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Gender and Rural Land Reform in Ethiopia: Reform Process, Tenure Security, and Investment

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Submitted for the Degree of Doctor of Philosophy

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Declaration

I hereby declare that this thesis has not been and will not be submitted in whole or in part to another University for the award of any other degree.

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GENDER AND RURAL LAND REFORM IN ETHIOPIA: REFORM PROCESS, TENURE SECURITY, AND INVESTMENT

SUMMARY

This thesis consists of three inter-related empirical papers. It examines the gender dimensions of rural land reform process and impacts by exploring the accessibility and benefits of land-use certificates for female household heads vis-à-vis male household heads in the Amhara region of Ethiopia. The existing literature lacks a gender lens of the reform process and impacts.

The first paper examines the factors that determine which lands are included in the household's land-use certificate (status of certification), when during the reform process they become included (timing of certification), and whether there are gender differentials in each of these outcomes. The findings show that there was gender bias in the rural land reform process of the Amhara region in terms of both outcomes.

The second paper examines the impact of land-use certificates and socioeconomic factors on household perceived tenure security by gender. The findings suggest that what consistently matters more for enhancing perceived tenure security of both male, and particularly female household heads is possession of legal documented rights to land holdings i.e. land-use certificates. The impact of socioeconomic factors such as male presence in the household, mode of production or land use do not seem to be relevant for determining the perceived tenure security of male and female household heads.

The third paper examines the impact of land-use certificates and socioeconomic factors on land related investments by gender. The findings suggest that land-use certificates are significant determinants for enhancing land investments among both male and female household heads, although a relatively lesser impact on the latter group is observed. While the findings show that land-use certificates are important for enhancing land related investments, the results also suggest that the impact of socioeconomic factors are relevant for the female household heads such as renting-out land, and male presence in the household.

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"Thank you" is not enough,
Nor can I repay you with a marshmallow fluff,
Together we built a castle that is tough,
Certainly in years without off the cuff,

I don't know where this degree will take me,
But for a while I will be certainly carefree.

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Abbreviations

LACs	Land Administration Committees
SWC	Soil and Water Conservation
WDI	World Development Indicators
GDP	Gross Domestic Product
GTP	Growth and Transformation Plan
PA	Peasant Associations
CSA	Central Statistical Agency
EPLAUA	Environmental Protection Land Administration and Use Authority
LACs	Land Administration Committees
SIDA	Swedish International Development Agency
SARDP	SIDA Amhara Rural Development Program
SNNPR	Southern Nations, Nationalities, and People’s Region

Chapter 1

Introduction

1.1 Gender and Rural Land Reform

Women are key players in the global agriculture sector, making up 43 percent of the overall agricultural labor force—ranging from 20 percent in Latin America to 50 percent in East Asia and sub-Saharan Africa (World Bank, 2016a). In fact, women in Sub-Saharan Africa account for 70 percent of Africa's food production (World Bank, 2016b). The wave of male migration out of rural areas has increased women's role in farming and contributed to the feminization of agriculture (Slavchevska et al., 2016).

Despite the significant and increasing role of women in agriculture, globally less than 20 percent of land holders are women (World Bank, 2016a). In particular, women in the developing world are less likely to feel secure in their land holdings. Although improving the security of land rights is important for both male and female landholders, it is especially necessary for the latter group, because women have traditionally been susceptible to greater economic and socioeconomic discrimination and are among the most vulnerable groups in rural societies (Joireman, 2008).

Improving women's land-holding rights can have a substantial impact, too. Secured land rights enrich women's well-being overall—that is, their advantages extend beyond their direct female beneficiaries to improvements in the situations of their families and communities. For example, using survey data from Peruvian urban households between 1995 and 2003, Field (2007) finds that receipt of ownership title increased the willingness of former urban squatters, especially women, to participate in the formal labor market instead of staying at home to protect their land. This increased their income and reduced the incidence of child labor in their households. Other studies have shown that when women's land rights improve, they are less likely to face long-term physical and psychological domestic violence (Panda, 2006; Gupta, 2006); their participation in household decision making is likely to increase (Allendorf, 2007); their families' nutrition is likely to improve (Allendorf, 2007; Katz and Chamorro, 2002); their children's educational achievements are likely to improve (Katz and Chamorro, 2002); and their fertility is likely to decrease (Field, 2003).

In recognition of the need for and impact of stronger land rights, many countries, especially in Africa, have introduced land-reform legislation and programs. One important and popular program that helped protect land rights, especially for marginalized groups such as women, was the rural land certification program introduced in Ethiopia in the late 1990s. This granted long-term usufruct rights, in the form of land-use certificates issued to land-holding households, while maintaining the existing land-tenure system of total land ownership by the state. Each region was given responsibility for implementing the reform locally. The Amhara region in the Ethiopian highlands, which is the area of study in this thesis, was the second to undertake the reform.

Amhara is the second-largest region of Ethiopia. Poverty is prevalent, livelihood is susceptible to famine and drought, and land degradation is a serious problem. It is a largely rural society, and agriculture is the main source of economic activity. Farming is dominated by small landholders mostly operating a mixed farming system.

Eighteen percent of agricultural holders are female (Berhanu Adenew and Fayera Abdi, 2005). They are constrained by economic and social marginalization in their rural society, they face higher levels of insecurity over their land holdings than their male counterparts, and they invest less in their lands to tackle land degradation.

The Amhara region implemented the rural land reform in 2002 to reduce insecurity over land holdings, strengthen female land-holding rights, and improve livelihoods. The outcome was the issuance of land-use certificates to land-holding households. To ensure that female-headed households were not excluded, the committees overseeing the implementation of the reform were required to have at least one female member each. This was necessary to ensure that female landholders had equal opportunities to reap the benefits of formalized land rights.

1.2 Gender, Reform Process, and Outcomes

Despite the potential benefits rural land-reform programs can deliver to landholders, attempts to implement these reforms come with the risk that the process may not be systematic—that is, the potential for bias in who receives land-holding right documents and when. As such, the reform process must be designed carefully to ensure that all landholders receive formalized land rights, especially those who are at a socio-economic disadvantage in rural societies, such as female landholders.

Several researchers have examined the accessibility of land-use certificates in terms of who receives them. Their findings (Do et al., 2008; Burnod et al., 2012; Deininger et al., 2008a; and Holden et al., 2009) are mixed, ranging from finding the outcomes systematic to finding them unsystematic. In addition, the application of the gender context to determining the allocation of certificates to lands and households is limited. But despite these problems, the literature is useful for guiding the empirical analysis of the determinants of certification in the Amhara region and for showing the implications of the findings of the empirical analysis regarding the impact of land-titling.

The first paper in this thesis employs probit estimations using cross-sectional data from the "Sustainable Land-Use in the Ethiopian Highlands" survey undertaken in the Amhara region in 2007 to examine the rural land-reform process there by gender. This paper investigates the determinants of parcel-certification status (whether a land parcel belonging to a household is certified) and timing (when the parcel is certified). Overall, the findings show that parcels held by female heads are less likely to be certified, but the sex of the head of household is irrelevant to when a parcel is certified. In addition, parcel characteristics and

certain socioeconomic factors affect the likelihood that a parcel is certified. This result holds in the aggregate sample of male- and female-headed households and in the male-headed-only sample when the estimations are re-run on data disaggregated by sex of the head of household. As for the parcel-certification timing, the impact of parcel characteristics is mixed, depending on both the parcel characteristic and the sample. The only relevant socioeconomic factor in the aggregate sample is schooling: more years of schooling increase the likelihood of early parcel certification. However, schooling is an irrelevant factor in the female-headed household sample.

Although the literature for the Amhara region shows that socioeconomic factors could affect the certification process for female landholders, the empirical data reveal otherwise. However, the sex of the head of the landholding household does matter for the allocation of certificates, and this suggests the presence of gender bias in the reform process. Therefore, rural land reforms can fall short of achieving their gender objectives when vulnerable groups such as women are not sufficiently taken into account in their design and implementation.

The literature points to three channels through which secure property rights can influence the ownership, use, investment, and transfer of land: First, well-defined land rights lower the chance of eviction, reduce the use of resources to protect one's land holdings, and increase incentives for land-related investments (Goldstein and Udry, 2008; Besley, 1995). Second, land registration reduces the transaction costs of land sale and rental (Besley, 1995). Third, formalized land rights increase access to credit, as they allow land to be used as collateral (Besley, 1995; De Soto, 2000; Goldstein and Udry, 2008; Deininger et al., 2011). Despite the general value of this literature, though, a gender lens has not been applied extensively in the analyses—for example, in explaining the potential gender differences in the channels through which secure property rights can influence land ownership.

The second paper in this thesis applies gender analyses to studying the impact of land-use certificates on households' perceived tenure security using the Chamberlain random-effects probit and linear probability model estimations. The paper also takes into account the endogeneity of certification, as determined in Chapter 4. The data are from the "Sustainable Land Use in the Ethiopian Highlands" survey undertaken in the Amhara region in 1999, 2002, 2004, and 2007. The empirical results of this second paper reveal that certification did enhance households' perceived tenure security, but as expected did not eliminate it, due to

the nature of Ethiopia's land-tenure system. This system permits land expropriation by the state for public purposes even in the presence of certification, and this applies to both male and female land holders. However, the finding that certification has a greater impact on female-headed households indicates that certification may matter more to female landholders, as their social and economic position in the Amhara society makes them more vulnerable in protecting their assets. The results in the second paper also show that the impact of socioeconomic factors seems weaker than that of certification, and in some estimations insignificant altogether, for determining perceived tenure security. This applies to both male and female household heads. The findings suggest that what matters most in for both male and female household heads in this context is certification: legally documented rights to land holdings. Although socioeconomic factors can be important for enhancing land rights, they are less significant than formal documentation for securing land rights. This is due simply to the nature of Ethiopia's land-tenure system. These results continue to hold, with the linear probability model and instrumental variable estimations being used as robustness checks. Using the predicted certification from the findings of Chapter 4 to take endogeneity into account reveals that overall, the sex of the household head remains a significant factor in perceived tenure security, and socio-economic characteristics remain largely insignificant. But the results pertaining to the impact of certification status are sensitive to the use of cross-section data and predicted certification—that is, certification becomes an insignificant determinant of perceived tenure security.

One critical outcome of strengthened land-holding rights is land-related investments that enhance agricultural productivity and livelihood. Place and Hazell (1993), Besley (1995), and Gavian et al. (1996) suggested that land investment decisions are affected by tenure security: there is a potential correlation between efficiency of agricultural resource allocation and formalization of land rights. Goldstein and Udry (2008) indicated that expectations of rights over the returns on that investment, and therefore the nature of property rights, influences investment incentives. Several works on property rights have presented this argument, including Desoto (2000), North (1981), Jones (1986), Mokyr (2002), and Engerman and Sokoloff (2003).

The third paper addresses the impact of land-use certificates on land-related investments. This paper contributes to the literature by applying the gender lens. The analyses

use probit estimations on cross-sectional data from the "Sustainable Land Use in the Ethiopian Highlands" survey undertaken in the Amhara region in 2007. This paper also takes into account the endogeneity of certification. The results reveal that certification has a significant impact and increases the likelihood that both new and additional soil and water conservation (SWC) investments and SWC maintenance are undertaken on parcels (using the data from both male- and female-headed households) and that parcels belonging to female-headed households are less likely to have both types on investment in them. However, with the female-household-only data sample, certification has an insignificant impact on the likelihood that either type of investment is undertaken. The results also show that, especially in the context of female heads, other factors significantly determine the likelihood of investments being undertaken on parcels. These include availability of male labor, and wealth. The estimations that take endogeneity of certification into account reveal the sensitivity of the impact-of-certification variable to changes in sample size. The predicted certification shows that certification has an insignificant impact on the likelihood of added SWC investments but a significant positive impact on SWC maintenance. This is similar to the result using IV estimations. Wealth and the presence of male labor remain significant factors in investment on parcels belonging to female heads, but not when the IV estimations are used.

The rest of this thesis is structured as follows: Chapter 2 provides background information on rural land policy, reform, and gender in Ethiopia and the Amhara region. Chapter 3 discusses the data. Chapter 4 is the first empirical paper and covers the rural land reform process by gender. Chapter 5 is the second empirical paper and addresses the impact of land-use certificates on perceived tenure security by gender. Chapter 6 is the third empirical paper and examines the impact of land-use certificates on land-related investments by gender. Chapter 7 concludes.

Chapter 2

Background on Rural Land Policy, Reform, and Gender: Ethiopia and the Amhara Region

2.1 Introduction

Ethiopia[1] is a diverse, large, and land-locked country situated in the Horn of Africa[2]. It has a land area of 1 million km^2. It has an estimated total population of 97 million, nearly 81 percent (of the total population) live rural areas (World Bank, WDI), and given the current annual population growth rate of 2.6 percent, Ethiopia's population is projected to total 130 million by 2025. Over the past decade, annual Gross Domestic Product (GDP) growth ranged from 8.6 percent to 12.6 percent, and the range for GDP per capita growth rate was 5.9-9.6 percent (World Bank, WDI). However, poverty continues to be prevalent i.e. in 2004/2005, the poverty rate estimated at national poverty lines was 38.9 percent, and in 2010, the poverty rate was 29.6 percent (World Bank, WDI).

[1] See Figure A.1: Map of Ethiopia in Chapter 2 Appendix Figures.
[2] Ethiopia is a federal democratic decentralized government system comprising of nine autonomous regions and two city administrations.

Agriculture continues to be a dominant sector in the Ethiopian economy. In 2014 agriculture, value added as a percent of GDP was 41.9. Majority of the population are employed in the agriculture sector i.e. in 2014 73 percent of the total employment was in agriculture; and in the same year 80 percent of males (as a percent of male employment) and 65 percent of females (as a percent of female employment) were employed in the agriculture sector. The sector is a driver of the currently implemented Government's Growth and Transformation Plan (GTP) which is a long-term agenda setting Ethiopia to become a middle-income country by 2025 (World Bank, 2015).

Given the prominence of the agriculture sector, addressing land issues become critical. Increasing population pressure, scarcity of land, soil erosion, land fragmentation, and insufficient land tenure security are the main land related concerns in Ethiopia. In addition, given the visible presence and role of women in the rural communities of Ethiopia, enhancing land holding rights of not only men but also women is key for sustainable rural livelihoods.

One of the key regions in Ethiopia facing these concerns is the Amhara[3] region. It is the second region in the country to have undertaken the rural land reform in Ethiopia to address the aforementioned constraints.

Therefore, this chapter provides the background and motivation for understanding rural land policy, reform, and gender in Ethiopia and the Amhara region. The sections in this chapter are organized as follows: First, this chapter describes the evolution of Ethiopia's land tenure system with an overview of the institutional actors, their role in the management of the land tenure system, and the implications for women's access and rights to land. Second, since the context under analysis in this thesis is the Amhara region of Ethiopia, a description of the socioeconomic overview, land policy, and women's access and rights to land in the region is provided. Following this, the chapter describes the rural land reform process in the Amhara region. The final section of this chapter is the conclusion.

2.2 Ethiopia: Evolution of Land Policy

Ethiopia's land history is better understood through the context of three very different

[3] See Figure A.2: Map of Amhara Region in Chapter 2 Appendix Figures.

political regimes, namely, the imperial regime which lasted until 1974, the Derg regime (1974-1991) and the current regime (1991 to present). The land tenure systems defining an individual's relationship in legal terms to the land under the three political regimes of Ethiopia were quite varied with mixed implications for the agriculture sector.

2.2.1 Land Policy under the Imperial Regime

During the imperial regime there were various land tenure systems. In the northern regions the main type of land ownership was the rist. Under this system, land did not belong to an individual. Rather it belonged to the descent group and those in the group were entitled to a segment of the land through *usufruct rights*. This system was also hereditary. An individual was not allowed to sell his/her land outside of the family. The rist system did not allow the user to sell, bequeath, or mortgage his/her share of the piece of land outside the family. The other major form of land tenure was the gult (grant land) in which land grants were made by the provincial rulers or monarch. Under this system peasants with traditional land rights were required to make payments to landlords in the form of cash, kind, or labor (Crewett et al. 2008). Other types of tenure in the North comprised of Samon, Gebbar Mengist, and Madeira[4]. Absentee landlordism in the north was infrequent, and landless tenants were limited.

In the South, majority of the land was controlled by a few such as by the nobility, high ranking military personnel, and the church. Therefore, landless tenants and absentee landlordism were frequent. High tenure insecurity was common as tenant farmers faced land expropriation. (Wikipedia, "Land Reform in Ethiopia").

Despite the variations in the land tenure systems between the northern and southern parts of Ethiopia, in both areas, peasant farmers lacked the mechanisms to enhance production because of land fragmentation, no access to credit, and the lack of modern

[4] "**Gebbar** is land for which one paid tax on to the government and became the property of the taxpayer. Lands for which taxes were not paid to the government became government lands. **Samon** was land the government had granted to the Ethiopian Orthodox Church in perpetuity. **Mengist** was land registered as government property. **Maderia** was land granted mainly to government officials, war veterans, and other patriots in lieu of a pension or salary".
Source: Wikipedia. "Land Reform in Ethiopia", https://en.wikipedia.org/wiki/Land_reform_in_Ethiopia

facilities. Over time, the feudal foundations of the land tenure system, deteriorating circumstances in the agriculture sector, deteriorating political, economic and social conditions led to the collapse of the imperial regime under a revolution led by Mengistu Haile Mariam in 1974 (Wikipedia, "Land Reform in Ethiopia").

2.2.2 Land Policy under the Derg Regime

In 1975, the communist regime (Derg) of Haile Selassie announced the agrarian reform program called Proclamation No. 31/1975 "Proclamation to provide for the Public Ownership of Rural Lands" (Wikipedia, "Land Reform in Ethiopia"). This proclamation ensured that all rural land is owned by the state, and formed the legal foundation for the distribution of usufruct rights to a great number of rural families.

During 1975-1976 the Derg regime implemented the "land to the tiller" approach which entailed land redistributions to farmers through Peasant Associations (PA)[5]. Sale, mortgage or lease of land by farmers was prohibited. Bequeathing was restricted to primary family members i.e. spouse and children upon death of the main land holder. Sharecropping, and use of hired labor were not permitted and the option of migration was ruled out as this meant abandonment of land bringing new claimants. The maximum plot size per family was 10 hectares. Land redistributions occurred frequently to meet population pressure and to ensure that families were not excluded from land access. However, land access was determined also by the permanent presence in one location which discouraged farmers from migrating.

Although the Derg land reform policies resulted in equitable access to land, the agricultural sector faced numerous challenges such as declining agricultural productivity, pervasiveness of poor farming techniques, land fragmentation, insecurity of tenure, and deficiencies of farm inputs and tools. The frequent land redistributions by the Peasants

[5] "Articles 8 and 10 of the 1975 Land Reform Proclamation necessitated that peasants be organized into a hierarchy of associations to assist in implementing the rural development programs and policies".
Source: Wikipedia. "Land Reform in Ethiopia", https://en.wikipedia.org/wiki/Land_reform_in_Ethiopia

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Associations led to severe land fragmentation discouraging farmers from undertaking land related investments.

In 1992, the Derg regime collapsed due to mounting political, economic, and social instability. Ethiopia became a federal democratic republic with a gradual shift towards a free market system.

2.2.3 Land Policy under the Current Regime (Post-Derg)

In the post-Derg regime era, substantial economic changes took place as a result of the gradual adoption of the free market system. However, land continued to be under state possession as explicitly stated in the 1995 Ethiopian constitution [Article 40]:

> "The right to ownership of rural land and urban land, as well as of all natural resource is exclusively vested in the state and the peoples of Ethiopia. Land is a common property of the Nations, Nationalities and peoples of Ethiopia, and shall not be subject to sale or other means of exchange." (Berhanu Adenew and Fayera Abdi, 2005)

Land transactions such as selling and mortgaging of land continued to be strictly prohibited. In the event land was needed for public purposes, evictions of land holders were permitted under the land policy and land holders were paid compensations. The 1995 constitution does mention the prohibition of land leasing, hiring of labor, and mandating a maximum size of 10 hectares of land allocation to each family, and the length of usufruct rights for land holders. Restrictions on renting and sharecropping have become less stringent. Frequency of land redistributions was reduced.

Although federal provisions continued to mandate state ownership of all lands, a law was legislated in 1997 which decentralized land administration/policy to the regions[6] leading to significant variations across the regions of key legal land provisions/requirements. For example, the possibility of future land redistribution was an area of variations in regional land policies. For example, the Oromia region rules out future land redistributions, in the

[6] Tigray region (1997, amended 2002), Amhara region (2000), Oromia Region (2002), and Southern Regional State (2003) (Crewett et al. 2008).

Amhara region and the Southern Regional State future land redistributions are considered, while the Tigray regional policy does indicate the possibility of future land redistributions. Moreover, in the Amhara and Tigray regions, the right to use land depends on the residence in the kebele. With the exception of the Amhara region, all other regions imposed limitations on the amount of land to be leased.

2.3 Ethiopia: Land Rights, Farming, and Gender

Prior to the land reform under the Derg regime, women were given the right to inherit land. The reform under the Derg regime which distributed the land according to family size registered the lands under the name of the male household head. Therefore, most women did not have rights to land possession. This changed during the post-Derg regime era i.e. the 1995 Constitution mandated equal rights to land between men and women in terms of access, management, and transfer as well as equal inheritance rights.

Currently there are four mechanisms by which women can acquire access and rights to land: (i) land acquired through marriage which is considered a shared tenure; (ii) continued access and right to land due to changes in marital status such as death, divorce, and even through polygamy; (iii) inheritance; and (iv) access and rights to land through purchase (Endalamaw, 2014). Access and actual enforcement of land rights under each one of these mechanisms varies across regions as each has its own legal stipulations on land administration and use.

Women in Ethiopia account nearly 48 percent of the agricultural labor force (Endalamaw, 2014). However, women are not culturally viewed as key farming agents. Perceptions on the role of women in farming are not supportive of their active involvement in agricultural activities.

Unpaid and casual labor growing subsistence crops for household consumption, weeding, storing, processing, and harvesting manually certain cash crops are the main agriculture related activities women in Ethiopia engage in. Men tend to use relatively more technology in farming activities relative to women, due to lack of access, and cultural prohibitions on technology use, as well as the view that crops grown by women have lower priorities for agricultural research than those grown by their male counterparts.

Overall women's activities in farming are also limited for several reasons: first, women have less access to key farming resources such as livestock (bulls/oxen) and farming equipment. Second, women's limited role in farming is also due to the gender-based division of labor confining them to undertake more household responsibilities. Third, women with land can be limited by the availability of male labor in the household who can undertake farming activities in the field. Fourth, cultural norms imposed on women through the prohibition of their involvement such as in sowing, ploughing, and planting makes them dependent on male labor. Female land holders respond to these constraints by rent-out their land to male members of the rural community with access to farming resources in exchange for share-cropped returns.

Female farmers have less access to extension services relative to men, mainly due to cultural restrictions which limit male-female interaction resulting in extension support being provided mostly to the male farmers. In addition, women in farming communities have no to less access to rural financial services compared to men due to several constraints: low literacy, cultural and social restrictions, and lack of collateral (Endalamaw, 2014).

2.4 Amhara Region: Socio-Economic Context and Land-Tenure Policy

2.4.1 Socio-Economic Context

The Amhara region is the second largest region in Ethiopia, following the Oromia region. It is located in the northern, north eastern and central areas of Ethiopia. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), the Amhara Region has a population of 17,214,056 with an urban population comprising 12.27 percent of the population. The region covers about 11 percent of Ethiopia's total area (Berhanu Adenew and Fayera Abdi, 2005). An overwhelming majority of the population in the region lives in rural areas. For example, a 2001/2002 estimate shows nearly 90 percent lives in rural areas (Berhanu Adenew and Fayera Abdi, 2005).

Frequent drought and land degradation is a serious challenge in the Amhara region.

Infact, 71 percent of the land in the region is vulnerable to soil erosion (Berhanu Adenew and Fayera Abdi, 2005). Lack of tenure security is argued to have exacerbated land degradation as it discourages farmers from undertaking soil erosion preventative measures.

The average landholding per household is 1.10 hectares and the average per capita holding is 0.24 hectares, which is much lower than the national average (Berhanu Adenew and Fayera Abdi, 2005). Among the agricultural holders, 18 percent are females, only 7.7 percent of the male agricultural holders specialize in livestock production, while it is 18 percent for female-headed agricultural holdings, and mixed farming is practiced by 48 percent of the female holders and 80 percent of male holders (Berhanu Adenew and Fayera Abdi, 2005).

In Amhara region, poverty is prevalent and livelihoods are susceptible to famine and drought. Specifically, the areas of south Gonder, north Shoa, and north Wollo suffer from recurrent drought and famine. On the other hand, eastern and western Gojam, the central and western zones, and northern Gonder are more productive agricultural areas (Berhanu, Adenew, and Fayera Abdi, 2005). Since agriculture is the main source of livelihood, access to land becomes very critical for survival and for sustained household welfare.

2.4.2 Land-Tenure Policy

As a result of the decentralization agenda of the 1997 federal law, the Amhara region enacted its own regional land policy in 2000. Among those was the 2004 Land Use and Administration Proclamation No. 46/96, 2000 which was updated in 2004 (see **Table 2.1** for a synopsis of the 2004 Proclamation). The proclamation describes the right of possession, use, rent, and inheritance. The objectives of the Proclamation are to safeguard the user rights of the land holders, encourage agricultural productivity, protect land from erosion and degradation, and promote sustainable development. For example, as a result of the severity of soil erosion in the Amhara region, the regional land administration policy emphasized on land management and environmental protection. On this end, the Proclamation indicated that improper management of land will lead to the loss of user rights to land. In addition, the regional land law states that land holders have the right to be compensated in the event of land loss. Nevertheless, implementation of this guideline has been challenging. Regarding

leasing land, the regional land policy does not impose limits on the amount of land to be leased (Teklu, 2005).

As for protecting women's land rights in the region, the regional law states the following: (i) in the event of divorce, both the man and woman have equal share of the land held jointly; (ii) land transfer via inheritance is only legal when the testament is countersigned by the wife; (iii) and in terms of titling, both the names of the husband and wife are included on the registration form with their photographs attached to the certificate. Such certificates can only be given to the household when both the wife and husband acknowledge the receipt of the certificate with their signatures (Teklu, 2005).

Table 2.1: **Synopsis of Amhara Region Rural Land Administration and Use Proclamations**

Use rights	Following the basic principle, land will not be transferred by sale or exchange by other property. Any rural resident of the region, who is 18 years or older has the right to get access to land free of charge for agricultural purposes.
Land redistribution	Based on the general principle, redistribution will be undertaken only in irrigable land, i.e., re-allotment of land developed by irrigation to different users. The beneficiaries will pay compensation for the land and the property developed by those who will lose land. Also, redistribution will be undertaken if members of the kebele decide to do so.
Minimum holding	(a) the maximum size of land possessed by one person cannot exceed 10 hectares, and (b) the minimum plot size should not be less than 0.2 hectares for rain-fed land and 0.06 for irrigated land.
Inheritance	The holder has the right to transfer land through inheritance to (a) to any rural resident involved in agricultural activities, (b) to persons living in towns engaging in low income generating activities to support their rural livelihood. Note this does not affect the right of minors or family member or the interest of surviving spouse.
Gift	The holder can transfer land by way of gift to a child or grand-child or family member who is a resident of the region who does not have any land, or who uses leased land due to the smallness of the size of his possession. But spouse approval required in case of joint ownership. It should be in a written form and should be registered at the woreda and kebele level.
The right to lease	Any holder has the right to lease out land to any person. Duration of lease: the maximum period is 25 years, and can be renewed after it expires. The agreement should be in a written form if the lease period is more than three years. The lease agreement should include the size, the duration, the kind and amount of payment. It should be registered by the Woreda EPLAU desk The rental price will be determined by negotiation between the contracting parties. Sub-lease is prohibited unless it is explicitly specified in the contract.
The right to mortgage and land related investments	The possessor has the right to mortgage the land use right or the property developed on the land or both. Both mortgaged land can only be transferred in lease or by means of exchange with the approval of the mortgage. It can only be concluded in writing and should be registered at the woreda level. The contract should specify the right of the creditor, and the duration of the rights in case of default. Note that mortgaging shall not have the effect of transferring the right of land possession to the creditor.
Obligation	The holder should undertake appropriate soil and water conservations.
Land dispute and resolution	Mutual agreements and local elders can be used to resolve land related conflicts. The detail of the formal institutions is not provided in the draft proclamation.
Loss of user rights	Any holder can lose his/her use rights: (a) if permanently employed with the payment of a monthly salary, (b) if absent for 10 consecutive years without leasing or assigning a person to administer it (and has no spouse or a minor child), and c) if fails to properly maintain the land. In all the above cases, the holder will get appropriate compensation for the permanent property developed on the land.
Land Expropriation	If supported by the kebele people, land can be expropriated for public interest by payment of appropriate compensation.
Certificates/book of holding/title deed	If jointly owned, it should be issued in the name of both spouses. Spouses may agree for joint ownership after marriage.

Source: Council of the Amhara National Regional Statae, 2006

2.5 Amhara Region: Gender and Rural Land

Equal rights to land for both men and women are spelled out in the 2000 Amhara regional land policy that was updated in 2004 (see Table 2.1). This section describes the gender differentials in the region in regards to land use and control, marital property rights, and inheritance rights.

2.5.1 Land Use and Control

The policy developed in 2000 provides for equal access to land for men and women. According to the Amhara Region Natural Resource and Land Administration Bureau, 38.6 percent of privately held land is registered under joint titling and equals 38.6 percent, 28.9 percent of land is registered under the name of female land holders, and 32.5 percent of the registered land is under men (Teklu, 2005).

Although the regional land policy gives women equal access to land as men, there is a difference between male- and female-headed households in terms of land-use as a result of the limitations women face (Teklu, 2005). Division of labor between women and men define work by gender. Farming activities such as ploughing, threshing, and sowing seeds is regarded suitable only for men. Women participate in harvesting, weeding, land preparation, and transporting harvest together with men. Nevertheless, women are mostly engaged in milking and milk processing, managing animal barns, tending to backyard gardens, and poultry management (Gella et al., 2014). Women also face limitations in terms of their access to key farming resources such as bulls/oxen, and available male labor in the household to undertake farming activities.

To help overcome the various aforementioned constraints, female-headed households engage in land rental activities through share-cropping agreements. According to Teklu (2005), the agreement on the share of the landlord and the tenant depends on how productive the land is and input provided by both. If the land is deemed productive and the sharecropper is responsible for the production costs, the harvest is shared equally. On the other hand, the owner gets one-third if the land is not fertile. For instance, if the woman delivers the seed, oxen, and land her compensation is two-thirds and the rest is allocated to the share-cropper. Even though women opt to hire labor to cultivate the land, it is challenging to find labor to hire which imposes limitations on the extent of land use (Teklu, 2005).

According to the regional proclamation (Table 2.1), the extent to which a land holder

is involved in cultivating the land influences the security of land holdings. In other words, as long as a land holder is continuously utilizing his/her land, security of their land holding is guaranteed. Since women in the region face restrictions that prevent them from appropriately and continuously using their land, female land holders could be among the first ones in the community to lose their land holdings.

Social status and family support women possess is one of the key factors the protection of their land rights. According to Teklu (2005), “if a woman has strong male family members it will be an embarrassment for them if they do not protect her rights”, as women are not culturally anticipated to handle such matters. Safeguarding land rights of individual family members is viewed as building family resources as a whole.

2.5.2 Marital Property Rights

Marital property rights in the region follow the national civil code. According to the customary law, upon divorce, except for the land and the house, a woman shares all the property she accumulated during the marriage (unless different terms are indicated in the marriage contract)age agreement. The land and house are excluded because these are expected to be the man’s contribution upon marriage. Recently this changed as a result of the law granting women equal access to land rights. Therefore, contributions at marriage now also include land held by women (Teklu, 2005).

2.5.3 Inheritance Rights

Those with legal rights to land are permitted to transfer land via inheritance as indicated in the Land Use Rights Proclamation. However, consent from the wife is required as regulated by the law. Land holders are also allowed to transfer their land to a caretaker. However, in practice, there is variation across the region in the manner of applying the inheritance regulations according to the Proclamation.

Widows are not included in the land policy. However, the customary practice has been if a couple have children and the husband dies, the wife inherits all property acquired during the marriage, including land. However, if there were no children, the wife will receive half of the property and the remaining is the share of her in-law. On the other hand, if the wife passes away, the husband inherits all the marital property, regardless of whether the couple had

children or not (Teklu, 2005).

2.6 Amhara Region: Rural Land Reform

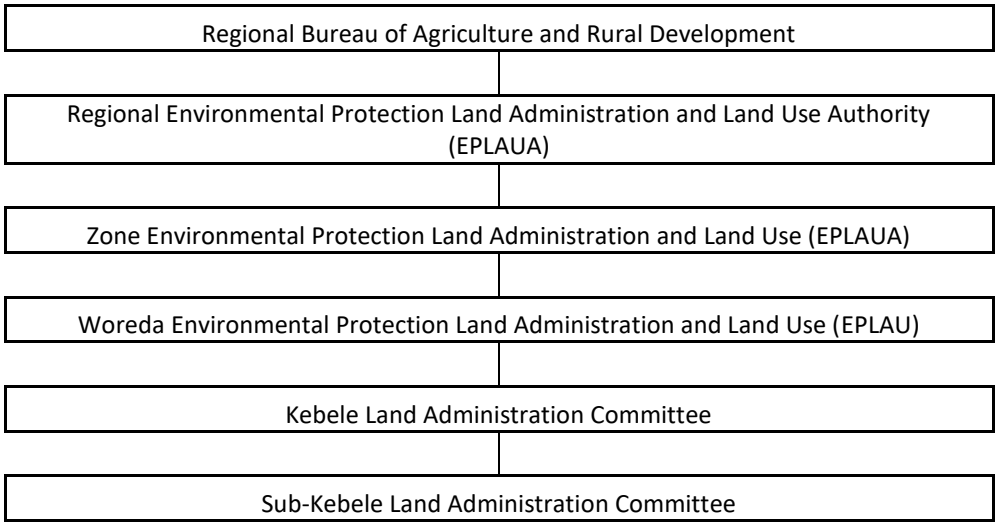
2.6.1 Motivation

This section provides an overview of the rural land reform process in the Amhara region based on the qualitative literature of Adenew and Abdi (2005), and Hailu (2010). The motivation behind the rural land certification program in the Amhara is not unique to the region. The program was implemented nationwide in order to tackle various land related concerns such as enhancing tenure security, land degradation, protection of women's land rights, and reductions in land related conflicts.

2.6.2 Amhara Land Administration

Figure 2.1 shows the organogram of the Amhara region land administration entities. The responsibility for the coordination of land registration in the Amhara region was delegated to the Environmental Protection Land Administration and Use Authority (EPLAUA) established in 2000. EPLAUA is answerable to the regional Bureau of Agriculture and Rural Development. (Adenew and Abdi, 2005). There is an EPLAU representative at the zonal level. The Woreda level EPLAUA participated in the planning and implementation of the land administration, registration, and certification activities. Land administration at the kebele and sub-kebele levels is responsible for the implementation of the certification process (Adenew and Abdi, 2005).

Figure 2.1: **Organogram of the land administration institutions in the Amhara region**



Source: Adenew and Abdi (2005).

2.6.3 Process

Land registration and title certification pilot program started in 2002 (certification process began to roll-out in 2003), as part of the effort to build the Amhara region's rural development program. A team of experts from the Woreda level supervised the certification program. On the other hand, a committee at the lowest level of local government (kebele or sub-kebele) undertook the data collection for the registration and land-use certificate issuance (Haile, 2010).

Registration of the land holdings was based on land allocated during the 1991-1996 redistributions. Lack of man-power led to an adoption of gradual roll-out (Deininger *et. al*., 2011) even though the implementation process started at the same time in all the Woredas. Field work took place during the dry season (January-July/August) when demand for agricultural labor was low, paper work and distribution of the land-use certificates occurred during the growing season.

The registration and consequently certification occurred in seven different steps. **First**, there was "preparation and awareness raising" i.e. provision of information to the Woreda and kebele administration and awareness campaigns among the farmers. In this step, land Administration Committees (LACs) are then formed with its members being elected by the farmers and trained. One of the requirements of the LACs establishment is the inclusion of at

least one female member to ensure that the registration and certification process are accessible to the female land holders.

The second step was “application and identification”. This step encouraged all farmers to register their land by applying to the LAC by filling in relevant information such as: land names, number of parcels, and total area claimed. Not only this, but the application also contains a description of present land use and gives the names of the land holders neighboring to the east, south, west and north.

In the third step, a temporary certificate is issued to the land users in a kebele. This step provides proof of the farmer’s tenure rights at an early stage. This is called the “first stage” certificate document (see Figure A.3 in “Chapter 2 Appendix” for a sample of “first stage” certificate). At this stage, an exact map depicting the precise location of the land is not included yet. In the event that the head of the household is a male, the spouse’s picture is included in the certificate jointly and if the land holder is a female then her picture is included in the certificate (see Figure A.4 and A.5 in Chapter 2 Appendix).

In the fourth step, the results of the temporary certificate are displayed in public for one month. The public hearing process involved reading out-loud all applications and invited all the farmers so that conflicts can be resolved. Necessary edits in the field sheets are made with the approval of the LAC chairperson and the Woreda EPLAUA head.

The fifth step involves registering the information from the field sheets in the Land Registry Book held at the Woreda office. Instances of land related conflicts are recorded. However, the registration continues as the conflicts are decided.

In the sixth step, based on information documented in the Land Registry Book, a Book of Holding is issued by the Woreda administration office for every household that had registered its land. This Book includes the picture and name of the land holders, list of family members and address, as well as a summary of the basic rights and obligations according to the law. It also includes the official certificate of a household’s usufruct right to their land, the Primary Certificate (see Figure A.3 in Chapter 2 Appendix for a sample of “first stage land possession certificate”).

In the last step, a Secondary Certificate and Mapping is issued which contains maps of the land area which is then distributed to the land holders. This is issued after carrying out a survey to provide detailed description of the parcels such as the geographical coordinates using modern survey techniques and equipment (see Figure A.3 in Chapter 2 Appendix for a sample of “second stag land possession certificate”).

Two aspects are important to note about the certification process. First, certification

was based on farmers applying to the LAC for registration, so in essence certification was based on demand from farmers. Second, the certification program was implemented in a decentralized manner i.e. the process involved farmers' participation.

Lack of sufficient capacity at the Woreda and kebele levels was cited as a major hindrance for program implementation. In addition, there seemed to be "competing interests, power and mandates between the political administration on the one hand and on the other, the land administration desks, and kebele land administration committees at Woreda and kebele levels" (Adenew and Abdi, 2005). Another primary concern regarding the land registration process was the lack of available budget and staff needed for implementing the registration and consequent certification of land holding. According to the Woreda EPLAUA desk officers there was less than half the human resources required (Adenew and Abdi, 2005). Financial constraints were also a challenge for the provision of training to farmers to encourage their participation in land registration, and for carrying out awareness-raising and communication with farmers. Woreda officials reported shortages in the availability of technical skills in various areas especially surveyors. Moreover, the delay in the delivery of the guidelines to the Woredas slowed implementation progress. The guideline was later provided in 2004. For these reasons, the registration has not progressed as it was envisioned, due to the financial, technical and administrative challenges faced, and contributed to the distinct variation in the progress of land registration across the zones in the region although the program started in all places at the same time.

In addition, it is also worth noting that there was a gap between the requirement to include females in the LACs during the registration process, and their actual participation, despite one of the land reform objectives of strengthening women's land holding rights. According to Teklu (2005), the LAC's were mostly composed of men. The author states that women's low participation in the land titling process and other socio-political activities is linked primarily to their low position in society. For example, a field visit research by Teklu (2005) found that women who never participated in the meetings to elect members of the LAC cited that they were not told of the details and logistics of the meetings. However, women in the region also believe that it is the role of men to attend such meetings and not a role for women to take part in.

2.6.4 Rights

The right provided by the certificate is such that as long as the holder properly utilizes the land given to him/her, he/she has usufruct rights. In other words, unless the land is required for public use, the holder has undeniable use right on his/her holding. In the event the holder is disposed of his holdings for public use, s/he has the right to get a replacement whenever is appropriate and get a compensation for her/his asset on the holdings. Also, the holder can be disposed of his/her land for irrigation development, but has the right to get similar land that used the newly developed irrigation system.

Overall, the certificates can be effective if enforced for protecting the land of rural land holders against "user right" claims by others such as neighbors. However, since land in Ethiopia belongs to the state, the certificates do not protect the landholders from evictions by the state nor from future land redistribution by the kebele (village) administrations. Therefore, the nature of tenure security the certificates bring in is limited due to the nature of the land tenure system.

2.7 Conclusion

This chapter provided the background and motivation for understanding rural land policy, reform, and gender in Ethiopia and the Amhara region. Political pressure, economic and social concerns motivated the evolution of the Ethiopian land tenure reform from a mix of private and public ownership of land to complete state control of all lands today.

Under the current land tenure system i.e. state ownership of all lands, economic concerns regarding rural livelihoods motivated a rural land reform initiative in the form of documenting the usufruct rights through issuance of land-use certificates to land holders. The program was implemented nationwide in order to tackle various land related concerns such as enhancing tenure security, tackle land degradation, protection of women's land rights, and reductions in land related conflicts. This initiative was undertaken at the regional level.

One of the main objectives of the reform was to strengthen the land holding rights of the female land holders. Despite the limited resources and cultural restrictions women face in the rural communities of Ethiopia, enhancing access and land rights for women is significant for their sustained livelihood. Nevertheless, cultural barriers and limited access to farming resources puts into question the ability of female land holders to improve their livelihoods from

the rural land reform relative to the male land holders who do not face the same kinds of constraints.

This thesis examines the Amhara region rural land reform, and attempts to assess its process and impacts on reducing tenure insecurity and land related investments, by gender. The Amhara region is the second Ethiopian region to have undertaken the reform. The land reform in the Amhara region was particularly important because of the need to address serious land degradation that could adversely impact rural livelihoods.

Since gender access to land rights was one of the main concerns of the Ethiopian rural land reform, this chapter provided a gender context of rural livelihoods in Ethiopia and the Amhara region, and its relation to land right and use. This provides an insightful background for the empirical analyses regarding the determinants of certification by gender, and impacts of the program on tenure security, and land related investments by gender.

Chapter 3

Data

3.1 Introduction

This chapter provides a description of the data that will be used for the descriptive and empirical analyses of this dissertation to understand the process and impacts of the Amhara region rural land reform by gender. The unit of analyses is the parcel (chapters 4 and 6) and household (chapter 5). This chapter is divided according to the following sections: section 3.2 describes the data source, section 3.3 describes the data, and section 3.4 summarizes the data limitations.

3.2 Data Sources

The household survey used for all the empirical analyses is the “Studies for Sustainable Land Use in the Ethiopian Highlands”. The survey was conducted by the Department of Economics of Addis Ababa University in collaboration with Gothenburg University, Ethiopian Development Research Institute, and the World Bank. It is a panel survey of rural households

covering the years 1999, 2002, 2004, and 2007[7]. The first wave of the surveys covered the period before the certification program was implemented. It is important to note that this survey was not originally designed to capture the Amhara certification program, and the potential impact on agriculture and rural livelihoods. The objective of the survey was to analyze the impact of a sustainable development program and comprehensive aspects of the certification program was added at a later stage of the survey, mainly in the fourth round of the wave i.e. in the 2007 survey year.

The Amhara regional survey is the most appropriate for the analyses of the thesis as it covers a comprehensive set of questions on the certification program as well as land-use, and has sufficient sample size for gender disaggregated analyses. The "Ethiopian Rural Household Survey (1989-2009)" does not capture the certification program. A Tigray region household panel survey[8] (1997/1998, 2000/01, 2002/03 and 2005/06) which captures certification covers a small sample size (400 households) restricting a gender disaggregated analyses. A Southern Ethiopia regional rural survey (1997-98)[9] was conducted but does not contain information on certification.

3.3 Data Description

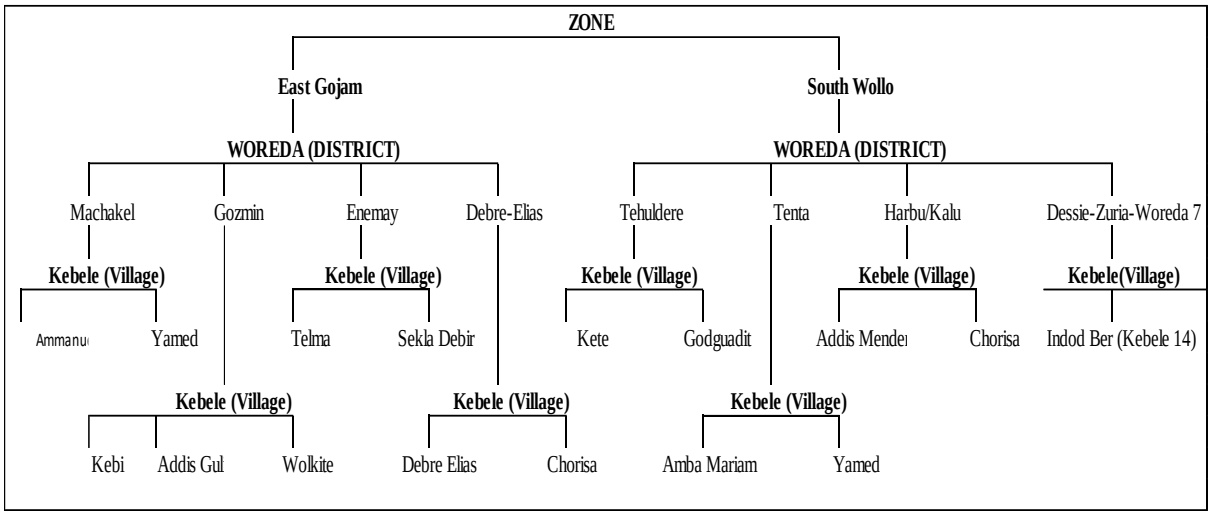
3.3.1 Survey Sampling Procedure

The surveys were conducted in 2 of the 11 zones of the Amhara region. They are the East Gojam and South Wollo zones. Each of the zones was purposefully selected to represent certain ecological characteristics in the areas of the region i.e. East Gojam is a surplus producing zone while South Wollo is a drought zone. The Woredas (districts) and the kebeles (villages) in each Woreda were also chosen based on similar criteria. However, the households in each kebele were selected randomly. This sampling procedure ensured that the selected kebeles were representative of the kebeles in the region (Deininger et al. 2011). The outcome of the sampling procedure for all the panel rounds are the following: In both the 1999 and 2002 rounds 6

[7] 1999 survey conducted during September-October, 2002 survey during July-August, 2004 survey during September-November, and 2007 round during July-August.
[8] This survey was used in the following research studies: Deininger et al. (2011); Holden et al. (2005); Holden et al. (2009).
[9] This survey was used in a study by Holden et al. (2002).

Woredas and 12 kebeles were selected, whilst in the 2002 and 2004 panel waves, 8 Woredas and 14 kebeles were selected, since one additional village in each zone was added.

Figure 3.1: **Sampling procedure**



Source: Surveys for Sustainable Land Use in the Ethiopian Highlands

3.3.2 Survey Questionnaire Description

This panel survey data is comprehensive in that it provides information both at the individual, household, parcel, and plot levels. The following sections in the survey questionnaire are common in all rounds: household composition, health, off farm-income and social capital; land registration, certification, use and production, livestock/poultry ownership and income; household and enterprise assets; housing and personal hygiene; credits; water, energy, cooking and consumption habits, consumption expenditure, shocks, and risk and time experiments . Survey questionnaire sections not repeated across all the rounds are: A survey questionnaire section of "Willingness to Pay for Community Plantation" is only captured in the 1999 round. "Preference Revelation" is only in the 1999 and 2002 rounds. "Risk and Time Experiments" are in the 2004 and 2007 surveys, and the section on "Shocks" is only in the final round.

The first section of the questionnaire is "household composition, health, and social capital". On household composition, questions asked were on characteristics of household members such as sex, age, marital status, main activity, literacy, education level, and training attended. Questions on health were asked to each household member, and included the following: presence of illness/injury/disease/disability and whether any medical consultations were undertaken. Questions on non-farm employment involved whether household members engaged in off-farm activities and type of such activities, and income from wage employment

and non-farm self-employment. Questions on social capital were asked to the household head and his/her spouse and included the following: participation in community organizations, actual and potential interaction of the household with people/other households in the kebele of residence, and questions on trust level in the community.

The second section of the survey questionnaire is on "land registration, certification, use, and production". This section begins with questions on whether the household has any land with land holding rights, land size holdings, expectations about changes in the size of land holdings (increase, decrease, no change, don't know), and whether the household undertakes any measures to maintain or increase their land holdings. This is followed by questions on the land certification program.

The 2007 survey is the only survey round comprising of a sub-section on land registration and certification to help capture the process of the rural land reform. This captures information on perception about the land registration and certification program (asked to household head) such as whether the household is concerned about land related conflicts, whether household thinks that certification reduces number of conflicts related to inheritance to children, whether certificate will reduce non-inheritance related conflicts, whether certificates encourage soil and water conservation measures on land, whether certificates provide incentives to plant more trees on land, whether certificate will increase possibility of obtaining compensation in case land is taken, whether certificate will improve the position of women, whether certificate will encourage people to migrate, whether certificate will encourage soil conservation by the kebele on common property, and whether demarcation of public and community land will reduce problem of encroachment on common property resource.

Questions on involvement in the land certification program includes when the program started in the kebele; whether the household believes that it has been well informed about the program; whether a household member attended the awareness campaign meetings; whether it received any written material on the land registration, certification program, and land law; whether the household has a certificate to its holding; when the certificate was received; amount paid to receive the certificate; other certificate related costs (e.g. cost of picture); whether household would like to add a map on the certificate and willingness to pay for the map; willingness to have a certificate if one is not currently certified, and willingness to pay for the certificate if the government increased the fee.

Both male- and female-headed households are then asked several questions on their knowledge about the land law. These questions include: what is the minimum number of years

for which households can rent out their user rights to others; what happens to the land if a household head with land holding rights migrates to the Zone capital for more than 5 years and engaged in non-farming activities; whether it is true that a holder who leaves his land fallow for 3 consecutive years without sufficient reasons will forfeit his user rights; whether a person can bequeath land through inheritance to individuals who are neither his/her direct nor adopted children as long as they would like to earn their livelihood in agriculture; whether a land holder can transfer his rights in donation to a person who is not a family member of care taker; whether it is legal for the household to mortgage the use rights of its land; whether use right of the family will be affected if the head of the household head has left the kebele for 10 years; whether a husband can transfer his and his spouse's common land in donation without the consent of his wife; and whether the holder will receive proper compensation in advance if his/her land is taken for the purpose of public purpose.

Questions are also asked about the men's and women's position and land certification (respondent is male/female household head or adult male/female age 18 years and older in the absence of the head). Such questions include: how often the household participates at the kebele assembly; whether household raises issues at the assembly, whether the household is aware that minutes are prepared for those meetings, who in the household decides how earned money will be used, who decides on common household resources, and whether the household has any money or physical asset (e.g. livestock) of its own that it can alone decide on its usage? Female-headed households are asked additional questions such as if they are permitted to go to the market place without being accompanied, who in their household has the final say on whether they should work to earn money from non-farm business/employment, whether they have ever wanted to take out or been given a loan (in cash or in-kind) to start or expand a business.

In the later survey sections i.e. section on "land holding and 1998/99 E.C. production cycle", questions on certification were again asked for each parcel owned and cultivated by the household and parcels rented-out/lent-out i.e. "do you have a legal document or certificate to this parcel?", "when did you acquire the legal certificate", and "whose name was the certificate issued to?".

The questionnaire includes information on three types of parcels: owned and cultivated by the household, owned and rented-out/lent-out, and leased-in. Information gathered on the self-cultivated and owned rented-out/lent-out gathered includes parcel size, when the parcel was acquired, whether household expects to lose the parcel in the coming 5 years due to land redistribution and reallocation, and primary use of the parcel. For parcel rented-out/lent-out

and rented-in questions are asked about the rental contract such as terms of the contract such as duration of rent, share-cropping/fixed rental arrangements, to whom the parcel rented out, etc. The survey also comprises of information on parcel characteristics, investments undertaken on parcels, type of crops grown, type, and amount of inputs used, labor, and non-labor inputs used.

The remaining sections in the survey contain information on livestock/poultry ownership and income i.e. type and amount of livestock used, amount sold, and income earned from livestock activities; information on household and farm assets i.e. asset type and amount and value owned; information on credit such as borrowing source, amount borrowed, and source of the loan; information on energy, water, cooking and consumption habits i.e. energy type and consumption amount; and information on household consumption expenditures (food, beverages, and tobacco, non-durable goods, semi-durable and durable goods and services, education and non-consumption expenditure).

3.3.3 Survey Data Description

This section describes the data relevant for the analyses of the three empirical papers in this thesis. Two of these papers use data at the parcel level and one paper uses data at the household level. This is due to the fact that the unit of analyses to examine the research questions differs.

The first empirical paper in this thesis explores the determinants of parcel certification status and parcel certification timing, by gender. In other words, the analyses will assess the gender differentials in what determines whether a parcel is certified and when it is certified. The analyses takes into account in which kebele parcels are located in, parcel characteristics, and household characteristics to which parcels belong to. Therefore, the dependent variables are two: first, parcel certification status i.e. whether a parcel is included in the household land-holding certificate; and second, parcel certification timing i.e. whether a parcel is certified "early" or "late during the certification process. Therefore, the unit of analyses in the first paper is the parcel.

The second empirical paper explores the impact of households' certification status on household tenure security, by gender. In other words, the analyses will assess the gender differentials in the determinants of household tenure security taking into account their certification status, household characteristics, and livelihood strategies. Therefore, the dependent variable is a households' perception of tenure security i.e. whether households feel

tenure secure (those who indicate they expect an increase or no change in the size of their land holdings) and tenure insecure (those who expect a decrease in the size of their land holdings). Hence the unit of analyses in the second paper is the household.

The third empirical paper explores the gender differential impact of parcel certification on the likelihood of investments are undertaken on parcels. The analyses take into account parcel characteristics and household characteristics in which parcels belong to. The paper looks at two dependent variables which represent investments on parcels: first, whether there are new Soil and Water Conservation (SWC) measures undertaken on the parcel; and second, whether SWC maintenance was undertaken on a parcel. Thus the unit of analyses in the third paper is the household.

3.3.3.1 Household Level Data

For the analyses of the second paper, the thesis uses unbalanced data since the larger sample size relative to the balanced panel provides an opportunity to undertake a gender disaggregated analyses. In addition, the data is panel because the dependent variable for the second paper is captured in all four survey waves relative to capturing the dependent variable at the parcel level which is only captured in the final survey round. For these reason, the analyses in this thesis (second empirical paper) at the household level will use the unbalanced and panel data from the four survey waves i.e. 1999, 2002, 2004, and 2007.

The attrition rates in the raw data are relatively low: household level attritions between the baseline survey in 1999 and first follow-up survey in 2002 is approximately 3 percent, and with the second follow-up is nearly 5 percent, and with the final follow-up in 2007 is approximately 6 percent. Nearly 94 percent of the households in the 1999 round are complete panel households implying that they were interviewed in all of the three follow-up panel waves (balanced panel). This amounts to 1,421 households in which 1,160 and 261 are male- and female-headed households, respectively.

A household level unbalanced panel dataset is constructed using each of the four survey waves[10] (Table 3.1). This dataset consists of 6,541 observations (82 percent of the observations are from male-headed households), and 1,864 households across the survey years. The 1,864

[10] This dataset is constructed after the data cleaning of the four survey rounds which led to the elimination of duplicate household identification numbers which resulted in the reduction of balanced panel households from 1421 to 1413 households.

households across the panel reflect the fact that some households have entered and/or dropped out from the survey. In the unbalanced panel dataset, there are 1,414 and 242 households headed by males and females across all the survey years, respectively i.e. there was no change in the sex of the head in these households. However, there are 208 households with changes in the sex of the household head across the survey years. Therefore, these changes as well as households leaving and entering the sample across the years influenced the change in the number of male- and female-headed households across the years as show in Table 3.1.

Table 3.1: **Survey sample size (unbalanced panel), by survey year**

Variable	1999	2002	2004	2007
No. of households	1516	1518	1748	1759
No. of male headed household	1265	1290	1436	1420
No. of female headed househo	251	228	312	339

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

Table 3.2 depicts the distribution of the male- and female-headed households during 1999-2007 in the household level balanced panel data. The balanced panel consists of 5,652 observations from 1,413 households. In this balanced panel sample, overall 84 percent of the observations are obtained from male-headed households. Across the aggregate survey period the number of male-headed households increased until 2004 when a total of 16 households disappeared from the sample relative to the previous year. Conversely, the number of female-headed households increased throughout the survey years.

Table 3.2: **Survey sample size (balanced panel), by survey year**

Variable	1999	2002	2004	2007
# of households	1413	1413	1413	1413
Male headed households	1189	1206	1174	1157
Female headed households	224	207	239	256

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

The certification program was not introduced until 1995 E.C.[11] (2002[12] in Gregorian Calendar). The 2007 survey first captures information on certification status at the household level and then at the parcel level. The survey asked each household the following: "Do you have a certificate to your holdings?" Nearly 78 percent of the households responded "Yes". Nearly 23 percent of the households did not have information about the year in which they received land certificates (397 households out of 1,759). Therefore, out of the 1,362 households with information, 0.34 percent of the households received certificates in 1995 E.C., 0.51 percent got certified in 1996, 12.68 percent and 46.76 percent of them received certificates in 1997 and 1998 respectively, and 17.12 percent obtained land-use certificates in 1999.

Conversion of the Ethiopian Calendar to Gregorian shows that a substantial proportion of both male- and female-headed households acquired certificates during 2005-2007 (2002 was the pilot year in Gregorian Calendar) due to the lengthy certification process and implementation delays as depicted in Table 3.3. In 2004, nearly only 1 percent of the male-headed households received certificates, and in 2007, 77 percent of the male-headed households were certified. In the female-headed households, nearly 2 percent and 78 percent received certificates in 2004 and 2007, respectively. Moreover, the data shows that there 7 observations in 2007 with missing information on household certification status.

Table 3.3: **Distribution of household certification status, by survey year**

Certification Status	No. of Male Headed Households				No. of Female Headed Households			
	1999	2002	2004	2007	1999	2002	2004	2007
No	1265	1290	1422	316	251	228	305	73
Yes	0	0	14	1097	0	0	7	266
.	0	0	0	7	0	0	0	0

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" survey.

In the total panel and pooled sample used for analyses at the household level, nearly 79 percent of observations report no certificates and mainly include observations from the first

[11] E.C. is Ethiopia Calendar. The Ethiopian Calendar has twelve months with 30 days each and a thirteenth month with 5 or 6 days depending on the year. The first day of the Ethiopian year for years between 1901 and 2099 (inclusive), is usually September 11 (Gregorian), but falls on September 12 in years before the Gregorian leap year. The Gregorian Calendar is 7 years ahead of the Ethiopian Calendar. See Table B.1 in Chapter Three Appendix Tables for an example of date conversion from Ethiopian to Gregorian Calendar.

[12] In this and upcoming chapters, years of certification are denoted in the Ethiopian Calendar while survey years are referred to in the Gregorian Calendar.

three survey waves, i.e. 1999, 2002, and 2004. Out of the total 6541 observations, only 20 percent with certificates come from female-headed households, while among observations with no certificates, a mere 17 percent are linked to households headed by women. However, these distributions are not surprising given that there are likely to be fewer female-headed households relative to male-headed households in the surveyed area in general, which is subsequently reflected in the gender distribution of land certification recipients. Nonetheless, there is sufficient variation in the survey data that allows carrying out the gender analysis in this thesis.

3.3.3.2 Parcel Level Data

For analyses at the parcel level (first and third empirical papers), this thesis uses cross-sectional data i.e. from the 2007 survey for two reasons: first, the parcels cannot be matched across time; second, variation in the dependent variables in the first empirical paper i.e. parcel certification status and timing are best captured in the 2007 survey. Therefore, the parcel level analyses will not capture changes across time i.e. pre and post certification program. Third, the analyses in the first paper is undertaken at the parcel level because it is the parcels that are certified i.e. documented in the land holding certificate awarded to the household. In the third empirical paper, household decisions to undertake investments are made at the parcel level. Therefore, determining the impact of certification on land investments requires parcel level analyses as well.

In the 2007 survey questionnaire, the cross-sectional dataset consists of 7,988 parcels belonging to 1,759 households. Nearly 83 percent of 7,988 parcels belong to male-headed households. Majority of the households have more than one parcel justifying the parcel to be the unit of analyses in papers 1 and 3. There are 1619 households with 6,873 owned and self-cultivated parcels, and 443 households with 1,109 owned and rented-out parcels. Table 3.4 shows the parcel summary statistics, including by type of parcel land-use i.e. whether the parcel is self-cultivated or rented-out.

Table 3.4: **Parcel summary statistics (no. of households)**

	Male headed households	Female headed households	Total
Households with 1 parcel	60	22	82
Households with more than one parcel	1360	317	1,677
Type of parcel land-use			
Households with all self-cultivated parcels	1,161	149	1,310
Households with all rented-out parcels	197	112	309
Households with self-cultivated and rented-out parcels	58	76	134
Households with missing information on type of parcel-land use	4	2	6

Source: Own estimation from the "Survey of Sustainable Land Use in the Ethiopian Highlands", 2007

Note: Total # of households=1,759, Total # of parcels = 7,988

The table shows that majority of the male and female households have all self-cultivated parcels implying that most are small-scale farmers followed by households with only rented-out parcels, and a few number of households with a mix of both self-cultivated and rented-out parcels. It is also evident that female-headed households have varied use of their land relative to the male-headed households i.e. more female heads have a mix of self-cultivated and rented-out land. The mix of land-use implies to some extent diversity in sources of crop production which is varied across the sex of the household head. Therefore, it is plausible that issuance of land rights i.e. certificates could impact male- and female-headed households differently.

There are 6 parcels from 6 households in the 2007 dataset with no information on whether they are self-cultivated, rented-out or leased-in which explains the shortfall in the total number of households under “type of parcel land-use” by 6 observations i.e. 1,753 parcels. Even though these 6 observations are negligible and will not impact the results of the analyses, they do contain information on certification i.e. they are non-certified parcels.

Only parcels owned and cultivated by the household and parcels owned and rented-out are considered for the analyses in the thesis. This is because the 555 households with 1,175 leased-in parcels either through sharecropping or fixed-rental arrangement do not belong to the households captured in the survey, and so the survey does not capture information on certification for such parcels.

Information on parcel certification are obtained from the parcel level section of the survey. Households were asked “Do you have a legal document or certificate to this parcel?” 83 percent of the observations (parcels) are from male-headed households. Out of the 7,988 parcels, 79 percent are certified. Out of the 79 percent certified parcels, 83 percent belong to male-headed households.

The 2007 survey also captured for each self-cultivated and rented-out parcel when it became certified in the following way: “When did you acquire the legal certificate, year?” The households’ response indicates that 0.54 percent of the parcel were certified in 1996 E.C., 15 percent of the parcels were certified in 1997 E.C. , 49 percent were certified in 1998 E.C., and 15 percent were certified in 1999 E.C. (nearly 21 percent of the parcels have missing years of certification recorded). The fact that majority of the parcels were certified in later years of the certification program implies that the certification process could have experience implementation delays. Overall, there are 1,658 parcel observations (21 percent of the total parcels in the sample) with information on whether they are certified parcels but with no information on their certification year. Out of these 1,658 observations, 98 percent are not certified (therefore, the certification year is not applicable) and 2 percent i.e. 27 parcels have missing information on year of certification.

Table 3.5 provides parcel summary statistics with certification. As the objective of the program was to certify all parcels in the kebeles, this did not seem to have occured. Among the non-certified parcels, the majority is from households that have none of their parcels certified and a fewer parcels from households in which some were not certified. The non-certification of these parcels could be due to unresolved land disputes at the time of the certification process.

Table 3.5: **Parcel summary statistics with certification (no. of households)**

	Male headed households	**Female headed households**	**Total**
Households with no parcels certified	317	84	401
Households with all parcels certified	1,038	242	1,280
Households with some parcels certified	65	13	78
Households with missing information on parcel certification for all parcels in the household	0	0	0

Source: Own estimation from the "Survey of Sustainable Land Use in the Ethiopian Highlands", 2007

Note: Total # of households=1,759, Total # of parcels = 7,988

3.4 Characteristics of the Sample

3.4.1 Individual and Household Profiles

All the kebeles in the sample are located in the Ethiopian Highlands with mean elevation of 2,563m. The sampled kebeles are quite distant to the nearest road and town. Distance to the nearest road and town is on average 32 km and 72 km, respectively. Majority of the kebele households (73 percent) reside in small dwellings (2 rooms) with corrugated roofs.

An average kebele has approximately 126 households (821 individuals) with on average 7 members in each household. The distribution of male to female residents is nearly equal i.e. 51 percent are male residents. On average the kebeles have young residents (mean age of 25 years). Majority of the residents are identified as children/too young to be married (38 percent), therefore, only 34 percent of the residents are married, 20 percent are single, 4 percent are divorced, and 3 percent are widowed. This distribution holds by gender as well. As for the main activity of the kebele residents, given the young population, majority are students (32 percent), 15percent are identified as children (too young to work), 23 percent are farmers/family farmer, and 17 percent are domestic workers. When disaggregated by gender, majority of the female residents are domestic residents (35 percent) and only 9 percent are engaged in farming, while the male residents are farmers/family workers (37 percent), and 34 percent are students.

As for the characteristics of the household heads, nearly 83 percent of the households are male headed. The average age is 49 years (48 years and 51 years for male and female residents, respectively). Majority of the heads are married (81 percent), 11 percent are widowed, 4 percent are divorced, and 2 percent are single (54 percent of the female heads are widowed, and 95 percent of the male heads are married). Household heads are primarily illiterate (55 percent), and a higher percentage of female heads are illiterate (88 percent) relative to the female heads (48 percent).

3.4.2 Rural Livelihoods

Agriculture is the main economic activity of the kebele heads. Nearly 83 percent of the heads are farmers/family farm workers, 9 percent are engaged in domestic work, and 3 percent are out of the labor force (the remaining 5 percent of the sample is engaged in various activities such as health worker, teacher, trader, traditional physician, etc.). While agriculture is the main

activity for the male heads, it is not for the female heads. Majority of the female heads are engaged in domestic work (48 percent) but a visible proportion is engaged in farming (34 percent), and 8 percent are not in the labor force. Majority of the households do not grow perennial crops i.e. cash crops (85 percent). Farming is primarily for subsistence.

The status of engagement in off-farm employment activities (working off the household's land either on someone else's land or in other employment against payments in cash or in-kind) by household heads in the kebeles is small (23 percent and 20 percent of the male and female heads, respectively). In fact, majority of household heads who responded they would not like to work (more) for wages or salary cited "needed on farm" as the reason i.e. 52 percent and 43 percent of male- and female-headed households, respectively. The location of the off-farm employment activities in exchange for wage is the kebele of residence for majority of both male heads (76 percent) and female heads (73 percent). The income from wage employment was primarily used for general purchases for the household both male- and female-headed households.

Engaging in labor sharing arrangements is common among male-headed households (55 percent) relative to their female counterparts (26 percent). Participation in non-farm self-employment activities is not common in both male- and female-headed households (15 percent and 13 percent of male- and female-headed households participated, respectively).

Majority of female-headed households engaged in non-farm self-employment activities are involved in grain trade (31 percent), and also in selling beverages (33 percent). As for male counterparts, the highest proportion is involved in handicraft including pottery (23 percent), 13 percent are engaged in trade in grain, and 3 percent of male HHHs are selling beverages. As for livestock trading, 9 percent of male-headed households are engaged in such activity but there is no female head participation. In both male- and female-headed households, income from non-farm self-employment activities was allocated to general household purchases.

There is a notable difference in the share of male and female HHHs who are involved in food-for-work activities. In this regard, more female-headed households are engaged in work activities in exchange for food (nearly 26 percent) whereas it is only 10 percent for male-headed households.

Male-headed households (76 percent) are endowed with key livestock for farming such as bulls/oxen relative to female-headed households (37 percent). Average number of bulls/oxen ownership in male-headed households is 2 compared to 1 in female-headed households. Bulls/oxen are also a sign of wealth in farming communities due to their high value relative to other types of livestock.

3.4.3 Land Holdings

Almost all male- and female-headed households have land with holding rights and over 50 percent feel that the farm belongs to self although more female heads have such feelings about their farm (nearly 59percent) whilst its 52percent for the males.

The kebeles in the Amhara region seem to be characterized by small farm holders. The average land size holdings in the kebele are 0.055 hectares with slightly larger land size in female than male-headed households (0.053 hectares in male-headed households and 0.066 in female-headed households). More male-headed households are actively engaged in maintaining their land holdings (62 percent) compared to the female heads (54 percent). Among those who are actively involved in maintaining their land holdings, 61 percent of both male and female heads use soil conservation, and the next most employed measure is planting trees. Among those who are not actively maintaining their land holdings, 68 percent and 51 percent of male and female heads, respectively, cite "land belonging to the state" as the reason for not taking any measures, claiming the reason that the "land belongs to the kebele".

3.4.4 Perceptions on Certification

Overall household perceptions about the usefulness of the land-use certificates are positive. For example, an overwhelming majority of both male- and female-headed households (77 percent and 83 percent, respectively) say they are concerned about land related conflicts than male HHHs (77 percent). Majority of the male (92 percent) and female (85 percent) headed households believe that land being surveyed and then obtaining a land use certificate will reduce the status of land related conflicts. Also more male (93 percent) than female (81 percent) heads think that a certificate encourages them undertake more soil and water conservations measures on their own land. The same pattern also holds for whether certificate provides households with the incentive to plant more trees on their land. Majority of both male (91 percent) and female heads (82 percent) think that a certificate will increase the possibility of obtaining compensation in case the land is taken. Also the majority of male (89 percent) and female heads (84 percent) think that certificates enhance the position of women. However, it interesting to note that slightly less percentage of female heads compared to the male heads thinks so. As for migration, both male- and female-headed households (73 percent) believe that possessing a land-use certificate encourages people to migrate.

3.4.5 Social Capital

The 2007 survey asks household heads whether there is a household is member of the ten listed organizations (kebele council, kebele administration, kebele social court, land-use and administrative committee, service cooperatives, political party, religious assembly committee, iddir (burial association), iqqub, and microfinance institutions) in the kebele. Majority of both male and female households have participated in one or more of these organizations with involvement in the iddir (burial association) being a common form of social capital and only a few are members of the land use and administrative committee. A second measure of "social capital" is whether household heads have blood relations or close acquaintance with the leader or leaders of the listed organizations/associations. Once again majority of both the male and female household heads responded as having connections/networks with those in the iddir (burial associations) followed by the "religious assembly" group. Despite the relevance of being a member of the "land use and administrative committee" under an environment of rural land reform, participation in such organizations do not seem to be extensive for both the male and female household heads.

3.4.6 Involvement in the Land-Certification Program Process

Most of the households in the kebeles indicated that they were well informed about the land registration and certification program i.e. nearly 79 percent of the households. However, the extent of being well informed visibly differs by gender, i.e. 81 percent and 70 percent of the male- and female-headed households said they were well informed, respectively. The survey data suggests that the relatively low awareness of the female-headed households could indicate that they may not have taken the initiative to attend and learn from the campaigns as much as the male-headed households (93 percent and 81 percent of the male- and female-headed households said they attended the public information meetings, respectively), even though the majority in both groups indicated that public information meetings about the registration and certification process were held (93 percent of male-headed households and 89 percent of female-headed households). From this it can be deduced that the Land Administrative Committee could have equally targeted both male- and female-headed households but female-headed households may not have actively participated in the process relative to the male-headed households (on average, male-headed households attended the public information meetings three times while female-headed households attended such meetings two times). Not

surprising, majority of both households did not receive written materials on the land registration and certification program, and land laws. Perhaps this was due to the fact that the Kebele residents are primarily illiterate, and information about the certification process and laws could have been orally transmitted during the awareness campaign meetings.

3.4.7 Households' Knowledge of Land-Related Laws

Overall, there is low level of awareness by both male and female household heads about the land related laws, and the lack of awareness is in some instances higher among female than male heads. For example, most of the male (38 percent) and female (35 percent) headed households do not think that leaving the land fallow for three consecutive years without sufficient reasons will forfeit his/her user rights, and more female household heads (17 percent) do not know about this specific regulation than the male heads (10 percent). As shown in Table 2.1 (Amhara Region Rural Land Administration and Use Proclamation) of Chapter 2, failing to properly maintain the land can lead to loss of user rights. In addition, both male- and female-headed households think that the maximum number of years that land holders can rent-out land is 4 years but the Proclamation stipulates it is 25 years. Also both male and female heads (76 percent and 75 percent, respectively) do not think that if the household head left the kebele where the land is located for 10 years it will affect the use rights of the family. The regional Proclamation stipulates that any holder can lose his/her user rights if absent for 10 consecutive years without leasing or assigning someone to administer it (and has no spouse or minor children). In this regard, 15 percent of female heads do not know the regulations compared to 8 percent of the male heads.

3.5 Data Limitations

Although the survey data is comprehensive in capturing details about sustainable land use in the Ethiopian Highlands and certification, this chapter identified several limitations influencing the level of the analyses i.e. parcel or household levels, and whether the analyses can be undertaken using panel or cross-sectional data. Key identified data constraints are: first, the parcels cannot be matched across the survey years confining parcel level studies to cross-sectional analyses; second, questions on certification were included only in the final survey

round imposing limitations on understanding the adoption of certification as it was being rolled-out from the start of program implementation; and third, questions on tenure security across time could be only captured at the household level and not parcel level. This chapter presented that although the sample size for the female-headed households is substantially smaller than the sample for male-headed households, it is still plausible to undertake gender disaggregated analyses. Limited female sample size is not unique to the Amhara rural data as in many Sub-Saharan Africa farming communities, it is common that household heads are often males.

3.6 Conclusion

The Amhara regional survey is comprehensive in its coverage of rural land-use and to some extent certification as well as having somewhat a reasonable sample size to allow for a gender disaggregated analyses on the determinants of certification and impacts on outcomes such as tenure security and land related investments. There are several data limitations that will influence the type of analyses to be undertaken in the empirical chapters of the thesis. Despite the limitations, it is important to assess the determinants and impacts of the Amhara rural land reform by gender. The gender context is largely understudied and this thesis tries to fill the gap in the literature by examining three research questions: First, what are the determinants of parcel certification status and timing by gender? Second, what is the impact of certification on household tenure security? Third, what is the impact of certification on land related investments? This is the objective of the upcoming chapters of this thesis.

Chapter 4

Gender, Rural Land Certification, and the Reform Process

4.1 Introduction

Implementing rural land reforms in an attempt to strengthen land-holding rights often requires meeting several challenges. There is the risk that the process may not be systematic—bias may determine who the beneficiaries are and when they benefited from the reform. Such bias might include gender or wealth. According to Deininger et al. (2008a), efforts at land titling must meet two conditions: first, documents need to be awarded systematically and all at once, with the award process being participatory and involving strong community participation; second, information campaigns must be held before titling documents are issued to ensure that all participants are aware of the rules and are on a level playing field. Other concerns include financial and technical capacity constraints. Cost constraints can prevent reforms (Deininger et al., 2008b) or limit them to fewer beneficiaries, and technical limitations, such as lack of manpower and administrative failures (Holden et al., 2009), can have similar results. Deininger et al. (2008a) pointed out that the feasibility of reforms in the institutional, political, and economic domains is linked to success in implementation.

This study builds on the aforementioned literature by examining the determinants of parcel-certification status and timing in the context of the Amhara region of Ethiopia. Parcel-certification status is measured by whether parcels belonging to male and female household

heads are included in the household's land-use certificate. Parcel-certification timing is measured by whether a parcel is included in the household's land-use certificate in the earlier or later rounds of the certification process. All the analyses will be assessed by gender, specifically for parcels belonging to male and female heads of household.

The research questions addressed in this chapter are important for several reasons. First, from a policy perspective, and on a sectoral level, rural land reforms are undertaken to enhance the development of the agricultural sector and especially to lift up vulnerable and marginalized members of rural communities, such as women. Therefore, the reform process should be understood thoroughly and designed carefully to meet sectoral objectives and ensure that the reform reaches everyone, especially the disadvantaged segments of the rural population.

Second, from a financial perspective, rural land reform is a costly initiative, especially for developing countries. These budget constraints mean that understanding the implementation process is critical for maximizing the anticipated gains from the reform. The micro-level benefits of strengthening land-property rights extend beyond the agriculture sector and have been cited by many authors, including De Soto (2000), Goldstein et al. (2008), Duflo (2003), World Bank (2006), and Deininger et al. (2008a).

Third, from a research perspective, understanding the process is important because it permits assessment of the causal relationship, if any, between land titling and expected outcomes. Kassa (2014) pointed out that empirical studies have had difficulty measuring the impact of, for example, titles on land-related investments, because the allocation of property rights to households may not be random. The lack of randomness in many land-rights initiatives has been pointed out by Do et al. (2008); who reported that it is hard to find a "natural experiment" that allocates land rights in a strictly random manner, with the exception being in Galiani et al. (2006). In other words, the issuing land titles can be determined by various characteristics at the household, parcel, and village levels. Moreover, if a land reform is aimed at benefiting a specific group, then understanding the implementation process is key to ensuring that the group is targeted effectively.

Fourth, gaining insights into the land-titling process is crucial because lessons learned from past titling reforms can be used to improve the implementation processes of future initiatives for strengthening property rights, especially initiatives targeting specific groups.

The current empirical literature disagrees on whether there was bias in the reform process of the Amhara region. The program's objective was to cover all the villages in the area, so the rural land-registration process required for the issuance of certificates was considered "systematic and methodological" (SIDA-Amhara Rural Development Program [SARDP] and

BoEPLAU, 2010). On this basis, the process was indicated to involve no gender or wealth bias (Deininger et al., 2011), and the variable capturing the households' certification status was assumed by Deininger et al. (2008a) to be exogenous. However, other writers have judged the certification process to be endogenous on the basis of the premise that "all farmers are encouraged to apply to the LAC[13] for registration" (SARDP, 2010). The land-registration procedure necessary for certificate issuance depended on farmers applying for registration by filling in applications. Hence there is potential bias in who applies for and eventually obtains certificates. In a similar rural land-reform agenda in Madagascar, the Ethiopian certification process was treated as based on "demand" and "non-systematic": Burnod et al. (2012)[14] regarded the process as endogenous because "legalization of property rights is not systematic but engaged on landowners' demand." Despite this conflict, however, no studies have undertaken a detailed quantitative assessment of the certification process of the Amhara region.

Holden et al. (2009) empirically assessed whether bias existed in the rural land certification program of the Tigray region. This kind of assessment has not been undertaken for the Amhara region, but several empirical papers assessing the impact of the program treated the process as exogenous in their empirical estimations. These included Deininger et al. (2011), Bezabih et al. (2010), Bekele et al. (2010), Deininger et al. (2008b), and Melesse et al. (2015).

Although one objective of Ethiopia's nationwide rural land reform was to strengthen the land-holding rights of female landholders, Holden et al. (2009), Deininger et al. (2011), and Burnod et al. (2012) did not undertake detailed gender assessments of the certification process. But given this objective, it is important to shed light on whether the certification process in Amhara and other regions was being systematic or not from the gender perspective: (1) Were parcels belonging to female household heads preferentially included in the household land-use certificate? And (2) were parcels belonging to female household heads targeted in earlier rounds of the certification process than parcels belonging to male household heads?

This chapter contributes to the literature by examining gender differentials in parcel- and socioeconomic characteristics of the heads of household who hold the land. By doing so, it helps resolve the conflict in the literature over whether the certification process in the region was biased. In addition to parcel certification status, this chapter also examines timing.

Because strengthening the land-holding rights of female landholders was one of the main objectives of Ethiopia's rural land reform, I hypothesize that parcel-certification status

[13] LAC is Land Administration Committee.

[14] Madagascar implemented a recent land certification program attempting to model Ethiopia's successful experience with the certification process.

and timing were pro-female: parcels belonging to female heads of household were more likely to be certified, and certified in earlier rounds of the certification process, than parcels belonging to male household heads. To test this, I employ probit estimations using cross-sectional parcel-level data to examine the determinants of certification status and timing by gender.

The empirical results reveal the following: (1) Parcels belonging to female heads of household were *less* likely to be certified than those belonging to males. (2) The sex of the household head was an insignificant factor in parcel-certification timing. (3) Male presence in the household was an insignificant factor in both certification status and timing, regardless of the sex of the head of household. (4) Greater wealth and proximity to the nearest road *were* significant factors, but only for parcels held by males. They decreased and increased the likelihood of parcel certification, respectively, but both were irrelevant to when a parcel was certified. The impact of schooling was significant and contributed to early certification in the overall and male-headed household samples. (5) Good parcel characteristics, especially being "fertile" and having SWC maintenance, made parcels more likely to be certified but were insignificant determinants for certification in the female-headed sample. (6) Years of schooling was the only significant socio-economic factor in certification timing, and this only for parcels held by male heads. (7) The impact of parcel characteristics on the timing of certification was mixed, depending on the parcel characteristics and the sample.

Although these results conflict with accounts of women in rural Amhara and the importance of socioeconomic factors for strengthening female land-holding rights, the evidence from the empirical analyses does suggest the presence of gender bias, as evidenced by the lower likelihood of certification for parcels belonging to female heads of household. This means that rural land reforms can fall short of their gender objectives when vulnerable groups are not adequately targeted and supported during the implementation.

The remainder of this chapter is structured as follows: Section 4.2 covers the literature on rural land certification programs in Ethiopia and elsewhere. Section 4.3 discusses the data and empirical methodology. Section 4.4 presents the estimation results. Section 4.5 concludes, discusses policy implications, and outlines areas for future research.

4.2 Literature Review

Empirical studies of land-use certification have undertaken detailed analyses of the socio-economic impact of certification. However, this research is thin on the determinants of

certification—that is, who receives certificates for land holdings and when. Empirical analysis involving a gender context is especially limited. This section summarizes the literature on the subject by looking at the cases of Vietnam, Madagascar, and Ethiopia. I refer to Vietnam and Madagascar because these they have undertaken rural land reforms similar to Ethiopia's in the issuance of household land-use certificates. This sections also summarizes the literature on problems of endogeneity resulting from rural land reforms, and suggested solutions to them.

Do et al. (2008) used nationwide province-level analyses to measure the percentage of households registered and the speed of registration for land-use certificate issuance in Vietnam. This is interesting because the analyses were done at the provincial level with nationwide coverage, making it important to determine why the implementation of the program varied between provinces. To estimate the status and speed of registration, the authors used several types of data: data from the two rounds of the Vietnam Living Standards Survey (VLSS), 1992–93 and 1997–98, and provincial data on the progress of certificate issuance and the number of land-department officials in each province. They also used data on provincial populations, agricultural yields, and urbanization, and data from the 1994 Agricultural and Rural Census to capture variables representing infrastructure facilities in rural areas.

Do et al. (2008) noted that land officials cited two main sources of delay in land titling: lack of manpower and time spent resolving disputes. All time-invariant household and provincial characteristics were controlled for in the regression, with the dependent variable being a measure of the land-use certificate issuance—specifically, the proportion of households with certificates in 1998—speed of registration—computing as 2001[15] minus the year in which certificates reached 50 percent of households—and explanatory variables representing provincial characteristics. The results show that land registration was not strongly correlated with land-department manpower or any other provincial characteristics, such as population density, urbanization, proportion of communes having a market, mean level of education, or per-capita household expenditure. The results also showed no significant difference in the implementation of the reform in the North and the South. Overall, the empirical analyses highlighted a lack of systematic relation to any observed provincial characteristics.

In Madagascar, where land-use certificates were part of the Malagasy land reform program, Burnod et al. (2012) indicated that certification was on-demand and "non-systematic." The authors undertook household-level analyses using cross-sectional data from

[15] 2001 is the target year in which land certificate issuance was expected to reach more than 11 million rural households.

a specially designed survey conducted in 2011 on a sample of 1,862 rural households in four regions and nine communes of Madagascar. They investigated the predictive factors of certification using descriptive evidence and empirical analyses through a linear probability model with household-fixed effects, controlling for parcel and household characteristics. They found the following: Level of education was not a determinant of certification, foreign-born people were not excluded from the certification process, and women resort to certification more than men. They also found that certification access was strongly determined by household wealth: the wealthier the household, the higher the probability of its holding a land document.

Deininger et al. (2008a) compared the certification process in different regions of Ethiopia, including Tigray, Oromia, and the Southern Nations, Nationalities, and People's Region (SNNPR), to assess qualitatively whether there was any bias at the village, household, or parcel level. The village-level evidence showed that although the process went largely as planned, several shortcomings contributing to incomplete certification: (1) Women's representation was limited, as only 20 percent of LACs included a female member. (2) Access to written information on the law, process, and purpose of certification was limited. At the household and parcel levels, they found little evidence of wealth bias in access to the program or information on it, and female participation in the early registration stages was limited. In assessing whether the outcomes were biased against women,[16] they found that women's awareness of the certification process was high, the majority of women knew where the certificate of their household was stored, and most knew whose name was on the certificate.

Holden et al. (2009) cited administrative factors as plausible sources of bias in a reform process. For example, some households might not have received certificates in the Tigray land-certification program for the following plausible reasons: "(*a*) administrative failures contributing to unfinished registration and certification in some communities, (*b*) absence of some households at the time of registration, (*c*) failure of the administration to obtain additional certificates once they were finished, (*d*) some households perceiving the certificates as not significant at that time leading to lack of certificate collection, and (*e*) loss of certificates by some households or, if there was a change in the household head, the new head did not take over the old certificate or acquire a new one." Holden et al. (2009) suggested that administrative failures appear to have affected households and communities in a random way and were not likely to have introduced any endogeneity bias. However, reasons (*b*), (*d*), and (*e*) above could have introduced bias.

[16] Questions asked to a female respondent which in most cases was the spouse of the household head.

Holden et al. (2009) carried out an empirical exercise to identify the determinants of the issuance of household land-use certificates in the Tigray region, using a unique balanced household and plot-level panel data set covering the five main zones of the region. The baseline survey—before the land registration and certification program was introduced—was in 1998, and follow-up survey rounds were in 2001 and 2006. The authors estimated three model for the determinants of land certificates. In the first, village-fixed effects were tested as instruments for predicting administrative failures through the use of a "years since certification" variable to represent loss of certificates or changes in household heads, with new heads failing to obtain a certificate. The second estimated the determinants of possessing a land certificate using observable household and plot characteristics. The third estimated these determinants using a linear probability model with household-fixed effects and observable plot characteristics.

The results of the first model showed that only 7.1 percent of households without certificates were predicted correctly. Holden et al. (2009) noted that the weak predictive power could indicate either that the instruments were weak or that the certification process was random. The inclusion of observable household characteristics, as in the second model, showed that livestock holdings and farm size were significant determinants of certification: households with fewer animals and larger farms had a higher likelihood of being certified. Livestock was explained as being a sign of wealth and influence, which could have a positive correlation with tenure security, and households with larger land holdings were likely to be more tenure-insecure due to their increased chance of losing land in the next redistribution.

The second model also revealed that only 1.2 percent of households without certificates were predicted correctly, meaning that this model was even weaker. The authors found that livestock holding and farm size were significant determinants of certification: households with fewer animals and larger farms were more likely to obtain certificates.

In the third model, the results showed a high predictive power for households without a certificate: nearly 88.1 percent. Nevertheless, Holden et al. (2009) pointed out that the result left an unexplained error that was uncorrelated with unobserved household heterogeneity.

Kassa (2014) empirically assessed the impact of land titling on investment in Tanzania using the 2010/2011 Tanzania Living Standard Measurement Survey. This was a household survey with national coverage. While this work does not qualitatively describe or empirically estimate the determinants of land titling in Tanzania, it is important for its emphasis on the endogeneity of land titling and its conclusion that a closer examination of the land-titling process is needed. Kassa (2014) noted that the allocation of property rights to households could be determined by household- and village-level characteristics, legal instruments, and household

unobservables. The author pointed out that the literature on the impact of land titling varied in its methodology for accounting for the endogeneity of land titling; for example, Smith (2004) used no instruments, and Besley (1995) suggested multiple instruments, such as the presence of a transfer deed, whether the household had ever contested the right to its holding, how the land was obtained, and the number of years of land ownership.

Overall, the literature shows that the results of land titling through land-use certificates are mixed, and certification outcomes range from systematic to non-systematic. Do et al. (2008) showed provincial characteristics not to be a determinant of certification. Among household characteristics, wealth is a significant determinant, but the direction of impact varies between the studies: in Holden et al. (2009), less wealth is positively associated with certification; in Burnod et al. (2012), wealthy households are more likely to receive certificates. On the other hand, Deininger et al. (2008b) found no wealth bias.

Regarding gender bias, the findings are also not consistent. Burnod et al. (2012) found that women were more likely to resort to certification than men, but Deininger et al. (2008b) found little evidence of gender bias. These works are useful for guiding analyses of the determinants of certification in the Amhara region, and for showing the implications of empirical analyses of the impact of land titling.

This paper contributes to the aforementioned literature in the following ways. First, it paper provides analyses at the parcel level, whereas Burnod et al. (2012), Holden et al. (2009), and Do et al. (2009) conducted their analyses at the household, plot, and province levels, respectively. Second, it provides an empirical assessment of gender differentials in the determination of parcel-certification status and timing. A detailed gender lens was used in the analyses of Burnod et al. (2012), Do et al. (2008), or Holden et al. (2009).

4.3 Data and Description

4.3.1 Data Source

The analyses in this chapter were undertaken at the parcel level using parcel cross-section data from the 2007 survey. This chapter uses parcel-level analyses because during the certification process, the LACs make a decision for each parcel belonging to the household whether to include it in the land-use certificate to be issued to the household: the certificate issued to the

household will include only the certified parcels. Seventy-eight of 1,759 households had some parcels certified. If all of its parcels are certified, a household is also issued a certificate, and the data show that 1,280 households were in this situation. No certificate is issued to the household if none of the parcels belonging it are certified. There are 401 such households in the data. Parcels may be denied certification because of unresolved land disputes or a household's failure to maintain the parcel properly.

Although the overall analysis uses data from the 2007 survey to capture the dependent variables and certain parcel characteristics, it uses lagged data from the 2004 survey to capture characteristics of the head of household, household wealth, and household accessibility. This is because most of the parcels were certified in 2005 and 2006, when there were no surveys of relevant household characteristics. Therefore, the analysis assumes there were no significant changes in the one or two years after the 2004 survey. SWC maintenance is the only parcel characteristic also captured in 2004, because it can be expected to vary in a short time span, unlike parcel size, soil quality, depth, or slope.

4.3.2 Descriptive Statistics

There are two dependent variables in this chapter: parcel-certification status and parcel-certification timing. Both are binary variables, taking a value of 0 or 1.

For each parcel a household owned and cultivated or rented-out, if it responded that it was certified, the "parcel-certification status" variable for that parcel is assigned the value 1. If the household responded that the parcel was not certified, that variable is 0. As mentioned in Chapter 3 (section 3.3.3.2), 83 percent of the parcels belonged to male heads of household. Of the 7,988 parcels, 79 percent were certified. Most of the certified parcels also belonged to males (83 percent). Tale 4.1 shows that most parcels belonging to either male or female heads of household were certified, and the proportion between the two groups is similar. (Details of the certification status at the household level are provided in section 3.3.3.1.)

The "parcel certification timing" variable captures when a parcels was first included in a household's land-holding certificate, expressed in Ethiopian Calendar (E.C.) years. Rather than treat each year of certification as a category in the dependent variable, the results are grouped into two categories: early and late. If a parcel was certified in 1996 or 1997 E.C., it is treated as certified early and is assigned a value of 0. If a parcel was certified in 1998 or 1999 E.C., it was certified late, and is assigned a value of 1. This categorization das deemed

appropriate for the analyses in this chapter as a way to allow sufficient sample sizes for gender analyses, and because only 0.54 percent of the parcels were certified in the first year, 1996, it is reasonable to assume that "early certification" mainly captures parcels certified in 1997 E.C.

Section 3.3.3.2 shows that most of the parcels (64 percent) were certified in 1998 and 1999 E.C., so in the later rounds of the process, and that most of these (85 percent) belonged to male household heads. Table 4.1 shows that parcels belonging to female household heads were targeted for certification earlier in the process than those belonging to males.[17]

Table 4.1**: Parcel certification status and timing, by gender (%)**

	Male-Headed Households		Female-Headed Households		Total	
	Uncertified Parcels	Certified Parcels	Uncertified Parcels	Certified Parcels	Uncertified Parcels	Certified Parcels
Parcel-Certification Status	21	79	21	79	21	79

	Male-Headed Households		Female-Headed Household		Total	
	Early	Late	Early	Late	Early	Late
Parcel-Certification Timing	14	65	22	57	15	64

Source: My estimation from the "Sustainable Land-Use in the Ethiopian Highlands" Survey, 2007

Note: The statistics capturing parcel-certification timing do not add up to 100 percent because 21 percent of the observations were of parcels that have not been certified.

Because certification was undertaken at the kebele level (see Section 2.6.3 for an overview of the process), I will describe parcel-certification status and timing across the kebeles. Because the unit of analysis is the individual parcel, I will also assess correlations between status and timing and parcel characteristics. Finally, because parcels were under the control of households, I describe characteristics of households the parcels belong to,

[17] In terms of capturing parcel certification timing at the household level, the 2007 survey data shows the following: out of the 1759 households, there are 401 households with no information on parcel certification timing; in male household heads 171, 928 households received certification for their parcels in the "early" and "late" rounds of the certification process, respectively (3 male-headed households have a mix of parcels with both "early" and "late" certification timing); in female household heads 65, 189 households received certification for their parcels in the "early" and "late" rounds of the certification process, respectively (2 female-headed households have a mix of parcels with both "early" and "late" certification timing).

disaggregated by certification status and timing.

4.3.2.1 Parcel Certification Status and Timing, by Kebele

Table 4.2 shows parcel-certification status by kebele and sex of the household head. Overall, 79 percent of parcels in male- and female-headed households were certified. The pattern of certification status within kebeles is similar for parcels in male- and female-headed households: the proportions of parcels certified in each kebele belonging to male- and female- headed households are nearly equal. Exceptions appear in Kebi and Telma. In Kebi, 98 percent of the parcels in female-headed households were certified, but only 75 percent in male-headed households were included in the households' land-use certificates. In Telma, the reverse holds: all parcels from male-headed households were certified but only 75 percent of those in female-headed households were. Looking at the status across the kebeles, we find that majority of the parcels certified in both the male- and female-headed households were in the East Gojjam zone. Perhaps there was more incentive to ensure that parcels from surplus-producing areas were titled so that production in those areas would not be jeopardized.

Table 4.3 shows that more parcels in female-headed households were certified early than in male-headed households, almost 22 percent versus 14 percent. Moreover, in some kebeles, such as Telma, Kete, Amba Mariam, and Addis Mender, more parcels from female-headed households were certified early than from male-headed households. Because one objectives of the Ethiopian rural land reform program was to strengthen the rights of female landholders, the reform process might have targeted female landholders in its earlier years.

The data show no evident correlation between parcel location and certification status. It also seems, on average, that there was no gender bias in the certification of parcels within or between kebeles. This might mean the certification process was systematic in parcel certification by location and by gender. This would not be surprising, as the objective of the reform was to ensure that all parcels were certified. As for timing, most parcels in most kebeles were certified late, suggesting that there were problems in the implementation process. On the other hand, the description also revealed the presence of noticeable variations within kebeles in favor of early certification for parcels in female-headed households. This suggests that the process targeted female-held parcels in its earlier rounds. In other words, gender bias could be present in the parcel-certification timing.

Table 4.2: **Parcel-certification status, by kebele and gender (%)**

	Parcel Certification Status					
	Parcels from Male Headed Households			Parcels from Female Headed Households		
Kebeles	**No**	**Yes**	**Total**	**No**	**Yes**	**Total**
Ammanuel	11	591	602	2	84	86
	1.83	98.17	100	2.33	97.67	100
	0.8	11.22	9.07	0.7	7.86	6.36
Debre Elias	8	551	559	1	69	70
	1.43	98.57	100	1.43	98.57	100
	0.58	10.46	8.43	0.35	6.45	5.17
Kebi	78	234	312	1	40	41
	25	75	100	2.44	97.56	100
	5.7	4.44	4.7	0.35	3.74	3.03
Wolkite	474	4	478	53	0	53
	99.16	0.84	100	100	0	100
	34.62	0.08	7.2	18.66	0	3.92
Telma	0	420	420	8	46	54
	0	100	100	14.81	85.19	100
	0	7.98	6.33	2.82	4.3	3.99
Sekla Debir	393	0	393	85	0	85
	100	0	100	100	0	100
	28.71	0	5.92	29.93	0	6.28
Kete	170	761	931	40	120	160
	18.26	81.74	100	25	75	100
	12.42	14.45	14.03	14.08	11.23	11.83
Godguadit	32	350	382	14	80	94
	8.38	91.62	100	14.89	85.11	100
	2.34	6.65	5.76	4.93	7.48	6.95
Amba Mariam	50	552	602	22	164	186
	8.31	91.69	100	11.83	88.17	100
	3.65	10.48	9.07	7.75	15.34	13.75
Yamed	23	464	487	0	141	141
	4.72	95.28	100	0	100	100
	1.68	8.81	7.34	0	13.19	10.42
Addis Mender	64	176	240	15	44	59
	26.67	73.33	100	25.42	74.58	100
	4.67	3.34	3.62	5.28	4.12	4.36
Chorisa	19	322	341	6	73	79
	5.57	94.43	100	7.59	92.41	100
	1.39	6.11	5.14	2.11	6.83	5.84
Indod Ber	29	522	551	16	127	143
	5.26	94.74	100	11.19	88.81	100
	2.12	9.91	8.3	5.63	11.88	10.57
Addis Gulit	18	319	337	21	81	102
	5.34	94.66	100	20.59	79.41	100
	1.31	6.06	5.08	7.39	7.58	7.54
Total	1,369	5,266	6,635	284	1,069	1,353
	20.63	79.37	100	20.99	79.01	100
	100	100	100	100	100	100

Source: Own estimation from the "Sustainable Land Use in the Ethiopian Highlands" Survey, 2007

Table 4.3: **Parcel-certification timing, by kebele and gender (%)**

	Parcel Certification Timing							
	Parcels from Male Headed Households				Parcels from Female Headed Households			
Kebeles	Early	Late	Missing Observations	Total	Early	Late	Missing Observations	Total
Ammanuel	14	576	12	602	0	84	2	86
	2.33	95.68	1.99	100	0	97.67	2.33	100
	1.5	13.32	0.87	9.07	0	10.88	0.7	6.36
Debre Elias	16	534	9	559	0	69	1	70
	2.86	95.53	1.61	100	0	98.57	1.43	100
	1.71	12.35	0.66	8.43	0	8.94	0.35	5.17
Kebi	0	234	78	312	0	40	1	41
	0	75	25	100	0	97.56	2.44	100
	0	5.41	5.68	4.7	0	5.18	0.35	3.03
Wolkite	4	0	474	478	0	0	53	53
	0.84	0	99.16	100	0	0	100	100
	0.43	0	34.5	7.2	0	0	18.66	3.92
Telma	4	410	6	420	5	41	8	54
	0.95	97.62	1.43	100	9.26	75.93	14.81	100
	0.43	9.48	0.44	6.33	1.68	5.31	2.82	3.99
Sekla Debir	0	0	393	393	0	0	85	85
	0	0	100	100	0	0	100	100
	0	0	28.6	5.92	0	0	29.93	6.28
Kete	9	760	162	931	15	105	40	160
	0.97	81.63	17.4	100	9.38	65.63	25	100
	0.96	17.57	11.79	14.03	5.05	13.6	14.08	11.83
Godguadit	2	348	32	382	0	80	14	94
	0.52	91.1	8.38	100	0	85.11	14.89	100
	0.21	8.05	2.33	5.76	0	10.36	4.93	6.95
Amba Mariam	401	150	51	602	147	15	24	186
	66.61	24.92	8.47	100	79.03	8.06	12.9	100
	42.84	3.47	3.71	9.07	49.49	1.94	8.45	13.75
Yamed	303	161	23	487	86	55	0	141
	62.22	33.06	4.72	100	60.99	39.01	0	100
	32.37	3.72	1.67	7.34	28.96	7.12	0	10.42
Addis Mender	0	174	66	240	5	41	13	59
	0	72.5	27.5	100	8.47	69.49	22.03	100
	0	4.02	4.8	3.62	1.68	5.31	4.58	4.36
Chorisa	0	320	21	341	0	73	6	79
	0	93.84	6.16	100	0	92.41	7.59	100
	0	7.4	1.53	5.14	0	9.46	2.11	5.84
Indod Ber	42	483	26	551	7	120	16	143
	7.62	87.66	4.72	100	4.9	83.92	11.19	100
	4.49	11.17	1.89	8.3	2.36	15.54	5.63	10.57
Addis Gulit	141	175	21	337	32	49	21	102
	41.84	51.93	6.23	100	31.37	48.04	20.59	100
	15.06	4.05	1.53	5.08	10.77	6.35	7.39	7.54
Total	936	4,325	1,374	6,635	297	772	284	1,353
	14.11	65.18	20.71	100	21.95	57.06	20.99	100
	100	100	100	100	100	100	100	100

Source: Own estimation from the "Sustainable Land Use in the Ethiopian Highlands" Survey, 2007

4.3.2.2 Variable Descriptions and Basic Summary Statistics

Tables C.1–C.3 in the appendix provide the variable descriptions and summary statistics for the parcel-level data used in the estimations. These tables show that nearly 79 percent of the parcels were certified, and nearly 81 percent of the certified parcels were certified late in the process. Approximately 17 percent of the parcels were owned by female-headed households.

Parcel characteristics include quality, slope, depth, and type. “Fertile” parcel quality is the best for its productive capacity; “flat” slope is most preferred because it is less vulnerable to soil erosion; “deep” parcels are also preferred for farming; and “black” parcel type is considered the best for farming.

As the tables in the appendix show, there is no distinct variation in parcel characteristics between male- and female-headed households. Both have a nearly equal distribution of the best parcel traits across the various characteristics. Most of the parcels are “red” in type, and slightly more parcels in female-headed households have the best, “black” type (40 percent to 34 percent). Most parcels are of “medium” depth, and “deep” parcels are distributed equally between male- and female-headed households at 34 percent. Most parcels are “flat,” and 76 percent and 72 percent respectively of female- and male-owned parcels are flat. And most parcels, 54 percent are “fertile”; 62 percent and 53 percent of parcels in female- and male-headed households are “fertile.” Parcels in female-headed households are larger on average than those in male-headed households. Because this is the average parcel size, the parcel area in female-headed households is distributed on a smaller sample than in male-headed households. In addition, male-headed households have more parcels with land-related investments, in terms of SWC maintenance, than parcels in female-headed households.

As for differences in household characteristics, parcels belonging to male-headed households also belong to households whose heads who are more literate and wealthier than female-headed households. The average number of prime-age males in both groups is almost the same. And parcels of households closest to roads belong to female-headed households.

Because a primary objective of Ethiopia’s rural land reform was to strengthen the rights of the female landholders, I hypothesize that parcels belonging to female-headed households were certified earlier in the reform. I also expect that parcel quality and investments such as SWC maintenance increase the likelihood and earliness of parcels being certified and for both male- and female-headed households. Two variables are reflected in the household land-use certificate: the certificate stipulates that the landholder “properly maintain” the land, and

quality is the only parcel characteristic captured in the certificate (see Figure A.3 in the Appendix). As for household characteristics, the prevalence of parcel certification, in terms of status and timing, increases in poorer households, especially female-headed households. Livelihoods in rural Amhara are vulnerable, especially for female landholders. Lastly, the further a household is from the nearest road, the more likely a parcel is to be certified. This is expected to apply equally to parcels in both male- and female-headed households. Distance to the nearest road could reflect the logistical difficulties encountered by the LACs during the reform implementation.

4.3.2.3 Parcel Characteristics, by Certification Status and Timing

This sub-section describes the correlations between parcel-certification status and timing, and various parcel characteristics. Three of these characteristics (slope, depth, and type) were also cited by Holden et al. (2009) for the study of the determinants of certification. Parcel quality was added because it is included in the first two stages of the land-holding certificate. Although Holden et al. (2009) focused on the Tigray region, this paper assumes that parcel characteristics other than quality are also relevant to certification status and timing.

Parcels with the "best" characteristics are expected to be certified, and certified earlier, given that the Amhara Land Administration and Use Proclamation mandates that landholders undertake appropriate measures to enhance the productivity of their parcels (see Table 2.1 for details). This implies that parcels with soil and water conservation measures are also likely to be certified, and earlier. Parcels that have not been properly maintained in accordance with the proclamation could be considered abandoned by the kebele officials and not certified. I expect no difference in certification status and timing by parcel size. Larger parcels could be at a greater risk of loss, so there is an added incentive to include them in the certificate, but households with smaller parcels are considered small farmers with vulnerable rural livelihoods, so the LACs could have ensured that small parcels were certified, and in earlier rounds.

Table 4.4 describes parcel-certification status and timing alongside various parcel characteristics. Certified parcels and parcels certified in earlier rounds tend to be fertile, flat, and medium depth. Red soil is the dominant characteristic of certified parcels, but these parcels are not certified in the earlier rounds. There is no visible difference in certification status or timing in terms of parcel size. Certified parcels and those certified earlier tend to have SWC maintenance invested in them.

These data are further disaggregated by sex of the head of household to which the parcels belong, in Table 4.5. Female-headed households have a greater proportion of certified and non-certified parcels with the "best" quality, slope, depth, and type characteristics. A similar pattern appears in certification timing, except in the cases of quality and depth, where the reverse holds. In addition, certified and early-certified parcels belonging to female-headed households are larger than those belonging to male-headed households. In terms of investments in land, certified and early-certified parcels tend to be those with SWC maintenance in both male- and female-headed households, but the number is higher in the former group.

Table 4.4: **Parcel characteristics, by outcome variable (male and female household heads)**

Parcel Characteristics	No Certificate	Certificate	Early Certification	Late Certification
Parcel quality (%)				
Fertile	41.32	57.52	70.07	54.44
Medium-fertile	35.33	30.37	24.01	31.96
Infertile	22.99	12	5.68	13.52
Parcel slope (%)				
Flat	68.54	73.12	80.05	71.51
Medium	25.41	21.58	17.76	22.5
Steep	5.69	5.15	1.95	5.93
Parcel depth (%)				
Deep	35.45	33.69	30.98	34.51
Medium	38.42	51.48	56.04	50.21
Shallow	25.77	14.65	12.73	15.11
Parcel type (%)				
Black	32.06	36.15	41.52	34.73
Red	49.67	47.07	39.58	48.99
Grey	9.5	6.17	2.68	7.02
Other	8.41	10.53	15.9	9.24
Parcel size, hectares (mean)	0.06	0.04	0.04	0.04
With SWC maintenane (%)	18.81	31.9	47.69	28.33

Source: Survey of Sustainable Land Use in the Ethiopian Highlands (2007)

Table 4.5**: Parcel characteristics, by outcome variables and gender**

	No Certificate		Certificate		Early Certification		Late Certification	
Parcel Characteristics	**Male Headed Households**	**Female Headed Households**	**Male Headed Households**	**Female Headed Households**	**Male Headed Households**	**Female Headed Households**	**Male Headed Households**	**Female Headed Households**
Parcel quality (%)								
Fertile	38.57	54.58	56.29	63.61	70.51	68.69	53.23	61.27
Medium-fertile	36.45	29.93	30.76	28.44	23.08	26.94	32.42	29.4
Infertile	24.69	14.79	12.82	7.95	6.09	4.38	14.27	9.33
Parcel slope (%)								
Flat	67.57	73.24	72.58	76.15	79.06	83.16	71.24	73.06
Medium	26.22	21.48	22.16	18.71	18.8	14.48	22.84	20.6
Steep	5.92	4.58	5.15	5.14	1.82	2.36	5.85	6.35
Parcel depth (%)								
Deep	34.55	39.79	33.95	32.37	31.84	28.28	34.64	33.81
Medium	38.13	39.79	51.25	52.57	55.24	58.59	50.22	50.13
Shallow	27.03	19.72	14.57	15.06	12.61	13.13	14.94	16.06
Parcel type (%)								
Black	30.31	40.49	35.47	39.48	40.17	45.79	34.36	36.79
Red	50.91	43.66	48.42	40.41	42.52	30.3	49.83	44.3
Grey	10.01	7.04	5.89	7.58	2.35	3.7	6.66	9.07
Other	8.47	8.1	10.14	12.44	14.64	19.87	9.13	9.84
Parcel size, hectares (mean)	0.05	0.12	0.03	0.1	0.01	0.12	0.03	0.1
With SWC maintenance (%)	19.5	15.49	32.78	29.59	50.16	41.86	29.2	25.35

Source: Survey of Sustainable Land Use in the Ethiopian Highlands (2007)

4.3.2.4 Household Characteristics, by Certification Status and Timing

This sub-section discusses average household characteristics by parcel-certification status and timing.

Years of schooling is included because I assume that household heads with more schooling are likely to be more informed and involved in the certification process, increasing the chance of their land holdings being certified early. This variable is also captured by Holden et al. (2009). Number of prime-age (15–45) males in the household, wealth, and distance to the nearest road are also included. Given the Amhara region context (see Chapter 2), male presence in the household or family can be crucial for protecting land rights, especially those of female landholders. Male household members can play an active role on behalf of female landholders during the registration and certification process, increasing the likelihood of their parcels being certified, and in early rounds. This variable thus allows for a gender analysis by showing differences in certification outcomes between male- and female-headed households. Holden et

al. (2009) did not capture the role of male presence on certification, so this paper makes a contribution to the literature.

As for wealth, this paper expects that in the Amhara region, poorer households are more likely to be certified and in earlier rounds. Land titling can be seen as a measure for strengthening the land-holding rights of poorer households to give them incentive to improve the productivity of their land and thus improve their livelihoods. The distance to the nearest road is important because it is plausible that households may not receive certificates or may get them later if it is difficult to reach them. It is equally plausible that the households farthest from roads could have found it difficult to attend awareness campaign meetings or to register for certification with LAC members. Either way, this paper expects the households farthest from roads to have been issued fewer land-holding certificates or to have received them in later rounds of the process.

Table 4.6 shows details of certification status and timing with respect to various household characteristics. Male-headed households are more likely to have their parcels certified, but female-headed households are more likely to have their parcels certified in earlier rounds. In addition, both households headed by either males or females with more schooling are more likely to have their parcels certified, and in earlier rounds. Both male- and female-headed households seem more likely to have their parcels certified, but in later rounds, with greater presence of male support in the household. The same is true for household wealth. Lastly, female-headed households tend to have their parcels certified, and earlier, if they are close to the nearest road.

Table 4.6: **Household characteristics by outcome variable**

Household Characteristics	No Certificate	Certificate	Early Certification	Late Certification
Sex of household head (%)				
Male	82.82	83.35	77.62	84.72
Female	17.18	15.47	20.92	14.17
Age of household head (mean)	50.59	51.22	49.27	51.64
Male	50.70	50.90	48.72	51.34
Female	50.04	52.93	51.34	53.38
Years of schooling (mean)	0.75	1.21	1.94	1.03
Male	0.79	1.36	2.21	1.16
Female	0.59	0.41	0.93	0.23
Number of prime age males in the household (mean)	1.05	1.19	0.85	1.27
Male	1.08	1.18	0.77	1.26
Female	0.89	1.25	1.14	1.28
Wealth Characteristics (mean # of bulls/oxen owned)	1.57	1.65	1.02	1.79
Male	1.75	1.78	1.1	1.92
Female	0.70	0.93	0.66	1.03
Distance to nearest road (metres)	58.45	24.69	22.2	25.29
Male	61.28	25.28	23.38	25.67
Female	44.79	22.02	17.94	23.63

Source: Survey of Sustainable Land Use in the Ethiopian Highlands (2007)
Note: Information is at parcel level

4.4 Estimation Strategy and Results

4.4.1 Estimation Strategy

The estimation strategy in this paper takes account of the fact that the rural land reform process in the Amhara region was not implemented simultaneously in all the kebeles. It was rolled out gradually for several reasons (highlighted in Chapter 2): lack of manpower, financial constraints, delays in the provision of guidelines, and administrative and technical difficulties. This paper uses cross-section data from 2007, as discussed Section 3.3.3.2.

This paper departs from Holden et al.'s (2009) strategy by examining the systematic differences in certification at the parcel level rather than the household level, and in using cross-sectional data rather than panel data. It also adds the gender dimension to the determinants of parcel-certification status by identifying mechanisms by which status could differ by gender. This paper also uses data from the Amhara region, whereas Holden et al. (2009) used data from the Tigray region. This provides an opportunity to explore differences in outcomes between different regions in Ethiopia that experienced the same type of land reform.

4.4.1.1 Parcel-Certification Status

Lack of parcel certification could result from observable and unobservable kebele characteristics and from observable and unobservable parcel and household characteristics. The determinants of parcel certification status are thus estimated using Equation 1, which follows the empirical strategy adopted by Holden et al. (2009). In Equation (1), the determinants of parcel certification status in a household, CS_{ih}, are modeled to depend on observable parcel and household characteristics and kebele dummies to control for observed differences among parcels, households, and kebeles. This is the estimation model used by Holden et al. (2009):

$$CS_{ih} = \alpha_{30} + \alpha_{31}P_{ih} + \alpha_{32}H_{ih} + \alpha_{33}D_k + e_{3ih} \quad (1)$$

CS_{ih} is equal to 1 if parcel i in household h has a certificate, and 0 otherwise; P_{ih} is a vector of parcel characteristics; H_{ih} is a vector of household characteristics; D_k is a vector of kebele dummies; and e_{1ih}, e_{2ih}, e_{3ih} are the error terms related to each of the specified models. Observable household characteristics include sex, age, and years of schooling of the head of household, number of prime-age males in the household, mean number of bulls or oxen in the household, and distance of the household to the nearest road. Proxies for parcel characteristics include parcel type, depth, slope, quality, size, and whether it has SWC maintenance.

Equation 1 is estimated using probit estimation. Following Holden et al. (2009), kebele dummies are included to capture unobserved kebele heterogeneities. The regression results will report the marginal effects from the probit estimations, namely the likelihood that a parcel is certified given certain parcel and household characteristics.

The equation is estimated using an aggregate sample of parcels belonging to male- and female-headed households, and on separate samples: one sample of parcels belonging to male-

headed households, and one of parcels belonging to female-headed households. Re-estimating the equations using disaggregated data sample allows us to determine whether the impact of each control variable is similar for parcels in male- and female-headed households. Given that female farmers in the Amhara region have different socio-economic status from males, it is plausible that the impacts on the likelihood of certification could differ.

4.4.1.2 Parcel Certification Timing

In regards to certification timing, this paper follows the same estimation strategy as for certification status. This is because in the Amhara region, the same constraints faced during the registration and certification process could very well affect certification timing. For example, lack of manpower could mean that some parcels were not certified, and that those certified were added to land-holding certificates in later rounds.

Do et al. (2008) measured the speed of land-reform implementation across the provinces of Vietnam. This paper departs from their strategy in several ways, due to the nature of the research question and to data limitations: First, the analyses in Vietnam was done at the provincial level due to the availability of data on province-level populations, agricultural yields, urbanization, and rural infrastructure facilities. Do et al. (2008) also used data on land-department manpower at the province level to capture delays in land reform implementation. These data are not available for the Amhara region. In addition, Do et al. used panel data for Vietnam, whereas the Amhara data in this chapter use cross-sectional analyses.

Therefore, the estimation model of Equation 2 is similar to Equation 1, the only difference being the specification of the dependent variable: CS_{ih} is replaced with CT_{ih}:

$$CT_{ih} = \alpha_{30} + \alpha_{31}P_{ih} + \alpha_{32}H_{ih} + \alpha_{33}D_k + e_{3ih} \quad (2)$$

CT_{ih} is equal to 1 if parcel i in household h is certified late (in 1998 or 1999 E.C.), and to 0 otherwise. The independent variables are the same as in Equation 1.

The estimation strategy for Equation 2 is the same as Equations 1, and the results will be estimated using the aggregate sample data and the samples disaggregated by the sex of the head of the household to which parcels belong. Note that the fewer observations will be used for estimating the determinants of parcel-certification timing than for status because timing is estimated on the subset of parcels that have been certified—it excludes non-certified parcels.

4.4.1.3 Bivariate Probit Estimation of Parcel-Certification Status and Timing

This chapter also undertakes a bivariate probit estimation to determine whether the two probit equations for determining parcel-certification status and timing should be estimated separately or simultaneously. This is important to know, given that a decision is first made on whether a parcel is included in the household's land-use certificate, and then another is made on whether it is certified in the early or late rounds. To assess this, the bivariate probit will report a correlation coefficient (ρ) between the residuals of each of the two probits. Through a Wald significance test, if (ρ) is significantly different from 0, then the two probits should be estimated simultaneously. Otherwise, they should be estimated separately.

If the Wald test shows that the probits should be estimated simultaneously, this result will be compared to the results of the two separate probits for determining parcel certification status and timing. This will determine whether the results of the separate estimations are robust to the joint estimation.

4.4.2 Estimation Results

4.4.2.1 Parcel Certification Status

The marginal effects from the probit estimations for the determinants of parcel-certification status are presented in Tables 4.7 and 4.8. On the impact of observable household characteristics, the results indicate that the Amhara rural land reform was not "pro-female": parcels belonging to female-headed households were less likely to be certified than those belonging to male-headed households. This result can be explained by a fact noted in Chapter 2: the LAC's were mostly composed of men, which could have affected female landholders' awareness of the certification program during the publicity campaign. I also pointed in Chapter 2 that women's low participation in the land-titling process and other socio-political activities was linked to their low position in society, as Teklu (2005) pointed out: women who never participated in meetings to elect members of the LAC also indicated that they were not informed of the dates and locations of the meetings and believed that they were a task for men, and that women did not go to meetings. This finding suggests that a level playing field is necessary to ensure that the initial conditions for disadvantaged community members. In this case, unless the land reform process actively targets participation by female landholders, those landholders are likely to continue suffering from weak land-holding rights despite the reform.

Wealth is the only socioeconomic factor that is significant in explaining the likelihood of parcel certification. Distance to the nearest road is also significant. However, these variables are still relevant only to parcels belonging to male household heads. Wealth decreases the likelihood of parcel certification, meaning the certification process may have targeted poorer households. This result could have also been driven by the correlation of wealth with unobservables within kebeles, especially as some kebeles are located in the surplus-producing East Gojjam area but others are in the drought-prone South Wollo. The data show that the average number of bulls or oxen owned in South Wollo kebeles is higher (2.21) than in East Gojjam kebeles (1.43). In Amhara, livestock is an important food-insecurity mitigating mechanism because, apart from its direct use, it acts as a source of wealth storage. Because South Wollo is also poorer than East Gojjam , it is plausible that the negative impact of wealth on the likelihood of certification is driven by kebeles in South Wollo who own more bulls and oxen. In fact, the data show that nearly 64 percent and 39 percent of the non-certified and certified parcels, respectively, are in South Wollo. As for proximity to roads, parcels closer to roads are more likely to be certified. These parcels were perhaps relatively easier to reach during the reform process.

Surprisingly, the number of males in the household is not a significant determinant of parcel certification. This stands in contrast to the literature on women in rural Amhara. A plausible explanation is that males, especially in female-headed households, might be more important for their role as laborers in farming activities than for their influence on the certification process.

For the most part, parcel characteristics are significant factors only in the overall and male-headed household samples. In other words, they play no important role on the likelihood that parcels belonging to female heads are certified. In the two samples, the results show that overall, “good” parcel characteristics and SWC maintenance are significant drivers of parcel-certification status. Parcels that are black, deep, flat, and fertile are more likely to be certified. Parcels that are being invested in with SWC maintenance are also more likely to be certified. SWC maintenance shows that land is being used appropriately, so land holders with such investments might have been certified to give them incentive to continue these activities. Lack of appropriate maintenance, as stipulated in the land-holding certificate, could act as a signal that the land is abandoned, and officials might not certify it.

Adding a variable to capture the interaction term between the “number of prime age males” and “sex” variables, as shown in specification (e), produces similar results to the other specifications in Table 4.7 . However, the impact of the interaction term itself is insignificant.

This suggests that having male members in the household has no relevance to whether a parcel is certified.

Table 4.7: **Determinants of parcel-certification status (male and female household heads)**

Variables	(a)	(b)	(c)	(d)	(e)
Parcel type_Red^	-0.0651***	-0.0658***	-0.0661***	-0.0611***	-0.0610***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Parcel type_Grey^	-0.0653***	-0.0657***	-0.0663***	-0.0572***	-0.0584***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Parcel type_Other^	-0.0347**	-0.0343**	-0.0353**	-0.0333**	-0.0329**
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Parcel depth_Medium^^	0.0443***	0.0452***	0.0453***	0.0460***	0.0456***
	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)
Parcel depth_Shallow^^	0.0603***	0.0617***	0.0620***	0.0573***	0.0566***
	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)
Parcel slope_Medium^^^	0.0216*	0.0195	0.0194	0.0159	0.0162
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Parcel slope_Steep^^^	0.026	0.0265	0.0269	0.0223	0.0224
	(0.018)	(0.019)	(0.019)	(0.018)	(0.018)
Parcel quality_Medium^^^^	-0.0263**	-0.0273**	-0.0273**	-0.0296***	-0.0303***
	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)
Parcel quality_Infertile^^^^	-0.0425***	-0.0444***	-0.0457***	-0.0383**	-0.0382**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Parcel size	-0.0138*	-0.012	-0.0121	-0.0150**	-0.0143*
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)
SWC Maintenance	0.0633***	0.0634***	0.0632***	0.0597***	0.0594***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Sex		-0.0432***	-0.0432***	-0.0573***	-0.0771***
		(0.016)	(0.016)	(0.017)	(0.024)
Age		0.0006	0.0006	0.0003	0.0004
		(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling			0.0008	0.0014	0.0013
			(0.003)	(0.003)	(0.003)
Number of prime-age males in household				0.0081	0.005
				(0.006)	(0.006)
Number of bulls/oxen				-0.0172***	-0.0172***
				(0.006)	(0.006)
Distance to nearest road				0.0011***	0.0011***
				(0.000)	(0.000)
Number of prime-age males*sex					0.0162
					(0.014)
Kebele fixed effects	Yes	Yes	Yes	Yes	Yes
N	6699	6647	6615	6488	6488
pseudo R-sq	0.4418	0.4431	0.44	0.4549	0.4557

* p<0.1, ** p<0.05, *** p<0.01

Standard errors are in parentheses, and clustered at the household level

^denotes "black" parcel type as reference group; ^^denotes "deep" parcel depth as a reference group; ^^^denotes "flat" parcel slope as a reference group; ^^^^ denotes "fertile" parcel quality as a reference group

Table 4.8: **Determinants of parcel-certification status (disaggregated sample)**

	Male Headed Households		Female Headed Households	
Variables	(a)	(b)	(c)	(d)
Parcel type_Red^	-0.0752***	-0.0701***	-0.0619	-0.0472
	(0.012)	(0.012)	(0.036)	(0.036)
Parcel type_Grey^	-0.0774***	-0.0670***	-0.0436	-0.0548
	(0.018)	(0.018)	(0.052)	(0.049)
Parcel type_Other^	-0.0488***	-0.0466***	0.0171	0.0371
	(0.016)	(0.016)	(0.061)	(0.059)
Parcel depth_Medium^^	0.0499***	0.0496***	0.0519	0.0459
	(0.013)	(0.013)	(0.042)	(0.039)
Parcel depth_Shallow^^	0.0641***	0.0596***	0.043	0.0438
	(0.020)	(0.020)	(0.061)	(0.058)
Parcel slope_Medium^^^	0.0229*	0.0189	0.0371	0.0271
	(0.014)	(0.013)	(0.046)	(0.044)
Parcel slope_Steep^^^	0.0361*	0.0303	0.0129	0.0022
	(0.021)	(0.021)	(0.059)	(0.058)
Parcel quality_Medium^^^^	-0.0297**	-0.0314***	-0.0486	-0.0556
	(0.012)	(0.012)	(0.045)	(0.044)
Parcel quality_Infertile^^^^	-0.0514***	-0.0431**	-0.0032	0.0019
	(0.016)	(0.017)	(0.056)	(0.052)
Parcel size	-0.015	-0.0177*	-0.006	-0.0103
	(0.011)	(0.010)	(0.016)	(0.016)
SWC Maintenance	0.0703***	0.0669***	0.0427	0.0498
	(0.015)	(0.014)	(0.044)	(0.042)
Sex	---	---	---	---
Age		0.0003		0.0013
		(0.001)		(0.002)
Years of schooling		0.0026		-0.0176
		(0.003)		(0.012)
Number of prime-age males in household		0.0074		0.0291
		(0.006)		(0.023)
Number of bulls/oxen		-0.0178***		-0.0326
		(0.007)		(0.021)
Distance to nearest road		0.0011***		0.0015
		(0.000)		(0.001)
Kebele fixed effects	Yes	Yes	Yes	Yes
N	5244	5079	830	804
pseudo R-sq	0.4671	0.4789	0.1257	0.1532

* p<0.1, ** p<0.05, *** p<0.01

Standard errors are in parentheses, and clustered at the household level

^denotes "black" parcel type as reference group; ^^denotes "deep" parcel depth as a reference group; ^^^denotes "flat" parcel slope as a reference group; ^^^^ denotes "fertile" parcel quality as a reference group

4.4.2.2 Results for Parcel-Certification Timing

The marginal effects from the probit estimations for the determinants of parcel certification timing are presented in Tables 4.9 and 4.10. Sex of the head of household is not a significant determinant of when parcels are certified. It was a significant variable for certification status, so this finding suggests that speed of certification is influenced more by administrative factors (the ability of LACs to reach households) than by household characteristics. In fact, years of schooling is the only socioeconomic characteristic that is significant, and only so in the aggregate and male-household-head samples. More years of schooling contributes to earlier certification for male heads but is irrelevant for female heads. Household heads with more schooling are more likely to be aware of the certification program and participate to ensure that their parcels are certified early.

The results for the impact of parcel characteristics are mixed, depending on the characteristic and the sample. Only parcel type and slope are significant, as shown in the results for the aggregate sample. I expect that parcels with "other" status are more likely to be certified early than black parcels, and that medium-sloped parcels are more likely to be certified late than flat parcels. Parcel depth, quality, size, and SWC maintenance are not significant determinants of the outcome. When the sample is disaggregated, parcel quality does become a significant determinant for male heads: medium-quality parcels are more likely to be certified late than fertile parcels. And some characteristics become significant in the female sample, such as parcel type and size: "other"-type and large parcels are more likely to be certified early than black or small parcels.

Table 4.9: **Determinants of parcel-certification timing (male and female household heads)**

Variables	(a)	(b)	(c)	(d)
Parcel type_Red^	-0.0084	-0.0097	-0.011	-0.0108
	(0.014)	(0.014)	(0.014)	(0.014)
Parcel type_Grey^	0.0188	0.0184	0.019	0.0126
	(0.030)	(0.029)	(0.029)	(0.029)
Parcel type_Other^	-0.0607**	-0.0596**	-0.0586**	-0.0464*
	(0.024)	(0.024)	(0.024)	(0.023)
Parcel depth_Medium^^	-0.017	-0.0149	-0.0137	-0.0159
	(0.018)	(0.018)	(0.018)	(0.017)
Parcel depth_Shallow^^	-0.0153	-0.0122	-0.0133	-0.0059
	(0.022)	(0.021)	(0.021)	(0.021)
Parcel slope_Medium^^^	0.0314**	0.0327**	0.0321**	0.0309**
	(0.014)	(0.014)	(0.014)	(0.014)
Parcel slope_Steep^^^	0.0405	0.0397	0.0393	0.0484*
	(0.027)	(0.027)	(0.027)	(0.028)
Parcel quality_Medium^^^^	0.023	0.0229	0.0229	0.0222
	(0.016)	(0.016)	(0.016)	(0.016)
Parcel quality_Infertile^^^^	0.0286	0.0254	0.0255	0.0204
	(0.022)	(0.022)	(0.022)	(0.022)
Parcel size	-0.0021	-0.0012	0.0007	-0.0018
	(0.007)	(0.008)	(0.008)	(0.007)
SWC Maintenance	0.0108	0.0104	0.0105	0.0091
	(0.019)	(0.019)	(0.019)	(0.019)
Sex		-0.0157	-0.0226	-0.0252
		(0.025)	(0.025)	(0.026)
Age		0.0008	0.0003	0.0001
		(0.001)	(0.001)	(0.001)
Years of schooling			-0.0069**	-0.0073**
			(0.003)	(0.003)
Number of prime-age males in household				0.0082
				(0.010)
Number of bulls/oxen				0.003
				(0.009)
Distance to nearest road				-0.0004
				(0.001)
Kebele fixed effects	Yes	Yes	Yes	Yes
N	4930	4896	4894	4810
pseudo R-sq	0.4956	0.5012	0.5051	0.5099

* p<0.1, ** p<0.05, *** p<0.01

Standard errors are in parentheses, and clustered at the household level

^denotes "black" parcel type as reference group; ^^denotes "deep" parcel depth as a reference group; ^^^denotes "flat" parcel slope as a reference group; ^^^^ denotes "fertile" parcel quality as a reference group

Table 4.10: **Determinants of parcel-certification timing (disaggregated sample)**

	Male Headed Households		Female Headed Households	
Variables	(a)	(b)	(d)	(e)
Parcel type_Red^	-0.0129	-0.0177	0.0284	0.0413
	(0.015)	(0.018)	(0.046)	(0.044)
Parcel type_Grey^	0.0477	0.0507	-0.0398	-0.0101
	(0.034)	(0.039)	(0.096)	(0.087)
Parcel type_Other^	-0.0572**	-0.0418	-0.1337*	-0.1411*
	(0.028)	(0.034)	(0.070)	(0.074)
Parcel depth_Medium^^	-0.014	-0.0169	-0.0561	-0.0556
	(0.019)	(0.023)	(0.053)	(0.051)
Parcel depth_Shallow^^	-0.0081	0.0061	-0.0883	-0.1205*
	(0.023)	(0.026)	(0.073)	(0.074)
Parcel slope_Medium^^^	0.0332**	0.0389**	0.0063	0.0157
	(0.015)	(0.017)	(0.056)	(0.060)
Parcel slope_Steep^^^	0.0345	0.0599	0.0745	0.0697
	(0.030)	(0.040)	(0.085)	(0.084)
Parcel quality_Medium^^^^	0.0314*	0.0385*	0.0204	0.0051
	(0.017)	(0.020)	(0.056)	(0.052)
Parcel quality_Infertile^^^^	0.0312	0.0223	0.0472	0.0674
	(0.024)	(0.026)	(0.089)	(0.082)
Parcel size	-0.0071	0.0016	-0.0194	-0.0315**
	(0.010)	(0.012)	(0.015)	(0.016)
SWC Maintenance	0.0023	-0.0038	0.0758	0.0972
	(0.021)	(0.025)	(0.070)	(0.079)
Sex	---	---	---	---
Age		-0.0001		-0.0025
		(0.001)		(0.002)
Years of schooling		-0.0093**		-0.0248
		(0.004)		(0.020)
Number of prime-age males in household		0.0207		-0.0574
		(0.013)		(0.037)
Number of bulls/oxen		0.0149		-0.0289
		(0.012)		(0.038)
Distance to nearest road		-0.0007		-0.0004
		(0.001)		(0.002)
Kebele fixed effects	Yes	Yes	Yes	Yes
N	4043	3286	484	480
pseudo R-sq	0.5102	0.4973	0.3958	0.4322

* p<0.1, ** p<0.05, *** p<0.01

Standard errors are in parentheses, and clustered at the household level

^denotes "black" parcel type as reference group; ^^denotes "deep" parcel depth as a reference group; ^^^denotes "flat" parcel slope as a reference group; ^^^^ denotes "fertile" parcel quality as a reference group

4.4.2.3 Results for Bivariate Probit Estimation of Parcel-Certification Status and Timing

Table 4.11 reports the results of the Wald significance test derived from the bivariate probit estimation in Table 4.12, determining whether rho is significantly different from 0. As the p-value in the table indicates, the null hypothesis, rho = 0, is not rejected. Therefore, the two probits for determining parcel certification status and timing are to be estimated separately, as in the earlier analyses of this chapter. This finding suggests that in the Amhara region, the decisions whether and when to certify were undertaken separately. This could be explained by the possibility that households had some control over when they received certification, as it depended on when they submitted their applications to register, but no control over whether they received the certification.

Table 4.11: **Wald significance test**

	Correlation Coefficient	**Standard Error**
Estimated rho	-0.0481189	0.1521183

Wald test of rho=0	
chi2(1)=0.319567	Prob > chi2 = 0.7521

The marginal effects from the bi-variate post-probit estimation are reported in Table 4.12. Column c shows the post-estimation marginal effects for the likelihood that parcel certification = 1 (certified) and parcel certification timing = 1 (certified late). Characteristics such as parcel quality and SWC maintenance have significant impacts on both outcomes. In addition, fertile parcels and SWC-maintained parcels are more likely to be certified and certified early than parcels of lesser quality and without SWC maintenance. As for household characteristics, the two important variables of “sex” and “number of prime-age males” appear to be insignificant. This contrasts with the results of the separate probit estimations.

Table 4.12: **Bivariate probit estimation of parcel-certification status and timing**

	(a) Certification Status	(b) Certification Timing	(c) Post-estimation Marginal Effects
Parcel type_Red^	-0.266*	-0.000	-0.002
	(0.139)	(0.086)	(0.012)
Parcel type_Grey^	-0.101	0.483***	0.1095***
	(0.345)	(0.166)	(0.027)
Parcel type_Other^	-0.250	-0.171	-0.0408**
	(0.293)	(0.127)	(0.016)
Parcel depth_Medium^^	0.858**	-0.241***	-0.0487***
	(0.388)	(0.093)	(0.011)
Parcel depth_Shallow^^	0.634*	-0.331***	-0.0708***
	(0.357)	(0.113)	(0.018)
Parcel slope_Medium^^^	0.147	0.218**	0.0508***
	(0.260)	(0.086)	(0.013)
Parcel slope_Steep^^^	-0.133	0.666***	0.1510***
	(0.268)	(0.172)	(0.030)
Parcel quality_Medium^^^^	-1.043*	0.317***	0.0646***
	(0.551)	(0.091)	(0.012)
Parcel quality_Infertile^^^^	-0.843	0.411***	0.0875***
	(0.695)	(0.135)	(0.020)
Parcel size	0.058	0.052	0.0123
	(0.045)	(0.048)	(0.011)
SWC Maintenance	-0.721**	-0.492***	-0.1177***
	(0.337)	(0.099)	(0.010)
Sex	0.014	-0.057	-0.013
	(0.339)	(0.138)	(0.014)
Age	0.023**	0.001	0.0004
	(0.011)	(0.004)	(0.000)
Years of schooling	3.658***	-0.060***	0.0133***
	(0.315)	(0.019)	(0.006)
Number of prime-age males	0.092	0.102**	0.0240***
	(0.117)	(0.047)	(0.005)
Number of bulls/oxen	0.133	0.311***	0.0720***
	(0.153)	(0.051)	(0.005)
Distance to nearest road	0.015*	-0.001	-0.0001
	(0.008)	(0.002)	(0.000)
_cons	1.638***	0.587***	---
	(0.494)	(0.227)	
Kebele Fixed Effects	Yes	Yes	Yes
Observations	5386	5386	5386

* p<0.1, ** p<0.05, *** p<0.01

Standard errors are in parentheses, and clustered at the household level

^denotes "black" parcel type as reference group; ^^denotes "deep" parcel depth as a reference group; ^^^denotes "flat" parcel slope as a reference group; ^^^^ denotes "fertile" parcel quality as a reference group

4.5 Conclusion

Land administration projects such as rural land reforms can suffer from bias influencing both the beneficiaries of the reform and when the reform reaches them. Land titling needs to be carried out in a systematic process guided by sufficient information campaigns.

Understanding the process of allocating land rights is critical for policy makers on many levels. First, it informs officials about the optimal ways of undertaking rural land reforms under technical, logistical, and financial constraints. Second, in contexts where females play active roles in farming but are vulnerable segments of rural communities, policy makers can ensure that the process does not exclude them, which could translate into adverse impacts on the productivity and overall welfare of rural communities. Third, gaining insight into the process allows quantitative research to better estimate the impact of land titling on rural livelihoods.

This paper explored the determinants of parcel-certification status and timing, taking into account the gender differentials in these outcomes. The analysis employed cross-sectional parcel-level data to empirically assess the outcomes. The estimations controlled for parcel and household characteristics and for unobserved kebele heterogeneities. The findings show that parcels held by female heads are less likely to be certified, but that sex of the head of household is irrelevant to when a parcel is certified. Parcel characteristics and socioeconomic characteristics are irrelevant to likelihood of certification. Regarding parcel-certification timing, the impact of parcel characteristics is mixed, depending on the characteristic and the sample. Socioeconomic characteristics are insignificant to the timing of certification for parcels held by female heads.

The bivariate probit estimation showed that the determinants of parcel certification status and timing must be estimated separately. While the decisions whether and when to certify a parcel can be made jointly, in the context of the Amhara region, they may not have been.

The empirical findings of this chapter suggest that treating all groups in communities as being similar does not ensure equal access to reforms and their benefits. While this reform process envisaged certain methods for ensuring that lands belonging to female heads would have access to the reforms, the empirical assessment suggests that the actual implementation fell short, as parcels owned by female heads were less likely to be certified.

Because the findings also suggest that the certification program in the Amhara region was not systematic, future research should consider the endogeneity of certification in the estimation of the impact of land-use certificates. Literature that has investigated the impact of

certification while assuming exogeneity of certification could be used to compare research findings and test the robustness of results, perhaps using predicted certificate variables and their impacts.

This is precisely the methodology used in the next two chapters. The results of this chapter imply that when estimating the impact of certification on outcomes, such as household tenure security in Chapter 5 and land-related investments in Chapter 6, the use of an actual certification variable may not be the best estimation strategy to control for the lack of randomness in the certification process. Using the predicted-certification variable could be the best strategy, given the lack of an appropriate instrument variable from the survey data. This is discussed in detail in the next two chapters.

Chapter 5

Gender, Rural Land Certification, and Tenure Security

5.1 Introduction

Secured land holdings are crucial for men and women in poor rural communities: land is a fundamental input for agricultural production, can be used as collateral to access capital, can generate income directly if rented or sold, and is a form of economic security, especially in old age. While the benefits of secured land holdings extend to both male and female landholders, improving female land rights is particularly important because women have traditionally been susceptible to greater economic and socioeconomic discrimination and are often among the most vulnerable groups in rural societies (Joireman, 2008).

Burnod et al. (2012) and Deininger et al. (2011) empirically assessed the impact of land-use certificates on tenure security in Madagascar, Vietnam, and Ethiopia. However, they did not provide formal evidence on the gender-specific impact of these reforms. This chapter fills in this gap in the literatures by examining the impact of land-use certificates on perceived tenure security of male and female heads of household in the Amhara region of Ethiopia. Given the socioeconomic constraints faced by female landholders in Amhara and the nature of Ethiopia's land-tenure system, I hypothesize that (1) land-use certificates enhance the perceived tenure security of both male and female household heads, (2) certification enhances the perceived tenure security of female more than male household heads, and (3)

socioeconomic factors play a more significant role in enhancing the perceived tenure security of female than male household heads. I try to uncover whether the land-policy environment of Ethiopia, certification, and socioeconomics play important roles in strengthening the land-holding rights of female heads of household in rural Amhara.

These are the key contributions of this paper: First, it incorporates a gender lens into its analysis to identify the channels by which land-use certificates may have different impacts on the perceived tenure security of male- and female-headed households. Second, it takes into account the findings in Chapter 4 regarding the endogeneity of the certification process, and compares the results of the impact of land-use certificates on the perceived tenure security of the male and female household heads using the actual and predicted certification-status variables, with the latter applied as determined in Chapter 4. It also uses instrumental variable estimation. Third, this paper takes into account socioeconomic factors that could contribute to gender differentials in perceived tenure security.

The research questions addressed in this paper are important for the following reasons: first, women account for 70 percent of Africa's food production but often lack access to secure land (World Bank, 2016b). Therefore, from a policy perspective, agriculture-sector strategies need to ensure that this group is not marginalized, as they are significant contributors to agriculture and rural development. Second, given the scale of Ethiopia's rural land reform program and the costs of its implementation, it is essential to assess the extent to which usufruct rights enhance tenure security via-a-vis other factors for improving the secure land holdings of females. By looking at this, we can determine whether enough of the objectives have been met to justify the resources allocated to the program. Third, for contexts with similar land-tenure systems to Ethiopia's, this research can provide lessons on usufruct rights and gender in agriculture.

This paper uses both panel and cross-sectional data to examine the impact of land-use certificates and socioeconomic factors on the perceived tenure security of the male and female heads of household. The Chamberlain random effects probit estimations are used as baselines estimations. Linear probability model and IV estimations are used to test the robustness of the results. This is followed by probit estimations using the 2007 cross-section data, and the results are compared between perceived tenure security with the actual and predicted certification-status variables using predictions from the estimates in Chapter 4. All the panel and cross-sectional estimations are undertaken using an aggregate data sample of male and female household heads and a disaggregated data sample of both groups. Of course, the sample of female household heads is rather small and puts analytical limitations on any extensive gender

analyses. But despite this, the paper makes a first step into understanding the gender dimension of strengthening land-holding rights through land-use certification.

The empirical results using the panel data reveal that land-use certificates (actual) in the Amhara region increased the likelihood of perceived tenure security in both the aggregate and disaggregated data samples. Furthermore, the impact of the certificates was greater for female heads of household, who also have a higher perception of tenure security than males. The IV estimation shows similar results. The findings from the cross-sectional data show that certificates have an insignificant impact overall, but female household heads retain a significant positive perception of tenure security. Socio-economic factors are largely insignificant determinants of perceived tenure security in all estimations and data samples.

The remainder of the chapter is structured as follows: Section 5.2 provides the background to the tenure-security and gender context in the Amhara region. Section 5.3 covers the literature on rural land certification and tenure security. Section 5.4 discusses the data and descriptions. Section 5.5 discusses the estimation strategy and results. Section 5.6 concludes, discusses policy implications, and outlines areas for future research.

5.2 Background

This section provides an overview of the tenure security situation of female landholders in the Amhara region. It briefly describes their socioeconomic constraints and mechanisms vis-à-vis male landholders for influencing the security of land holdings.

Female-headed households in rural Amhara tend to be poorer than households headed by men and more disadvantaged in access to economic resources that are vital for farming and sustaining a livelihood. Class and economic status influence the land rights of both women and men because they determine the position and influence of individuals and their households in the community. Essentially, the land-use certification program was expected to provide equitable rights to land by protecting women from socioeconomic vulnerabilities, land disputes, discrimination, and expropriation. However, efforts to improve land rights through state intervention alone may not be sufficient for giving women equal control of land. Tenure security is also strongly influenced by access to male labor and by ownership of key farming resources, such as oxen, which female-headed households are less well-endowed with than their male counterparts. Another factor in tenure security is mode of production, or how the land is used. The patriarchal nature of Amhara society, and various cultural norms and

traditions, restrict women from certain modes of production, such as ploughing, that can help them secure their land holdings. All these constraints encourage female land holders in the region to rent out more of their land than male land holders do, to community members with better farming-resource endowments in exchange for share-cropped returns.

The protection of a woman's land rights in Amhara is strongly correlated with the level of family support she can mobilize. For example, if a woman has able male family members, it is considered an embarrassment for them if they do not protect her rights (Teklu, 2005). Family support is even more important in societies where female illiteracy is high, is this can hinder women's ability to safeguard their own rights.

Finally, social capital is also expected to determine women's land rights in the Amhara region. In the literature on rural land reform, informal channels of securing resource rights include "social capital," which is defined by many aspects: as an aggregate of actual and potential resources linked to membership in a group; as a stock of trust and emotional attachment to a group (Bourdieu, 1986; Coleman, 1988); as tacit knowledge; as a collection of networks; as an aggregation of reputations and organizational capital; and as features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit (Stiglitz, 1999; Putman, 1995). Social capital, in the form of organizational membership, networks, and support systems, is expected to affect the status of women in the community, and in turn to determine their land-tenure security. Whether formal or informal means are used to achieve it, the objective of this security is to "allow right holders to gain a social and legal recognition of their rights and to reaffirm it against challenging claims" (Burnod et al., 2012). Although this paper recognizes the role of social capital in strengthening tenure security, the forthcoming analyses do not incorporate it, due to data limitations in variables to capturing the concept.

Even though the primary goal of the rural land-certification program was to strengthen women's land entitlements, this paper argues that improvements in the socioeconomic status of landholders, especially female ones, could play a key role in enhancing tenure security. This chapter incorporates these factors into the analyses to seek evidence supporting this argument.

5.3 Literature Review

The extensive body of empirical literature on land-use certificates and their impact on tenure security provides important insights into the usefulness of land titling that falls short of granting

private ownership. Nonetheless, the mainstream literature on this topic has not formally incorporated gender-differential impacts of land-certification schemes. Given that women face greater traditionally defined productive constraints than men, which could hurt tenure security, the exclusion of gender from formal analysis can lead to spurious results and mislead policy decisions about such certification schemes.

Burnod et al. (2012) examined the impact of the Malagasy land reform, which introduced land certificates, on households' "sense of tenure security," using cross-sectional data on rural households in four regions and nine communes of Madagascar. The authors defined tenure insecurity as "land holders' perceptions that someone can challenge their land rights, and eventually, make them lose their rights" (p. 8). This definition is based on the context of Madagascar, in which the authors assert that possession of a land title does not imply tenure security for several reasons: "land conservation system is not up-to-date, torn or lost land register, title in the name of the dead parents, or if State land administration practices are not transparent (clientelism, corruption)."

The authors added that landholders may feel secure about their land holdings even without possessing documentation securing their rights by having "strong social recognition" (Burnod et al., 2012, p.8). They applied a linear probability model in two sets of regressions: (1) a regression examining correlations between plot and household characteristics and lack of fear, in terms of a "feeling of security"; and (2) a regression exploring whether the effect of a document, such as a title, certificate, *petits papiers*,[18] or tax receipt, differs between plots attained through purchase, inheritance, and other modes of acquisition. They found that the reform contributed significantly to reduced perceptions of tenure insecurity and led to fewer households fearing competing claims on their plots in the short term. However, most of the households acknowledged that they were not protected against all risk of contestation in the long term. The authors concluded that land certificates were viewed as complements to *petits papiers*: increased demand for land-use certificates did not lead to a reduced demand for *petits papiers*.

Specifically, the results showed that the probability of tenure insecurity increased when a plot's economic value increased (through production of rice and perennial crops), when plots were obtained through improvement (especially in the absence of a land document), and when plots were owned by the family or received through donation. Tenure insecurity was also higher

[18] "A system in Madagascar in which "people try to prove their property rights to a particular plot pf land by having a piece of paper describing their plot of land drafted on a computer and stamped by any government office" (Sandra F. Joireman, 2012, p. 78)

among the foreign-born and newcomers to the village (interviewees whose family tombs were not in their village of residence). The regressions also showed that the distance between the house and the plot had no impact on perceived tenure insecurity. Among female landholders in Madagascar, perceptions of tenure security are not affected by the fact that women may not fare well in local inheritance rules in addition to facing the risk of plot expropriation by their in-laws upon being widowed. Burnod et al. (2012) also found that the probability of perceived tenure insecurity falls when the number of plots (a proxy for the wealth or importance of the family) increases. A strong sense of tenure security was correlated with inherited and donated plots, due to the owners of such plots being protected from claims by relatives (the owners enjoying a "strong social role and position inside their large family," p. 12), whereas this social role might not protect them from competing claims by outsiders on purchased plots. Household wealth was not a significant determinant of perceived tenure insecurity. The analyses also showed that the probability of tenure insecurity decreased when landholders' rights were formalized and legalized. However, the authors noted that in Madagascar, a lack of land documents does not necessarily mean household is tenure-insecure, as most people are not concerned about losing their rights in the short term.

Using data from four waves of a rural panel survey conducted in the Amhara region, Deininger et al. (2011) empirically investigated the impact of the land-certification program on perceived tenure security. They used two dependent variables: the regressands take a value of 1 if a household expects an increase or decrease in the size of its land holdings due to administrative intervention in the five years following the survey. The empirical model assessed the effect of changes in the size of households' land holdings (increases or decreases) on various independent variables, including the treatment variable (certification status). That is, whether the household lived in a treated village and the treatment was at the household level; a vector of controls at the household level; household-specific unobserved effects; time dummies; and the iid error term.

Deininger et al. (2011) tested the hypothesis that certification increases tenure security. They used the Chamberlain random-effects probit, allowing for correlation between household-specific unobserved effects and the average of the time-varying covariates at the household level. For robustness checks, they used a household fixed-effects linear probability model. They found that despite certification in the Amhara region failing to eliminate tenure insecurity, it did significantly reduce fear of land loss, by nearly 10 percentage points. This result was found to be robust across specifications. Specifically, land tenure for households with certificates was found to be significantly more secure because of reduced expectations of

administrative interventions. The Chamberlain village-level estimation results indicated that certification decreased the share of people expecting to gain from land redistribution by nearly 14 percentage points, and the share of those expecting to lose by nearly 9 percentage points. The robustness-check estimates from the household fixed-effects linear probability model showed that the results were consistent for decreases in landholding size but insignificant for increases. The authors concluded that although certification had a positive impact, substantial levels of tenure insecurity remained due to the threat of expropriation resulting from Ethiopia's land-policy environment. Deininger et al. (2011) pointed out that a full realization of the potential of certification requires, in addition to honoring the existing certificates, that the policy environment does not undermine the certificates.

None of the aforementioned works undertook an empirical assessment of the gender impact of land-use certificates. They did not assess, for instance, whether the certification program had different effects on male- and female-headed households, or what mechanisms drove this difference.

Other important determinants of rural land tenure security have been discussed by empiricists in the formal literature. For example, Deininger et al. (2011) found that household composition (the number of adult males and adult females between 15 and 60) had an insignificant effect on the household's expectation of an increase or decrease in land holdings due to redistribution or reallocation over the next five years. Older households, and a higher per-capita endowment than the village median, were correlated with fear of land loss due to the expectation of administration redistribution measures. A larger share of high-quality land was found not to be an important factor by officials in the decision-making process for land redistributions. In addition, education and possession of iron roofs and oxen were found to have a little impact on expectations of changes in the size of land holdings. These results were consistent regardless of whether the land-certification treatments were examined at the household or village level.

This paper contributes to the literature in three ways: First, it undertakes an empirical assessment of the gender differentials in the determination of perceived tenure security. Second, it takes into account the endogeneity of the certification process, which was determined in Chapter 4. Third, it explores the effect of gender differentials on perceived tenure security as a result of household socioeconomic factors. These contributions build on the existing literature by presenting the mechanisms by which households' perceived tenure security can differ by sex of the household head, and by ensuring that the empirical findings are robust when endogeneity of certification is incorporated into the analyses.

5.4 Data and Description

5.4.1 Data Source

The analyses in this chapter are undertaken at the household level using unbalanced panel data from the 1999, 2002, 2004, and 2007 rounds of the "Studies for Sustainable Land Use in the Ethiopian Highlands" survey, and cross-sectional data from the 2007 survey. I use household-level analyses because the question in the survey that captures the dependent variable, "perceived tenure security" was asked of household heads. The data are unbalanced because, as noted in Chapter 3, the larger sample size relative to the balanced panel provides an opportunity to undertake a gender-disaggregated analyses. I use the 2007 cross-section data too because variation in households' certification status is evident only in the final round of the survey. This is because, although the certification program started in 2002, delays in implementation (see Chapter 3) meant that most certifications occurred in the later years (2005–07). Because the first follow-up survey after 2004 was in 2007, the variations in household certification status are best captured in the 2007 survey.

The unbalanced household-level panel data include 6,541 observations of 1,864 households; 82% of the observations are from male-headed households. The numbers of both male- and female-headed households increased between 1999 and 2007. Details of the household level data are provided in Section 3.3.3.1.

As for the certification status of households captured in the unbalanced panel data, nearly 21% of the observations were of households with certificates, and of these observations, nearly 80% were of male-headed households. A substantial proportion of both male and female household heads acquired certificates from 2005 to 2007 (see Chapter 3), even though 2002 was the pilot year, due to the lengthy certification process and delays in implementation. Further details of household-level data and certification status are provided in Section 3.3.3.1.

The analyses in this chapter capture independent variables representing household characteristics that are likely to explain perceived tenure-security differentials between male and female household heads in the Amhara region.[19] This is in addition to capturing the households' certification status variable (whether households have land-use certificates), which

[19] Although "social capital" is expected to be an important determinant of tenure security, this study excludes proxies of social capital in the analyses due to lack of variation and an insufficient number of observations in the survey data.

is also expected to determine the perceived tenure security of the household heads.

5.4.2 Descriptive Statistics

This sub-section provides a descriptive overview of the perceived tenure security of the household heads over their land holdings disaggregated by sex of the household head, certification status, and survey year; provides variable descriptions and summary statistics; and a discussion of the household characteristics by outcome and certification status disaggregated by sex of the household head, and survey year. The descriptive statistics presented in this section are important in assessing the potential channels by which land certificates could impact tenure security, in addition to exploring the heterogeneity of these channels and household characteristics which affect perceived tenure security across male versus female household heads.

5.4.2.1 Household Perceptions of Changes in the Size of Land Holdings, by Gender and Certification Status

The survey captured two variables that can act as proxies for households' perceptions of tenure security: (1) "Have you ever been concerned about land related conflicts?" and (2) "What are your expectations about changes in the size of your land holdings in the next five years?" This paper does not use the first, but only the second, as Deininger et al. (2011) did. The first question was rejected because it only captured the household's past perceptions, which makes it ill-suited to correlating a household's current certification status with its perceieved tenure security.

Given these limitations, the second question is preferable. The possible responses to it in all the survey years (1999, 2002, 2004, and 2007) included "increase," "decrease," "no change," and "don't know." I use these categories to infer whether a household is perceived to be tenure-secure or -insecure. Note, though, that the question captures "expected" rather than unexpected changes in the size of land holdings. This means that as long as the change is expected, a decrease in land holdings may not mean that the household head feels tenure-insecure, in contrast with an unexpected decrease, in which case it is plausible to infer that the household is perceived as being tenure-insecure. In addition, in some situations, such as a decline in household size, a decrease in the land holdings might not contribute to the household

head feeling tenure-insecure, since there may be less need for a large land area.

Similarly, an increase in land holdings, whether expected or unexpected, may not mean that the household is perceived as tenure-secure. In fact, an increase in holdings may cause the head to feel more insecure, due to fear of land loss through, for example, expropriation or conflict.

While at first glance, the "don't know" response represents uncertainty about the changes to land holdings, those who "don't know" could in fact end up with an increase (implying perceived tenure security) or a decrease (implying insecurity) in land holdings over the next five years. This paper recognizes the difficulties in defining a household's perceived tenure insecurity and notes that the definition is open to various interpretations.

Despite the difficulty of identifying household perceptions of tenure security using expectations of changes to the land holdings, I argue that the nature of Ethiopia's land-tenure system—land is state-owned, and holdings can change for mainly administrative reasons—as indicated in the survey data (most households cite redistribution and reallocation as the reasons for change) makes it reasonable to infer the following about perception of tenure security: (1) a household expecting an "increase" in land size is perceived to be tenure secure, as the state is awarding it additional land. (2) A household expecting no change in holdings is also perceived to be tenure secure, as this expectation represents confidence that the state will not intervene. (3) A household expecting a "decrease" is perceived to be tenure insecure, as this implies a loss of holdings due to the state taking away land, even though it is expected. To avoid difficulty of interpreting "don't know" responses, this category is excluded from the sample.[20]

Survey respondents were asked about the reasons for their expectations for the next five years. In the Amhara context, expected changes to the size of land holdings could occur for two kinds of reasons: administrative and non-administrative ones. Administrative reasons include village redistribution and land reallocation. These land-size changes are community-wide and induced by the government for specific purposes, such as tackling population pressure. Non-administrative reasons include family redistribution, inheritance (from the head's parents, the spouse's parents, or other relatives), buying, mortgaging, and bequests or gifts to others. These changes are not induced by the government and affect only a few

[20] There are 576 observations (576 households) in the "don't know" response category. Nearly 76 percent of these observations are from male-headed households; and 79 percent have a certificate. In addition, these observations are random i.e. their characteristics in terms of age, years of schooling, number of prime-age males in the household, number of bulls/oxen owned by the household, whether the households grow perennial crops, and size of total parcels in the household are not considered to be outliers to the total sample average. Therefore, this paper does not consider the exclusion of "Don't know" observations to be influencing the analyses.

members of the community. Most of the observations (50 percent) came from households that cited administrative factors as their reasons for expecting changes to their holdings. Fewer (12.21 percent) cited non-administrative factors.[21] But because a gender analysis needs plentiful observations from female-headed households, this paper does *not* distinguish between administrative and non-administrative reasons. However, because only 12 percent of respondents cited non-administrative reasons, I expect the results to be driven by the administrative factors, reflecting the nature of Ethiopia's land-tenure system.

This definition of household perceived tenure security departs from Deininger et al. (2011). In their paper, household perceived tenure security was whether the household "expects an increase or decrease in land holdings over the coming 5 years due to land redistribution and reallocation." I chose to categorize the variable of interest by grouping the responses (increase, decrease, no change) as much as possible to ensure enough observations of female-headed households for a gender analysis. For the same reason, this paper does not distinguish between administrative and non-administrative reasons for expected changes.

Using the panel information from the survey, Table 5.1[22] presents household heads' perceptions off the size of their land holdings in each year, disaggregated by sex of the head, but regardless of the reasons for the expectation. Nearly 28 percent of the households reported negative views of their land-tenure security, as reflected by responses of "decrease." On the other hand, nearly 72 percent reported positive perceptions, as reflected by "no change" or "increase."

Table 5.1: **Expectations of changes in land holdings, by gender**

	Total					Male Household Heads					Female Household Heads				
	1999	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**
Decrease (%)	24.12	28.11	29.20	30.23	27.68	24.6	28.62	29.97	31.8	28.47	21.69	25.23	25	22.66	23.52
"Perceived tenure insecurity" (%)	**24.12**	**28.11**	**29.20**	**30.23**	**27.68**	**24.6**	**28.62**	**29.97**	**31.8**	**28.47**	**21.69**	**25.23**	**25**	**22.66**	**23.52**
No change (%)	26.38	33.40	39.26	57.92	38.12	24.44	32.86	38.79	56.24	56.24	36.14	36.49	41.86	66.01	44.56
Increase (%)	49.50	38.49	31.54	11.85	34.20	50.96	38.52	31.24	11.96	11.96	42.17	38.29	33.14	11.33	31.91
"Perceived tenure security" (%)	**75.88**	**71.89**	**70.80**	**69.77**	**72.32**	**75.4**	**71.38**	**70.03**	**68.2**	**68.2**	**78.31**	**74.78**	**75**	**77.34**	**76.47**

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

[21] Nearly 38 percent did not provide reasons for their expectations of change, as they had answered "no change" to the earlier question.

[22] The 1999, 2002, and 2004 surveys did not have the "don't know" category for expectations of changes to land holdings. In 2007, 32.78 percent responded "don't know." Between male- and female-headed households, 31.03 and 40.12 percent, respectively, gave the same response.

Disaggregating the responses on expectations by sex of the household head shows that perceived tenure insecurity is lower among female than male heads of household. A potential reason is that, according to the 2007 survey, a greater percentage of male household heads than female (47 vs. 39 percent) felt that the land they farmed belonged to the government.[23] A sense of ownership may indicate less fear of land being taken away through administrative measures. Another reason could be that some female household heads are less aware of the nature of Ethiopia's land-tenure system (see Section 3.4.7 for details).

The last land redistribution in the Amhara region was in 1996 E.C., which corresponds to 2002/2003 A.D. Although households' perceived tenure insecurity increased from 2002 to 2007 in the total and male-household-head samples, the increase was only slight, which suggests that once the certification program was being rolled out in the kebeles, households started to feel more secure in their land holdings (Table 5.1). Interestingly, among the female heads, there was a noticeable decline in perceived tenure insecurity after 2004. This could mean that they were more sensitive to the issuance of usufruct rights than their male counterparts were. In other words, certificates might be having a greater impact on the tenure security perceptions of females than of males. And, as Chapter 4 showed, female heads were more likely to be certified in the later rounds of the certification process, which could explain the drop in perceived insecurity after 2004.

Table 5.2 depicts household heads' expectations of changes in the size of their land holdings, by certification status. It shows that certification is correlated to reductions in perceived tenure insecurity. The expectation of a decrease in holdings is lower in households with certificates than without certificates, as noted in the 2007 survey year.

Table 5.2: **Expectations of changes in land holdings, by certification status**

	No Certificates					Certificates				
	1999	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**
Decrease (%)	24.12	28.11	29.28	43.5	27.98	--	--	0	26.18	26.1
"Tenure insecure" (%)	**24.12**	**28.11**	**29.28**	**43.5**	**27.98**	**--**	**--**	**0**	**26.18**	**26.1**
No change (%)	26.38	33.4	39.28	42.75	33.06	--	--	33.33*	62.49	62.39
Increase (%)	49.5	38.49	31.44	13.75	38.96	--	--	66.67**	11.33	11.51
"Tenure secure" (%)	**75.88**	**71.89**	**70.72**	**56.50**	**72.02**	**--**	**--**	**100**	**73.82**	**73.9**

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.
Note: * no of observtations=1; ** no. of observations=2

[23] 52 percent and 59 percent of male- and female-headed households felt that the land they farmed belonged to them.

Table 5.3 shows the correlation between household heads' expectations of changes in their holdings, by sex head and by certification status in each year. The table indicates that certification may have reduced expectations of changes to land holdings in both males and females. Note that more female-headed households with certificates expect "no change" than their male counterparts. One potential explanation is a relative lack of knowledge of the land-policy environment among female household heads.

Table 5.3: **Expectations of changes in land holdings, by gender and certification status**

Male Household Heads										
	No Certificates					**Certificates**				
	1999	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**
Decrease (%)	24.6	28.62	30.03	43.18	28.48	--	--	0	28.34	28.27
"Tenure insecure" (%)	**24.6**	**28.62**	**30.03**	**43.18**	**28.48**	--	--	**0**	**28.34**	**28.27**
No change (%)	24.44	32.86	38.76	44.09	32.17	--	--	50*	59.87	59.84
Increase (%)	50.96	38.52	31.2	12.73	39.34	--	--	50*	11.79	11.89
"Tenure secure" (%)	**75.4**	**71.38**	**69.96**	**56.82**	**71.51**	--	--	**100**	**71.66**	**71.73**
Female Household Heads										
	No Certificates					**Certificates**				
	1999	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**
Decrease (%)	21.69	25.23	25.15	44.9	25.33	--	--	0	15.58	15.48
"Tenure insecure" (%)	**21.69**	**25.23**	**25.15**	**44.9**	**25.33**	--	--	**0**	**15.58**	**15.48**
No change (%)	36.14	36.49	42.11	36.73	37.77	--	--	0	75.32	74.84
Increase (%)	42.17	38.29	32.75	18.37	36.9	--	--	100*	9.09	9.68
"Tenure secure" (%)	**78.31**	**74.78**	**74.86**	**55.1**	**74.67**	--	--	**100**	**84.41**	**84.52**

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.
Note: * no. of observations=1

Table 5.4 depicts the reasons for household heads' expectations of changes in the size of their land holdings. Given Ethiopia's land-policy environment, most of the households expected changes due to administrative reasons, regardless of their certification status. However, the table also suggests that certification provides some level of tenure security from administrative changes to holdings. This holds for both male and female heads, although there is no visible difference between the female-headed households with and without certificates. The last administrative change in the Amhara region was in 1996 E.C. (2003/2004 A.D.) and was due to village redistribution. The table also shows a declining trend of households citing administrative reasons for their expectations of changes in the size of their holdings from 1999 to 2004, After which administrative reasons are increasingly cited, seemingly as people recall the most recent redistribution.

Looking at the data to explain households' perceived tenure security by reasons for

expectations about changes in the size land holdings (Table 5.5) reveals that most household heads who felt tenure-secure or insecure cited administrative reasons for expecting changes to their holdings. The effect does not differ between male and female household heads.

Table 5.4: **Reasons for expected changes in holdings, by gender and certification status**

	No Certificate					With Certificate				
	Panel	1999	2002	2004	2007	Panel	1999	2002	2004	2007
Non-administrative (%)	17.4	11.6	22.4	22.3	9.94	25.6	--	--	--	25.4
Administrative (%)	82.5	88.4	77.6	77.7	90.1	74.4	--	--	--	74.6

Male Household Heads

	No Certificate					With Certificate				
	Panel	1999	2002	2004	2007	Panel	1999	2002	2004	2007
Non-administrative (%)	17.5	11.9	22.1	22	9.9	26.4	--	--	--	26.49
Administrative (%)	82.5	88.1	77.9	78	90.1	73.6	--	--	--	73.51

Female Household Heads

	No Certificate					With Certificate				
	Panel	1999	2002	2004	2007	Panel	1999	2002	2004	2007
Non-administrative (%)	17.5	9.7	24.1	23.6	10	19.5	--	--	--	17.5
Administrative (%)	82.5	90.3	75.9	76.4	90	80.5	--	--	--	82.5

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

Table 5.5: **Reasons for expected changes in holdings, by gender and perceived tenure security**

	Tenure Insecure					Tenure Secure				
	Panel	1999	2002	2004	2007	Panel	1999	2002	2004	2007
Non-administrative (%)	23.92	22.1	29.56	19.93	22.57	14.16	6.53	17.51	24.28	15.56
Administrative (%)	76.08	77.9	70.44	80.07	77.43	85.84	93.47	82.49	75.72	84.44

Male Household Heads

	Tenure Insecure					Tenure Secure				
	Panel	1999	2002	2004	2007	Panel	1999	2002	2004	2007
Non-administrative (%)	24.24	22.92	29.76	18.99	23.53	14.07	6.65	16.84	24.48	16.96
Administrative (%)	75.76	77.08	70.24	81.01	76.47	85.93	93.35	83.16	75.52	83.04

Female Household Heads

	Tenure Insecure					Tenure Secure				
	Panel	1999	2002	2004	2007	Panel	1999	2002	2004	2007
Non-administrative (%)	21.86	17.31	28.3	26.47	15.91	14.66	5.83	21.43	23.21	8.7
Administrative (%)	78.14	82.69	71.7	73.53	84.09	85.34	94.17	78.57	76.79	91.3

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

5.4.2.2 Household Perceptions of Changes in Holdings, by Kebele and Gender

Because the certification program was implemented at the kebele level, it is useful to examine the distribution of perceived tenure security across kebeles and genders using the panel data.

Overall, the patterns in the distribution of perceived tenure security and insecurity seem similar in both male- and female-headed households and within and across kebeles. In each kebele, the majority of both male and female household heads felt tenure secure. With the exception of Wolkite, Yamed, and Addis Mender, a greater percentage of female-headed households felt tenure-secure than their male counterparts. Kete is the kebele with the highest percentage of male- and female-headed households feeling tenure secure.

Table 5.6: **Households' perceived tenure security across kebeles, by gender (%)**

	Male Household Heads			Female Household Heads		
Kebeles	**Insecure**	**Secure**	**Total**	**Inecure**	**Secure**	**Total**
Ammanuel	144	248	392	11	32	43
	36.73	63.27	100	25.58	74.42	100
	11.38	7.8	8.82	5.53	4.95	5.08
Debre Elias	143	237	380	15	35	50
	37.63	62.37	100	30	70	100
	11.3	7.46	8.55	7.54	5.41	5.91
Kebi	131	217	348	13	45	58
	37.64	62.36	100	22.41	77.59	100
	10.36	6.83	7.83	6.53	6.96	6.86
Wolkite	123	281	404	13	27	40
	30.45	69.55	100	32.5	67.5	100
	9.72	8.84	9.09	6.53	4.17	4.73
Telma	121	265	386	14	36	50
	31.35	68.65	100	28	72	100
	9.57	8.34	8.69	7.04	5.56	5.91
Sekla Debir	109	252	361	22	59	81
	30.19	69.81	100	27.16	72.84	100
	8.62	7.93	8.13	11.06	9.12	9.57
Kete	126	488	614	21	104	125
	20.52	79.48	100	16.8	83.2	100
	9.96	15.36	13.82	10.55	16.07	14.78
Godguadit	67	241	308	16	80	96
	21.75	78.25	100	16.67	83.33	100
	5.3	7.58	6.93	8.04	12.36	11.35
Amba Mariam	96	237	333	28	80	108
	28.83	71.17	100	25.93	74.07	100
	7.59	7.46	7.49	14.07	12.36	12.77
Yamed	86	196	282	23	48	71
	30.5	69.5	100	32.39	67.61	100
	6.8	6.17	6.35	11.56	7.42	8.39
Addis Mender	47	209	256	9	35	44
	18.36	81.64	100	20.45	79.55	100
	3.72	6.58	5.76	4.52	5.41	5.2
Chorisa	35	226	261	8	40	48
	13.41	86.59	100	16.67	83.33	100
	2.77	7.11	5.87	4.02	6.18	5.67
Indod Ber	17	47	64	3	9	12
	26.56	73.44	100	25	75	100
	1.34	1.48	1.44	1.51	1.39	1.42
Addis Gulit	20	34	54	3	17	20
	37.04	62.96	100	15	85	100
	1.58	1.07	1.22	1.51	2.63	2.36
Total	1,265	3,178	4,443	199	647	846
	28.47	71.53	100	23.52	76.48	100
	100	100	100	100	100	100

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

5.4.2.3 Variable Descriptions and Basic Summary Statistics

Tables D.1 to D.9 in the Appendix provide variable descriptions and summary statistics of the panel and cross-sectional data at the household level. The information in these tables is disaggregated by sex of the household head for both the panel and the 2007 data. The variables in the tables were selected to best capture the socioeconomic context of the Amhara region by gender and potential correlation with perceived tenure security. In addition, these variables are similar to the ones used in the literature on the impact of land-use certificates on tenure security, such as Deininger et al. (2011).

The "sex" variable is included to assess the gender differences in perceived tenure security and differences in the socioeconomic contexts of male- and female-headed households. "Age" acts as a proxy for the generational cycle (as explained by Deininger et al., 2011) that land goes through: older households are expected to be tenure insecure, as their land is being passed on to younger generations by the state to meet increased population pressure. Older households could be also less likely to protect their land holdings, making them more vulnerable to loss. "Years of schooling" is used to capture households' awareness of land-related policies and the nature of the land-tenure system: more-informed households are expected to be more tenure secure than less informed ones, as the former would know better how to protect their holdings.

"Number of prime-age males" is considered because it represents to some extent the amount of male labor available to the household for farming and for protecting land holdings, as this is a key variable in the case of female landholders in the Amhara region. Households with more prime-age males are expected to feel more tenure secure because male labor is needed for farming (especially for households that are culturally restricted in the farming activities women can engage in) both to sustain livelihoods and to ensure that land is being used appropriately to avoid expropriation by the state. "Number of bulls/oxen" is included to capture household wealth, which is expected to reduces households' perceived tenure security, as wealthier households can be targeted by the state for redistribution of lands to poorer people in the community. But wealth could also be correlated with a reduction in perceived insecurity, as it could indicate status, influence, and social networks which could be leveraged to safeguard land holdings.

"Total parcel size" is important because in the context of the Amhara region, land redistributions have been carried out by the state to meet increased demand from a growing

rural population. Households with larger parcels are thus expected to feel less secure. “Share of fertile parcels,” “share of rented parcels,” and “perennial crops” are all proxies for how land is used. A high share of fertile parcels, and growing of perennial crops are expected to increase perceived tenure security, as these could indicate that the household is managing the land well in accordance with the region’s Rural Land Administration and Use Proclamations (see Chapter 2 for details). An increase in “share of rented parcels” could either increase or decrease perceived tenure security: land is rented out, especially by female landholders, when a household lacks the resources to farm or manage the land themselves. If land is rented out, a household might feel more tenure-secure for knowing that its land is being managed well. On the other hand, the household might feel more tenure-insecure as there is a risk that the land will not be returned, especially if there are no formal mechanisms securing land holdings.

Overall, it is evident from the panel data derived from the male- and female-headed households sample that most of the observations (72%) belong to households who feel tenure secure, although only 21% of the observations are certified. The data reflect the fact that the majority of the observations (83%) are of male-headed households, the average age in the sample is 49, most have low educational attainment (one year of schooling), and more than half the sample observations have a prime-age male present in the household, with an average of one prime-age male present. On average, more than half the households in the sample own bulls or oxen (the mean number owned is 1), the average parcel size is 0.0553 hectares, most of the parcels are fertile, and a few are rented-out and grow perennial crops.

Disaggregating the panel data by sex of the household head shows the following: slightly more female- than male-headed households feel tenure-secure and have certificates, and female-headed households are slightly older (by two years) and have less educational attainment. More than half the male- and female-headed households have prime-age males, with an average of one prime-age male present. Most of the female-headed households do not own bulls or oxen, and they own fewer on average than male-headed households. Female-headed households have slightly larger parcels and fewer fertile parcels, rent-out a greater fraction of their parcels, and are less likely to grow perennial crops.

The summary statistics from the 2007 sample of male- and female-headed households indicates the following: Most of the observations (70 percent) belong to households who feel tenure-secure, and most of the households (79 percent) have certificates. The majority of the observations (80 percent) are of male-headed households, the average age is 51, most have low educational attainment (1 year of schooling), more than half the households have a prime-age male present, with an average of one prime-age. On average, more than half the households

own bulls or oxen (the mean number owned is 1), the average parcel size is 0.1907 hectares, most of the parcels are fertile, and a few are rented-out and grow perennial crops.

Comparing the 2007 summary statistics by sex of the household head reveals the following: More female- than male-headed households feel tenure secure, similar percentages of male- and female-headed households have certificates, and female-headed households are slightly older (by two years) and have less educational attainment. More than half the male- and female-headed households have prime-age males, with an average of one prime-age male present. Most of the female-headed households do not own bulls or oxen, and they own fewer than male-headed households. Female-headed households have slightly larger parcels and fewer fertile parcels, and they rent out a greater fraction of their parcels than do male-headed households. However, both male- and female-headed households are unlikely to grow perennial crops.

5.4.2.4 Household Characteristics, by Outcome and Sex of Household Head

This section discusses household characteristics by outcome variable (perceived tenure security), with the data disaggregated by sex of household head to assess gender differentials. The description covers a number of variables that are expected to determine households' perceived tenure security.

Certification is included in the analyses because it is expected to enhance perceived tenure security, as it is expected to strengthen land-holding right. Older household heads are expected to feel tenure insecure, as their capacity to protect their land holdings may have decreased. Increases in years of schooling are expected to enhance households' perceived tenure security, because this is a proxy for knowledge that could be used to protect land-holding rights. Households with prime-age males present and with higher numbers of them are expected to protect their land holdings by using labor to maintain and work the land and to exercise their rights in formal legal proceedings to protect their lands. Households with larger parcels may have negative perceptions of tenure-security, as these parcels could be subject to land redistributions by kebele officials, for example in response to local population increases. Households with fertile parcels and growing perennial crops are expected to feel secure in their holdings because this suggests that their lands are being maintained and used in accordance with regulations and may not be seized. Households that rent out their lands are expected to have a positive perception of tenure security because rented out land is likely to be maintained

and used properly, lowering the risk of its being taken away. Ownership of bulls or oxen is expected to reduce perception of tenure security because cattle are a proxy for households' wealth, and wealth could mean a greater risk of losing land.

Tables 5.7a through c describe household characteristics by outcome variable for all households and survey years, and disaggregate them by sex of the household head. It is evident from the descriptive statistics that feeling tenure-secure may not be correlated to households' certification status. For example, most households that feel tenure-secure or tenure-insecure lack certificates (82.37% and 83.72%, respectively), and this pattern holds for both male- and female-headed households, although slightly more female-headed households that feel tenure secure (20.25%) do have certificates than their male counterparts (17.09%). Households that feel tenure secure are younger, have more schooling on average, and have fewer prime-age males. This pattern also holds for both male- and female-headed households.

As for the correlation between perceptions of tenure security and parcel characteristics across all households, those who feel tenure-insecure have larger average land holdings than those who feel tenure-secure. This may be due to increased vulnerability to redistributions of large holdings. The same holds true across male- and female-headed households. In addition, for the entire sample and for both male- and female-headed households those who feel tenure-secure have a greater share of their land rented out (as a fraction of their total land) than those who feel tenure-insecure. This may be because households that rent out their land can have their land used, which increases their sense of tenure-security due to a reduced fear of the land being taken away for neglect. Furthermore, households that feel tenure-secure have more fertile parcels (as a share of total number of parcels) than households that feel insecure. However, the opposite is true with female-headed households.

In the pooled sample, there is no visible difference between households feeling tenure-insecure and tenure-secure in whether they grow perennial crops, and this holds for male-headed households. Among female-headed households, there are more that are tenure-secure and grow perennial crops (10.95 percent) than are tenure-insecure and do not grow perennial crops (7.65 percent). Notably, the percentage of households growing perennial crops increased significantly after 2004 in all samples. The increased issuance of certificates after 2004 may have provided households with sufficient incentives for doing so. Also interestingly, households that feel tenure-insecure own more cattle than tenure-secure ones, among both male- and female-headed households. Wealthier households may feel threatened that their resources, including land, will be taken away.

Table 5.7a: **Male- and female-headed household characteristics, by outcome variable**

	Tenure Insecure					Tenure Secure				
Household Characteristics	**1999**	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**
Certification status (%)										
No	100.00	100	100	32.96	83.72	100	100	99.62	18.47	82.37
Yes	---	---	0	67.04	16.28	---	---	0.38	81.53	17.63
Age	48.27	48.56	49.75	51.78	49.53	45.9	48.02	49.9	49.42	48.07
Years of schooling	1.70	1.06	1.21	0.84	1.20	1.43	1.11	1.19	1.12	1.22
Number of prime-age males	0.72	0.86	1.18	1.26	0.99	0.62	0.77	1.03	1.14	0.86
Parcel size	0.0006	0.0038	0.0022	0.2676	0.0700	0.0008	0.0038	0.0020	0.1334	0.0300
Share of rented-out parcels	0.1634	0.1766	0.2046	0.2022	0.1858	0.1874	0.1941	0.2123	0.1873	0.1944
Share of fertile parcels	0.5731	0.6159	0.5884	0.5689	0.5878	0.6161	0.6085	0.5935	0.5802	0.6015
Perrenial crops (%)										
No	85.03	92.34	91.05	70.00	85.06	91.63	91.03	93.91	61.10	85.70
Yes	14.97	7.66	8.95	30.00	14.94	8.37	8.97	6.09	38.90	14.30
Number of bulls/oxen	1.2459	1.2810	1.4154	2.0056	1.4788	1.0386	1.0829	1.2348	1.6820	1.2301
Observations	362.00	420.00	325.00	357.00	1464.00	1139.00	1074.00	788.00	824.00	3825.00

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

Table 5.7b: **Male-headed household characteristics, by outcome variable**

	Tenure Insecure					Tenure Secure				
Household Characteristics	**1999**	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**
Certification status (%)										
No	100	100.00	100.00	30.74	83.06	100.00	100.00	99.70	18.77	82.91
Yes	---	---	0.00	69.26	16.94	---	---	0.30	81.23	17.09
Age	47.95	48.10	48.78	51.42	49.03	45.46	47.47	49.62	49.33	47.70
Years of schooling	1.88	1.18	1.35	0.99	1.33	1.61	1.24	1.36	1.25	1.38
Number of prime-age males	0.71	0.84	1.17	1.27	0.99	0.61	0.76	1.00	1.13	0.84
Parcel size	0.0005	0.0037	0.0022	0.2232	0.0578	0.0008	0.0039	0.0011	0.1420	0.0330
Share of rented-out parcels	0.1379	0.1489	0.1604	0.1531	0.1498	0.1446	0.1482	0.1581	0.1271	0.1447
Share of fertile parcels	0.5720	0.6132	0.5847	0.5738	0.5872	0.6192	0.6176	0.6033	0.5898	0.6092
Perrenial crops (%)										
No	83.39	91.99	90.75	68.56	83.99	90.46	90.83	93.17	60.84	85.04
Yes	16.61	8.01	9.25	31.44	16.01	9.54	9.17	6.83	39.16	14.96
Number of bulls/oxen	1.3669	1.3764	1.5177	2.1576	1.5976	1.1706	1.1938	1.3612	1.8711	1.3638
Observations	308.00	364.00	282.00	311.00	1265.00	944.00	908.00	659.00	667.00	3178.00

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

Table 5.7c: **Female-headed household characteristics, by outcome variable**

	Tenure Insecure					Tenure Secure				
Household Characteristics	**1999**	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**
Certification status (%)										
No	100	100	100	47.83	87.94	100	100	99.22	17.2	79.75
Yes	---	---	0	52.17	12.06	---	---	0.78	82.8	20.25
Age	50.09	51.5	56.14	54.27	52.74	48.04	51.06	51.36	49.79	49.9
Years of schooling	0.67	0.32	0.28	0.02	0.34	0.55	0.38	0.34	0.58	0.47
Number of prime-age males	0.74	0.96	1.26	1.2	1.02	0.66	0.83	1.19	1.18	0.94
Parcel size	0.0012	0.0041	0.0026	0.5660	0.1376	0.0009	0.0032	0.0070	0.0972	0.0276
Share of rented-out parcels	0.3090	0.3563	0.4943	0.5343	0.4145	0.3950	0.4451	0.4893	0.4430	0.4383
Share of fertile parcels	0.5790	0.6334	0.6127	0.5353	0.5916	0.6008	0.5589	0.5436	0.5394	0.5637
Perrenial crops (%)										
No	94.34	94.64	93.02	83.87	92.35	97.35	92.12	97.67	62.5	89.05
Yes	5.66	5.36	6.98	16.13	7.65	2.65	7.88	2.33	37.5	10.95
Number of bulls/oxen	0.5556	0.6607	0.7442	0.9783	0.7236	0.4	0.4759	0.5891	0.879	0.5734
Observations	54	56	43	46	199	195	166	129	157	647

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

5.4.2.5 Household Characteristics, by Certification Status and Sex of Head

This section discusses household characteristics by the treatment variable (certification status), with the data disaggregated by sex of household head to assess gender differentials. Tables 5.8a, 5.8b, and 5.8c describe across the survey years and by sex of the head. They show that overall certification did not eliminate tenure insecurity, and in both male- and female-headed households. In fact, there is no difference in perceived tenure security between households with and without certificates, and regardless of the sex of the household head.

Households with certifications are older, have fewer years of schooling in both male- and female-headed households, and have more prime-age males. This holds for both the male- and female-headed households.

As for correlations between parcel characteristics and certification status, certified households have larger parcels than those without certificates. Comparing both male- and female-headed households shows that the latter group with certificates have larger total parcel sizes. In addition, certified households rent out less land (though the difference with non-certified households is insignificant), with female-headed households renting out greater shares

of their parcels than their male counterparts, regardless of the certification status. Furthermore, there is no difference overall in the share of fertile parcels between certified and non-certified households. However, certified male-headed households have a higher share of fertile parcels than male-headed households without certificates. The opposite is true in female-headed households.

As for the correlation between certification and growing perennial crops, Tables 5.8a, 5.8b, and 5.8c show that in the overall sample and in the male- and female-headed households, certification may have provided more incentive for certified households than uncertified households to grow perennial crops. It also seems that certification provided greater incentive for male-headed households to undertake such productive activities than for female-headed households.

Moreover, households with certificates have a higher average number of bulls or oxen than households without certificates, regardless of the sex of the head of household. Male-headed households with certificates own more bulls or oxen than female-headed households, irrespective of the certification status.

Table 5.8a: **Male- and female-headed household characteristics, by certification status**

	No Certificate					Certificate				
Household Characteristics	**1999**	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**
Certification status (%)										
No	24.12	28.11	29.28	43.49	27.98	---	---	0.00	26.18	26.10
Yes	75.88	71.89	70.72	56.51	72.02	---	---	100*	73.82	73.90
Age	46.51	48.23	50.04	50.94	48.53	---	---	50.19	51.25	51.24
Years of schooling	1.49	1.08	1.19	0.69	1.21	---	---	1.48	1.03	1.04
Number of prime-age males	0.64	0.79	1.06	1.01	0.86	---	---	0.76	1.25	1.24
Parcel size	0.0008	0.0038	0.0021	0.2340	0.0207	---	---	0.0004	0.1765	0.1741
Share of rented-out parcels	0.1819	0.1887	0.1967	0.2516	0.1941	---	---	0.3058	0.1872	0.1890
Share of fertile parcels	0.6071	0.6126	0.5843	0.5127	0.5939	---	---	0.3719	0.5934	0.5900
Perrenial crops (%)										
No	90.06	91.44	94.26	78.92	91.13	---	---	95.24	58.06	58.67
Yes	9.94	8.56	5.74	21.08	8.87	---	---	4.76	41.94	41.33
Number of bulls/oxen	1.09	1.13	1.35	1.54	1.22	---	---	1.10	1.80	1.79
Observations	100.00	100.00	98.80	22.20	78.82	---	---	1.20	77.80	21.18

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

Note: *no. of observations=3

Table 5.8b: **Male-headed household characteristics, by certification status**

	No Certificate					Certificate				
Household Characteristics	**1999**	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**
Certification status (%)										
No	24.60	28.62	30.03	43.18	28.48	---	---	0.00	28.34	28.27
Yes	75.40	71.38	69.97	56.82	71.52	---	---	100.00	71.66	71.73
Age	46.14	47.72	49.57	50.86	48.09	---	---	47.79	50.76	50.72
Years of schooling	1.67	1.21	1.35	0.75	1.36	---	---	2.21	1.18	1.20
Number of prime-age males	0.64	0.78	1.05	1.06	0.85	---	---	0.86	1.25	1.24
Presence of prime-age males (%)										
No	55.73	49.69	41.91	41.14	48.26	---	---	50*	35.73	35.91
Yes	44.27	50.31	58.09	58.86	51.74	---	---	50*	64.27	64.09
Parcel size	0.0007	0.0038	0.0018	0.2334	0.0201	---	---	0.0004	0.1727	0.1707
Share of rented-out parcels	0.1433	0.1485	0.1388	0.1850	0.1464	---	---	0.1362	0.1219	0.1221
Share of fertile parcels	0.6091	0.6180	0.5918	0.5156	0.5991	---	---	0.4112	0.6078	0.6053
Perrenial crops (%)										
No	88.74	91.20	93.60	78.93	90.42	---	---	92.86	57.77	58.22
Yes	11.26	8.80	6.40	21.07	9.58	---	---	7.14	42.23	41.78
Number of bulls/oxen	1.22	1.24	1.48	1.78	1.35	---	---	1.36	2.01	2.00
Observations	100.00	100.00	99.03	22.36	79.44	---	---	0.97	77.64	20.56

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

Note: * no. of observations=7

Table 5.8c: **Female-headed household characteristics, by certification status**

	No Certificate					Certificate				
Household Characteristics	**1999**	**2002**	**2004**	**2007**	**Total**	**1999**	**2002**	**2004**	**2007**	**Total**
Certification status (%)										
No	21.69	25.23	25.15	44.9	25.33	---	---	0	15.58	15.48
Yes	78.31	74.77	74.85	55.1	74.67	---	---	100*	84.42	84.52
Age	48.42	51.11	52.24	51.27	50.73	---	---	55.00	53.26	53.31
Years of schooling	0.57	0.36	0.43	0.44	0.45	---	---	0.00	0.39	0.38
Number of prime-age males	0.68	0.86	1.11	0.77	0.89	---	---	0.57	1.26	1.24
Presence of prime-age males (%)										
No	52.99	42.11	35.74	49.32	43.64	---	---	42.86*	33.83	34.07
Yes	47.01	57.89	64.26	50.68	56.36	---	---	57.14**	66.17	65.93
Parcel size	0.0010	0.0035	0.0036	0.2369	0.0241	---	---	0.0004	0.1919	0.1877
Share of rented-out parcels	0.3766	0.4160	0.4670	0.5398	0.4332	---	---	0.6448	0.4563	0.4611
Share of fertile parcels	0.5974	0.5820	0.5494	0.5001	0.5678	---	---	0.2933	0.5338	0.5276
Perrenial crops (%)										
No	96.72	92.83	97.38	78.85	94.78	---	---	100.00	59.61	60.95
Yes	3.28	7.17	2.62	21.15	5.22	---	---	0.00	40.39	39.05
Number of bulls/oxen	0.43	0.51	0.74	0.49	0.57	---	---	0.57	0.95	0.94
Observations	100.00	100.00	97.76	21.53	75.84	---	---	2.24	78.47	24.16

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" panel survey.

Note: * no. of observations=3; ** no. of observations=4

5.5 Estimation Strategy and Results

5.5.1 Estimation Strategy

The estimation strategy in this paper takes into account the fact that the certification process, as empirically tested in Chapter 4, was found to be endogenous. Therefore, in addition to using the actual certification variable to test for impacts on the outcome of interest—perceived tenure security—I apply predicted certification with kebele-fixed effects from Chapter 4 (Tables 4.8 and 4.9, specification g in) to the estimations to test for robustness of results. I also make an instrumental variable estimation to account for the endogeneity of certification. And as I noted earlier, because variation in household certification status is captured only in the 2007 survey, the estimation methods are applied using both the panel data and the 2007 cross-section data.

This paper does not use the difference-in-difference estimation strategy (DID). Although panel data are used, the DID does not apply when the treatment variable does not necessarily have an immediate impact on the outcome variable. Households' perceptions of changes in their land holdings may not immediately change when they are issued land-use certificates. In these cases, the treatment variable could be wrongly interpreted as having no impact on the outcome. In addition, the DID approach requires treatment and control groups. In the context of the Amhara region survey, the objective of the certification program was to issue land-use certificates to all landholders. As such, households without certificates may have adjusted their perceptions of tenure security even if they were eventually issued certificates. Therefore, having a control group in a non-experimental survey design does not meet a core requirement of the DID estimation strategy.

Given the socio-economic constraints on female landholders in the Amhara region and the nature of Ethiopia's land-tenure system, I hypothesize that (1) certification reduces but does not eliminate perceived tenure insecurity in both male- and female-headed households; (2) certification enhancing perceived tenure security more for female- than male-headed households; and (3) socioeconomic factors play a more significant role in enhancing perceived tenure security in female- than in male-headed households. These hypotheses will be tested using the Chamberlain random-effects probit, linear probability model, and probit estimations.

The estimation strategy involves the use of unbalanced panel data followed by the use of cross-sectional data. There are two estimation strategies using the panel data: (1) Chamberlain random-effects probit; and (2) linear probability model. These two estimations

will be undertaken using the actual household certification status variable. Then cross-sectional data will be used in the probit estimation strategies with both the actual and predicted household certification status variables.

5.5.1.1 Panel Data Estimations

a) Chamberlain Random-Effects Probit

The impact of land certification on households' perceived tenure security is estimated using Equation 1, which follows the empirical strategy of Deininger et al. (2011). A household's perceived tenure security, Y_{it}, is modeled to depend on its land-certification status and a number of household-level explanatory variables to control for observed differences among households over the survey years. This builds on Deininger et al.'s strategy in examining the gender dimension of certification impacts in more detail, by isolating household characteristics that are relevant to the rural livelihoods of female-headed households in the Amhara region. Specifically, this paper explores the mechanisms through which certifications affects female versus male-headed households, and considers the interplay between the certification status and key socioeconomic variables.

$$Y_{it} = \lambda_t + \beta_1 w_{it} + \beta_2 x_{it} + c_i + u_{it}, \quad (1)$$

Here, Y_{it} is a dummy variable that takes a value of 1 if household i at time t feels "tenure secure" about the size of its land holdings (expecting an increase or no change) in the face of administrative or non-administrative interventions in the next five years, and 0 otherwise; w_{it} is the policy variable of interest for household i at time t (1 if the household has a land holding certificate, 0 otherwise); x_{it} is a vector of controls for household i at time t that include the head's gender, age, and years of schooling, family support (number of prime-age males), wealth (cattle owned), parcel characteristics (share of fertile parcels, share of parcel rented out, total household parcel size), and mode of production or land-use (whether the household grows perennial crops). Finally, c_i captures household-specific unobserved effects (through the kebele dummy variable, as the certification process was undertaken at the kebele level), t is a full set of time dummies; and u_{it} is an iid error term. Equation 1 uses the actual household certification variable.

Equation 1 is estimated using Chamberlain's (1980) random-effects probit model. A traditional random-effects probit model would have sufficed if c_i were known to follow a

normal (0, σ^2_u) and iid distribution. We can avoid this arbitrary assumption by using Chamberlain's model, which is a special case of the traditional model that permits dependence between c_i and the vector of control variables, where c_i represents potential unobserved heterogeneity in the model (Chamberlain, 1980; Chamberlain, 1984; Wooldridge, 2001). In effect, Chamberlain's model works under a correlated random-effects framework in which unobserved heterogeneity is independent of the time-dependent covariates. In other words, this approach maintains the strict exogeneity assumption on x_{it} conditional on c_i, but allows for arbitrary correlation between c_i and x_{it} in the following way:

$$c_i = \gamma + \bar{x}_I \zeta + a_i , \quad (1a)$$

In Equation 1a, $\bar{x}_i$ represents a vector of the mean time-varying household covariates for household i across the years, and a_i is an error term. The idea behind this approach is to replace the unobserved effect c_i with its linear projection onto the explanatory variables in all time periods, in addition to the projection error (Woolridge, 2002). This continues to be a fixed-effects estimation, and x_{it} comprises only time-varying explanatory variables. This approach was used in one empirical study to assess the impact of a similar land reform on land-related investment and productivity, and in another to assess the impact on tenure security, by Holden et al. (2009) and Deininger et al. (2011), respectively. A conditional logit model with household-fixed effects would also work but would result in dropping a large part of the sample and would have less flexibility for computing the marginal effects (Woolridge, 2002).

Unbalanced panel data are used to estimate Equation 1 with the Chamberlain random-effects probit, and this estimation is taken as the baseline strategy when the panel data are applied. Marginal effects of the estimations will be derived to assess the marginal impact of certification and socioeconomic variables on the likelihood of a household enhancing its perceived tenure security.

The equation is estimated using an aggregate sample of observations from male- and female-headed households, and on separate samples of both. Re-estimating the equations using the disaggregated data allows us to determine whether the impact of each control variable is similar in male- and female-headed households. Given that the socio-economic status of female farmers in the Amhara region differs from that of males, it is plausible that the marginal impacts on perceived tenure security could be different.

b) Linear Probability Model

Next, I use a linear probability model with kebele-fixed effects to check the sensitivity of the

Chamberlain random-effects probit as Deininger et al. (2011) did. The equation to be estimated is the following:

$$P(Y_{it} = 1|X_{it}) = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \ldots + \beta_k X_{kt}, \qquad t = 1, 2, \ldots, T, \qquad (2)$$

where Y_{it} is a dummy variable that takes the value 1 if household i at time t feels "tenure-secure" in the size of its land holdings (expects an increase or no size change) in the face of administrative and non-administrative interventions in the next five years, and 0 otherwise; X_{it} represents the explanatory variables for household i at time t (including a kebele dummy variable): household certification status, the head's gender, age, and years of schooling, family support (number of prime-age males), wealth (bulls or oxen owned), parcel characteristics (share of fertile parcels, share of parcel size rented out, total parcel size), and mode of production or land-use (whether the household grows perennial crops).

The estimation assumes that X_1 is not functionally related to the other explanatory variables, $\beta_1 = \partial P(y = 1|x) / \partial x_1$. Therefore, β_1 is the change in the probability of success given a one-unit increase in X_1. On the other hand, if X_i is a binary explanatory variable, β_1 represents the difference in the probability of success when $X_1 = 1$ and $X_1 = 0$, holding the other X_j fixed. The linear probability approximates the response probability for common values of the covariates, and this takes care of potential values of X that may not be within a restricted range (Woolridge, 2002). As the linear probability model with exogenous explanatory variables is based on standard regression, the zero-conditional mean assumption $E(\varepsilon|X) = 0$ is assumed to hold. The estimation uses the actual household certification variable.

Equation 2 will be estimated using the unbalanced panel data. In addition, the equations will be estimated for the total sample of male- and female-headed households, followed by separate estimations for each.

c) Instrumental Variable (IV) Estimation

Endogeneity of the variable capturing the certification status of the household is a significant econometric concern when we are estimating certification effects on the household's perceived tenure insecurity, resulting in biased estimates. As Chapter 4 showed, several factors affect which parcels and households are certified. This makes it difficult to determine whether perceived tenure security is driven by the household's certification status or by an unobserved variable jointly determining certification status and perceived security. If land-use certificates were assigned randomly, establishing causality would be as easy as

ascertaining whether certification and perceived tenure security were correlated.

In the presence of endogeneity or measurement error, the corresponding assumption $E(\varepsilon|X) = 0$ applies, with the set of instruments *Z*, including the exogenous elements of *X*. Given that household certification status in Equation 3 is potentially endogenous, a linear probability model by two-stage-least-squares (2SLS) is estimated, in which

$$y_1 = 1[z_1 \delta_1 + \alpha_1 y_2 + u_1 > 0], \text{ and} \quad (3)$$

$$y_2 = 1[z \delta_2 + v_2 > 0] \quad (4)$$

The instrument chosen to undertake the IV estimation is "years since certification" and kebele-fixed effects. This is based on the approach taken by Holden et al. (2009), who used "years since certification" to capture the loss of certificates by households after receiving them, and changes in household heads with the new heads failing to acquire certificates. Holden et al. (2009) also used "kebele-fixed effects" as instruments to predict administrative failures that could have contributed to incomplete registration and certification in some communities. The IV estimation will be undertaken using the total sample of male and female household heads.

5.5.1.2 Cross-Section Data Estimations

As mentioned earlier in this chapter, the empirical analysis is also undertaken using the 2007 cross-sectional data because variation in households' certification status is evident only in the final round of the survey. This section describes two probit estimations using the 2007 cross-section data. The first uses the actual household certification status variable, and the second uses the predicted variable derived from Chapter 4.

a) Probit Estimation with Actual Household Certification Variable

Equation 3 is estimated to compare the results of estimating Equations 1 and 2 using the panel data. It follows a probit estimation with kebele-fixed effects, which will be the baseline estimation strategy when cross-section data is applied. The following is the equation to be estimated:

$$Y_i = \lambda_t + \beta_1 w_i + \beta_2 x_i + D_k + u_i, \quad (3)$$

where Y_i is a dummy variable that takes a value of 1 when household *i* feels "tenure-secure" in the size of its land holdings (expecting an increase or no change in size) regarding administrative and non-administrative interventions in the next five years, and 0 otherwise; w_i

is the policy variable of interest (1 if the household has a land-holding certificate, 0 otherwise); x_{it} is the same vector of controls at the household level as was used in the Chamberlain random-effects probit and the linear probability model estimations; D_k is the kebele dummy variables; and u_i is an iid error term. This probit estimation is made using the actual certification variable. The equation is estimated using an aggregate sample of observations from male- and female-headed households, as well as on separate samples.

b) Probit Estimation with Predicted Certification Variable

Recall that the empirical analyses in Chapter 4 found that the certification process in the Amhara region was endogenous and thus that parcel-certification status was an endogenous outcome determined by various parcel and household characteristics. In this section, I gauge the robustness of the results of the probit estimations with the actual certification status variable, as in Equation 3, by using the predicted certification status variable.

Chapter 4 used the following equation to determine parcel certification status:

$$CS_{ih} = \alpha_{30} + \alpha_{31}P_{ih} + \alpha_{32}H_{ih} + \alpha_{33}D_k + e_{3ih.} \quad (4)$$

CS_{ih} is 1 if parcel i in household h has a certificate (actual certification status variable), and 0 otherwise; P_{ih} is a vector of parcel characteristics; H_{ih} is a vector of household characteristics; D_k is a vector of kebele dummies; and e_{3ih} is the error term. Observable household characteristics include the household head's sex, age, and average years of schooling, the number of prime-age males, the mean number of bulls or oxen owned, and distance to the nearest road. Proxies for parcel characteristics include parcel type, depth, slope, quality, size, and whether the parcel has SWC maintenance.

Equation 4 was estimated in Chapter 4 using the 2007 cross-section data at the parcel level. Because the analyses in this paper are at the household level, the predicted parcel certification status variable CS_{ih} was aggregated to the household level by taking the mean predicted certification status across the parcels owned by the household to derive the households' predicted certification variable $\bar{w}_i$.

Third, Equation 3 is re-estimated using a probit estimation with kebele-fixed effects and including the predicted household certification status in the following way:

$$Y_i = \lambda_t + \beta_1 \bar{w}_i + \beta_2 x_i + D_k + u_i, \quad (5)$$

in which both Y_i, w_i, x_i, and D_k are the same as in Equation 3, with one exception: Equation 5 is estimated using the predicted household certification status $\bar{w}_i$ instead of w_i, derived from the aggregation of the parcel certification status outcome in Equation 4 to the household level.

The predicted certification status variable was estimated using the 2007 data in Chapter 4. Therefore, the application of predicted certification to determine perceived tenure security is works only in the context of analyses using the cross-section data. Equation 5 is estimated using an aggregate sample of observations from male- and female-headed households, and on separate samples of each.

5.5.2 Estimation Results

5.5.2.1 Panel Data Estimation Results

a) Chamberlain Random-Effects Probit

Table 5.9 reports baseline results from the Chamberlain random-effects probit model estimation of Equation 1. Columns 1 to 3 shows the impact of land certification on perceived tenure security of male- and female-headed households across different specifications of parcel characteristics (total household parcel size, share of parcel size rented out, and share of fertile parcels in the household). In particular, the results from the pooled sample indicate that, overall, land-use certificates did not eliminate tenure insecurity in rural Amhara. Nonetheless, certifications significantly improved tenure security at the 1-percent level, and positive certification status is associated with an increase in the perceived probability of the households' land holdings increasing or remaining unchanged. This result is robust across specifications involving different measures of parcel characteristics.

The nature of Ethiopia's land-tenure system may explain why certification did not eliminate perceived tenure insecurity. In Ethiopia, land is state-owned and landholders are granted only usufruct rights, so regional authorities can expropriate land from its holders for public purposes. This is indicated in the household's land-use holding certificate under "Responsibilities of the Holder," which provides guidance to landholders on the regulations they are expected to follow. Therefore, the results of the estimations on the total sample suggest that even in the presence of certificates, perceived tenure insecurity will remain.

Next, Equation 1 is separately re-estimated for male- and female-headed households, and the results are reported in columns 4 to 9. Under all specifications employing different parcel characteristics, the results of estimating Equation 2 for male- and female-headed households are closely consistent with the pooled estimation results, showing a strong positive

impact of certifications on perceived tenure security among male and female land-holders. What is interesting to note is that the results with the female sample show a higher effect. This could be attributed to the fact that female landholders in Amhara are economically and socially vulnerable, giving them a lower baseline perception of tenure security and making the marginal impact of certification larger for them than for male landholders. In addition, the results for the female sample suggest that certification not only enhances their perceived tenure security but eliminates perceived tenure insecurity. While this is surprising, given that Ethiopia's land-tenure system allows land to be expropriated for public use, which causes some level of tenure insecurity to remain, the findings could reflect the importance of legal land-holding rights, especially for female landholders. These findings indicate that certification is more crucial for the protection of land-holding rights for the rural female population of the region than for their male counterparts. This could be because to greater socio-economic vulnerabiliy of the female landholders makes "legal" rights ensuring securing land holdings more critical for them than for male landholders.

The impact of household characteristics on perceived tenure security is as follows: The effect of the "sex" variable on the outcome indicates that households headed by females are more likely to feeling tenure-secure than their male counterparts, and the impact is significant. One potential explanation is that female landholders are less well informed about the nature of Ethiopia's land tenure system. As I noted in Chapter 3, although there is low overall awareness of land laws among both male and female household heads, this lack of awareness is in some instances greater among female than male heads.

In the pooled sample, older households have a higher likelihood of feeling insecure, and the impact is significant. This is also true in the male sample, but age has an insignificant impact in the female sample. Increased years of schooling decrease likelihood of being tenure-secure in the aggregate and male samples, but the impact is significant only in specifications 1 and 3. The impact of schooling is insignificant in the female sample. This suggests that even with increased education, cultural constraints among females in rural Amhara, such as limited participation in the community, still act as barriers to women protecting their land holdings through formal legal platforms.

The number of prime-age males in the household is insignificant only in the female sample. In addition, an increase in prime-age males decreases perceived probability that the households' land holdings will increase or remain unchanged. This suggests an interplay between the power structure in the household (the presence of more male members may suggest a reduction in the households' holdings through future family redistribution) and the economic

need for income-generating labor (male members is particularly necessary in female-headed households due to cultural constraints in Ahmara restricting women's role on the farm, and due to human-resource constraints). The insignificant impact on the female sample is puzzling. One possible explanation is that, because female landholders are economically disadvantaged against their male counterparts, the presence of prime-age males may not make a difference in their ability to secure their land holdings. However, it is important to note that the results from the female sample are derived from a small number of observations, and this could be driving the insignificant result.

Wealth, as proxied by the number of cattle owned by the household, decreases the perceived probability that a household's land holdings will increase or remain unchanged. This is significant in all the specifications of the female sample and specification 3 in the aggregate sample. Wealthy female-headed households may fear a reduction of their holdings in favor of poor landholders through redistributions by the state. The impact is insignificant in the male sample, however, perhaps because male landholders have better mechanisms for securing their landholdings than their female counterparts.

Parcel characteristics do not seem to have a significant impact on households' perceptions of tenure security except in specifications 1 and 7, where an increase in the average size of parcels belonging to the household decreases perceived tenure security, as households may fear future land redistributions reducing their holdings. Mode of production or livelihood strategy, such as growing cash crops, has an insignificant impact on perceived tenure security in all samples: overall, the results do not change due to different parcel characteristics, such as total size, share of fertile parcels, or share of rented-out parcels.

The overall results of Deininger et al. (2011) are similar to these: certification in the Amhara region reduced tenure insecurity significantly: it reduced in fear of land loss by nearly 10 percentage points. This result was also found to be robust across specifications. Specifically, land tenure for households with certificates was significantly more secure due to less expectation of administrative intervention. While the Chamberlain random-effects probit estimation in this paper reaches a similar conclusion, that certification did reduced tenure insecurity, Deininger et al. (2011) did not undertake a gender assessment to examine differentials between male and female landholders and potential mechanisms for them.

b) Linear Probability Model Estimation

Table 5.10 shows the results of estimating Equation 2 using the household fixed-effects linear

probability model. These are robust in terms of significance and direction of impact with the results obtained from the Chamberlain random-effects probit model, across all samples and specifications. The most notable difference between the two is the magnitude of the effects of certification and other variables.

Certification continues to have a significant positive impact on perceived tenure security, but the magnitude of the impact appears smaller in all specifications and samples according to the results obtained under the linear probability estimations. The magnitude of the impact on perceived tenure security in the female sample remains larger than that for the male sample. Nevertheless, under the linear probability model there is a significant drop in the size of the marginal impact of certification, especially in the female sample. This seems consistent with the expected implications of Ethiopia's land-tenure system: expropriation of land by the state is expected even in the presence of certification.

The "sex" variable remains significant, but its impact is smaller than in specifications 1 to 3 using the Chamberlain random-effects probit. Being a female-headed household increases perceived tenure security. The impacts of the other control variables are similar to those reported in Table 5.9.

The robustness-check estimates from the household fixed-effects linear probability model in Deininger et al. (2011) showed that the results were consistent for the case of decreases in the landholding size, but insignificant for increases. In other words, certification significantly reduced fear of reduction in holdings but had no significant impact on expectations about increases in holdings.

c) Instrumental Variable Estimation

The results of the instrumental-variables linear probability model are reported in Table 5.11. In the first-stage regressions, "years since certification" significantly determines certification status (1% significance level). Furthermore, wealth and production of perennial crops appear to significantly increase likelihood of certification. This implies that household wealth and livelihood strategies determine who obtains land-use certificates.

Land-use certificates remain a significant and positive determinant of perceived tenure security, as exhibited in the second-stage IV regression, a result similar to the Chamberlain random-effects probit and linear probability estimation without the IV. In particular, the IV estimation indicates that land-use certificates lead to a 29 percent increase in the perceived probability of the household' land holdings increasing or at least remaining unchanged. The

impact of the "sex" variable on perceived tenure security remains significant and positive, a result similar to the joint findings of the baseline model and the linear probability estimation.

Table 5.9: **Determinants of perceived tenure security: Chamberlain random-effects probit (1999, 2002, 2004, 2007)**

Determinants of Perceived Tenure Security Marginal Effects from Chamberlain Random Effects Probit Model									
	Total Sample			Male Household Head Sample			Female Household Head Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Certification Status	0.591***	0.581***	0.580***	0.533***	0.519***	0.519***	1.147***	1.094***	1.097***
	(0.104)	(0.104)	(0.103)	(0.112)	(0.111)	(0.111)	(0.308)	(0.302)	(0.303)
Sex	0.127**	0.107*	0.115**	---	---	---	---	---	---
	(0.058)	(0.058)	(0.057)						
Age	-0.025***	-0.027***	-0.027***	-0.031***	-0.033***	-0.033***	0.008	0.002	0.002
	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.022)	(0.021)	(0.021)
Age-squared	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling	-0.014*	-0.012	-0.012	-0.014*	-0.012	-0.012	0.002	0.003	0.004
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.036)	(0.036)	(0.036)
Number of prime-age males	-0.045**	-0.036*	-0.038*	-0.048**	-0.042*	-0.042*	-0.043	-0.011	-0.006
	(0.021)	(0.021)	(0.021)	(0.023)	(0.023)	(0.023)	(0.065)	(0.064)	(0.064)
Parcel size	-0.101**			-0.072			-0.295**		
	(0.048)			(0.052)			(0.140)		
Share of rented-out parcels		0.046			0.001			0.124	
		(0.063)			(0.073)			(0.130)	
Share of fertile parcels			-0.035			0.007			-0.267
			(0.063)			(0.069)			(0.167)
Number of bulls/oxen	-0.023	-0.026	-0.030*	-0.007	-0.015	-0.015	-0.123*	-0.109*	-0.113*
	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)	(0.064)	(0.065)	(0.063)
Perennial crops	-0.077	-0.075	-0.077	-0.102	-0.096	-0.096	0.050	0.036	0.022
	(0.061)	(0.060)	(0.060)	(0.064)	(0.063)	(0.063)	(0.211)	(0.204)	(0.205)
2002	-0.105**	-0.123**	-0.122**	-0.111**	-0.128**	-0.128**	-0.068	-0.100	-0.097
	(0.052)	(0.051)	(0.051)	(0.057)	(0.055)	(0.055)	(0.138)	(0.133)	(0.133)
2004	-0.071	-0.076	-0.074	-0.069	-0.081	-0.081	-0.105	-0.075	-0.064
	(0.057)	(0.056)	(0.056)	(0.062)	(0.061)	(0.061)	(0.151)	(0.149)	(0.149)
2007	-0.501***	-0.526***	-0.522***	-0.514***	-0.527***	-0.527***	-0.516*	-0.603**	-0.592**
	(0.097)	(0.095)	(0.095)	(0.104)	(0.103)	(0.103)	(0.269)	(0.265)	(0.265)
Kebele FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4867	5119	5117	4130	4337	4336	737	782	781
Log Likelihood	-2798.4	-2910.1	-2910.0	-2404.6	-2495.4	-2495.3	-378.5	-401.8	-400.8

Standard errors in parentheses, and clustered at the Kebele level

* p<0.1, ** p<0.05, *** p<0.01

Table 5.10: **Determinants of perceived tenure security: Linear probability model (1999, 2002, 2004, 2007)**

Determinants of Perceived Tenure Security Linear Probability Model									
	Total Sample			Male Household Head Sample			Female Household Head Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Certification Status	0.205***	0.203***	0.202***	0.189***	0.184***	0.184***	0.333***	0.329***	0.328***
	(0.0522)	(0.0546)	(0.0543)	(0.0578)	(0.0597)	(0.0595)	(0.0571)	(0.0644)	(0.0618)
Sex	0.0398**	0.0330*	0.0357**	---	---	---	---	---	---
	(0.0149)	(0.0164)	(0.0152)						
Age	-0.00796**	-0.00842**	-0.00840**	-0.0101**	-0.0103**	-0.0103**	0.00226	0.000559	0.000747
	(0.00350)	(0.00316)	(0.00316)	(0.00451)	(0.00411)	(0.00413)	(0.00476)	(0.00469)	(0.00503)
Age-squared	6.36e-05*	6.74e-05**	6.77e-05**	8.72e-05**	8.81e-05**	8.82e-05**	-4.68e-05	-3.14e-05	-3.37e-05
	(2.96e-05)	(2.62e-05)	(2.65e-05)	(3.77e-05)	(3.38e-05)	(3.45e-05)	(4.84e-05)	(4.89e-05)	(5.21e-05)
Years of schooling	-0.00447*	-0.00372	-0.00367	-0.00468*	-0.00384	-0.00382	0.000561	0.00101	0.00157
	(0.00242)	(0.00212)	(0.00212)	(0.00257)	(0.00221)	(0.00220)	(0.00673)	(0.00643)	(0.00682)
Number of prime-age males	-0.0147**	-0.0120*	-0.0124*	-0.0160*	-0.0141	-0.0141	-0.0125	-0.00316	-0.00204
	(0.00643)	(0.00638)	(0.00619)	(0.00870)	(0.00837)	(0.00818)	(0.0136)	(0.0118)	(0.0125)
Parcel size	-0.0362*			-0.0261			-0.0938***		
	(0.0170)			(0.0184)			(0.0210)		
Share of rented-out parcels		0.0147			-0.000201			0.0368	
		(0.0256)			(0.0288)			(0.0355)	
Share of fertile parcels			-0.0108			0.00256			-0.0802**
			(0.0224)			(0.0244)			(0.0342)
Number of bulls/oxen	-0.00827	-0.00930	-0.0104*	-0.00264	-0.00528	-0.00526	-0.0380*	-0.0342	-0.0355*
	(0.00511)	(0.00637)	(0.00553)	(0.00510)	(0.00711)	(0.00596)	(0.0182)	(0.0199)	(0.0193)
Perennial crops	-0.0247	-0.0231	-0.0234	-0.0328	-0.0300	-0.0299	0.00849	0.00649	0.00312
	(0.0341)	(0.0336)	(0.0333)	(0.0336)	(0.0341)	(0.0338)	(0.0495)	(0.0504)	(0.0508)
2002	-0.0310	-0.0356	-0.0353	-0.0338	-0.0378	-0.0378	-0.0146	-0.0237	-0.0228
	(0.0331)	(0.0313)	(0.0313)	(0.0305)	(0.0292)	(0.0292)	(0.0683)	(0.0629)	(0.0625)
2004	-0.0189	-0.0196	-0.0191	-0.0186	-0.0217	-0.0217	-0.0238	-0.0141	-0.0111
	(0.0577)	(0.0573)	(0.0577)	(0.0521)	(0.0513)	(0.0515)	(0.0928)	(0.0973)	(0.0987)
2007	-0.175***	-0.183***	-0.182***	-0.180***	-0.185***	-0.185***	-0.162**	-0.192**	-0.187**
	(0.0536)	(0.0553)	(0.0554)	(0.0553)	(0.0570)	(0.0572)	(0.0713)	(0.0678)	(0.0674)
Kebele FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,867	5119	5117	4130	4337	4336	737	782	781
R-squared	0.019	0.017	0.017	0.017	0.016	0.016	0.048	0.037	0.039

Standard errors are in parentheses, and clustered at the Kebele level

* p<0.1, ** p<0.05, *** p<0.01

Table 5.11: **Determinants of perceived tenure security: IV estimation using linear probability model (1999, 2002, 2004, 2007)**

Linear Probability Model **Determinants of Perceived Tenure Security**		
	Second Stage IV Regression	**First Stage IV Regression**
Variables	**Tenure Security**	**Certification Status**
Certification status	0.288*** (0.0916)	---
Sex	0.158** (0.0718)	-6.84e-05 (0.0114)
Age	-0.0136 (0.00979)	-0.00110 (0.00142)
Age-squared	0.000110 (9.13e-05)	7.21e-06 (1.35e-05)
Years of schooling	-0.00921 (0.00963)	-0.00113 (0.00153)
Number of prime-age males	-0.0519** (0.0248)	0.00422 (0.00450)
Number of bulls/oxen	-0.0114 (0.0226)	0.0337*** (0.00468)
Parcel size	-0.104* (0.0592)	0.0142 (0.0153)
Perennial crops	-0.0759 (0.0809) (0.198)	0.111*** (0.0166) (0.0549)
Years since certification		0.566*** (0.0145)
Constant	0.603** (0.248)	0.0503 (0.0351)
Kebele FEs	Yes	Yes
Observations	3,261	3,261

Robust standard errors in parentheses, and clustered at the kebele level

*** p<0.01, ** p<0.05, * p<0.1

5.5.2.2 Cross-Sectional Data Estimation Results

a) Probit Estimation with Actual Certification Status Variable

The results of estimating Equation 3 with probit estimation using kebele-fixed effects and the 2007 data are reported in Table 5.12. Overall, the Table 5.9 results derived from the Chamberlain random-effects probit seem to be sensitive to the changes in data from panel to cross-section. Using the 2007 data reveals that household certification status is no longer significant for perceived tenure security in the total and male samples, though it remains significant with a greater positive impact in the female sample (but with level of significance dropping from 1 to 5 percent). This is surprising, given that certification is expected to enhance perceived tenure security in both male and female landholders. Nevertheless, the results continue to suggest that certification is more useful for female landholders, as they are the socioeconomically marginalized group.

Even more evident is the substantial drop in the size of the marginal contribution of certification on perceived tenure security across all specifications. Specifically, in the female sample, certification no longer eliminates perceived tenure insecurity, a result consistent with the implications derived from Ethiopia's land-tenure system.

On the robustness of the results predicting the impacts of other control variables on perceived tenure security, the following emerges: female-headed households are more likely to have a positive perception of tenure security than male-headed households. Years of schooling in the female sample now has a positive significant impact on perceived tenure security in one of the specifications. On the other hand, number of prime-age males is now insignificant in all specifications. The insignificance of variables can be attributed to the sensitivity of the results to drops in the number of observations between the data samples.

b) Probit Estimation with Predicted Certification Status Variable

The results of estimating Equation 5 with probit estimation using the predicted certification variable are reported in Table 5.13. Note that the number of observations drops for all samples when predicted certification status rather than actual certification is used. The results of comparing the robustness of the baseline estimations are summarized as follows: the determinants of perceived tenure security on a smaller number of observations could explain

the insignificance of the impact of predicted certification on perceived tenure security across all samples.

The results of the probit estimation using the actual certification status variable also seem to be sensitive when we examine the impact of socioeconomic variables, with the exception of the “sex” variable. Being a female-headed household enhances perceived tenure security. But interestingly the significance has increased from 5 percent in the Chamberlain random-effects probit estimation to 1 percent in the results using the cross-section data with actual and predicted certification. On the other hand, all the other variables but “age” have an insignificant impact on perceived tenure security in all samples.

Table 5.12: **Determinants of perceived tenure security: Probit estimation using actual certification status variable (2007)**

Determinants of Perceived Tenure Security Marginal Effects from Probit Model Using Actual Certification (2007)									
	Total Sample			Male Household Head Sanple			Female Household Head Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Certification Status	0.1102	0.1005	0.1033	0.0833	0.0711	0.0759	0.2552***	0.2418***	0.2352***
	(0.081)	(0.082)	(0.087)	(0.099)	(0.100)	(0.106)	(0.046)	(0.049)	(0.053)
Sex	0.1035***	0.1071***	0.1020***	---	---	---	---	---	---
	(0.035)	(0.037)	(0.035)						
Age	-0.0169***	-0.0167***	-0.0169***	-0.0209***	-0.0206***	-0.0208***	0.0188	0.0239	0.0242
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.018)	(0.019)	(0.019)
Age-squared	0.0001***	0.0001***	0.0001***	0.0002***	0.0002***	0.0002***	-0.0002	-0.0002	-0.0003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling	-0.0047	-0.0033	-0.0035	-0.0054	-0.004	-0.0041	0.0612	0.0713*	0.0701
	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.038)	(0.041)	(0.043)
Number of prime-age males	-0.0053	-0.0047	-0.0038	-0.0056	-0.006	-0.0048	-0.0001	0.0002	0.0039
	(0.013)	(0.013)	(0.013)	(0.015)	(0.016)	(0.015)	(0.036)	(0.032)	(0.032)
Parcel size	-0.0322*			-0.0261			-0.0624***		
	(0.017)			(0.018)			(0.023)		
Share of rented-out parcels		-0.0292			-0.0498			-0.1027	
		(0.055)			(0.057)			(0.080)	
Share of fertile parcels			-0.0119			-0.01			0.0767
			(0.043)			(0.050)			(0.105)
Number of bulls/oxen	-0.0074	-0.0098	-0.0077	-0.0038	-0.0077	-0.0047	-0.0500*	-0.0594**	-0.0522**
	(0.011)	(0.013)	(0.011)	(0.012)	(0.014)	(0.012)	(0.027)	(0.025)	(0.023)
Perennial crops	0.0011	-0.0066	-0.0065	-0.0197	-0.0293	-0.0281	0.0567	0.0697	0.0775
	(0.053)	(0.054)	(0.054)	(0.058)	(0.059)	(0.059)	(0.089)	(0.085)	(0.086)
Kebele FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1077	1082	1082	927	932	932	132	132	132
Pseudo R-Squared	0.099	0.0939	0.0936	0.0884	0.0851	0.0845	0.2058	0.1889	0.1857

Standard errors are in parentheses, and clustered at the Kebele level

* p<0.1, ** p<0.05, *** p<0.01

Table 5.13: **Determinants of perceived tenure security: Probit estimation using predicted certification status variable (2007)**

Determinats of Perceived Tenure Security Marginal Effects from Probit Model (2007) Using Predicted Certification									
	Total Sample			Male Household Head Sample			Female Household Head Sample		
Predicted certification status	0.4194	0.3892	0.3993	0.3192	0.2863	0.308	0.5384	0.4543	0.419
	(0.285)	(0.290)	(0.310)	(0.313)	(0.329)	(0.354)	(0.636)	(0.666)	(0.606)
Sex	0.1347***	0.1387***	0.1341***	---	---	---	---	---	---
	(0.047)	(0.052)	(0.049)						
Age	-0.0145**	-0.0141**	-0.0141**	-0.0160**	-0.0154***	-0.0156***	0.0313	0.0393*	0.0416
	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.020)	(0.020)	(0.028)
Age-squared	0.0001*	0.0001*	0.0001*	0.0001**	0.0001**	0.0001**	-0.0003	-0.0004*	-0.0004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling	-0.002	-0.0017	-0.0016	0.0016	0.0021	0.0023	0.0281	0.0274	0.0282
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.031)	(0.032)	(0.036)
Number of prime-age males	-0.0099	-0.0094	-0.0086	-0.0112	-0.0119	-0.0104	-0.0186	-0.0177	-0.0162
	(0.014)	(0.014)	(0.014)	(0.016)	(0.017)	(0.017)	(0.040)	(0.041)	(0.047)
Total household parcel size	-0.0236			-0.0262			-0.0725		
	(0.018)			(0.019)			(0.048)		
Share of parcel size rented-out		-0.0344			-0.0658			-0.0324	
		(0.047)			(0.052)			(0.131)	
Share of fertile parcels in household			0.0243			0.0154			0.077
			(0.050)			(0.069)			(0.146)
Number of bulls/oxen	-0.0052	-0.0087	-0.0068	-0.003	-0.0082	-0.0047	-0.0479	-0.0454	-0.0475
	(0.012)	(0.013)	(0.012)	(0.015)	(0.016)	(0.014)	(0.041)	(0.045)	(0.039)
Growing perennial crops	0.0098	0.0034	0.0061	-0.0096	-0.0184	-0.0141	0.1615	0.1551	0.1604
	(0.056)	(0.057)	(0.057)	(0.062)	(0.062)	(0.064)	(0.110)	(0.110)	(0.117)
Kebele FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	893	895	895	703	705	705	73	73	73
Pseudo R-Squared	0.0873	0.0849	0.0847	0.0741	0.0724	0.0714	0.1974	0.1832	0.1853

Standard errors are in parentheses, and clustered at the Kebele level
* p<0.1, ** p<0.05, *** p<0.01

5.6 Conclusion

Understanding the impact of land-holding rights on tenure security, especially for female landholders, is critical: First, women account for 70 percent of Africa's food production, so

agricultural-sector strategies must ensure that this group is not marginalized. Second, allocating resources to rural land reform programs in developing countries can only be justified by comprehensive assessments of the reform's impacts on various matters of interest to the sector and rural development. Third, for other developing countries with similar land-tenure systems this research could provide valuable lessons on usufruct rights and gender in agriculture.

An extensive body of literature provides insights into the effects of strong land-holding rights, especially for female landholders. Some of this research has examined the impact of land-use certificates on tenure security in Ethiopia and elsewhere and found that certification did enhance perceived tenure security among landholders. However, empirical literature on the gender impact of land-use certificates on tenure security is missing. I attempt to fill this gap.

In this paper, I infer that (1) certification reduces but does not eliminate perceived tenure insecurity in both male- and female-headed households; (2) certification enhances perceived tenure security more for female- than for male-headed households; and (3) socioeconomic factors play a more significant role in enhancing perceived tenure security for female- than for male-headed households. The analysis is aimed at determining whether the Ethiopian land policy or local socio-economics plays a key role in strengthening the land-holding rights of women in rural Amhara.

The empirical analysis was aimed at determining households' perceived tenure security while controlling for their certification status and various other socio-economic characteristics. The baseline estimation strategy using the panel data was the Chamberlain random-effects probit, which assumes strict exogeneity of the vector of controls, in this case at the household level, conditional on the household's unobserved effects. A linear probability model estimation with kebele-fixed effects was used to test the robustness of the Chamberlain random-effects probit estimation. These estimations were based on actual household certification status. IV estimations using the panel data were also undertaken to take into account the endogeneity of certification. Next, given that variation in household certification status was captured only in the 2007 survey data, probit estimations were undertaken using the cross-sectional data and the actual and predicted certification status variables. This allowed for comparison with the results of the estimations using the panel data.

The empirical results reveal that the issuance of usufruct rights (land-use certificates) in the Amhara region enhanced perceived tenure security in both male- and female-headed households. The impact was greater in female-headed households. This result holds across all specifications, using the total and disaggregated samples with both the Chamberlain random-effects and linear probability model estimations. The findings also hold with the use of the IV

estimation. On the other hand, the robustness checks show that the results are sensitive to the use of cross-section data and predicted certification. In all the estimation strategies, the results show that female-headed households tend to have greater perceptions of tenure security than male-headed households. The impact of key socioeconomic factors seems to be smaller than that of certification, in some estimations insignificant, on perceived tenure security. This applies in all estimation strategies. The findings suggest that what consistently matters most in this, for both male and female landholders, is certification: legally documented rights to land holdings. This is simply due to the nature of Ethiopia's land-tenure system.

The sample of female-headed households is rather small and places analytical limitations on the gender analysis. Despite that, this paper makes a first cut at understanding the gender dimension of strengthening land-holding rights through land-use certification.

The findings of this chapters suggest that although advancing women's socioeconomic standing is important, legally strengthening land-holding rights is even more important for female landholders of rural Amhara, who are economically and socially more marginalized than their male counterparts. Therefore, it is critical that these usufruct rights are enforced. In addition, because Ethiopia's land-tenure system permits *only* usufruct rights, households normally expect that land can be taken away from them for public purposes, as the land-use certificate states. Therefore, the certification program is limited in its ability to eliminate perceived tenure insecurity in both male- and female-headed households.

This paper contributes to the literature by applying a gender lens to tenure security in the context of usufruct rights. Its findings are similar to those of Holden et al. (2009), Burnod et al. (2012), Deininger et al. (2008a), and Do et al. (2008): namely, usufruct rights enhance perceived tenure security. But this chapter adds to these findings the relevance of certification and socio-economic factors, in the cases of both male and female heads, and takes into account the endogeneity of certification.

From here, future research should dive deeply into the constraints and opportunities female landholders face at both the individual and household levels. Only then can we assess the ability of legal rights to enhance tenure security of female versus male landholders. Meanwhile, policy makers ought to consider mechanisms for strengthening the tenure security of landholders in contexts where usufruct rights are granted, for female landholders. Certification is a necessary first step to reducing tenure insecurity, especially its gender differentials. But policy makers must ask whether this is sufficient to improve rural livelihoods and development at large, especially in the case of gender. This is essentially the central question of the analyses of Chapter 6.

Chapter 6

Gender, Rural Land Certification, and Investment

6.1 Introduction

Land-holding rights form the foundation for secure land holdings, which can lead to enhanced land-related economic outcomes (North et al., 1973; Knack et al., 1995; Acemoglu et al., 2001; Besley et al., 2010). The current literature points to three channels by which secure property rights can affect land ownership, use, investment, and transfer: First, well-defined rights to land and the ability to draw on public enforcement lower the risk of eviction, reduce the need for landowners to expend resources defending claims, and increase incentives for land-related investments (Goldstein & Udry, 2008; Besley, 1995). Second, registration of land ownership reduces the cost of renting and selling transactions and encourages increased exchange, enhancing the "possibilities for gains from trade" (Besley, 1995). Third, formalization of land rights facilitates the use of land as collateral and improves access to credit (Besley, 1995; de Soto, 2000; Goldstein & Udry, 2008; Deininger et al., 2011).

One critical outcome of strengthened land-holding rights is land-related investments that enhance agricultural productivity and livelihood. Place and Hazell (1993), Besley (1995), and Gavian and Fafchamps (1996) pointed to the fact that land-investment decisions are affected by tenure security. Various authors have argued that there is a correlation between formalized land rights and the efficiency with which agricultural resources are allocated,

especially land-related investments. Goldstein and Udry (2008) indicated that expectations of rights over the returns on these investment—and thus the nature of property rights themselves—influence investment incentives. Several works on property rights have presented this argument: Desoto (2000), North (1981), Jones (1986), Mokyr (2002), and Engerman and Sokoloff (2003).

Although these authors have argued for the importance of land titling to outcomes such as land investments, the empirical evidence is not clear and definite. Holden et al. (2011) noted that although many researchers have studied the impact of land rights on investment, most of their studies did not take into account the endogeneity of land rights.

Empirically estimating the effects of land titling is difficult due to the endogenous nature of titling: the allocation of titles to households is not random (Kassa, 2014). But from a conceptual perspective, Kassa (2014) makes the following argument that improvements in land rights through titling may not lead to increased investment: First, in the context of land markets in developing countries, which may not be efficient and free, the anticipated gains in efficiency from trade may not be observed, thus reducing incentives to investment. Second, property titling could lead to "rent seeking" by local elites who might have better access to information about land registration procedures (this could actually increase investment, due to the investment capacity of the local elites). Third, land registration could fuel conflict, uncertainty over land rights, and increased transaction costs for landholders who depend on informal mechanisms to safeguard their rights.

The issuance of land-use certificates in the Amhara region was expected to provide incentives for landholders to undertake activities that improve their livelihood, such as increased land-related investments. But female landholders in the region face greater resource and cultural constraints than their male counterparts, which could contribute to gender differentials in investment outcomes.

Deininger et al. (2008a), Holden et al. (2009), and Deininger et al. (2011) have empirically investigated the impact of usufruct rights on land investment. But none of them investigated gender-differentiated impacts and the endogeneity of land rights. This paper investigates the impact of land-use certificates on investment by gender. It attempts to identify the pathways by which certification impacts can differ on land belonging to male- and female-headed households. The analysis also takes into account the endogeneity of certification, as determined in Chapter 4.

The research question addressed in this chapter is important for several reasons: First, it informs policy on whether investing in rural land reforms can spur land-related investments

and increase rural incomes, or whether complementary investments need to occur simultaneously, especially for female landholders. Second, rural land reforms, especially in developing countries are costly, and assessments of their impacts can informs similar programs elsewhere on whether this investment is justified. Third, this research will assess whether there is a difference in land-investment when endogeneity is taken into account.

Cross-sectional data are used to undertake the analyses at the parcel level. The probit estimations of the likelihood of investment use actual and predicted parcel-certification status and control for unobserved kebele heterogeneities and parcel and household characteristics. IV estimation will be also undertaken to account for the endogeneity of certification.

The findings reveal that certification has a significant and positive marginal impact on the likelihood of both new SWC investments and SWC maintenance being undertaken, in both male- and female-headed households, and that parcels belonging to female-headed households are less likely to have both types on investment on them. While the findings show that certification is important for both new and maintenance investments, they also show that in for female-headed households, other factors significantly determine the likelihood of investment. These factors include land rental, availability of male labor, and wealth. The findings are also sensitive to the use of predicted certification, but only in the case of new SWC investments, for which predicted certification has an insignificant impact. The effect of predicted certification on SWC maintenance is significant across all specifications.

The remainder of the chapter is structured as follows: Section 6.2 provides the background context. Section 6.3 reviews the literature. Section 6.4 discusses the data and descriptions. Section 6.5 presents the estimation strategy and results. Section 6.6 concludes, discusses policy implications, and outlines areas for future research.

6.2 Background

Land degradation is a serious challenge facing male and female farmers in the Amhara region. It takes three main forms: soil erosion, nutrient depletion, and deforestation. Nearly 29 percent, 31 percent, 10 percent, and 30 percent of land in Amhara experiences high, moderate, very high, and low soil erosion rates, respecively (Desta et al.). High rainfall and a topography of steeply sloping plateaus are the main natural factors behind soil erosion in the region. As indicated by Desta et al., nutrient depletion occurs through inadequate recycling of dung and crop residues in the soil, low usage of chemical fertilizers, declining fallow periods, soil

erosion, and burning of soil and organic matter. Furthermore, deforestation is a common practice and there is a lack of replacement of harvested trees, leading to the washing away of fertile topsoil into lakes and rivers.

These factors all cause land degradation directly, but several socio-economic factors underlying them. These include population pressure, poverty, limited and costly access to agricultural inputs and credit, fragmentation of land holdings, and lack of awareness among farmers of suitable technologies for land management (Desta et al.). Berhanu and Fayera (2005) pointed out that land degradation in the region is also thought to be accelerated by "inadequate" land-property rights, and that in an environment where property rights are not secure, land degradation will be aggravated.

The consequences of land degradation are evident and significant. It reduces the productivity of arable land. In an agricultural context of small landholders in which subsistence farming dominates, food insecurity becomes a crucial threat. Rural livelihoods become vulnerable, and there are adverse impacts on poverty.

The construction of soil and water conservation (SWC) structures is one of the primary measures used by farmers to tackle soil degradation. These structures take various forms, such as stone bunds, soil bunds and watersheds. They are effective for retaining important soil characteristics from erosion and for increasing and sustaining agricultural production. Investment in SWCs, through either new construction or maintenance, is a labor-intensive activity. In addition, small farm holders who mostly engage in subsistence farming may not have the incentive to undertake such investments in the absence of economies of scale, when the returns are often realized only in the long term. Therefore, SWCs may not be financially viable, let alone profitable, as poverty in rural communities of the Amhara region is high.

Managing land degradation is difficult for all landholders, but it is particularly difficult for female landholders. Structural and social factors limit women's ability to invest in improving the quality of their land. For example, according to Frank (1999), most male farmers and Peasants Association (PA) leaders view women as incapable of undertaking autonomous farming initiatives, as women are not regarded as farmers (regarding them as farmers is considered a "threat to the social fabric of rural communities"; Frank, 1999). This attitude limits women's access to extension services on the effective use of agricultural inputs and technologies, as these initiatives are almost exclusively directed toward male farmers. This constrains the management of land, and the productive capacity of female-headed households with rights to land.

The labor requirement for constructing and maintaining SWC means that female-

headed households with insufficient male labor may be unable to undertake this kind of land related-investment. Furthermore, the fact that female landholders in the Amhara region are constrained in their access to farming resources and are poorer than their male counterparts could make them less likely to undertake land-related investments.

These constraints induce female landholders to engage in land-rental activities with others who have access to the resources needed for land-related investments. This increases the likelihood that the necessary investments are undertaken on their lands. On this end, in addition to assessing the impact of certification on land-related investments, it is equally important to assess the impact of renting-out of land, especially by female landholders, on the likelihood that investments are undertaken on the rented-out lands.

6.3 Literature Review

Several empirical studies have examined the impact of land-use certificates on land-related investments in Ethiopia using nationwide data (Ethiopia) and regional data (Tigray and Amhara regions). These have not taken into account the gender-differentiated implications of certification on land-related investments. In addition, these studies have treated the certification process as exogenous to their contexts of study. This section summarizes the literature.

Holden et al. (2009) empirically assessed the investment impact of the Tigray region's land-certification program using plot-level panel data (1998, 2001, and 2006). Three dependent variables were used as proxy for the type of investments undertaken by the households: (1) stone terracing and soil bunds, (2) maintenance or improvement of soil conservation structures, and (3) tree stock and tree planting. The hypothesis was that farm-plot certificates improved land-related investments on the plot through the building of new conservation structures, improvement and maintenance of existing structures, and the planting of trees. In addition, the authors tested the hypothesis that land-use certificates did not increase tree planting (especially eucalyptus trees) because of restrictions on tree planting in the land proclamations.

Holden et al. (2009) used different empirical methods to test these hypotheses, depending on the dependent variable in question. A household random-effects probit and fixed-effects logit panel data models were used with "stone terraces and soil bunds" as a proxy for investment. A household random-effects proportional-odds ordered logit panel data model was used with "maintenance/improvement of soil conservation structures" as the dependent

variable. And a random-effects tobit panel data model was used with "tree stock and tree planting." The regressions used several independent variables to capture the impact on land investments not only of certification but of household-head characteristics, plot characteristics, ownership of livestock, and whether there was any public investment in the plot.

Holden et al. (2009) found the following results: For the "soil bunds" models, the certificate variable was never significant. For the "stone terrace" variable, certification had a positive but weak impact. This was explained by the presence of a strong role for public investment and local collective action in soil conservation. The "public investment" variable in the regression was highly significant and positive in all the model specifications, leading to the conclusion that the majority of this investment was driven by public efforts. With "maintenance or improvement of conservation structures," the effects of certification were positive and significant at the 10% level. The authors also found that maintenance was better on homesteads and large plots, and poorer on shallow and distant plots. On "investment in trees," certification had a positive and significant (5% level) impact. On the basis of this finding, the authors rejected the hypothesis that restrictions on planting trees did not lead certificates to contribute to tree planting. In fact, they found that certification enhanced tree planting, including the planting of eucalyptus trees. Tree planting was also significantly lower in distant plots. The authors suggested that this might have be a result of lower tenure security on distant plots.

Deininger et al. (2008a) assessed the impact of certification on land-related investment using a second-round country-wide panel survey of about 2,300 households in 115 villages. The data included whether households had undertaken new land-related investment, mainly on terracing and bunding, in the last 12 months, and the amount of labor spent on such works. The authors assumed that land certification was exogenous and that the expectation of having their land certified in the not-too-distant future would not affect households' investment behavior. Probit and tobit regressions were used to estimate the investment impact of certification for households owning plots and residing in certain kebeles (villages), using vectors of household and plot characteristics. The results showed a positive and highly significant investment effect of certification in probit and tobit methodologies.

Using data from the last two rounds of a rural panel survey conducted in the Amhara region, Deininger et al. (2011) assessed the early effects of certificate issuance on land-related investment. They used two dependent variables: the regressand was equal to 1 if the plot owned by the household received soil- or water-conservation investment (repairs or new investment) in the past 12 months, or the same number of hours spent in such investment in the past 12

months. The empirical model assessed the impact on land investment using various independent variables, including the treatment variable (certification status), a vector of controls representing household-head characteristics, and a vector of controls for taking plot characteristics into account. The authors noted that although information on land investment was captured at the plot level, the fact that a single certificate is issued for all of a household's plots means that impact can be assessed on average at the household level, by controlling the right-hand-side variables.

Deininger et al. (2011) used the Chamberlain random-effects probit to measure impacts on repairs and new investment in the preceding 12 months, and a tobit model to assess the impact on hours spent on repairs and new investment in the last 12 months. They tested the hypothesis certification creates higher investment incentives. The last two rounds of the survey were used because comparable information on investment was available for those two years and because plots cannot be matched over time. Their approach excluded any initial stock of investments. The econometric results showed a significant positive impact of certification on land-related investment, regardless of whether the outcome variable was in soil or water conservation, or in the number of hours spent on such investment.

This paper contributes to the literatures in several ways: First, it undertakes a detailed assessment of the gender differentials in investments and tries to uncover the mechanisms for any differentials. Second, it takes into account the endogeneity of the certification process, as demonstrated in the empirical findings in Chapter 4.

6.4 Data and Description

6.4.1 Data Source

Unlike Deininger et al. (2011), I use parcel-level information to study the determinants of investment, because certification was captured at the parcel level. In addition, parcels cannot be matched across the survey years which limits the analysis in this chapter to the use of cross-section data.

The cross-sectional dataset used for the analysis consists of 7,988 parcels belonging to 1,759 households from the 2007 survey. Nearly 83 percent of the observations (parcels) are from male-headed households. Seventy-nine percent of the parcels are certified. As indicated in Chapter 3, of this 79 percent, 83 percent belong to male-headed households. The 2007 survey

indicates that 15 percent of the parcels were certified in 1997 E.C.,[24] 49 percent in 1998 E.C., and 15 percent in 1999 E.C. Almost 21 percent do not have years of certification recorded.

6.4.2 Descriptive Statistics

This section provides an overview of the type and incidence of land-related investments undertaken by households on their parcels, disaggregated by sex of the household head and parcel-certification status. It also includes a discussion of the socio-economic characteristics of the surveyed households, differentiated by the type of investments made and by the sex of the household head. This lets the statistics identify plausible pathways for land-use certificates to influence land-related investments in both male and female-headed households.

The 2007 dataset captures several parcel-level variables representing land-related investments. Two of these are binary, simply capturing whether households undertook land-related investments: (1) Did you make new/additional Soil and Conservations (SWC) structures during the past 12 months? (2) Did you undertake SWC maintenance during the past 12 months? The remaining variables are continuous, in that they capture the amount of investment: (1) the average number of hours worked per day for new/additional SWC during the past 12 months, (2) the number of trees and bushes on the parcel, and (3) the number of eucalyptus trees on each parcel.

For the average hours worked per day on SWC, the following data are recorded: out of the 7,988 parcel observations, there are 783 with information on this variable, of which 700 and 83 are from parcels belonging to male- and female-headed households, respectively. For the number of trees and bushes on the parcel, there are 2,663 observations, of which 2,244 and 419 are from parcels belonging to male- and female-headed households, respectively. For the number of eucalyptus trees, there are 2,643 observations, of which 2,224 and 419 are from parcels belonging to male- and female-headed households, respectively.

For the binary variables on new and additional SWC structures undertaken in the past 12 months, there are 4,083 observations, of which 3,330 and 753 belong to male- and female-headed households, respectively. For the variable capturing SWC maintenance in the past 12 months, there are 7,948 observations, of which 6,606 and 1,342 are from parcels belonging to male- and female-headed households, respectively.

Given the number of observations available for each variable, for this analysis only the

[24] Years are recorded in Ethiopian Calendar (E.C.)

binary variables will be used. The rest of the variables have insufficient observations for a gender analyses, which requires disaggregating the variables by sex of the household head.

6.4.2.1 New and Additional SWC and Maintenance, by Parcel-Certification Status and Gender

Despite the Amhara region's vulnerability to soil erosion and degradation, the 2007 survey data show that the incidence of new and additional SWC investments is low (19%). The incidence of SWC maintenance is also low (31%). Because some parcels do have SWC on them, there may be a greater need to maintain existing structures to retain parcel quality, and this maintenance might be less costly than new or additional SWC investments.

Table 6.1 shows the distribution of each type of investment by sex of the household head to which the parcel belongs. Although most of the parcels in male- and female-headed households have neither type of investment, a greater percentage of the parcels belonging to male heads have new or additional SWC investments as well as SWC maintenance. This could be because female landholders in this region are socioeconomically constrained and prefer to use their limited resources to maintain existing investments rather than undertake new ones.

Furthermore, the majority of the investments of each type in the data sample belong to male heads. Among parcels with new SWC investments on them, 89% belong to male heads; for total SWC maintenance undertaken, nearly 85% belong to male heads.

Table 6.1**: Land investments, by gender (%)**

	Parcels from Male Household Heads	**Parcels from Female Household Heads**
New/Additionl SWC Structures		
No	79.10	88.58
Yes	20.90	11.42
SWC Maintenance		
No	68.51	72.21
Yes	31.49	27.79

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" 2007 survey

6.4.2.2 Variable Descriptions and Summary Statistics

Tables E.1, E.2, and E.3 the Appendix provide the variable descriptions and summary statistics

for the parcel-level data used in this analysis. These variables are similar to those used by Deininger et al. (2011), as this paper examines the relationship of land investment to certification in the same region.

The tables show that nearly 79% of the parcels are certified. Approximately 17% of the parcels are owned by female-headed households. Parcels in male-headed households more often have investments in SWC maintenance than parcels in female-headed households. Likewise, more parcels belonging to male-headed households have new SWC investments.

As for parcel characteristics, there is no distinct variation in characteristics between male- and female-headed households: they have a nearly equal distribution of best parcel traits across the various characteristics. Most of the parcels are "flat" (56% and 57% in female- and male-headed households, respectively); 73% are "fertile" (66% and 73% in female- and male-headed households). Parcels in female-headed households are on average larger than those in male-headed households. Because this is average parcel size, however, parcel area in female-headed households is distributed on a smaller sample than in male-headed households.

As for differences in household characteristics, parcels belonging to male-headed households have heads who are more literate and wealthier than female-headed households. On the other hand, the average number of prime-age males in the household (a proxy for the availability of male labor) is nearly the same in the two groups.

Given the socioeconomic status of female farmers in the Amhara region, I hypothesize that parcels belonging to female-headed households are less likely to have new SWC investments and SWC maintenance. Parcels with the "best" characteristics and larger size are expected to increase the likelihood of new SWC investments and maintenance. Large parcels could decrease the cost of parcel investment through economies of scale. As for the impact of household characteristics on new SWC investments and maintenance, I expect wealth and number of prime-age males to increase the likelihood. Increased wealth implies the ability to afford the cost of investment and maintenance, and prime-age males mean availability of the male labor required as input to new SWC investments and maintenance. Years of schooling could increase the likelihood of investment and maintenance, as this could be a proxy for the household having the required knowledge to undertake such activities. In addition, I expect that parcels belonging to older households are less likely to have new SWC investments and maintenance, as both of these are labor intensive, and younger households might be physically better able to undertake them.

It is important to note the difference in the shares of land rented out by male- and female-headed households (a proxy for the level of rental activity in the household). Nearly

45% of the parcel area belonging to female-headed households is rented out, but only 13% is rented out by male-headed households. This points to the significance of land-rental activities by female heads as a way of overcoming socioeconomic constraints to ensure the sustainability of their livelihoods. These constraints include access to key farming resources like male labor and oxen. In addition, female farmers face cultural constraints on performing farming activities that are traditionally considered more suitable for males. Renting-out their land helps them overcome these barriers, so there is a high correlation between investing and renting, especially among women.

Furthermore, it is likely that female heads with no prime-age males in their households will opt to rent out more of their land to meet the labor and farming requirements and overcome the gender-based division of labor defined by Amhara cultural norms (Table 6.2). Although both male and female heads rent out more of their land when they lack male labor in the household, rental activity is significantly greater in female-headed households. The relevance of rental activity to female heads suggests that they are substantially constrained in the labor needed to farm and undertake investments.

Table 6.2: **Availability of male labor and land-rental in the household**

	Male Headed Households			Female Headed Households			Male and Female Headed Households		
	No Prime-age Males in Household	Prime-age Males in Household	Total	No Prime-age Males in the HH	Prime-age Males in the Household	Total	No Prime-age Males in Household	Prime-age Males in Household	Total
Share of rented-out parcels	0.1664836	0.1547637	0.1291482	0.6615304	0.4528225	0.445518	0.2507784	0.2066347	0.1827346

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" 2007 survey.

6.4.2.3 Variable Characteristics, by Outcome Variable and Gender

Table 6.3 reports on the variable characteristics that will be used in the empirical analysis by outcome variables—that is, by whether parcels have new or additional SWC structures or maintenance. First, the majority of parcels with and without investments are certified. In the case of new and additional investments, there is no distinct variation in certification status between invested and non-invested parcels. However, a greater proportion of parcels with maintenance investment than without are certified. When we apply the gender lens to the samples of invested and non-invested parcels, we find no difference between the proportions

of parcels held by male and female heads that are certified.

Parcels with new or additional SWC investments are smaller than parcels without. The same is true for SWC maintenance. Parcels belonging to female heads are larger regardless of investment status or type. Furthermore, for each parcel-investment type, the majority of parcels in both male- and female-headed households with investments are fertile and flat. However, more of these parcel characteristics are found on parcels belonging to female heads, regardless of investment status.

In each of the two types of investment, a greater share of parcels held by females are rented out. This shows the importance of renting out land as a way for female heads to overcome socioeconomic constraints. There is no significant difference in the age of household heads with and without investments, and there is no marked variation in age by sex of the household head. However, there is a difference in years of schooling: investments are more likely to be undertaken by heads with more education, regardless of sex. Wealthier heads are also more likely to undertake SWC investments. The number of prime-age males is higher on average in female-headed households with either type of investment. SWC maintenance is undertaken more by younger heads of household.

Table 6.3**: Household characteristics, by outcome variable and gender**

	New/Additional SWC Stuctures			No New/Additional SWC Structures			SWC Maintenance			No SWC Maintenance		
	Male Headed Households	Female Headed Households	Total	Male Headed Households	Female Headed Households	Total	Male Headed Households	Female Headed Households	Total	Male Headed Households	Female Headed Households	Total
Certification status (%)												
No	15.77	11.63	15.3	14.07	16.56	14.57	13.01	11.91	12.84	24.35	24.97	24.46
Yes	84.23	88.37	84.7	85.93	83.44	85.43	86.99	88.09	87.16	75.65	75.03	75.54
Parcel size (hectares)	0.0209	0.0629	0.0255	0.0236	0.1262	0.0442	0.0173	0.0940	0.0288	0.0343	0.1124	0.0481
Parcel quality (%)												
Fertile	52.52	66.28	54.03	55.62	61.62	56.83	56.73	63	57.68	50.87	61.51	52.75
Medium-fertile	28.92	19.77	27.91	32.99	32.23	32.84	30.67	30.29	30.62	32.66	28.07	31.85
Infertile	18.56	13.95	18.05	11.39	6.15	10.33	12.6	6.7	11.7	16.47	10.42	15.4
Parcel slope (%)												
Flat	62.93	76.74	64.45	64.87	70.46	66.00	64.55	70.78	65.5	74.98	77.5	75.43
Medium	28.74	17.44	27.49	29.78	23.39	28.48	29.2	23.86	28.38	20.15	17.54	19.69
Steep	8.33	5.81	3.06	5.36	6.15	5.52	6.25	5.36	6.12	4.86	4.95	4.88
Share of rented-out parcels	0.0742	0.1816	0.0860	0.1060	0.4260	0.1706	0.0629	0.2753	0.0952	0.1598	0.5126	0.2220
Age (mean)	49.7856	50.4217	49.8535	51.0407	52.8521	51.4053	50.6600	50.9378	50.7020	51.5761	54.1287	52.0268
Years of schooling (mean)	1.3358	0.5060	1.2451	1.2788	0.4070	1.1014	1.2811	0.4000	1.1451	1.0234	0.4105	0.914
Number of bulls/oxen (mean)	2.0273	1.1047	1.5562	1.7286	0.8756	1.9258	1.8202	1.1019	1.711	2.179	0.8689	1.948
Number of prime age male (mean)	1.1552	1.5233	1.1957	1.2221	1.2399	1.2257	1.2274	1.3887	`1.2519	1.3166	1.192	1.2946
Observations (%)	89.00	11.00	19.15	79.79	20.21	80.85	84.79	15.21	30.86	82.37	17.63	69.14

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" 2007 survey.

6.4.2.4 Variable Characteristics, by Treatment Variable and Gender

Table 6.4 shows variable characteristics by treatment variable. Certificates appear to have more impact on SWC maintenance on new or additional SWC structures. This applies to parcels belonging to both male- and female-headed households.

Regardless of certification status, most of the parcels are flat, although this is more often the case with certified than non-certified parcels. Female-headed households rent out more of their parcels than their male counterparts, regardless of certification status. In addition, certified parcels belong more often belong to heads with more schooling when they belong to male-headed households, but this is not the case for female heads. Certified parcels also belong to wealthier households (in particular to male heads) and to households with more prime-age males. This holds regardless of the sex of the household head.

Table 6.4**: Household characteristics, by parcel-certification status and gender**

	With Certificates			No Certificates		
Household Characteristics	**Male Headed Households**	**Female Headed Households**	**Total**	**Male Headed Households**	**Female Headed Households**	**Total**
New/Additional SWC Stuctures (%)						
No	79.44	87.64	80.91	77.17	91.45	80
Yes	20.56	12.36	19.09	22.83	8.55	20
SWC Maintenance (%)						
No	65.71	69.31	66.31	80.49	84.75	81.22
Yes	34.29	30.69	33.69	19.51	15.25	18.78
Parcel size (hectares)	0.025	0.1063	0.0386	0.0461	0.1173	0.058
Parcel quality (%)						
Fertile	56.34	62.87	57.44	38.68	54.96	41.47
Medium-fertile	30.82	29.00	30.51	36.56	30.14	35.46
Infertile	12.84	8.13	12.05	24.76	14.89	23.07
Parcel slope (%)						
Flat	72.68	75.69	73.19	67.77	73.76	68.79
Medium	22.20	19.04	21.67	26.30	21.63	25.50
Steep	5.12	5.26	5.14	5.93	4.61	5.71
Share of rented-out parcels	0.1147	0.4132	0.1647	0.1818	0.5887	0.2517
Age (mean)	51.5155	54.1000	51.9517	50.7061	50.0605	50.5951
Years of schooling (mean)	1.1352	0.3602	1.0028	0.7856	0.5893	0.7513
Number of bulls/oxen (mean)	2.1417	1.0144	1.9527	1.7750	0.6831	1.7458
Number of prime age male (mean)	1.3471	1.3081	1.3406	1.0862	0.8873	1.0520
Observations (%)	83.23	16.77	79.03	82.82	17.18	20.97

Source: Own estimation from "Studies for Sustainable Land Use in the Ethiopian Highlands" 2007 survey.

Given the greater constraints female landholders face, I hypothesize that (1) certification has a significant impact on land investments in parcels belonging to both male- and female-headed households, and (2) socioeconomic constraints such as the availability of labor have a greater impact on land investments in parcels belonging to female-headed households.

6.5 Estimation Strategy and Results

6.5.1 Estimation Strategy

The estimation strategy in this paper takes into account the endogeneity of the certification process: in addition to using the actual parcel certification status variable to test the impact of certification on SWC investments, it uses predicted parcel certification status for robustness

checks, as determined in Chapter 4.

The empirical strategy of this paper departs from that of Deininger et al. (2011), who also estimated the impact of certification on land investments, in the following ways: (1) This paper explores the mechanisms by which the propensity to invest in parcels may differ between male- and female-headed households. (2) The estimations are made at the parcel level, because certification is at the parcel level. (3) The analysis is undertaken using cross-sectional data from 2007, because there is no variation in the certification variable in the survey years before 2007. (4) This paper distinguishes between new SWCs and SWC maintenance. (5) This paper takes into account the endogeneity of certification. One data limitation of this paper is that parcels cannot be matched across time.

6.5.1.1 Probit Estimation with Actual Parcel-Certification Status Variable

Besley (1995) provided the basic estimation framework for determining investment on land:

$$Y_{ijk} = f\,(R_{ij}\,,\, P_{ij}\,,\, X_{ij}\,,\, \varepsilon_{ij}\,), \qquad (1)$$

in which Y_{ijk} is the investment level[25] K by household i on plot j. R_{ij} is the plot's property-rights status, P_{ij} is a vector of plot characteristics, X_{ij} is a vector of household characteristics, and ε_{ij} is the stochastic element. Given the binary choice-dependent variable of this paper, K represents a household's decision to undertake a land-related investment on its parcel.

In this paper, the impact of land certification on land-related investments is estimated using Equation 2, following the basic framework in Equation 1. In Equation 2, investment in a parcel in a household, Y_{ji}, is modeled as depending on actual parcel certification status and a number of observable parcel and household characteristics. The model applies a kebele dummy variable to control for unobserved heterogeneities among kebeles. Two dependent variables represent households undertaking land-related investments on each parcel: (1) whether the household made new or additional SWC structures on each parcel, and (2) whether the household conducted SWC maintenance on each parcel in the past 12 months. Each dependent variable is equal to 1 if the household did undertake this kind of investment, and 0 otherwise. The following is the empirical strategy to be estimated using probit estimations:

$$Y_{ji} = \beta_0 + \beta_1 C_{ji} + \beta_2 X_{ji} + \beta_3 P_{ji} + D_k + u_{ji} \qquad (2)$$

Here, Y_{jit} is a dummy variable that takes a value of 1 if a land-related investment was undertaken

[25] For purposes of this paper, this will be whether parcels have land-related investments undertaken on them by the household.

on parcel *j* by household *i*, and 0 otherwise. C_{ji} is the parcel-certification status in household *I* (1 if certified, 0 otherwise); x_i is a vector of controls representing characteristics of household *i* to which parcel *j* belongs, which include the household head's gender, age, years of schooling, and wealth (number of cattle owned by the household), and the number of prime-age males; P_{ji} is a vector of controls at the parcel level (characteristics of parcel *j* belonging to household *i*, including parcel size, quality, and slope).[26] Finally, D_k captures kebele-specific unobserved effects (a dummy variable representing the kebele parcel that *j* is located in), and u_{ji} is a parcel-specific error term. The estimation uses the actual household certification variable. Given that the decisions to invest in and to rent out land are closely related, especially for female landholders, the regressions are estimated without using "share of rented-out parcels" as an independent variable.

Equation (7) is estimated using three data samples: (1) the aggregate sample of parcels belonging to male- and female-headed households, (2) the sample of parcels belonging to male-headed households, and (3) the sample of parcels belonging to female-headed households. To test the robustness of the probit estimation results, the models for all samples are estimated using the linear probability model. The results are reported in the Appendix.

6.5.1.2 Probit Estimation with Predicted Parcel-Certification Status Variable

The probit estimation in Equation 2 could be limited by the potential endogeneity of certification, as found in Chapter 4. While certification is expected to enhance investment in parcels, it is possible that farmers might undertake investments simply to safeguard their land holdings (Besley, 1995). Therefore, to recognize the endogeneity of certification, this section undertakes a robustness check of the results of Equation 2 using "predicted" parcel certification status instead of "actual" parcel certification status. The predictions are derived from specifications g in Tables 4.8 and 4.9 which yield the following equation for determining parcel certification status:

$$CS_{ih} = \alpha_{30} + \alpha_{31}P_{ih} + \alpha_{32}H_{ih} + \alpha_{33}D_k + e_{3ih} \quad (3)$$

CS_{ih} is equal to 1 if parcel *i* in household *h* has a certificate (actual certification status variable), and 0 otherwise; P_{ih} is a vector of parcel characteristics; H_{ih} is a vector of household characteristics; D_k is a vector of kebele dummies; and e_{3ih} is the error term. The observable

[26] The variable "number of years since parcel certification" is not included to take into account the time effect of investment. This is due to the high correlation with the variable capturing parcel-certification status.

household characteristics include the household head's sex, age, and average years of schooling, the number of prime-age males, the mean number of bulls or oxen owned, and the distance to the nearest road. Proxies for parcel characteristics include parcel type, depth, slope, quality, and size, and whether the parcels has SWC maintenance.

Equation 3 was estimated using three different data samples: (1) the aggregate data of parcels belonging to male- and female-headed households, (2) the data of parcels belonging to male-headed households; and (3) the data of parcels belonging to female-headed households. The predicted parcel certification status determined in Chapter 4 through Equation 3 is then applied to Equation 2 to estimate the likelihood of investing in a parcel using probit estimation in the following way:

$$Y_{ji} = \beta_0 + \beta_1 \hat{C}_{ji} + \beta_2 X_{ji} + \beta_3 P_{ji} + h_w + u_{ji}, \quad (4)$$

in which the dependent and independent variables are similar to those in Equation 2, with the exception of the parcel certification status variable: $\hat{C}_{ji}$ is the predicted parcel-certification status, whereas in Equation 2, C_{ji} is the actual parcel-certification status.

Equation 4 is estimated using the same three data samples. The predicted certification status variable will differ depending on the sample used to estimate the predictions, whether derived from the aggregate sample or from either of the male- or female-headed household sample.

6.5.1.3 Probit Estimation Instrument Variable (IV)

As with the estimation strategy of Chapter 5, this paper follows the approach of Holden et al. (2009) to take into account the endogeneity of certification. The instrument variables to be applied are "years since certification" and "kebele-fixed effects." Given that household certification status in Equation 2 is potentially endogenous, the following equation is estimated with an IV probit estimation:

$$y_1 = 1[z_1 \delta_1 + \alpha_1 y_2 + u_1 > 0] \quad (5)$$

$$y_2 = 1[z \delta_2 + v_2 > 0], \quad (6)$$

where y_1 captures the likelihood of SWC investment (new or maintenance), z_1 captures household and parcel characteristics, y_2 captures certification status, and z captures "years since certification" and "kebele fixed effects."

6.5.2 Estimation Results

6.5.2.1 Probit Estimation with Actual Parcel-Certification Status Variable

The results of the probit estimation to determine the impact of parcel certification status on the likelihood that a new SWC investment is undertaken are presented in Table 6.5. Parcel-certification status has a significant positive impact on the likelihood of new SWC investment being undertaken on the parcel in the aggregated data and the male-headed household sample. On the other hand, as shown in column 3, the impact is not significant for parcels belonging to female-headed households.

The significant impact for the aggregated and male-headed samples can be explained by the fact that certification is expected to enhance households' perceived tenure security, and as such to translate into an increased likelihood of investment. Because such investment is costly for the small farmers of the Amhara region, it is not likely to occur unless farmers perceive a decreased likelihood of their land holdings being expropriated. Certification is expected to reduce this risk to justify a costly investment. Moreover, certification is significant at the 5% level in the aggregate sample.

On the other hand, the insignificant impact in the female-headed households sample could be attributed to the small sample size. Another plausible explanation is that female heads of household more often feel that the land they farm belongs to them and thus always have lower expectations that their land holdings will be reduced. This higher initial perception of the security of their holdings could make certificates less valuable to female than male landholders.

The impact of parcel characteristics is mixed, depending on the data sample applied to the estimation. Overall, the results show that new SWC investments are more likely to be undertaken on parcels with the "best" characteristics. New SWC investments are less likely if the parcels are of less than "fertile" quality—"medium" quality, for example. This is consistent across all the data samples. However, the impact of slope is significant only in the female-headed sample: in that group, a medium or steep-sloped (rather than flat) parcel reduces the likelihood of new SWC investment.

In regards to household-head characteristics on, parcels belonging to female heads are less likely to see new SWC investments than parcels belonging to male heads. Female landholders in the Amhara region are resource-constrained in terms of the farming assets and

labor needed to undertake land investments.

In addition, older household heads are less likely to make new SWC investments on them, though this result is significant only in the aggregate sample and specification 3 of the male sample. Years of schooling, which is a proxy for level of knowledge about SWC investments, is an insignificant factor in the likelihood of SWC investments. Parcels belonging to female-headed households with more prime-age males are more likely to get new SWC investments. This result is significant at the 5% level. It indicates that because new SWC investments are labor-intensive activities, the availability of male labor is critical because females are constrained in their access to farming resources such as labor; the impact is insignificant in the aggregate and male-headed samples. The impacts of wealth and schooling are also insignificant in all the data samples.

Table 6.6 reports the likelihood of SWC maintenance being undertaken on parcels. The table shows that certification increases the likelihood that SWC maintenance is undertaken, but the result is significant only in the aggregate and male-headed household samples. It seems certification generates relatively more incentives for farmers to undertake SWC maintenance initiatives rather than new land related investments. This could suggest that the type of investment on parcels may matter as investments are accompanied with costs that need to be justified with sufficient returns i.e. it could be relatively easier and cheaper to maintain existing SWC structures rather than build new/additional ones. Similar to the earlier results on the impact of certification using the female-headed households sample, since female land holders in the Amhara region feel relatively more tenure secure over their land holdings, this could contribute to the insignificant impact of certification on the likelihood that a parcel will have SWC maintenance.

Parcel characteristics are insignificant determinants of SWC maintenance, except for slope: the likelihood of SWC maintenance being undertaken is higher if the parcel is “medium” or “steep” than if it is “flat.” This result is intuitive, as SWC initiatives are intended to prevent soil erosion, which is often needed on steep land.

In regards to the impact of household-head characteristics, parcels belonging to female-headed households are less likely to receive SWC maintenance. The reason is similar to the case of new SWC investments: female heads are more resource constrained and culturally constrained from undertaking such investments. Parcels belonging to older household heads are also less likely to have SWC maintenance, but the impact is insignificant for male-headed households. Wealth seems to have a significant impact on the likelihood of SWC maintenance, but only among female-headed households, which tend to be more resource constrained. A

linear probability model estimation was done to measure the impact of actual parcel certification status variable and check the sensitivity of the probit estimation results when applying a linear probability model. The results are reported in Tables E.4 and E.5 in the Appendix.[27]

[27] The results using the linear probability model are similar to the results of the baseline probit estimations. However, the results in the case of SWC maintenance change. First, certification has a significant impact on the likelihood that SWC maintenance is undertaken on parcels belonging to female-headed households. Second, wealth becomes a significant variable across all data samples. Third, the presence of males in the household becomes significant, but only in the female-headed sample. The change in results for the female-headed households could be attributed to the increased number of observations, implying that the results for this group are sensitive to sample size.

Table 6.5: **Determinants of new and additional SWC investment: Marginal effects from probit estimation with actual parcel-certification status variable**

	Parcels from Male and Female Headed Households	**Parcels from Male Headed Households**	**Parcels from Female Headed Households**
	(1)	(2)	(3)
Certification Status	0.1010**	0.0955**	0.0923
	(0.041)	(0.048)	(0.069)
Parcel size	-0.0065	0.0037	-0.0018
	(0.019)	(0.026)	(0.017)
Medium parcel quality	-0.0660***	-0.0740***	-0.0566*
	(0.019)	(0.022)	(0.032)
Infertile parcel quality	-0.0151	-0.0313	0.0645
	(0.023)	(0.026)	(0.040)
Medium parcel slope	-0.0227	-0.013	-0.0622*
	(0.017)	(0.019)	(0.037)
Steep parcel slope	-0.0066	0.0095	-0.1290**
	(0.027)	(0.031)	(0.056)
Age	-0.0014*	-0.0012	-0.0011
	(0.001)	(0.001)	(0.001)
Sex	-0.0745**	---	---
	(0.031)		
Years of schooling	0.0012	0.0012	0.0073
	(0.004)	(0.005)	(0.008)
Number of bulls/oxen	0.0049	0.0061	-0.0189
	(0.009)	(0.010)	(0.015)
Number of prime-age males	-0.0023	-0.0084	0.0386**
	(0.010)	(0.012)	(0.018)
Kebele FE	Yes	Yes	Yes
N	3903	3184	718
Pseudo R Squared	0.1104	0.11	0.1748

Standard error in parentheses, and clustered at the household level

* p<0.1, ** p<0.05, *** p<0.01

Table 6.6: **Determinants of SWC maintenance: Marginal effects from probit estimation with actual parcel-certification status variable**

	Parcels from Male and Female Headed Households	Parcels from Male Headed Households	Parcels from Female Headed Households
	(1)	(2)	(3)
Certification Status	0.1350***	0.1527***	0.0754
	(0.032)	(0.038)	(0.054)
Parcel size	-0.0188	-0.0441**	0.004
	(0.013)	(0.020)	(0.016)
Medium parcel quality	-0.0094	-0.0099	0.003
	(0.016)	(0.017)	(0.036)
Infertile parcel quality	-0.0264	-0.0196	-0.0632
	(0.021)	(0.023)	(0.061)
Medium parcel slope	0.1175***	0.1200***	0.1047***
	(0.015)	(0.017)	(0.038)
Steep parcel slope	0.1016***	0.1081***	0.0539
	(0.025)	(0.028)	(0.056)
Age	-0.0015**	-0.0009	-0.0034**
	(0.001)	(0.001)	(0.001)
Sex	-0.0648***	---	---
	(0.023)		
Years of schooling	-0.0027	-0.0018	-0.0094
	(0.003)	(0.004)	(0.012)
Number of bulls/oxen	0.0086	0.0062	0.0342*
	(0.007)	(0.007)	(0.018)
Number of prime-age males	0.0036	-0.0039	0.0263
	(0.008)	(0.009)	(0.019)
Kebele FE	Yes	Yes	Yes
N	7628	6326	1252
Pseudo R Squared	0.1641	0.1678	0.1812

Standard error in parentheses, and clustered at the household level

* p<0.1, ** p<0.05, *** p<0.01

6.5.2.2 Probit Estimation with Predicted Parcel-Certification Status Variable

The results from the robustness checks using probit estimation with predicted parcel-certification status to determine the likelihood of new or additional SWC investments (Table 6.7) show that the only result that changes is the variable capturing certification status. The marginal impact of the variables capturing parcel and household characteristics are similar to the results in Table 6.5 using the actual certification variable. Table 6.7 shows that predicted certification has no significant impact on the likelihood of SWC maintenance in any of the samples. One explanation could be the sensitivity of the estimations to a drop in the number of observations, particularly in the female sample. It is important to note that when predictions are estimated from the determinants of parcel certification status in Chapter 4, variables with any missing observations will lead to missing predictions for that particular parcel observation. This tends to reduce the number of observations for the predicted-certification variable.

However, the overall results of the robustness checks in the case of SWC maintenance (Table 6.8) retain their significance in the aggregate and male-headed household samples. Interestingly, the results now show a significant impact on the female-headed households too. The predicted certification status variable also has a higher positive marginal impact on the likelihood of SWC maintenance than the actual certification variable. Recall that SWC maintenance has more observations than the variable capturing new and additional SWC investments. This ensures that even when the predicted certification is used in the estimation, a fairly decent sample size is captured, especially in the female-headed household sample. This could explain the significance of the certification status.

Table 6.7: **Determinants of new and additional SWC investment: Marginal effects from probit estimation with predicted certification status variable**

	Parcels from Male and Female Headed Households	**Parcels from Male Headed Households**	**Parcels from Female Headed Households**
	(1)	(2)	(3)
Predicted Certification Status	0.0533	0.0328	0.2825
	(0.159)	(0.188)	(0.356)
Parcel size	-0.007	-0.0049	0.0159
	(0.023)	(0.034)	(0.021)
Medium parcel quality	-0.0606***	-0.0729***	-0.0739*
	(0.021)	(0.026)	(0.042)
Infertile parcel quality	-0.0121	-0.0207	0.0485
	(0.028)	(0.034)	(0.073)
Medium parcel slope	-0.0157	-0.0185	-0.0809
	(0.019)	(0.023)	(0.055)
Steep parcel slope	0.0025	0.0108	-0.1529**
	(0.030)	(0.037)	(0.074)
Age	-0.0013	-0.0007	-0.0050**
	(0.001)	(0.001)	(0.002)
Sex	-0.0914***	---	---
	(0.035)		
Years of schooling	0.0014	0.0012	0
	(0.005)	(0.006)	
Number of bulls/oxen	0.002	0.0125	-0.0298
	(0.010)	(0.012)	(0.025)
Number of prime-age males	-0.0005	-0.0164	0.0491**
	(0.011)	(0.013)	(0.025)
Kebele FE	Yes	Yes	Yes
N	3265	2450	367
Pseudo R Squared	0.1035	0.1062	0.1943

Standard error in parentheses, and clustered at the household level

* p<0.1, ** p<0.05, *** p<0.01

Table 6.8: **Determinants of SWC maintenance: Marginal effects from probit estimation with predicted certification status variable**

	Parcels from Male and Female Headed Households	**Parcels from Male Headed Households**	**Parcels from Female Headed Households**
	(1)	(2)	(3)
Predicted Certificaton Status	1.0492***	0.9534***	1.2712***
	(0.129)	(0.135)	(0.283)
Parcel size	-0.0051	-0.0148	0.0213
	(0.016)	(0.025)	(0.023)
Medium parcel quality	0.0199	0.0174	0.0305
	(0.017)	(0.020)	(0.042)
Infertile parcel quality	0.0008	0.0166	-0.1604*
	(0.023)	(0.026)	(0.085)
Medium parcel slope	0.0924***	0.0779***	0.1202**
	(0.017)	(0.020)	(0.046)
Steep parcel slope	0.0721***	0.0417	0.0228
	(0.026)	(0.030)	(0.067)
Age	-0.0018***	-0.0015*	-0.0062***
	(0.001)	(0.001)	(0.002)
Sex	-0.0026	---	---
	(0.027)		
Years of schooling	-0.001	-0.0016	0.0297
	(0.004)	(0.004)	(0.020)
Number of bulls/oxen	0.0199**	0.0133	0.0671***
	(0.008)	(0.009)	(0.021)
Number of prime-age males	0.0045	-0.0031	-0.0053
	(0.008)	(0.010)	(0.022)
Kebele FE	Yes	Yes	Yes
N	6375	4858	735
Pseudo R Squared	0.1767	0.1902	0.175

Standard error in parentheses, and clustered at the household level

* p<0.1, ** p<0.05, *** p<0.01

6.5.2.3 Probit Estimation with Instrument Variable (IV)

Tables 6.9 and 6.10 report the results of using the IV estimation to determine the likelihood of new or additional SWC investment and SWC maintenance. In both tables, the first-stage regressions show the instrument variable "years since certification" to be positive and significant at the 1% level. However, the magnitude of the instrument variable's impact on certification status is 0. Moreover, the results of the second-stage regressions show that certification has an insignificant impact on likelihood of new or additional SWC investments, while certification has a significant impact (1% level) on the likelihood of SWC maintenance. Interestingly, both IV estimations reveal that female household heads are less likely to undertake either type of investment, a result confirmed by the baseline estimation and by applying predicted certification in the estimations.

Regardless of whether predicted certification or IV estimation is used, the results show that female household heads may require additional support beyond certification to increase their incentive to undertake land-related investments. As the empirical analyses show, depending on the type of investment, wealth and the availability of male support are significant determinants of these investments.

Table 6.9: **Determinants of new and additional SWC investment: Probit estimation with IV**

	Second Stage IV Regression	**First Stage IV Regression**
	New/Additional SWC	**Certification Status**
Certification status	0.0069	---
	(0.365)	
Parcel size	-0.0267	-0.0267
	(0.077)	(0.077)
Medium parcel quality	-0.2721***	-0.2721
	(0.077)	(0.077)
Infertile parcel quality	-0.0708	-0.0708
	(0.097)	(0.097)
Medium parcel slope	-0.0895	-0.0895
	(0.070)	(0.070)
Steep parcel slope	-0.0237	-0.0237
	(0.112)	(0.112)
Age	-0.0055	-0.0055
	(0.003)	(0.003)
Sex	-0.3217***	-0.3217
	(0.124)	(0.124)
Years of schooling	0.0046	0.0046
	(0.018)	(0.018)
Number of bulls/oxen	0.0214	0.0214
	(0.036)	(0.036)
Number of prime-age males	-0.0056	-0.0056*
	(0.042)	(0.042)
Years since certification		0.0000***
		(0.000)
Kebele FEs	Yes	Yes
Observations	3903	3903

Robust standard errors in parentheses, and clustered at the household level

*** p<0.01, ** p<0.05, * p<0.1

Table 6.10: **Determinants of SWC maintenance: Probit estimation with IV**

	Second Stage IV Regression	**First Stage IV Regression**
	SWC Maintenance	**Certification Status**
Certification status	0.5647***	---
	(0.178)	
Parcel size	-0.0635	-0.0635**
	(0.045)	(0.045)
Medium parcel quality	-0.0301	-0.0301**
	(0.054)	(0.054)
Infertile parcel quality	-0.0863	-0.0863***
	(0.073)	(0.073)
Medium parcel slope	0.4005***	0.4005***
	(0.054)	(0.054)
Steep parcel slope	0.3454***	0.3454***
	(0.086)	(0.086)
Age	-0.0052**	-0.0052
	(0.002)	(0.002)
Sex	-0.2204***	-0.2204*
	(0.081)	(0.081)
Years of schooling	-0.0092	-0.0092
	(0.012)	(0.012)
Number of bulls/oxen	0.0303	0.0303
	(0.023)	(0.023)
Number of prime-age males	0.0114	0.0114**
	(0.027)	(0.027)
Years since certification		0.0000***
		(0.000)
Kebele FEs	Yes	Yes
Observations	7628	7628

Robust standard errors in parentheses, and clustered at the household level

6.6 Conclusion

Land-related investments are important for enhanced rural livelihoods. They can increase farmers' productivity and incomes, which is especially important for small farmers and for socioeconomically marginalized and vulnerable groups such as female landholders. Positive gains of this sort for rural communities were expected from the certification programs in the various regions of Ethiopia, such as the Amhara region.

Understanding the impact of certification land-related investments is thus important for several reasons. First, it informs policy on whether investment in rural land reforms is enough to spur land-related investments and increase incomes, or whether complementary investments need to occur simultaneously, especially for female land holders. Second, rural land reforms, especially in developing countries, are costly, and assessments of their impact can inform future other reforms about whether the investment is justified. Third, this research assesses whether there is a difference in the land investment when endogeneity is taken into account so it can inform agricultural policies and strategies.

Various researchers have looked at the impact of certification in different regions of Ethiopia. None of them has studied gender-differentiated impacts. I have attempted to fill this gap by identifying pathways by which certification can differently affect land-related investments in parcels belonging to male and female landholders.

To do so, I explored the determinants of two types of land-related investments: new SWC investments and SWC maintenance. The analyses used probit estimation as the baseline estimation strategy with the actual parcel-certification status variable. A probit estimation with the predicted certification status variable, and IV probit estimation were used as robustness checks for taking the potential endogeneity of certification into account. The analysis employed cross-sectional parcel level data to empirically assess the outcomes. The estimations controlled for parcel and household characteristics and for unobserved kebele heterogeneities. The analyses was also undertaken using aggregate and disaggregated data samples of parcels belonging to male- and female-headed households.

The empirical results from the baseline estimation strategy reveal that certification has a significant and positive marginal impact on both new SWC investments and SWC maintenance in the total and separated samples. In addition, parcels belonging to female-headed households are less likely to have both types on investment. Although the findings show that certification is important for both new and maintenance SWC investments, they also show

that for female-headed households, other factors significantly determine the likelihood of investments. These include wealth and the presence of males in the household. The findings are also sensitive to the use of predicted certification, but only in the case of new SWC investments, for which predicted certification has an insignificant impact. The results from the IV estimations show that female household heads are less likely to undertake land-related investments, a result similar to the baseline estimation and application of predicted certification. However, in the IV estimations, wealth and male support are insignificant.

These findings are similar to those of Holden et al. (2009), Deininger et al. (2008a), and Deininger et al. (2011): usufruct rights enhance land-related investments. This chapter adds to these findings by exploring in detail and through a gender lens whether certification is the main contributor to land-related investments, especially for female land holders.

These findings suggest that policy makers should take into account the fact that where rural contexts are defined by certain socio-economic constraints, complementary investments into enhancing productive capabilities and resources might be equally necessary to ensure that the anticipated benefits of land reforms are realized. This is especially important in the case of resource-poor and generally marginalized rural community members. This thesis suggests overall that providing men and women with equivalent opportunities is an initial step, but true gender equality will not arrive without gender equity by via the provision of necessary compensations based on the differentiated needs and life experiences of men and women.

Future research should consider gender-differential contexts both socioeconomically and culturally when estimating various impacts of formalized land rights. Supplementing quantitative analyses with qualitative analyses might help researchers explain gender differences in these outcomes. In addition, the existing literatures on the impact of certification, which assumes its exogeneity, could be compared to new research findings taking into account the endogeneity of certification.

Chapter 7

Conclusion

In this thesis I have studied the rural land reform process and impacts by gender in the Amhara region of Ethiopia. The first paper explored the gender differentials in the rural land-certification process. It examined the factors that determine which lands are included in a household's land-use certificate, when in the process they are included, and whether there are gender differentials in either of these outcomes. This is an important topic because by understanding the reform process we can ensure that vulnerable community members are not excluded from receiving documented land-holding rights. The findings suggest that the certification process in the Amhara region was not systematic—it was biased especially in terms of gender, in both certification status and timing.

The second paper explored the gender-differential impact of land-use certificates and socioeconomic factors on perceived household tenure security. This is an important topic because one objective of Ethiopia's land reform program was to secure land holding rights, especially for women. The findings suggest that what consistently matters most for enhancing perceived tenure security, of everyone but particularly of female landholders in the context of Ethiopia's land-tenure system, is possession of legal documentation of rights to land holdings— that is, land-use certificates. The impact of socioeconomic factors such as male presence in the household, mode of production, and land use do not seem to matter to perceived tenure security.

The third paper explored the gender-differential impact of land-use certificates on land-related investments. This an important area for research because the rural land-reform program

was expected to improve the livelihood of farmers, especially female landholders, through enhanced tenure security. The findings suggest that land-use certificates are significant determinants for enhancing land investments among both male and female land holders, although the impact on the latter group is rather smaller. But the results also suggest that various socioeconomic factors are also relevant for female landholders, including male presence in the household and wealth.

The overall implication of the first paper is that policy makers should recognize that in rural contexts defined by certain socio-economic constraints, land reforms can fall short of their objectives if vulnerable groups are not purposefully targeted and supported. Merely treating all groups in communities as similar will not ensure equal access to the reform and its benefits.

The policy implication of the second paper is the following: policy makers ought to consider further mechanisms for strengthening the tenure security of landholders in contexts where usufruct rights are granted, especially for female landholders. Certification is a necessary step to reducing insecurity and gender differentials. But policy makers should investigate whether this is enough to induce better rural livelihoods and rural development, especially in terms of gender. This is especially important in the context of resource-poor rural communities.

The implication of the third paper is that policy makers understand that in rural contexts defined by certain socio-economic constraints, complementary investments could be necessary in addition to the granting of land titles to ensure that other influences on investment outcomes do not discourage investments even when landholders have documented rights.

In the rest of this chapter, I discuss the main limitations of this research and explore avenues for extending it. The largest limitation of the first paper is its use of survey data that were not originally designed to capture the certification program. The survey was imperfect at capturing certain variables that theoretically play a role in certification outcomes. These missing variables include observable kebele characteristics that could capture whether observed differences between kebeles could explain certification-process differentials in terms of whether parcels are certified and when, and whether this played a role in the gender differentials of the outcomes. One of the essay's main objectives was to gain insights into the certification process in the Amhara region, and this requires capturing not only parcel and household characteristics, but kebele heterogeneities. The survey did not capture variables representing various kebele characteristics that might have been useful for deepening its insights into kebele differentials in the certification process.

The first paper does open avenues for future research. For example, it is important to re-assess the impact of certification on the various outcomes considered in the literature once

the endogeneity of certification is taken into account rather than simply using actual certification as the studies do. This will help us test the robustness of the results, which can have implications for the policy recommendations put forward.

The second paper acknowledges that the sample of female-headed households is small and puts analytical limitations on an extensive gender analysis. Despite these, the paper takes a first step toward understanding the gender dimension of strengthening land-holding rights through land-use certification. Another limitation is that although panel data are used, the fact that variation in certification status was captured mainly in the 2007 survey year made it difficult to assess pre- and post-certification impacts. A third limitation is that households' perceptions of changes to land holdings might not immediately change when they are issued land-use certificates. In such cases, the treatment variable, certification status, could be wrongly interpreted as having no effect on perceived tenure security. A related limitation is the definition of perceived tenure security used in the paper's analyses. Tenure security is captured through expectations of changes to land holdings, which is based on a future outlook. A more accurate way of capturing tenure security might be via a variable that asks households about their current tenure-security situations, such whether they are experiencing an event that making them feel more or less tenure-secure.

One avenue for extending the research in the second paper is to take a deep dive into the constraints and opportunities that female landholders face, at both the individual and household levels. Only then will we be able to assess the extent to which legal rights can enhance the tenure security of female versus male land holders. A qualitative survey to capture the socioeconomic and cultural contexts of male and female land holders would complement the quantitative analyses by exploring variables that cannot be captured well quantitatively.

The third paper has the following notable limitations. First, parcels cannot be matched across time, and there is no variation in the certification variable before 2007. Both of these contributed to the use of cross-section data, which limited the choice of estimation approaches. Second, due to data limitations, land investment could be only captured in binary variables, not continuous ones, making it hard to assess the extent to which certification enhanced investments—that is, hard to identify the optimal level of investment, given a household's certification status.

Future research should consider gender-differential contexts, both socioeconomically and culturally, when estimating the impacts of formalized land rights. Current literature that has investigated the impacts of certification while assuming its exogeneity can be compared to newer research findings to test the robustness of their results, perhaps using the predicted

certificate variable.

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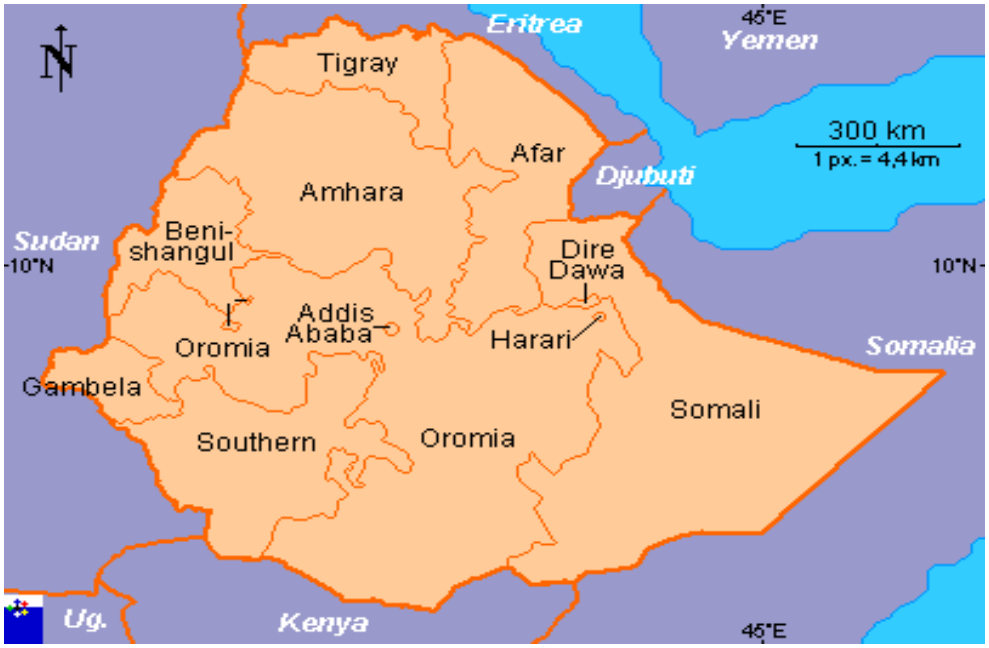
Appendix A

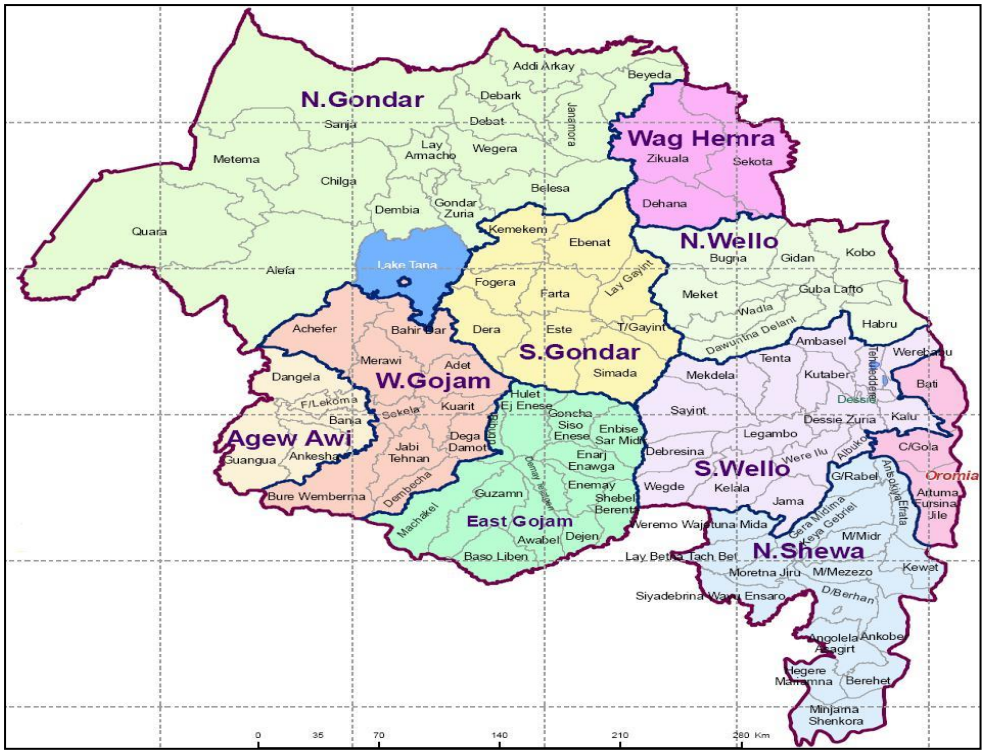
Chapter 2 Appendix

A.1 Chapter 2 Appendix Figures



Source: http://www.crwflags.com/fotw/flags/et(.html)

Figure A.1: **Map of Ethiopia**



Source: http://www.ethiodemographyandhealth.org/Amhara.html

Figure A.2: **Map of Amhara Region**

Figure A.3: **Household land-use certificate**

Picture of land holder Picture of spouse

1. The holder's full name and address

1.1 . Holder's name Sex Date of birth
a.---------- --- ----------
b.---------- --- ----------

1.2. Care taker's name Sex date of birth
---------- --- ----------

1.3 Spouse's name Sex date of birth
a.---------- ---- ----------
b.---------- --- ----------

1.4 Family members/Inheriting under age children

	Name	Sex	Date of Birth	Relationship	Remark
.	a.----------	---	-------	---------- ---------	
	b.----------	---	-------	---------- ---------	
	c.----------	---	-------	---------- ---------	

1.5 Holder's permanent address
Killil---------- Zone------ Woreda------ Kebele----------
Sub-Kebele-------- Sub-sub Kebele (Gote)-------- Remark----------

2. ID number of the land

2.1 This book is given to testify the legal protection that rural land holders enjoy to use their land.
2.2 The holder of this book is considered as the user of the land described in here.
2.3 Till a precise map indicating the exact location of the land is prepared, the land owner will be given the 'first stage' certificate document indicated in item 6.
2.4 When the map indicating the exact location is ready, the land owner will be given 'the second stage' certificate document indicated in item 7.
2.5 The rights and responsibilities indicated in this book are equally applicable to both the first stage and second stage certificates.
2.6 Incentives will be given to those who are exemplary in their use and management of own land.
2.7 Fee free certification renewal service will be provided for those who transfer land in order to consolidate their holdings.
2.8 This book is valid only if signed and sealed by the appropriate officials.
2.9 This book is a 20 page legal document.

3. The rights of the holder.
3.1 So long as the holder properly uses the land given to him under item 6.2/7.1, he has the right to use the land and has a legal guarantee not to lose his holding.
3.2 The holder has a constitutional right to accumulate asset on his holding. Unless it is required for public use, the holder has undeniable use right on his holding.
3.3 Whenever according to the law the holder is disposed of his holdings for public use, s/he has the right to get a replacement whenever is appropriate and get a compensation for her/his asset on the holdings.
3.4 The holder has the right, according to the law, to rent out and inherit his/her holdings.
3.5 The holder has the right to borrow against assets on own holdings.
3.6 The holder can terminate his rights to hold the land at any time. When dispossessing once land voluntarily, one has the right to recover all the assets on the holdings.
3.7 In carrying out his responsibility of properly using the land, the holder has the right to ask for assistance from appropriate government offices.
3.8 When the holder is disposed of his land for irrigation development, s/he has the right to get a comparable land that used the newly developed irrigation system.
3.9 The holder has the right to harvest and maintain/replace tree that s/he planted on the side of feeder roads.
3.10 The holder has the right to collectively develop and use CPRs within the village.
3.11 In the absence of own entry and exit to the holdings, the holder has the right to enter and exit her/his livestock to own land using holdings owned by other person(s).

Figure A.3: **Household land-use certificate, cont'd.**

4. **The responsibilities of the holder.**

4.1 The holder has the obligation to properly maintain the land under his possession.

4.2 The holder can prepare land use plan in consultation with appropriate professionals. The land use plan shall consider the safety of the environment and the holder has the obligation to reduce environmental damages.

4.3 The holder has the obligation to confirm that land related improvements on his land shall not have any adverse effects on the neighboring parcels.

4.4 The holder has the obligation to construct suitable flood control structures.

4.5 In case of expropriation of land for public interest, the holder has the obligation to cooperate with the authorities after receiving the appropriate compensation.

4.6 The holder has the obligation to give access to his land if irrigation canals and other related infrastructures have to pass through his land.

4.7 If the holder benefits from an irrigation scheme, part of the irrigable land will be taken to compensate the person who lost land due to the construction of the irrigation infrastructure

4.8 If the land is adjacent to a river or cliff, the holder has the obligation to plough within a certain distance, which will be decided by the concerned authority, from the river or the cliff. In additions, the holder has the obligation to properly maintain the borders by planting trees and has the right to use the benefits from the trees.

4.9 If the land is adjacent to main or feeder roads, the holder has the obligation to plant trees alongside the road, and to properly maintain them, and he has the right to use the benefits.

4.10 The holder has the obligation to contribute in the protection of communal land in accordance with the customary laws of the community.

4.11 The holder has the obligation to cooperate in measuring or surveying and demarcation of his land when asked by the appropriate authority.

4.12 As long as they are not harmful, the holder has the obligation to give due care to wild animals found around his land to protect them from harm.

4.13 The holder shall not plant/grow any trees (species) that are hazardous to the society.

4.14 The holder has the obligation to provide land related information when asked by the appropriate authorities for the purpose of making land administration related studies.

4.15 The holder shall keep this book of possession and he has the obligation to show it when asked by the appropriate authorities.

5. Effects of failure to discharged obligations

5.1 Any land possessor who fails to properly maintain his land (if the land is damaged due to negligence) shall be punished in accordance with the regulations issued for the implementation of proclamation 46/92.

5.2 Any possessor who does not cooperate in maintaining common property land shall be punished according to the law.

5.3 Any land possessor who fails to respect his obligations and cause any damage on others land shall be punished on the ground of committing breach of law and he will be also obliged to pay compensation in accordance with the country's civil law.

5.4 A punishment will be imposed on the ground of committing breach of law against a holder who refuses to cooperate with the community to protect communal land, who does not provide others access to their land, and who cause danger to wildlife that are not harmful in any way.

Figure A.3: **Household land-use certificate, Cont'd.**

6. First stage land possession certificate

6.1 Holding identification number

_____ Local area measurement unit_____

6.2 Holding details

Parcel ID No.	Current land use	Adjacent (neighbor) parcels				Parcel size in local measurement unit	Soil quality (relative)	Mode of acquisition	Location of the parcel	Remark
		East	West	South	North					
Total										

6.3 This first stage land possession certificate is issued to the holders whose names are entered in 1.1 on condition that they properly maintain and use the parcels listed in 6.2 above.

6.4 Date issued or updated

Day _____ Month _____ Year_____

6.5 Holders signature

Name _____ Signature_____

Name _____ Signature_____

6.6 Name and signature of the officials who certified the book of possession

a Kebele rural land administration committee chairman

Name_____ Signature_____

b Woreda environmental protection and rural land administration bureau, official

Name_____Singature_____

Note: *The soil quality of each parcel should be recorded as high, medium or low, relatively.*

Figure A.3: **Household land-use certificate, cont'd.**

7. Second stage land possession certificate

7.1 Holding identification number_____

7.2 Holding details

Parcel ID No.	Current land use	Reference map number	Type of cadastral survey instrument	GPS coordinates of the parcel (at the center of the parcel)		Parcel size in hectare	Soil of quality	Mode of acquisition	Location of the parcel	Remark
				North	East					
Total										

7.3 This first stage land possession certificate is issued to the holders whose names are entered in 1.1 on condition that they properly maintain and use the parcels listed in 6.2 above.

7.4 Date issued or updated

Day _____ Month _____ Year_____

7.5 Holders signature

Name _____ Signature_____

Name _____ Signature_____

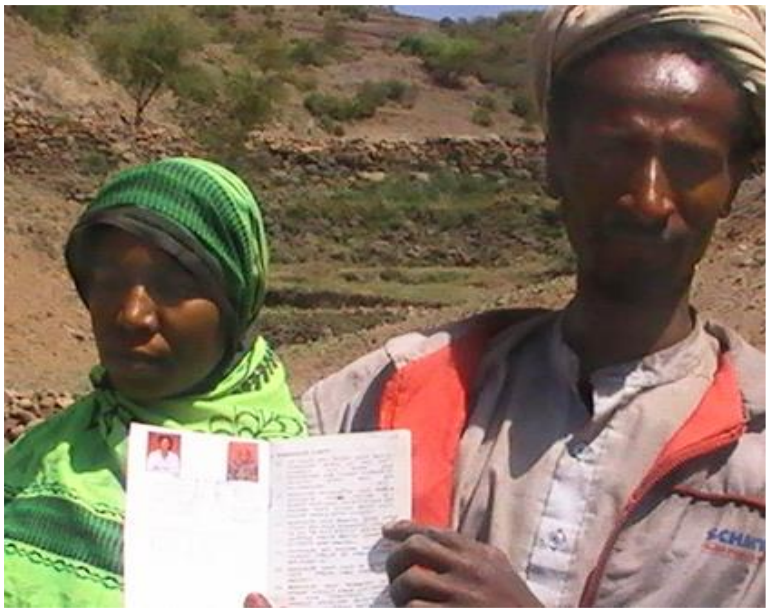
7.6 Name and signature officials

Name_____

Signature_____

b Woreda environmental protection and rural land administration bureau, official

Figure A.4: **Joint land-use certificate in the Amhara region**



Source: Haile, Zerfu (2010)

Figure A.5: **Land-use certificate of a female household head in the Amhara region**

Source: Haile, Zerfu (2010)

Appendix B

Chapter 3 Appendix

B.1 Chapter 3 Appendix Tables

Table B.1: Conversion of Ethiopian Calendar (E.C.) to Gregorian Calendar

Ethiopian Calendar (E.C.)	Gregorian Calendar
Septmber 1, 1996	September 11, 2003
October 1, 1996	October 11, 2003
November 1, 1996	November 10, 2003
December 1, 1996	December 10, 2003
January 1, 1996	January 9, 2004
February 1, 1996	February 8, 2004
March 1, 1996	March 10, 2004
April 1, 1996	April 9, 2004
May 1, 1996	May 9, 2004
June 1, 1996	June 8, 2004
July 1, 1996	July 08, 2004
August 1, 1996	August 7, 2004
Pagume (13th month in E.C.)	September 6, 2004

Source: http://calendar-converter.com/index.php?p=ethiopian

Appendix C

Chapter 4 Appendix

C.1 Chapter 4 Appendix Tables

Table C.1: **Variable summary statistics and descriptions (parcels belonging to male and female household heads)**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	total number of parcels belonging to both male and female headed households	7,988				
Total # of households	total number of both male and female headed household	1,759				
Certification						
Certificate status	equals 1 if parcel is certified, and 0 otherwise	7988	0.793	0.405	0	1
Certificate timing	equals 1 if parcel is certified "late", and 0 otherwise	6330	0.805	0.396	0	1
Location of Parcel						
Kebele	equals 1 if parcel is located in Amanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Aaddis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	7988	7.346	3.931	1	14
Parcel Characteristics						
Parcel type	equals 1 if parcel is Black; 2= Red; 3= Gray; 4= Other	7977	1.917	0.905	1	4
Parcel depth	equals 1 if parcel is Deep; 2= Medium; 3= Shallow	7970	1.829	0.694	1	3
Parcel slope	equals 1 if parcel is flat; 2=Medium; 3=Steep	7976	1.329	0.571	1	3
Parcel quality	equals 1 if parcel is fertile; 2=Medium-fertile; 3= Infertile	7975	1.600	0.725	1	3
Parcel size (hectares)	Average parcel size in each household	7969	0.042	0.415	0	7.13015
SWC maintenance	equals 1 if there was soil and water conservation structures maintenace undetaken on parcel, and 0 otherwise	7203	0.324	0.468	0	1
Household Head Characteristics						
Sex	equals 0 if male; and 1 otherwise	7913	0.160	0.366	0	1
Age	average age of household head	7851	51.089	14.803	13	100
Years of schooling	average numer of household head schooling years	7839	1.119	2.553	0	14
Number of prime age males	average number of prime-age males in the household	7913	1.161	1.176	0	8
Household Wealth Characteristics						
Number of bulls/oxen	average number of bulls/oxen in the household	7658	1.632	1.315	0	8
Household Accessability						
Distance to nearest road	average distance of household residence to the nearest road in metres	7894	31.608	32.869	0	180

Source: 2007 Survey of Sustainable Land Use in the Ethiopian Highlands

Note: Parcel type: "black" is the "best"; Parcel depth: "deep" is the best; Parcel slope: "flat" is the best; Parcel quality: "fertile" is the best.

Table C.2: **Variable summary statistics and descriptions (parcels belonging to male household heads)**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	total number of parcels belonging to male headed households	6,649				
Total # of households	total number of male headed households	1,422				
Certification						
Certificate status	equals 1 if parcel is certified, and 0 otherwise	6649	0.794104	0.404385	0	1
Certificate timing	equals 1 if parcel is certified "late", and 0 otherwise	5275	0.818578	0.3854038	0	1
Location of Parcel						
Kebele	equals 1 if parcel is located in Amanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Aaddis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	6649.00	7.19	3.92	1.00	14.00
Parcel Characteristics						
Parcel type	equals 1 if parcel is Black; 2= Red; 3= Gray; 4= Other	6641	1.921849	0.8941274	1	4
Parcel depth	equals 1 if parcel is Deep; 2= Medium; 3= Shallow	6633	1.835067	0.6965324	1	3
Parcel slope	equals 1 if parcel is flat; 2=Medium; 3=Steep	6639	1.336346	0.5725386	1	3
Parcel quality	equals 1 if parcel is fertile; 2=Medium-fertile; 3= Infertile	6638	1.623832	0.7346141	1	3
Parcel size (hectares)	Average parcel size in each household	6640	0.029522	0.3216979	0	6.55974
SWC maintenance	equals 1 if there was soil and water conservation structures maintenace undetaken on parcel, and 0 otherwise	6073	0.328997	0.4698876	0	1
Household Head Characteristics						
Sex	equals 0 if male; and 1 otherwise	6649	0	0	0	0
Age	average age of household head	6594	50.86078	14.84841	13	100
Years of schooling	average numer of household head schooling years	6579	1.246086	2.673206	0	14
Number of prime age males	average number of prime-age males in the household	6649	1.159723	1.188365	0	8
Household Wealth Characteristics						
Number of bulls/oxen	average number of bulls/oxen in the household	6463	1.771004	1.302159	0	8
Household Accessability						
Distance to nearest road	average distance of household residence to the nearest road in metres	6571	32.61642	33.46169	0	180

Source: 2007 Survey of Sustainable Land Use in the Ethiopian Highlands

Note: Parcel type: "black" is the "best"; Parcel depth: "deep" is the best; Parcel slope: "flat" is the best; Parcel quality: "fertile" is the best.

Table C.3: **Variable summary statistics and descriptions (parcels belonging to female household heads)**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	total number of parcels belonging to female headed households	1,264				
Total # of households	total number of female headed households	325				
Certification						
Certificate status	equals 1 if parcel is certified, and 0 otherwise	1264	0.77532	0.417539	0	1
Certificate timing	equals 1 if parcel is certified "late", and 0 otherwise	980	0.73673	0.44063	0	1
Location of Parcel						
Kebele	equals 1 if parcel is located in Amanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Aaddis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	1264	8.22389	3.822221	1	14
Parcel Characteristics						
Parcel type	equals 1 if parcel is Black; 2= Red; 3= Gray; 4= Other	1261	1.88898	0.958859	1	4
Parcel depth	equals 1 if parcel is Deep; 2= Medium; 3= Shallow	1262	1.7916	0.688751	1	3
Parcel slope	equals 1 if parcel is flat; 2=Medium; 3=Steep	1262	1.30032	0.566848	1	3
Parcel quality	equals 1 if parcel is fertile; 2=Medium-fertile; 3= Infertile	1262	1.47227	0.665527	1	3
Parcel size (hectares)	Average parcel size in each household	1254	0.11136	0.733916	0.000001	7.1302
SWC maintenance	equals 1 if there was soil and water conservation structures maintenace undetaken on parcel, and 0 otherwise	1130	0.29558	0.456503	0	1
Household Head Characteristics						
Sex	equals 0 if male; and 1 otherwise	1264	1	0	1	1
Age	average age of household head	1257	52.284	14.50713	20	90
Years of schooling	average numer of household head schooling years	1260	0.45238	1.647233	0	12
Number of prime age males	average number of prime-age males in the household	1264	1.16851	1.106057	0	4
Household Wealth Characteristics						
Number of bulls/oxen	average number of bulls/oxen in the household	1195	0.87782	1.113403	0	6
Household Accessability						
Distance to nearest road	average distance of household residence to the nearest road in metres	1248	27.0895	29.66495	0	180

Source: 2007 Survey of Sustainable Land Use in the Ethiopian Highlands

Note: Parcel type: "black" is the "best"; Parcel depth: "deep" is the best; Parcel slope: "flat" is the best; Parcel quality: "fertile" is the best.

Appendix D

Chapter 5 Appendix

D.1 Chapter 5 Appendix Tables

Table D.1: **Variable summary statistics and descriptions (male and female headed households) – 1999, 2002, 2004, 2007**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	Total number of observations belnging to male and female headed households in 1999, 2002, 2004, and 2007	6541				
Total # of households	Total number of male and female headed households in 1999, 2002, 2004, and 2007	1864				
Tenure Security	Dummy for household's perceived tenure security: =0 if HH is insecure; 1=HH is secure	5289	0.7232	0.4475	0	1
Household's certification status	Dummy for HH certification status: = 0 if HH is not certified; 1=HH is certified.	6534	0.2118	0.4086	0	1
Kebele	Kebele households reside in: 1=Aamanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Addis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	6541	7.0610	3.6978	1	14
Sex	Sex of household head: 0=male, 1=female	6541	0.1728	0.3781	0	1
Age	Age of household head	6499	49.1120	15.5419	13	102
Years of schooling	Years of schooling of household head	6541	1.1703	2.6076	0	19
Number of prime-age males	Number of prime age (15-45 years old) males in the household	6541	0.9372	1.0868	0	8
Number of bulls/oxen	Average number of bulls/oxen owned by the household	6541	1.3422	1.2954	0	25
Ownership of bulls/oxen	Dummy for whether a household owns bulls/oxen: 0=No; 1=Yes	6541	0.6909	0.4622	0	1
Parcel size	Total parcel size in HH (hectares)	6223	0.0553	0.4873	0	11.115
Share of fertile parcels	Proportion of total land area in hectares that is fertile	6518	0.5930	0.3286	0	1
Share of rented-out parcels	Proporton of total land area in hectares that is rented-out	6541	0.1934	0.3602	0	1
Perrenial Crops	Dummy for whether a household grows perrenial crops:0=No; 1=Yes	6337	0.1543	0.3613	0	1

Source: Own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table D.2: **Variable summary statistics and descriptions (male-headed households) - 1999, 2002, 2004, 2007**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	Total number of observations belonging to male headed households in 1999, 2002, 2002, and 2007	5411				
Total # of households	Total number of male headed households in 1999, 2002, 2004, and 2007	1622				
Tenure Security	Dummy for household's perceived tenure security: =0 if HH is insecure; 1=HH is secure	4443	0.7153	0.4513	0	1
Household's certification status	Dummy for HH certification status: = 0 if HH is not certified; 1=HH is certified.	5404	0.2056	0.4042	0	1
Kebele	Kebele households reside in: 1=Aamanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Addis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	5411	6.8814	3.7079	1	14
Sex	Sex of household head: 0=male, 1=female	5411	0.0000	0.0000	0	0
Age	Age of household head	5375	48.6428	15.5514	13	102
Years of schooling	Years of schooling of household head	5411	1.3240	2.7338	0	19
Number of prime-age males	Number of prime age (15-45 years old) males in the household	5411	0.9300	1.0950	0	8
Number of bulls/oxen	Average number of bulls/oxen owned by the household	5411	1.4851	1.3015	0	25
Ownership of bulls/oxen	Dummy for whether a household owns bulls/oxen: 0=No; 1=Yes	5411	0.7588	0.4278	0	1
Parcel size	Total parcel size in HH (hectares)	5152	0.0531	0.4789	0	11.115
Share of fertile parcels	Proportion of total land area in hectares that is fertile	5394	0.6002	0.3268	0	1
Share of rented-out parcels	Proporton of total land area in hectares that is rented-out	5411	0.1419	0.3147	0	1
Perrenial Crops	Dummy for whether a household grows perrenial crops:0=No; 1=Yes	5303	0.1609	0.3674	0	1

Source: Own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table D.3: **Variable summary statistics and descriptions (female-headed households) - 1999, 2002, 2004, 2007**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	Total number of observations belonging to female headed households in 1999, 2002, 2004, and 2007	1130				
Total # of households	Total number of female headed households in 1999, 2002, 2004, and 2007.	450				
Tenure Security	Dummy for household's perceived tenure security: =0 if HH is insecure; 1=HH is secure	846	0.7648	0.4244	0	1
Household's certification status	Dummy for HH certification status: = 0 if HH is not certified; 1=HH is certified.	1130	0.2416	0.4282	0	1
Kebele	Kebele households reside in: 1=Aamanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Addis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	1130	7.9212	3.5259	1	14
Sex	Sex of household head: 0=male, 1=female	1130	1.0000	0.0000	1	1
Age	Age of household head	1124	51.3559	15.3053	15	92
Years of schooling	Years of schooling of household head	1130	0.4345	1.7091	0	18
Number of prime-age males	Number of prime age (15-45 years old) males in the household	1130	0.9717	1.0468	0	5
Number of bulls/oxen	Average number of bulls/oxen owned by the household	1130	0.6575	1.0182	0	6
Ownership of bulls/oxen	Dummy for whether a household owns bulls/oxen: 0=No; 1=Yes	1130	0.3655	0.4818	0	1
Parcel size	Total parcel size in HH (hectares)	1071	0.0657	0.5262	0	7.1393
Share of fertile parcels	Proportion of total land area in hectares that is fertile	1124	0.5581	0.3355	0	1
Share of rented-out parcels	Proporton of total land area in hectares that is rented-out	1130	0.4399	0.4512	0	1
Perrenial Crops	Dummy for whether a household grows perrenial crops:0=No; 1=Yes	1034	0.1209	0.3262	0	1

Source: Own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table D.4: **Variable summary statistics and descriptions (male and female headed households) – 1999**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	Total number of obervations belonging to male and female headed households in 1999	1516				
Total # of households	Total number of male and female headed households in 1999	1516				
Tenure Security	Dummy for household's perceived tenure security: =0 if HH is insecure; 1=HH is secure	1501	0.7588	0.4279	0	1
Household's certification status	Dummy for HH certification status: = 0 if HH is not certified; 1=HH is certified.	1516	0.0000	0.0000	0	0
Kebele	Kebele households reside in: 1=Aamanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Addis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	1516	6.5297	3.3565	1	12
Sex	Sex of household head: 0=male, 1=female	1516	0.1656	0.3718	0	1
Age	Age of household head	1516	46.5139	15.7293	17	100
Years of schooling	Years of schooling of household head	1516	1.4901	2.7432	0	19
Number of prime-age males	Number of prime age (15-45 years old) males in the household	1516	0.6438	0.8597	0	5
Number of bulls/oxen	Average number of bulls/oxen owned by the household	1516	1.0871	1.2493	0	25
Ownership of bulls/oxen	Dummy for whether a household owns bulls/oxen: 0=No; 1=Yes	1516	0.6194	0.4857	0	1
Parcel size	Total parcel size in HH (hectares)	1407	0.0008	0.0052	0	0.1001
Share of fertile parcels	Proportion of total land area in hectares that is fertile	1502	0.6071	0.3328	0	1
Share of rented-out parcels	Proporton of total land area in hectares that is rented-out	1516	0.1819	0.3500	0	1
Perrenial Crops	Dummy for whether a household grows perrenial crops:0=No; 1=Yes	1479	0.0994	0.2993	0	1

Source: Own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table D.5: **Variable summary statistics and descriptions (male and female headed households) – 2002**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	Total number of obervations belonging to male and female headed households in 2002	1518				
Total # of households	Total number of male and female headed households in 2002	1518				
Tenure Security	Dummy for household's perceived tenure security: =0 if HH is insecure; 1=HH is secure	1494	0.7189	0.4497	0	1
Household's certification status	Dummy for HH certification status: = 0 if HH is not certified; 1=HH is certified.	1518	0.0000	0.0000	0	0
Kebele	Kebele households reside in: 1=Aamanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Addis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	1518	6.5171	3.3561	1	12
Sex	Sex of household head: 0=male, 1=female	1518	0.1502	0.3574	0	1
Age	Age of household head	1513	48.2274	15.6627	15	102
Years of schooling	Years of schooling of household head	1518	1.0804	2.4829	0	12
Number of prime-age males	Number of prime age (15-45 years old) males in the household	1518	0.7945	0.9510	0	6
Number of bulls/oxen	Average number of bulls/oxen owned by the household	1518	1.1331	1.0805	0	11
Ownership of bulls/oxen	Dummy for whether a household owns bulls/oxen: 0=No; 1=Yes	1518	0.6607	0.4736	0	1
Parcel size	Total parcel size in HH (hectares)	1406	0.0038	0.0255	0	0.3161
Share of fertile parcels	Proportion of total land area in hectares that is fertile	1513	0.6126	0.3268	0	1
Share of rented-out parcels	Proporton of total land area in hectares that is rented-out	1518	0.1887	0.3551	0	1
Perrenial Crops	Dummy for whether a household grows perrenial crops:0=No; 1=Yes	1496	0.0856	0.2798	0	1

Source: Own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table D.6: **Variable summary statistics and descriptions (male and female headed households) – 2004**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	Total number of observations belonging to male and female headed households in 2004	1748				
Total # of households	Total number of male and female headed households in 2004	1748				
Tenure Security	Dummy for household's perceived tenure security: =0 if HH is insecure; 1=HH is secure	1113	0.7080	0.4549	0	1
Household's certification status	Dummy for HH certification status: = 0 if HH is not certified; 1=HH is certified.	1748	0.0120	0.1090	0	1
Kebele	Kebele households reside in: 1=Aamanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Addis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	1748	7.4840	3.9360	1	14
Sex	Sex of household head: 0=male, 1=female	1748	0.1785	0.3830	0	1
Age	Age of household head	1735	50.0461	15.4887	13	100
Years of schooling	Years of schooling of household head	1748	1.1905	2.6151	0	13
Number of prime-age males	Number of prime age (15-45 years old) males in the household	1748	1.0584	1.1549	0	8
Number of bulls/oxen	Average number of bulls/oxen owned by the household	1748	1.3450	1.1336	0	8
Ownership of bulls/oxen	Dummy for whether a household owns bulls/oxen: 0=No; 1=Yes	1748	0.7220	0.4482	0	1
Parcel size	Total parcel size in HH (hectares)	1658	0.0021	0.0159	0	0.355
Share of fertile parcels	Proportion of total land area in hectares that is fertile	1746	0.5818	0.3260	0	1
Share of rented-out parcels	Proporton of total land area in hectares that is rented-out	1748	0.1980	0.3649	0	1
Perrenial Crops	Dummy for whether a household grows perrenial crops:0=No; 1=Yes	1747	0.0572	0.2324	0	1

Source: Own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table D.7: **Variable summary statistics and descriptions (male and female headed households) – 2007**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	Total number of observations belonging to male and female headed households in 2007	1759				
Total # of households	Total number of male and female headed households in 2007	1759				
Tenure Security	Dummy for household's perceived tenure security: =0 if HH is insecure; 1=HH is secure	1181	0.6977	0.4594	0	1
Household's certification status	Dummy for HH certification status: = 0 if HH is not certified; 1=HH is certified.	1752	0.7780	0.4157	0	1
Kebele	Kebele households reside in: 1=Aamanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Addis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	1759	7.5679	3.8873	1	14
Sex	Sex of household head: 0=male, 1=female	1759	0.1927	0.3945	0	1
Age	Age of household head	1735	51.2196	14.9434	15	97
Years of schooling	Years of schooling of household head	1759	0.9522	2.5594	0	15
Number of prime-age males	Number of prime age (15-45 years old) males in the household	1759	1.1927	1.2165	0	7
Number of bulls/oxen	Average number of bulls/oxen owned by the household	1759	1.7396	1.5366	0	16
Ownership of bulls/oxen	Dummy for whether a household owns bulls/oxen: 0=No; 1=Yes	1759	0.7476	0.4345	0	1
Parecel size	Total parcel size in HH (hectares)	1752	0.1907	0.9042	0	11.115
Share of fertile parcels	Proportion of total land area in hectares that is fertile	1757	0.5750	0.3282	0	1
Share of rented-out parcels	Proporton of total land area in hectares that is rented-out	1759	0.2027	0.3685	0	1
Perrenial Crops	Dummy for whether a household grows perrenial crops:0=No; 1=Yes	1615	0.3734	0.4839	0	1

Source: Own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table D.8: **Variable summary statistics and descriptions (male-headed households) – 2007**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	Total number of observations belonging to male headed households in 2007	1420				
Total # of households	Total number of male headed households in 2007	1420				
Tenure Security	Dummy for household's perceived tenure security: =0 if HH is insecure; 1=HH is secure	978	0.682	0.4659361	0	1
Household's certification status	Dummy for HH certification status: = 0 if HH is not certified; 1=HH is certified.	1413	0.77636	0.4168295	0	1
Kebele	Kebele households reside in: 1=Aamanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Addis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	1420	7.35916	3.900347	1	14
Sex	Sex of household head: 0=male, 1=female	1420	0	0	0	0
Age	Age of household head	1399	50.8306	14.9569	15	97
Years of schooling	Years of schooling of household head	1420	1.0831	2.696825	0	15
Number of prime-age males	Number of prime age (15-45 years old) males in the household	1420	1.20282	1.230224	0	7
Number of bulls/oxen	Average number of bulls/oxen owned by the household	1420	1.95211	1.531153	0	16
Ownership of bulls/oxen	Dummy for whether a household owns bulls/oxen: 0=No; 1=Yes	1420	0.82535	0.3797994	0	1
Parcel size	Total parcel size in HH (hectares)	1413	0.18808	0.9004386	0	11.115
Share of fertile parcels	Proportion of total land area in hectares that is fertile	1419	0.5866	0.327515	0	1
Share of rented-out parcels	Proporton of total land area in hectares that is rented-out	1420	0.13788	0.3122529	0	1
Perrenial Crops	Dummy for whether a household grows perrenial crops:0=No; 1=Yes	1360	0.375	0.484301	0	1

Source: Own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table D.9: **Variable summary statistics and descriptions (female-headed households) – 2007**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	Total number of observations belonging to female headed households in 2007	339				
Total # of households	Total number of female headed households	339				
Tenure Security	Dummy for household's perceived tenure security: =0 if HH is insecure; 1=HH is secure	203	0.7734	0.4196672	0	1
Household's certification status	Dummy for HH certification status: = 0 if HH is not certified; 1=HH is certified.	339	0.78466	0.4116651	0	1
Kebele	Kebele households reside in: 1=Aamanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Addis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	339	8.44248	3.712138	1	14
Sex	Sex of household head: 0=male, 1=female	339	1	0	1	1
Age	Age of household head	336	52.8393	14.79969	20	92
Years of schooling	Years of schooling of household head	339	0.40413	1.778932	0	14
Number of prime-age males	Number of prime age (15-45 years old) males in the household	339	1.15044	1.158104	0	5
Number of bulls/oxen	Average number of bulls/oxen owned by the household	339	0.84956	1.205666	0	6
Ownership of bulls/oxen	Dummy for whether a household owns bulls/oxen: 0=No; 1=Yes	339	0.42183	0.4945815	0	1
Parcel size	Total parcel size in HH (hectares)	339	0.2016	0.9210482	0	7.1393
Share of fertile parcels	Proportion of total land area in hectares that is fertile	338	0.52651	0.3270253	0	1
Share of rented-out parcels	Proporton of total land area in hectares that is rented-out	339	0.47427	0.45322	0	1
Perrenial Crops	Dummy for whether a household grows perrenial crops:0=No; 1=Yes	255	0.36471	0.4822942	0	1

Source: Own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Appendix E

Chapter 6 Appendix

E.1 Chapter 6 Appendix Tables

Table E.1: **Variable summary statistics and descriptions (parcels belonging to male and female household heads), 2007**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	total number of parcels belonging to both male and female headed households in 2007	7,988				
Total # of households	total number of both male and female headed households in 2007	1,759				
New SWC investment	Dummy for new SWC investment on parcel: =0 if no SWC investment; 1=if there is SWC investment	4083	0.1915	0.3936	0	1
SWC maintenance	Dummy for SWC maintenance on parcel: =0 if no SWC maintenance; 1=if there is SWC maintenance	7948	0.3086	0.4620	0	1
Certificate status	equals 1 if parcel is certified, and 0 otherwise	7988	0.7931	0.4051	0	1
Kebele	Village location of parcel equals 1 if parcel is located in Amanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Aaddis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	7988	7.3461	3.9306	1	14
Parcel size	Total parcel size belonging to household (hectares)	7969	0.0421	0.4145	0	7.1302
Parcel quality	1=fertile; 2=medium-fertile; 3=infertile	7975	1.6004	0.7252	1	3
Parcel slope	1=flat; 2=medium; 3=steep	7976	1.3294	0.5712	1	3
Share of rented-out parcels	Proportion total parcel area in hectares that is rented-out by the household	7988	0.1827	0.3516	0	1
Sex	Sex of household head: 0=male, 1=female	7988	0.1694	0.3751	0	1
Age	Age of household head	7898	51.6055	14.4218	15	97
Years of schooling	Years of schooling of household head	7786	0.9842	2.5965	0	15
Number of prime-age males	Number of prime age (15-45 years old) males in the household	7988	1.2807	1.2281	0	7
Number of bulls/oxen	Average number of bulls/oxen owned by the household	7988	1.8729	1.6045	0	16

Source: Authors' own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table E.2: **Variable summary statistics and descriptions (parcels belonging to male household heads), 2007**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	total number of parcels belonging to male headed households in 2007	6,635				
Total # of households	total number of male headed households in 2007	1,420				
New SWC investment	Dummy for new SWC investment on parcel: =0 if no SWC investment; 1=if there is SWC investment	3330	0.2090	0.4067	0	1
SWC maintenance	Dummy for SWC maintenance on parcel: =0 if no SWC maintenance; 1=if there is SWC maintenance	6606	0.3149	0.4645	0	1
Certificate status	equals 1 if parcel is certified, and 0 otherwise	6635	0.7937	0.4047	0	1
Kebele	Village location of parcel equals 1 if parcel is located in Amanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Aaddis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	6635	7.1590	3.9352	1	14
Parcel size	Total parcel size belonging to household (hectares)	6626	0.0290	0.3210	0	6.5597
Parcel quality	1=fertile; 2=medium-fertile; 3=infertile	6624	1.6258	0.7349	1	3
Parcel slope	1=flat; 2=medium; 3=steep	6625	1.3366	0.5741	1	3
Share of rented-out parcels	Proportion total parcel area in hectares that is rented-out by the household	6635	0.1291	0.3006	0	1
Sex	Sex of household head: 0=male, 1=female	6635	0.0000	0.0000	0	0
Age	Age of household head	6561	51.2681	14.4550	15	97
Years of schooling	Years of schooling of household head	6450	1.1043	2.7310	0	15
Number of prime-age males	Number of prime age (15-45 years old) males in the household	6635	1.2879	1.2362	0	7
Number of bulls/oxen	Average number of bulls/oxen owned by the household	6635	2.0644	1.6053	0	16

Source: Authors' own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table E.3: **Variable summary statistics and descriptions (parcels belonging to female household heads, 2007**

Variable	Variable Description	Obs	Mean	Std. Dev.	Min	Max
Total # of observations	total number of parcels belonging to female headed households in 2007	1,353				
Total # of households	total number of female headed households in 2007	339				
New SWC investment	Dummy for new SWC investment on parcel: =0 if no SWC investment; 1=if there is SWC investment	753	0.1142	0.3183	0	1
SWC maintenance	Dummy for SWC maintenance on parcel: =0 if no SWC maintenance; 1=if there is SWC maintenance	1342	0.2779	0.4482	0	1
Parcel certification status	Dummy for parcel certification status: = 0 if parcel is not certified; 1=parcel is certified.	1353	0.7901	0.4074	0	1
Kebele	Village location of parcel equals 1 if parcel is located in Amanuel; 2=Debre Elias; 3=Kebi; 4=Wolkite; 5=Telma; 6=Sekla Debir; 7=Kete; 8=Godguadit; 9=Amba Mariam; 10=Yamed; 11=Aaddis Mender; 12=Chorisa; 13=Indod Ber; 14=Addis Gulit	1353	8.2639	3.7773	1	14
Parcel size	Total parcel size belonging to household (hectares)	1343	0.1066	0.7117	0.0000	7.1302
Parcel quality	1=fertile; 2=medium-fertile; 3=infertile	1351	1.4759	0.6616	1	3
Parcel slope	1=flat; 2=medium; 3=steep	1351	1.2939	0.5553	1	3
Share of rented-out parcels	Proportion total parcel area in hectares that is rented-out by the household	1353	0.4455	0.4516	0	1
Sex	Sex of household head: 0=male, 1=female	1353	1.0000	0.0000	1	1
Age	Age of household head	1337	53.2610	14.1470	20	92
Years of schooling	Years of schooling of household head	1336	0.4042	1.6964	0	14
Number of prime-age males	Number of prime age (15-45 years old) males in the household	1353	1.2454	1.1875	0	5
Number of bulls/oxen	Average number of bulls/oxen owned by the household	1353	0.9342	1.2257	0	6

Source: Authors' own estimation from the "Sustainble Land Use in the Ethiopian Highlands" survey.

Table E.4: **Determinants of new/additional SWC investment – linear probability model estimation with actual parcel certification status variable**

	Parcels from Male and Female Headed Households	Parcels from Male Headed Households	Parcels from Female Headed Households
	(1)	(2)	(3)
Certification Status	0.102***	0.099***	0.058
	(0.025)	(0.030)	(0.044)
Parcel size	-0.009	0.003	-0.007
	(0.015)	(0.027)	(0.015)
Medium parcel quality	-0.062***	-0.075***	-0.046*
	(0.014)	(0.016)	(0.026)
Infertile parcel quality	-0.009	-0.030	0.069
	(0.021)	(0.024)	(0.049)
Medium parcel slope	-0.020	-0.011	-0.052*
	(0.014)	(0.016)	(0.028)
Steep parcel slope	-0.005	0.012	-0.096*
	(0.027)	(0.031)	(0.050)
Age	-0.001**	-0.001*	-0.001
	(0.000)	(0.001)	(0.001)
Sex	-0.061***	---	---
	(0.017)		
Years of schooling	0.002	0.002	0.007
	(0.002)	(0.003)	(0.007)
Number of bulls/oxen	0.008	0.008	-0.019
	(0.006)	(0.006)	(0.012)
Number of prime-age males	-0.004	-0.009	0.036***
	(0.006)	(0.007)	(0.012)
Kebele FE	Yes	Yes	Yes
N	3903	3184	719
Pseudo R Squared	0.0193	0.0145	0.0358

Standard error in parentheses, and clustered at the household level

* p<0.1, ** p<0.05, *** p<0.01

Table E.5: **Determinants of SWC maintenance – linear probability model estimation with actual parcel certification status variable**

	Parcels from Male and Female Headed Households	Parcels from Male Headed Households	Parcels from Female Headed Households
	(1)	(2)	(3)
Certification Status	0.148***	0.168***	0.078**
	(0.018)	(0.021)	(0.038)
Parcel size	-0.014	-0.029*	0.005
	(0.011)	(0.016)	(0.016)
Medium parcel quality	-0.011	-0.010	0.007
	(0.011)	(0.012)	(0.026)
Infertile parcel quality	-0.031*	-0.024	-0.050
	(0.016)	(0.017)	(0.043)
Medium parcel slope	0.121***	0.122***	0.106***
	(0.012)	(0.013)	(0.029)
Steep parcel slope	0.104***	0.110***	0.052
	(0.022)	(0.024)	(0.053)
Age	-0.001***	-0.001*	-0.003***
	(0.000)	(0.000)	(0.001)
Sex	-0.067***		
	(0.013)		
Years of schooling	-0.003	-0.002	-0.009
	(0.002)	(0.002)	(0.007)
Number of bulls/oxen	0.008**	0.007*	0.034***
	(0.004)	(0.004)	(0.011)
Number of prime-age males	0.004	-0.004	0.027**
	(0.004)	(0.005)	(0.011)
Kebele FE	Yes	Yes	Yes
N	7628	6326	1302
Pseudo R Squared	0.0317	0.0276	0.0460

Standard error in parentheses, and clustered at the household level

* p<0.1, ** p<0.05, *** p<0.01