformation in Ethiopia. *Agricultural Economics* 40, 773-787.

Gebremedhin, B., and Hoekstra, D., 2008. Market orientation of smallholders in selected grains in Ethiopia: Implications for enhancing commercial transformation of subsistence agriculture. *IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 11. ILRI (International Livestock Research Institute), Nairobi, Kenya. 44 pp.*

Gebremedhin, B., Hoekstra, D., and Tegegne, A. 2006. Commercialization of Ethiopian agriculture: Extension service from input supplier to knowledge broker and facilitator*IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 1. ILRI (International Livestock Research Institute), Nairobi, Kenya. 36 pp.*

Gebreselassie, S. and Sharp, K. 2007, Agricultural Commercialisation in Tef-growing Areas of Ethiopia. Paper presented at the Fifth International Conference on the Ethiopian Economy, EEA, June 2007, Addis Ababa.

Goetez,.S. 1992. Selectivity Model of Household Food Marketing Behavior in Sub-Saharan Africa. *American Journal of Agricultural Economics* 74(2), 444-452

Govereh, J., Jayne, T.S and Nyoro, J. 1999. Smallholder Commercialization, Interlinked Markets and Food Crop Productivity: Cross Country Evidence in Eastern and Southern Africa, the Department of Agricultural Economics and the Department of Economics, Michigan State University.

Haggblade, S., P.B.R. Hazell and T. Reardon (eds) (2007) Transforming the Rural Nonfarm Economy: Opportunities and Threats in the Developing World. (1st edn). Baltimore: International Food Policy Research Institute.

Heckman, J. J. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47 (1):153-161.

Hernandez, R., Reardon, T., Guan, Z., 2010. Rural Nonfarm Employment and Agricultural Mechanization and Diversification in Guatemala. Selected paper for presentation on the Agricultural and Applied Economics Association, Denver, Colorado.

Holden, S., Shiferraw, B., Pender, J., 2004. Non-Farm income, Household Welfare, and Sustainable Land Management in a Less Favoured Area in Ethiopian Highlands. *Food Policy* 29 (4), 369-392

Holloway, G., Nicholson, C., Delgado, C., Staal, S., Ehui, S., 2000. Agro industrialization through institutional innovation: transactions costs, cooperatives and milk market development in east African highlands. *Agricultural Economics* 23 (3), 2000.

Immink, M.D.C and J.A. Alarcon. 1993. Household Income, Food Availability, and Commercial Crop Production by Smallholders Farmers in the Western Hifghlands of Guatemala. Economic. *Development and Cultural Change*, 41: 319-342

Islam, N. 1996. Commercialization of Agriculture and Food Security: Development Strategy and Trade Policy Issues. In: von Braun, J., and E. Kennedy (eds.). Agricultural Commercialization, Economic Development, and Nutrition. Johns Hopkins University Press, Baltimore, MD. pp. 103-118.

Jaleta, M., B. Gebremedhin, and D. Hoekstra, 2009. Smallholder Commercialization: Processes, Determinants and Impact. Discussion Paper No. 18. Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project, ILRI, Nairobi, Kenya. 55pp

Jayne, T.S., T. Yamano, M.T. Weber, D. Tschirley, R. Benfica and A. Chapoto. 2003 'Smallholder Income and Land Distribution in Africa: Implications for Poverty Reduction Strategies', *Food Policy 28(3): 253-275.*

Jones, A. M., 1989. A double-hurdle model of cigarette consumption. *Journal of Applied Econometrics 4(1), 23-39.*.

Kan, I., Kimhi, A. Lerman, Z., 2006. Farm output, Non-farm Income and Commercialization in Rural Gorgia. electronic *Journal of Agricultural and Development Economics 3(2) 276-286.*

Key, N., Sadoulet, E. and de Janvry, A. 2000. Transaction Costs and Agricultural Household Supply Response. *American Journal of Agricultural Economics, 82(2): 245-259.*

Lemi, A. (2006) 'The Dynamics of Income Diversification in Ethiopia: Evidence from Panel Data', Working Papers 3. University of Massachusetts, Boston.

Lerman, Z. 2004. "Policies and Institutions for Commercialization of Subsistence Farms in Transition Countries." *Journal of Asian Economcs*, 15: 461-479.

Leavy J. and Poulton C. 2007. Commercializations in Agriculture, Future Agricultures http://www.futureagricultures.org/pdf%20files/commercialisations%20theme%20paper%20final.pdf last accessed on 10.05.2013.

Maddala, G. S. 1983. Limited Dependent and Qualitative Variables in Econometrics. Cambridge: Cambridge University Press.

Maddala, G.S. 1987. Limited Dependent Variable Models Using Panel Data. *The Journal of Human Resources,* 22 (3): 307-338.

Man, N. and S.I. Sadiya. 2009. 'Off-Farm Employment Participation among Paddy Farmers in the Muda Agricultural Development Authority and Kemasin Semerak Granary Areas of Malaysia', *Asia-Pacific Development Journal* 16(2): 142-157.

Mathenge and Tschirley. 2008: Off-farm work and Farm Production Decisions: Evidence from Maize-Producing Households in Rural Kenya, 2008, Tegemeo Working Paper series No 33/2008, Tegemeo Institute/Egerton University

Mduma, J., and P. Wobst. 2005. Determinants of Rural Labor Market Participation in Tanzania. African Studies Quarterly 8(2).

MOFED, 2010. Growth and Transformation Plan 2010/11 – 2014/15. Addis Ababa. Mundlak, Y. 1978. On the Pooling of Time Series and Cross Section Data. *Econometrica* 46: 69–85.

Olwande,J. and Mathenge, M. 2012. Market Participation among Poor Rural Households in Kenya. Selected paper prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil, 18-24 August, 2012.

Omiti, J.M.. 2009. "Factors Affecting the Intensity of Market Participation by smallholder farmers: A Case Study of Rural and peri-urban areas of kenya." *African Journal of agricultural and Resource Economics*, Vol. 3(1): 57-82.

Oseni, G. and Winters, P. 2009. Rural nonfarm activities and agricultural crop production in Nigeria. *Agricultural Economics.* 40 (2): 189–201.

Pender, J. and Alemu, D. 2007. Determinants of Smallholder Commercialization of Food Crops: Theory and Evidence from Ethiopia. Discussion Paper No. 75, IFPRI, Washington D.C.

Pingali, P. 1997. From Subsistence to Commercial Production System: The Transformation of Asian Agriculture. *American Journal of Agricultural Economics*. 79(2): 628-634.

Pingali, L.P. and Rosegrant, M.W. 1995. Agricultural Commercialization and Diversification: Process and Polices. *Food Policy* 20(3): 171-185.

Reardon, T. 1997. Using Evidence of Household Income Diversification to Inform Study of the Rural Non-farm Labor Market in Africa. *World Development* 25:735-747.

Reardon, T., Crawford, E., and Kelly, V. 1994. Link between Non-farm Income and Farm Investment in African Households: Adding the Capital Market Perspective. *American Journal of Agricultural Economics* 76: 1172-1176.

Reardon, T., J. Berdegué and G. Escobar 2001 'Rural Nonfarm Employment and Incomes in Latin America: Overview and Policy Implications', *World Development* 29(3): 395-409.

Ricker-Gilbert, J., T., Jayne, and E., Chirwa, 2011. Subsidies and Crowding Out: A Double-Hurdle Model of Fertilizer Demand in Malawi. *American Journal of Agricultural Economics,* 93(1): 26–42.

Rijkers,B., Söderbom, M. and Teal, F. 2008. Rural Non-Farm Enterprise in Ethiopia: Challenges and Prospects.

Ruben, R., Van Den Berg, M. 2001. Nonfarm Employment and Poverty Alleviation of Rural Farm Households in Honduras. *World Development* 29 (3), 549-560.

Sadoulet, E. and de Janvry, A. 1995. Quantitative Development Policy Analysis: The Johns Hopkins University press, Baltimore and London

StataCorp.,2011. Stata: Release 12. Statistical Software. College Station, TX: StataCorp LP.

Timmer CP. 1997. Farmers and markets: The political economy of new paradigms. *American Journal of Agricultural Economics* 79(2), 621–627.

Tobin, J. 1958. Estimation of Relationships for Limited Dependent Variables. *Econometrica*,Vol. 26 (1): 24-36.

van den Berg,M. and G.E. Kumbi. 2006. Poverty and the rural non-farm economy in Oromia, Ethiopia. *Agricultural Economics 35 (supplement), 469–475.*

Woldehanna, T., 2000. Economic Analysis and Policy Implication of farm and off-farm employment: A Case Study in theTigray Region of Northern Ethiopia. Mansholt Studies 18 and PhD Thesis, Agricultural Economics and Rural Policy Group, Wageningen University.

Woldehanna, T. and Oskam, A. 2001. Off-farm employment and income inequality: The implication for poverty reduction strategy. *Ethiopian Journal of Economics*, 4(.1), pp. 41-57

Wooldridge, J. M., 2002. Econometric Analysis of Cross Section and Panel Data. Boston: MIT Press

World Bank . 2007. 'World Development Report 2008: Agriculture for Development', The International Bank for Reconstruction and Development.

Appendix A: Descriptive statistics

Table A 1 Summary descriptive statistics - off-farm participation, crop marketing status and household characteristics by year (n=1184)

Variables	1997		1999		2004	
	Mean	SD	Mean	SD	Mean	SD
Value of crop produced	2108.854	3216.014	1798.395	2097.275	2602.758	9407.443
Market participation	0.661	0.473	0.646	0.478	0.726	0.446
Value of crop sold (ETB)	950.753	2473.315	814.512	2473.315	1296.207	6933.838
Household commercialization index	.294	.279	.322	.317	.352	.299
Off-farm participation	0.290	0.454	0.519	0.500	0.440	0.497
Off-farm income (ETB)	422.245	1086.870	629.744	1174.785	559.241	2075.187
Age of household head	46.317	15.260	47.747	15.045	51.784	14.781
Male household head	0.779	0.415	0.736	0.441	0.716	0.451
Household head education (Dummy)	0.258	0.438	0.259	0.438	0.280	0.449
Family size (no)	6.053	2.744	5.332	2.563	5.748	2.526
Available family labor	2.904	1.693	2.703	1.412	3.188	1.437
Farm land owned(ha)	1.532	1.408	1.316	1.370	1.583	1.302
Transportation animal (=1 if owned any)	0.398	0.489	0.425	0.495	0.397	0.489
Livestock owned(TLU)	3.279	3.635	2.883	2.818	2.992	3.218
Distance to the nearest market (km)	12.764	5.877	10.684	4.853	8.541	5.858
Involvement in extension	0.061	0.239	0.115	0.319	0.147	0.354

Source: own calculation based on 1997, 1999 and 2004 ERHS data

Table A 2 Crop output marketing status and household characteristics by farm size quintiles

variables	Land quintiles				
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Total value of crops produced	788.3697 (1432.024)	1297.487 (1344.429)	2293.447 (3249.101)	2821.844 (4610.08)	3845.634 (11449.59)
Market participation	.5828 (.4934)	.7485 (.4343)	.7438 (.4368)	0.7927 (0.4063)	.6366 (.4813)
Value of crop sold	349.924 (957.530)	640.5223 (967.0845)	1116.324 (2288.894)	1275.614 (3519.36)	1828.386 (8599.181)
Household commercialization Index (HCI)	.28278 (.3039)	.3877 (3032)	.3658 (.2993)	.3243 (.2892)	.2827 (.2908)
Off-farm participation	.4666 (.4992)	.4487 (.4978)	.4032 (.4908)	.3842 (.4867)	.3761 (.4847)
Off-farm income	217.353 (787.1413)	200.1603 (718.189)	263.775 (1878.807)	172.4563 (615.135)	154.5497 (503.8233)
Total value of crops produced	788.3697 (1432.024)	1297.487 (1344.429)	2293.447 (3249.101)	2821.844 (4610.08)	3845.634 (11449.59)
Age of household head	47.8441 (15.7898)	48.5957 (14.7117)	48.6695 (15.235)	47.9096 (15.3147)	50.2943 (14.5203)
Family size (no)	5.133 (2.5425)	5.8201 (2.6721)	5.7453 (2.7326)	5.908 (2.5471)	6.1591 (2.5612)
Male headed household	0.547 (0 .498)	.7582 (.4285)	.7700 (.4211)	.81638 (.3874)	.7817 (.4133)
Education of household head	.2311 (.4218)	.3249 (.4688)	.2911 (.4546)	.2838 (.4512)	.2254 (.4181)
Land owned (ha)	.3205 (.1507)	.7235 (.0898)	1.1231 (.1397)	1.8278 (.2731)	3.4976 (1.1625)

Livestock owned (TLU)	.3205 (.1507)	2.0353 (1.9103)	2.62 (2.4648)	3.6308 (3.4822)	5.533 (4.1947)
Transport Animals (no)	.2322 (.6543)	.3346 (.7141)	.6332 (.1018)	1.012 (1.3428)	1.915 (2.1940)
Participation in extension program	0 .038 (0.193)	.1276 (.3340)	.1018 (.3027)	.1215 (.3269)	.1211 (.3265)
Observation	930	517	687	708	710

Notes: values in the parenthesis show standard error.

Source: own calculation based on 1997, 1999 and 2004 ERHS data

Table A 3 Comparison of market participation and marketed surplus intensity by off-farm participation status (N= 3552)

Variables	Off-farm work Participant(n=1482)		Non-participant (n=2070)		Mean difference (participant-Non part.
	Mean	SD	Mean	SD	
Value of crop produced	1704.257	2788.253	2503.449	7306.672	-799.193*
Market participation	0.680	0.467	0.676	0.468	0.004
Value of crop sold (ETB)	752.179	2064.436	1212.586	5413.164	-460.407*
Household commercialization index	32.480	30.486	32.066	29.681	0.414
Age of household head (year)	47.386	14.250	49.493	15.792	-2.107*
Male headed household	0.746	0.435	0.742	0.438	0.004
Education of household head	0.298	0.457	0.243	0.429	0.055*
Family size(no)	5.683	2.662	5.731	2.605	-0.048
Available family labor	2.964	1.530	2.908	1.533	0.056
Land owned (ha)	1.365	1.186	1.545	1.309	-0.1793*
Transport animal owned(no)	0.617	1.262	0.959	1.584	-0.342*
Livestock owned(TLU)	2.575	2.857	3.390	3.455	-0.815
Distance to the nearest market(km)	10.846	5.582	10.533	5.965	0.312
Involvement in extension program	0.113	0.317	0.104	0.305	0.009

Note: ***, ** and * indicates significance at 10%, 5% and 1% level

Source: own calculation based on 1997, 1999 and 2004 ERHS data

Appendix B: Econometric Results

Table B 1 Maximum likelihood estimates of CRE double-hurdle model for market participation and marketed surplus intensity

Variables	Hurdle 1 Market participation decision –probit estimator	Hurdle 2 Value of crop sold (ETB) –Truncated normal regression
Off-farm Income (ETB)	2.18e-05 (4.00e-05)	-0.119** (0.0699)
Total value of crop produced (ETB)	5.38e-04* (3.58e-05)	0.749* (0.0051)
Age of household head (year)	-0.009 (0.0071)	14.32 (14.018)
Gender (=1 if head of household is male)	0.197* (0.674)	175.05 (130.83)
Education (=1 if head of hh enrolled at least in any primary level)	-0.0023 (0.0760)	100.10 (105.19)
Family size (no)	-0.048 (0.0253)	-3.375 (34.597)
Land owned (ha)	0.581** (0.379)	306.738* (58.81)
Livestock owned (TLU)	0.050** (0.022)	-58.007*** (29.812)
Transport animals (no)	0.032 (0.420)	107.386 (70.316)
Distance to the nearest market (km)	- 0.013 (0.012)	-39.553*** (23.050)
Involvement in extension program (=1 if participated	-0.1053 (0.1037)	332.501* (125.991)
Oromia[a]	0.885* (0.106)	4737.187* (792.2945)
Amhara[a]	0.186** (0.102)	4397.64* (787.215)
SNNP [a]	1.694 (0.104)	4514.196* (779.677)
Round 1 (1997)[b]	-0.249** (0.989)	-358.981** (175.092)
Round 2 (1999)[b]	-0.263** (0.799)	-271.588** (137.838)
Constant	-0.8431* (0.1746)	-5819.128* (837.4017)

sigma	-	1280.861* (31.211)
Observation (N)	3552	2410
Pseudo R^2	0.3916	-
Log likelihood	-1355.794	-18455.29

Note: ***, ** and * indicates significance at 10%, 5% and 1% level; values in the parenthesis shows standard error.[a] indicates reference region is Tigray, [b] indicates reference survey round is 2004

Source: own calculation based on 1997, 1999 and 2004 ERHS data