Land Tenure, Investment, Land Markets, Off-farm Employment, and Rural Welfare in Ethiopia

By

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Abstract

Ethiopia is one of the few countries in Africa to implement large-scale land titling programmes aiming to improve land related-investments. Since 1995, Ethiopia also has partially liberalised rural land rental markets with the aim of improving the functioning of these markets. Evidence on whether these reforms resulted in improved land access by the poor and increased land-related investments though are scarce and inconclusive. This thesis investigates empirically the relationship between land tenure issues on one hand, and land-related investments and the functioning of rural land and labour markets on the other. It also analyses the relationship between participation in land rental markets and household welfare. Detailed descriptive data analysis and various econometric models were used to examine these issues. The data source for the study is the Ethiopian Rural Household Survey (ERHS), which consists of a panel of 1477 sample households covering four regions in the country.

Findings from the study show that factor, input, and financial markets are poorly developed in rural Ethiopia. In addition, land title ownership does not give farmers additional rights other than the rights provided in the federal and regional legislation. This has particular ramifications. For instance, despite having a land title, farmers in Ethiopia are not allowed by law to sell or use their land as collateral in credit markets. There are also various limitations on land rental transactions. These findings suggest that the preconditions for economic effectiveness of land titling are not satisfied in the case of Ethiopia.

Furthermore, in contrast to earlier studies, this study finds no significant link between farmers' perceptions of tenure insecurity and their land-related investment and factor

market participation decisions. Instead, it establishes that poverty in faming resources and market failures in the credit and factor markets are the major binding constraints that adversely affect farmers' land-related investment and factor market participation decisions in rural Ethiopia. The results reveal that asset rich households were more likely to get access to more land and labour through factor markets, and they were also more likely to invest on their land, while female-headed and/or asset poor households were more likely to lease out their land and remain poor.

The findings of this study do not necessarily suggest that the existing land tenure system in Ethiopia is satisfactory for farmers' intensification efforts. It is widely argued that past and current land polices in the country have led to reduced and fragmented land size holdings in rural areas. As a result, there is limited room for farm intensification. For instance, data from this study show that among sample households who did not grow tree crops on their land, 40% of them reported that land shortage is the first major problem. In this regard, the existing land tenure system can be equally restrictive for most farmers. Therefore, the results of the study suggest that, without reforming the existing land policy and addressing problems in factor and credit markets, land titling is expected to play a very limited role in improving tenure security, investment, and land access for the rural poor.

Dedication

I dedicate this work to my little sister, Sity Shifa, who passed away in January 2014. I am sorry that, because of my studies, I could not be there in the last minutes of your time.

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I extend my most special gratitude to my parents and all my siblings for your unreserved love and endless moral support.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

FAO	Food and Agriculture Organization of the United Nations
CSA	Central Statistical Agency of Ethiopia
ERHS	Ethiopian Rural Household Survey
ERSS	Ethiopian Rural Socioeconomic Survey
FDRE	Federal Democratic Republic of Ethiopia
IFPRI	International Food Policy Research Institute
MDGs	Millennium Development Goals
MoFED	Ministry of Finance and Economic Development
OPHI	Oxford Poverty and Human Development Initiative
PA	Peasant Association
PPP	Purchasing power Parity
SNNP	Southern Nations, Nationalities and Peoples'
SSA	Sub-Saharan Africa

CHAPTER 1: INTRODUCTION

1.1. Background and Motivation

Halving extreme poverty rates by the target date of 2015 is one of the Millennium Development Goals (MDGs) (UN Millennium Project, 2005). Although there are some success stories in reducing poverty in the developing world, recent evidence suggests that the share of undernourished people in Sub-Saharan Africa (SSA) has increased from 17% in 1990–92 to 27% in 2010–12 (Food and Agriculture Organization of the United Nations [FAO], 2012). This indicates that food insecurity remains a great challenge in the continent. In most settings, poverty in the region is predominantly a rural phenomenon where the majority of the population works in agriculture and related activities (El-Ghonemy, 2007).

Subsistence farming is the main economic activity in rural Ethiopia as the majority of the population (82%) lives in rural areas (Ministry of Agriculture and Rural Development [MoARD], 2010). Despite the large percentage of the labour force being employed in agricultural sector, Ethiopia faces challenges of high levels of food insecurity and poverty. For instance, the share of economically active labour force that works in agriculture is significantly higher (about 85%) than the contribution of agricultural output to total GDP (about 43%), implying that people who work in agriculture earn a very low income in Ethiopia (MoARD, 2010). Over the past decade, Ethiopia has achieved high economic growth rates, averaging 11% per year (Ministry of Finance and Economic Development [MoFED], 2014). Despite the strong economic growth, Ethiopia remains one of the world's poorest countries.

Recent estimates show that close to 29.6% of the population lives below the national poverty line (1.5$ in 1993 PPP) and 87.3% of the population in Ethiopia is multidimensional poor (Oxford Poverty and Human Development Initiative [OPHI], 2014).These figures highlight not only the extreme poverty but also the immense development challenges the country faces in the future.

Lack of improved technology investment in agriculture, acute land shortage, and soil degradation coupled with continuous growth in the rural labour force are among the major reasons for the low levels of growth in agricultural productivity in Ethiopia (Deininger, Ali, & Alemu, 2009; Hurni, 1993; MoARD, 2010; Shiferaw & Holden, 1998). Under such conditions, policies that enhance efficient allocation of scarce resources such as land, investment in improved technology, and soil conservation practices are considered key to increased agricultural productivity and reduced rural poverty in the country (Dercon, 2009; Dercon, Hill, & Zeitin, 2009; Mellor & Dorosh, 2010).

In this regard, poor land governance and lack of tenure security are considered important challenges that must be addressed in order to increase land-related investments and agricultural productivity in poor agrarian economies (Byamugisha, 2013; Deininger, 2003). For these reasons, formalisation of property relations through the registration of land and the issuance of title deeds is widely recommended in the developing world. The rationale for land registration and titling is based on the perception that provision of land titling increases tenure security, thereby improving access to credit, efficient allocation of resources, and land-related investments (Deininger & Binswanger, 1999; Feder & Nishio, 1999). However, there is lack of consensus on whether or not formalisation of property relations through the

registration of land and the issuance of title deeds can, in and of itself, really improve tenure security, access to credit, and land-related investments in poor agrarian economies (Bromley, 2008; Firmin-Sellers, 1995).

Ethiopia is one of the few African countries to successfully implement a cost effective and large-scale land registration programme (Deininger, Ali, Holden, & Zevenbergen, 2008). The programme started first in Tigray regional states in 1998, Amhara region in 2002/2003, Oromia and SNNP in 2004 and 2005, respectively. Close to 88 % of the rural households in Tigray and 79 % of them in Amhara received land titles at the end of 1999 and in 2004/2005, respectively (Deininger et al., 2008). Although registration started, land title provision has been delayed in Oramia and SNNP regional states. As of 2008, close to 20 million plots (6.3 million households out of about 13 million rural households) have been registered (Deininger et al., 2008; MoARD, 2010). Overall, the first stage of the land registration process is considered low-cost and efficient, because mainly local traditional methods were used in the process (cadastral system was not used) (Deininger et al., 2008).

Although evidence from other parts of Africa show limited economic benefits of title deeds (Bellemare, 2013; Brasselle, Gaspart & Platteau, 2002; Carter, Wiebe, Blarel, Bruce, & Migot-Adholla, 1994; Place & Migot-Adholla, 1998), recent studies from Ethiopia showed that title ownership had significant and positive impact on land-related investments, land productivity, and land rental market participations (Deininger, Ali & Alemu, 2011; Holden, Deininger & Ghebru, 2009, 2011). However, there are also researchers who argued that land title ownership have no significant long-term economic impact in Ethiopia (Rahmato, 2004, 2009; Segers et al., 2010) as the land tenure system in Ethiopia is characterised by unique features.

For example, all land is under state ownership and farmers only have usufruct rights. Land transfer through sale and the use of land as collateral in credit markets are prohibited by law, despite the land-titling programme. In such context, it would be important to understand how the land registration and titling programme in Ethiopia could have a long-term positive economic impact. This issue is not well addressed in the existing studies. This study aims to fill this gap by investigating whether or not the preconditions for economic effectiveness of land registration and titling are satisfied in the case of Ethiopia.

Additionally, although economic theory suggests that secure property rights in land lead to increased investment and enhanced efficiency in allocating resources (Besley, 1995; Besley & Ghatak, 2010; Deininger, 2003; Demsetz, 1967), the empirical evidence linking insecurity of tenure and lack of land-related investment is less clear, especially in Africa (Arnot, Luckert & Boxall,2011; Brasselle et al., 2002; Fenske, 2011; Place, 2009). The existing studies of the relationship between tenure insecurity and investment incentives in Ethiopia also reported conflicting results.

On one hand, there are studies that documented a significant relationship between tenure insecurity and land-related investment (Ali, Dercon & Gautam, 2011; Deininger & Jin, 2006; Gebremedhin & Swinton, 2003; Mekonnen, 2009). On the other hand, there are studies that found no significant impact of tenure insecurity on farmers' land-related investment decisions (Gavin & Ehui, 1999; Hagos & Holden, 2006; Holden & Yohannes, 2002; Pender & Fafchamps, 2005). Therefore, whether it is lack of tenure security or if there are other and more binding constraints to land related investments remains an empirical question in Ethiopia. Hence, the second aim

of this thesis is to analyse the effects of land tenure insecurity on land-related investment decisions in rural Ethiopia.

Aside from land tenure issues, in densely populated countries such as Ethiopia, lack of access to additional agricultural land is one of the major constraints to increasing agricultural production (FAO, 1993; Rahmato, 2009). Currently, the average land holding size per household is less than one hectare in rural Ethiopia (Central Statistical Agency of Ethiopia [CSA], 2012). In addition, access to well-developed employment opportunities off the farm is very limited with less than 3% of the rural population exclusively relaying on non-farm jobs (MoARD, 2010). This implies that growth in agricultural productivity and sustainable poverty reduction depends on how problems relating to access to land and labour markets are addressed in the country (Omiti, Parton, Ehui, & Sinden, 2000). Therefore, understanding the barriers that affect farmers' participation decisions in rural labour and land rental markets, and the potential link between these participation decisions has significant policy relevance to reduce rural poverty in the country.

A limited number of studies in Ethiopia have analysed, separately, decisions by households concerning participation in the land rental markets (Benin, Ahmed, Pender & Ehui, 2005; Deininger, Ali & Alemu, 2007; Deininger, Jin, Adenw, GebreSelassie & Demeke, 2005; Holden, et al., 2011), and decisions concerning participation in off-farm employment (Bedemo, Getnet, Kassa & Chaurasia, 2013; Bhatta & Årethun, 2013; Lemi, 2006; Woldenhanna & Oskam, 2001). However, these studies ignore the potential interdependency between land and labour market participation decisions in the rural areas. Therefore, the third aim of this study is to fill this gap by analysing the factors that influence decisions by households in rural

Ethiopia concerning land and labour market participations, while explicitly taking into account the potential connectedness of land and labour allocation strategies in rural areas.

Moreover, although the development of land rental markets is central to facilitating access to land for the poor, thereby reducing rural poverty (Deininger, 2003), there is a scarcity of empirical work analysing the effects of participation in land rental markets on household economic well-being. This study also aims to fill this gap by examining the relationship between farmers' land rental market participations and household economic well-being for both tenant and landlord households using data from rural Ethiopia.

1.2. Objective and Research Questions

The broad objectives of this thesis are: (i) to examine whether or not the preconditions for economic effectiveness of land registration are satisfied in the case of Ethiopia. (ii) to analyse the effect of land tenure insecurity on land-related investments, (iii) to analyse the factors influencing decisions by households in rural Ethiopia concerning land and labour market participation, and, (iv) to analyse the relationship between farmers' participation in land rental markets and household economic well-being in rural Ethiopia.

Consequently, the purpose of the thesis is to answer the following core research questions:

1) Are the prerequisites for economic effectiveness of land registration and titling satisfied in the case of Ethiopia?

2) Is tenure insecurity a major binding constraint to land-related investments in rural Ethiopia?

3) What factors determine farmers' land rental and labour market participation decisions in rural Ethiopia? Are these participation decisions interdependent?

4) What is the relationship between farmers' land rental market participation and poverty dynamics in rural Ethiopia?

The study will contribute to the existing literature in four major ways. First, existing studies provide little evidence regarding whether or not the prerequisites for economic effectiveness of land titling are satisfied in the case of Ethiopia. Given the nature of the land tenure system in Ethiopia and the lack of significant effectiveness of land titling projects in other parts of Africa (Deininger & Jin, 2006), it is important to examine this issue in the case of Ethiopia. This thesis aims to fill this research gap.

Second, many of the existing studies analysing the relationship between tenure insecurity and land-related investment decisions in Ethiopia relied on small samples and/or cross-sectional data with limited geographical representativeness. One exception is a study by Deininger and Jin (2006), which used large data covering seven regions of the country[1]. Their study, however, employed cross-sectional data and did not control for regional variations in the analysis. It is known that, in the case of Ethiopia, land redistribution experiences and land-related investment (for example soil conservation practices) systematically vary across different regions (villages)

[1] The seven regions are Amhara, Tigray, Oromia, Southern Nations, Nationalities and Peoples' (SNNP), Benshangul-Gumz, Afar, and Somali regional states.

indicating the importance of controlling for regional variations. As a result, their result might suffer from omitted variables bias.

This study uses a panel dataset covering four regions of the country. The regions included are Tigray, Amhara, Oromia, and SNNP regional states. These four regions are the largest of the nine regions of the country, where 85 % of the population lives (CSA, 2012). In addition, the study augments the econometrics analysis of the impact of tenure insecurity on land-related investments with additional evidence based on analysis of farmers' perceptions of factors affecting their investment decisions. Such an analysis can help identify, directly, households' major investment constraints as mentioned by the farmers themselves. It can also help to check the robustness of econometrics results.

Third, the study investigates the potential interdependency between land and labour market participation decisions in rural Ethiopia. From existing studies, it is not possible to derive conclusions about which combinations of factor market participation decisions are more likely to be taken up by rural households in Ethiopia. This study models and quantifies the degree of inter-linkage between land and labour market participation decisions, recognising the probable correlations between the participation decisions across the two factor markets for the same household through unobserved characteristics. For example, asset-poor households often may rent out their land and then participate in off-farm jobs. This suggests that policy makers should give due consideration to the development of rural off-farm jobs to reduce poverty in rural areas.

Finally, the study will improve understanding of the effects of participation in land rental markets on household welfare in rural areas. The relationship between participation on the supply side of the land rental markets and household welfare is not well addressed by the studies conducted to date. This study examines these relationship for both tenant and landlord households. In addition, in contrast to other studies that use consumption or income data to analyse poverty transitions, the study uses both an asset index and self-rated subjective poverty indicators to measure household poverty. One advantage of using self-rated and asset-based poverty indicators is that these indicators account for non-income dimensions of welfare. Asset-based poverty indicators are considered less prone to measurement errors and it enables us to distinguish persistent structural poverty from transitory poverty (Baulch & Hoddinott, 2000; Carter & Barrett, 2006).

1.3. Data Sources and Sample Design

The data for this research are obtained from the Ethiopian Rural Household Survey (ERHS). The ERHS is a rich panel dataset made available by the International Food Policy Research Institute (IFPRI).[2] The initial survey was conducted in 1989 covering seven Peasant Associations (PAs)[3] and 450 households located in three regional states: Amhara, Oromia, and SNNP. The panel survey began in 1994, incorporating six areas surveyed earlier and covered in the 1989 survey, and an additional nine new areas that were selected to account for diversity in the farming system. Farming systems were used as a stratification base to select the fifteen PAs from the Amhara, Oromia, SNNP, and Tigray regions of the country. Random sampling was then

[2] The data set is available at: http://www.ifpri.org/dataset/ethiopian-rural-household-surveys-erhs
[3] PA is the smallest administrative unit of one or a small number of villages.

employed to select households within each PA (Dercon & Hoddinott, 2011). Appendix C provides the details of the sampling frame used in the survey.

In the 1994 survey, samples of 1477 households were selected from the 15 PAs, with the sample size in each PA determined by an attempt to obtain a self-weighting sample. Accordingly, each person represents approximately the same number of persons from the same farming system (Dercon & Hoddinott, 2011). Survey weights were not used in this study as none were available in the dataset. Although the self-weighting sampling is considered adequate for regional representation, it is suggested that the data should not be considered as nationally representative as sample households might only represent the non-pastoralist farming systems in the country (Dercon & Hoddinott, 2011).[4] Further rounds were conducted in 1995, 1997, 1999, 2004, and 2009. Because some important variables are not available in the 1995 and 1997 survey rounds, the thesis uses data from four rounds of the survey (1994, 1999, 2004, and 2009).

In addition to the ERHS data, some data from the 2011/12 Ethiopian Rural Socioeconomic Survey (ERSS) were also used as additional data source in Chapter 2. The survey was conducted as a collaborative project between the Central Statistics Agency of Ethiopia (CSA) and the World Bank Living Standards Measurement Study – Integrated Surveys of Agriculture (LSMS-ISA) team. The ERSS covered all regional states except the capital, Addis Ababa. It primarily collected information on

[4] The pastoralist population is about 10 % of the total population (CSA, 2012).

rural areas. It was implemented in 290 rural and 43 small town Enumeration Areas (EAs) and 3,969 households.[5]

Regarding the ERHS, the attrition rate between the 1994 and 1999 survey rounds was 7.89%, and a further 5% were lost between 1999 and 2004, along with a further 3% between 2004 and 2009. According to Dercon & Hoddinott (2011), these attrition rates were partly caused by some site-specific factors such as the loss of agricultural land in some villages because of expansion work on Lalibela airport, and households in some resettlement villages have decided to return to their original villages. Although the attrition rates were low, I examine whether attrition rates were non-random and whether attrition potentially biases estimates of model parameters. In doing so, I followed the framework proposed by Fitzgerald, Gottschalk, and Moffitte (1998) to analyse attrition bias.

Following Fitzgerald et al.(1998), I examine first whether the 1994 survey year household characteristics differ between those who were present in 2009 and those who were ever out after 1994. Then, I provide attrition probit estimates for the main model variables used in the study. The analysis in this thesis models farmer participation decisions in land-related investments, land rental and labour markets, and analyse poverty dynamics. Thus, the main variables of interest in the attrition probit model are dummy variables indicating farmers' participation decisions in land rental markets, off-farm employments, tree growing, and household livestock

[5] The data are available at: http://go.worldbank.org/81H4VQ7U10

holdings.[6] If the coefficients on these variables are significant in the attrition probit models it suggests that attrition rates might bias model parameter estimates (Fitzgerald et al., 1998; Outes-Leon, & Dercon, 2008).

Table C.3 in the Appendix shows mean values of the 1994 characteristic variables for those households who were "always in" between 1994 and 2009 and those households "ever out" during the same period. Results indicate that, on average, attritors had smaller family size, livestock and land holdings; and female household heads; were more likely to lease out their land, and less likely to grow trees and work off-farm. These results suggest the presence of non-random attrition pattern in the sample. However, it has been suggested that the presence of non-random attrition does not necessarily lead to a biased estimate (Outes-Leon, & Dercon, 2008).

Hence, to test whether the presence of non-random attrition pattern may lead to a biased estimate, I presented results from attrition probit model estimates for the above selected variables (Table C.4 in the Appendix). Estimation results suggest little evidence of attrition bias. The estimated coefficients of the variables indicating household participation in land rental markets, off-farm employment, tree crop planting, and livestock holdings are insignificant. Furthermore, R-square is very low (< 10%) in all the model estimates indicating that less than 10% of the attrition rates could be explained by the variables included in the models. This suggests that attrition remains largely a random phenomenon. From these results, I can conclude that although there is evidence of non-random attrition rates, there is little evidence that

[6] Livestock holding was among one of the main variables that used to construct an asset index to measure poverty which is available in all the survey years. Thus, this variable is used as a proxy indicator of asset holdings in a household.

parameter estimates on non-attriting samples be biased. Thus, in this study, correction for attrition is assumed to be not important.

1.4. Organisation of the Thesis

The thesis is divided into six chapters. Chapter 1 provides an introduction to the thesis, the main theme, motivation and the objectives of the thesis, and description of the dataset used in the study. Chapter 2 addresses the issues relating to land titling, tenure insecurity, and rural factor and credit markets in rural Ethiopia. It provides a historical review of land reform and land titling in Ethiopia and answers questions pertaining to whether or not the prerequisites for economic effectiveness of land titling are satisfied in the context of Ethiopia. Chapter 3 empirically investigates the relationship between land tenure insecurity and land-related investments in Ethiopia, while Chapter 4 presents results from the analysis of land and labour market participation decisions in rural Ethiopia. Investigation of the relationship between participation in land rental markets and household economic well-being in rural Ethiopia is addressed in Chapter 5. A summary of major research findings of the study and policy implications are provided in Chapter 6.

CHAPTER 2: LAND TITLING, TENURE SECURITY, AND LAND RENTAL MARKETS: CAN LAND TITLING BE A PANACEA IN ETHIOPIA?

2.1. Introduction

Secure property rights in land are considered important in most developing countries where land is the primary means for generating a livelihood for most of the population (Deininger, 2003). However, there have been heated debates on the structure of tenure system associated with better tenure security and what measures should be used to improve tenure security over land (Bromley, 2008; Firmin-Sellers, 1995). In particular, the debate has been immense in Africa where various customary land tenure systems and individual property right systems coexist (Firmin-Sellers & Sellers, 1999). Despite this, as part of the individualising process, formalisation of property relations through the registration of land and the issuance of land titles is widely recommended in Africa and other parts of the developing world (Deininger, 2003)

Ethiopia is one of the few African countries to successfully implement a large-scale and cost-effective land registration programme (Deininger et al., 2008). However, there are on-going debates on whether land titling in Ethiopia meaningfully benefit smallholder farmers in the country. Some researchers showed that land title ownership had significant and positive impacts on investment, land productivity, and land rental market participation (Deininger, et al., 2011; Holden, et al., 2009, 2011), others argued that unless appropriate measures are taken to improve the existing land tenure system and other social and economic conditions in rural areas, the economic benefits of land titling in Ethiopia are limited and will not be sustainable (Rahmato, 2004, 2009; Segers et al., 2010).

It is suggested that land registration and titling are likely to be effective/attractive where there are well-functioning formal financial markets, incentives for investment in land (such as distance to markets, availability of inputs), demand for land transactions, an enabling regulatory framework for land registration, and in areas where indigenous land rights are week or absent (Barrows & Roth, 1990; Bromley, 2008; Feder & Nishio, 1999; Lipton, 2009; Migot-Adholla, Hazell, Blarel, & Place, 1991). Hence, it is important to ask to what extent these conditions are satisfied in rural Ethiopia. This issue is not well addressed in the existing studies. Thus, this chapter aims at contributing to the debate over whether or not the prerequisites for economic effectiveness of land titling are satisfied in the case of Ethiopia. The following research question guides the study: Are the prerequisites for economic effectiveness of land registration and titling satisfied in the case of Ethiopia? To answer the question, I examine the land tenure system, and the structure of rural factor and credit markets in rural Ethiopia.

The structure of the chapter is as follows. Section 2.2 presents a review of the literature on land tenure and land titling issues. Section 2.3 provides a review of the land tenure system and the titling programme in Ethiopia. Section 2.4 discusses the relationship between the security of land tenure and the land titling programme in Ethiopia. Section 2.5 explores the relationship between development of land rental markets and the land titling programme in rural Ethiopia. The structure of credit and input markets in rural Ethiopia is examined in section 2.6. The chapter concludes with a summary of the main findings in section 2.7.

2.2. Literature Review: Theory and Empirical Evidence

Land tenure has important implications for equity, growth and political stability (Deininger, 2003; Deininger & Feder, 2009). For this reason, in most developing countries, land tenure institutions have long been the subject of agricultural and economic development policy measures aimed at improving the asset base of the poor, as well as enhancing overall growth and efficiency (Bardhan, 1996; Maxwell & Wiebe, 1998; Lipton, 2009). In the literature, tenure is defined as "a bundle of rights" and tenure insecurity can be narrowly defined as the perception of losing land in some future time. Or it can be broadly defined as "... the fear of not being able to benefit in full from the set of rights to which one lays claim, and the uncertainty associated with the nature of this set of rights"(Sjaastad & Bromley, 2000, p. 373).

Economic theory suggests that secure property rights lead to increased investment, enhanced efficiency in allocating resources, and environmental sustainability (Besley, 1995; Besley & Ghatak, 2010; Carter & Yao, 2002; Coase, 1960; Demsetz, 1967; Dorner, 1972; Gordon, 1954). In particular, secure property rights in land are considered important in most developing countries where land is the primary means for generating a livelihood for most of the population (Deininger, 2003).The principal arguments for a positive link between secure property rights and investment include the following three points. First, secure property rights remove disincentives to invest as such rights give the assurance that individuals would not be expropriated from their property (Binswanger, Deininger & Feder, 1995; Demsetz, 1967; Feder & Onchan, 1987). Second, secure property (usually land) can be used as collateral in the credit market, which may increase access to funds for investment through formal credit markets (Feder & Onchan, 1987). Third, improvement in transfer rights due to tenure

security allows individuals to sell or rent their investment, which increases the incentive to invest and benefit from trade (Besley, 1995; Besley & Ghatak, 2010).

Although there is a general consensus, at least at the conceptual level, on the importance of secure property rights to induce individual investment and economic growth, there has been heated debates on the structure of tenure system associated with better tenure security and what measures should be used to improve tenure security over land (Bromley, 2008; Firmin-Sellers, 1995). In particular, the debate has been immense in Africa where various customary (usually communal) land tenure systems and individual property right systems coexist (Firmin-Sellers & Sellers, 1999).

On one hand, proponents of individual property rights over land argue that change in relative factor prices (due to increase in population density or technological change) generates economic rents, and that these economic rents can be better captured by private property rights than communal property right systems (Demsetz, 1967; Dorner 1972; Johnson, 1972; Harrison 1987 as cited in Firmin-Sellers, 1995). These researchers consider individual property rights as the most efficient and secure. They argue that customary tenure systems discourage investment and induce inefficient allocation of resources because property rights are not clearly defined and contracts are not enforceable under customary tenure systems.

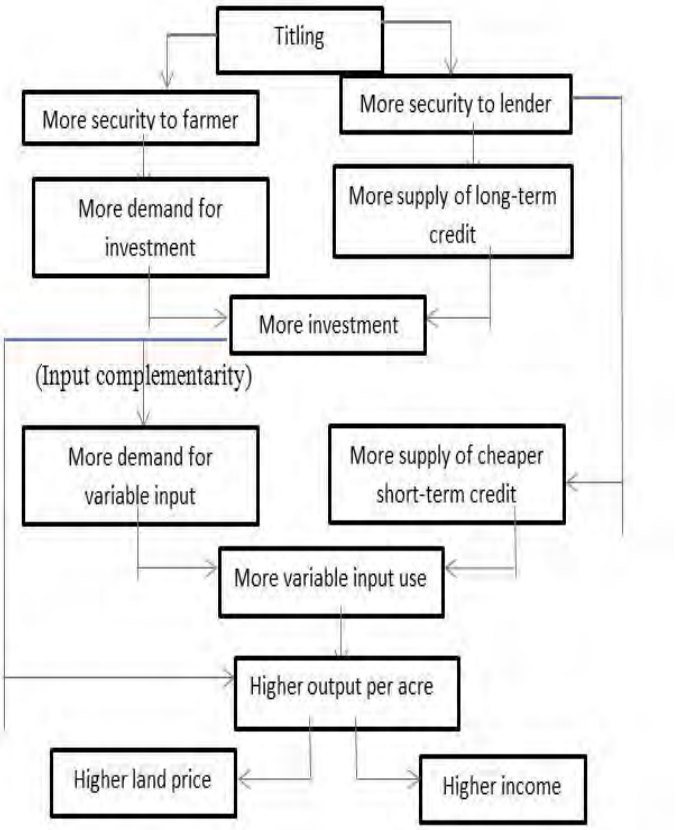
On the other hand, there are researchers who argue that tenure security should not be equated with private property as it can be vested in a community of users (Atwood, 1990; Bromley, 1991; Ho & Spoor, 2006; Platteau, 1996). These researchers suggest that local communities often recognise individuals land rights informally because the

community they belong socially constructs these rights. Furthermore, some researchers argue that customary land tenure system is a dynamic and complex phenomenon as it evolves in an economically efficient manner to changing socio-economic conditions (Barrows & Roth, 1990; MigotAdholla, et al., 1991; Sjaastad & Bromley, 1997, 2000). This means that under specific conditions, customary land tenure systems are sufficient in providing landlords with basic tenure security to rights of use as well as, facilitate land transfers, and investment (Atwood, 1990; Barrows & Roth, 1990; Brasselle et al., 2002; Deininger & Feder, 2009; Feder & Nishio, 1999).

Despite the on-going debate on the structure of tenure system for better tenure security, formalisation of property relations through the registration of land and the issuance of land titles is continuing in Africa. In the context of most developing countries, the rationale for registration and titling is based on the perception that provision of land titling increases tenure security and, thereby, improves access to credit, increases incentive to investment, and facilitates efficient resource allocation (Deininger & Binswanger, 1999; Feder & Nishio, 1999).

A formal treatment for the link between land titling, credit access, investment, and productivity is provided by Feder and Onchan (1987) and Feder and Nishio (1999). The latter paper identifies three channels through which land titling will have positive impacts (Figure 2.1). First, increases in land productivity require increases in complementary land-related investments. The incentive to invest in such activities depends on tenure security. In such case, registration of land ownership can provide tenure security, thereby increasing the incentive to invest on land leading to increase in productivity.

Figure 2. 1. The link between land titling and economic outcomes.



Source: Adapted from Feder & Nishio (1999).

Second, formal lenders with limited information on borrowers require collateral to limit risks around default and usually fixed assets, mainly land, are used as collateral in credit markets. In this regard, provision of land title reduces the cost of verification of ownership of the land used as collateral. Access to cheap credit increases investment on land, leading to increase in land productivity. Third, land registration

and titling can reduce asymmetric information in land markets, thereby facilitating efficient land transfers.

However, it has also been proposed that land registration and titling is not always a necessary or sufficient measure to improve tenure security (Deininger, 2003; Deininger & Feder, 2009; Feder & Nishio, 1999; Lipton, 2009). Deininger (2003), for example, noted that: "Increasing security of tenure does not necessarily require issuing formal individual titles and in many circumstances more simple measures to enhance tenure security can make a big difference at much lower cost than formal titles" (p.39). Additionally, it is suggested that the economic impacts of land titling depends among other factors, on farmers' capacity to respond to investment options, the functioning of other input and credit markets, the rights that are conveyed by individualised land title, as well as the level of technological changes (Barrows & Roth, 1990; Boucher, Carter & Guirkinger, 2007; Bromley, 2008; Feder & Nishio, 1999; Lipton, 2009; Rahmato, 2009). For example, Bromley (2008) points out that:

> If the legal foundations of an economy are tenuous then titles are meaningless and will lack the necessary force to do the work they are claimed to do. That is, formalisation will do little good if it is not backed up by a coherent legal system and authority structure that promises effective enforcement of the rights inherent in, and implied by, the granting of titles (p.2).

This implies that the act of implementing formal land title may not ensure that the benefits of land titling will be realised if it is undertaken without improving the poor legal, social, and economic conditions in the developing countries.

Existing empirical evidence on the relationship between land titling and economic outcomes documented mixed results. Some studies from Latin America and Asia found positive effects of land titling on access to credit, investment, and land value (Deininger 2003; Feder, 2002; Feder & Onchan, 1987; Galiani, & Schargrodsky, 2010). For example, the study by Feder (2002) found that land titling had led to increased land values (in Thailand, Brazil, Indonesia, and Philippines), increased investment levels (in Thailand, Brazil, and Honduras), and increased access to credit (in Honduras and Thailand). Similarly, Deininger (2003) also found increased land values and agricultural investment following registration programmes in Nicaragua, Ecuador, and Venezuela.

In contrast, there are studies that found limited impacts of land titling programmes on investment and credit market participation in Latin America (e.g. Carter & Olinto, 2003; Fields & Torero, 2006). For instance, Carter and Olinto (2003) show that the credit supply effects of tenure security are absent for the smallest farms in Paraguay suggesting that the impact of land tilting on credit supply has a wealth or land size bias. Likewise, Field & Torero (2006) show that the effect of titling on credit access is limited in Peru. In particular, they found no effect of titling on receiving credit from private sector banks, although interest rates are significantly lower for titled applicants. According to Boucher, Carter and Guirkinger (2007) the limited impact of land tiling on credit access can partly be explained by the presence of moral hazard constraints and lack of insurance markets, which induces risk rationing in credit markets. This means, while titling may reduce quantity rationing in credit markets (by improving farmers' ability to use their assets as collateral), it does not necessarily

increase the farmers' willingness to put her/his wealth at risk (increased risk rationing).

When it comes to Africa, many studies found no significant relationship between land titling, on the one hand, and tenure security, credit use, investment, agricultural productivity, or expansion of land rental markets, on the other (Atwood 1990; Bellemare, 2013; Brasselle et.al., 2002; Carter et al., 1994; Jacoby & Minten, 2007; Migot-Adholla et al., 1991; Migot-Adholla, Benneh, Place, & Atsu, 1994; Place & Migot-Adholla, 1998; Roth, Unruh, Barrows, Bruce, & Migot-Adholla, 1994). For example, the study by Bellemare (2013) showed that land titles had no significant impact on changing agricultural productivity in Madagascar, although some informal land rights were significantly associated with changes in agricultural productivity. Among other reasons, imperfections in other complementary markets and lack of infrastructure are suggested as the major reasons for the lack of significant economic impacts of land titling reforms in Africa (Barrows & Roth, 1990; Bruce & Migot-Adholla, 1994; Ensminger, 1997; Migot-Adholla et al., 1991).

Contrary to what was found in other African countries, new research from Ethiopia showed that land title ownership had significant and positive impact on investment, land productivity, and land rental market participation (Deininger et al., 2011; Holden et al., 2009, 2011). For example, the study by Deininger et al. (2011) assessed the impacts of land registration and titling using data from the Amhara region of Ethiopia. Their results showed that tenure security increased with land title ownership as these households expected less administrative redistributions in the future. Regarding investment decisions, they showed that the propensity to invest in soil and water conservation measures significantly increased with land title ownership in Ethiopia.

Ownership of land titling in Ethiopia also significantly improved participation in land rental markets in the Tigray and Amhara regions of Ethiopia (Holden et al., 2009, 2011). In particular, Holden et al. (2011), who analysed the impact of land titling on both tenant and landlord households, argued that land certification significantly increased land rental market participation of (potential) tenant and landlord households.

However, there are others that suggested that ownership of land certificate does not entitle the holder to any more rights or benefits than those already included in existing federal and regional land legislation (Rahmato, 2004, 2009; Segers et al., 2010). Therefore, the expected positive economic benefits of land titling are very limited. For example, a study by Rahmato (2009) from two districts in the country found that despite land titling, large percentage of households reported that they expected land redistributions in the future, which may increase tenure insecurity.

Similarly, based on their study from Tigray region of the country, Segers et al. (2010) argued that there is no "evidence that farmers' land rental decisions are influenced by the level of legal or perceived tenure security" (p.1025). These findings imply that unless measures are taken to address problems in the existing land tenure system and other development challenges, land titling is not expected to result in any long-term solution in Ethiopia.

The discussion above clearly suggests that the positive economic impacts of owning land titles will be realised if farmers are able to mortgage their land, and are able to sell or rent the land more smoothly to others. However, in Ethiopia, land is owned by the state and farmers are not allowed to use their land as collateral in credit markets.

Given the lack of significant effectiveness of land titling projects in other parts of Africa (Deininger & Jin, 2006), it is important to ask whether the prerequisites for economic effectiveness of land titling are satisfied in the case of Ethiopia. This issue has been not well addressed in the existing studies.

This chapter aims to examine whether or not the prerequisites for economic effectiveness of land titling are satisfied in the case of Ethiopia. To do so, I examine the land tenure system, and the structure of rural factor and credit markets in rural Ethiopia. The next section provides a review of the land tenure system and the land titling programme in Ethiopia. In subsequent sections, I examine the link between the land titling programme and the development of rural factor and credit markets in the case of Ethiopia.

2.3. Overview of the Land Tenure System in Ethiopia

The land tenure system in Ethiopia has undergone a remarkable shift, mainly associated with regime changes over the past forty years. This section provides an overview of the land tenure system in Ethiopia. It summarises the land policies based on the three recent regime changes in the country: (i) the imperial regime (Pre-1974), (ii) the military-socialist government of the Derg (1974-1990), and (iii) the current regime (since 1991).

2.3.1. Tenure Systems in Pre-1974 Ethiopia

During the imperial regime prior to 1974, land was predominantly controlled by the king, the church, and the ruling elites. Land tenure system was not uniform in the country. In particular, there was a basic distinction between land ownership patterns in the Northern and Southern parts of the country (Rahmato, 1984). A communal land

tenure system known as *rist* was the major land ownership system in the Northern part of the country. According to this system, an individual's access to land was determined, based on his or her membership of a village community and both male and female descendants of the original settlers could access land but only through family inheritance (Rahmato, 1984; Jemma, 2004). Community leaders were responsible for the allocation of land to the members of the village community (Rahmato, 1984). As land was a common property of the village community, individual holders had only usufruct rights over their land holdings, which restricted land transfer by sale, mortgage, or gift. However, they were allowed to rent out their land to others. Problems faced by *rist* claimants include disputes among peasants and diminishing land holding sizes due to excessive land fragmentation (Rahmato, 1984; Rahmato, 1993; Jemma, 2004).

In the late nineteenth century, following the conquest of the Southern region by Northern emperors, land was redistributed among the new landlords, local elites, and the church in the Southern part of the country. In this region, government land was given to local elites associated with the emperor. Members of this elite group were responsible for tax collection as civil servants in lieu of salary. Because of this policy, many local people were left landless and became servants and tenants to the Northern elites. Furthermore, there was a clear contrast in what tenancy meant to Northern and Southern peasants. According to Hoben (as cited in Jemma, 2004, p.7), in the Northern part, tenancy meant "a system of sharecropping among different households who pooled their resources together based on the mutual interest of the parties involved, while, in the South, tenants were landless laborers and landlords were absentee landlords". In addition, arbitrary eviction of tenants and uncompensated

labour services of tenants to landlords was common in the Southern part of the country. In effect, the agrarian structure was characterised by an exploitative landlord-tenant relationship with great inequality in land distribution (Rahmato, 1993; Jemma, 2004).

2.3.2. The Derg Era (1974-1990)

Lack of commitment to reform the land policy by the imperial regime led to the popular unrest and revolution with the famous slogan "Land to the Tiller" which resulted in the collapse of the imperial system in 1974. Following the overthrow of the imperial regime by the military regime (Derg), the government announced a radical land reform in 1975 that nationalised all rural and urban land, as well as all natural resources in the country. The land reform placed emphasis on abolishing the exploitive landlord-tenant relations that prevailed in the South, and the granting of land to those people who actually produced from the land.

Following the land reform, the government confiscated all privately owned land without compensation to the former owners. Land was redistributed to individual households based mainly on family size, and the land holding per household was restricted to no more than ten hectares. The reform also applied in the Northern part of the country. Because every plot of land was held by the peasants in the Northern part (mainly under the *rist* land ownership system), the reform also gives possessory rights over the lands they were tilling during the reform period (Ambaye, 2013, p. 62). Thus, uniform land polices followed throughout the country, in both the Northern and Southern parts. Peasants were granted only usufruct rights depending on a peasant's continued residence in the village, and inheritance was possible only among immediate family members (Rahmato, 1993).

In addition, as a means of transition to socialism, Peasant Associations (PAs) were created as lower administrative units in every village. They were responsible for approximately 800 hectares of land, and large-scale state farms were organised (Rahmato, 1984). Furthermore, farmers were organised into producers' cooperatives, and usually forced to sell fixed proportion of their output at fixed prices to the state owned agricultural marketing corporations established in 1979. Members of producers' cooperatives were favoured in terms of obtaining subsidies and the best land in their PAs. In some cases, peasants who had fertile lands but did not belong to the association were displaced to other areas if the land was needed for cooperative farming (Rahmato, 1993; Jemma, 2004).

The land reform banned any private ownership of land, and land transfer through sale, rental, or mortgage market. It also restricted the hiring of agricultural labour in family farming (unless the individual is sick or weak), despite the availability of surplus labour from large households (Omiti et al., 2000). To some extent, households attempted to overcome the problems related to these restrictions though inter household exchange of labour on alternate working days and sharecropping (Omiti et al., 2000; Rahmato, 2004). Formally, administrative land redistribution was the only instrument used to adjust land holdings and address landlessness problems (Pender & Fafchamps, 2005; Rahmato, 1984). As a result, as time passed, many Peasant Associations (PAs) had to redistribute land frequently to meet the demand for land caused by high population growth or for other reasons such as the demand from government to implement collectivisation and compulsory resettlement programmes (Rahmato, 1993; Teklue & Lemi, 2004).

The initial land reform in 1975 was successful in terms of changing the land tenure system and reconfiguring social class in Ethiopia (Rahmato, 1984). However, the subsequent agrarian policies, and the limited technical ability of administrative officials to anticipate and correct changes in factor proportion at farm level resulted in land fragmentation, increased tenure insecurity, and lowered labour mobility, and agricultural productivity (Rahmato, 1993; Teklue & Lemi, 2004). For instance, during the period 1982–1991, the overall GDP growth was 1.4% with agricultural GDP growing at only 2%.[7]

2.3.3. The Current Land Tenure System (Since 1991)

After the downfall of the socialist regime in 1991, the transitional government adopted a new economic policy in 1992, which more closely resembled the free market economic policy. Despite the transition from a socialist to market economy, the government reserved ultimate control over land. A new Constitution in 1995 (Proclamation No. 1/1995) asserted that all rural and urban land belonged to the state and the people of Ethiopia. Accordingly, land is the property of the state and individuals have only usufruct rights. This, once again, limits transfer of land through sale or mortgage. The Constitution guarantees access to land free of charges for any individual aged 18 and above who wishes to take farming as the main livelihood activity. Unlike the previous regime, the current land policy officially allows farm households to rent out their land on a short-term basis, hire agricultural labour, and to claim compensation for investment on their land in cases of displacement from that land.

[7] World Bank data retrieved at: http://data.worldbank.org/country/ethiopia

In 1997, the government enacted a Federal Rural Land Administration Proclamation (Proclamation No. 87/1997) which was later replaced in 2005 with the current governing legislation (Proclamation No. 456/2005). This legislation transferred power to regional governments to formulate their own land legislation within the framework of the general principles provided in the federal law. The implications are that there are regional variations in regards to some land laws. For example, despite land renting out being officially allowed since 1995, different regions impose different restrictions on the size of the land to be rented out and the rental duration. For example, in Tigray, the length of a lease period can extend up to 20 years for modern technology and up to only two years for traditional technology.

Likewise, in the Amhara regional state, farm households are allowed to rent out their land for a duration of up to 25 years, irrespective of the technology being used, while duration is restricted to a maximum of 3-15 years in Oromia, and 2-25 years in the SNNP regional states based on the technology employed. The restriction on the maximum amount of land area to be leased also varies across different regions. For instance, farmers in the Oromia and Tigray regional states are allowed to rent out only 50% of their land holdings, while in other regions, although the size is not mentioned, the amount of land remaining should be enough to produce the annual food consumption needs for the farming families.

There are also important regional differences regarding access to land and residency requirements. For example, the land policy in the Amhara and Tigray regional states emphasised that rights to land will be terminated if the holder leaves his/her village (for example for more than two years in Tigray), while the legislation in Oromia and SNNP regions states indicates that land will not be terminated if the holder resides

elsewhere. The land legislation in Tigray region further declares that siblings can inherit land from their parents only if they have no land of their own or have insufficient income from non-agricultural activities.

With diminishing per capita land holding sizes in rural areas, restrictions on land transactions are expected to reduce farmers' transaction in land rental activities. For instance, data from the 2009 ERHS round show that less than 10% of the lands used by farmers were obtained through land rental markets (Table 2.1). Land allocated by PA officials and inheritance were the two most important means of access to cultivated land in rural Ethiopia. Among the plots used in 2009 by sample households a large proportion were PA- allocated plots (60.8%), followed by inheritance (27.2%).[8] However, there are significant regional variations. For example, compared to other regions, land acquisition through inheritance was larger in SNNP (67.2%), followed by Oromia (22.6%).

Table 2.1: Mode of plot acquisitions by region (2009)

	Mode of plot acquisitions (% of plots)						
Region	PA[a] allocated	Inheritance	Share-cropping	Cash-rent	Purchase	Other means*	Total Plots
Tigray	90.42	5.56	3.83	0.19	0	0	522
Amhara	74.99	8.9	13.29	2.39	0.19	0.23	2,594
Oromia	67.55	22.59	3.08	5.15	1.19	0.44	3,439
SNNP	20.03	67.15	3.34	1.35	7.86	0.27	1,857
Total	60.77	27.15	6.34	3.15	2.28	0.31	8,412

Source: Own calculations using data from ERHS, 2009.Note: *' Other means' includes mortgage and land borrowed free; PA means Peasant Association. About 19 plots had missing information or "don't know" response.

[8] Other means includes mortgage and land borrowed free. However, close to 93% of the land borrowed free had been kept under the current holder for more than seven years and those who reported the plot as mortgaged or purchased also kept it for more than 20 years. This might suggest that these plots can be considered as inheritance or endowments (Rahmato, 2004).

With the objective of increasing tenure security, starting in 1998, the current government has begun the implementation of the first stage of a land titling programme in various parts of the country. According to the current ruling land legislation (*Proclamation No. 456/2005),* land titling is defined as: "certificate of title issued by a competent authority as proof of rural land use right". The programme started first in Tigray regional states in 1998, Amhara region in 2002/2003, Oromia and SNNP in 2004 and 2005, respectively. Close to 88% of the rural households in Tigray and 79% of them in Amhara received land titles at the end of 1999 and in 2004/2005, respectively (Deininger et al., 2008).[9] Although registration started, land title provision has been delayed in Oramia and SNNP regional states. As of 2008, close to 20 million plots (6.3 million households out of about 13 million rural households) have been registered (Deininger et al., 2008; MoARD, 2010). [10]

The first stage land registration and titling process did not involve the use of cadastral system. Except in two selected pilot areas (in Amhara region), where relatively better technologies were used, mainly local traditional methods (e.g. measuring tapes and ropes) were used in the demarcation process and the registration and documentations were done manually (Bezu & Holden, 2014; Deininger et al., 2008). According to Bezu and Holden (2014: p.193), "The main sources for determining plot boundaries were field markings, in conjunction with the memories of the neighbors whose farm plots border those owned by the households in question." As a result, the first stage of

[9] The current ruling land proclamation, proclamation No.456/2005, was enacted at federal level with the main objective of consolidating the land tenure laws in various regions. So the timing of this law does not relate with the ongoing land titling programmes in various regions. However, the 2005 proclamation formalises the land registration programmes in various regions.

[10] The estimated number of total agricultural land holders in 2009/10 production season was about 13,252,639 (CSA, 2012).

the land registration process is considered low-cost and efficient (Deininger et al., 2008).The process also avoids the common shortcomings of land titling programmes in other parts of Africa as it is considered to be cost effective, accessed equitably, and participatory.[11] However, Rahmato (2009) has argues that the cost advantage of using traditional methods will be overshadowed by other limitations of the process.

For example, results of area delineations from this process are not up to-date. Therefore, results can be inaccurate, inconsistent, and unreliable in the long run, which may lead to more conflicts (Rahmato, 2009: p.81).To overcome these shortcomings the government is currently staging the second round of the land certification programme, which seeks to be more accurate in terms of delineation and the recording of property boundaries using modern methods. This second-stage process is expected to be expensive though as it intends to use advanced technology (Deininger et al., 2008).

In summary, the discussion in this section shows that despite some policy change relative to the previous regime land policy, the current land tenure system in Ethiopia is very restrictive in many aspects. Land is owned by the state and although renting is allowed, there are still various restrictions imposed on land rental market transactions and labour movements. In addition, land titling in Ethiopia grants usufruct rights only because private ownership of land is prohibited by law.

[11] Land titling and registration programmes in other parts of Africa have proved to be expensive, very slow, exclusive of poor claimants and holders of secondary land rights(for example women), difficult to keep up-to-date, and in some cases led to increased conflict among multiple claimants (FirminSellers & Sellers, 1999; Toulmin, 2009).

The main objective of the land reform (land titling) in Ethiopia is to enhance tenure security of farmers, thereby stimulating greater land-related investments and minimising boundary disputes. This in turn is expected to increase agricultural productivity. However, the discussion in the conceptual framework clearly indicates that land titling will have significant positive impact only if there is well-functioning credit, input and other factor markets, and where existing tenure systems are weak/not effective (Barrows & Roth, 1990*;* Feder & Nishio, 1999; Migot-Adholla et al., 1991). Based on this conceptual framework, in the subsequent sections, I examine whether such basic prerequisites for economic effectiveness of land registration are in place or not in the context of Ethiopia.

2.4. Tenure Insecurity and Land Title Ownership

During both previous and current regimes, government sponsored land redistributions have been widely used to equalize the distribution of operational land holdings in rural Ethiopia (Benin & Pender, 2001). This can be seen from the figures in Table 2.1 as more than 60% of operated plots in rural areas are acquired through government allocation. However, land redistributions are also the main source of tenure insecurity among farmers because redistributions to date have generally taken place without fair compensation (Ambaye, 2013; Holden & Yohannes, 2002; Rahmato, 2009). In particular, as land belongs to the state, farmers have not been compensated for the lands they lost during land redistributions and in events when farmers were moved, often they received land which was of poor quality (Rahmato, 2009).This means farmers can lose their investments in improving soil fertility.

Improvement in tenure security of farmers is one channel through which land registration and title ownership is expected to improve both investment and efficient resource allocations, thereby increasing agricultural productivity (Feder & Nishio, 1999). Supporting this theory, some researchers from Ethiopia found that land title ownership increased tenure security of farmers (Deininger et.al, 2011; Holden et.al, 2009, 2011). For example, Holden et al. (2009) noted that:

> The main reason for positive impacts of certification is that certification has reduced tenure insecurity that was high due to the past policy with state ownership of land, providing households restricted use rights to land only, and frequent land redistribution that undermined investment incentives (p.360).

Deininger et al. (2011) also argue that the main channel through which land titling is expected to result in a positive outcome is only through its positive impact on tenure security. These arguments suggest that land title ownership gives farmers more secure land rights than earlier tenure systems in rural Ethiopia. However, there are also others who have argue that land title ownership has hardly changed the situation from what is stated in the existing land policies in rural Ethiopia (Rahmato, 2004, 2009; Segers et al., 2010).

For example, Rahmato (2009) argues that titling could not guarantee tenure security to farmers because the government still possesses the power to expropriate their land from farmers when it is necessary to do so. The current reform (land titling) does not eliminate the government's contradictory objectives of achieving social equity and tenure security at the same time. The

Constitution and regional legislation continues to promise the right to have land for all adults living in rural areas free of charge. In reality though, given the existing land scarcity and population pressure on land, the government could achieve social equity objectives mainly using periodic land redistributions, which may also increase tenure insecurity (Ege, 1997; Rahmato, 2004). This fact is confirmed in the current land legislation which states that:

> Upon the wish and resolution of peasants farmers, semi-pastoralists and pastoralists where land distribution becomes the only alternative, it shall be undertaken in such a way that it shall not be less than the minimum size of holding and in a manner that shall not result in fragmentation of land and degradation of natural resources (Article 9, Sub-Article 3 of Proclamation No. 456/2005).

Additionally, under some conditions, farmers may lose their land rights. For instance, both federal and regional legislation in all regional states clearly declares that rights holders must 'properly manage' the land, soil and other natural resources that are in their possession. According to Rahmato (2004), the term 'properly manage' is problematic because it is not clearly defined. As a result, different officials can interpret it differently. These restrictions and ambiguities in the land policy are expected to undermine tenure security of farmers. In this regard, de facto land title ownership does not relax any of the above restrictions or clarify the existing ambiguities in the land law. In fact, titling reinforces what is already stated in the

federal and regional land legislation. The new land proclamation (Proclamation No. 456/2005) states that:

> Any holder of rural land shall be given a holding certificate to be prepared by the competent authority and that indicates size of the land, land use type and cover, level of fertility and borders, as well as the obligation and right of the holder (Article 6, Sub-Article 3 of Proclamation No. 456/2005).

Article 10 Sub-Article 1 of the legislation further states that:

> A holder of rural land shall be obliged to use and protect his land. When the land gets damaged, the user of the land shall lose his use right. Particulars shall be given in the land administration laws of the regions.

This suggests that ownership of land titling does not protect farmers from expropriation by government officials if they fail to 'properly manage' their land. Fear of land expropriation by the government remains high among farmers despite titling programme in some parts of the country. For instance, since 1997, land redistribution has been banned in Tigray regional state and the actual land redistribution experience among the sample households was zero after 1997 (Table 2.2). However, the number of households who reported fear of losing land because of land redistribution in Tigray was 11.6% during the period 1999–2004 which declined only to 9.7% during 2004–2009. In other regions though, farmers' fear of losing land because of land redistribution declined by more than 45% during the same time. The

data also show that none of the households in the sample area had reported that they had lost land in the past or expected land loss in the future due to land grabs by other households.[12] This suggests that governments' power to expropriate land is the main source of tenure insecurity.

Table 2.2: Percentage of households that experienced and expected land redistribution reforms (1994-2009)

	Tigray	Amhara	Oromia	SNNP	Total (%)	Total sample
Households Lost land due to land redistribution (%)						
Lost land before 1994	38.1	44.5	34.7	19.1	33.5	1,455
Lost land during 1983-1994	20.9	17.1	6.3	1.1	9.8	1,455
Lost land during 1994-1999	0.8	22.7	1.6	2.3	8.6	1,358
Lost land during 1999-2004	0.0	2.6	0.9	2.1	1.7	1,353
Lost land during 2004-2009	0.0	1.3	0.3	2.7	1.3	1,345
Households Expected redistributions and land loss due to redistributions (%)						
Expected land redistributions during 1999-2004*	14	21	33	10.6	20.4	1,403
Expected land loss during 1999-2004	11.6	14.4	13.2	6.4	11.4	1,403
Expected redistributions during 2004-2009	12.7	11.1	12.8	4	9.6	1,348
Expected land loss during 1999-2004	9.7	6.2	7.0	3.2	5.9	1,348

Source: Own calculations using data from ERHS.Note:* 'Expected redistributions' includes both those expected land losses and gains due to land redistributions.

Likewise, other studies from the Amahar region of the country suggest that despite titling, fear of land expropriation by the government remained high (Rahmato 2009; Deininger, et.al, 2009). For example, Rahmato (2009) reported that among a sample of 110 peasants interviewed, more than 44% reported that land redistribution was

[12] The result is not reported here.

likely in the future, while 28% of them reported that they were not sure about it. According to Rahmato (2009, p. 89), such uncertainties about future government land policies are prevalent in rural areas because often peasants are not consulted beforehand when new initiatives are planned. Regarding the land registration programme Rahmato (2009) stated that: “Almost all peasants in our two research locations said they heard about land registration when they were called to attend a general meeting to elect the committee that was to be responsible for implementing it”(p.89).

Some researchers, however, argue that titling is beneficiary in the case of expropriation by the government as “possession of a certificate can improve negotiating power or at least provide a basis for compensation, again implying that certification could lead to potentially large tenure security effects” (Deininger et al., 2009, p.316). Previous land redistribution experiences suggest that often fair compensation was not necessarily guaranteed during expropriation by government officials (Ambaye, 2013; Holden & Yohannes, 2002; Rahmato, 2009). For instance, during the land redistribution in Amhara in 1997, farmers were compensated for their trees only if the trees were at harvestable age when they lost their land. This means that they lost rights to younger trees planted (Holden & Yohannes, 2002, p. 577).

This indicates that despite the fact that both the constitution and regional land legislation promise fair compensation for investment on land during expropriation, the government does not fully respect these rights in practice. After extensive study of the land redistribution in the Amara region in 1997, Ege (1997) described the situation as follows:

> The current reform confirmed the worst fears of those who opposed state ownership of land, since it showed very clearly that the state reserves for itself the right to dispose of land at will, and the peasants have no independent rights, only the rights that the state at any point chooses to respect (p. 143).

Also, a recent study of two villages in Ethiopia suggests that although farmers indicated that they are sure they will get some compensation if they lose land due to government expropriation, they are not sure whether the compensation will be fair (Rahmato, 2009, p.88). This is because, when peasants lose land due to land expropriations, they often receive land that is of poor quality as compensation. This is mainly because local officials cannot afford to pay compensation in cash, and good quality land is not easily available due to land scarcity (Rahmato, 2009).

Furthermore, there is some evidence that despite having land titling proof, some farmers were denied fair compensation to part of their previous land use rights such as rights to communal grazing lands during expropriation by government (Rahmato, 2009). Communal lands were not included in the land titling process. Given that all rural land belongs to the state, the government has the right to change communal lands to private holdings (Proclamation No. 456/2005). As a result, there have been a number of problems associated with communal lands during the land titling process. For example, Rahmato (2009) described the conflict between local officials and farmers who lost their land due to road development projects in Amhara regional state (west of the Dessie Zuria district) as follows:

> The local authorities argued that commons were no man's land and not

> eligible for compensation. Peasants were angry because they felt cheated: they had been farming those lands for over a generation and had their certificates as proof of ownership, yet they were denied the fair treatment that they were promised by the certification programme (p.77).

This situation suggests that land titling does not necessarily guarantee full compensation in the case of expropriation. In fact, by delineating use rights only to individual farm sizes, it may even restrict farmers' use rights on secondary land rights, such as communal grazing lands.

In general, from the above discussions, it is clear that land reform in the form of land titling has changed little with regard to the existing land tenure system in the case of Ethiopia. Considerable tenure insecurity remains high mainly due to government sponsored land redistribution practices in the country. Thus, if the objective is to reduce tenure insecurity (which is mainly due to government-sponsored land redistributions), the government can commit itself to stopping land redistribution and respect the rights already stated in the Constitution and regional legislation without land titling.

2.5. Land Titling and Land Rental Markets in Ethiopia

The other major benefit of titling mentioned in the literature is that land registration and titling leads to the emergence of a well-functioning land markets as it can reduce asymmetric information between buyers and sellers (Feder & Nishio, 1999; Deininger & Feder, 2009). Feder and Nishio (1999) has, nevertheless, emphasised that land titling might not have much impact on land markets under the following conditions: i)

if the transaction in land markets mainly takes place within a village where everyone knows each other; ii) if there is a low demand for land transactions, or the existing land tenure system is sufficient to the types and volumes of transactions that are typical in the area under consideration; and, iii) if there are restrictions in the functioning of land markets.

In the context of Ethiopia, where land sale and private ownership of land are prohibited, the development of land rental markets is considered important in order to equalise the marginal product of land across households with different land and labour endowments. Hence, land renting out is officially allowed since the introduction of the new Constitution in 1995. However, as the discussion in section 2.3 shows, both federal and regional legislation impose restrictions on the size of the land to be rented out and the rental duration. In this regard, land titling does not change any of the restrictions imposed on land rental markets. Additionally, land sale and the use of land as collateral in credit markets are still prohibited in Ethiopia, despite the land-titling programme. The current land proclamation states that:

> Peasant farmers, semi-pastoralists and pastoralists who are given holding certificates can lease to other farmers or investors land from their holding of a size sufficient for, the intended development in a manner that shall not displace them, for a period of time to be determined by rural land administration laws of regions based on particular local conditions (Article 8, Sub-Article 8 of Proclamation No.465/2005).

This legislation seems even more restrictive as it states that farmers "who are holding certificates" are allowed to rent out their land. There is no mention of farmers who do not own certificates, which suggests that, without a certificate, they are not allowed to rent out land. Such ambiguity in the land law may in fact increase tenure insecurity among households who do not receive titling due to various reasons.

Despite the law, more recent data from the Ethiopian Rural Socioeconomic Survey (ERSS) in 2011/12 show that households leased out their plots even if they did not have titling (Table 2.3). Out of 5,752 parcels, 63.7% of the parcels had land title, and 4.8% of the parcels had at least one field that rented out during the agricultural season (in 2010/11). Looking at renting-out activities by land title ownership suggests that there was no significant difference between parcels that had land titles and those without it, with the exception in Oromia where the mean difference is marginally significant (at 10% level of significance).

However, these figures do not include land rentals through sharecropping, which is the dominant contractual arrangement in rural Ethiopia (see Table 2.5 and Table 4.1 in chapter 4). Based on the main data set used in this thesis, ERHS, households' participation in land rental markets (including sharecropping) was 33.5% in 1994, which is comparable with other countries (e.g about 27% in China, in 2000 (Kimura, Otsuka, Sonobe, & Rozelle, 2011); and 24% in Hungary in 1998 (Vranken & Swinnen, 2006)).

Table 2.3: Parcel level information on land titling and rental activities (2011/12)

Region	Num. of parcels	Parcels with titles (%)	Parcels rented out (%)	Parcels rented out (%)		
				With titles	Without titles	mean test
Tigray	768	62.11	3.62	3.35	4.12	
Amhaa	2,129	77.45	9.11	9.52	7.71	
Oromia	1,513	56.64	2.3	2.92	1.52	*
SNNP	1,342	50.89	1.56	1.76	1.37	
Total	**5,752**	**63.73**	**4.82**	**5.73**	**3.26**	

Source: Own calculations using data from ERSS, 2011/12.
Note: Number of parcels excludes parcels which have missing data on whether the parcel is rented out or not. Thus, out of the total of 6579 parcels 820 parcels excluded. And parcels rented out does not necessarily mean that the whole parcel, it could be fields in the given parcel. * Significant at 10%.

Furthermore, the nature of the transactions in land rental markets suggests that a significantly large proportion of the land transactions are between relatives. For example, data on rented plots from the 2009 survey years of the ERHS indicate that 40% of the plots were leased from relatives (Table 2.4). In addition, there is evidence that most of the land rental transactions took place within the same village where farmers reside. For example, data from the 1994 survey year reveal that among households who leased out land, close to 88% of the plots leased out were to tenants who were located within the same PA the landlords resided in, while 35% being neighbours.

Table 2.4: Transacting agents in land rental markets(1994 and 2009)

Pots leased out in 1994 (%)		Plots leased in 2009 (%)	
To families in the same village	31.82	From peasant associations	3.64
To neighbours	35.39	From husband's/ wife's parents	2.64
To others in the same village	21.1	From other relatives	37.64
To others, elsewhere	4.55	From non-relatives	55.33
To families, elsewhere	7.14	From others (not specified)	0.75
Total sample	308		797

Source: Own calculations using data from the ERHS.
Note: 'Others' indicates non-relatives.

Other similar studies from Ethiopia also show that land rental transactions in Ethiopia were mainly between relatives, neighbours or friends (Belay & Manig, 2004; Deininger et al., 2009; Segers, et al., 2010). Likewise, using data from Dominican Republic, a study by Macours, De Janvry and Sadoulet (2010) also show that among the plots rented out in their study area, about 43 % of them rented out to family members. In the presence of tenure insecurity, renting out land to family members or neighbours may help reduce the likelihood of losing land to tenants who are socially distant (Macours et al, 2010).

In the context of rural Ethiopia, where there is limited mobility, information about land ownership, assets, and ability is easily available among residents of the same village. This suggests that transaction costs related to verification of land owners or tenants are not expected to be a constraint to land rental transactions. As a result, the benefit of land titling in reducing transaction costs in land rental transaction is expected to be very limited in the case of rural Ethiopia. However, it is suggested that land renting to family members or individuals within the same community may lead to efficiency loss if landlords rent less or rent it to less productive tenants when the landlord cannot find productive tenants among those with close social relationships (Macours et al, 2010; p.898).

Despite the above conditions, recent studies analysing the impact of land titling on land rental markets in Ethiopia have indicated that titling had positive and significant impacts on land rental market participation, in particular for female-headed households (Deininger et al., 2011; Holden et al., 2011). For instance, Holden et al. (2011)'s study disclosed that female-headed households were more likely to rent out land than male-headed households because they lacked complementary non-land

resources (endowment effect), but female-headed households supplied less land because they felt more tenure-insecure. Their estimation results show that the coefficient on ownership of titling variable (proxied by a random certificate residual variable) was insignificant in the landlord model; while the interaction variable between the random certificate residual and sex of household head was positive and significant. Based on the positive coefficient on the interaction term, they concluded that tenure security (in the form of land titling) significantly increased land supply by female-headed households, despite evidence of strong dominance of the endowment effect over the tenure insecurity effect. However, other researchers (Ali & Norton, 2003; Green, 2010) have noted that this way of interpretation of the 'coefficient on interaction' term is incorrect[13]. This suggests that further analysis is needed before any conclusion on the estimation result is made.

The result found by Holden et al. (2011) also suggests that land renting-in had increased in the sample area because land titling increased land supplies, making more land available in the market. To test this, they included a variable "years since certificate" in the tenant model. The coefficient on "years since certificate" was positive and significant in the tenant model, implying that access to land for tenants improved in the sample area. However, contrary to their hypothesis, their descriptive statistics show that land supply increased by only 12% (from 24% to 27%) immediately after certification (between 1997 and 2000), while land demand increased by more than 280% (from 0.08% to 31%) during the same period.

[13] Ai & Norton (2003) showed that the statistical significance of the interaction effect cannot be tested with a simple t-test on the coefficient of the interaction term. Unlike the case in the linear model, the interaction effect is conditional on other independent variables. As a result, the interaction effect may have different signs for different values of covariates. Therefore, the sign of the coefficient on the interaction term does not necessarily indicate the sign of the interaction effect.

Therefore, it is not clear why land renting-in increased by such a large number while land renting out increased only marginally.

Contrary to the findings in the literature (Holden et al., 2011; Deininger et al., 2011), analyses of land transaction activities using panel data from four regions of Ethiopia, suggest that there is a limited relationship between land titling and participation in land rental markets in rural Ethiopia (Table 2.5). The data show that participation in land rental markets, in particular land supply, significantly increased in all regions during the period 1994–1999. The increase in participation rate mainly comes from an increased participation in land rental markets using cash rental arrangements. For instance, the incidence of participation using the cash rental contractual arrangement in 1999 increased by more than 200% from a level of less than 5% in 1994.

The increase in land supply was higher in the Oromia and SNNP regional states where, land titling started only after 2004. During the same time, the percentage of households that rented out land in the SNNP regional state increased by about 150%, followed by the Oromia regional state with an increase of 123%, while the figure was 39% in the Tigray region where, by the end of 1999, almost 88% of the households had received a title. Following the substantial increase in 1999, the average participation rate in land rental markets declined in 2004 (except in the Amhara region), then significantly increased again in 2009 in all regions.

This trend in land rental market participation seems not following the land titling process because land registration and titling only started after 2003 in all regions except in the Tigray regional state. The figure in 1994 also suggests that farmers have been participating in land rental markets even before 1995, mainly using

sharecropping. Thus, the initial period increase in land rental activities is consistent with the change in land policy in 1995 that officially allows farm households to rent out their land, while the decline in land rental market participation rates in all regions in 2004 may be related to the recurrence of drought in the 2002/2003 production year. This could have significantly reduced transactions in the land rental markets. During this period, agricultural GDP fell by 10.5%. It then registered an average growth rate of 10% during the 2005–2008 production years (MoFED, 2011). The average trend in land rental market participation thus seems to follow a similar pattern to weather conditions and the associated agricultural production. This is a plausible explanation because agricultural production in Ethiopia is highly vulnerable to weather conditions.

Table 2.5 also shows that the average amount of land area transacted in both the supply and demand side of the land rental markets was lower than 0.2 hectare, however with significant regional variations. For instance, in 2009, a relatively higher average area was transacted in the Amhara and Oromia regional states (0.72 and 0.33 hectares, respectively) compared to the Tigray and SNNP regional states (0.09 and 0.16 hectares, respectively). From Table 2.5 it is evident that sample households from the Amhara and Oromia regional states had relatively higher averages allocated per adult land holdings and higher participation rates in land-renting transactions. This may suggest that given policy restrictions on the amount of land to be rented out, relative to other regions, sample households with higher average land labour ratio were more likely to participate actively in land rental markets.

Table 2.5: Land rental market participation by tenancy type and region (1994-2009)

	1994	1999	2004	2009
Tigray region				
Rented- in (% households)	3.3	2.0	6.1	10.1
Rented-out (% households)	12.0	16.7	8.8	14.7
Cash rental (% of rents)	0.0	6.9	4.5	5.6
Area rented in(hectares)	0.01	0.01	0.04	0.03
Area rented out(hectares)	0.03	0.08	0.03	0.05
Per capita land size	0.14	0.14	0.18	0.17
Total households	**150**	**150**	**148**	**148**
Amhara region				
Rented- in (% households)	32.7	37.3	39.2	42.3
Rented-out (% households)	22.6	29.0	26.8	33.2
Cash rental (% of rents)	4.9	15.2	13.0	17.5
Area rented in(hectares)	0.34	0.34	0.34	0.43
Area rented out(hectares)	0.24	0.27	0.23	0.29
Per capita land size	0.83	0.57	0.58	0.6
Total households	**480**	**466**	**426**	**418**
Oromia region				
Rented- in (% households)	14.1	14.9	13.8	12.2
Rented-out (% households)	10.4	23.2	20.7	27.4
Cash rental (% of rents)	21.6	55.6	55.4	49.7
Area rented in(hectares)	0.11	0.14	0.12	0.1
Area rented out(hectares)	0.07	0.18	0.2	0.23
Per capita land size	0.47	0.46	0.61	0.63
Total households	**405**	**396**	**363**	**371**
SNNP				
Rented- in (% households)	17.6	14.8	11.0	12.7
Rented-out (% households)	5.2	13.0	11.7	15.3
Cash rental (% of rents)	10.78	26.98	24.47	21.01
Area rented in(hectares)	0.09	0.06	0.04	0.08
Area rented out(hectares)	0.03	0.06	0.06	0.08
Per capita land size	0.18	0.17	0.34	0.28
Total households	**442**	**440**	**426**	**418**

Source: Own calculations using data from ERHS. Note: Per capita land size indicates land holdings excluding land obtained through land rental marks. Cash rental indicates the percentage of households transacted in the land rental markets using cash rental (both rent in and rent out).

Overall, parcel and regional leve1 analysis of land rental market participations suggests that the link between land-renting transactions and land title ownership is limited in rural Ethiopia. The analysis in this section may suggest that, due to the existing nature of land rental transactions in rural Ethiopia, lack of titling may not be a major problem for participation in land rental markets. This result is consistent with Segers et al. (2010)'s findings that farmers' participation in land rental markets was not influenced by titling or perceived tenure insecurity in the Tigray region of Ethiopia.

However, some of the studies that found positive impacts of titling (for example Holden et al., 2011) argue that land title ownership increased tenure security of landlords, which increased participation in land rental markets. This claim suggests that landlords (without land title) fear land grab by potential tenants. It is necessary to point out though this claim is merely proposed but not justified. Data from three rounds of the ERHS (1999, 2004, and 2009) show that none of the households in the sample had reported that they had lost land in the past or expected land loss in the future due to land grab by tenants (potential tenants). Instead, land redistribution by the government was reported as the main reason for actual or expected land losses reported in the sample area. This suggests that the mere allocation of land titling is unlikely to lead to the emergency of well-functioning land rental markets in rural areas unless the various restrictions on land rental markets are removed.

2.6. The Structure of Credit and Input Markets in rural Ethiopia

In this section, I examine the functioning of credit and input markets in rural Ethiopia. It is recognised that improved access to working capital plays a significant role in a farmer's production decisions (Eswaran & Kotwal, 1986). In this regard, the dominant advantage of titling is that it reduces transaction costs in credit markets as it allows lenders to verify ownership of collateral (usually land) with lower cost. The demand for credit and collateral availability in turn is expected to improve the development of rural credit markets. Thus, in the absence of other constraints of the operation of financial markets, access to land title is expected to increase access to more credit (Feder & Nishio, 1999; Deininger & Feder, 2009).

It is necessary to note that in Ethiopia, provision of land titling does not provide benefits, which are linked to credit markets. This is because farmers are not allowed to mortgage or use their land as collateral in credit markets even if they have land title[14]. This suggests that a meaningful development in rural financial markets in Ethiopia is not expected in the near future. The existing financial markets in rural areas are poorly developed with the informal and semi-formal sectors still playing significant roles in providing credit to rural households (Table 2.6). For example, the informal and semi-formal sectors provided 90.8% and 66.9% of the total loans taken by farmers in 1999 and 2009, respectively.[15]

[14] However, investors are allowed to use land as collateral in credit markets.

[15] Farmers were asked if any member of their household had taken a loan amount of at least 20 Birr in the past 12 months of each production year. Birr is Ethiopian currency, currently 1$=16 Birr.

Table 2.6: Changes in rural credit markets in rural Ethiopia (1994-2009)

Category	1994	1999	2004	2009
Households take loans (%)	46.99	52.2	54.45	62.69
Loan Source				
Informal and semi-formal (%)	*****	***90.83***	***67.71***	***66.98***
Friend and relative	*	65.76	63.79	68.65
Moneylender	*	17.01	9.99	9.56
Equb and Eddir	*	14.4	25.04	20.28
Other**	*	2.83	1.19	1.52
Formal(Micro-finance, banks and NGOs\ local government bureaus)	*****	***9.17***	***32.29***	***33.02***
Reasons for taking Loans For production purpose	33.6	25.41	46.76	38.41
For consumption purpose	66.4	74.59	53.24	61.59
Total number of loans	**862**	**971**	**991**	**1,281**
Total sample households	**1477**	**1452**	**1372**	**1358**

Source: Own calculations using data from ERHS.
Note: * indicates information is not available. ** no list is provided here. The figures for friends and relative, Money lender, *Equb* and *Eddir*, and other are as a percentage of informal and semiformal loans.

Amongst the informal and semi-formal providers, mutual help amongst friends and relatives provided more than 60% of the total loans. Other sources such as *Equb* (rotating saving) and *Eddir* (informal funeral insurances services) provided 25% and 20% of the loans in 2004 and 2009, respectively. However, there was an increase in access to formal sector loans. The significant increase in the formal sector loan access from 9.2% in 1999 to 33.0% in 2009 comes from an increase of loans provided by rural microfinance services, NGOs, and local government bureaus. This is consistent with government programmes in microfinance since 1995.

The data also show that loans for covering consumption expenditures such as food, health care, and other expenses accounted for more than 50% of the loans taken

during the study period. This indicates that households in Ethiopia mainly use informal credits to overcome temporary shortfalls in consumption expenditures rather than to finance investment projects. In addition, the data show that the percentage of households that had taken out loans for production purposes increased with land size (Table 2.7). For example, the percentage of households that participated in credit markets for production purposes was at least two times higher for households with land holding size of greater than three hectares compared to those households with land holding size of 0.5 hectares or less, except in 1999.

Table 2.7: Percentage of households taken loans for production by land size (1994-2009)

Land holding size (in hectares)	1994	1999	2004	2009
<= 0.5	14.16	9.87	23.24	19.65
> 0.5 and <= 1	13.13	18.61	18.55	22.35
>1 and <=3	19.76	18.74	29.40	31.37
>3	22.03	8.80	47.95	48.06
Total (%)	**17.47**	**15.01**	**28.50**	**29.75**
Total households	**1477**	**1452**	**1372**	**1358**

Source: Own calculations using data from ERHS.

These results may suggest that land-poor households may be rationed out from the credit markets due to their perceived low re-payment potentials. Furthermore, formal credits, which were taken mainly for production purposes usually included interest payments that could be too high for poor farmers to afford. For example, Table 2.8 shows that 42.7% of the loans from the informal and semi-formal sectors included interest payments, while the figure was 84.3% for loans from the formal sectors.[16] Similarly, while 26.0% of the loans from the informal and semi-formal sectors required provision of some guarantor, the figure was 47.1% for formal sector loans.

[16] Information regarding interest rate and collateral requirements was collected only in the 1999 data set.

However, among informal loans, 88.6% of the loans from local moneylenders included interest payments and 46.5% required provision of some guarantor. In general, these figures suggest that relative to poor farmers, better-off farmers in terms of land holdings are more likely to get loans for production purposes.

Table 2.8: Interest payment and collateral requirements (1999)

Loan Sources	Percentage of loans with		
	Interest requirements	Collateral requirements	Guarantor requirements
Informal and semi-formal loans (% loans)	**42.74**	**12.9**	**26.04**
Friends and relatives	26.13	11.56	17.51
Moneylender	88.67	17.24	46.53
Equb and *Eddir*	57.94	12.6	40
Other	72	20	33.33
Formal loans(% loans)	**84.27**	**17.44**	**47.13**
Total number of loans	**966**	**963**	**966**
Total (% of loans)	**46.58**	**13.31**	**27.97**

Source: Own calculations using data from ERHS.

In addition to rural credit markets, private sector development was also very limited in input markets. As a result, farmers had to rely on government or other NGOs and local organisations to get access to fertiliser and other improved farm inputs. For instance, data from the 1999 survey year show that farmers who used fertiliser and improved seeds reported that close to 75% of the fertiliser and 80% of the improved seed they had purchased were provided by government related organisations (Table 2.9). Moreover, more than 60% of the sample households reported that market competition between the existing input suppliers was low or did not exist. This indicates that due to lack of competition in input markets, farmers face high prices in

input markets. This is demonstrated by the fact that as close to 67% of the sample households reported high input prices as a major problem they faced in input markets.

Table 2.9: Markets for improved farm inputs (1999)

	Input types			
	Chemical fertiliser	Improved seeds	Chemicals	All inputs
Households supplied by (%)				
PAs	41.5	22.5	19.5	31.8
MOA nurses*	33.3	57.4	28.1	36.0
Other sources	25.2	20.1	52.5	32.3
Reported level of market competition among input suppliers (% of households)				
High	16.4	5.9	15	14.2
Average	18.8	18.5	19.4	18.9
Low	23.1	25.1	27.7	24.8
None	41.7	50.5	37.9	42.2
Major problems in input markets (% of households reported)				
No problem	5.3	14.3	2.3	5.3
High price	67.5	42.9	67.4	67.4
Late arrival	9.6	14.3	7.0	9.5
Lack of credit	8.5	0.0	14.0	8.7
Other reasons	9.1	28.6	9.3	9.2

Source: Own calculations using data from ERHS.
Note: * MOA (Ministry of Agriculture).

In summary, the analysis in this section shows that input and credit markets are poorly developed in rural Ethiopia. The incentive to invest on one's farm requires well-functioning input, credit, and output markets. In the absence of these markets, farmers' response to land titling is expected to be very limited (Barrows & Roth, 1990; Feder & Nishio, 1999). Additionally, in the absence of formal credit access and private sector development in the input markets, farmers were forced to rely heavily on local officials to get credit and improved farm inputs. Such heavy reliance on local officials for access to credit and improved farm inputs may add to the insecurity of peasants which cannot be addressed by provision of land titling.

2.7. Conclusion

This chapter examine whether the preconditions for positive economic impacts of land titling are satisfied or not in the case of Ethiopia. A review of the details concerning land reform indicates that land title ownership in Ethiopia does not give farmers any more rights other than the rights provided in both the federal and regional legislation. All land is under state ownership and farmers have only usufruct rights. There are also legal restrictions that limit farmers' transactions in land rental markets. Despite land titling programmes, land expropriation by government officials and uncertainty about future land polices were major sources of tenure insecurity in Ethiopia. In addition, the land law prohibits both land transfer through sale and the use of land as collateral. This suggests that provision of land titling in Ethiopia does not provide benefits that are linked to credit access.

Analyses of land rental transactions from four regions of the country show that in 1999, participation in land rental markets increased in all regions considered in this study, while it declined in all regions in 2004. This pattern is not in line with the timing of the land titling process in Ethiopia, which started only in 1998 in Tigray followed by Amhara region in 2003. In contrast, the increase in land renting out in 1999 is consistent with the change in land policy in 1995 that officially allows farm households to rent out their land, while the decline in 2004 may be related to the recurrence of drought in the 2002/2003 production year. Additionally, land rental transactions in Ethiopia were mainly between relatives, neighbours or friends. Given this type of land rental transactions, the role of land titling in reducing asymmetric information between landlords and tenants is expected to be very limited.

The study also demonstrated that existing input, credit, and land rental markets are poorly developed in rural Ethiopia. This means that under the prevailing condition, land titling is expected to play a highly muted role in improving access to credit, investment, and participation in land rental markets in rural Ethiopia. Thus, policies that encourage private sector development, in both input and credit markets, and improve the functioning of rural factor markets may be more important if real change in poverty reduction is to be seen.

The rationale for land tilting is based on the perception that insecure tenure conditions are a primary impediment to prompt land-related investments and efficient land transfer in rural Ethiopia. Thus, it is important to examine to what extent farmers' perception of tenure insecurity affects their land-related investment decisions and transaction in land rental markets. In the next two chapters, I will further examine empirically if tenure insecurity can play any role in explaining the variations in land-related investments and land rental market participation decisions in rural Ethiopia.

CHAPTER 3: DOES TENURE INSECURITY EXPLAIN THE VARIATIONS IN LAND-RELATED INVESTMENT DECISIONS IN RURAL ETHIOPIA?

3.1. Introduction

The analysis in the previous Chapter show that the prerequisites for economic effectiveness of land titling were not satisfied in the context of Ethiopia. However, there are also studies that have documented significant and positive impacts of land titling on, investment, productivity, and land rental market participations in the case of Ethiopia (Deininger, et al., 2011; Holden, et al., 2009, 2011). These findings depend on the presumption that tenure insecurity is among the major binding constraints to households' investment and land rental market participation decisions in rural Ethiopia.

However, existing studies of the relationship between tenure insecurity and investment incentives in Ethiopia reported mixed results. There are studies that documented a significant relationship between tenure insecurity and investment (Ali, et al., 2011; Deininger & Jin, 2006; Gebremedhin & Swinton, 2003; Mekonnen, 2009). In contrast, other studies found no significant impacts of tenure insecurity on farmers' investment decisions in rural Ethiopia (Gavin & Ehui, 1999; Hagos & Holden, 2006; Holden & Yohannes, 2002; Pender & Fafchamps, 2005).

Furthermore, some of the studies that have reported a significant impact of tenure insecurity on investment have documented conflicting results on how tenure insecurity affects investment decisions in rural Ethiopia. For example, Mekonnen (2009) found that tenure insecurity measured as a perception of losing land in the future, had increased the likelihood that farmers grow Eucalyptus trees, while the perception of future land redistribution had decreased the likelihood of growing trees

in the study by Deininger and Jin (2006). Hence, it is open to question as to whether lack of tenure security or perhaps other and more binding issues are the main constraints to land-related investments in rural Ethiopia.

In other parts of Africa, the debate on the impact of secure land rights on land-related investment has also continued with no consensus although there is empirical evidence that supports both sides of the debate (Arnot, et al., 2011; Brasselle, et al., 2002; Fenske, 2011). Such empirical uncertainty suggests that the relationship between the degree of tenure security and farmers' investment decisions need further scrutiny. With this purpose in mind, this chapter is set out to ascertain whether there is a link between tenure insecurity and farmers' land-related investment decisions in rural Ethiopia.

The study contributes to the existing literature on land tenure and investment issues in the following ways. First, unlike many of the studies which relied on small samples and/or cross-sectional data with limited geographical representativeness, this study uses a panel data set covering four regions of the country[17]. This allows us to control for unobserved time-invariant household heterogeneity. Unobserved household heterogeneity such as farming ability, the farmer's attitude towards risk, and time preferences are expected to affect farmers' decisions in land-related investments.

While Deininger and Jin (2006) use a large cross-sectional data set covering seven regions of the country[18], they do not have panel data and they do not control for

[17] The regions included are Tigray, Amhara, Oromia and SNNP regional states. The four regions are the largest regions from the nine regional states of the country, where 85% of the population lives (CSA, 2012).
[18] The seven regions include: Amhara, Tigray, Oromia and SNNP, Benshangul-Gumz, Afar, and Somali regional states.

regional variations in their analysis. In the case of Ethiopia, land redistribution experiences and land-related investments (for example soil conservation practices) systematically vary across different regions (villages) indicating the importance of controlling for regional variation. As a result, their result may suffer from omitted variables bias. Second, the study augments the econometrics analysis with additional evidence based on analysis of farmers' perceptions of factors affecting their investment decisions. Such an analysis can help to identify, directly, households' major investment constraints as identified by the farmers themselves. These efforts also help to check the robustness of our econometrics results.

Third, recent studies suggest that access to extension services and learning from others (social learning), has significant impact on the decision to adopt new technologies among rural farmers (Conley & Udry, 2010; Krishnan & Patnam, 2014). For example, the study by Krishnan and Patnam (2014) suggests that visits by extension officers and neighbours' decisions to adopt a new technology (i.e. improved seeds and fertiliser) raise the probability of one's own decisions to adopt a new technology. This suggests the importance to account for such factors in our analysis. Therefore, I analysed the impacts of access to extension services and informal social networks (for example labour-sharing arrangements) together with perceived tenure insecurity on farmers' land-related investments.

The chapter is organised as follows: Section 3.2 provides a review of the literature on land tenure and investment issues. Section 3.3 discusses the theoretical model. A data description and descriptive statistics are presented in section 3.4. Section 3.5 deals with estimation strategies used in the analysis. Section 3.6 discusses the results. Section 3.7 concludes with a summary of the main findings.

3.2. Literature Review: Theory and Empirical Evidence

According to the discussion in Chapter 2, security assurance, collateralisation, and benefit from trade are the three main channels through which secure property rights are expected to affect investment positively (Besley, 1995; Besley & Ghatak, 2010; Demsetz, 1967; Feder & Onchan, 1987). Hence, it is believed that improvement in tenure security leads to increased investment and efficient allocation of resources. Although the theory is clear about why secure land rights are expected to enhance investment incentives, the empirical evidence linking land tenure security and investment is less clear, especially in Africa (Arnot et al., 2011; Brasselle et al., 2002; Fenske, 2011; Place, 2009).

Some studies showed that greater security of tenure was associated with more land related investments (for example Ali et al., 2011; Deininger & Jin, 2006; Deininger et al., 2011; Gebremedhin & Swinton, 2003), while others found no significant relationship between insecurity of land tenure and investment decisions (Hagos & Holden, 2006; Holden & Yohannes, 2002; Pender & Fafchamps, 2005; Place & Otsuka, 2002). Further, some studies reported mixed results (Besley, 1995; Place & Hazell, 1993). For example, looking at two regions in Ghana (Wassa and Anloga), Besley (1995) showed that tenure security had a positive impact in only one of the regions that he studied (Wassa). A similar study by Place and Hazell (1993), using data from Kenya, Ghana and Rwanda, found a significant impact of tenure security on investment, only in Rwanda.

Research in Sub-Saharan Africa also found evidence of reverse causality. There are a number of studies that suggest that insecurity of land tenure might lead to more investment in land, especially in the case of tree planting (Besley, 1995; Brasselle et

al., 2002; Deininger & Jin, 2006; Holden et al., 2009; Mekonnen, 2009; Sjaastad & Bromley, 1997). For example, the study by Mekonnen, (2009) showed that the perceived risk of land expropriation was associated with more likelihood of tree-growing in the Amhara region of Ethiopia. Similarly, Deininger and Jin (2006) found that past redistribution experiences at village level encouraged tree-planting in rural Ethiopia. Deininger and Jin (2006) argued that tree growing plays a significant role as a means to enhance security of tenure in addition to its productivity enhancing and other roles.

Despite the substantial number of studies of secure property rights and investment incentives, research on the relationship between tenure insecurity and land-related investment incentives has not yet reached a definitive consensus on whether the existing poor farm-related investments in Africa can be explained by the lack of tenure security or other more binding factors. A number of potential reasons are proposed for such mixed findings in the literature. Among other factors, some of the main problems mentioned include: lack of clarity in the definition of tenure security, variations in the use of different aspects of tenure to quantify tenure security, endogeneity of tenure security and investment decisions, measurement error, and omitted variable bias (Aront et al., 2011:308; Fenske, 2011). Because of these, even the studies that reported a significant impact of tenure insecurity on investment have documented conflicting results on how tenure insecurity affects investment decisions.

For example, some of the studies in Ethiopia found that the perception of the possibility of losing land in the future (measured at household level) was not a significant factor in the decision to grow perennials (Ali et al., 2011; Holden & Yohannes, 2002), while this factor had a positive and significant impact on the

likelihood of tree planting in another study by Mekonnen (2009). In another study, Deininger and Jin (2006) showed that past redistribution experiences at woreda (village) level increased the likelihood of tree growing, while past land redistribution experiences at household level had no impact on tree growing. The perception, at household level, of possible future land redistribution had decreased the likelihood of growing trees by the same households.

Likewise, studies that used transfer rights as an indicator of tenure security reported mixed results. For example, Deininger and Jin (2006) reported that at household level, a perceived right to mortgage land significantly increased the likelihood of tree planting (all types of trees) and increased the likelihood of applying soil conservation practices, while the perceived right to sell land had affected only soil conservation. However, Ali et al. (2011) showed that perceived transfer rights (not specified)[19] at plot level affected investment decisions positively in coffee and chat crops but had no significant impact on the decision to grow Eucalyptus trees. Further, Holden et al. (2009) documented that land title ownership (as a measure of tenure security) had a weak impact on soil conservation practices, while Deininger et al. (2011) found that it had significantly increased the propensity to invest in soil and water conservation. These studies reported conflicting results, although they have used similar indicators for tenure insecurity and investment variables.

Furthermore, estimation problems such as measurement error or omitted variable bias might also explain the observed mixed results. For example, Deininger and Jin (2006)

[19] For each plot cultivated by the household, household members were asked whether anyone in the household had a right to transfer the plot to other family members. However, from the questionnaire, it is not clear whether the transfer right variable indicates the right to sell, mortgage or other transfer rights.

did not control for regional variations in their study that covered seven regions of the country. In addition, unlike the other studies, Deininger and Jin (2006) made no distinction between households who expected to lose land and households who expected to gain land through land redistribution when measuring tenure insecurity.

The study by Ali et al. (2011) has not specified which aspect of the transfer right they actually measured. For example, does their term 'transfer right' refer to the right to sell or mortgage, the right to rent out, or give it as a gift, or any combination of these? In addition, the question was asked in respect of all plots that a farmer cultivated including plots that were sharecropped or rented from other households. Therefore, it is not clear from the outset why one could reasonably expect a farmer who sharecropped someone else's land to have a right to transfer the plot. Such ambiguity can lead to serious measurement errors and misleading results.

Furthermore, in some of the studies, temporal ordering was violated when measuring tenure insecurity and investment variables. For example, in the studies by Mekonnen (2009) and Ali et al. (2011) the investment variables indicated investments that took place just before each survey was conducted. In contrast, the tenure insecurity variables indicated perceptions of expropriation of land in the five-year period after the surveys were conducted (future perceptions). In such cases, it is difficult to assert that the results indicate causality rather than a mere statistical correlation.

Overall, the available evidence on the relationship between land tenure insecurity and investment is far from conclusive in Ethiopia and elsewhere in Africa. Therefore, further empirical investigation is needed in order to understand better the potential link between tenure security, or the lack thereof, and land-related investment

decisions in rural areas. Against this background, this study tries to examine the relationship between insecurity of tenure and farmers' investment decisions in rural Ethiopia. In doing so, I tried to overcome some of the observed shortcomings mentioned in the existing literature.

3.3. Theoretical Model

According to the discussion in the previous section, security assurance, collateralisation, and benefit from trade are the three main channels through which secure property rights are expected to influence investment positively. However, it is difficult to separate the impact of these channels in empirical analysis. In the context of Ethiopia, it is mainly the assurance aspect of tenure security that is important because farmers are not allowed to sell or use their land as collateral in credit markets even if they have land titling. This makes it possible to test the 'assurance effect' in isolation from the other effects.

The theoretical framework used for this study is based on a simple model developed by Besley (1995) to explain how land rights could enhance investment incentives. Following Besley (1995), consider a farm household deciding at each period t how much capital, denoted by k_t, to invest in land. The returns function for time $t+1$ is given by V (k_t, R_{t+1}), and depends on property rights at period $t+1$ denoted by R_{t+1}. It is assumed that the return function, V (k_t, R_{t+1}) is increasing in both arguments and concave in k_t. The cost of the investment is denoted by C (k_t, R_{t+1}), which is

assumed to be increasing in k_t and non-increasing in R_{t+1}.[20] The optimal investment choice thus satisfies:

$$\underset{K_t}{Max} \ \{ W(k_t, R_{t+1}) \} \equiv V(k_t, R_{t+1}) - C(k_t, R_{t+1}) \qquad [1]$$

where $W(k_t, R_{t+1})$ indicates net returns. From equation 1 we obtain:

$$\frac{\partial k_t}{\partial R_{t+1}} = -\frac{W_{12}(k_t, R_{t+1})}{W_{11}(k_t, R_{t+1})} \qquad [2]$$

Because $W_{11} < 0$ at a maximum, equation [2] implies that investment increases as rights are improved, provided that $W_{12} > 0$. Based on the security argument, let us assume that in the period $t+1$ there is a finite probability that a household will have its land expropriated and that this probability is a decreasing function of the rights that the household enjoys. The probability of expropriation function is given by

$\tau(R_{t+1})\,(\in[0,1])$, where $\frac{\partial \tau}{\partial R_{t+1}} < 0$.

The expected return on investment is $V(k_t, R_{t+1}) = [1 - \tau(R_{t+1})]F(k_t)$, where the physical return on the investment is $F(k_t)$, and it is assumed that the farmer keeps none of the return after an expropriation. By differentiating the returns function with respect to capital first and then with respect to property rights, we obtain.

$$V_{12} = -\tau'(R_{t+1})\, F'(k_t) > 0 \qquad [3]$$

[20] The return on investment increases with more tenure security. The return on investment also increases with the amount of capital used for the investment; however, with a decreasing rate. And investment cost increases as farmers use more capital to invest, but it does not necessarily increase as the degree of tenure insecurity increases (investment costs are independent of tenure security).

Further, under the assumption that costs are independent of R_{t+1}, the result implies that, $W_{12} > 0$. The approach models insecurity in property rights in a very similar way to a random tax on land and it is suggested that this view is most relevant "for situations in which the rule of law has broken down and individuals are able to appropriate others' assets or else that the state seizes individuals' property after a revolution" (Besley, 1995, p.908). This assumption is a bit extreme, but it serves as a simple benchmark to represent how governments' land expropriation policy affects investment incentives.

In the context of Ethiopia, the discussion in section 2.4 (Chapter 2) indicates that land appropriation by individuals was not a serious problem but the government has ultimate power to expropriate land from farmers whenever it is necessary to do so. However, some writers argued that government expropriation of land should not necessarily be associated with tenure insecurity as long as there is an institutional setting that guarantees fair compensation (Sjaastad & Bromley, 2000). In the context of Ethiopia, however, redistributions to date have generally taken place without fair compensation (Ambaye, 2013; Holden & Yohannes, 2002; Rahmato, 2009). In particular, as land belongs to the state, farmers had not been compensated for the lands they lost during land redistribution and in events when farmers were displaced from their land, often they receive land which of poor quality (Rahmato, 2009).

In addition, if we assume land rights are exogenously given the return function can be written as V (k_t, R_t), in which case the decision to invest during one period does not affect future land rights. The optimal investment choice thus satisfies:

$$\underset{K_t}{Max} \ \{ \ W(k_t, R_t) = V(k_t, R_t) \ \} \equiv V(k_t, R_t) - C(k_t, R_t) \qquad [4]$$

In this model, we can assume that land rights are exogenously determined. This means we do not expect reverse causality in estimating the relationship between tenure insecurity and investment decisions. Therefore, tenure insecurity is expected to have a negative impact on land-related investment decisions. In the context of Ethiopia, this is a plausible assumption because land-related investments such as tree planting do not prevent the government from practising land redistributions or expropriations. Some previous evidence suggests that land loss due to redistribution could happen even though households planted trees on their land, and in some cases without fair compensation (Ambaye, 2013; Holden & Yohannes, 2002; Rahmato, 2009). As a result, farmers might not expect that they can change their tenure status by growing trees.

3.4. Measurement Issues and Descriptive Statistics

In this section, I first discuss the variables used to indicate tenure insecurity and the type of investments considered in the analysis. Then, I provide descriptive evidence on the factors that affect farmers' land-related investment decisions in rural Ethiopia.

3.4.1. Indicators of Insecurity of Tenure

Although there is no significant variation in *de jure* land rights in Ethiopia, there have been a number of government-sponsored land redistribution experiences in the past with significant regional variations (see Table 2.2 in Chapter 2). As a result, the perception of land security can vary among households, mainly due to past land redistribution experiences and expectations about potential land redistributions in the future. For this reason, in this study, insecurity of tenure is defined in terms of the

households' perceptions of the probability of losing land in the future due to potential land redistribution. In addition, issues relating to insecurity of tenure such as perceived transfer rights and past redistribution experiences were also included in the analysis in order to compare results from other studies that have used these variables as tenure security indicators (for example Ali et al., 2011; Deininger & Jin, 2006).

Thus, three variables are used to measure security of tenure in this study. The first is whether a household expected, within the next five years, a reduction in land size due to government sponsored land redistribution. The second variable indicates whether or not a household actually lost land as a result of government sponsored land redistribution in the past; that is, before 1999. The third variable indicates whether a household has transfer rights on its plots. In the dataset, information on the perceived risk of expropriation and past land redistribution experiences were collected at household level, while transfer rights were measured at plot level.

Table 2.2 (in Chapter 2) shows that 33.5% of the sample households reported that they had lost land due to land reforms before 1994, and this mainly reflects the land reforms that took place in 1975. Reported land losses because of land reform were only 9.8% during the period 1983-1994; however, there were significant regional variations. During the same period, land losses as a result of redistribution were reported by 21% and 17% of the sample households in Tigray and Amhara regional states, respectively, while the figure was only 1.1% in SNNP and 6.3% in the Oromia regional states. Similarly, in 1994-1999, 22.7% of the sample households in the Amhara regional state reported land losses because of land redistribution, while the figure was less than 3% in other regional states. These results are consistent with

the fact that there were major land redistributions between the period 1983 and 1999, mainly in the Tigray and Amhara regional states.

Information on future land redistribution expectations, which is the main variable of interest in this study, was collected only in the 1999 and 2004 survey rounds. In the 1999 survey round, 20% of the sample households reported that they expected land redistributions (both gain and loss) in the next five years (during 1999-2004); 11.5% of the sample households expected land loss because of redistributions. It is clear from Table 2.2 that the farmers' fear of losing land because of land redistribution declined significantly over time. This might be related to the fact that the actual experience of losing land because of land reform had significantly declined in most regions. However, this might not be the case in all regions. For instance, since 1997, land redistribution has been banned in the Tigray regional state and the actual redistribution experience was zero after 1997. However, the number of households who reported fear of losing land as a result of land redistribution decreased only by 16% between 1999 and 2009, while in the same period the figure decreased by 56% in the Amhara region, where there were some redistribution experiences after 1997.

Table 3.1 provides information on the mode of plot acquisition and plot level transfer rights in the 2004 and 2009 survey rounds[21]. During both periods, large numbers of plots were either Peasant Association (PA) allocated or inherited. For instance, in the 2009 survey round, 61%, and 27% of the plots were acquired via PA allocation and inheritance, respectively. During the same time 89.5% of PA allocated plots and 83.6% of inherited plots were reported had transfer rights, while the figures were

[21] Although information on plot level transfer rights was collected during the 1999 survey round the plot level data has too many missing observations. For this reason I cannot use it in this analysis.

only 74.5% and 57.1%, respectively in 2004. In addition, average duration of ownership by a single owner for plots acquired via PA allocation, inheritance and purchase was more than 20 years. However, the average duration and the percentage of plots with transfer rights were systematically lower for plots that were leased from other households. The percentage of plots with transfer rights was only 4.9% for leased-in plots (using chase rental) and 7.8% for sharecropped-in plots in 2004, while the figure was only 2.7% and 1.2% in 2009.

From Table 3.1 it is clear that there is a significant change in the perception of transfer rights between 2004 and 2009 even for PA-allocated plots. Ali et al. (2011) also reported similar large changes in plot level transfer rights. However, it is puzzling why this is the case because there were no major policy changes concerning transfer rights in Ethiopia since 1995 (these rights include sell, mortgage and lease rights). Measurement error could be one potential explanation. The transfer right variable measures the extent to which a head of a household perceives that a plot can be transferred to someone else (Ali et al., 2011). For example, in the 2004 and 2009 survey rounds, the question was: “Does anyone in the household have the right to transfer this land to someone else?” However, it is not clear from the questionnaire which aspects of the transfer right were measured in each round. For example, was reference being made to the right to sell or mortgage, the right to rent out or to give it as a gift to someone else, or any combination of these?

In addition, the question was posed in respect of all the plots that a farmer had cultivated, including plots that were sharecropped or rented-in from other households. In such cases, it is not clear whether the researcher was expecting the farmer to answer the question on behalf of the owner of the plot, who was renting it to the

farmer. This is an important issue because it is possible that the respondent might not have understood the question properly and therefore gave misleading information regarding the transfer right on rented-in plots.

For instance, in the 1999 survey round, households were asked whether or not they could transfer plots they had cultivated to other family members.[22] Those respondents who reported "yes" were then asked who in the household has the right to transfer the plots.[23] Among households who reported that they had transfer rights for plots which they had leased from others, 44% responded that the original land owner had the right to transfer the plots. This is clearly inconsistent with the following question posed to them: "Does anyone in the household have the right to give away this land to other family members?" This indicates either that they were answering the question on behalf of the landlord or they did not understand the question properly. This implies that based on the way the question posed by the interviewer we can get different results across periods.

[22] The question on plot-level transfer rights in both the 1997 and 1999 survey rounds was as follows: "Does anyone in the household have the right to give away this land to other family members?"
[23] In the 1999 survey round there was a follow-up question asking households: "Who in the household has a right to transfer each plot cultivated". However, this question was removed in the 2004 and 2009 survey rounds.

Table 3.1: Mode of plot acquisitions and plot transfer rights(2004 and 2009)

	2004			2009		
Mode of plot acquisitions	Plots with transfer right (%)	Average holding period (years)	Total plots	Plots with transfer right (%)	Average holding period (years)	Total plots
From PAs	74.5	17.8	3 604	89.5	23	4 002
Purchased	52	24	173	73.1	26	167
Inherited	57.1	25.1	1 710	83.6	23.8	1 776
Mortgaged[a]	35.7	4.5	14	66.7	13	3
Cash rental	4.9	4.2	143	2.7	4.1	148
Sharecropped-in	7.8	5.1	397	1.2	5.5	435
Borrowed free	33.3	22.1	36	0.0	7.4	12
Others	30.8	17.2	13	0.0	*	1

Source: Own calculations using data from ERHS, 2004 and 2009.

Note: [a] Mortgaged refers to informal form of mortgage between farmers. * indicates information is not available. Farmers asked the following question for each plot they cultivate: Does anyone in the house have the right to transfer the plot?

In this study, I attempted to determine whether a given household reported different transfer rights for the various plots that they had cultivated in a given survey round. Table 3.2 shows that 84.1% of the households in 2004 and 78.9% in 2009 reported no variations in transfer rights for the different plots they had cultivated. In the same period, 14% of the households in 2004 and 19.3% in 2009 were reported within household variations in transfer rights because those households had at least one plot they had leased (including sharecropping) from others. This finding suggests that the source of within-household variations in transfer rights is mainly because of the existence of rented-in plots in a household. Often households did not have the right to transfer such plots (rented plots). For this reason, this study uses a variable that indicates transfer rights at household level, while excluding plots that were leased in from others. For those reported variations in transfer rights that not related to the

presence of leased plots in a household(which were <2%), a household is considered to have a transfer right if the respondent in that household had reported that at least one of the household plots can be transferred[24].

Table 3.2: Transfer rights and within household variations in plot transfer rights(2004 and 2009)

Plot transfer rights	2004	2009
Percentage of households that reported		
No within household variations in plot transfer rights	84.1	78.9
Within household variation in plot transfer rights due to the presence of leased-in plots	14.0	19.3
Within household variations in plot transfer rights for reasons not related with leased-in plots	1.9	1.8
Household level transfer rights excluding leased-in plots		
Households with transfer rights at least for one plot (%)	**71.7**	**88.1**
Total sample households	**1360**	**1355**

Source: Own calculations using data from ERHS.

The variable indicating household level plot transfer rights indicates that 71.7% of the households in 2004 and 88.1% of them in 2009 reported that they had transfer rights. Significant change in the perception of transfer rights between 2004 and 2009 remained high. After excluding plots that were leased-in, we expect this reported variation across the two periods indicates the real change in the perception of plot transfer rights. However, as the discussion above indicates the 'transfer right' variable in the questionnaire is not specific therefore it can indicate the right to sell or mortgage, the right to rent out, or give it as a gift, or any combination of these. Thus, care is required while interpreting the coefficients on the transfer right variable.

[24] After excluding the leased plots the observed variations in most cases are most likely due to coding error.

Table A.11 in the Appendix shows that the proportion of households that had a change in their tenure status between 2004 and 2009 is small in the sample. Among the sample households, 10.31% had a change in tenure status regarding their perception of losing land due to land redistribution, while the figure is 6.45 % for tenure status measured using transfer rights. Looking at household characteristics, among households who reported change in transfer rights (reported had transfer rights in 2004 but not in 2009) a large proportion are female headed, had on average smaller livestock holdings, experienced more land redistributions in 2004, and a large proportion of them are located in Oromia and SNNP regional states. Such limited intrahousehold variation over time means panel data methods, which rely on changes in households' perception of tenure security, and other household characteristics over time can be statistically demanding. For this reason, regression analyses of cross-sectional and pooled data are used as a robustness check.

3.4.2. Investment Decisions

Soil degradation is one of the most serious environmental problems in Ethiopia and it adversely affects agricultural production and food security (Hurni, 1993; Shiferaw & Holden, 1998). Despite the seriousness of the problem, the extent of adaptation of soil conservation practices remains low in the country (Gebremedhin, 2004). Tree planting and soil conservation practices (mainly stone bund) are considered long-term land-related investments in rural Ethiopia. For this reason, participation in soil conservation and tree planting activities has been the subject of many studies that looked at the potential link between tenure insecurity and land-related investment decisions in rural Ethiopia. Following the literature, I used tree planting and soil conservation practices to indicate long-term land-related investment decisions.

Table 3.3 shows that 44.6% and 56.6% of the sample households reported that they had practised some kind of soil conservation on their land in 2004 and 2009, respectively. However, there are significant regional variations during both years. For instance, the data for 2004 show that participation in soil conservation practice was very high in Tigray (89.2%), while the figure was only 12% in SNNP.[25] Moreover, long-term investment in soil conservation (stone bund) was the dominant type of soil conservation practice in Tigray (70.3%), while a relatively large number of households invested in short-term soil conservation practices (soil bund) in Oromia regional state (36.6%).

The result is consistent with the fact that soil erosion is a relatively serious problem in the highlands of Ethiopia. For this reason, since 1991, soil conservation practices have been encouraged by the government and NGOs through mandatory community labour, food-for-work projects and provision of extension services in these areas (Gebremedhin & Swinton, 2003; Hagos & Holden, 2006). The results are also in line with what was found in village studies. According to these studies, in *Harresaw* (in Tigray), both government extension agents and local NGOs were heavily involved in facilitating afforestation works and soil and water conservation practices. For instance, after 1991 more than 26,625 eucalyptus seedlings and about 11,000 other tree seedlings were grown in the area through food-for-work projects (Bevan & Pankhurst, 1996; p. 28).

Turning to the subject of tree planting, 70% of the sample households had planted some tree crops (permanent crops) on their land during the period 1999–2009.

[25] Because very similar regional patterns were observed during the 2004 and 2009 survey rounds, I presented only the information from the 2004 survey round.

However, a significant regional variation in the tree planting practice becomes apparent from examining the types of trees planted. The results from the 2004 survey round show that planting of fruit trees and cash crops (for example chat and coffee) was dominant in the regional states of SNNP (88%), followed by Oromia (43%), while the figure was only 2.7% in Tigray and 10.7% in Amhara. Eucalyptus trees were the dominant tree type planted in the sample area. In the 2009 survey round, 50% of the households reported that they had planted Eucalyptus trees on their plots (without time reference), while 26% planted Eucalyptus trees over the past five years (during 2004–2009).

Table 3.3: Percentage of households that practiced land-related investments(2004 and 2009)

Investment type	**Year**		**Region (in 2004)**			
	2004	2009	Tigray	Amhara	Oromia	SNNPR
Grew any tree crops	73.0	74.0	72.5	59.8	66.4	92
Grew fruits or cash crops	42.6	43.9	2.7	10.7	43.3	88.3
Grew Eucalyptus	43.8	52	40.9	43.7	36.4	50.2
Grew Eucalyptus (5 yrs)*	21.3	26.1	27.5	15.1	14.9	29.8
Practice soil conservation	44.6	56.6	89.2	56.8	50.4	12
Stone bund (terracing)	24.9	32.7	70.3	50.2	3.1	2.4
Soil bund	14.9	18.1	18.9	4.9	36.6	4.9
Total sample	**1,358**	**1,358**	**150**	**466**	**396**	**440**

Source: Own calculations using data from ERHS.
Note: Cash crops include coffee and "chat" (a stimulant crop).
** indicates investment within the past five year during each survey round.

3.4.3. Descriptive Evidence on Reasons for Land-related Investment Decisions

In the 1999 survey round, farmers were asked to provide information on the main factors that had affected their investment decisions in tree planting and soil

conservation practices.[26] Of those households that reported that they did not grow any type of tree crops, 41.6% reported that land shortage was the main constraint; however, there were significant regional variations (Table 3.4). The figure was significantly higher in Tigray (75%) and SNNP (68%) regional states, while it was lower in the Oromia region (19%). The result is consistent with the fact that per capita land size is relatively smaller in the Tigray and SNNP regional states (see Table 2.5 in chapter 2).

Other factors, such as water shortage, labour shortage, and lack of funds were reported by 17.8%, 13.2%, and 10.4% of the respondents, respectively. A lack of security of tenure was reported as a major constraint by only 1.2% of the respondents with the figure being higher in Tigray (3.6%) and Amhara (1.9%). This result is expected as Tigray and Amhara are the regions where land redistributions were widespread during the current regime. Likewise, in the case of households that did not practised any soil conservation on their plots, a large number reported absence of erosion as a major reason (75.9%), followed by labour shortage (16.2%). None of the households in the sample areas reported lack of security of tenure as a reason for not practising soil conservation on their land.[27] These results may suggest that farmers' tree planting and soil conservation decisions in rural Ethiopia are mainly determined by the cost and availability of resources, not by the incentive structure of the land tenure system.

[26] The same information was collected in the 2004 and 2009 survey rounds, but it is available only for soil conservation practices. However, the reasons provided for not participating in soil conservation practices were more or less the same in all three survey rounds: 1999, 2004 and 2009.

[27] None of the households reported tenure insecurity as a reason, also in the 2004 and 2009 survey rounds.

Table 3.4: Major investment binding constraints by region(1999)

Reasons	**Regions**				
	Tigray	Amhara	Oromia	SNNPR	Total
Reasons for not growing trees (% hhs)					
Land shortage	75	47.6	19.1	68.1	41.6
Shortage of labour	3.6	16.5	10.5	12.8	13.2
Lack of fund	7.1	9.7	12.5	8.5	10.4
Shortage of water	0.0	1.0	49.3	0.0	17.8
Less profitable	0.0	2.4	3.3	8.5	3.2
Tenure insecurity	**3.6**	**1.9**	**0.0**	**0.0**	**1.2**
Other reasons	10.7	20.9	5.3	2.1	12.7
Reasons for not practising soil conservation (% hhs)					
No erosion	68.2	63.6	74.2	86.6	75.9
Labour shortage	31.8	27.1	16.3	7.1	16.2
Other reasons*	0.0	9.3	9.5	6.3	7.9

Source: Own calculations using data from the 1999 ERHS round. Note: * indicates none of the households reported tenure insecurity as a reason.

In addition, during the 1999 survey round, farmers were asked to provide information on the main reasons why they were growing tree crops on their land (Table 3.5). About 50.5% of the sample households who planted trees reported that they did this to provide a source of income, while 23.9% reported that they did this as a source of food. None of the sample households reported that they had planted tree crops in order to improve their tenure security status. The result is consistent with the assumption I made in the theoretical model (section 3.3) that tree planting does not prevent the government from practising land redistributions. As a result, farmers might not expect that they could change their tenure status by growing trees.

Table 3.5: Major reasons for growing tree crops (1999)

Reason for growing tree crops	Region (%)				
	Tigray	Amhara	Oromia	SNNPR	**Total**
Source of Income	54.5	75.8	50.1	43.9	**50.5**
Consumed as food	21.7	4.6	28.9	27.4	**23.9**
For own use	19.57	7.12	11.16	9.33	**10.16**
Income security	1.06	0.85	3.28	11.09	**7.35**
Other reasons*	3.18	11.69	6.57	8.35	**8.08**

Source: Own calculations using data from the 1999 ERHS round.
Note: Of the total of 1452 sample households, 990 had planted some type of trees on their land. * indicates mainly for construction material and firewood.

Further, Table 3.6 indicates that participation in soil conservation and tree planting exercises were higher for those households who were richer in resources than in resource-poor households. For example, compared to those who did not grew trees households which participated in tree planting had relatively higher proportion of households with access to extension services (46.9% vs 31.5%), educated and male headed households, and had more livestock holdings. Similarly, compared to those who did not invest in soil conservations household who practiced soil conservations on average hade higher proportion of households with access to extension services, own a pair of oxen, and had more livestock holdings.

Table 3.6: Household characteristics by investment decisions (pooled data 2004 and 2009)

	Grow Eucalyptus tree			Practice soil conservation		
	Yes	No	t- test	Yes	No	t-test
Lost land during 1983-99[a] (yes=1)	15.1	18.9	*	34.1	11.1	***
Expected smaller land during 1999-2009[b](yes=1)	15.0	17.0		17.3	16.0	
Extension service(yes=1)	46.9	31.5	***	41.4	33.8	***
Labour sharing(yes=1)	44.2	40.5		43.5	40.7	
Male labour (num)	1.6	1.4	***	1.4	1.5	
Female labour (num)	1.7	1.5	***	1.5	1.6	
Head sex(=1 female)	23.9	33.3	***	31.8	29.9	
Head age(years)	51.9	51.8		53.0	51.4	*
Head can educated(yes=1)	51.4	38.2	***	41.0	42.4	
Primary education(yes=1)	37.6	41.2		39.7	40.3	*
Secondary and above education(yes=1)	48.0	29.1		31.4	35.9	
Have a pair of oxen(yes=1)	36.4	33.5		49.5	28.2	***
Plot size(hectares)	1.7	1.6		1.6	1.6	
Livestock holdings(real value)	1881	1301	***	1996	1253	***
observations	**704**	**1751**		**713**	**1736**	

Source: Own Calculations using data from ERHS.
Notes: 'a' indicates lost land due to land redistributions; 'b' indicates expected smaller land size due to land redistributions in either between 1999 and 2004 or between 2004 and 2009. The education variable indicates the maximum level of education in the household. Male and female labour refers to the number of working age family members.

Regarding land redistribution experiences, of those households that participated in soil conservation practice, 34.1% had lost land because of previous land redistributions (during the period 1983-1999). This was significantly higher than the corresponding figure of 11.1% for the non-participant households. The result is consistent with the fact that those areas affected by land redistribution in the past (i.e. Tigray and Amhara regional states) are also areas where there were large government interventions such as public work programmes to encourage farmers to practice soil conservation practices due to serious soil degradation in this regions. However, there

was no significant difference in the perceptions of tenure insecurity (expected smaller land during 1999–2009) of participants and non-participants. These results together with the observed regional patterns of change in tenure security indicators (Table 2.2) may imply that time-varying unobserved regional factors affect both farmers perception of tenure security and investment decisions.

Overall, the descriptive evidence suggests that lack of security of tenure appears to be unimportant in farmers' investment decisions in rural Ethiopia. Instead, factors, such as topography (erosion), lack of resources (land and labour), and lack of funds were reported as major constraints for not participating in land-related investments in rural areas. However, the descriptive analysis cannot control for factors that affect both farmers perception of tenure insecurity and decisions to participate in land-related investments. Therefore, the next section provides a further econometric analysis examining whether or not a lack of tenure security is a significant factor in explaining the variations in land-related investment decisions in rural Ethiopia.

3.5. Estimation Strategies

The empirical analysis in this section is based on the conceptual model developed in section 3.3. One assumption made in that model was that land-related investment does not affect tenure security status of farmers in rural Ethiopia, which means I assume that there is no reverse causality. The descriptive statistics in the previous section also suggest that long-term investment in either tree planting or soil conservation practices were not expected to affect the tenure security status of a farmer as none of the farmers reported that they were planting trees for improving their tenure security status. Therefore, tenure insecurity is expected to have unambiguous negative impact

on land-related investment decisions, while improvement in transfer rights is expected to have a positive impact on such investment decisions.

The validity of the identification strategy depends on the fact that the tenure insecurity variables were measured in the 1999 and 2004 survey rounds; here, the main tenure insecurity variable is the one that indicates whether a household had expected to lose land due to redistribution during 1999–2004 and 2004–2009. [28] Investment variables reflect investment decisions made after 1999, at least, for tree-growing[29]. In effect, a household's decision to invest in the periods 1999–2004 and 2004–2009 would have taken into consideration the household's expected tenure security status as reported in 1999 and in 2004, respectively.

However, in measuring transfer rights, the data collected in the 1999 survey round could not be relied on as the plot level data have too much missing information. As a result, the transfer right variables in 2004 and 2009 indicate transfer rights with reference to about one year before each survey was conducted, while the investment decisions could be made at any time between 1999 and 2004 or 2004 and 2009. The data on past redistribution refer to experiences only before 1999 because the figures are too small after that year (1.7% and 1.3% during 1999–2004 and 2004–2009, respectively).

All the dependent variables measured whether or not a farmer invested in a particular investment activity. Therefore, in line with the literature, the decision to invest in a

[28] In the 1999 survey round, households were asked whether or not they had expected land redistributions in the next five years, that is, between 1999 and 2004. A similar question was asked in the 2004 survey round, but not in the 2009 survey round.

[29] The information on soil conservation practices did not have any time frame. It could be possible to identify whether the household had been practising soil conservation before 2004 by referring to data from the 1999 Survey round. However, the plot level data in 1999 are not reliable as there is a large amount of missing information.

particular type of investment was modelled as a binary choice model. Incorporating unobserved time-invariant heterogeneity in the model the underlying latent variable can be defined as:

$$I_{it} = 1[\alpha_{iI} + \beta S_{it} + X_{it}\phi_I + \varepsilon_{it1} \geq 0] \qquad [5]$$

$$\varepsilon_{it1} \mid X_i \sim Normal(0,1)$$

In [5], I_{it} is a dummy variable equal to one if household i has undertaken land-related investments at time t (in 1999–2004 and 2004–2009), S_{it} indicates the expected tenure security status at time t which is reported at the beginning of time t (in 1999 and 2004, except for the transfer right variable), X_{it} indicates other socio-economic household characteristics that are expected to affect land-related investment decisions at time t, β and ϕ (ignoring the subscript I) are parameters to be estimated, ε_{it} is a random error term, and α_i (ignoring the subscript I) indicates time-invariant unobserved household heterogeneity. Unobserved household heterogeneity such as farming ability, farmer's attitude towards risk, and time preferences may also affect farmer's decisions in land-related investments.

The standard panel data approach to estimating equation (5) is to use either fixed-effects or random effects estimation techniques. In the case of fixed effects approach no assumptions are made about the unobserved time-invariant household heterogeneity; therefore α_i is treated as a nuisance parameter. The fixed effects approach allows the unobserved time-invariant factors (for example farming ability) captured by α_i to be correlated with observed regressors in the model and provides

consistent estimates of the coefficients of time-varying regressors (for example the tenure insecurity variable) in the model. However, the coefficients for time-invariant variables are not identified if fixed effects model is used. In addition, Greene (2002) showed that with very small T, the fixed effects estimator shows a large finite sample bias. This is a relevant issue as I have used a short panel data set.

The use of a standard random effects technique is also problematic due to the strong assumption that the unobserved factors are uncorrelated with all explanatory variables in the model. In the case of this study, the assumption that unobserved variables such as farming ability and attitude towards risk may be correlated with some of the explanatory variables included in the model. In particular, unabsorbed factors like attitude towards risk could be correlated with the tenure security measure variables. For instance, perception of tenure insecurity could be more prevalent among more risk-averse households. Failing to control for such unobserved factors (or factors which are not easy to measure) could bias our estimates.

The alternative approach to the standard random effects probit model was proposed by Mundlak (1978) and Chamberlain (1984). According to this approach the unobserved household heterogeneity α_i can be assumed to be correlated with the exogenous variables X_{it} for all t in a linear way. This method specifies that the unobserved factors (for example farming ability or attitude towards risk) captured by α_i is partially dependent on a function of the other exogenous covariates in the model. Thus, α_i in (5) can be modelled as:

$$\alpha_i = \tau + \bar{X}_i\theta + a_i \qquad [6]$$

$$a_i \mid X_i \sim Normal(0, \sigma_a^2)$$

Where $\overline{X}_i$ are time averages of strictly exogenous covariates in the model (5), a_i is a new unobserved individual effect, which is simply assumed as identically and independently distributed with mean zero and constant variance. After substituting equation (6) into equation (5), both the parameters of the model and average partial effects can be identified.

Additionally, the approach allows estimating dynamic models (Wooldridge, 2009).[30] In this case, the model can be extended to estimate whether past investment decisions have feedback effects into future investment decisions. This can be done by including a variable indicating past investment decisions in equation (5). For such reasons, I used both the static and dynamic correlated random effects probit models (CRE) to estimate equation (5). Data on the main variable of interest, perception of expected land loss due to land redistribution were not collected in the 1994 and 2009 ERHS survey rounds. Thus, the static CRE probit model is estimated based on data from the last two rounds of the survey (2004 and 2009). However, the dynamic CRE probit model used data from 1999, 2004, and 2009 survey rounds. Thus, the model includes variables indicating households' perceived transfer rights and land loss experiences in the past as an indicator of tenure security.

[30] According to Wooldridge (2009,p.5) although the CRE approaches put restrictions on the conditional distribution of heterogeneity given the entire history of the covariates which is a drawback relative to fixed effects (FE) or conditional maximum likelihood estimation (CMLE) approaches. CRE requires few other assumptions for estimating average partial effects, and the restrictions needed on the conditional heterogeneity distribution can be weak.

Besides, the tenure insecurity variable, household characteristics such as the gender of the head of the household, education, and household asset measures such as livestock holdings and plot size, availability of working age male and female family members were included in the model. Further, social networks and access to extension services were found to be important factors in farmers' decisions in land-related investments (Conley & Udry, 2010; Krishnan & Patnam, 2014). Access to extension services can provide farmers with more information on the benefits of land-improvements and improves their access to inputs such as fertiliser or seeds.

Similarly, participation in local labour-sharing arrangements is expected to solve labour shortage problems in rural areas. To account for such institutional factors, I included a variable indicating whether a household had participated in local labour sharing arrangements and whether a household had access to extension services. Furthermore, village (woreda) dummies were also included in the estimation model to control for the differences in agro-ecological conditions, cropping practices, population pressure, access to markers, and prices.

Endogeneity Issues

One potential econometric problem that arises when estimating equation (5) is that the tenure insecurity variable can be endogenous in the investment equation. Although I assumed that there is no reverse causality, measurement error and time varying omitted variables (e.g village specific policy changes) can bias the estimate. One possible approach to deal with this endogeneity is to find instruments that are correlated with the endogenous variable but not with the error term in equation (5). Then estimate equation (5) using the linear probability model (Angrist, 2001).

However, the choice of the appropriate instruments is difficult to get in the data. Furthermore, some studies show that the conventional linear IV method can lead to bias in the estimation of a binary endogenous variable on a binary response variable (Bhattacharya, Goldman & McCaffrey, 2006; Terza, Bradford & Dismuke, 2008). With the presence of both heterogeneity and binary endogenous variables in non-linear panel data, Wooldridge (2010) suggests the use of a pooled bivariate probit model with correlated random effects. This allows us to specify a reduced form equation for the perception of tenure security status as follows:

$$S_{it} = 1[\alpha_{is} + X_{it}\phi_s + \varepsilon_{its} \geq 0] \qquad [7]$$

$$\varepsilon_{its} \mid X_i \sim Normal(0,1)$$

The time-constant unobserved factor in equation (7), α_{si}, is modelled the same way as equation (6). Then, we can write the resulting models as:

$$I_{it} = 1[\psi_{aI} + \beta_{aI}S_{it} + X_{it}\phi_{aI} + \overline{X}_{it}\gamma_{aI} + \upsilon_{it1} \geq 0] \qquad [8]$$

$$S_{it} = 1[\psi_{as} + X_{it}\phi_{as} + \overline{X}_{i}\gamma_{as} + \upsilon_{it2} \geq 0] \qquad [9]$$

In each equation $\upsilon_{it} = (a_i + \varepsilon_{it})/(1+\delta_a^2)^{1/2}$ has a standard normal distribution conditional on X_i. The subscript "a" in the parameters indicates division by $(1+\delta_a^2)^{1/2}$. In this way, we can estimate the scaled coefficients, and we can identify both the parameters of the model and average partial effects (Wooldridge, 2010). In this case, the error terms in equations 8 and 9 are assumed identically distributed as bivariate normal with zero mean, unit variance, and correlation coefficient (ρ_{jm}). According to Wooldridge (2013), in using this approach we are averaging out both time-invariant and time-variant unobservables.

In addition to tenure security measures, some of the variables such as access to extension services and participation in labour-sharing arrangements may also are endogenous in the investment model. For instance, access to extension services may not be random as extension officers may select farmers with better land management practices or large landholdings. Similarly, unobserved factors that increase the likelihood of land-related investments can also increase households' likelihood of participation in local labour-sharing arrangements. Thus, a reduced from equations is specified for labour sharing participation and access to extension as follows:

$$E_{it} = 1[\psi_{ae} + X_{it}\phi_{ae} + \bar{X}_i\gamma_{ae} + \upsilon_{it3} \geq 0] \quad [10]$$

$$L_{it} = 1[\psi_{aL} + X_{it}\phi_{aL} + \bar{X}_i\gamma_{aL} + \upsilon_{it4} \geq 0] \quad [11]$$

$$Cov[\upsilon_{itj}, \upsilon_{itm} \mid X_{it}] = \rho_{jm}$$

Where E_{it} and L_{it} represent access to extension services and participation in labour sharing arrangements respectively. A recursive multivariate probit model is used to simultaneously estimate equations indicating decisions to participate in land-related investments, access to extension services, participation in local labour sharing arrangements, and households' perception of tenure insecurity while controlling for potential unobserved heterogeneity affecting these equations. Following the method of Cappellari and Jenkins (2006), model parameters were estimated using the simulation maximum likelihood (SML) estimation procedure.[31] When ρ_{jm} is zero it means that the univariate probit models will generate consistent estimates. Pooled data from 2004 and 2009 EHRS years were used in this estimation.

[31] More on the estimation procedure is also presented in Chapter 4.

3.6. Results and Discussions

This section, presents estimation results from the CRE probit model, the pooled bivariate probit model, and the recursive multivariate probit model regarding farmers' participation decisions in land related investments. In addition to these models, estimation results from cross-sectional probit models and the standard random effects probit models are also presented as a robustness check.

In all estimation result tables (except for the bivariate and the reclusive multivariate probit model), Model 1 presents the results of the baseline estimation model. Thus, Model 1 includes perception of expected land loss due to land redistribution as the main variable of interest in the model, and controlled for family labour, education, head characteristics (age and sex), per capita land size, and time and village dummies. Models 2, 3, and 4 include additional variables indicating farmers' tenure insecurity status, livestock holdings, access to extension services, and participation in labour sharing arrangements. Model 5 presents results from the dynamic CRE probit model, but only for the tree planting decisions due to data limitation regarding the soil conservation practices. In addition, the dynamic CRE probit model (Model 5) did not include the main variable of interest, perception of expected land loss due to land redistribution, as data on this variable were not collected in the 1994 and 2009 survey rounds.

3.6.1. Participation in Tree Planting

Table 3.7 presents estimation results from the correlated random effects (CRE) probit model. Estimation results from the static CRE probit model show that the coefficient on the perception of expected land loss due to land redistribution is negative and

significant (at 10% level) in some of the models suggesting that tenure insecurity was negatively associated with the decision to plant trees. The coefficient is significant (at 10% level) in Model 1 where other tenure insecurity variables are not included. Then, it becomes insignificant in Model 3 when I introduced the variable indicating whether a household had lost land in the past due to land redistributions. Then, it becomes significant again when another tenure insecurity indicator is included, perceived transfer rights in the model. However, it becomes insignificant when other determinants of investments such as access to extension services, livestock holdings, and participation in labour sharing arrangements are controlled for.

Similar estimation results found from the dynamic CRE probit model (Model 5 in Table 3.7), the standard random effects (SRE) probit model estimates (Table A.3 in the Appendix),and from separate cross-sectional probit estimates for each year (Table A.1 and Table A.2 in the Appendix) that tenure insecurity was not a significant factor in the tree planting estimations. However, the coefficient on perceived transfer rights variable is positive and significant (at 10% level) only in the 2009 cross-sectional probit model even after including all the other control variables in the model. This suggests that improvement in perceived transfer rights was associated with more likelihood of growing trees. However, as in the discussion in the earlier section (sub-section 3.4.1) care should be taken in interpreting the coefficient in this variable.

Table 3.7:Static and dynamic CRE probit estimates of the determinants of tree planting decisions (1999-2009)

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Expected land loss in 5 years' time	-0.21*	-0.20	-0.21*	-0.22	
	(0.12)	(0.13)	(0.11)	(0.15)	
Lost land during 1983-1999		0.04	0.04	-0.02	-0.13
		(0.12)	(0.12)	(0.14)	(0.08)
Perceived land transfer right			0.11	0.08	-0.08
			(0.10)	(0.09)	(0.07)
Male family labour	0.04	0.04	0.05	0.03	-0.01
	(0.05)	(0.06)	(0.05)	(0.05)	(0.03)
Female family labour	-0.01	-0.01	-0.01	-0.02	-0.05
	(0.05)	(0.05)	(0.05)	(0.06)	(0.04)
Adult literacy	0.00	0.01	0.03	0.00	-0.00
	(0.21)	(0.20)	(0.22)	(0.19)	(0.17)
Primary education	0.18	0.18*	0.18	0.14	0.12*
	(0.12)	(0.10)	(0.11)	(0.11)	(0.07)
Secondary education	0.29**	0.29**	0.29**	0.20	0.12
	(0.12)	(0.12)	(0.14)	(0.13)	(0.08)
Head sex	-0.34**	-0.34**	-0.32**	-0.29**	-0.22*
	(0.15)	(0.16)	(0.15)	(0.12)	(0.12)
Head age	0.01	0.01	0.01	0.01	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Per-capita land size	0.51**	0.48**	0.45	0.35	0.27
	(0.23)	(0.22)	(0.29)	(0.25)	(0.19)
Access to Extension services				0.08	0.04
				(0.10)	(0.07)
Livestock holdings (TLU)				0.02	0.03**
				(0.02)	(0.01)
Member in labour sharing arrangements				0.26***	0.22***
				(0.10)	(0.07)
Planted tree in the previous year					0.19**
					(0.09)
Planted tree in initial year (1994)					0.16**
					(0.07)
Observations	2,437	2,431	2,413	2,361	3,472
chi2	541,4	506.8	627,8	491,5	791.0
p	0.00	0.00	0.00	0.00	0.00
sigma_u	0,548	0.545	0,536	0,486	0.258
lnsig2u	-1.20***	-1.22***	-1.25***	-1,44	-2.19
	-0,31	(0.33)	-0,4	-1,48	(2.35)
Loglikelihood	-1118	-1115	-1111	-1074	-1705

Source: Own calculations using data from ERHS. Note: Regression includes woreda(village) and time dummies, head age square , land size square , time averages of the covariates ,and, a constant. I Model 1-4 used data from the 2004, and 2009 survey years. Bootstrap standard errors in parentheses (200 replications); TLU indicates Tropical Livestock Units; *** p<0.01, ** p<0.05, * p<0.1.

Estimation results from the dynamic CRE probit model (Model 5) indicate that the estimation coefficient on variables indicating previous period investment decisions are positive and significant (at 5% level) indicating that households that had invested in the past were more likely to invest in the current period. This suggests that households' current decisions to invest in land directly influence their propensity to invest in the future by altering the cost of investment and preferences. For instance, having invested in the past could allow farmers to learn about the benefits associated with land-related investments. Thus, they would be more likely to invest again. This implies that providing more information regarding the benefits of tree planting may improve farmers' participation in growing trees.

3.6.2. Participation in Soil Conservation

Regarding farmers' participation decisions in soil conservation practice, Table 3.8 presents estimation results from the CRE probit model. Moreover, Table A.4 and A.5 in the appendix provide estimation results from the cross-sectional probit models for years 2004 and 2009, respectively, while Table A.6 in the Appendix presents estimation results from the SRE probit model.

The coefficient on the variable indicating households perception of tenure insecurity, perceived expected land loss due to land redistribution is significant (at 10% level) only in the 2009 cross-sectional probit model. This result suggests that households who had expected land loss due to land redistribution were less likely to invest in soil conservation. However, the coefficient on this variable becomes insignificant in the panel data models, both in the SRE probit model (Table A.6 in the Appendix) and the CRE probit model (Table 3.8).

Table 3.8: Static CRE probit estimates of the determinants of soil conservation practices (2004 and 2009)

VARIABLES	Model 1	Model 2	Model 3	Model 4
Expected land loss in 5 years' time	-0.19	-0.19	-0.19	-0.15
	(0.15)	(0.15)	(0.14)	(0.12)
Lost land during 1983-1999		0.11	0.12	0.06
		(0.12)	(0.11)	(0.14)
Perceived land transfer right			-0.00	-0.03
			(0.12)	(0.12)
Male family labour	0.12**	0.12**	0.12**	0.10
	(0.06)	(0.06)	(0.06)	(0.06)
Female family	-0.04	-0.04	-0.04	-0.03
	(0.06)	(0.06)	(0.07)	(0.07)
Adult literacy	0.12	0.14	0.14	0.13
	(0.18)	(0.18)	(0.16)	(0.18)
Primary education	-0.09	-0.09	-0.10	-0.08
	(0.13)	(0.12)	(0.11)	(0.13)
Secondary education	0.00	0.00	-0.01	-0.02
	(0.14)	(0.14)	(0.14)	(0.16)
Head sex	-0.14	-0.14	-0.15	-0.15
	(0.16)	(0.15)	(0.17)	(0.17)
Head age	-0.01	-0.01	-0.02	-0.02
	(0.02)	(0.01)	(0.02)	(0.02)
Per capita land size	-0.12	-0.12	-0.09	-0.11
	(0.24)	(0.28)	(0.25)	(0.29)
Access to Extension services				0.16
				(0.13)
Livestock holdings (TLU)				-0.01
				(0.02)
Member in labour sharing arrangements				0.23**
				(0.10)
Observations	2,312	2,306	2,289	2,247
chi2	408.9	431.4	421.2	288.7
P	0.00	0.00	0.00	0.00
sigma_u	0.408	0.425	0.420	0.460
lnsig2u	-1.79	-1.71	-1.74	-1.55
	(2.02)	(2.01)	(1.87)	(1.53)
Rho	0.143	0.153	0.150	0.174
Loglikelihood	-816.0	-811.2	-805.9	-770.1

Source: Own calculations using data from ERHS. Note: Regression includes woreda (village) and time dummies, head age square, land size square, time averages of the covariates, and a constant. Bootstrap standard errors in parentheses (200 replications) *** p<0.01, ** p<0.05, * p<0.1.

Likewise, the estimated coefficient on the transfer rights variable is insignificant in all the estimation models. These results suggest that limited land transfer rights were not an important factor in farmers' decisions in practising soil conservation in rural Ethiopia. Given land rental markets and non-farm economic activities are poorly developed in rural Ethiopia, the limited impact of land transfer rights on land related investments is not surprising. Improvements in land transfer rights facilitate factor price equalization across households (Carter &Yao, 1999). However, Carter &Yao (1999; 2002) suggest that the impact of land transfer rights on labour intensity (or investment) depends on households' land rental regime and expected future off-farm employment growth. They suggest that in the absence of prospects for future off-farm employment growth, the effect of improved transfer rights on labour intensity is positive, negative or null, when a household is in rent-out, rent-in, or autarky regime. According to Carter and Yao (1999:p.1), land transfer rights become more important when a given economy "industrializes and its population begins to specialize in non-agricultural activities."

3.6.3. Results from bivariate and multivariate probit models

Table 3.9 provides coefficient estimates from the pooled bivariate probit model with CRE controlling for both household heterogeneity and possible endogeneity of the tenure insecurity variable in the investment equation. The estimated correlation coefficient (ρ_{jm}) between the investment equation and the tenure security equation is not statistically significant at conventional levels in all specifications (for both tree planting and soil conservation equations). This suggests that the tenure security variables are not endogenous in the investment model. Consequently, estimated marginal effects based on pooled probit and panel CRE probit model estimates are

presented in Table A.7 (for tree planting decisions), and Table A.8 (for soil conservation practices). In the case of panel CRE probit model estimates, the tables provide average partial effects along with bootstrapped standard errors (200 replicates).

Results from Table 3.9 indicate that the estimated coefficient on farmers' perception of losing land is not significant in the pooled bivariate probit model estimates for both tree growing and soil conservation practices. In contrast, results from the pooled probit model estimates suggest that households with tenure insecurity have 5% lower probability (at a 10% significant level) of planting eucalyptus trees when compared to households that had reported more tenure security (Table A.7). However, the estimated marginal effect on this variable becomes insignificant once we control for unobserved household heterogeneity in the panel CRE probit model. Likewise, the estimated marginal effect on the plot transfer rights variable is 0.02 and not significant in tree planting equation. These results suggest that, *ceteris paribus*, perceived tenure security is not a significant factor in tree growing decisions.

In the case of soil conservation practices, the marginal effect on the perceived plot transfer rights variable is not significantly related with soil conservation in the form of stone terraces, while it is significantly related with land improvements in the form of soil bunds. This result contrasts with what was found by Gebremedhin and Swinton (2003; p.80) that "tenure security favours long-term soil conservation investments such as stone terraces, whereas insecurity favours short-term investments, such as soil bunds." Thus, measurement error in the transfer rights variable could be responsible

for the significant land rights coefficients obtained for soil conservation. In addition, the information on soil conservation practices does not have a time frame.

Table 3.9:Pooled bivariate probit estimates of the determinants of land-related investment decisions

	Eucalyptus tree		Soil conservation	
	1	2	3	4
Expected land loss	0.48		0.65	
	-0.57		-0.78	
Perceived land transfer rights		-0.34		-0.22
		-0.48		-0.32
Male family labour (num)	0.00	0.00	0.13**	0.13**
	-0.05	-0.05	-0.06	-0.06
Female family labour (num)	-0.05	-0.06	0.11*	0.09
	-0.06	-0.06	-0.06	-0.06
Head can read and write	0.07	0.05	0.1	0.06
	-0.11	-0.11	-0.12	-0.12
Head sex	-0.13	-0.13*	-0.16**	-0.17**
	-0.08	-0.08	-0.08	-0.08
Land size (hectares)				
Land size (>0.5 and <=1)	0.18*	0.18*	0.20*	0.20*
	-0.11	-0.1	-0.12	-0.12
Land size (>1 and <=3)	0.21**	0.22**	0.26**	0.27**
	-0.1	-0.1	-0.12	-0.12
Land size (>3)	0.50***	0.51***	0.13	0.15
	-0.15	-0.15	-0.15	-0.15
Livestock holdings (log)	0.02**	0.02***	0.01	0.01*
	-0.01	-0.01	-0.01	-0.01
Access to extension services	0.24***	0.24***	0.26***	0.25***
	-0.07	-0.07	-0.07	-0.07
Labour sharing	0.23***	0.23***	0.16**	0.16**
	-0.07	-0.07	-0.07	-0.07
Observations	2,359	2,359	2,359	2,359
Rho	-0.37	0.24	-0.42	0.27
	-0.31	-0.27	-0.48	-0.18

Source: Own calculations using data from ERHS (2004 & 2009). Note: Regression includes, head age and age square, time averages of time-varying exogenous covariates, time and village dummies, and a constant. Cluster-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Looking at other factors, results indicate that access to extension services, participation in labour sharing arrangements, and land and livestock holdings are important determinants of land-related investment decisions. Increase in land holding size is associated with more likelihood of planting eucalyptus trees. This result suggests that farmers plant trees on their land if the opportunity cost of forgone benefits on the land used is lower than the benefits they get from planting trees. In particular, given most farmers in rural Ethiopia are subsistence farmers with very small land holdings, we expect planting of non-food trees such as eucalyptus could be easier for farmers with more land holdings compared to land-poor farmers. In the case of soil conservation, results show that the marginal effect on land size is insignificant. These results may suggest that an increase in land holding size is not necessarily associated with more soil conservations because soil conservation practices are largely driven by presence of soil erosion.

Likewise, access to extension services and participation in local labour sharing arrangements are associated with more likelihood of land related investments. As mentioned it the previous section access to extension services and participation in labour sharing arrangements could be endogenous variables in the investment decision models. For this reason, Table A.9 and A.10 present estimation results from the recursive multivariate probit model. The null hypothesis of no joint significance of the correlation coefficients is rejected using a likelihood ratio test (at 1% level). This result implies that the equations are not statistically independent and that single probit estimates would have led to inefficient standard errors.

There is a negative relationship between the equation indicating access to extension services and the perceived tenure insecurity equation. Likewise, there is a positive

correlation between the equation indicating households' participation in labour sharing arrangements and the equation indicating households' access to extension services, and between the equation indicating households' access to extension services and the equation indicating households' tree planting decisions. These results suggest that after controlling for observed factors there were unobserved factors that increased the likelihood of getting access to extension services also improved households' perception of tenure security (reduced perceived tenure insecurity), increased their likelihood of tree planting and participation in labour sharing arrangements. This might suggest that access to extension services, *ceteris paribus*, may increase knowledge about the benefits associated with tree planting, and information on land policy issues (for example minimise uncertainties about future land redistributions). Such knowledge in turn may increase the incentive to invest in land. In addition, access to extension services may also improve access to farm inputs such as access to tree seeds.

Results from the recursive multivariate probit estimation also indicates that after controlling for the endogenity of access to extension services and participation in labour sharing arrangements, tenure insecurity was not a significant factor in farmers' decisions either to plant tree crops or practice soil conservations. Instead, factors such as education, sex of the household head, land and livestock holdings, and participation in local labour sharing arrangements found to be important factors in farmers' decisions to plant tree crops or practice soil conservations.

Those households with more educated members, had more land and livestock holdings, and got access to local labour sharing arrangements were more likely to invest in their land. These results suggest that better-off households were more likely

to invest in their land (plant trees). On the contrary, the coefficient on household head variable is negative and significant suggesting that female-headed households were less likely to invest in tree planting when compared to their male counterparts. This finding is expected as female-headed households are on average poorer (in terms of farming reduces) than their male counterparts they may lack the necessary resources needed to invest in land.[32]

Estimation results from the recursive multivariate probit model indicates that female-headed households were also associated with less likelihood of getting access to extension services and participation in labour sharing arrangements. Looking at the other determinants of access to extension services indicates that households that had more educated family members, older household head, and more land and livestock holdings were more likely to get access to extension services. Likewise, looking at the determinants of participation in labour sharing arrangements suggests that households with more labour, land and livestock holdings were more likelihood to participate in local labour sharing arrangements, while households with old age household head were less likely to participate in labour sharing arrangements. These results indicate that access to extension services and participation in local labour-sharing arrangements in rural areas were more biased towards farmers with better faming experiences and recourse.

However, perception of tenure insecurity was not significantly different for female headed and/or resource poor households compared to their male-headed and/or resource rich counter parts. Instead, village dummies found to be the main variables

[32] Table 4.4 in Chapter 4 shows that on average female-headed households were poorer than their male counterparts.

that explained the variations in farmers' perception of tenure insecurity as the coefficients on other variables in the model are insignificant.[33] These results might suggest that variations in farmers' perception of tenure insecurity in rural areas can mainly be explained by village factors (for example past land redistribution experiences).

In summary, the estimation results in this section show that after controlling for household wealth, education, access to extension services, participation in local labour sharing arrangements and village dummies, tenure insecurity had limited impact on the decision to participate in land-related investments in rural Ethiopia. These findings suggest that the observed low level of land-related investments by female-headed and/poor households can be mainly explained by their limited access to farming resources such as land, labour and other capitals. These findings suggest that the tenure security variables should be interacted with the other variables such as land size, sex of the household head, and access to extension services. Given limited variability over time in most of these variables, interacting all other investment constraints with the tenure security variable is statistically demanding. Thus, only the land size variable is interacted with tenure security indicator in the pooled probit model. The coefficient estimate on this interaction term, however, is insignificant.

[33] One exception here is the coefficient on the variable indicating adult literacy education in a household, which is positive and significant at the margin (10% level).

3.7. Conclusion

This chapter examine whether there is a relationship between tenure insecurity (measured by farmers' own perception of tenure insecurity) and farmers' investment decisions in rural Ethiopia. Results from econometric analyses of determinants of land-related investment decisions indicate that perceived tenure insecurity was not a significant factor in farmers' decisions to participate in land related investments in rural Ethiopia. Instead, other factors, such as topography (erosion), access to extension services and labour, education and availability of other resources (for example land) were important determinants of land-related investment decisions.

However, the empirical analyses in this chapter are not without shortcomings. One limitation is that the proportion of households that had a change in their tenure status between 2004 and 2009 is small in the sample. Given this, panel data estimation methods are statistically demanding. Thus, the little statistical significance of the tenure insecurity variable could be due to such small change over time in the tenure security variables. In addition, the observed regional patterns of changes in the tenure security variables may imply that time varying unobserved regional factors affect both farmers perception of tenure security and investment decisions.

The use of cross-sectional data method do not allow us to control for unobserved heterogeneity that affects both tenure security and investment decisions. As a robustness check pooled data regression analysis is used while controlling for unobserved heterogeneity. In addition, the study provides evidence on major investment constraints as mentioned by the farmers themselves. Consistent with the empirical evidence farm households reported that other factors not tenure insecurity that is the major constraint in their investment decisions.

In general, results indicate that male-headed and/or resource rich households were more likely to invest in land, while female-headed and/or resource poor households were associated with less likelihood of participation in land-related investments.These findings are robust to changes in model specifications. In addition, results show that female-headed and/or resource poor households were less likely to get access to extension services and labour (in the form of labour sharing arrangements). However, the perception of tenure insecurity was not significantly different across these groups.

These findings suggest that the observed variations in land-related investment decisions among the sample households can be explained by their limited access to farming resources such as land, labour and other capitals. This corresponds to the findings of other previous studies that it is not tenure insecurity but poverty in farming resources and lack of access to credit, input, and other factor markets are the major constraints affecting land-related investment decisions in rural Ethiopia (Gavin & Ehui, 1999; Hagos & Holden, 2006; Holden & Yohannes, 2002; Pender & Fafchamps, 2005).Therefore, land policy reforms (e.g. titling) that are aiming to reduce tenure insecurity in Ethiopia should also improve farmers' ability to use their land as collateral in credit markets in order to finance their investments.

The findings of this study do not necessarily suggest that the existing land tenure system in Ethiopia is satisfactory for farmers' intensification efforts. It is widely argued that past and current land polices in the country have led to decreased and fragmented of land holdings in rural areas (Rahmato, 1993; Teklue & Lemi, 2004). As a result, there is limited room for farm intensification. For instance, data from this study show that among sample households who did not grow tree crops on their land, 40% of them reported land shortage as the first major problem with the figure being

more than 65% in regions with serious land shortages (Tigray and SNNP). In this regard, the existing land tenure system can be equally restrictive for most farmers.

Therefore, policy-makers should implement development strategies that will improve access to more land, credit, labour, and extension services in order to improve land related investments in rural Ethiopia. In this regard, developments in rural land and labour markets are expected to improve farmers' access to more land and labour and facilitate efficient allocation of these resources (Deininger, 2003). However, the analyses in Chapter 2 show that markets for both land and labour are poorly developed in rural Ethiopia. Thus, understanding the factors that affect farmers' participation decisions in these markets has significant policy relevance in order to improve household welfare in rural areas. This is the subject of the next chapter.

CHAPTER 4: LAND AND LABOUR MARKET PARTICIPATION DECISIONS IN RURAL ETHIOPIA

4.1. Introduction

In an agrarian economy like Ethiopia, where a large share of households are poorly endowed with non-labour assets, access to land and participation in rural labour markets is an important strategy for food security and poverty reduction. However, lack of access to additional agricultural land in rural areas is among one of the major constraints to increasing agricultural production in Ethiopia (FAO, 1993). The analysis in Chapter 3 also shows that farmers cited land shortage as one of the major constraints to investing in their land. Currently, the average land holding size per household in rural Ethiopia is less than 1 hectare (CSA, 2012).

Additionally, access to off-farm employment opportunities is very limited with only 3% of households relying exclusively on non-farm employment income in rural Ethiopia (Loening, Rijkers, & Söderbom, 2008; MoARD, 2010). In rural settings, income diversification through the development of alternative and sustainable off-farm employment opportunities can provide rural households with additional income sources and help them to reduce income risks associated with agricultural production (Block & Webb, 2001; Lemi, 2006). Therefore, it is crucial for policy-makers to understand the factors that affect farmers' participation decisions in rural labour and land rental markets.

Few studies in Ethiopia have analysed, separately, decisions by households concerning participation in land rental markets (Benin et al., 2005; Deininger et al., 2005; Deininger et al., 2007; Deininger et al., 2011;Holden et al., 2011), and decisions concerning participation in off-farm employment (Bedemo et al., 2013;

Bhatta & Årethun, 2013; Lemi, 2006; Woldenhanna & Oskam, 2001). However, these studies ignored the potential interdependency between land and labour market participation decisions in rural areas. The prevalence of multiple market imperfections in most developing countries suggests that farm households' decisions regarding farm operation and off-farm employment are made jointly (Binswanger & Rosenzweig, 1986; Pereira & Sumner, 1990). This implies that analysis of land and labour market participation decisions in rural areas should take into account the potential jointness of land and labour allocation decisions.

This chapter aims to examine the determinants of farm households' participation decisions in rural labour and land rental markets while explicitly taking into account the potential jointness of land and labour allocation strategies. The multivariate probit (MVP) technique is used in the analysis. Joint analysis of land and labour market participation decisions allows one to derive conclusions about which combinations of factor market participation decisions are more likely to be taken up by a given rural household. For instance, asset-poor households often may rent out their land and then participate in off-farm jobs. This suggests that policy makers should give due consideration to the development of rural off-farm jobs to reduce poverty in rural areas.

The chapter is organised as follows: Section 4.2 provides relevant descriptive statistics for sample households on labour and land rental market participations in rural Ethiopia. Section 4.3 provides a brief review of the literature on the determinants of land and labour market participation decisions. Section 4.4 discusses the theoretical model. The estimation strategy and estimation results are then

discussed in section 4.5 and section 4.6, respectively. Section 4.7 concludes with a summary of the main findings.

4.2. Land and Labour Market Participation in Rural Ethiopia

Land and labour are the two main factors of production in rural Ethiopia, where there is a lack of farm mechanisation. The discussion in Chapter 2 indicates that land tenure system plays a significant role in determining the prevalence and characteristics of land rental markets in rural Ethiopia. During the socialist era from 1975 to 1991, households were restricted, legally, from participating in both the land-rental markets and from hiring outside labour on their farms. Thus, land allocation through PA officials and family inheritance was the only formal way of getting access to land. Despite the ban, households had started leasing out their land informally over time (Omiti et al., 2000; Rahmato, 2004).

Since 1991, restrictions on labour and land-rental markets have been relaxed. In particular, the land reform in 1995 officially allowed households to rent out their land and to hire in agricultural labour on their farm. Following this reform, the incidence of participating in labour and land rental markets has increased in rural Ethiopia (Benin et al., 2005; Pender & Fafchamps, 2005). Data from the ERHS also show that participation by households in both the land rental and labour markets increased in the sample area (Table 4.1).[34] For example, households' participation in land rental

[34] A household is considered as a participant in land rental markets if it either leased- in or leased-out land using either sharecropping and/or cash rental contract arrangements. Similarly, participation in labour markets indicates that a household either supplied labour to the labour market or hired outside labour. A household is considered as a participant in off-farm employment if there was at least one family member in the household who participated in any kind of local employment activities outside the family's own farm (but excluding migration to urban areas).

markets increased from 33.5% in 1994 to 48.6% in 2009. The increase after 1994 was mainly due to an increase in land renting using cash rental contracts, which increased from only 9.3% in 1994 to 25.27% in 2009. Despite this, sharecropping remains the dominant contractual arrangement suggesting markets for credit and other non-land factors are underdeveloped in rural areas.

Similarly, the percentage of households who hired outside labour on their farm increased from 25.7% in 1994 to 35.5% in 2009, while the percentage of households that participated in off-farm employment increased from 62.7% in 1994 to 74.6% in 2009. The increase in participation in off-farm employment was mainly due to increased participation in off-farm wage employment from its level of 23.4% in 1994 to 36% in 2009. However, the apparent increase in off-farm employment was partly because there was a change in the definition of the term to include activities which were previously excluded. For instance, activities such as religious work[35] and brewing of local alcohol were considered as off-farm employment in the 2009 survey but not in the 1994 survey (Table 4.2).

[35] Religious work includes working in churches. This was not included in the list of off-farm employment in the 1994 survey year.

Table 4.1: Percentage of households participated in land rental and labour markets (1994-2009)

Land rental and labour market participations	Year			
	1994	1999	2004	2009
Participation in land rental markets (% of households)	33.5	44.6	40.8	48.6
Leased in	20.1	20.7	20.0	21.4
Leased out	13.0	21.3	18.5	24.1
Participations using sharecropping	90.7	72.3	74.8	74.7
Participations using cash rental contracts	9.31	27.67	25.18	25.27
Participation in off-farm employment (% of households)	62.7	58.8	71.4	74.6
Wage employment	23.4	27.0	37.2	36.0
Self-employment	39.3	31.8	34.2	38.6
Participation in labour hiring (% households)	25.7	23.2	31.5	35.5
Total sample households	1477	1452	1363	1355

Source: Own calculations using data from ERHS.
Note: Leased in and Leased out refers participation in land rental markets using both sharecropping and cash rental contractual arrangements.

Despite the large percentage of households participating in off-farm job, existing off-farm employment opportunities in rural Ethiopia are poorly developed. In general, activities such as selling firewood, religious work, and participation in food-for-work programmes were the dominant type of jobs available in rural areas (Table 4.2). For example, in the 2009 survey, religious work was reported as off-farm employment by 26.9% of individuals in the sample area. This was followed by agricultural wage employment (15.9%) and participation in food-for-work schemes (10.1%). Skilled work and professional jobs, such as teaching, were reported only by 3% and 1.9% of individuals, respectively.

Table 4.2: Types of off-farm employment activities (2004 and 2009)

Types of wage employment	Percentage participated		Average duration worked in 2009	
	1994	2009	Month	Day[b]
Food-for-work	25.7	10.1	5.0	31.9
Farm worker	18.0	15.9	4.4	25.6
Unskilled worker	7.1	11.4	6.1	51.4
Skilled labour	4.9	3.0	6.2	42.9
Professional	1.3	1.9	11.4	100.7
Religious work[a]	-	26.9	4.8	30.7
Other wage employments	6.6	4.7	7.6	43.3
Types of self-employment	**Percentage participated**		**Average duration worked in 2009**	
	1994	2009	Month	
Collecting and selling of firewood	39.1	16.5	7.2	
Trade in grain	23.5	25.2	9.3	
Handicraft and pottery	12.7	10.9	10.3	
Weaving/Spinning	11.8	6.7	9.7	
Trade in livestock and livestock products	4.1	10.4	8.0	
Traditional healer	2.0	3.7	9.6	
Transport (by pack animal)	1.6	4.9	7.7	
Milling	1.0	3.5	10.4	
Brewery of local alcohol[a]	-	12.8	9.3	
Other self-employments	4.2	5.4	8.5	

Source: Own calculations using data from ERHS.
Note: [a] not reported in 1994 survey. [b] average day only refers to days worked within 4 months before the survey.

Among self-employment opportunities, collecting and selling firewood was reported by 39.1% and 16.5% of individuals in 1994 and 2009, respectively. This was followed by trade in grain, which accounted for 23.5% and 25.2% of off-farm self-employment in 1994 and 2009, respectively. These results show that the structure of off-farm employment in rural Ethiopia has hardly changed over the 15 years covered by the survey. Moreover, the nature of off-farm wage employment opportunities was seasonal. On average, there were about four months in a year when those individuals

involved in off-farm wage employment were actually employed for five or more days. However, individuals with professional jobs had employment for longer duration. These results indicate that farmers in rural Ethiopia have a very limited access to well-paying off-farm jobs. It is suggested that among other reasons, lack of alternative employment opportunities elsewhere in the country, and past and current land polices, prohibit labour movement out of agriculture and impede the development of non-farm income generating activities in rural areas (Rahmato, 1993, 2004).

Table 4.3 presents summary results indicating household characteristics according to their participation in land rental and labour markets. Note that 49.8% of households that leased out land and 37% of households that did not participate in any of the factor markets were female-headed. These households also had, on average, smaller number of male family labour and livestock. Only 20.6% of those who leased out land and 26.7% of non-participating households had a pair of oxen for farming. Similarly, although households that participated in off-farm employment had, on average, large number of family members, they were constrained in terms of other farming resources and skills. Thus, only 31.2% of them had a pair of oxen for farming and 31.2% were female-headed households. In addition, more than 60% of the households that leased out their land, or work in off-farm employment or did not participate in any of the markets, reported that they had food shortage problems at least once in the previous production year. In contrast, those households that leased in land and hired outside labour were mainly male-headed and were better endowed with farming resources such as land and livestock.

Table 4.3: Household characteristics by land rental and labour market participations (2009)

	Leased out land	Leased in land	Worked Off_farm	Hired in labour	Not participated
Total household size (num)	4.5	6.6	6	6	5.2
Male labour (num)[a]	1.3	2.4	2	2.1	1.8
Female labour (num)	1.8	2.2	2.2	2.1	1.9
Head sex (=1 if male)	50.2	86.9	68.8	73	63
Head age (years)	55.2	49	50.8	52.2	57.4
Consumption (in Birr)	741.4	823.8	668.3	884.4	630
Food shortage (=1 if yes)	62.5	49.6	65.3	46.7	67.1
Plot size (in hectares)	1.8	1.7	1.5	2.1	1.6
Land to labour ratio	0.7	0.4	0.4	0.6	0.5
Cultivated land to labour ratio	0.2	0.6	0.3	0.5	0.5
Livestock holdings (in value)	1381.1	4436.8	1986.3	3601.3	1440.8
Own a pair of oxen (=1 if yes)	20.6	71	31.2	51.8	26.7
Access to production loan (=1 if yes)	25.3	34.7	31.4	36.8	22.4
Total observations	296	259	802	467	165

Source: Own calculations using data from ERHS round 2009.
Note: [a] male and female labour refers to the number of working age family members.

The findings in Table 4.3 show that a significant percentage of households that leased out land were female-headed and were relatively poor in non-land resources. These observations may suggest that female-headed households were motivated to rent out their land because they were poorly endowed in farm equipment and skills. From Table 4.4 it is evident that on average, compared to male-headed households female-headed households had significantly smaller male labour force (1.2 vs 2.3) and livestock holdings (1312.3 Birr vs 2660.4 Birr).

In addition, only 20.9% of female-headed households owned a pair of oxen and 22.8% of them took loans to finance production-related expenses, while these figures were 41.2% and 32.6% for male headed-households. Likewise, on average, female-

headed households also had significantly smaller allocated and cultivated land sizes, while the average land area leased out was significantly larger in the case of female-headed households. These results suggest that households lacking the necessary physical and managerial ability for farming, in particular, female-headed households are more likely to rent out their land though they have on average smaller land holdings.

Table 4.4: Household characteristics by the sex of a household head (2009)

	Male-headed households	Female-headed households	Mean test
Total household size(number)	6.3	4.4	***
Male labour (number)	2.3	1.2	***
Female labour (number)	2.1	2.0	*
Head age (years)	52.4	53.4	
Consumption (value)	720	723.1	
Food shortage (=1 if yes)	57.6	67.7	***
Plot size (in hectares)	1.8	1.4	***
Land to labour ratio	0.5	0.5	
Cultivated land to labour ratio	0.4	0.3	***
Livestock holdings (in value)	2660.4	1312.3	***
Own a pair of oxen (=1 if yes)	41.2	20.9	***
Access to production loan (=1 if yes)	32.6	22.8	***
Participated in off-farm jobs (=1 if yes)	63.1	59.8	
Hired in outside labour (=1if yes)	39.1	30.4	**
Leased out land (=1 if yes)	16.9	35.3	***
Leased in land (=1 if yes)	25.8	8.2	***
Area Leased out (in hectares)	0.1	0.3	***
Area Leased in (in hectares)	0.2	0.1	***
Number of Observations	874	421	1295

Source: Own calculations using data from ERHS.

Furthermore, although households that leased out land had, on average, a larger land size than those that leased in land, they cultivated a much smaller land size relative to those who leased in additional land. The result may indicate that land rental markets were not equalising land/labour ratios among the sampled households. In fact, land rental markets may lead to transfer of land from households that are poorly endowed with non-land productive assets (but not necessary rich in land) to those better endowed with these assets (but not necessary poor in land).

Finally, Table 4.5 highlights the likely correlations between land rental market participation decisions and labour market participation decisions, based on data from the 2009 survey year. An estimated 41.5% of the sample households participated in off-farm employment; however, this estimate increased to 50% in the case of those households that leased out their land. In the case of those households that participated in off-farm employment activities, 27.1% also leased out their land. Likewise, an estimated 15% of the sampled households were hired outside labour but this estimate increased to 21% in the case of households that leased in land. Furthermore, in some instances, farm operators hired outside labour while, at the same time, supplying labour to off-farm employment. This typically happens when there is a mismatch between the skills or education level of the household members and the lower requirements of the farm job; here, the household may supply the high-priced labour of well-educated household members and then hire cheap agricultural labour (Sadoulet et al., 1996). However, given a very small proportion of individuals who work in professional or skilled work (1.9 % and 3 % in 2009), this may suggest that due to seasonality of agricultural production, famers may hire outside labour at peak

times and work off-farm (mainly self-employment) during slack seasons in the same year.

Table 4.5:Participation in labour and land rental markets, sample conditional probabilities (2009)

Participation in labour markets given land rental market participations					
	Land markets (%)				
Labour markets	Leased out	Leased in	Both leased in and out	Not participated	Total
Worked off -farm	50	30.9	50	41.6	41.5
Hired in labour	8.6	21.6	10	15.6	15.1
Both hired in and out labour	12.3	32	30	19.8	20.7
Not participated	29.1	15.6	10	23	22.7
Participation in land rental markets given labour market participations					
	Labour markets (%)				
Land markets	Work off-farm	Hire in labour	Both hire in and out	Non-participant	Total
Leased out	27.1	12.8	13.3	28.9	22.5
Leased in	14.9	28.6	30.9	13.8	20
Both Leased in and out	1.8	1.0	2.2	0.7	1.5
Not participated	56.2	57.6	53.6	56.7	56

Source: Own calculations using data from ERHS.

4.3. Literature Review: Theory and Empirical Evidence

In a model of perfectly functioning factor markets, where transaction costs are close to zero, participation in land and labour markets depends on the relative prices of land and labour, the land to labour ratio, and the amount of other non-tradable inputs in the household (Collier, 1989; Otsuka, 2007; Sadoulet, De Janvry, & Benjamin,1998). If one assumes that production exhibits constant returns to scale and no production uncertainty, then small-scale farm households can either rent in or buy land to be

utilised by their family labour or they can supply their extra labour to the labour market. Likewise, large-scale producers can either hire outside labour or supply their land to the market[36]. Thus, efficiency can be improved either by a land market transaction or by exchange of labour through factor markets (Otsuka, 2007; Otsuka, Chuma & Hayami, 1992).

If markets for all non-land factors of production are perfect then achieving efficiency may not entail land markets to function (Pender and Fafchamps, 2006).However, it is well recognised that in the context of developing economies, those markets for insurance, factors of production, and output are either missing or highly imperfect (Carter & Yao; 2002; Skoufias, 1995). In particular, it is widely argued that labour market transactions in agrarian economies resulted in efficiency and welfare losses (Binswanger & Rosenzweig, 1986; Eswaran & Kotwal, 1986; Holden, Shiferaw & Pender, 2001; Sadoulet et al., 1998; Skoufias, 1995). The main source of imperfection in labour markets lies in an incentive problem in relation to the work efforts of hired labour (Binswanger & Rosenzweig, 1986; Eswaran & Kotwal, 1985, 1986; Otsuka, 2007). Given the disutility of work, the incentive problem arises whenever information is costly and asymmetrically distributed (Binswanger & Rosenzweig, 1986). In such conditions, hired labour has a tendency to shirk, while the level of effort applied by that hired labour cannot be easily observed, especially for tasks that

[36] Otsuka (2007, pp. 2680-2681) argued that the equality of the marginal product of land can be achieved also through land sales market as land-rich farmers can sell a portion of their land to land poor farmers, at the price reflecting the present value of future returns to land. Thus, with perfect markets in land tenancy, land sell, land rent and labour employment can lead to identical and equally efficient outcomes. However, land adjustment through land rental markets is more dominant than adjustment through the land sales market. This is mainly because relative to the land sales market, land rental markets are characterised by low transaction costs. Also, they are less vulnerable to credit market imperfections, and require only a limited amount of initial capital (Binswanger et al., 1995; Deininger, 2003).

require care and judgment, such as land preparation and fertiliser application (Eswaran & Kotwal, 1985; Hayami & Otsuka, 1993; Otsuka, 2007**)**.

To overcome problems associated with the incentive problem of hired labour, farm operators exercise either strict supervision over the work of that labour or design various mechanisms that provide better incentives to work well, such as permanent labour contracts (Binswanger & Rosenzweig, 1986).[37] In this regard, compared to small-scale farmers large farm owners are expected to hire outside labour as they are in a better position to bear the fixed costs of supervision (Ray, 1998). However, because the variable supervision cost associated with hired labour increases as land size increases the efficiency of supervision diminishes as farm size increases (Carter & Olinto, 1998; Vranken & Swinnen, 2006; Lipton, 2009). Thus, due to high transaction costs associated with supervision of hired labour, large-scale producers may prefer to supply their land rather than to use hired labour (Binswanger & Rosenzweig, 1986; Collier, 1989; Skoufias, 1995).

In contrast to hired labour, labour provided from within the family is perceived as having a high incentive to provide effort when compared with labour hired from elsewhere, suggesting that small-scale farmers prefer to utilise, fully, their family labour by renting-in more land (Eswaran & Kotwal, 1986). As a result, compared to large-scale farmers, small-scale farmers employ more labour per acre. This implies that with relatively high labour to land ratios and assuming that hired labour is not a

[37] The high cost of supervising hired labour is used to explain the use of permanent farm labour contracts in most agrarian economies because a permanent contract helps the employer to elicit credibility from hired workers (Binswanger & Rosenzweig, 1986; Eswaran & Kotwal, 1986). Binswanger & Rosenzweig (1986), however, argued that because of seasonality and synchronic timing of agricultural production, short-term labour contracts are dominant in rural areas, despite their shortcomings.

perfect substitute for family labour, small-scale farmers have been considered more productive than large-scale farmers with hired labour (Benjamin & Brandt, 2002; Berry & Cline, 1979; Eswaran & Kotwal, 1985; Feder, 1985).

A constraint limiting labour supply to off-farm jobs was identified as another source of inefficiency in the labour market (Pereira & Sumner, 1990). With a limited number of off-farm jobs, farm households cannot sell their extra labour to the labour market and so the marginal product of one's own labour on the farm would be less than the market wage, leading to inefficiency in allocation of resources. Additionally, markets for hiring managerial ability and draught animals are often either missing or imperfect in rural economies of developing countries (Bardhan, 1977; Binswanger & Rosenzweig, 1986).

The presence of multiple market imperfections in non-land factors were suggested as being the rationale for the emergence of tenancy markets in rural areas (Binswanger & Rosenzweig, 1986; Pant, 1983; Pereira & Sumner, 1990; Skoufias, 1995). It was also suggested that relative to other factor markets, land tenancy markets are characterised by fewer problems relating to moral hazard, because in most instances any behaviour that does damage to the land can be easily observed (Binswanger & Rosenzweig*,* 1986*;* Skoufias, 1995). As a result, farm households prefer to adjust their land holding sizes in relation to other non-land factor endowments.

However, credit market imperfections may prevent small-scale farmers with liquidity constraints, as well as landless workers, from borrowing in the same way as the better-off households on the on-going market price (Eswaran & Kotwal, 1986; Kochar, 1992; Pant 1983). This implies that despite their family labour advantage,

credit-constrained small-scale farmers and landless workers may find it difficult to get access land through land market, and finance their production costs.

Moreover, transaction costs in land rental markets affect farmers' participation decisions and the extent of their participation in land rental markets (Key, Sadoulet, & de Janvry, 2000; Skoufias, 1995). Transaction costs in land rental markets imply that the effective rent price paid to rent in land by the lessee is greater than the effective rented out price received by the lessor (Carter & Yao 2002; Key, Sadoulet, & de Janvry, 2000). The larger the gap between these prices the greater the number of households that opt not to participate in land rental markets. For instance, Carter and Yao (2002) show that improved land transfer rights lower transaction costs in land rental markets, which in turn increases participation in land rental markets.

Building on the earlier work of Bliss and Stern (1982), Skoufias (1995) developed a theoretical model in order to assess the role of transaction costs in land rental markets in developing countries. He showed that both fixed and variable costs associated with land rental markets restricted farm households from making full and efficient adjustments of their land holdings to the desired optimal holding size. Similar studies from Africa showed the presence of significant transaction cost in land rental markets (Deininger et al, 2009; Holden et al., 2011; Pender & Fafchamps, 2006; Teklu & Lemi, 2004).

Imperfections in other factor markets, together with restrictive regulations over land leasing, asymmetric information, contract enforcement, and search and negotiation costs were identified as some of the sources of transaction costs in the tenancy markets (Deininger & Jin, 2005; Otsuka 2007; Pender & Fafchamps, 2006; Skoufias,

1995). For example ,according to Otsuka (2007), in China migration of individuals from a village to a city was limited due to restrictions on land transfer rights and because migrants feared losing their land rights as a result of land reallocations in the future. Similar studies conducted in Ethiopia also showed that an improvement in security of tenure was associated with a higher propensity for land renting transactions and for migration to take place (De Brauw & Mueller, 2012; Deininger, et al, 2011; Holden et al., 2011). These results suggest that institutional settings that determine the cost of land rental transactions significantly affect the propensity of individuals to participate in decisions relating to labour and land rental markets.

Farmers' participation decisions in land rental markets are also affected by labour market imperfections in rural areas. Lack of off-farm employment opportunities in rural areas increases the propensity of farm households to farm their own land, thereby decreasing their propensity to supply land to the market (more efficient farmers). Similarly, binding constrains on hired labour (such as availability, monitoring and supervision constraints) can limit the demand for renting in additional land, while these constraints increase the propensity of labour-constrained farm households to supply land (Pereira & Sumner, 1990).

The potential link between the development of land rental markets and availability of off-farm employment in rural areas is well recognised in the international literature (Feng, Heerink, Ruben & Qu, 2010; Kung, 2002; Pereira & Sumner, 1990; Yao, 2000; Zhang, Qingguo, & Xu, 2004). Some of these studies showed that access to employment opportunities off the farm was associated with more transactions in land rental markets (Kung, 2002; Yao, 2000; Zhang et al., 2004). Others showed that the development of a land rental market encouraged participation in off-farm employment

activities (Kung & Lee, 2001; Shi, Heerink, & Qu, 2007). These results suggest that any gain from participation in land rental markets can be affected by availability of off-farm employment opportunities in rural areas. Likewise, demand for land can improve the development of land rental markets, thereby encouraging land supply to the market and participation in off-farm jobs. This implies that participation in the off-farm jobs in rural areas is contingent on the presence of well-functioning land rental markets and institutional settings that improve the security of tenure of farm households.

In summary, the main factors that influence land rental transactions in rural areas have been identified: availability of other non-land factor endowments, farming ability, insecurity of tenure, transaction costs in land lease markets, access to credit, and imperfections in rural labour and credit markets (Benin, et al., 2005; Deininger et al., 2005; Deininger et al, 2007; Holden et al., 2011; Otsuka et al., 1992; Pant, 1983; Skoufias, 1995). The descriptive analysis in the previous section also shows that imperfections in markets for draught animals, managerial skills for farming, and lack of male labour force were important factors that affected farmers' participation decisions in labour and land rental markets in the sample area.

Land renting transactions involving a contractual arrangement for sharecropping are considered to be one means to mitigate labour and capital market imperfections (Eswaran & Kotwal, 1986; Otsuka, 2007; Pant, 1983). A sharecropping arrangement allows a combination of risk sharing with some work incentives for hired labour (Eswaran & Kotwal, 1985; Otsuka, 2007; Otsuka, et al., 1992; Stiglitz, 1974). In addition, sharecropping can lead to access to production credit and non-tradable inputs (for example, management know how). Sharecropping is the dominant

contractual arrangement in rural Ethiopia (Table 4.1). In general, resources pooling (i.e. management knowledge, oxen, and labour) and credit provision by the landlords are suggested as the main rationale for the existence and persistence of sharecropping in rural Ethiopia (Rahmato, 1984).

Likewise, the literature on income diversification suggests that households mainly diversify into off-farm jobs either due to 'push' or 'pull' factors (Barrett, Reardon, & Webb, 2001; Ellis, 2000; Reardon, 1997). The 'push' factors include land shortage, risk and seasonality of agricultural production, inadequate farm income, and absence or failure of input and credit markets. The 'pull' factors include increased opportunities and profitability in the non-farm employment sector. In the context of Ethiopia, the data in Table 4.3 shows that farmers who participated in off-farm work, on average, had smaller per capita land holing sizes and small proportion of them had owned a pair of oxen (31.2%). This may suggest that farmers in rural Ethiopia participate in off-farm employment mainly because of the 'push' factors. Moreover, Table 4.5 shows that a significant proportion of farm households in the sample simultaneously adjusted both their land and labour margins.

The discussion in this section suggests that the gain from participation in land rental markets can be affected by availability of off-farm jobs in rural areas. Likewise, participation in off-farm jobs is contingent on functioning of rural land rental markets. This suggests that the two participation decisions are interlinked. Therefore, an understanding of the pattern and determinant factors of land rental and labour market participations and the interaction between these factors, has significant relevance in formulating policy for poverty reduction in rural areas. Against this background, this chapter aims to provide an empirical analysis of decisions by farm households to

participate in land and labour markets while explicitly taking into account the potential jointness of land and labour allocation strategies. Ignoring the correlation between different factor market participation decisions that are in competition for the same resources may lead to erroneous results.

4.4. Theoretical Model

The discussion in the previous section suggests that imperfections in markets for draught animals, managerial skills for farming, heterogeneity in access to credit and other farming assets are important factors in determining farmers' participation decisions in rural labour and land rental markets. The theoretical model used for this study is based on an agricultural household model with imperfect factor markets developed by Vranken and Swinnen (2006). The advantage of this model is that it incorporates the multiple factor market imperfections, which are common in Ethiopia. The model assumes the presence of transaction costs in land rental markets, credit market imperfections, moral hazard in hired labour, and rationing in off-farm labour markets. These conditions are considered generally applicable in rural Ethiopia.

Consider a farm household with endowments of labour $\overline{L}$, land $\overline{A}$, some initial wealth $\overline{W}$, and other non-tradable inputs and fixed productive assets $\overline{Z}$ (for example managerial or technical skills). Farm households can derive their income from farming their own farm, supplying land to land-rental markets and supplying labour to labour markets. Agricultural output is produced according to the following production function, which is increasing, strictly quasi-concave and twice continuously differentiable:

$$Q = f(A, L, X, \overline{Z}) \qquad [1]$$

Here, A is the land used by a household, L is the effective labour input on the farm (i.e. family or hired labour or both) , X is the amount of purchased inputs (for example seed and fertilizer) used on the farm with price vector P_x , and $\overline{Z}$ is managerial or technical skills. The land used, A, is defined as $A = \overline{A} + A^i - A^o$ with $\overline{A}$ being the land initially owned by the household, A^i being the amount of land rented in, and A^o the amount of land rented out. The household allocates its labour endowment, $\bar{L} = L^f + L^o + l$, between leisure (l), on-farm labour (L^f), and off-farm labor (L^o). Due to the assumption of moral hazard in the hired labour family labour can be used to supervise hired labour. Then the effective labour input L is given by:

$$L = L^f + s(A, L^f).L^i \qquad [2]$$

Here, L^f is the family labour devoted to farming, L^i is the number of hired labour. The function $s(A, L^f)$ is a supervision function, with 0≤ s (.) ≤1, which reflects how nominal labour input is transformed into labour effort (Vranken & Swinnen, 2006). The discussion in the previous section suggests that variable supervision cost increases with increase in land and so the efficiency of supervision diminishes as farm size increases (Carter & Olinto, 1998). Following, the efficiency of supervision is assumed to be positive, but the concave function of family labour input ($\partial s / \partial L \geq 0$ and $\partial^2 s / \partial L^{f2} \leq 0$) diminishes as the farm size increases, for a given level of family labour input: $\partial s / \partial A \leq 0$ and $\partial^2 s / \partial A^2 \geq 0$ (Vranken & Swinnen, 2006).

It is also assumed that farm households face binding credit constraints associated with renting in land; moreover, access to a loan (B) depends on the amount of land

owned[38] and other productive assets. Although land cannot be used as collateral in the formal credit markets in rural Ethiopia, close to 70% of the loans (26% informal loans and 47% formal loans) needed to provide some type of guarantor (see Table 2.8 in Chapter 2). In addition, the descriptive statistics in Chapter 2 also show that the percentage of households who got access to loans for production purposes increased as land size increased (see Table 2.7 in Chapter 2). Thus, it is reasonable to assume that loan access depends on household wealth and land size.

It is further assumed that the labour market is cleared by quantity rationing. Off-farm employment opportunity in rural Ethiopia is institutionally limited as movement of labour out of agriculture is restricted. Thus, due to limited off-farm employment opportunities in rural areas, not all household members will find jobs in rural off-farm employment. Household endowment, household-specific characteristics, or kinship may determine access to the limited off-farm employment opportunities. Thus, it is assumed that the quantity of wage employment is rationed. That quantity rationing imposes a ceiling in the form of $L^o \leq \overline{L}^o$. The assumption of the presence of transaction costs in land rental markets implies that the price of land rented in (r^i) will be higher than the price for land rented out (r^o). The larger the gap between r^i and r^o the greater the number of households opt not to participate in land rental markets (remain Autarky).

Furthermore, labour market imperfections due to lack of off-farm employment opportunities and moral hazard problems associated with hired labour imply that the

[38] 'Land owned' refers to land obtained through non-market means (allocated by PA officials or inheritance or both).

wage paid to hired labourers (w^i) will be less than the wage that household members can secure from off-farm employment (w^o). Finally, output price is normalised to one.

Incorporating all of the above conditions, a given household maximises the following utility function which is an increasing function of income (y) and leisure (l):

$$\max_{\substack{L^f, L^i, L^o, l \\ A^i, A^o, X}} U(y, l) \qquad [3]$$

s.t.

$$P_x X + r^i A^i + w^i L^i \leq B(\overline{A}) + \overline{W} + r^o A^o + w^o L^o \qquad [4]$$

$$L^o \leq \overline{L}^o \qquad [5]$$

$$\bar{L} = L^f + L^o + l \qquad [6]$$

Where household net income, y , is given by:

$$y = f(L, A, X, \overline{Z}) - P_x X - r^i A^i - w^i L^i + r^o A^o + w^o L^o \qquad [7]$$

Equation (4) reflects the liquidity constraint, which specifies total expenditure on factor inputs may not exceed the amount of loan at a household's disposal ($B(\overline{A})$), initial wealth ($\overline{W}$) revenue from off-farm employment ($w^o L^o$), and received rental payment ($r^o A^o$). Equation (5) and equation (6) capture constraints on off-farm employment opportunities and time constraints of household members, respectively. Thus, a households' decision problem is to choose the amount of land leased in or leased out, the number of hired labour, the level of purchased inputs, and whether to allocate its labour endowments between working on farm, working off farm, and

leisure time. The first order conditions for the amount of land rented in A^i and the amount of land rented out A^o, and the number of family labour L^f and hired labour L^i devoted to the farm are:

$$A^i : f_A \leq (1+\frac{\delta}{U_y})r^i - f_L s_A.L^i \quad [8]$$

$$A^o : f_A \geq (1+\frac{\delta}{U_y})r^o - f_L s_A.L^i \quad [9]$$

$$L^f : f_L.(1+s_{L^f}.L^i) + w^o(1+\frac{\delta}{U_y}) + \frac{\mu}{U_h} \leq 0 \quad [10]$$

$$L^i : f_L.s(A,L^{f)} - w^i(1+\frac{\delta}{U_y}) \leq 0 \quad [11]$$

Here, δ and μ are the Lagrange multipliers for the liquidity constraint and off-farm employment constraints, respectively. The more households that are credit-constrained implies the larger the value of δ ,which means that the likelihood of renting in land decreases while the likelihood of renting out land increases (equation 8 and 9). From equation 10 and 11, larger value of δ implies that fewer farm labour will be employed due to credit constraints. This in turn decreases the marginal product of land, thereby decreasing land renting in while it increases land renting out. Similarly, limited access to off-farm jobs (the large the value of μ) implies that farm household use more labour on their farm (equation 10 and 11), increasing the marginal product of land. This in turn is expected to increase the likelihood of land renting in, while it is expected to decrease the likelihood of land renting out.

In the context of Ethiopia, a lack of access to credit and substantial market imperfections in non-land factor markets implies that households that are better endowed with agricultural production resources such as farming ability, male family labour, and oxen are expected to participate as a tenant in land rental markets while supplying less labour to off-farm jobs. In contrast, households that are less endowed with these resources are expected to participate as a landlord in land rental markets. Moreover, lack of access to well-paying off-farm employment opportunities in rural areas is expected to increase the probability of additional land renting in, while this factor is expected to decrease the probability of land renting out.

Furthermore, Table 4.5 suggests positive correlation between renting out land and participation in off-farm employment. This correlation probably arises because households that were not able to farm their land due to lack of farming ability and resources were more likely to rent out part of their land and then obtain off-farm employment for additional income. Similarly, households that leased in additional land also hired outside labour. Thus, it would be interesting to examine the extent to which these various correlations can be explained by differences in the observable household characteristics and unobservable factors. The next section provides description of the estimation strategy used to examine these issues.

4.5. Estimation Strategy

According to the theoretical model presented in an earlier section, a farm household can make four possible decisions in a given production year regarding participation in the land and labour markets. Therefore, four separate participation equations are specified: (1) rent out land (landlord), (2) rent in land (tenant), (3) supply household

labour to off-farm employment, and (4) hire outside labour for farming. The dependent variables are all binary dummy variables that assign 1 if a household participated in a given activity and 0 if it did not participate.

In the literature, a multinomial logit model (MNL) has been widely used to analyse such equations. However, the potential problem of using a MNL within this framework lies in the assumption of 'Independence of Irrelevant Alternatives (IIA)', which implies that the relative probability of any two given alternatives for market participation is not influenced by the existence of other alternatives. This assumption is likely to be violated in my case. For example, the relative probability of participation in off-farm employment and land renting activities can be influenced by the availability of outside labour (hired labour). If there is an option to hire outside labour, then this may increase the propensity to rent in more land or reduce the propensity to rent out land and participate in off-farm employment.

Alternatively, a multivariate probit model (MVP) is used to fit, jointly, the distribution of different types of factor market participation outcome equations. The MVP model relaxes the IIA assumption while taking into account the potential endogeneity of the alternative participation equations. The M–equation multivariate probit models may be specified as (Cappellari & Jenkins, 2006; Greene, 2008):

$$y_m^* = X_m' \beta_m + \varepsilon_m \qquad [12]$$

$$y_m = 1 \text{ if } y_m^* > 0 \text{ and 0 otherwise, } m = 1, \ldots, \text{M}$$

$$E\left[\varepsilon_m \mid x_1, \ldots, x_M\right] = 0$$

$$Var\left[\varepsilon_m \mid x_1, \ldots, x_M\right] = 1$$

$$Cov\left[\varepsilon_j, \varepsilon_m \mid x_1,...,x_M\right] = \rho_{jm}$$

$$(\varepsilon_1,...,\varepsilon_m) \sim N_M[0,R]$$

Here, y_m^* denotes the underlying latent response associated with the m^{th} type of market participation outcome for m =1,….,M; y_m denotes the binary response outcome associated with the m^{th} type of market participation outcome, and ε_m, m =1,…,M, are error terms distributed as multivariate normal, each with an expected value of zero, and variance-covariance matrix R, where R has values of 1 on the leading diagonals and correlations $\rho_{jk} = \rho_{kj}$ as off-diagonal elements for j, k=1,…, M. $X_m^{'}$, denotes a vector of control variables, and β_m denotes model parameters to be estimated. The errors in each equation are assumed to be orthogonal to the covariates. The log likelihood function for the sample of N independent observations is given by:

$$L = \sum_i^N w_i \log \Phi_M\left(k_{i1}X_{i1}^{'}\beta_1,...,k_{iM}X_{iM}^{'}\beta_M, R^*\right) \qquad [13]$$

where $\phi_M(.)$ denotes the multivariate standard normal distribution, and k_{im} are 'signs' variables, being equal either to 1 or to -1, depending upon whether the observed binary outcome equals 1 or 0: $k_{im} = 2y_{im} - 1$ for each observation. R^* is a matrix which constitutes elements R_{jm}^*, where $R_{jj}^* = 1$ for j=1,…, M and $R_{jm}^* = R_{mj}^* = k_{ij}k_{im}\rho_{jm}$ for $j \neq m$. The joint probability of observing all possible outcomes is given by:

$$P(y_1 = 1,..., y_M = 1) = \phi_M\left(k_{i1}X_{i1}^{'}\beta_1,...,k_{iM}X_{iM}^{'}\beta_M, R^*\right) \qquad [14]$$

Following the method of Cappellari and Jenkins (2003, 2006), model parameters were estimated using the simulation maximum likelihood (SML) estimation procedure. The same covariates were included in all equations because participation was assumed to occur simultaneously[39]. In line with the literature (for example, Bedemo et al., 2013; Deininger et al., 2007; Holden et al., 2011; Lemi, 2006), the control variables included were number of male and female working age family members in a household, characteristics of a household head such as sex, age and education level, highest education level of family members, land and non-land endowments, tenure security indicators, and access to credit and extension services.

Proxy variables were used to indicate household level liquidity constraints; for example, whether a household stored any crops from previous harvest and whether a household could get access to cash, 100 Birr, if needed. In order to control for potential effects of insecurity of tenure, two variables were included: farmers' perception of the probability of losing land within five years' time and farmers' perceived land transfer rights. In addition to these variables, woreda (village) level dummy variables were included to control for differences in geographic and socioeconomic characteristics of the sample area. Because some of the variables were only available in the last two survey rounds, I estimated the model using pooled data from the 2004 and 2009 years. Thus, year dummies were included in the pooled data estimation in order to control for policy changes over the study period.

[39] Further, Greene (2008) suggests that in the bivariate probit model estimation case there is no requirement that different variables should appear in different equations, nor that a variable be excluded from each equation.

4.6. Results and Discussions

Table 4.6 presents results from the MVP model estimates for the determinants of participation in land and labour markets. Note, first that the likelihood ratio test of the null hypothesis that all the correlation coefficients, $\widehat{\rho}_{jk}$, are jointly zero is strongly rejected(with p value=0.000); this justifies the more general specification here in comparison with the restrictive single-equation or MNL approach. The estimated correlation coefficient between the landlord equation and the tenant equation is negative and significant; this finding suggests that after controlling for observed household characteristics, those households that rented in land had unobserved characteristics that made them less likely to rent out their land.[40]

Similarly, the positive and significant correlation between the equation indicating land renting in and the equation indicating labour hiring suggests that those unobserved characteristics that increased the likelihood of renting in land also increased the probability of hiring outside labour. Likewise, the correlation coefficient is positive and significant for the landlord and the off-farm employment participation equations. The result suggests that after controlling for observed household characteristics, those households that leased out their land had unobserved characteristics that made them more likely to supply labour to the off-farm employment activities.

The coefficient estimates for the observed determinants of participation in land and labour markets agree with results found from the earlier descriptive analysis in section

[40] The estimated correlation coefficient between the landlord and the tenant equations is 0.866 (with p value=0.000), while the figure is -0.088(with p value=0.064) between the landlord and the off-farm employment equations, and it is 0.238(with p value=0.000) between the tenant and the labour hiring equations.

4.2 in this chapter. The coefficient of male family labour is negative and significant in the landlord and the labour hiring equations, while it is positive and significant in the off-farm employment equation. This result suggests that due to imperfections in the labour and the land rental markets, households prefer to use their own family labour on their farm; therefore, it is less likely for them either to hire outside labour or to rent out their land.

In contrast to male labour in a household, the availability of more female labour force in a household did not affect either participation in the land rental markets or labour hiring. However, more female family labour in a household was associated with the likelihood of supplying some of that labour to off-farm employment. The result is consistent with the fact that in the Ethiopian context, the male labour force is more important for farming (and can supervise hired labour), while female household members often participate more in domestic work and in some off-farm employment activities such as collecting firewood and brewing local alcohol.

The presence of a family member with higher education (at least primary education) in a household was associated with more likelihood of hiring outside labour and renting in land. These results may suggest that highly educated family members were more likely to earn higher wages from off-farm work either within the village or outside their village. Income from the off-farm jobs could be used to finance labour hiring and land renting costs. As a result, households with skilled or well-educated household members could supply those members to work at off-farm jobs and at the same time, hire outside labour for farming.

However, households with an educated head (in this context, one who can read and write) were associated with less likelihood of land renting in activities, while they were more likely to rent out their land and work at off-farm jobs. One possible explanation could be that compared to households that had a household-head without education those with educated household heads could find some off-farm jobs. However, income from such jobs might not be enough to finance labour hiring and land renting activities. Moreover, due to time constraints, they might found it difficult to supervise farm works.

The sex of a household head is a significant factor only for the decisions concerning land rental market participation; male-headed households were more likely to rent in land, and less likely to rent out land. These results are consistent with what I found in the descriptive analysis: female-headed households on average were poorly endowed with farming resources such as oxen and a male labour force, both of which are crucial for successful farm operation; therefore, a large proportion of households on the supply side of the rental markets were female-headed.

Table 4.6: Multivariate probit estimates of determinants of land and labour market participations (2004 and 2009)

VARIABLES	Landlord	Tenant	work off-farm	Hire in labour
Male family labour (num)	-0.18***	0.00	0.08**	-0.13***
	-0.05	-0.04	-0.04	-0.04
Female family labour(num)	0.04	-0.04	0.19***	-0.05
	-0.05	-0.05	-0.04	-0.04
Head can read and write(1=yes)	0.15*	-0.26***	0.16**	0.12
	-0.09	-0.09	-0.08	-0.08
Adult literacy (proportion)	-0.39**	0.31	-0.01	0.14
	-0.19	-0.19	-0.16	-0.16
Primary education(proportion)	-0.09	0.33**	0.12	0.17*
	-0.11	-0.13	-0.09	-0.1
Secondary and above education	-0.05	0.26*	-0.04	0.46***
	-0.13	-0.15	-0.11	-0.12
Head sex(1=male)	0.37***	-0.59***	-0.06	0.04
	-0.09	-0.11	-0.08	-0.08
Per capita land size(hec)	1.24***	-1.94***	-0.79***	0.42**
	-0.2	-0.26	-0.18	-0.19
Land size square	-0.27***	0.54***	0.17***	-0.14**
	-0.06	-0.08	-0.06	-0.07
Livestock holdings(htu)	-0.55***	0.51***	-0.41***	0.21**
	-0.11	-0.11	-0.09	-0.09
Have a pair of oxen (1=yes)	-0.06***	0.08***	-0.01	0.07***
	-0.02	-0.01	-0.01	-0.01
Access to credit(1=yes)	-0.09	0.26***	-0.01	0.19***
	-0.09	-0.09	-0.07	-0.07
Equb member(1=yes)	-0.06	-0.07	0.34***	0.06
	-0.11	-0.1	-0.09	-0.09
Store crops(1=yes)	-0.11	0.27**	0.07	0.49***
	-0.09	-0.11	-0.08	-0.09
Perceived land transfer rights(1=have right)	0.09	0.11	0.06	-0.09
	-0.10	-0.11	-0.08	-0.08
Expected land loss in 5 years' time (1=yes)	0.10	0.08	-0.10	0.16
	-0.14	-0.11	-0.10	-0.11
Labour sharing(1=yes)	-0.62***	0.34***	0.17**	0
	-0.08	-0.08	-0.07	-0.07
Access to cash(100 Birr)(1=yes)	-0.13*	0.15	-0.03	0.17**
	-0.08	-0.09	-0.07	-0.07
Access to extension services(1=yes)	-0.19**	0.14	-0.17**	0.14*
	-0.09	-0.09	-0.07	-0.08

Source: Own calculations using data from ERHS. Note: Regression includes woreda(village) and time dummies, head age and age square ,and a constant. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. N=2245, chi2=1784(p=0.000), ll=-3811.

Draught animal power is a critical input in agricultural production. The coefficient on the possession of a pair of oxen is negative and significant in the landlord equation, while it is positive and significant in the tenant and the labour-hiring equations. These results indicate that relative to land and labour markets, rental markets for oxen are highly imperfect in rural areas. As a result, households without oxen tend to rent out their land, while households with oxen were in a position to lease in land and hire outside labour.

The size of a household's land holdings is another important factor that had a significant impact on that household's decisions concerning participation in the land and labour markets. In general, and against a background of limited off-farm employment opportunities, households with larger land holdings but with limited non-land resources such as labour can be expected either to rent out some of their land or to hire outside labour to cultivate their land. These households are less likely to rent in additional land or supply labour to off-farm employment. Consistent with this expectation, the estimated coefficient of per *capita* plot size is positive and significant in the landlord and labour hiring equations, while it is negative and significant in the tenant and off-farm employment equations.

However, the relationship between plot size and decisions concerning factor market participation is non-linear. The estimated coefficient of the square of *per capita* plot size is negative and significant in the landlord and labour hiring equations, while it is positive and significant in the tenant and off-farm employment equations. These results show that an increase in plot size initially increased the likelihood of renting out land, but the likelihood decreased after a certain level of plot size is reached. Similarly, increased plot size initially decreased the likelihood of renting in additional

land, but this likelihood increased after a certain level of plot size is reached. These results might suggest that because of imperfections in the non-land factor markets, land can be leased from land-rich to land-poor farmers; likewise, land can also be leased from land-poor farmers to land-rich farmers.

The propensity to hire labour initially increased with respect to plot size but then decreased after a certain level of plot size is reached. One possible explanation is that up to a certain plot size, large farm owners were in a better position to bear fixed costs of supervision; therefore, they were more likely to hire outside labour (Ray, 1998). However, variable supervision cost increases as land size increases and so efficiency of supervision diminishes as farm size increases; this implies that there is a critical plot size at which inefficiencies of supervision start to outweigh the advantage of larger plot size (Carter & Olinto, 1998).

Regarding participation in off-farm employment, an increase in plot size was associated with a lower propensity to supply labour to off-farm employment, but that propensity started to increase after a certain level of plot size. One reason why this observation applies to Ethiopia is that household income in rural areas is determined by the agricultural sector rather than labour markets due to lack of well-developed off-farm employment opportunities in rural Ethiopia. As shown in Table 4.2 above, most available off-farm employment opportunities were not well paid (there were only fewer than 2% professional jobs, such as teaching). As a result, income from off farm work is not attractive in comparison to farm income in rural areas, suggesting that farm households with more land and less education prefer to spend more time on their own farms in order to achieve food self-sufficiency. However, the positive coefficient on the square of the plot size might indicate that households with larger

plot sizes could participated in off-farm self-employment activities such as grain and livestock trades.

Furthermore, it is suggested that in addition to imperfections in labour and oxen markets, imperfections in the credit market also affect decisions by households on whether to participate in land lease markets. Consistent with this view, I found that households that stored crops during the survey period and got access to credit were more likely to rent in additional land and hire in outside labour. Similarly, households that were richer in livestock holdings were more likely to rent in additional land and hire in outside labour, while they were less likely to rent out their land and work in off-farm jobs. Results also show that households who had the ability to get at least 100 birr if needed were more likely to hire outside labour, while they were less likely to rent out their land. These results suggest that poor farmers with liquidity constraints tend to find it difficult to rent in more land, and to finance their production costs.

One variable that indicates both a social network and access to finance is referred to as *Equb*, which is a rotating saving scheme. The coefficient of this variable is positive and significant only as far as participation in off-farm employment activities is concerned. This result suggests that credit constrained individuals might exploit this kind of saving scheme to provide start-up capital, particularly in order to participate in off-farm self-employment activities.

Likewise, participation in local labour sharing arrangements indicates both a social network and access to labour. The coefficient on this variable is positive and significant in the tenant equation, while it is negative and significant in the landlord equation suggesting that access to labour via labour sharing arrangements was

associated with more likelihood of land renting in and less likelihood of land renting out. The result suggests that there is significant labour market failure in rural areas. Participation in local labour sharing arrangements was also associated with more likelihood of supplying labour to off-farm jobs. The result may suggest that those households who participated in labour sharing arrangements were also had more family labour that could work at off-farm jobs.

In addition, farm households who got access to extension services were less likely to rent out their land and work at off-farm jobs, while they were more likely to hire outside labour. This result is expected as the analysis in Chapter 3 showed that compared to poor household (in farming resources) those households that were rich in in farming resources(for example, land, labour and livestock) were more likely to get access to extension services. Thus, relative to poor farmers, rich farmers are expected to rent in more land and less likely to rent out their land.

A lack of secure land tenure was identified as one of the key determinants of farmers' land and labour market participation decisions in rural Ethiopia (De Brauw & Mueller, 2012; Deininger, et al, 2011; Holden et al., 2011). In contrast to these findings, in this study none of the variables indicating household tenure security status are significant in the factor market participation equations. Thus, farmers' perception of tenure insecurity (expectations of losing land) and land transfer rights had no impact on their land rental and labour market participation decisions. The result is consistent with what was found by Segers et al. (2010) and results I found in Chapter 2; given the nature of rural factor markets farmers' participation in land rental markets are not influenced by land titling or perceived tenure insecurity.

Lastly, the coefficients on village dummy variables suggest that there were significant differences in factor prices and other socio-economic variables from one village to another; thus, decisions on participation in the land and labour markets could differ from one village to the next.

In summary, the analysis in this Chapter shows that households who were well endowed with farming resources were more likely to participate as a tenant in land rental markets and hire outside labour, while household who were poorly endowed with farming resources were more likely to rent out part of their land and work at off farm jobs. These results suggest the presence of significant market imperfections in credit and non-land factor markets in rural areas. Although farm households use sharecropping contractual arrangements to overcome credit and factor market imperfections, poor frames may still be rationed out from tenancy markets, if sharecropping involves initial input cost sharing arrangements.

4.7. Conclusion

This chapter examine decisions pertaining participation in the land rental and labour markets made by farm households in rural Ethiopia. Results from descriptive and econometric analysis suggest that imperfections in land, labour, drought animals, and credit markets were important factors in determining the nature of household participations in rural factor markets. However, perceived tenure security status was not related to any of the factor market participation decisions. In general, results show that households that were well endowed with farming skills and resources, and got access to credit were more likely to participate as a tenant in land lease markets and hire outside labour. In contrast, female-headed households and/ or households that

were less endowed with farming skills and resources were more likely to rent out their land and participate at off-farm jobs. In this way, land rental markets enhanced allocative efficiency by transferring land from less efficient farmers to farmers that are more efficient.

Moreover, results show evidence of a non-linear relationship between plot size and decisions by households concerning land rental and labour market participations. An increase in plot size was initially correlates positively with a greater likelihood of renting out land, but this likelihood decreased after a certain level of plot size. Likewise, an increase in plot size initially decreased the likelihood of land renting in, but land renting in increased after a certain level of plot size. These findings suggest that, against the background of many imperfections in the non-land factor markets, not only land rich households who rent out land, but households that are poorly endowed with non-land productive assets (but not necessary rich in land)

If markets for insurance and credit function perfectly (smoothly), and there are no significant transaction costs associated with land and labour markets, efficiency can be achieved either by using the land rental markets or the labour markets (Otsuka et al, 1992; Otsuka, 2007). In such cases, farmers with less faming ability can rent out their land to more able famers and earn income by selling their labour in the nonfarm sector. This suggests that given the lack of well-paid off-farm employment opportunities in rural areas coupled with a lack of credit to finance agricultural production, it appears that land renting out by poor households can increase their vulnerability, worsen their poverty, and make their food supply insecure. This implies that participation in land rental markets has important implications for income distribution and poverty alleviation in rural Ethiopia. In the next chapter, I further

examine the relationship between households' participation in land rental markets and their welfare in rural Ethiopia.

CHAPTER 5: POVERTY PERSISTENCE IN ETHIOPIA: THE ROLE OF LAND RENTAL MARKETS

5.1. Introduction

While the agricultural sector in Ethiopia accounts for about 43% of the national GDP, it employs approximately 85% of the country's labour force (MoARD, 2010). This indicates a lower return to agricultural labour. A decline in per capita farm size, owing to lack of alternative employment opportunities coupled with rapid population growth in the country, resulted in a reduction in the marginal productivity of farm labour and increased the prevalence and persistent of poverty in rural areas (Rahmato, 2004). In this regard, access to additional land is an important determinant of farm household income in rural Ethiopia. For this reason, in Ethiopia and many other poor agrarian economies, there has been a renewed interest in facilitating access to land for the poor as a poverty-reducing tool (Holden, Otsuka & Place, 2009).

Several studies show that access to land had a significant and positive effect on household welfare (Bigsten, Kebede, Shimeles & Taddesse, 2003; de Janvry & Sadoulet, 2001; Ellis & Bahiigwa, 2003; Ellis & Mdoe, 2003; Finan, Sadoulet & de Janvry, 2005; Jayne et al., 2003; Karugia, Oluoch-Kosura, Nyikal, Odumbe, & Marenya, 2006; Keswell & Carter, 2014; Mukherjee & Benson, 2003; Nguyen & Tran, 2013; Van Landeghem, Swinnen, & Vranken, 2013). However, it is also suggested that the welfare benefit of access to land can be very limited if other complementary assets, such as access to credit and labour, are not available for small-scale farmers (Carter & May, 1999;Carter & Olinto, 2003; Carter & Zimmerman, 2000; Finan et al., 2005;Guirkinger & Boucher, 2008; Yao, 2000).

In the face of multiple market imperfections in credit and other non-land factor markets in many developing countries, well-functioning land rental market is considered important in facilitating access to land for the poor (Deininger, 2003; Deininger & Jin, 2005). Despite this, little is known about the impacts of farmers' participation in land rental markets on household poverty dynamics. For example, studies by Tatwangire and Holden (2011) from Uganda, and Jin and Jayne (2013) from Kenya, show that access to land through land rental markets increased household income. These studies though only considered the impacts of participation in land rental markets on household income/welfare for those households that participated on the demand side of the land rental markets.

The study by Jin and Jayne (2013) show that once the rental payment and other production costs are accounted for, access to land through land rental markets increased households' crop and total income by an average of 25.1% and 6.65%, respectively, compared to not renting (p.267). They show that households who leased in land generated 2.19 shillings of net crop revenue on rented land for every 1 shilling paid to the owner of the land. This suggests that tenants received high net revenue from producing on rented plots. Likewise, a recent study by Keswell and Carter (2014) in South Africa show that the long-term effects of asset transfer programs (land transfers) are larger than cash transfer programs because asset transfers "have the potential to crowd-in investment, learning, and income increases beyond what would be expected from the direct transfer alone" (p.260).

Furthermore, the analysis in Chapter 4 shows that in contrast to tenants, those farmers who leased out their land were at the lower end of the asset distribution scale. Therefore, it is important to examine whether households participation in land rental

markets is associated with poverty reduction for both landlord and tenant households. Thus, this chapter aims to analyse the relationship between households' land rental market participation decisions and poverty dynamics using data from rural Ethiopia. Given landlords are relatively asset poor compared to tenants, this study hypothesised that agricultural output and total income would be higher for those households who leased in land, while it would be smaller for those who leased out land. Thus, participation in land rental markets as a tenant is expected to improve households' chance of escaping poverty, while participation as a landlord is expected to be associated with less likelihood of escaping poverty.

The study contributes to the existing literature on the relationship between land access and household welfare in two ways. First, the study examines the relationship between participation on the supply side of the land rental markets and household poverty dynamics; this issue is not well studied. Second, and in contrast to other studies which used consumption or income data to analyse poverty transitions, this study uses both an asset index and self-rated subjective welfare indicators to measure household welfare. It is well known that poverty in rural areas is multidimensional (El Ghonemy, 2007). Thus, one advantage of using self-rated and asset-based poverty indicators is that these indicators account for the non-income dimensions of welfare. In addition, asset-based poverty indicators are considered less prone to measurement errors, and it enable us to distinguish persistent structural poverty from transitory poverty (Baulch & Hoddinott, 2000; Carter & Barrett, 2006; Filmer & Scott, 2012).

The organisation of this chapter is as follows: Section 5.2 begins with a literature review. Section 5.3 describes the patterns of land inequality in the sample area and their relation to household economic wellbeing. The estimation strategies and

estimation results are then discussed in sections 5.4 and 5.5, respectively. Section 5.6 concludes the chapter by providing a summary of the major findings.

5.2. Literature Review: Theory and Empirical Evidence

In a model of perfectly functioning factor markets, where it is assumed that factors of production are paid their marginal products, the initial land ownership distribution will not matter. This is because the market would re-allocate land to more efficient and able producers, thus contributing both to allocative and productive efficiency (Benjamin & Brandt, 1997; Otsuka, 2007). In such a situation, "Inequality of land thus maps directly into inequality of income through the implied distribution of rental income" (Benjamin & Brandt, 1997, p.461).

In contrast, in areas characterised by both land scarcity and substantial market failures in labour, credit, and insurance markets, land ownership grants benefits in excess of the scarcity rent (Benjamin & Brandt, 1997; Finan et al., 2005). In this case, secure access to land determines a household's ability to produce for its subsistence. That household then self-insures itself against food price increases, unemployment risks, as well as improves its position in financial markets (Benjamin & Brandt, 1997; Burgess, 2001; Deininger, 2003; de Janvry & Sadoulet, 2000, 2001; Ellis, 2000; Finan et al., 2005; Jayne et al., 2003). The initial distribution of land, hence, has important implications for poverty reduction and income inequality. In addition, improved access to land usually leads to an increase in economic growth and poverty reduction (Deininger, 2003; Jayne et al., 2003; Salam, Kamara & Brixiova, 2010). For this reason and because of an increase in the degree of land scarcity, in many poor

agrarian economies, there has been a renewed interest in facilitating access to land for the poor as a poverty-reducing tool (Holden et al, 2009).

Moreover, the observed inverse relationship between farm size and land productivity and/ or labour intensity in most developing countries suggests that small-scale farmers with family labour are more productive compared to large-scale farmers with hired labour (Benjamin & Brandt, 2002; Berry & Cline, 1979; Carletto, Savastano & Zezza, 2013; Feder, 1985; Lipton, 2006, 2009).[41] One implication of these findings was that land redistribution from large-scale farmers to small-scale farmers would improve overall welfare by improving efficiency and farm output (Berry & Cline, 1979; Griffin, Khan & Ickowitz, 2002; Lipton, 2009). Consequently, government mandated land redistributions have been wildly used in most parts of the developing world, including Ethiopia, to improve access to land for the poor, and equalise factor proportions at farm level.

Some researchers argued that given a high degree of initial land inequality, government mandated land redistributive reforms could enhance equitable access to land, increase overall output, and reduce income inequality and poverty in rural areas (Berry & Cline, 1979; Griffin, Khan & Ickowitz, 2002). However, government mandated land redistribution is also criticized on the ground that it adversely affects security of tenure and efficient resource allocation, thereby negatively affecting investment and agricultural productivity (Deininger et al., 2011; Holden et al., 2011).

[41] A good review of the literature on this issue can be found in Lipton (2009)

In this regard, it is suggested that from both the equity and efficiency perspectives, land markets can play a key role in adjusting factor ratios at farm level (Deininger, 2003; Jin & Deininger, 2009; Yamano, Place, Nyangena, Wanjiku, &Otsuka, 2009). In particular, land rental markets tend to promote the transfer of land from large and/or less efficient farmers to small and/or more efficient farmers (Ahmed, Gebremedhin, Benin & Ehui, 2002; Deininger, 2003; Deininger & Mpuga, 2009; Deininger et al., 2011; Jin & Deininger, 2009; Gavian & Ehui, 1999; Kassie & Holden, 2007; Otsuka, 2007). In this way, better allocative and productive efficiency can be achieved through land rental markets, as these markets can allow land to be used by households that need it and are able to farm it.

However, as mentioned in Chapter 4, due to significant transaction costs, land rental markets do not often operate efficiently (Deininger et al., 2009, 2011). Moreover, because of multiple imperfections in credit and non-land factor markets, the contribution of land rental markets to achieve equitable distribution of land holdings is also limited. Previous studies show that land rental markets transferred land from land-rich farmers to land-poor and landless farmers contributing to more equitably operational land holdings (Deininger et al., 2009, 2011; Deininger & Mpuga, 2009; Pender & Fafchamps 2001). However, there is also evidence that land rental contracts tend to transfer land from land-poor and/or female-headed households to land-rich and/male-headed households (Gebregziabher & Holden, 2009; Ghebru & Holden, 2008; Tikabo, 2003). The analysis in Chapter 4 of this study also shows that due to significant market imperfections in other non-land factor and credit markets, asset poor households tend to rent out their land more.

Such land renting out by poor landlords important means of mitigating their resource constraints in the short-run. In particular, land rental contracts such as sharecropping can directly compensate for market failures in credit, insurance, and managerial skills (Binswanger & Rosenzweig, 1986; Eswaran & Kotwal, 1986). However, in the face of limited access to credit and off-farm employment opportunities in rural Ethiopia, land renting out by poor farmers may increase their vulnerability and affect their long-term welfare adversely. For example, a study by Gebregziabher and Holden (2011) showed that poor landlords that had experienced shocks such as food shortage were more likely to rent out their land at reduced price at the expense of future income. For this reason, it is important to understand the impacts of land renting by poor-farmers on their household welfare.

Although existing evidence suggests a significant and positive impact of access to land on household income/welfare, most of the existing studies on this issue looked at the effects of access to land, mainly obtained through either administrative allocation or inheritance on household income/welfare. There is a lack of empirical evidence showing the connection between decisions by farm households to participate in land rental markets and household poverty. In the context of Africa, Jin and Jayne (2013) in Kenya have recently analysed the impact of participation in land rental markets on the sample households' crop and total income. These researchers show that access to land through land rental markets increased households' crop and total income by an average of 25.1% and 6.65%, respectively, compared to not renting (p.267). This suggests that tenants received high net revenue from producing on rented plots.

Likewise, using data from Uganda, Tatwangire and Holden (2011) examined the impacts of land access both through market and non-market avenues on poverty. They

found that land acquired through land markets (both rent and purchase) has strong positive welfare effect. However, these studies considered the impacts of participation in land rental markets on household income only for those households that participated on the demand side of the land rental markets. Against this background, this chapter is concerned with the analysis of the relationship between households' participation decisions in land rental markets and their welfare for both tenant and landlord households.

The analysis relies on the agricultural household model developed in Chapter 4, where farm households assumed to get their income from working on farm (including rented land), from off-farm employment, and from renting out their land. The model assumes that loan access depends on household wealth and land size. Thus, if we assume that the same production technology is used in the production process, then agricultural productivity (output) depends on resource endowments (Guirkinger & Boucher, 2008). As a result, resource poor households are expected to have lower agricultural output compared to resource rich households. Moreover, land-poor households have limited access to well-paying off-farm jobs in rural Ethiopia. For example, the study by Jayne et al. (2003) showed that in the case of Ethiopia, the off farm income share as a whole was only 12.7% of the total income for households in the lower land-size quantiles.[42]

Furthermore, the analysis in Chapter 4 shows that in contrast to tenants, those farmers who leased out their land were at the lower end of the asset distribution scale. Given landlords are relatively asset poor compared to tenants, this study hypothesised that

[42] The countries they covered in their study were: Ethiopia, Kenya, Rwanda, Mozambique and Zambia.

agricultural output and total income would be higher for those households who leased in land, while it would be smaller for those who leased out land. Thus, participation in land rental markets as a tenant is expected to improve households' chance of escaping poverty, while participation as a landlord is expected to be associated with less likelihood of escaping poverty.

Data on the amount of net farm and non-farm income, and income obtained from land renting out activities are not complete in the dataset. As a result, it is not possible to directly compare net gains obtained from land renting in activities with that of land renting out activities. Instead, using asset index and subjective poverty indicators, this study examines whether the likelihood of escaping poverty is related with participation on either side of the land rental markets. In subsequent sections, I examine the relationship between land access, participation in land rental markets, and household poverty. Appendix B, provides the framework used to construct asset-based poverty measures in this study.

5.3. Land Endowments, Land Rental Markets and Economic Well-being

The pre-1975 land tenure system was characterised by a highly unequal distribution of land. Thus, equity, efficiency and the provision of a social safety net were the primary functions of both the initial land reform in 1975 and other subsequent land reforms in Ethiopia. In general, following the land reform in 1975, there was a strong presumption that land was more equitably distributed in Ethiopia when compared to other African countries (Rahmato, 1993). However, recent empirical studies have questioned this presumption (Kebede, 2008; Githinji & Mersha & 2007). For example, using data from the 1995 and 1997 survey years of the ERHS, Kebede

(2008) showed that the Gini coefficient for *per-adult (PA) allocated land size* is 0.596; moreover, this coefficient remains as high as 0.439, even after trimming the top and bottom 10% of the data. This result suggests the presence of high inequality in land holdings among rural areas of the country. In this section, using a more recent data set (from 1994 and 2009 survey rounds), I examine the current land distribution pattern in the sample area, together with the change over time and its relation to household income and asset holdings.

5.3.1. Land distribution pattern in the sample area

Table 5.1 provides decile rankings of allocated and cultivated land sizes for sample households in the 1994 and 2009 survey years. In 1994, households in the bottom two deciles of land distribution of had only 0.34 hectares of allocated land which reduced to 0.1 and 0.07 hectares when one takes into account the per-adult allocated land size and the per-adult cultivated land size, respectively. These figures show that there were very many almost-landless households in the sample area.

Table 5.1: Deciles of allocated and cultivated land sizes (1994 and 2009)

	1994			2009		
Deciles	Allocated land size	Per-adult allocated land size	Per-adult cultivated land size	Allocated land size	Per-adult allocated land size	Per-adult cultivated land size
10	0.09	0.02	0.01	0.37	0.09	0.03
20	0.25	0.08	0.06	0.50	0.14	0.09
30	0.50	0.14	0.12	0.75	0.20	0.15
40	0.75	0.19	0.17	1.00	0.27	0.21
50	1.00	0.28	0.25	1.15	0.33	0.29
60	1.44	0.39	0.36	1.50	0.42	0.36
70	2.00	0.53	0.50	2.00	0.54	0.48
80	2.75	0.73	0.69	2.75	0.71	0.63
90	4.25	1.15	1.00	3.50	1.03	0.86

Source: Own calculations using data from ERHS. Note: here 'allocated land' means land not obtained via land rental markets.

However, the results shown in Table 5.1 indicate that both the allocated and cultivated land sizes increased significantly in 2009, especially for households in the bottom four deciles of the land distribution. On the one hand, allocated land size increased by about 300% for households in the first (bottom) decile and by about 100% for those in the second-from-bottom decile. On the other hand, the per-adult allocated land size declined by 2% and 10% for households in the top two deciles of the land distribution, respectively. Such shifts may reflect the nature of land redistributions in the past as in many instances, land redistribution in Ethiopia had involved taking land from large holders and giving it to smaller holders (Alemu, 1999).

Results in Table 5.1 also indicate evidence of high inequality in the land- holding sizes in the sample area. For example in 1994, the average allocated land-holding size per adult in the top two deciles was 18.8 times larger than the corresponding figure in the bottom two deciles, while the average per-adult cultivated land size in the top two deciles was 24 times larger than the figure in the bottom two deciles of the distribution. Likewise, the Pen's Parade dispersion measure (Figure B.1 in the Appendix) also shows that for all study periods, the land-rich household had over five times more land than the mean land size allocated per adult. Moreover, the Gini coefficient in 1994 was 0.54 and 0.53 for the per-adult allocated and cultivated land sizes, respectively (Table 5.2). These results suggest that there is a high degree of inequality in land holdings in the sample area.

Table 5.2: Inequality in land holdings (1994-2009)

Year	Gini coefficient	Theil index GE(a = 1)	Mean Log Deviation GE(a = 0)	Half Coeff. Var. squared GE(a = 2)
Per-adult equivalent PA Allocated land				
1994	0.54	0.51	0.70	0.67
1999	0.51	0.45	0.52	0.67
2004	0.47	0.38	0.46	0.51
2009	0.46	0.36	0.45	0.46
Per-adult cultivated land size				
1994	0.53	0.48	0.68	0.61
1999	0.46	0.36	0.44	0.44
2004	0.45	0.35	0.43	0.47
2009	0.45	0.35	0.46	0.41

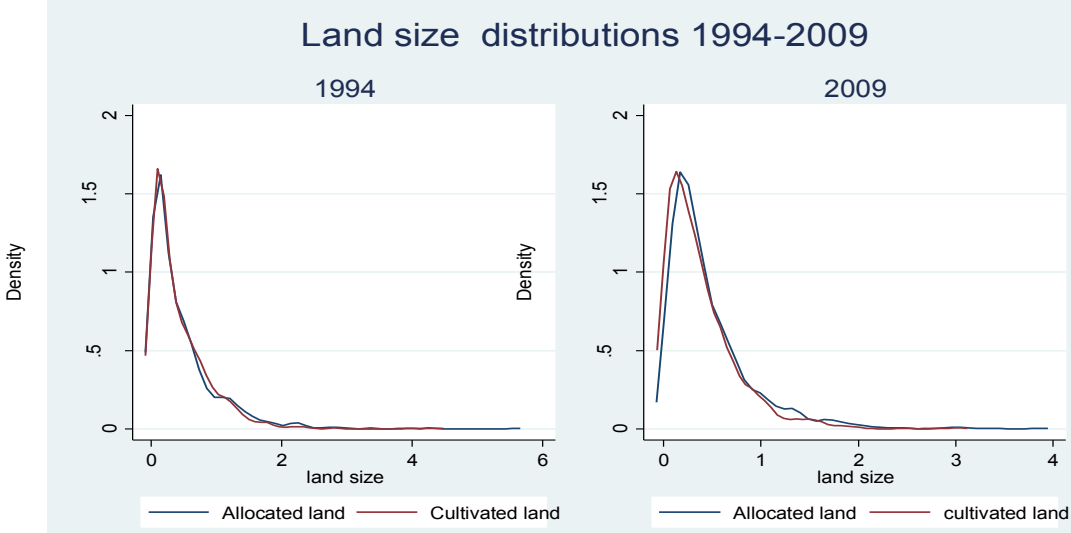
Source: Own calculations using data from ERHS.

However, there is a slight decrease in inequality over time for both the per-adult allocated and cultivated land sizes; this decrease is evident for all inequality measures (Refer to Table 5.2. and Figures B.2 and B.3 in the Appendix). For example, the Gini coefficient for the per-adult allocated land size reduced from 0.54 in 1994 to 0.46 in 2009, while it reduced from 0.53 to 0.45 for the per-adult cultivated land size. Access to additional land through Peasant Associations (PA) allocation might have contributed to the decline in inequality in the per-adult allocated land holdings. The change in inequity in the per-adult cultivated land size could be partly attributed to land rental markets because participation in land rental markets is officially allowed after 1994.

Despite the decline in land inequality over time, the inequality analysis suggests that there is a significant gap between the land-poor and land-rich households in rural

areas of Ethiopia. Furthermore, the data show evidence of a strong and monotonic relationship between the average amount of per-adult cultivated land size and the per adult allocated land size (Table B.1 in the Appendix and Figure 5.1). For example, Table B.1 shows that 10% of the land-poor households, on average, cultivated only 0.06 and 0.08 hectares of land in 1994 and 2009, respectively. The corresponding figures for the top 10% of the land-rich households were 1.28 and 1.05 hectares, respectively. These figures show that on average households with small amounts of allocated land holdings also cultivated small sizes of land, while land-rich households cultivated, on average, larger land sizes.

Figure 5.1: Allocated and cultivated land size distributions (1994 and 2009)



Kernel density estimates from the 1994 and 2009 rounds of ERHS panel data.
Note: Allocated and cultivated land sizes are per-adult equivalent land sizes.
Allocated land refers to land holdings excluding plots obtained thorough land rental markets.
Cultivated land refers to land obtained thorough both market and non-market means.
Source: Own calculations.

5.3.2. Land endowment and poverty

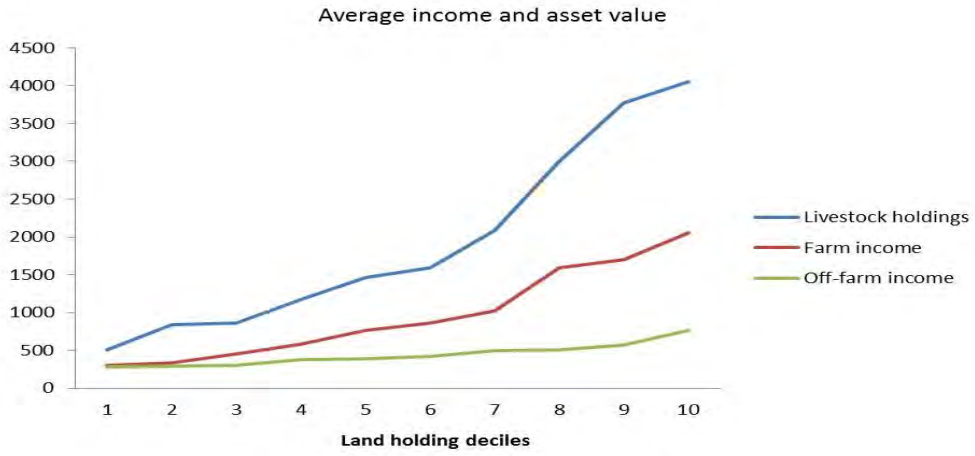
Using both asset-based and subjective poverty indicators, this sub-section discusses the relationship between land size endowment and poverty profile for the sample

households. Data on the subjective poverty indicators were collected only during the 2004 and 2009 survey years of the ERHS. Household heads were asked to answer these questions. One of the subjective well-being indicator asked respondents to evaluate economic well-being of a household in general. Answers to this question coded "poor" (code 1) to "rich" (code 5). Multiple correspondence analysis is used to construct the asset index. See Appendix B for the detail on the methodology.

Given that farming is the dominant source of employment and the main income source in rural areas, household income is expected to be lower for households that are poor in terms of PA allocated land holdings. To examine this, Figure 5.2 presents the trends in 2009 for average per-adult livestock holdings and gross farm and nonfarm income by allocated land holding deciles.[43] The figure shows the presence of a positive and monotonic relationship between per-adult allocated land deciles and per-adult livestock holdings and farm income. In contrast, there is relatively little correlation between off-farm income and the land holding size distribution, though off-farm income was on average higher for land-rich households compared to land-poor households. The result indicates that land is the key determinant of household income and welfare in rural Ethiopia.

[43] Calculating net farm income is not easy because the data on agricultural inputs seem unreliable and incomplete. Data on off-farm income were collected only for participation in off-farm jobs in four months for each year. Therefore, to make it comparable with farm income, I multiplied the off-farm household income by 3. However, given the seasonal nature of the off-farm jobs this figure surely exaggerates the total off-farm income a household gets in a given year. Even so this income is very low.

Figure 5.2: Average income and asset values by land size deciles (2009)



Source: Own calculations using data from ERHS, 2009. Note: Both farm and off-farm incomes are gross incomes. All the figures are expressed in terms of per-adult equivalent household size.

Table 5.3 further illustrates the relationship between the distribution of land holdings and household poverty in the sample area. Both the subjective poverty indicators and the asset index variable were used to measure poverty.[44] The result shows that the average asset index increases with respect to the increase in land holding quantile. The average welfare index for households in the first land holding quintile was only 0.6, while the figure increased to 2.1 for those in the second land holding quantile and it further increased to 2.8 for those in the fifth quintile. Likewise, for households in the first quintile, the percentage of households reporting that they were poor was 36.3% based on the self-rated poverty scale variable and 62.5% based on the general economic condition indicator variable: the corresponding percentages were only

[44] Households were classified as 'poor' based on the self-rated poverty scale variable if they had reported that they were poor/destitute or they never had enough for their family. Similarly, based on the general economic condition variable, households were classified as poor if they had reported that they were unable to meet family needs or were struggling.

17.4% and 36% for those in the fifth quintile. These results also suggest that land is among the key determinants of household poverty in rural Ethiopia.

In addition, it is evident that the average household size increases with respect to an increase in the size of land holdings (Table B.1 in the Appendix). This finding is consistent with the fact that PA officials often allocate land to farm households based mainly on family size. In view of the existing low level of technology in rural Ethiopia, labour is an important input for agricultural production, which suggests that land-rich households were in a better position than land-poor households to exploit their land holdings and family labour.

Table 5.3: Household poverty status by land holding quintile (2009)

Per-adult allocated land holding quintile	Percentage of poor households		Average asset index (CIP)
	Self-rated poverty scale	General economic condition indicator	
First	36.3	62.5	0.6
Second	33.5	56.5	2.1
Third	23.4	50.4	2.2
Fourth	19.0	41.7	2.6
Fifth	17.4	36.0	2.8
Total	25.9	49.4	2.9

Source: Own calculations using data from ERHS.

The positive relationship between allocated land holding size, other household asset holdings, and household poverty suggests that the initial land distribution has important implications for the distribution of income and rural poverty. Unlike allocated land holdings, the degree of inequality in operational land holdings can be reduced by means of land rental markets as these markets allow for the transfer of land from land-rich to land-poor households (Deininger et al., 2011). However, the

findings in this section suggest that the factor-equalising effect of land rental markets was very limited; indeed, it appears that the operational land holding size depends far more on the initial land holding size for a given household. This strong positive relationship between the operational land holding size and the initial land holding size suggests that poor households are less likely to get access to additional land through land rental markets.

Table 5.4 illustrates the relationship between the self-rated poverty status of households and their decisions concerning participation in the land rental markets.[45] The table shows that as far as those households that consider themselves as poor are concerned, 29% never participated, 11% leased in land, and 60.1% leased out land. As far as those who reported never having enough for their family are concerned, 35.5% remained self-sufficient, 17.4% leased in land, and 47.2% leased out land. The percentage of households that participated at least three times in the demand side of the rental market was higher in the case of those that were very rich or rich (28.5%) than those were poor/destitute households (2%). In contrast, the percentage of households that leased out land more frequently was found to be higher for those who were poor/destitute (18%) compared to rich/very rich households (4.1%).

[45] In the analysis, the participation condition for land rental markets was not restricted to the period 2004 and 2009. For example, the variable Rent in (>=3times) indicates that households have been participating in land rental markets even before 2004.

Table 5.4: Rental market participations by self-rated poverty status (pooled data, 2004 and 2009)

		Leased in		Leased out			
	Autarkic	1 or 2 times	>=3 times	1 or 2 times	>=3 times	Total Sample	(% poor)
Poor/ destitute	29.0	9.0	2.0	42.0	18.1	410	17.1
Never had enough	35.5	13.2	4.2	36.5	10.7	310	12.9
Can manage	29.6	19.6	8.0	34.2	8.5	739	30.8
Comfortable	28.4	22.2	17.8	25.8	6.0	772	32.1
Very rich/rich	21.5	24.4	28.5	21.5	4.1	172	7.2
Total sample	704	436	266	774	223	2403	
(%)	29.3	18.1	11.1	32.2	9.3		100

Source: Own calculations using data from ERHS.
Notes: Leased in(>=3 times) and leased (>=3 times) indicate participation in land rental markets for at least three times since 1994.

To summarise, the preceding descriptive analysis suggests evidence of high inequality in per-adult allocated and per-adult cultivated land size distributions in rural Ethiopia. Moreover, there is evidence of a strong and monotonic relationship between allocated land holdings and cultivated land holdings implying that households with smaller initial allocated land holdings also cultivated smaller land sizes. Farm households with smaller land holdings were also found to be poorer (in terms of livestock and farm income) than land-rich households.

Furthermore, the findings provide evidence of a relatively higher incidence of poverty among households that participated on the supply side of the land rental markets, when compared with those that participated as tenants. This implies that those households that leased out lands were more likely to be poor compared to those who leased in land. The descriptive analysis, however, cannot control for factors that affect both poverty and households 'decisions to participate in the land rental markets.

Therefore, in the next section, I use estimation techniques to analyse the impacts of participation in land rental markets on household poverty using both the asset index variable and the self-rated subjective poverty indicator to measure household poverty.

5.4. Estimation Strategies

This section describes the estimation strategies used in the econometric analysis. First is a discussion of the estimation techniques used to analyse the relationship between participation in land rental markets and household poverty status. Following this, I discuss the estimation technique used to analyse poverty dynamics for tenant and landlord households.

5.4.1. Relationship between participation in land rental markets and household poverty

The dependent variable of interest is poverty (measured at household level). Two alternative poverty measures were used in this analysis. The first one is the subjective welfare indicator variable (self-rated poverty scale), which indicates a sample household's perception of their current level of economic well-being, using a scale from 1 to 5. The second one is the welfare index variable, the Composite Poverty Index (CPI1) variable, which is a continuous variable.[46] The use of these alternative measures may help to check the robustness of my findings to different measures of poverty.

[46] The Composite Poverty Index (CPI1) is calculated without including variables that directly affect land rental market participation decisions using data from the 2004 and 2009 survey rounds. The variables excluded from the CPI1calculation are land size, number of oxen in a household, ownership of farming equipment (hoe and plough), household-head characteristics (sex and education), and male labour force (See Appendix B for more detail).

The general empirical model depicting the relationship between a household's land renting activity and the household's poverty status is provided using the following single latent variable index model (Wooldridge, 2010):

$$Y_{it}^{*} = X_{it}^{'}\beta + \theta R_{it} + \lambda_i + \upsilon_{it} \qquad [1]$$

Here, Y_{it}^{*} indicates unobserved latent variable for the dependent variable indicating a given welfare indicator; $X_{it}^{'}$ indicates a vector of independent variables measuring certain household characteristics that are expected to affect household welfare; R_{it} indicates a variable used to distinguish rental behaviour of households (i.e. rent in, rent out or autarkic); λ_i indicates time-persistent, unobserved household heterogeneity; and, υ_{it} indicates random error term, while β and θ are vectors of parameters related to the independent variables in the model. In addition to the socio-economic household characteristics, village (woreda) dummies were included in the estimation model to control for differences in agro-ecological conditions, cropping practices, population pressure, access to markets, and prices.

Due to the ordered nature of the subjective welfare indicator variable, it is common practice to employ ordered probit/logit estimation models in order to estimate the impact of participation in land rental markets on subjective economic well-being. Based on these estimation models, the observed ordinal variable, Y_i, takes on values ranging from 1 through M according to the following scheme (ignoring λ_i and the time subscript for simplicity):

$$Y_i = j \text{ if } \alpha_{j-1} < Y_i^{*} \leq \alpha_j,\ J = 1,...,M \qquad [2]$$

where $\alpha_0 = -\infty$ and $\alpha_m = \infty$

Then, the probability that observation 'I' will select alternative 'j' is:

$$\Pr(Y_i = j) = \Pr(\alpha_{j-1} < Y_i^* \leq \alpha_j)$$

$$= \Pr(\alpha_{j-1} < X_i'\beta + \theta R_i + \upsilon_i \leq \alpha_j)$$

$$= \Pr(\alpha_{j-1} - (X_i'\beta + \theta R_i) < \upsilon_i \leq \alpha_j - (X_i'\beta + \theta R_i))$$

$$= F(\alpha_{j-1} - X_i'\beta - \theta R_i) - F(\alpha_{j-1} - X_i'\beta - \theta R_i)$$

For ordered probit, F is a standard normal cumulative density function, while for ordered logit, F is the logistic cumulative density function. The sign of the regression parameters, β and θ, shows whether the latent variable Y_i^* increases with a regressor. For instance, if β_j is positive, then any increase in x_{ij} decreases the probability of being in the lowest category (in my case being poor) and increases the probability of being in the highest category (being less poor).

One of the assumptions underlying the standard ordered probit/logit models is the proportional odds/parallel regression assumption; this assumes that the estimated coefficients of independent variables are the same across all categories of an ordered dependent variable. However, this assumption is often violated (Pfarr, Schmid, & Schneider, 2011; Williams, 2006). For instance, it is possible that the effects of participation in land rental markets could be different in respect of different parts of the outcome distribution. In this event, alternative models such as the generalised ordered probit/logit models can be used. These models relax the parallel regression assumption of the standard ordered probit/logit models (Williams, 2006). Moreover,

individual heterogeneity in the model can be accounted for using the random-effects generalised ordered probit model (Pfarr, Schmid, & Schneider, 2011). For these reasons, I estimated both the standard ordered probit models and the generalised ordered probit models with random effects specification.

In the case of the second dependent variable, the asset index variable, ordinary least squares (OLS) estimation technique can be used. However, in estimating the effects of participation in land rental markets on household poverty, the decision to participation in land rental markets could be endogenous. One potential source of endogeneity bias is that unobserved characteristics could influence poverty status and farmers' participation decisions in the land rental markets simultaneously. Another source of endogeneity is reverse causality. Poverty in farming resources may lead to farmers to participation in land rental activities (for example rent out their land). These endogeneity issues could result in a biased estimation.

In order to deal with the endogeneity problems mentioned above, I used the estimation framework proposed by Deb and Trivedi (2006). The model allows estimating the outcome equation and a selection equation that generating process of the treatment simultaneously. The outcome variable can be continuous, binary or integer-valued, while the treatment choice is assumed to follow a mixed multinomial logit distribution. In my case, the outcome variable is the Composite Poverty Index variable (CPI1), while the endogenous multinomial treatment variable is the variable indicating households' land rental market participation choices. Following Deb and Trivedi (2006), maximum simulated likelihood method is used to estimate the model.

Three alternative models were estimated using three alternative measures of the main variable of interest (R_{it}), which indicates the status of a household's participation in land rental markets. The first model (Model 1) includes a variable indicating participation in land rental markets for each survey year separately (2004 and 2009), and all households fall into one of three categories: leased in, not participated, and leased out. The second model (Model 2) includes a variable indicating the type of participation in land rental markets since 2004 for those households that never participated in rental markets before then; the purpose is to exclude the effect of earlier land renting activity on current poverty status (2009). The third model (Model 3) includes a variable indicating the frequency of household participation in rental markets since 1994. Accordingly, households were classified as follows: never participated (never); leased in one or two times (leased in sometimes); leased in three or more times (leased in most of the time); leased out one or two times (leased out sometimes) ,and leased out three or more times (leased out most of the time). In all the models, non-participates are the base category.

5.4.2. Poverty Persistency and Land Rental Markets

This section presents the techniques used to analyse poverty dynamics for tenant and landlord households. Survival (duration) data analysis has been used widely to study poverty dynamics (Bane & Ellwood, 1986; Jenkins, 2000). In survival data analysis, the outcome to be modelled is the time to an event of interest: the survival time (Allison, 1995). The main advantage of using survival (duration) data analysis is that it overcomes the estimation bias due to the problem of non-normality of the distribution for time to an event.

In addition, all survival data analysis techniques accommodate right censoring which is a common phenomenon in longitudinal and survival data (Allison, 1995). Usually three types of censoring are encountered in any survival data analysis: right censoring, left censoring, and interval censoring (Allison, 1995). Right censoring occurs either when the subject under study stops being at risk for various reasons (for example, dropping out of the study or experiencing another competing risk) or the event does not occur before the end of the observation period. This leads to an underestimate of the true (but unknown) time to the event of interest. The standard approach to address right censoring is to assume that the censoring is non-informative (independent censoring) which means that censoring time is conditionally independent from the survival time of interest, given the covariates (Allison, 1995; Rabe-Hesketh & Skrondal, 2012).

Left censoring occurs when one begins observing an individual at some arbitrary point in time, but the observer does not know when the subject becomes at risk for the event. One common remedy is to drop data from the first observation. However, most studies ignore this type of censoring because left censoring is less common than right censoring; in particular, in the medical field. The third type of censoring is interval censoring, which occurs when the event in question occurred between two time points, but the exact time is unknown. This type of censoring is also common in longitudinal studies. For example, a sample household's poverty status can change from poor at the first round to non-poor at the next round, and then the poverty time is interval because we do not know the exact time the event occurred. If the censoring times are regularly spaced, then interval censoring can often be addressed by discrete time methods (Allison, 1995).

In this study, the event of interest is the amount of time to the end of poverty spells or non-poverty spells. The approach followed in the study to analyse poverty dynamics is the hazard rate approach initiated by Bane and Ellwood (1986). This approach estimates the probability of ending poverty spells (exit rates) or non-poverty spells (entry rates). The model also accounts for unobserved heterogeneity and duration dependence in the hazard rates; this allows for an examination of the effects of time varying factors on poverty persistence.

Most studies define a spell of poverty as beginning at time t, when a household becomes poor after being observed as not poor at time t-1. Similarly, a non-poverty spell begins at time t when a household becomes not poor after being poor at time t-1. According to this approach the data eligible for analysis start at wave two (in my case data collected in 1999). However, the data show that most households which were poor (non-poor) at the first round in 1994 continued to be poor (non-poor) in 1999. Therefore, if one follows a similar approach to define poverty spells, then much of the data will be dropped as the study has only a short period panel (four regularly spaced waves). For this reason, the study analyses the time taken to end a spell of poverty as defined for a cohort of households that started poverty spells at the start of the observation (1994). Likewise, the study analyses the time taken to end non-poverty spells as defined for a cohort of households that started their non-poverty spells at the start of the observation (also 1994). Thus, all first spells are left censored because it is not known for how long the poor or non-poor households in 1994 started being at risk of becoming non-poor or poor, respectively. However, note that even if one were to start following the newly poor or non-poor households since 1999, then the transition probabilities would be overstated or understated, as the selected sample would have

experienced at least one transition since 1994 (over five-year gap). As a result, left censoring is unavoidable in this analysis.

One can apply methods for continuous time survival analysis if the exact survival and censoring times are recorded in relatively fine time units. Discrete-time survival data are usually characterised by relatively little possible survival (or censoring) times with many subjects sharing the same survival time (Allison, 1995; Rabe-Hesketh & Skrondal, 2012). Discrete-time data can result from interval censoring, where the event occurs in continuous time but the time interval within which it occurred is not known or the time scale is inherently or intrinsically discrete. In my data set, households were observed within five-year time intervals. Even if the event of interest could be generated in a continuous time process, one could only observe the occurrence of the event within the given interval; it is not possible to give the exact time of occurrence, resulting in discrete-time survival data. Because of this, I applied a technique for discrete-time survival data analysis.

Following Allison (1995), discrete-time hazard survival model is specified in terms of the discrete-time hazard; this is defined as the conditional probability that an event occurs at time t, given that it has not yet occurred:

$$h_t = \Pr(T = t \mid T > t-1) = \Pr(T = t \mid T \geq t) \qquad [3]$$

In this study, T is the time in years to exit poverty or enter into poverty; this can take on integer values t=1, 2,...,T. The discrete-time survival function is the probability of not experiencing the event by time t:

$$S_t = \Pr(T > t) \qquad [4]$$

The survival function is given by:

$$S_t = \prod_{s=1}^{t}(1-h_s) \qquad [5]$$

Regarding the analysis procedure, one can use non-regression approaches such as Life-table analysis or regression method approaches such as logit or a complementary log-log model (Allison, 1995). In particular, a logit model is more appropriate for event times that are truly discrete, while a complementary log-log is more appropriate for events that can happen at any time but are only observed to occur at discrete intervals (Allison, 1995). In my case, I could only observe household poverty transitions with five-year intervals indicating the presence of interval censoring. For this reason, I used a complementary log-log estimation model to analyse poverty transitions.

The complementary log-log model is one of the alternative proportional hazard models applicable to discrete-time hazards (Allison, 1995; Rabe- Hesketh & Skrondal, 2012). Proportional hazard models are the most widely used techniques for modelling covariate effects in continuous-time survival data analysis (Rabe- Hesketh & Skrondal, 2012).These models assume that continuous-time hazards are proportional; in other words, after controlling for covariate effects the hazard functions of different individuals are proportional (the hazard ratio does not depend on time). Given Z_{ij} indicates a continuous survival time for subject i in cluster j, and if the survival times are interval-censored, then one can only observe the integer

values $T_{ij} = t$, if $z_{t-1} < Z_{ij} \leq z_t$, then the discrete time hazard is given by (Rabe-Hesketh & Skrondal, 2012:777-782):

$$h_{tij} = \Pr(T_{ij} = t \mid X_{ij}, T_{ij} > t-1) = \frac{\Pr(Z_{ij} > z_{t-1} \mid X_{ij}) - \Pr(Z_{ij} > z_t \mid X_{ij})}{\Pr(Z_{ij} > z_{t-1} \mid X_{ij})} = 1 - \frac{S(z_t \mid X_{ij})}{S(z_{t-1} \mid X_{ij})} \quad [6]$$

Here, h_{tij} is the hazard rate, $S(.)$ is the survival function. Using the complementary log-log link, the random intercept complementally log-log discrete-time survival model is specified as:

$$\ln\{-\ln(1-h_{sij})\} = \alpha_1 d_{1sij} + \alpha_2 d_{2sij} + \alpha_3 d_{3sij} + \beta X + \zeta_j \quad [7]$$

Here, $\zeta_j \sim N(0, \psi)$ is the random intercept term, which is assumed to be independent from the covariates, d_{tsij} indicates a dummy variable for each period. The model also can be written in terms of a continuous latent response as:

$$y^*_{sij} = \alpha_1 d_{1sij} + \alpha_2 d_{2sij} + \alpha_3 d_{3sij} + \beta X + \zeta_j + \varepsilon_{sij} \quad [8]$$

Where, ε_{sij} has a standard extreme-value type-1 or Gumbel distribution, given the covariates and the random intercept ζ_j. The observed binary response y_{sij} assigns 1 if $y^*_{sij} > 0$ and otherwise assigns zero.

I used the Composite Poverty Index (CIP2) variable to measure poverty status of a sample household in each period considered when analysing the poverty dynamics. The Composite Poverty Index (CPI2) was calculated without including variables that directly affect land rental market participation decisions using data from 1994, 1999, 2004, and 2009 survey years (see Appendix B for more details). Here, poverty is

defined in relative terms and households were categorised as asset poor if their asset index is less than 60% of the median Composite Poverty Index (CPI2) value. The variable that indicates the frequency of household participation in rental markets since 1994 was included in the model to capture household's land rental market participation status. Data from the four rounds (1994, 1999, 2004, and 2009) of ERHS were used in the analysis.

5.5. Results and Discussions

This section first presents estimation results from the ordered probit models and the endogenous multinomial treatment effects models. Then, estimation results from the survival data analysis are presented.

5.5.1. Relationship between Participation in Land Rental Markets and Household Poverty

I estimated two different models of subjective well-being: the standard ordered probit model (Table B.2 in the Appendix) and the generalised ordered probit model with random effects, where parameters were allowed to be outcome-specific (Table 5.5).[47] Estimation results from Table B.2 show that the coefficient on the variable indicating participation in land rental markets for each year (2004 and 2009) is positive and significant ($p<0.01$) for households who leased in land, while it is negative and significant ($p<0.01$) for households who leased out their land. The estimation coefficient on the variable indicating participation in land renting after only 2004 is significant ($p<0.01$) only in the case of land renting out. Similarly, the estimated coefficient on the frequency of participation in the land rental markets is positive and

[47] Test of parallel regression employed after ordered logit(result not reported here). A significant test statistic provides evidence that the parallel regression assumption has been violated.

significant for households that leased in land at least once, while it is negative and significant for those that leased out their land at least three times. These results suggest that the likelihood of being non-poor was higher for households who leased in land than non-participants, while the likelihood of being poor was higher for households who leased out their land.

I found similar result from the generalised ordered probit model estimates that land renting out was associated with more likelihood of being poor, while land renting in was associated with less likelihood of being poor (Table 5.5). In this model, the negative effect of land renting out on household welfare is higher for the lower categories of the self-rated poverty indicator. For example, the coefficient on the frequency of participation in land rental markets is negative and significant for households that leased out land at least three times, but only for lower categories (categories C1 and C2). These results suggest that among households who leased out their land the likelihood of becoming poor was higher for poor households than relatively better-off households.

The results are consistent with the findings in Chapter 4 that asset poor household were more likely to participate on the supply side of the land rental markets. These results are also consistent with what we have seen in the descriptive analysis that there is evidence of a relatively higher incidence of poverty among households that participated on the supply side of the land rental markets, when compared with those that participated as a tenant.

Table 5.5: Random effects generalized ordered probit model (2004 and 2009)

	Model 1				Model 3			
VARIABLES	C1	C2	C3	C4	C1	C2	C3	C4
Land renting in 2004 and 2009								
Leased in land	0.20***	0.20***	0.20***	0.20***				
	(0.07)	(0.07)	(0.07)	(0.07)				
Leased out land	-0.32***	-0.21**	-0.20**	0.22				
	(0.09)	(0.08)	(0.09)	(0.14)				
Frequency of participation								
Leased in sometimes					0.16**	0.16**	0.16**	0.16**
					(0.08)	(0.08)	(0.08)	(0.08)
Leased in most of the time					0.27**	0.27**	0.27**	0.27**
					(0.11)	(0.11)	(0.11)	(0.11)
Leased out sometimes					-0.07	-0.07	-0.07	-0.07
					(0.07)	(0.07)	(0.07)	(0.07)
Leased out most of the time					-0.38***	-0.32**	-0.12	0.22
					(0.13)	(0.13)	(0.13)	(0.21)
Observations	2,371	2,371	2,371	2,371	2,376	2,376	2,376	2,376
loglikelihood	-3006	-3006	-3006	-3006	-3015	-3015	-3015	-3015
chi2	714.7	714.7	714.7	714.7	707.1	707.1	707.1	707.1

Source: Own calculations using data from ERHS.

Note: The estimation includes regional dummies and other control variables (see Table B.3 for this). Model 2 failed to converge. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. C1-C4 indicates the four categories of the self-rated poverty indictor variable.

Using the Composite Poverty Index (CPI1) variable as a dependent variable Table 5.6 provides estimation results from the endogenous multinomial treatment effects model. Estimation results from this model also suggest that participation as a tenant in the land rental markets was associated with increased household welfare, while participation as a landlord was with decreased household welfare. For example, the estimated coefficient on the variable indicating participation in the land rental markets for each year (2004 and 2009) is 0.45 for tenants and it is -0.55 for landlords (both significant at 1% level). This result suggests that in comparison with households that did not participate, participation as a tenant increased household welfare by 0.45 units, while participation as a landlord decreased household welfare by 0.55 units.

Likewise, in comparison with households that did not participate, participation as a tenant at least three times increased household welfare by 0.13 units (significant at 5% level), while participation as a landlord at least three times decreased household welfare by 0.62 units (significant at 1% level). Moreover, the estimation coefficient on the variable indicating participation in land renting after only 2004 is 0.43 units (significant at 1% level) for tenants, while it is -0.48 units (significant at 1% level) for landlords. The result suggests that in comparison with households that did not participate, participation as a tenant since 2004 has increased household welfare by 0.43 units, while participation as a landlord decreased household welfare by 0.48 units. Thus, results from the multinomial treatment effects model estimate consistently indicate that being a tenant was associated with increased household welfare, while being a landlord was associated with decreased household welfare. These results are also consistent with what I found in the ordered probit model estimates using the subjective poverty indicator that households that leased in land were less likely to be poor than those that did not participate in the rental markets, while

households that leased out land were more likely to be poor than those that did not participate.

Table 5. 6: Multinomial treatment effects model (pooled data, 2004 and 2009)

VARIABLES	Model 1	Model 2	Model 3
land renting in 2004 and 2009			
Leased in land	0.45***		
	(0.04)		
Leased out land	-0.55***		
	(0.04)		
Land renting only after 2004			
Leased in land		0.43***	
		(0.07)	
Leased out land		-0.48***	
		(0.07)	
Frequency of participation			
Leased in sometimes			0.06
			(0.05)
Leased in most of the time			0.13**
			(0.05)
Leased out sometimes			-0.63***
			(0.03)
Leased out most of the time			-0.62***
Observations	2,384	1,114	2,389
Loglikilhood	-3666	-1606	-4702
chi2	4126	1383	4634
p	0.00	0.00	0.00

Source: Own calculations using data from ERHS.
Note: Results from the land rental market participation equation is not provided here. The poverty equation includes regional dummies and other control variables (see Table B.4 for this). In Model 2 only data from 2009 used. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Finally, in both the ordered probit and the multinomial treatment effects models, the estimated coefficients on other determinants of poverty status are all as expected. In general, households that had more family labour, a member with secondary and above

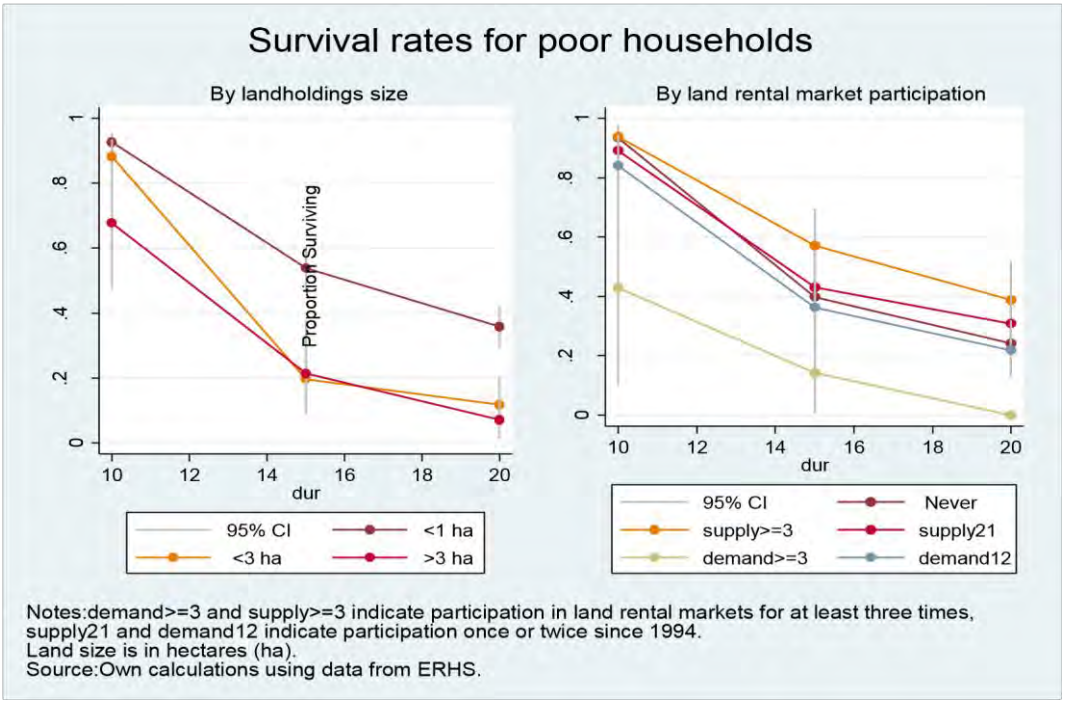
education, male household-head, own a pair of oxen, and had more livestock and per capita land holdings were associated with less likelihood of being poor.

5.5.2. Poverty Persistency and Land Rental Markets

This section presents estimated results from the survival data analysis. Figure 5.3 and Figure 5.4 indicate estimates of the survival function from *Life-table analysis* by participation status in the land rental markets and size of initial land holdings, for ending poverty spells and ending non-poverty spells, respectively. The results show that the survival rate for ending poverty spells was higher for those households that had a land holding size of less than one hectare, while it was the lowest for households with a land holding size of three or more hectares (Figure 5.3). This result indicates that households who were initially poor (in 1994) were more likely to remain poor if they had a landholding size of one hectare or less (high survival rate), while they were more likely to escape poverty if they had a landholding size of three or more hectares (low survival rate). The result is consistent with results found by other similar studies that access to additional land (not necessarily via land rental markets) had a positive effect on household welfare (Bigsten et al., 2003; de Janvry & Sadoulet, 2001; Ellis & Bahiigwa, 2003; Ellis & Mdoe, 2003; Finan et al., 2005; Jayne et al., 2003)

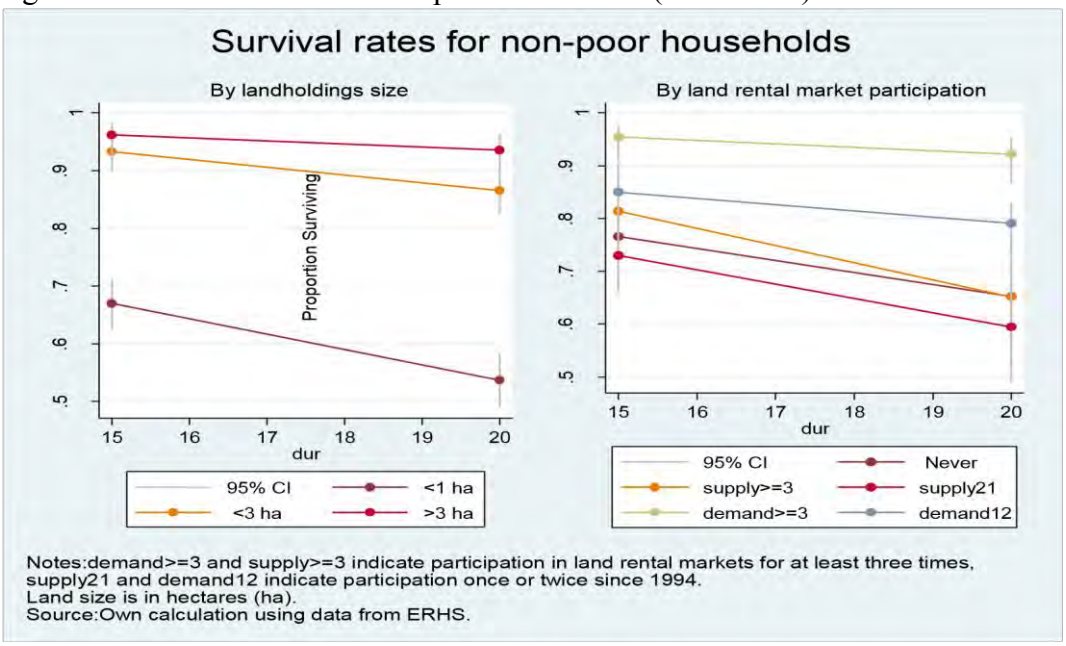
Results also show that the survival rate for ending poverty spells was higher for those households that leased out lands three or more times during the study period, while it was the lowest for households that leased in land three or more times during the study period. These results suggest that households who were poor in 1994 were more likely to remain poor if they leased out their land more frequently, while they were more likely to become not poor if they leased in land more frequently.

Figure 5.3: Survival rates for poor households (1994-2009)



Likewise, results show that the survival rate for ending non-poverty spells was higher for those households that had a land holding size of three or more hectares/leased in land more frequently, while it was the lowest for households with a land holding size of one or less hectares/ leased out land more frequently (Figure 5.4). These results suggest that households who were not poor in 1994 were more likely to remain not poor if they had a land holding size of three or more hectares/leased in land more frequently, while they were more likely to become poor if they had a land holding size of one or less hectares/ leased out land more frequently. These results are consistent with the findings in section 5.3 that there is a positive relationship between land holdings on the one hand, and household income and other household asset holdings on the other hand.

Figure 5.4: Survival rates for non-poor households (1994-2009)



Results from the Life-table analysis are consistent with results I found from other estimation models that land renting out was associated with more likelihood of being poor, while land renting in was associates with more likelihood of becoming non-poor. However, the *Life-table analysis* does not control for other determinants of poverty transitions. Thus, controlling for other determinants of poverty transitions, Table 5.7 presents results from the complementary log-log models. Constituent with what I found from the *Life-table analysis*, estimation results show that the estimated hazard rate of escaping poverty (for those who were poor in 1994) was significantly (significant at 1% level) lower for households that leased out land more frequently, relative to those that did not participate in the land rental markets. The result suggests that among households who were poor in 1994 the likelihood of escaping poverty was significantly lower for those households who leased out their land at least three times, relative to those that did not participate in the land rental markets.

Likewise, the estimated hazard of entry into poverty was significantly (significant at 1% level) higher for households that leased out land at least once, in comparison with those households that never participated in the land rental markets, while it is significantly (significant at 1% level) lower for those households that leased in land more frequently. These results suggest that among households who were not poor in 1994 the likelihood of becoming poor was significantly higher for those households who leased out their land at least once, relative to those that did not participate in the land rental markets. However, the likelihood of non-poor households becoming poor was significantly lower for households who leased in land at least three times during the study period.

Despite the different model estimates used in the analysis, I found consistent results that support the stated hypothesis in section 5.2 that in the absence of well-paying off-farm jobs in rural areas, land renting-out by poor farmers could adversely affect their effort to accumulate assets over time, and so they are more likely to remain in a poverty trap.

Table 5.7: Estimation results from complementary log-log models (1994-2009)

Variables	Exit rates	Entry rates
Leased out land most of the time	0.44***	2.22**
	(0.13)	(0.77)
Leased out land sometimes	0.83	1.74***
	(0.19)	(0.32)
Leased in land most of the time	2.18	0.40***
	(1.13)	(0.13)
Leased in land sometimes	0.99	0.75
	(0.21)	(0.14)
Plot size > 1 hectares	2.25***	0.41***
	(0.50)	(0.09)
Plot size >2 hectares	2.66***	0.33***
	(0.89)	(0.14)
Have a pair of oxen	2.85***	0.62*
	(0.90)	(0.17)
Male family labour	0.99	0.87**
	(0.09)	(0.06)
Female family labour	1.03	1.02
	(0.09)	(0.06)
Number of children	0.99	0.94*
	(0.05)	(0.03)
Head sex	1.20	1.18
	(0.24)	(0.23)
Head can read and write	1.64**	0.52***
	(0.34)	(0.08)
Access to credit	0.88	0.82
	(0.19)	(0.15)
Work off-farm wage emp.	1.05	1.16
	(0.12)	(0.11)
Work off-farm self emp.	1.03	0.96
	(0.16)	(0.11)
Receive transfer income	1.67*	0.86
	(0.51)	(0.21)
Equb member	0.76	0.68*
	(0.21)	(0.15)
Observations	687	1,715
Loglikilhood	-322.2	-561.6
Rho	0.129	0.296
sigma_u	0.494	0.833
lnsig2u	0.24**	0.69
	(0.15)	(0.34)
chi2_c	14.83	54.66

Source: Own calculations using data from ERHS.

Note: PA is used as a clustering variable and the estimation includes interval dummies. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Regarding other control variables, results show that the estimated hazard rate of escaping poverty was significantly (significant at 1-5% level) higher for households that had more land holdings, oxen, a household head that can read and write, while the estimated hazard of entry into poverty was significantly lower for these households and households that had more male family labour. Although the estimated hazard rate of escaping poverty was significantly higher (at 10% level) for households that received some transfer income, participation in local off-farm employment was not significant. This result suggests that given most available off-farm employment jobs were not well-paid works (only less than 2% professional jobs such as teaching) participation in off-farm jobs play a limited role in helping farm household to escape poverty in rural Ethiopia. These results suggest that farm related assets such as land, oxen, and male labour are the key determinants of household income and poverty in rural Ethiopia.

In summary, the estimation results in this section show that the decisions to lease in land was associated with increased household welfare, while the decisions to lease out land was associated with decreased household welfare. Furthermore, the findings from the poverty dynamics analysis indicate that the probability of falling into poverty (for the non-poor) was lower for households that leased in land and/or were rich in farming resources, while it was higher for those households that were poor in farming resources and/or leased out their land more frequently. These findings are robust across alternative model specifications and the use of different poverty indicators.

5.6. Conclusions

This chapter examine the relationship between participation by households in land rental markets and household poverty, using a panel dataset from ERHS. Results show that both household income and asset holdings were positively correlated with household land holding sizes. In addition, households with more land holding size were less likely to become poor compared to those households with small land holdings. This show that access to land is a key determinant of income and poverty in rural Ethiopia. However, results also show that access to more land by land-poor households was very limited as land poor households on average cultivated smaller land sizes compared to land-rich households. For instance, 10% of the land-poor households in the sample, on average, cultivated only 0.08 hectares of land in the 2009 survey year, while the corresponding figure for the top 10% of the land-rich households was 1.05 hectares. This implies that there is a high degree of inequality in land holdings in the sample area.

Analysis of the relationship between participation in land rental markets and household poverty status shows that participation in the land rental markets as a tenant was associated with a relatively low probability of being poor, while participation as a landlord was associated with a higher probability of being poor. Furthermore, estimation results from the survival data analysis also suggest that the hazard rate of entering into spells of poverty (for initially non-poor) is significantly higher for households that frequently participated as a landlord in the land rental markets. This rate is lower for households that participated as a tenant. These results suggest that in the absence of alternative income sources and multiple market failures in credit and insurance markets, the chance of becoming poor(and remain poor) is higher for those households who rent out their plots, unless the income landlords earn from renting out is higher than the amount they might get by faming the land. In this

regard, the findings in this chapter imply that the income landlords earn from land renting out is not enough to let them escape poverty.

The analysis in this chapter does not necessary imply that land renting out by farm households is a cause of poverty, however. In general, participation in land rental markets, which was mainly in the form of sharecropping, is important for households with less farming assets to secure their food. However, without improvements in the off-farm employment sector, asset poor households that leased out their land could face difficulties to accumulate assets in the long-run and recover from their poverty.

CHAPTER 6: CONCLUSIONS

6.1. Introduction

In poor agrarian economies, secure access to land determines the ability of households to produce food for their subsistence and serves as a source of insurance against unemployment and food price shocks (Benjamin & Brandt, 1997; Burgess, 2001; Deininger, 2003; de Janvry & Sadoulet, 2001; Jayne et al., 2003). For this reason, land reforms aimed at enhancing land access by the poor and tenure security over land are considered important for reducing rural poverty in the developing world (Deininger, 2003; Holden et al., 2009). Among the reforms, land titling and registration programmes, and liberalisation of land rental markets have been widely proposed as fundamental policy instrument for improving tenure security and access to land by poor farmers. Despite this, there are on-going debates on whether such land reforms meaningfully benefited smallholder farmers in poor agrarian economies.

Ethiopia is among the few African countries to implement large-scale land titling programmes. One of the main objectives of the land reform (land titling) is to enhance tenure security of farmers, thereby stimulating greater land-related investments in rural areas. Since 1995, Ethiopia also has partially liberalised rural land rental markets with the aim of improving the functioning of these markets. However, evidence on whether these reforms resulted in improved land access by the poor and increased land-related investments are scarce and inconclusive.

This thesis aimed to achieve four main objectives: (i) to examine whether or not the preconditions for economic effectiveness of land registration are satisfied in the case of Ethiopia, (ii) to analyse the effects of land tenure insecurity on land-related investments,

(iii) to analyse the factors that influence decisions by households in rural Ethiopia concerning land and labour market participation, and, (iv) to analyse the relationship between farmers' participation in land rental markets and household economic well-being in rural Ethiopia.

The data source for this study is the Ethiopian Rural Household Survey (ERHS), which consists of a panel of 1477 sample households covering four main regions in the country (Amara, Tigray, Ormina, and SNNP). The dataset covered the period 1994–2009. In addition, some data from the 2011/12 Ethiopian Rural Socioeconomic survey (ERSS) were also used as additional data source in Chapter 2.

6.2. Summary of Research Findings

The findings of the thesis were presented in four chapters. Chapter 2 presented results of the data analysis answering the research question as to whether prerequisites for economic effectiveness of land registration and titling are satisfied in the case of Ethiopia. To answer the research question, I examined the land tenure system, and the structure of rural factor and credit markets in rural Ethiopia. Overview of the details of the land tenure system in Ethiopia shows that despite some policy changes relative to the previous regime land policy (before 1991), the current governing land tenure system in Ethiopia is very restrictive in many aspects. Land is owned by the state and framers only have usufruct rights, and are not allowed to sell or mortgage their land. Access to land, through either PA allocation or inheritance, is strictly contingent on continued residence in the area where the land is located. The individual involved must also be engaged in farming as main livelihood activity.

In addition, although land renting has been officially allowed since 1995, there are still various institutional restrictions that limit farmers' transactions in land rental markets. For instance, farmers are allowed to rent out land only as long as the amount of land remaining is enough to produce annual food consumption for the farming families. Given small per capita land holdings in rural areas, such restrictions are expected to limit farmers from participating in land rental markets, and prevent land rental markets from functioning freely. In this regard, the land reform (land tilting) does not relax any of the existing restrictions imposed by the land policy on land rental transactions or labour movements.

In regards to the land rental markets, the main benefit of land title ownership is that it helps to reduce asymmetric information between transacting agents (Feder & Nishio, 1999; Deininger & Feder, 2009). The data in this study show that, in the 2009 survey year, less than 10% of the plots used by farmers were obtained through land rental markets, of which 6.4% was sharecropping arrangement (Table 2.1). Moreover, land rental transactions in rural Ethiopia were mainly among relatives, neighbours or friends residing within the same village (Belay & Manig, 2004; Deininger et al., 2009; Segers, et al., 2010). Data from this study also show that among households who leased out plots in the 1994 survey year, close to 88% of the plots leased were located within the same PA they resided in, while 33% were adjacent to their own plots. This suggests that transaction costs related to verification of landlords or tenants could not be a constraint to participate in land rental markets in rural Ethiopia.

Results from descriptive data analysis of participations in land rental markets from four regions of the country suggest that there was no significant relationship between land renting transactions and land titling programmes in rural Ethiopia. These findings support the hypothesis that land titling might not make much impact on land transactions if these

transactions taken place within a village where everyone knows each other, and the existing land tenure system is sufficient to the types and volumes of land transactions that are typical in the area under consideration (Deininger & Feder, 2009; Feder & Nishio, 1999). Therefore, under the existing conditions, land title ownership is expected to have limited role in improving the functions of land rental markets in rural Ethiopia

Ownership of land titling in rural Ethiopia also does not provide benefits that are linked to credit markets, as farmers are not allowed to mortgage or use their land as collateral in the credit markets. Findings from analysis of the structure of input and credit markets suggest that both input and credit markets are poorly developed in rural Ethiopia. For instance, in the 2009 survey year more than 65% of the loans taken by farmers were informal sector loans. Furthermore, the data show that access to loans for production purposes (mainly from formal sources) were wealth biased as land rich households were more likely to get access to these loans than land-poor households (Table 2.7). These findings suggest that despite having a title, poor farmers may not be able to invest in their lands if they lack access to working capitals that is needed to finance their investments.

Improvement in tenure security is one of the main rationales for the land titling programme in Ethiopia. There is some evidence that land title ownership has increased tenure security for farmers in rural Ethiopia (Deininger et.al, 2011; Holden et.al, 2009, 2011). However, detailed examination of the land policy in Ethiopia indicates that ownership of land titling does not provide any more rights than the rights stipulated on the existing land laws in the country. For instance, despite land titling, local government officials in all regions still possess the power to expropriate farmers from their land when it is necessary to do so. As a result, expectations about potential government sponsored land redistributions in the future form the main source of land tenure insecurity in Ethiopia. This is illustrated in the data

from the three rounds of the ERHS (1999, 2004, and 2009) which show that none of the households in the sample area reported land loss in the past or expected land loss in the future due to land grabs by other households.

Moreover, fear of land expropriation by the government remained high among farmers despite the titling programme in many parts of the country. For instance, since 1997, land redistribution has been banned in Tigray regional state and the actual land redistribution experience among the sample households was zero after that year (Table 2.2). Despite this, the number of households who reported fear of losing land because of land redistribution in Tigray was 11.6% and 9.7% during the period 1999– 2004 and 2004–2009, respectively. These results suggest that the land titling programme is expected to have limited impact to improve tenure security in rural Ethiopia.

In spite of the above mentioned institutional limitations, the main justification for the land tilting programme in rural Ethiopia is based on the view that insecure tenure is a major impediment to prompt land-related investments. Chapter 3 of the thesis empirically examined the relationship between tenure insecurity and farmers' land-related investments.[48] Estimation techniques such as the correlated random effects probit model, pooled bivariate probit model, and the recursive multivariate probit model were used in the analysis. Estimation results from these models show a lack of significant relationship between farmers' perceived tenure insecurity and land-related investment decisions. Instead, other factors, such as access to extension services, education, sex of a household head, participation in local labour sharing arrangements, household wealth (livestock and

[48] The discussion in Chapter 2 shows that government sponsored land redistributions (or expropriations) are the main sources of tenure insecurity. Thus, tenure insecurity is defined as a perception of losing land in the future due to land redistributions (or expropriations).

land), and village dummies were important determinants of land-related investment decisions in rural Ethiopia. For example, households with more members who are educated, had more land and livestock holdings, and got access to extension services and local labour sharing arrangements were more likely to invest on their land. In contrast, households that lacked these resources and/or female-headed households were less likely to invest on their land.

The estimation results also show that access to extension services and participation in labour sharing arrangements were more biased towards the better-off households. For example, it was found that compared to male-headed and/or resource-rich households, female-headed and/or resource-poor households (had less land, labour, and livestock) were less likely to get access to extension services and participate in labour sharing arrangements. The perception of tenure insecurity though was not significantly different across these groups. These findings suggest that low levels of land-related investments by female-headed and/poor households are due to limited access to farming resources such as land, labour and other capitals.

Furthermore, descriptive analysis of farmers' response as to why they did not invest in tree cropping indicates that among the sample households about 75% in Tigray, 46% in Amhara, 68% in SNNP, and 19% in Oromia reported land shortage was the main constraint. A lack of security of tenure was reported as a major constraint only by 1.2% of the respondents that are from Tigray and Amhara regional states–regions where land redistributions were widespread during the current regime. Other factors reported are water shortage, labour shortage, and lack of funding. Regarding reasons for not investing in soil conservation practices, a large number of them reported absence of erosion as a major reason (75.9 %), followed by labour shortage (16.2 %). None of the households in the

sample areas reported lack of security of tenure as a reason for not practising soil conservation on their land.

Chapter 4 of the thesis presented results from the analysis of land and labour market participation decisions in rural Ethiopia. The study used a multivariate probit model to account for potential endogeneity in land and labour market participation decisions. The analysis in the chapter also found no significant relationship between farmers' perception of tenure insecurity and farmers' participation decisions in local labour and land rental markets. Instead, heterogeneity in access to farming endowments and multiple market failures in rural areas were important factors in determining farmers' participation decisions in rural labour and land rental markets. The estimation results show that male-headed households and/ or households that were well endowed with farming resources, such as oxen, livestock, and managerial ability, were more likely to participate as a tenant in land lease markets. They were also more likely to hire outside labour on their farm. In contrast, female-headed households and/or households that were less endowed with farming skills and resources were more likely to rent out their land, and they were also more likely to participate at off-farm jobs.

Finally, Chapter 5 of the thesis presented results from analysis of the relationship between households' participation in land rental markets and household economic well-being. The study used both asset-based and subjective poverty indicators to measure poverty in a multidimensional sense. Estimation techniques used include: generalised ordered probit model, endogenous multinomial treatment effects model, and survival data analysis. Results from the descriptive analysis show that there is positive relationship between land holding sizes, and livestock holdings and household farm income. These results suggest that access to land is the main source of income in rural Ethiopia. Despite the importance of land as the

main source of income, large numbers of households in the sample cultivated very small land sizes with the median per-adult cultivated land size being 0.29 hectares in the 2009 survey year. Results also show that there is strong and monotonic relationship between the average amount of per-adult cultivated land size and the per-adult allocated land size. For instance, 10% of the land-poor households on average cultivated only 0.08 hectares in 2009. The corresponding figures for the top 10% of the land-rich households were 1.05 hectares. These figures show that households with small amounts of allocated land holdings also cultivated only small sizes of land, while land-rich households cultivated, on average, larger land sizes.

Additionally, estimation results from analysis of the relationship between participation in land rental markets and household poverty suggests that households that leased in land were less likely to be poor than those that did not participate in rental markets, while households that leased out land were more likely to be poor than those that did not participate. Furthermore, findings from the survival data analysis also show that the estimated hazard rate of escaping poverty (for those who were poor) was significantly lower for households that leased out their land relative to those that did not participate in the land rental markets, while the likelihood of escaping poverty was significantly higher for households that leased in land more frequently. Similarly, the estimated hazard of entry into poverty (for those who were not poor) was significantly higher for households that leased out land more frequently, in comparison with those households that never participated in the land rental markets, while it was significantly lower for those household that leased in land more frequently. Results from both Chapter 4 and Chapter 5 suggest that poor households tend to rent out their land more often, and they remain trapped in poverty mainly due to lack of well-paid off-farm jobs in rural areas.

6.3. Policy Implications

The research findings from this thesis have some important policy implications. One of the key findings of this study is that limited access to land and other farming resources are important determinates of farmers' participation in land-related investments and their decisions to participate in rural factor markets. In particular, land shortage was reported as a key factor in limiting land-related investments in all regions covered in this study. It is evident that because of the high population pressure, land scarcity is becoming prevalent, and the degree of near-landlessness is increasing among the rural population of the highlands of Ethiopia. Currently, most households in rural areas are farming land holdings that do not allow them to produce enough to feed their families (MoARD, 2010). In the 2009 survey year, close to 60% of the households covered in this study reported that they had food shortage problems at least once in the previous production year.

Although, since 1995, land lease markets have been officially allowed to operate in rural areas to facilitate efficient land allocations, the analysis in this research shows that this policy change does not guarantee access to land by poor farmers if the functioning of other non-land factor and credit markets are not reformed as well. Under existing conditions, land rental markets transfer land mainly from less able farmers (relatively poor) to more able farmers (relatively rich). The study also showed that although land renting out is one strategy for poor farmers to solve some of their production related-constraints, asset poor households who leased out land were more likely to remain poor.

These findings suggest that policy makers should give priority to solving problems related to land shortages in rural areas. However, this is easier to say than to do. Provision of additional land to farmers is unattainable, especially in the highland areas where almost all land are already cultivated (MoARD, 2010). Furthermore, access to non-farm jobs is very

limited in rural areas with less than 3% of the rural households relying exclusively on income from non-farm employment (MoARD, 2010). Thus, the distribution of income in rural areas significantly depends on land ownership distributions. In this regarded, government's policy to redistribute land to new comers (which often involves taking land from land rich to land poor farmers) only creates more near-landless farmers in the future. This, in turn, can adversely affect investment and productivity in rural areas. Therefore, policy makers should give more emphasis for strategies seeking to create an environment conducive to development in the off-farm employment sector and small enterprises in rural area. Such strategies may provide an important contribution towards reducing the existing pressure on land and improving food security in rural areas.

Given a serious shortage of arable land in the country, the government needs to revisit its land policy in order to create non-farm employment opportunities in rural areas. The existing land tenure policy in rural Ethiopia explicitly restricts free labour movement outside agriculture despite the dire shortage of land in rural areas. It has long been argued that lack of alternative employment opportunities, and past and current land policies in the country prohibit labour movement out of agriculture and impede the development of non-farm enterprises in rural areas (Rahmato, 1993, 2004). In general, under the current land law, access to land is contingent on continued residence in the area where the land is located and the individual must be engaged in farming as main livelihood activity. Such policy presupposes that land only serves as a means of production.

Nevertheless, it is well recognised that access to land also serves as a means of insurance against unemployment and food price shocks in rural areas (de Janvry & Sadoulet, 2001; Deininger, 2003). This means that in the face of uncertainty to get permanent non-farm jobs elsewhere in the country, farmers may become reluctant to give up their land, even if it is

too small for framing. For this reason, this thesis proposes that farmers should be allowed to diversify their livelihood strategies without the fear of losing their land rights if they migrate or work in non-farm jobs. Furthermore, the findings in the thesis suggest that without reforming the existing land policy, and addressing problems in factor and credit markets, land titling is expected to play very limited role in improving tenure security, investment, and land rental market participations in rural Ethiopia. Therefore, policy measures that improve credit access by the poor, increase access to more land, facilitate the creation of non-farm jobs, and remove current legal restrictions on land transactions and labour movements are expected to be more effective in increasing investment and reducing poverty than the mere allocation of land title in rural Ethiopia.

6.4. Limitations of the Study

Although a consistent story emerges from the analysis in the different chapters of the study, there are some limitations that need to be acknowledged. First, analysis of the impacts of land rental market participation decisions on household poverty in Chapter 5 was based on subjective and asset index poverty indicators. These measures were found to be a good proxy to measure multi-dimensional poverty. The results from this analysis indicate how the decision to rent out land or rent in land was associated with poverty status. Due to data limitations though, it was not possible to calculate the net income households received from renting out land and off-farm employments, and compare these with net income revenue received from producing on rented plots. Thus, future research can address the issue so that we can better understand the welfare impacts of different livelihood strategies in rural areas.

Second, analysis of poverty dynamics in Chapter 5 was based on short panel data set; as a result, left censoring was inevitable. Consistent with other estimation models used to

analyse the relationship between land renting activities and poverty status, results from the poverty dynamics analysis indicate that the likelihood of falling into poverty (for non-poor) was lower for households that leased in land, while it was higher for those households that leased out their land more frequently. The presence of left censoring, however, may overstate/understate transition probabilities. Thus, it is advisable that future research use longer panel data sets to improve estimates of poverty transitions.

Third, the study is based on data that represent mainly the sedentary farming systems in the country, excluding the pastoralists and semi-pastoralist areas that represent about 10% of the total population in the country (CSA, 2012). These, areas also have slightly different land tenure polices. Results from this study thus should not be considered as nationally representative. More studies are required to understand the impacts of land tenure arrangements and access to land on livelihoods of the pastoralist and semi-pastoralist areas in rural Ethiopia.

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Appendix A: Appendix for Chapter 3

Table A.1: Probit estimates of the determinants of tree-planting (2004)

VARIABLES	Model 1	Model 2	Model 3	Model 4
Expected land loss in 5 years' time	-0.17	-0.18	-0.18	-0.19
	(0.15)	(0.15)	(0.18)	(0.17)
Lost land during 1983-1999		-0.13	-0.14	-0.20
		(0.17)	(0.16)	(0.16)
Perceived land transfer right			0.05	0.01
			(0.12)	(0.12)
Male labour (num)	0.06	0.06	0.06	0.04
	(0.05)	(0.05)	(0.05)	(0.06)
Female labour (num)	-0.03	-0.03	-0.03	-0.04
	(0.05)	(0.05)	(0.05)	(0.05)
Adult literacy	-0.22	-0.21	-0.20	-0.23
	(0.25)	(0.24)	(0.27)	(0.30)
Primary education	0.14	0.13	0.13	0.11
	(0.13)	(0.13)	(0.11)	(0.12)
Secondary education	0.32**	0.32**	0.32*	0.25
	(0.16)	(0.16)	(0.17)	(0.17)
Head sex	-0.31**	-0.30**	-0.29**	-0.22*
	(0.13)	(0.12)	(0.14)	(0.13)
Head age	0.00	0.00	-0.00	-0.00
	(0.02)	(0.02)	(0.02)	(0.02)
Per-capita land size	0.07	0.05	0.03	0.07
	(0.30)	(0.32)	(0.41)	(0.36)
Access to Extension services				0.24*
				(0.13)
Livestock holdings (TLU)				0.03**
				(0.01)
Member in labour-sharing arrangements				0.01
				(0.09)
Constant	-0.37	-0.39	-0.29	-0.36
	(0.50)	(0.57)	(0.52)	(0.53)
Observations	1,117	1,114	1,105	1,067
chi2	257.4	314.5	563.6	405.4
P	0	0	0	0
Loglikelihood	-518.1	-516.7	-514.0	-496.0

Source: Own calculations using data from ERHS.
Note: Regression includes woreda(village) dummies, head age square , land size square.
Bootstrap standard errors in parentheses (200 replications) *** p<0.01, ** p<0.05, * p<0.1.

Table A.2: Probit estimates of the determinants of tree-planting (2009)

VARIABLES	Model 1	Model 2	Model 3	Model 4
Expected land loss in 5 years' time	-0.26	-0.26	-0.28	-0.31
	(0.23)	(0.20)	(0.18)	(0.23)
Lost land during 1983-1999		0.14	0.12	0.06
		(0.14)	(0.15)	(0.15)
Perceived land transfer right			0.27*	0.28*
			(0.14)	(0.17)
Male labour (num)	0.09	0.09*	0.09*	0.06
	(0.05)	(0.05)	(0.05)	(0.05)
Female labour (num)	0.09	0.09	0.08	0.07
	(0.06)	(0.06)	(0.05)	(0.05)
Adult literacy	0.59*	0.65	0.64*	0.62*
	(0.35)	(0.41)	(0.38)	(0.36)
Primary education	0.35**	0.36**	0.36**	0.33**
	(0.15)	(0.17)	(0.18)	(0.16)
Secondary education	0.36*	0.36*	0.36**	0.27
	(0.19)	(0.21)	(0.17)	(0.17)
Head sex	-0.30**	-0.29***	-0.28**	-0.19*
	(0.13)	(0.10)	(0.12)	(0.11)
Head age	0.03	0.03*	0.03	0.03
	(0.02)	(0.02)	(0.02)	(0.02)
Per capita land size	1.15***	1.09***	1.07***	0.80**
	(0.25)	(0.32)	(0.35)	(0.34)
Access to Extension services				0.27***
				(0.09)
Livestock holdings (TLU)				0.03**
				(0.02)
Member in labour sharing arrangements				0.42***
				(0.12)
Constant	-1.63***	-1.63***	-1.84***	-2.08***
	(0.52)	(0.50)	(0.58)	(0.55)
Observations	1,127	1,124	1,119	1,117
chi2	456.1	767.3	363.7	549.9
p	0	0	0	0
Loglikelihood	-580.8	-578.6	-575.5	-556.4

Source: Own calculations using data from ERHS.

Note: Regression includes woreda(village) dummies, head age square , land size square.

Bootstrap standard errors in parentheses (200 replications) *** p<0.01, ** p<0.05, * p<0.1.

Table A.3: Standard random effects probit estimates of the determinants of tree-planting (2004 and 2009)

VARIABLES	Model 1	Model 2	Model 3	Model 4
Expected land loss in 5 years' time	-0.21*	-0.21	-0.21*	-0.21
	(0.12)	(0.13)	(0.11)	(0.15)
Lost land during 1983-1999		0.04	0.03	-0.03
		(0.12)	(0.12)	(0.14)
Perceived land transfer right			0.11	0.07
			(0.10)	(0.09)
Male labour (num)	0.07*	0.07	0.07*	0.04
	(0.04)	(0.05)	(0.04)	(0.04)
Female labour (num)	0.01	0.01	0.01	-0.01
	(0.04)	(0.04)	(0.05)	(0.04)
Adult literacy	0.01	0.02	0.04	0.04
	(0.21)	(0.20)	(0.22)	(0.19)
Primary education	0.20*	0.19*	0.20*	0.16
	(0.11)	(0.10)	(0.11)	(0.11)
Secondary education	0.32***	0.32***	0.32**	0.24*
	(0.12)	(0.11)	(0.14)	(0.13)
Head sex	-0.35***	-0.34***	-0.33***	-0.25***
	(0.08)	(0.09)	(0.09)	(0.08)
Head Age	0.02	0.01	0.01	0.01
	(0.02)	(0.02)	(0.02)	(0.02)
Per capita land size	0.51**	0.49**	0.47*	0.35
	(0.21)	(0.20)	(0.25)	(0.24)
Access to Extension services				0.28***
				(0.08)
Livestock holdings (TLU)				0.03***
				(0.01)
Member in labour sharing arrangements				0.24***
				(0.09)
Constant	-0.70	-0.71	-0.74*	-0.92**
	(0.46)	(0.47)	(0.44)	(0.42)
Observations	2,437	2,431	2,413	2,361
Number of uhhid	1,227	1,224	1,223	1,222
chi2	512.9	433.5	524.0	374.4
p	0.00	0.00	0.00	0.00
sigma_u	0.544	0.541	0.532	0.496
lnsig2u	-1.22***	-1.23***	-1.26***	-1.40
	(0.31)	(0.33)	(0.40)	(1.46)
Loglikelihood	-1120	-1117	-1113	-1080
rho	0.228	0.226	0.220	0.197

Source: Own calculations using data from ERHS. Note: Regression includes woreda(village) and time dummies, head age square , land size square, and time averages of the covariates. Bootstrap standard errors in parentheses (200 replications) *** p<0.01, ** p<0.05, * p<0.1.

Table A.4: Probit estimates of the determinants of soil conservation (2004)

VARIABLES	Model 1	Model 2	Model 3	Model 4
Expected land loss in 5 years' time	0.04	0.05	0.06	0.18
	(0.17)	(0.19)	(0.16)	(0.15)
Lost land during 1983-1999		0.20*	0.21	0.19
		(0.12)	(0.14)	(0.15)
Perceived land transfer right			0.13	0.09
			(0.13)	(0.12)
Male labour (num)	0.10*	0.09	0.10*	0.07
	(0.05)	(0.07)	(0.05)	(0.06)
Female Labour (num)	0.04	0.03	0.04	0.04
	(0.07)	(0.06)	(0.08)	(0.06)
Adult literacy	0.03	0.02	0.02	0.03
	(0.21)	(0.20)	(0.19)	(0.20)
Primary education	-0.15	-0.15	-0.18	-0.12
	(0.14)	(0.15)	(0.13)	(0.15)
Secondary and above education	-0.21	-0.21	-0.25	-0.23
	(0.17)	(0.19)	(0.22)	(0.22)
Head sex	-0.22*	-0.24	-0.26*	-0.28**
	(0.13)	(0.17)	(0.14)	(0.14)
Head age	-0.02	-0.02	-0.02	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Per capita land size	-0.10	-0.03	0.00	0.04
	(0.37)	(0.32)	(0.35)	(0.37)
Access to Extension services				0.14
				(0.12)
Livestock holdings (TLU)				0.01
				(0.02)
Member in labour sharing arrangements				0.27*
				(0.15)
Constant	0.67	0.67	0.75	0.78
	(0.56)	(0.54)	(0.60)	(0.60)
Observations	1,016	1,013	1,002	963
chi2	593.0	874.7	1764	1137
p	0	0	0	0
Loglikelihood	-375.0	-371.4	-365.7	-335.4

Source: Own calculations using data from ERHS. Note: Regression includes woreda(village) dummies, head age square , land size square. Bootstrap standard errors in parentheses (200 replications) *** p<0.01, ** p<0.05, * p<0.1.

Table A.5: Probit estimates of the determinants of soil conservation practices(2009)

VARIABLES	Model 1	Model 2	Model 3	Model 4
Expected land loss in 5 years' time	-0.38*	-0.38*	-0.38*	-0.37*
	(0.21)	(0.20)	(0.21)	(0.22)
Lost land during 1983-1999		0.05	0.06	0.00
		(0.16)	(0.14)	(0.14)
Perceived land transfer right			-0.12	-0.10
			(0.19)	(0.18)
Male labour (num)	0.12**	0.12**	0.12**	0.10*
	(0.05)	(0.05)	(0.06)	(0.06)
Female labour (num)	0.07	0.08	0.08	0.08
	(0.06)	(0.07)	(0.05)	(0.06)
Adult literacy	0.63*	0.70**	0.71**	0.65**
	(0.32)	(0.33)	(0.33)	(0.30)
Primary education	0.21	0.21	0.22	0.14
	(0.19)	(0.19)	(0.20)	(0.18)
Secondary and above education	0.31	0.31	0.32	0.24
	(0.19)	(0.21)	(0.21)	(0.20)
Head sex	-0.15	-0.13	-0.14	-0.07
	(0.13)	(0.12)	(0.13)	(0.13)
Head age	-0.01	-0.01	-0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)
Per capita land size	0.34	0.27	0.28	0.22
	(0.36)	(0.36)	(0.39)	(0.42)
Access to Extension services				0.30**
				(0.13)
Livestock holdings(TLU)				0.00
				(0.01)
Member in labour-sharing arrangements				0.30**
				(0.13)
Constant	0.28	0.29	0.37	0.20
	(0.55)	(0.49)	(0.53)	(0.55)
Observations	1,067	1,064	1,059	1,057
chi2	454.7	430.0	611.0	499.5
p	0	0	0	0
Loglikelihood	-425.2	-423.8	-423.0	-414.9

Source: Own calculations using data from ERHS. Note: Regression includes woreda(village) dummies, head age square , land size square. Bootstrap standard errors in parentheses (200 replications) *** p<0.01, ** p<0.05, * p<0.1.

Table A.6: Standard random effects probit estimates of the determinants of soil conservation practices (2004 and 2009)

VARIABLES	Model 1	Model 2	Model 3	Model 4
Expected land loss in 5 years' time	-0.18	-0.18	-0.18	-0.12
	(0.15)	(0.14)	(0.14)	(0.12)
Lost land during 1983-1999		0.11	0.11	0.07
		(0.12)	(0.10)	(0.14)
Perceived land transfer right			-0.00	-0.03
			(0.12)	(0.11)
Male labour (num)	0.11***	0.11**	0.12***	0.10**
	(0.04)	(0.05)	(0.04)	(0.05)
Female labour (num)	0.05	0.05	0.05	0.05
	(0.05)	(0.05)	(0.05)	(0.05)
Adult literacy	0.12	0.14	0.14	0.13
	(0.18)	(0.18)	(0.16)	(0.18)
Primary education	-0.08	-0.08	-0.10	-0.07
	(0.12)	(0.12)	(0.10)	(0.12)
Secondary education	0.01	0.01	-0.00	0.00
	(0.14)	(0.13)	(0.14)	(0.15)
Head sex	-0.20**	-0.20**	-0.20**	-0.17*
	(0.09)	(0.10)	(0.09)	(0.10)
Head age	-0.01	-0.01	-0.01	-0.01
	(0.02)	(0.01)	(0.02)	(0.02)
Per capita land size	0.05	0.06	0.08	0.05
	(0.23)	(0.27)	(0.23)	(0.27)
Access to Extension services				0.25***
				(0.10)
Livestock holdings (TLU)				0.00
				(0.01)
Member in labour-sharing arrangements				0.29***
				(0.09)
Year dummy (1=2004)	-0.41***	-0.41***	-0.42***	-0.28***
	(0.08)	(0.08)	(0.08)	(0.10)
Constant	0.82*	0.84**	0.88**	0.75*
	(0.43)	(0.37)	(0.43)	(0.41)
Observations	2,312	2,306	2,289	2,247
Number of uhhid	1,167	1,164	1,163	1,162
chi2	413.7	424.8	447.8	304.9
p	0	0	0	0
sigma_u	0.390	0.407	0.400	0.441
lnsig2u	-1.88	-1.80	-1.83	-1.64
	(2.17)	(1.91)	(2.19)	(1.64)
Loglikelihood	-819.8	-814.9	-809.5	-774.3

Source: Own calculations using data from ERHS. Note: Regression includes woreda (village) dummies, head age square, land size square, time averages of the covariates. Bootstrap standard errors in parentheses (200 replications) *** p<0.01, ** p<0.05, * p<0.1.

Table A.7: Marginal effects on the marginal probability of investment (Eucalyptus tree)

	Pooled probit			Panel CRE probit	
	1	2	3	4	5
Expected land loss	-0.06*		-0.05*	-0.05	
	(0.03)		(0.03)	(0.03)	
Perceived land transfer right		0.02			0.02
		(0.02)			(0.02)
Male family labour (num)	0.01	0.01	0.01	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.013	(0.02)
Female family labour (num)	-0.00	-0.00	-0.00	-0.02	-0.02
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Head can read and write	0.05**	0.05**	0.05**	0.01	0.02
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Head sex	-0.04*	-0.04*	-0.03	-0.04	-0.04*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Land size(hectares)					
Land size (>0.5 and <=1)	0.04	0.04	0.03	0.04	0.04
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Land size (>1 and <=3)	0.05**	0.05**	0.04*	0.05*	0.05*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Land size (>3)	0.13***	0.12***	0.11***	0.12***	0.12***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)
Livestock holdings (log)	0.01***	0.01***	0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Access to extension services	0.06***	0.06***	0.06***	0.06***	0.06***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Labour sharing	0.06***	0.06***	0.06***	0.06***	0.06***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Previous tree planting			0.11***		
			(0.02)		
Planted trees in 1994			0.04*		
			(0.02)		
Observations	2,373	2,374	2,372	2,373	2,374

Source: Own calculations using data from ERHS (2004 and 2009). Notes: Regression includes, head age and age square, time averages of time-varying exogenous covariates, time and village dummies, and a constant. Standard errors of the estimated marginal effects are presented in parentheses. Bootstrap standard errors (200 replicates) used in the case of CRE model estimates. *** p<0.01, ** p<0.05, * p<0.1

Table A.8:Marginal effects on the marginal probability of investment (soil conservations)

	Both stone terraces and soil bund (pooled probit)			Stone terraces (panel CRE probit)	
	1	2	3	4	5
Expected land loss	-0.03	-0.03		-0.03	
	(0.03)	(0.03)		(0.02)	
Perceived land transfer right			0.07***		0.00
			(0.02)		(0.02)
Male family labour (num)	0.02**	0.03**	0.03**	0.02	0.02
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Female family labour (num)	0.02**	0.03	0.03*	-0.03*	-0.03*
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Head can read and write	0.06***	0.02	0.02	0.01	0.01
	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
Head sex	-0.04**	-0.04**	-0.04**	-0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Land size(hectares)					
Land size (>0.5 and <=1)	0.06*	0.05*	0.05*	0.01	0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Land size (>1 and <=3)	0.07**	0.07**	0.07**	-0.01	-0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Land size (>3)	0.04	0.03	0.03	-0.01	-0.01
	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
Livestock holdings (log)	0.00	0.00*	0.00	0.00	0.00
	(0.00)	(0.002)	(0.002)	(0.00)	(0.00)
Access to Extension services	0.07***	0.07***	0.07***	0.06***	0.06***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Labour sharing	0.04**	0.04**	0.04**	0.04**	0.04***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Observations	2,373	2,372	2,373	2,372	2,373

Source: Own calculations using data from ERHS (2004 and 2009). Notes: Regression includes, head age and age square, time averages of time-varying exogenous covariates, time and village dummies, and a constant. Standard errors of the estimated marginal effects are presented in parentheses. Bootstrap standard errors (200 replicates) used in the case of CRE model estimates. *** p<0.01, ** p<0.05, * p<0.1

Table A.9: A recursive multivariate probit estimation for participation in tree planting (pooled data 2004 and 2009)

VARIABLES	Extension services	Participation in labour sharing arrangement	Perception of tenure insecurity	Plant tree
Expected land loss in 5 years' time				-0.12
				(0.25)
Perceived land transfer right			-0.10	0.14
			(0.10)	(0.09)
Lost land during 1983-1999			-0.04	
			(0.11)	
Male labour	-0.08**	0.05*	0.02	0.02
	(0.03)	(0.03)	(0.05)	(0.04)
Female labour	-0.00	0.06*	-0.07	-0.02
	(0.03)	(0.03)	(0.05)	(0.04)
Adult literacy	0.33**	0.13	0.31*	0.10
	(0.15)	(0.15)	(0.19)	(0.19)
Primary education	0.59***	0.01	0.13	0.30***
	(0.09)	(0.08)	(0.12)	(0.10)
Secondary education	1.03***	-0.07	0.14	0.45***
	(0.10)	(0.10)	(0.14)	(0.11)
Head sex	-0.26***	-0.16**	-0.11	-0.20***
	(0.07)	(0.07)	(0.10)	(0.08)
Head age	0.03**	-0.03**	0.01	0.01
	(0.01)	(0.01)	(0.02)	(0.01)
Per capita land size	0.39**	0.44***		0.39*
	(0.17)	(0.17)		(0.21)
Livestock (TLU)	0.03***	0.05***	0.01	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)
Member in labour-sharing arrangements				0.28*
				(0.16)
Access to Extension services				0.17
				(0.15)
Relative land size			0.03	
			(0.05)	
Member of informal funeral associations		0.04		
		(0.13)		
Observations	2,354	2,354	2,354	2,354
chi2	11622	11622	11622	11622
P	0.00	0.00	0.00	0.00
Loglikelihood	-4395	-4395	-4395	-4395

Source: Own calculations using data from ERHS.

Note: The education variable indicates the highest education level in a household. Regression includes woreda(village) and time dummies, head age square , land size square ,and a constant. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A.10: A recursive multivariate probit estimation for participation in soil conservation practice (pooled data 2004 and 2009)

Variables	Extension services	Participation in labour-sharing	Perception of tenure insecurity	Soil conservation
Expected land loss in 5 years' time				-0.06
				-0.21
Perceived land transfer right			-0.12	0
			-0.1	-0.1
Lost land during 1983-1999			-0.04	
			-0.11	
Male labour	-0.09***	0.05*	0.02	0.08**
	-0.03	-0.03	-0.05	-0.04
Female labour	0	0.06*	-0.08	0.05
	-0.03	-0.03	-0.05	-0.04
Adult literacy	0.33**	0.14	0.32*	0.14
	-0.15	-0.15	-0.18	-0.16
Primary education	0.60***	0.01	0.13	0.01
	-0.09	-0.08	-0.12	-0.11
Secondary and education	1.04***	-0.06	0.15	0.12
	-0.1	-0.1	-0.14	-0.13
Head sex	-0.26***	-0.17**	-0.11	-0.15*
	-0.07	-0.07	-0.09	-0.09
Head Age	0.03**	-0.03**	0.01	-0.01
	-0.01	-0.01	-0.02	-0.01
Per capita land size	0.38**	0.44***		0.1
	-0.17	-0.17		-0.23
Land size square	-0.07	-0.13**		-0.07
	-0.06	-0.06		-0.08
Livestock (TLU)	0.03***	0.05***	0.01	0
	-0.01	-0.01	-0.01	-0.01
Member in labour-sharing				0.11
				-0.15
Access to Extension services				0.27*
				-0.16
Relative land size			0.03	
			-0.05	
Member in local informal funeral associations		0.02		
		-0.13		
Observations	2,353	2,353	2,353	2,353
chi2	15594	15594	15594	15594
p	0.00	0.00	0.00	0.00
Loglikelihood	-4081	-4081	-4081	-4081

Source: Own calculations using data from ERHS. Note: Regression includes woreda(village) and time dummies, head age square , land size square ,and a constant. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1,

Table A.11: Household characterises by change in tenure status between 2004 and 2009

	change in transfer rights		change in expected land lose	
	Yes	NO	Yes	NO
Head can read and write (%)	44	36	42	35
Household size(num)	5.89	5.77	5.58	5.75
Head sex (male)	61	72	68	71
Male labour size	1.58	1.43	1.47	1.42
Female labour size	1.61	1.49	1.4	1.5
Have a pair of oxen(%)	28	34	42	32
land labour ration	0.44	0.47	0.45	0.47
livestock holdings(value)	1883.12	2403.55	2347.47	2339.25
Lost land in 2004(%)	4.0	2.0	3.0	2.0
Region (%)				
Tigray	10.0	11.3	10.2	11.08
Amhara	20.0	32.4	41.4	30.70
Oromia	45.0	25.4	30.5	26.43
SNNP	25.0	30.9	18.0	31.79
Total households with change in tenure status (%)	6.45	90.89	10.31	88.72

Source: Own calculations using data form ERHS.

Appendix B: Appendix for Chapter 5

Table B.1: Cultivated land size and household size by allocated land size(1994 and 2009)

Deciles of Per-adult PA allocated land	1994		2009	
	Average Per-adult cultivated land	Average Household size	Average Per-adult cultivated land	Average Household size
10	0.06	3.09	0.08	2.95
20	0.07	3.73	0.14	3.4
30	0.11	3.78	0.19	3.77
40	0.17	3.79	0.23	3.82
50	0.22	3.82	0.29	3.85
60	0.33	3.88	0.32	3.97
70	0.47	4.39	0.39	4.13
80	0.59	4.55	0.53	4.31
90	0.79	4.56	0.63	4.43
100	1.28	5.36	1.05	4.63

Source: Own calculation using data from ERHS.

Table B.2: Standard ordered probit estimates(2004 and 2009)

VARIABLES	Model 1	Model 2	Model 3
Land renting in 2004 and 2009			
Rent in land	0.18***		
	(0.07)		
Rent out land	-0.18***		
	(0.07)		
Land renting only after 2004			
Rent in land		0.01	
		(0.11)	
Rent out land		-0.37***	
		(0.12)	
Frequency of participation			
Rent in sometimes			0.15**
			(0.07)
Rent in most of the time			0.25**
			(0.1)
Rent out sometimes			-0.07
			(0.07)
Rent out most of the time			-0.20*
			(0.12)
Male family member(num)	0.09***	0.13***	0.10***
	(0.03)	(0.04)	(0.03)
Female family member(num)	0.09***	0.16***	0.10***
	(0.03)	(0.04)	(0.03)
Head can read and write	0.06	0.01	0.06
	(0.06)	(0.08)	(0.06)

Source: Own calculation using data from ERHS.
Note: The estimation model includes village dummies.*** p<0.01, ** p<0.05, * p<0.1 .

Table B.2 (continued): Standard ordered probit estimates

VARIABLES	Model 1	Model 2	Model 3
Family member age <15	0.11***	0.14***	0.11***
	(0.02)	(0.02)	(0.02)
Family member age >65	0.13***	0.16**	0.13***
	(0.05)	(0.07)	(0.05)
Adult literacy	0.02	0.31	0.03
	(0.12)	(0.2)	(0.12)
Primary education	0.27***	0.38***	0.26***
	(0.07)	(0.1)	(0.07)
Secondary and above education	0.48***	0.58***	0.47***
	(0.08)	(0.11)	(0.08)
Head sex	0.16***	0.21**	0.14**
	(0.06)	(0.09)	(0.06)
Consumption expenditure(log)	0.31***	0.39***	0.30***
	(0.04)	(0.08)	(0.04)
Have pair of oxen	0.22***	0.23**	0.24***
	(0.07)	(0.12)	(0.07)
Livestock holdings (htu)	0.08***	0.08***	0.08***
	(0.01)	(0.02)	(0.01)
Per capita land size	0.93***	1.13***	0.93***
	(0.15)	(0.22)	(0.14)
Land size square	-0.21***	-0.23***	-0.20***
	(0.05)	(0.06)	(0.04)
work of farm wage employment	-0.04*	-0.10***	-0.04*
	(0.02)	(0.04)	(0.02)
work of farm self-employment	0.05	0.05	0.05
	(0.04)	(0.06)	(0.04)
Cut1	1.88***	2.58***	1.83***
	(0.27)	(0.42)	(0.27)
Cut2	2.42***	3.16***	2.37***
	(0.27)	(0.43)	(0.27)
Cut3	3.42***	4.19***	3.36***
	(0.27)	(0.44)	(0.27)
Cut4	4.92***	5.73***	4.87***
	(0.28)	(0.46)	(0.28)
Observations	2,371	1,104	2,376
N_clust	1234	564	1235
Loglikilhood	-3046	-1416	-3053
ll_0	-3515	-1623	-3523
chi2	774.4	412.4	795.1
p	0	0	0

Source: Own calculation using data from ERHS.

Note: The estimation model includes village dummies.*** p<0.01, ** p<0.05, * p<0.1 .

Table B.3: Random effects generalised ordered probit models(2004 and 2009)

	Model 1				Model 3			
VARIABLES	C1	C2	C3	C4	C1	C2	C3	C4
Land renting in 2004 and 2009								
Rent in land	0.20***	0.20***	0.20***	0.20***				
	(0.07)	(0.07)	(0.07)	(0.07)				
Rent out land	-0.32***	-0.21**	-0.20**	0.22				
	(0.09)	(0.08)	(0.09)	(0.14)				
Frequency of participation								
Rent in sometimes					0.16**	0.16**	0.16**	0.16**
					(0.08)	(0.08)	(0.08)	(0.08)
Rent it most of the time					0.27**	0.27**	0.27**	0.27**
					(0.11)	(0.11)	(0.11)	(0.11)
Rent out sometimes					-0.07	-0.07	-0.07	-0.07
					(0.07)	(0.07)	(0.07)	(0.07)
Rent out most of the time					-0.38***	-0.32**	-0.12	0.22
					(0.13)	(0.13)	(0.13)	(0.21)
Male labour (num)	0.10***	0.10***	0.10***	0.10***	0.10***	0.10***	0.10***	0.10***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Female labour (num)	0.10***	0.10***	0.10***	0.10***	0.10***	0.10***	0.10***	0.10***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Head can read and write	0.19**	0.23***	-0.04	-0.03	0.18**	0.23***	-0.04	-0.03
	(0.09)	(0.08)	(0.07)	(0.1)	(0.09)	(0.08)	(0.07)	(0.1)
Family member age <15	0.11***	0.11***	0.11***	0.11***	0.11***	0.11***	0.11***	0.11***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Family member age >65	0.14***	0.14***	0.14***	0.14***	0.14***	0.14***	0.14***	0.14***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)

Source: Own calculation using data from ERHS. Note: The estimation model includes village dummies. Model 2 is failed to converge. Standard errors in Parenthesis *** p<0.01, ** p<0.05, * p<0.1. C1-C4 indicates the four categories of the self-rated poverty indictor variable.

Table B.3 (continued): Random effects generalised ordered probit models

	Model 1				Model 3			
VARIABLES	C1	C2	C3	C4	C1	C2	C3	C4
Adult literacy	-0.04	-0.04	-0.04	-0.04	-0.03	-0.03	-0.03	-0.03
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Primary education	0.24***	0.24***	0.24***	0.24***	0.24***	0.24***	0.24***	0.24***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Secondary above education	0.48***	0.48***	0.48***	0.48***	0.47***	0.47***	0.47***	0.47***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Head sex	0.17***	0.17***	0.17***	0.17***	0.15**	0.15**	0.15**	0.15**
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Consumption expenditure (log)	0.20***	0.29***	0.39***	0.43***	0.19***	0.29***	0.38***	0.42***
	(0.05)	(0.05)	(0.05)	(0.07)	(0.05)	(0.05)	(0.05)	(0.07)
Have pair of oxen	0.22***	0.22***	0.22***	0.22***	0.24***	0.24***	0.24***	0.24***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Livestock holdings (htu)	0.09***	0.09***	0.09***	0.09***	0.09***	0.09***	0.09***	0.09***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Per capita land size	1.17***	1.08***	0.97***	0.61***	1.17***	1.09***	0.96***	0.64***
	(0.17)	(0.17)	(0.16)	(0.18)	(0.17)	(0.17)	(0.16)	(0.18)
Land size square	-0.23***	-0.23***	-0.23***	-0.23***	-0.22***	-0.22***	-0.22***	-0.22***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Work of farm wage employment	-0.05*	-0.05*	-0.05*	-0.05*	-0.04	-0.04	-0.04	-0.04
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Work of farm self-employment	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Constant	-1.39***	-2.44***	-3.88***	-5.50***	-1.35***	-2.41***	-3.80***	-5.46***
	(0.3)	(0.3)	(0.31)	(0.42)	(0.3)	(0.3)	(0.32)	(0.42)
Observations	2,371	2,371	2,371	2,371	2,376	2,376	2,376	2,376
loglikelihood	-3006	-3006	-3006	-3006	-3015	-3015	-3015	-3015
chi2	714.7	714.7	714.7	714.7	707.1	707.1	707.1	707.1

Table B.4: Multinomial treatment effects model (pooled data, 2004 and 2009)

VARIABLES	Model 1	Model 2	Model 3
land renting in 2004 and 2009			
Rent in land	0.45***		
	(0.04)		
rent out land	-0.55***		
	(0.04)		
Land renting only after 2004			
rent in land		0.43***	
		(0.07)	
rent out land		-0.48***	
		(0.07)	
Frequency of participation			
rent in sometimes			0.06
			(0.05)
rent it most of the time			0.13**
			(0.05)
rent out sometimes			-0.63***
			(0.03)
rent out most of the time			-0.62***
			(0.06)
hhsise15	0.04***	0.03**	0.04***
	(0.01)	(0.01)	(0.01)
Male family member(num)	0.10***	0.10***	0.11***
	(0.01)	(0.02)	(0.01)
Female family member(num)	0.11***	0.08***	0.11***
	(0.01)	(0.02)	(0.01)
Head can read and write	0.25***	0.26***	0.28***
	(0.03)	(0.04)	(0.03)
Head sex	-0.09***	-0.09**	-0.13***
	(0.03)	(0.04)	(0.03)

Table B.4(continued): Multinomial treatment effects model

VARIABLES	Model 1	Model 2	Model 3
Per capita land size	0.68***	0.48***	0.67***
	(0.07)	(0.1)	(0.07)
Land size square	-0.16***	-0.11***	-0.17***
	(0.02)	(0.03)	(0.02)
Have pair of oxen	0.27***	0.29***	0.36***
	(0.03)	(0.05)	(0.03)
Consumption expenditure (log)	0.10***	0.07***	0.10***
	(0.02)	(0.03)	(0.02)
Work of farm wage employment	-0.03**	0.01	-0.01
	(0.01)	(0.02)	(0.01)
Work of farm self-employment	0.07***	0.04	0.06***
	(0.02)	(0.03)	(0.02)
Regional dummies			
Amhara	0.87***	0.92***	0.95***
	(0.05)	(0.07)	(0.05)
Oromia	0.88***	0.98***	0.87***
	(0.05)	(0.06)	(0.05)
SNNP	0.65***	0.81***	0.64***
	(0.05)	(0.06)	(0.05)
Constant	-0.10	0.07	0.03
	(0.11)	(0.15)	(0.11)
Observations	2,384	1,114	2,389
Loglikilhood	-3666	-1606	-4702
chi2	4126	1383	4634
p	0	0	0

Source: Own calculations using data from ERHS. Note: The land rental market participation equation includes village dummies. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Figure . 1: Pen's parade estimates for the distribution of per adult land holding sizes (1994-2009)

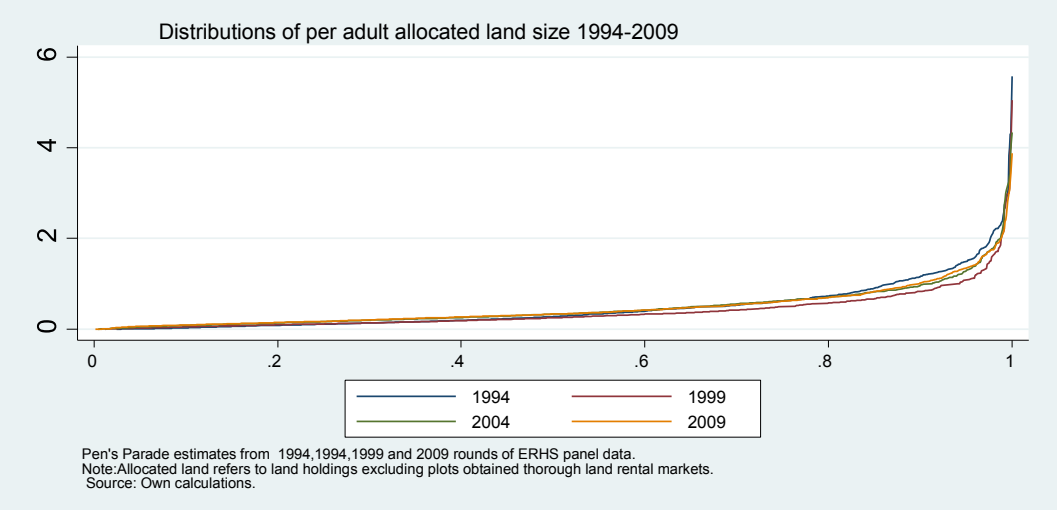


Figure B. 2: Lorenz curves for land holding sizes (1994-2009)

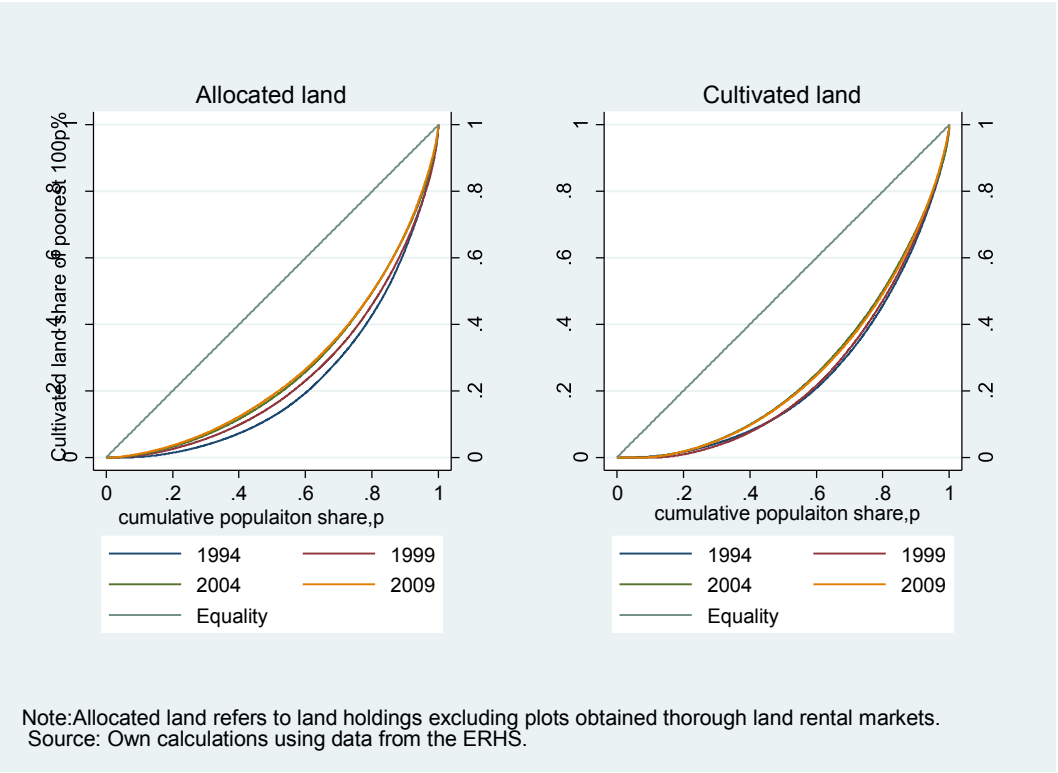
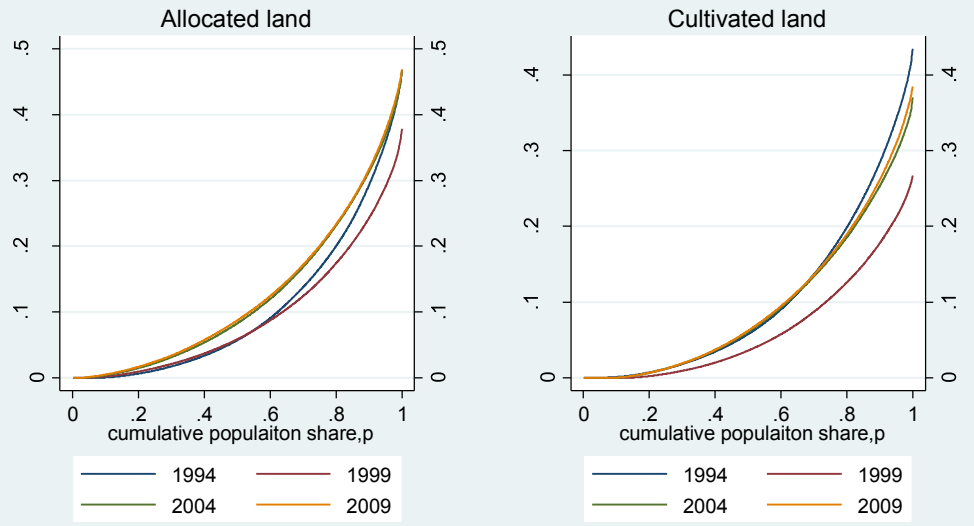


Figure B. 3: Generalised Lorenz curves for land holding sizes (1994-2009)



Note:Allocated land refers to land holdings excluding plots obtained thorough land rental markets.
Source: Own calculations using data from the ERHS.

Poverty Indicators

The standard approach in the literature analysing poverty dynamics is to use income or consumption (the monetary approach) as a measure of household or individual poverty (Bane & Ellwood, 1986; Bigsten & Shimeles, 2008; Devicienti, 2002).This approach identifies poverty with a shortfall in income or consumption below some defined poverty line. Yet, a number of shortcomings may be anticipated in those studies analysing poverty dynamics that rely exclusively on income or consumption as a measure of poverty or welfare. First, any poverty analysis that relies exclusively on income or expenditure data fails to adjust for all relevant non-income dimensions of welfare such as literacy, life expectancy, and provision of public goods (Ravallion, 2012; Sen, 1992; Thorbecke, 2005).

Second, poverty measures based on consumption or income data are prone to measurement errors, and seasonality effects (Baulch & Hoddinott, 2000; Devereux & Sharp, 2006). As a result, any random changes in income or consumption measures may lead observers to conclude wrongly that households have made transitions in their poverty status (exit or entry) when their poverty status in reality is unchanged. Alternatively, an asset-based poverty analysis based on visible assets such as land or livestock is less sensitive to measurement errors (Baulch & Hoddinott, 2000; Carter & Barrett, 2006).

The multidimensional nature of poverty has been widely recognised in the literature since the seminal work of Amartya Sen (1979, 1985, 1987). Sen proposed a capability approach and argued that well-being should be measured by looking at the capabilities of people such as the freedom that people have to achieve the lifestyle

that they value. Despite the degree of flexibility in selecting the dimensions to be included in the measurement of well-being, the one main challenge in adapting the capability approach is that it is difficult to define and measure capabilities empirically. For this reason, other alternative approaches including the Basic Needs Approach (BNA) and the Sustainable Livelihoods Approach (SLA) have been used widely in the literature to understand multidimensional aspects of poverty (Clark, 2005; Frediani, 2010).

Poverty measurement using BNA takes into account needs such as consumption of food, shelter, clothing, and access to pure water, sanitation, public transport, health, and education. On the other hand, the SLA method states that household welfare depends upon their asset accumulation and the context in which they develop their livelihood strategy (Ellis, 2000). This latter approach aims to address issues of vulnerability and risk building on the belief that people need various kinds of assets to achieve positive livelihood outcomes (Ellis, 2000; Frediani, 2010; Petersen & Pedersen, 2010). These different kinds of assets are divided into five categories: physical (productive assets such as domestic equipment, access to infrastructure); financial (credit access, saving); human (education, health, nutrition); social (trust and reciprocity); and natural (land, water, mineral). The SLA method differs from Sen's Capability approach, as it does not explore other dimensions of well-being, such as freedom to appear in public (Frediani, 2010).

The conceptual framework for an asset-based poverty measure suggests that poverty or the welfare status of a household reflects a conjunction of low asset endowments, low returns on these endowments, and vulnerability to shocks (Baulch & Hoddinott, 2000). In addition, an asset-based poverty analysis is less sensitive to measurement

errors and it enables one to distinguish persistent structural poverty from transitory poverty; in other words, poverty that passes naturally with time (Baulch & Hoddinott, 2000; Carter & Barrett, 2006). Nevertheless, an asset-based approach is criticised on the ground that it is usually based on a relatively narrow range of assets that are measurable and that arbitrary weights are applied to each asset (Hulme & McKay, 2005). A study by Filmer and Scott (2012), however, showed that those results from assed-based welfare measures are systematically consistent across alternative aggregations.

Another alternative to conventional ways of defining poverty is to use subjective poverty/welfare indicators. It is suggested that a person's perception of his or her own welfare situation should be considered as a reliable source of information on poverty as that person is the best judge of his or her own poverty status (Deaton, 2010). Furthermore, the self-reported poverty status includes other dimensions of deprivation that are not captured by consumption/income-based poverty estimates such as asset ownership, health status, social capital, and relative deprivation (Ravallion, 2012; Thorbecke, 2005). According to Thorbecke (2005), the main advantage of using this type of subjective approach is that:

The answers that are given rely implicitly on the utility function of the subject in question. In other words, the individual stating that he does not feel poor uses an implicit set of individual weights and minimum thresholds from the various attributes of wellbeing and aggregates accordingly to obtain a scalar measure. This resolves the very thorny and essentially arbitrary issue of having to select a set of attributes' weights in the quantitative multi-dimensional poverty measures and indicators (p.25).

Different approaches have been used to quantify poverty or welfare by using subjective indicators and these can be classified broadly into two: the first approach uses a money-metric of subjective welfare, while the second approach uses qualitative categories in the welfare space (Ravallion, 2012). The first approach includes the Income Evaluation Question (IEQ) that asks what level of income is considered 'very bad', 'bad', 'not good', 'not bad' and 'good'. It also includes the Minimum Income Question (MIQ) that asks what levels of income are needed to 'make ends meet'. The second approach includes the Satisfaction with Life question (SWL) and the Economic Ladder Question (ELQ).

The SWL approach is based on answering the question: 'Overall, how satisfied are you with your life?' with the answers ranging from 1 to 5: 1 means 'very unsatisfied' and 5 means 'very satisfied' The ELQ is based on answering the following question: 'Imagine six steps, and at the bottom, on the first step, stand the poorest people and on the top, on the sixth step, stand the rich. On which step are you today?' Unlike the money-metric approach, which uses income as an indicator of welfare, the qualitative approach uses self-rated welfare as the welfare indictor (Ravallion & Lokshin, 2002).

Mainly because of its tractability, the SLF approach was chosen for this study and used an asset-based approach to measure household poverty. The Multiple Correspondence Analysis (MCA) technique was used to construct a Composite Poverty Index (CPI) for each household. The detailed procedure for constructing the asset indices is provided in the next section. In addition, to the asset indices, subjective economic well-being indicators were also used in the analysis to quantify poverty.

Construction of an asset index

A substantial number of literatures in poverty analysis use an asset-based alternative to the conventional use of consumption or income in defining poverty (Filmer & Pritchett, 2001; Carter & May, 2001; Carter & Barrett, 2006). Those studies that use an asset-based approach to poverty either used a one-dimensional asset or constructed an asset index using various techniques to define poverty. In most developing countries, ownership of land and livestock is considered as a key indicator of household wealth in rural areas. As a result, several studies have used a one dimension asset measurement, such as livestock, to analyse poverty dynamics in rural areas (Barrett & McPeak, 2004; Lybbert, Barrett, Desta, & Coppock, 2004; Mogues, 2006).

Alternatively, a number of other studies have used various assets and then have constructed an asset index using different aggregation methods to measure poverty (Barrett, Carter, & Little, 2006; Liverpool & Winter-Nelson, 2011; Sahn & Stifel, 2003). The key issues in constructing an asset index are to decide which assets should be considered and then to consider how diverse categories of assets should be aggregated. There are several ways of constructing an asset index, of which factor analysis (FA) or principal components analysis (PCA) are the most widely used methods in the literature (Filmer & Pritchett, 2001; Sahn & Stifel, 2003).

Recent studies have used multiple correspondence analysis (MCA) to construct poverty/welfare indices in the area of multidimensional poverty analysis (Asselin, & Anh, 2009; Booysen, Van Der Berg, Burger, Maltitz, & Rand, 2008). The multiple correspondence analysis (MCA) involves application of simple correspondence

analysis algorithm to multivariate categorical data coded in the form of an indicator matrix or a Burt matrix[49] (Greenacre, 2010). It is suggested that the use of MCA is more appropriate than PCA when using categorical data or a mix of continuous and categorical data; this is because PCA is mainly designed for continuous variables (Asselin, & Anh, 2009). In addition, factor Analysis technique does not take into account the relative importance of different assets in generating income (Hulme & Mckay, 2005).

The other advantage of MCA over PCA or FA is that MCA satisfies two desirable properties (Asselin, & Anh, 2009).The first of these is the distributional equivalence property: this ensures that MCA gives extra weight to the smaller categories within each primary indicator. The second is the reciprocal bi-addivity or duality property which states that: (a) the composite poverty score of a population unit is the simple average of the standardised factorial weights or the poverty categories to which it belongs, and (b) the weight of a given poverty category is the simple average of the standardised composite poverty scores of the population units belonging to the corresponding poverty group.

For the reasons stated above, and because most of the variables available to measure welfare/poverty are categorical indicators, I used MCA and constructed a Composite Poverty Index (CPI) to define poverty for sample households. Following the works of Asselin, & Anh (2009), the functional form of the MCA-based CPI can be written as:

$$C_i = \frac{1}{K}\left(\sum_{k=1}^{K}\sum_{j_k=1}^{J_k} W_{j_k}^{*I,k} I_{i,j_k}^{k}\right) \quad \text{---------- [B1]}$$

[49] The Burt matrix is the indicator matrix transposed and post-multiplied by itself.

Here, K is the number of primary welfare indicator variables, j_k is the number of categories for indicator K, $W_j^{*I,k}{}_k$ is the core of category j (the weight determined with MCA) which is the factor score on the first axis normalised by the eigenvalue, $I_i^k{}_{,jk}$ is the binary variable 0/1 taking the value 1 when the unit I has the category j_k.

According to Asselin, & Anh (2009), the MCA-based CPI must satisfy two important axioms: (i) the CPI must be monotonically increasing in each of its primary indicators. This implies that if the welfare condition of an individual is improved according to a given primary indicator then the CPI must increase, representing a decrease in poverty, and (ii) the CPI must satisfy the composite poverty ordering consistency; thus, the population ordering for a primary indicator is preserved with the composite indicator.

The MCA procedure is applied using the Burt matrix calculated from the data.[50] Data from the last two rounds (2004 and 2009) of the ERHS were used for this analysis. In order to consider poverty over time, weights were derived by applying the MCA procedure using the weights only in the first year, 2004[51]. The scoring coefficients from the MCA procedure were then used to calculate the CPI for each household. Because the weights that result from the MCA procedure can have both positive and negative values, one can rescale the CPI so that the composite index is always greater or equal to zero. Based on the sustainable livelihoods approach (SLA), the variables

[50] The MCA was used with the joint option and this procedure is called the Joint Component Analysis (JCA).This method analyses a variant of the Burt matrix, in which the diagonal blocks are iteratively adjusted for the poor diagonal fit of MCA.

[51] The weights calculated from the pooled data set differ slightly.

taken into account to construct the Composite Poverty Index (CPI) are grouped into four main groups.

These are: (i) natural assets (land holding size, number of oxen and livestock quintile excluding oxen), (ii) other assets (ownership of hoe, plough and radio), (iii) human capital (proportion of available male labour force in a household, proportion of female labour force, proportion of household members considered as being old, and sex of a household head as proxy for farming ability), and (iv) education levels, financial and social capitals. These three items designated under (iv) are variables that indicated highest level of education in a household, if a household stored any crop, could get access to 100 Birr if needed, had food shortage problems, and was a member of social networks such as *equb, eddir*, or labour-sharing arrangements[52]. Other additional variables were also included in the MCA and this included ownership of a toilet, sole access to a source of water and health status. However, these variables were dropped after the first stage of the MCA because they did not satisfy the monotonicity axiom property of the MCA.

Table B.5 lists all the variables used, and the coefficient estimates obtained, from the MCA procedure. The first dimension explains 76% of the total inertia of the cloud of variables. The explanatory power drops to 9% for the second dimension (axis). This finding indicates that most of the variance of the set of variables used is captured by one axis. Results in Table B.5 also show that all variables satisfy the monotonicity property of MCA. The indicators that are negatively correlated to the first axis describe deterioration in the state of poverty, while the indicators that are positively correlated with the first axis describe improvement in poverty condition.

[52] *Eddir* is an informal funeral service, while *equb* is a rotating saving scheme.

A review of the most negatively correlated variables to the first axis allow one to identify poor households as follows: households with a small land size (<0.5 ha); households in the lowest livestock quintile with no oxen; those with a higher proportion of female and old individuals in the household; those with no individuals with schooling; and, households that did not own assets such as a hoe or plough, did not store any crop, and couldn't get access to 100 Birr if needed. In addition, poor households had no radio and faming equipment such as hoe and plough, were not members of social networks such as *eddir, equb,* and labour-sharing arrangements. In contrast, rich households generally had more land (>3 ha), own more livestock holdings, had at least a pair of oxen, own a radio, were members of *equb*, had at least one member with a maximum education level of high school and above, and the head is educated (in this context 'educated' means 'can read and write').

For the 2004 survey year, the minimum value for CPI is -4.26 and the maximum value is 3.14. An examination of the characteristics of households with the lowest value of CPI indicates that: the household head is female and cannot read and write; there was no working age male family member in the household; the household had no ox; it experienced food shortages in both periods (2004 and 2009); livestock holding is in the first quantile (in other words, owns no livestock); the size of the land holding was less than 0.5 hectare; and, no household member completed school.

In contrast, the household with the largest value of CPI was characterised as follows: the household head was male and can read and write; the maximum education in the household was high school and higher; the household had more than two hectares of land; it had at least two male family members of working age; it owns a pair of oxen; it never experienced problems of food shortage, and was in the fifth livestock quantile

during both years under review (2004 and 2009). Overall, the results from the MCA suggest that the first axis describes adequately the welfare situation in the sample area.

In addition to the CPI, I constructed additional Composite Poverty Index1 (CPI1) and Composite Poverty Index2 (CPI2) variables without excluding variables that directly affect land rental market participation decisions. The CPI1 is constructed using data from the 2004 and 2009 survey rounds, while the CPI2 is calculated using data from the four survey rounds (1994, 1999, 2004 and 2009) in which case weights are derived by applying the MCA procedure using the weights in the first year, 1994. The variables excluded from the CPI1 and CPI2 calculation are land ownership, number of oxen, farming equipment (hoe and plough), household sex and education, and male labour force.

Table B.5: Description of variables used in MCA and estimated weight from the first dimension (2004)

	Variables	Category	weights		Variables	Category	weights
1	**Land and livestock**			3	**Other household assets**		
	Land size				own hoe		
	1	less than 0.5 hectares	-1.82		1	No	-1.23
	2	between 0.5 and 1 hectares	-0.83		2	Yes	0.489
	3	between 1 and 3 hectares	0.668		own plough		
	4	greater than 3 hectares	1.824		1	No	-2.389
	Livestock quintile				2	Yes	0.813
	1	Q1	-2.3		own radio		
	2	Q2	-0.47		1	N0	-0.293
	3	Q3	-0.08		2	Yes	1.788
	4	Q4	0.637	4	**Financial and social**		
	5	Q1	2.219		Can get 100 Birr		
	Number of oxen				1	No	-1.277
	1	own no oxen	-1.46		2	Yes	0.909
	2	own one ox	0.355		store crop		
	3	own a pair of oxen	2.276		1	No	-1.652
	4	own more than 3 oxen	3.275		2	Yes	0.821
2	**Human capital**				food shortage		
	Head sex				1	no	-0.6
	1	Female	-1.35		2	yes	1.72
	2	Male	0.561		*eddir* member		
	Proportion of male labour				1	No	-1.705
	1	less than 1/3	-0.27		2	yes	0.417
	2	between 1/3 and 2/3	0.652		*equb* member		
	3	greater than 2/3	-0.37		1	yes	-0.279
	Proportion of female labour				2	No	1.337
	1	less than 1/3	0.297		Labour-sharing		
	2	between 1/3 and 2/3	-0.37		1	No	-0.585
	3	greater than 2/3	-1.7		2	Yes	0.777
	Proportion of old age						
	1	less than 1/3	0.174				
	2	between 1/3 and 2/3	-1.47				
	3	greater than 2/3	-2.48				
	Maximum education level						
	1	no schooling	-1.56				
	2	some adult literacy	0.776				
	3	primary	0.554				
	4	high school level	0.939				
	Head can read and write						
	1	no schooling	-0.68				
	2	Yes	1.227				

Source: Own calculations using data from ERHS.

Subjective welfare indicators

In addition, to the asset indices, subjective economic well-being indicators were also used in the analysis to quantify poverty. One of the subjective economic wellbeing indicator variables (labelled as 'self-rated poverty scale'), which is similar to the ELQ, is based on answering the following question*:*

'Just thinking about your own household circumstances, would you describe your household as: 1) very rich, 2) rich, 3) comfortable, 4) can manage to get by, 5) never have quite enough, 6) poor, and 7) destitute?'[53]

Another subjective economic well-being indicator (labelled as 'General economic condition') is based on answering the following question:

'*In general how would you describe your household : 1) Doing well: able to meet household needs by our own efforts and making some extra for store, savings and investment, 2) doing just okay: able to meet household needs by own effort but with nothing extra to save or invest, 3) struggling: managing to meet household needs but by depleting productive assets and or sometimes receiving support, 4) unable to meet household needs or dependent on support from community or government*'.

In addition, to the above subjective poverty indicators, households were asked about the adequacy of household expenditures on food, health, and housing in a given period. For example, the issue of adequacy of food consumption is explored, based on answers to the following question:

[53] Only a small percentage of households reported that they were very rich, and therefore I combined code 1 with code 2. For a similar reason, code 6 and code 7 were combined.

'C*oncerning your family's food consumption over the past month, which of the following is true?: 1) It was less than adequate for the family's needs; 2) it was just adequate for the family's needs; and 3) it was more than adequate for the family's needs'*.

Similar questions were also asked regarding health and housing expenditures over the year. Moreover, respondents were also asked to rate their welfare status based on broader concepts of welfare such as 'happiness' and using the following question:

'*Taken all together, how would you say things are for you these days? Would you say you are: 1) very happy, 2) pretty happy, and 3) not too happy'*.[54]

Table B.6 shows the percentages of sample households ranked according to the subjective economic well-being indicators. Results from the self-rated poverty indicator variable show that for those households sampled, 17% reported that they were poor or destitute, 12.9% reported that they never had enough for their family, while 31.9% and 7.2% reported that they were comfortable and rich, respectively. Based on the self-rated poverty scale variable, households were classified as 'poor' if they reported that they 'never had enough' or 'poor/destitute'. Based on this poverty line, 29.9% of the sample households were poor.

[54] For the purpose of this analysis the variables were re-coded as 1 indicating 'not too happy' and 3 indicating 'very happy'.

Table B.6: Percentage of households by subjective economic well-being indicators (Pooled data , 2004 and 2009)

	Self-rated poverty scale					
Other economic well-being indicators	Poor/ destitute	Never had enough	Can manage	Comfortable	Very rich/rich	Total
Happiness						
Not too happy	68.4	49.0	27.3	10.4	8.0	30.3
Pretty happy	27.7	44.3	62.5	69.3	56.0	55.9
Very happy	3.9	6.7	10.3	20.3	36.0	13.8
Food expenditure						
Less than adequate	76.3	70.7	38.1	15.4	5.7	39.1
Just adequate	19.3	26.1	57.9	78.2	73.7	54.9
More than adequate	4.4	3.2	4.0	6.4	20.6	5.9
Health care expenditure						
Less than adequate	64.2	51.3	37.9	23.0	16.7	37.7
Just adequate	33.3	45.8	57.1	67.9	64.4	55.7
More than adequate	2.5	2.9	5.0	9.1	19.0	6.6
Housing expenditure						
Less than adequate	64.4	54.1	36.2	20.5	16.6	36.8
Just adequate	31.5	40.5	58.7	69.1	64.0	55.5
More than adequate	4.2	5.4	5.2	10.4	19.4	7.7
General economic condition						
Unable to meet family needs	34.3	18.3	6.2	2.4	1.2	11.0
Struggling	53.1	62.5	51.0	21.1	6.6	40.1
Just doing okay	10.6	17.3	38.9	66.4	62.9	41.8
Doing well	2.0	2.0	3.9	10.1	29.3	7.1
Total households (%)	17.0	12.9	31.1	31.9	7.2	100.0
Total households	410	310	739	772	172	2403

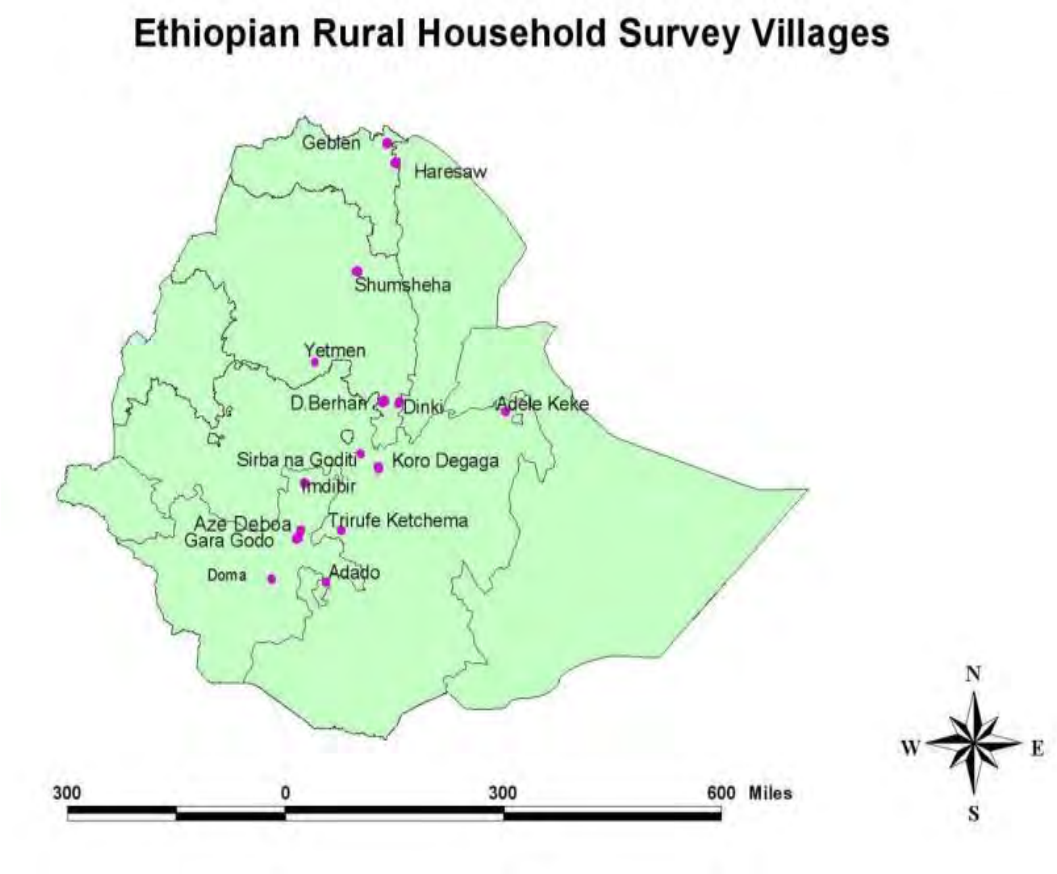
Source: Own calculations using data from ERHS.

A comparison was made between other subjective indicators of poverty and the self-rated poverty status indicator. The comparison centred on those 17% of households who reported that they were poor or destitute: 68.4% of those households also

reported that they were ‘not too happy’, 76.3% had inadequate expenditure on food, 64% reported that housing and health care expenditures were less than adequate, and about 87% reported that either they were unable to meet their family needs or struggling to meet their family needs. These results suggest a strong correlation among various subjective welfare indicators considered this study.

Appendix C: Appendix for Chapter 1

Figure C.1: Survey sites in rural Ethiopia



Source: Dercon and Hoddinot, 2011)

Table C.1: The sample frame of the ERHS

Farming system	Population share* in 1994(%)	Sampling share in 1994(%)	number of villages in 1989	number of villages in 1989 and 1994	Sampling share in 1989(%)	panel households
Grain-plough complex-Highlands						
Grain plough complex - Northern	21.2	20.2	3	0		
Grain plough complex-Central	27.7	29	4	2	31	32.4
Grain-plough/hoe complex						
Grain plough Arsi/Bale	9.3	14.3	2	1	25.4	25.6
Sorghum plough/hoe Hararghe	9.9	6.6	1	1	15	12.4
Enset (with or without coffee/cereals)	31.9	29.9	5	2	8.7	29.6
Total	***100***	***100***	***15***	***6***	***100***	***100***

Source: Dercon and Hoddinot, 2011). Note: * Percentage of rural sedentary population, pastoralist population is about 10 percent of total population.

Table C.2:Summary statistics on characteristics of sample households

	1999(N=1456)		2004(N=1373)		2009(N=1357)	
Variable	mean	S.D.	mean	S.D.	mean	S.D.
Household composition						
Family size	5.8	2.7	5.6	2.5	5.7	2.6
Male family labour (number)	1.8	1.3	1.9	1.3	1.9	1.3
Female family labour (number)	1.9	1.2	1.9	1.1	2.1	1.2
Sex of head (1 if male)	0.7	0.4	0.7	0.5	0.7	0.5
Age of head (in years)	49.3	15.6	50.8	15.3	52.6	15.1
Head can read and write (dummy)	0.3	0.5	0.3	0.5	0.5	0.5
Head main economic activity (proportions)						
Farmer	0.7	0.5	0.7	0.4	0.7	0.5
Domestic worker	0.2	0.4	0.2	0.4	0.2	0.4
Non-farm work	0.0	0.2	0.0	0.2	0.0	0.2
Not in the labour force	0.0	0.2	0.0	0.2	0.1	0.3
Proportion of family members working in:						
Farming	0.5	0.3	0.5	0.3	0.5	0.3
Domestic work	0.5	0.2	0.4	0.3	0.5	0.3
Non-farm jobs	0.0	0.1	0.0	0.1	0.1	0.2
Land and asset holdings						
Land held (in hectares)	1.3	1.2	1.6	1.5	1.6	1.5
Land/labour ratio	0.4	0.4	0.5	0.5	0.5	0.5
Livestock value (in 1994 price)	1535	1811	2193	2876	2228	3174
Own a pair of oxen (% of HH)	0.3	0.5	0.3	0.5	0.3	0.5

Source: Own calculations using ERHS (1994-2009).

Table C.3: Characteristics by attrition status(1994)

	Mean values		
	Non-attritors (n=1241)[a]	Attritors (n=236)[b]	t-test
Male family labour	1.57	1.14	***
Female family labour	1.68	1.42	**
Family member aged <15	2.70	2.13	***
Family member aged >15	0.25	0.28	
Head sex	0.80	0.67	***
Head can read and write	0.34	0.28	
Head age	46.17	47.89	
Livestock holdings(value)	1800.82	1159.62	***
Plot size	1.74	1.35	***
Per capita consumption	70.53	80.68	
Leased in land	0.21	0.16	
Leased out land	0.12	0.17	*
Hired labour	0.26	0.28	
Worked off-farm	0.58	0.47	**
Planted tree crops	0.37	0.23	***
Village dummies			
Haresaw	0.06	0.03	*
Geblen	0.05	0.04	
Dinki	0.06	0.05	
Yetmen	0.04	0.05	
Shumsha	0.09	0.17	***
Sirbana Godeti	0.06	0.09	
Adele Keke	0.07	0.05	
Korodegaga	0.07	0.08	
Trirufe Ketchema	0.07	0.06	
Imdibir	0.05	0.02	
Aze Deboa	0.06	0.03	
Adado	0.08	0.15	***
Gara Godo	0.07	0.02	**
Doma	0.05	0.08	**
D.B. -Milki	0.05	0.02	*
Kormargefia	0.04	0.03	
Karafino	0.03	0.02	
Bokafia	0.02	0.00	

Source: Own calculations using data from ERHS.
Note: [a] n=1237 and 1240 for leased out variable and head education variable, respectively. b n=288 for the village dummies.

Table C.4: Attrition probit estimates (1994-2009)

	Model 1	Model 2	Model 3	Model 4	Model 5
Leaded in land	-0.07				
	(0.11)				
Leased out land		0.08			
		(0.13)			
worked off-farm			-0.06		
			(0.09)		
Planted trees				-0.11	
				(0.12)	
Livestock holdings					-0.00
					(0.00)
Male family labour	-0.13**	-0.13**	-0.13**	-0.13**	-0.12**
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Female family labour	-0.02	-0.02	-0.02	-0.02	-0.01
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Family member aged <15	-0.04	-0.04	-0.04*	-0.04	-0.03
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Family member aged >65	-0.07	-0.07	-0.08	-0.07	-0.06
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Male household-head	-0.26**	-0.28**	-0.27**	-0.27**	-0.26**
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Head can read and write	-0.04	-0.04	-0.04	-0.05	-0.04
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Primary education	-0.11	-0.10	-0.11	-0.10	-0.11
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
High school and above	0.04	0.05	0.03	0.04	0.04
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
Head age	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age square	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Plot size	-0.15**	-0.16**	-0.15**	-0.14*	-0.13*
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Plot size square	0.01	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Per capita consumption	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table C.4(continued): Attrition probit estimates(1994-2009)

	Model 1	Model 2	Model 3	Model 4	Model 5
Village dummies					
Geblen	0.17	0.17	0.18	0.16	0.18
	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)
Dinki	0.48*	0.47*	0.48*	0.44	0.46*
	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)
Yetmen	0.72**	0.68**	0.69**	0.73**	0.76***
	(0.29)	(0.29)	(0.29)	(0.29)	(0.28)
Shumsha	1.01***	1.02***	0.98***	0.96***	1.00***
	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)
Sirbana Godeti	1.04***	1.06***	1.02***	1.05***	1.11***
	(0.25)	(0.25)	(0.26)	(0.25)	(0.26)
Adele Keke	0.47*	0.49*	0.46*	0.45*	0.47*
	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)
Korodegaga	1.11***	1.12***	1.11***	1.06***	1.10***
	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)
Trirufe Ketchema	0.73***	0.69***	0.70***	0.73***	0.73***
	(0.26)	(0.27)	(0.27)	(0.27)	(0.26)
Imdibir	0.39	0.40	0.41	0.43	0.40
	(0.30)	(0.30)	(0.30)	(0.31)	(0.30)
Aze Deboa	0.40	0.39	0.37	0.43	0.38
	(0.30)	(0.30)	(0.30)	(0.31)	(0.30)
Adado	0.94***	0.94***	0.92***	0.91***	0.90***
	(0.24)	(0.24)	(0.25)	(0.25)	(0.24)
Gara Godo	0.29	0.28	0.28	0.32	0.25
	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)
Doma	1.19***	1.19***	1.18***	1.15***	1.15***
	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)
D.B. -Milki	0.40	0.38	0.39	0.39	0.46
	(0.34)	(0.34)	(0.34)	(0.34)	(0.34)
Kormargefia	0.98***	0.96***	0.97***	0.99***	1.10***
	(0.35)	(0.34)	(0.34)	(0.35)	(0.34)
Karafino	0.66*	0.65*	0.67*	0.68*	0.73**
	(0.36)	(0.36)	(0.36)	(0.36)	(0.36)
Bokafia	0.21	0.19	0.20	0.23	0.27
	(0.54)	(0.54)	(0.54)	(0.55)	(0.55)
Constant	-1.10***	-1.10***	-1.07***	-1.10***	-1.12***
	(0.37)	(0.37)	(0.37)	(0.37)	(0.37)
Observations	1,475	1,471	1,475	1,475	1,475
R-square	0.0927	0.0945	0.0928	0.0931	0.0944

Source: Own calculations using data from ERHS.
Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.