LAND REGISTRATION AND LAND INVESTMENT: THE CASE OF TIGRAY REGION, NORTHERN ETHIOPIA

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Abstract

The study explored whether land titling fostered tenure security and, thereby, increased investment on land improvement. We assessed the determinants of the probability and intensity of investment by using random effects and modified random effects probit and truncated regression models on 437 randomly selected households operating 1696 plots from eighteen selected communities (tabias) located in the five zones of the Tigray Region. Findings indicated that registration enhanced holders' feeling of tenure security, there was significant increase in probability and composition of investments, and increased private initiatives. The likelihood and the intensity of conservation were low on land lost in the last redistribution or taken away by the public for different purposes. Length of tenure, initial investment, and access to food-for-work positively influenced the likelihood and intensity of conservation. Households with more livestock, land holding and adult male labor (although significant only in the random effects probit and at 10 percent level) were found to be more likely to make investments on land. Moreover, the intensity of investment was significantly influenced by the year of registration. Finally, households operating rented-in land were found to be less likely to and invested less indicating that tenants commit fewer resources to long-term investments because they strive to maximize immediate benefits. There were various time invariant household and plot level characteristics that influenced the probability and intensity of conservation. This calls for policy makers to minimize the potential sources of insecurity such as threats of future land redistribution and land taking without proper land compensation. Moreover, land registration/certification is vital for creating tenure security; this has to out scaled throughout the country.

Key words: titling, tenure security, conservation investment, random effects model; Ethiopia, Africa.

JEL Classification: C23, C.24, D13, D23.

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1. Introduction

Land is one of the most critical assets to the livelihood of farming households in developing countries. In Ethiopia, until recently, rural households' access to land was met through regular government sponsored land redistribution and informal land transactions. Formal land sales have been prohibited during the last three decades or more. This is because land is declared the property of the state; it may not be sold or mortgaged. Peasants and pastoralists have only user rights (Rahmato, 1992; FDRE, 1995; Joireman, 2001).

The land issue has a strong bearing on a wide range of issues and policy concerns, including agricultural development, food security, natural resource management, poverty reduction and even human rights (Feder and Nishio, 1999; Rahmato, 2003; Deininger and Chamorro, 2004). In Ethiopia, while there is still policy debate on the choice of ownership type, there is a move in the policy realm to give rural land users a title of 'ownership', in short title, by issuing user certificates, to the land they received during the last land redistribution or through inheritance from close kins. One such case is the process that unfolded in Tigray Regional National State, northern Ethiopia after 1997. The regional Government of the Tigray undertook land inventory and registered all rural lands before issuing title certificates. This process continued later on in areas where land registration took place (e.g. in the recent resettlement areas) and to other people who obtained land recently through partial community redistribution processes.

Titling through land registration is widely believed to improve efficiency of land use and agricultural production by increasing farmers' incentives to adopt new technology, on-farm investment and soil conservation practices (Feder and Nishio, 1999; Rahmato, 2004). The government of Ethiopia (GoE) aims to boost farmers' sense of security, which, in turn, is expected to encourage investment on erosion-reducing and land quality enhancing technologies (FDRE, 2005a).It is also possible that the GoE's policy measures might have triggered other outcomes, intended or otherwise. The expected changes associated with land registration could be the development of land and credit markets. This case provides, hence, an important study for drawing important policy lessons on the impacts of land registration/certification on on-farm investment.

There is an on-going discussion about the differentiated effects of land registration/certification may have on tenure security and labor-intensive land

conservation investment. The evidence so far is mixed. There are evidences from Asia and elsewhere that indicates that such government sponsored titling enhances tenure security (Feder et al., 1988; Binswanger, 1996; Firmin-Sellers and Sellers, 1999). On the other hand, there are evidences, especially from Africa, that call against land registration and tilting as the cost of land registration is quite high, and the effect of land registration is contrary to expectations (Atwood, 1990; Place and Mighot-Adholla, 1998; Jacoby and Minten, 2007).

The study by Holden et al., (2007) assessed the impact of registration/titling on the functioning of land markets and their results revealed that the land reform contributed to increased land rental market participation. However, there exist no previous studies that have attempted to quantify the impacts of registration on tenure security and land investment or crop productivity.

This study, which is the first of its kind in the region explores whether exogenous registration and certification improved land users' feeling of security and whether land investment increased after certification. The study utilizes data from 437 randomly selected households operating 1696 plots collected from eighteen selected communities (*tabias*) located in the five zones of the Tigray Regional National State in 2004/05. In the survey, we tried to capture investments made before and after registration to assess whether there was significant increase in long-term land investment after the registration. Once this was established, we explained the probability and intensity of investment after registration by controlling for covariates using probit and truncated regression random effects models. The dependent variable of intensity of investment is measured by the length (in meters) of conservation investments, which may lead to measurement error[2], especially in the light of changes in type of conservation measures. We used a modified random effects model framework proposed by Mundlak (1978), whereby we included on the right-hand side of each equation the mean value of plot varying explanatory variables. The effect of certification is estimated by the inclusion of the year of registration/certification in the model and relies on sufficient variation in this variable (Deininger and Chamorro, 2004).

The paper is outlined as follows: in part 2 we present a short description of the process of land registration and certification followed by presentation of a simple conceptual

[2]A measurement error on the dependent variable does not destroy the unbiasedness property of the estimators but the standard errors (variances) of the estimated coefficients could be higher (Verbeek, 2000).

framework to understand the effect of land registration on tenure security and land investment. In section three we present the empirical model and the methods of estimation. Sections 4 and 5 present the study sites and sampling strategy employed and the empirical findings respectively. The final part concludes by summarizing the findings and drawing relevant policy conclusions.

2. Background and Process of Land Certification in Tigray

The land tenure system in Ethiopia has been substantially affected by past and current government policies (Rahmato, 1992; Joireman, 2001; EEA/EEPRI, 2002; Teklu, 2003). Land is declared the property of the state; hence, it may not be sold or mortgaged. Peasants and pastoralists have only user rights. Holding rights are defined in the Federal Constitution of Ethiopia as "the right any peasant shall have to use rura11and for agricultura1 purposes as well as to lease and, while the right remains in effect, bequeath it to his family member; and includes the right to acquire property thereon, by his labor or capita1, and to sell, exchange and bequeath [the] same" (FDRE, 1995 Art 2 Sub Art. 3). Art. 51 of the constitution states that the Federal Government shall enact laws for the utilization and conservation of land and other natura1 resources (FDRE, 1995). Art. 52 also states, that Regional Governments have the duty to administer land and other natura1 resources according to Federa1 laws and on behalf of the same (FDRE, 1995). A law was enacted in July 1997 on "Rura1 Land Administration Proclamation, No. 89/1997" that vested Regiona1 Governments with the power of land administration (defined as "the assignment of holding rights and the execution of distribution of holdings"[3] (FDRE, 1997 Art. 2.6). The Federal land policy states that farmers have a perpetual use right on their agricultural holdings, and that this right will be strengthened by issuing certificates and keeping registers (FDRE, 1997a; Deininger *et al.*, 2006).

A new land policy enacted in the Tigray Regional State in 1997[4], and subsequently revised three times, prohibited further redistribution, except in few cases, as indicated below. By prohibiting further land redistribution, the policy hopes to end further land fragmentation. The 1997 and subsequent laws also formalized land-lease practices

[3] The latest Federal legislation on land administration and use, proclamation No. 456/2005, also calls for regional states to come up with proclamations and regulations to implement the federal proclamation.

[4] This first law follows the spirit of the 1997 Federal Rural Land Administration Proclamation while the latest one Proclamation No. 136, 2007 follows the spirit of Federal legislations No 455/2005 and 456/2005.

among farmers and between farmers and investors with contracts up to three years if the leaser uses traditional technology and up to 20 years if he/she uses modern technology. However, the definition of use of "modern technology" was left to be decided by the regional guideline. The policies also triggered the process of registration and certification of holdings of users. In line with the provisions of the constitution, the land polices granted holders use rights, rights to bequeath, and rights to rent land. In the spirit of this legal provision, the Tigray Regional State undertook land inventory surveys and issued use-right certificates to current users (Hagos *et al.*, 1999) starting 1998. By doing so the regional government hoped to boost farmers' sense of ownership or land security and encourage investment on erosion reducing and landing quality enhancing technologies without the state losing its right of ownership to land. Lately, different regional governments in Ethiopia, namely, Amhara and Oromia, have also initiated a process of land registration and certification (Deininger *et al.*, 2006: p. 5).

The latest land policy also outlines obligations of the land users: not to cut trees on farm, protect plot boundaries, undertake soil and water conservation measures and plant trees, among others. Failing to do so could lead upto withdrawal of the household's holding rights (FDRE, 2005a; RNST, 2007: p. 10), which is contrary to tenure security per se. The policy also provides guarantees to land users against expropriation without proper compensation (FDRE, 2005b) and is expected to increase farmers' incentives to make long-term land investments.

The aim of this study is to assess the impact of land registration and certification undertaken in Tigray Regional State after 1997.

The process of land registration and certification in Tigray Regional State, the problems faced, people's attitude on the registration and institutions involved is well documented by Haile *et al.*, (2005) and Deininger *et al.*, (2007). We present a brief description of the last land redistribution, registration and certification in Tigray Regional State so that we understand the context under which this took place. Most of the cultivated land had been redistributed for the last time in Tigray Regional State between 1989 and 1991 although exact dates vary a bit from place to place. By the time of the last distribution, most people, even many of those who had lost land, said they thought a fair distribution had been achieved (Haile *et al.*, 2005). Land distributions have (with a few exceptions) only occurred – to date – when 1) a new micro-dam created newly irrigated land and the existing land holdings were reduced and distributed; 2) when people abandoned

land (e.g., left their village for more than 2 years) or died without "legal heirs"[5] and the land returned to the *tabiabaito* (local village government) for distribution; or 3) when some government improvement or infrastructure development (e.g., roads) cause land to be taken away rendering compensation necessary. Otherwise, the vast majority of land holdings have not changed hands since about 1991 in Tigray Regional. Nonetheless, farm households still expect future land redistribution even if it is ruled out in the current land policy.

It is roughly twenty years since the last redistribution, most of the children under eighteen at that time have come of age but have not received land. This probably accounts for something like half to two-thirds of adults today. Some have received land through inheritance but due to high population growth rate and prohibitions against further fragmentation of land, most have not obtained land of their own. The problem of landless youth is today one of the growing problems in Ethiopia (EEA, 2007) in general and Tigray Regional National State in particular and is becoming a cause of growing tenure insecurity.

Registration and certification of most cultivated land was completed in Tigray Regional State between 1996 and 1998 and appears not to have changed the size of holdings. The registration of cultivated land had been preceded for seven or eight years by fairly strong and clear policy statements that there would not be any further land distributions in the foreseeable future. So, existing landholdings were simply registered. For each household the plots of cultivated land held by the household (whether brought to it through marriage or given in the last distribution or a more recent distribution) were recorded in *Tigrigna*, the local language, by hand in ink on a pre-printed page in a record book at the *tabia* office, with each page listing each parcel of land held by the household. The approximate size of each plot (in *tsimdi*, a local unit of measure that is the amount of land that can be cultivated in one day using oxen plough and averages about 0.25 hectares), the type of land of each plot (poor, medium, and fertile) is registered. The record book describes each plot only by the local area name or a geographical marker and the names of the neighbouring landholders on the north, south, east and west sides are registered. In addition, the family size is registered. The certificate was typically issued in the name of the household head, who in most cases is male. The certificate is nearly identical in form and content to the registration book

[5] The Tigray land law excludes some heirs allowed by the Civil Code, e.g., those with another source of income.

page and is also written in ink on a pre-printed form in the local language; that is Tigrigna in all of our sites.

In most cases "technicians" worked together with the local Agricultural Development Agent and community members (usually men who had been involved in the last land distribution), performed a study of land ownership and recorded the land details on a pre-printed form. In almost all cases these findings of the study were then reviewed publicly with the landholders. In some cases landholders were involved in the study of their land.

This procedure is commonly described as low cost registration.

3. Conceptual Framework

The notion that the greater tenure security accorded by possession of registered land title will be associated with higher levels of investment is a key element in the literature (Feder *et al.*, 1986; Feder *et al.*, 1988) and the relationship between possession of title and higher levels of land-attached investments has been confirmed (Binswanger, 1996; Deininger and Chamorro, 2004) although there are also evidences of weak or non-existent land-attached investments in spite of land titling (Atwood, 1990; Mighot-Adholla *et al.*, 1991; Carter *et al.*, 1991; Roth *et al.*, 1994; and Place and Mighot-Adholla,1998).

From the literature (Feder *et al.*, 1986; Feder *et al.*, 1988; Besley, 1995; Feder and Nishio, 1999; Deininger and Chamorro, 2004) secure property rights in land are generally considered to be a precondition for economic growth and development for three reasons: (i) land titles have positive effect on land tenure security and provide investment incentives for owners to undertake land-related investments; (ii) land titling reduces the transaction costs in land markets thus helping decrease cost and increase allocative efficiency; and (iii) formal land titles improve access to institutional credit by creating collateral value for land. We briefly outline each of these linkages and put it together into a schematized graph in Figure 1 below.

Land tenure security, which accrues from land registration/certification, removes uncertainties on whether or not land owners can reap the benefits from any long-term investment they make such as on-farm soil and water conservation, water harvesting structures and trees. With positive expectations about the exclusive enjoyment of any

returns earned from investment, landowners develop interest in investing in land improvements as well as making land-based investments in agriculture. This boosts demand for investment which in turn increases demand for complementary inputs including labour and agricultural inputs (including capital). There are empirical evidences in support of the positive impact of land registration on investment (see Feder et al., 1986; Feder *et al.*, 1988; Binswanger, 1996; Feder and Nishio 1998; Firmin-Sellers and Sellers, 1999; Deininger and Chamorro, 2004).

Land registration provides the necessary information to overcome the asymmetries in information available between two contracting parties to a land transaction. Consequently, land registration plays an important role in reducing land transaction costs and thereby raising the efficiency of any planned investment. This may enhance efficiency in land use by creating a market in land and/or increases market efficiency, thereby enabling property rights in land to move from less efficient to more efficient users of land. There is emerging evidence that land registration contributed to increased land rental market participation in Ethiopia (Holden *et al.*, 2007).

Land titles are associated with collateral in the following way: when borrowers apply for loans, land titles are often pledged as collateral. The pledging of titles as collateral, accompanied by registration of mortgage transactions, helps to overcome the problem of asymmetric information and the related incentive problems of moral hazard and adverse selection. These collateral arrangements are crucial for lending institutions and the credit market because they partly or fully shift the risk of loan loss from the lenders to the borrowers since a default on the loan would trigger the loss of collateral to the borrower. A combination of an increase in investment demand and credit supply associated with land registration leads to more investment, greater use of variable inputs, higher output per unit land area, greater income and higher land values.

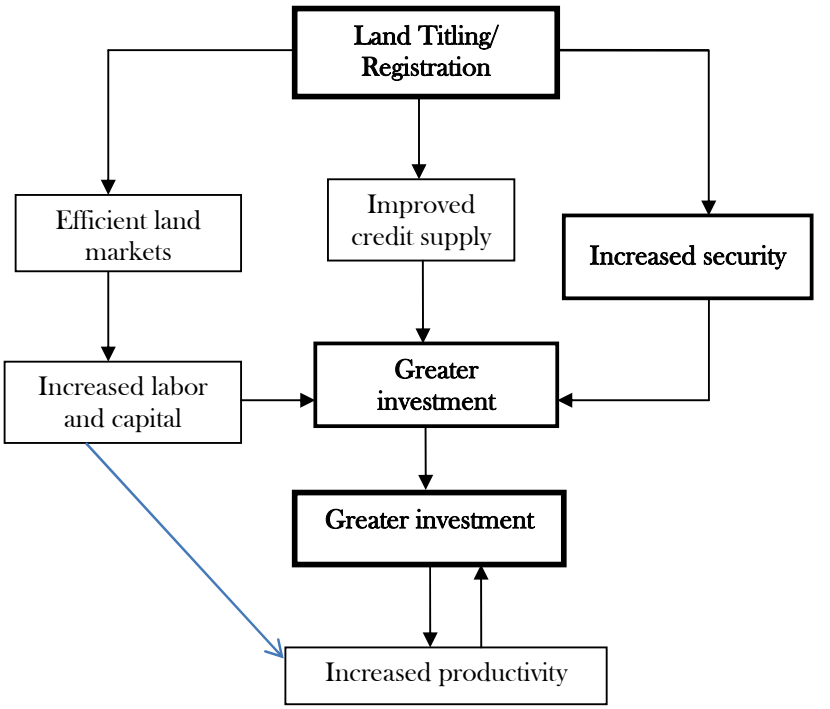
Evidence from Asia and Latin America suggests that formalizing land ownership, through registration and titling, can deliver large productivity gains. Feder and Nishio (1998) found that land registration led to higher land values in Thailand, Philippines, Indonesia, Honduras, Brazil and Peru. Carter and Olinto (2003) found that farmers in Paraguay have a positive investment demand effect.

On the other hand, evidences from Africa have found hardly any linkage between land titling and better credit market performance(Roth *et al.*, 1994).Cross-sectional data from Ghana, Kenya and Rwanda on the incidence of land improvements and on land

yields provide little support for the view that limitations under indigenous law on the right to transfer land are a constraint on productivity (Mighot-Adholla *et al.*, 1991) underlying that indigenous tenure systems may be preferable to improvements in tenure regimes through land registration. Recently Jacoby and Minten (2007) reported that, in Madagascar, having a title has no significant effect on plot-specific investment and correspondingly little effect on land productivity and land values. Results from Kenya also indicate that land registration and titling had weak impacts on perceived land rights of farmers, credit use and terms, crop yields, or concentration of land holdings (Place and Mighot-Adholla,1998).

Based on the reviews made on both theoretical and empirical literature, the study develops the following conceptual framework, which explicates the interaction(s) among variables of interest.

Figure 1: Conceptual framework on the effect of registration and land tilting on land related investment:



Source: Modified version of Feder et al., 1988

In this paper, we focused on the land tenure security and investment incentive effects instead of the land title, collateral and credit linkages because foreclosure of land is not within the law in Ethiopia because land is not used as collateral to access formal credit markets by smallholder farmers, but commercial farmers do so, while livestock or other property may be confiscated for indebted people. The land markets, transactions and efficiency linkages of land registration/titling in Ethiopia has been assessed by Holden *et al.*, (2007) by exploring on the functioning of land markets and market participation before and after registration. This paper intends to explore if land registration/certification has led to improved tenure security and whether this is translated to increased investment in land conservation, the so-called land tenure security and investment incentives effect, by focusing on the case study from Ethiopia. Furthermore, we identify the most important determinants of land conservation investment by smallholder farmers in northern Ethiopia.

4. Empirical Model and Econometric Approaches

Availability of data on investment before and after titling allowed estimating if there is a significant difference in the likelihood and level of investment which in turn enables us to capture the impact of land registration and certification on land-related investments before and after titling. We could have explained differences in investment before and after (see Deininger and Chamorro, 2004), if (1) the same households have been observed before and after registration, (2) it is possible to run a household fixed effects model. The later required adequate variation in plot level variables and year of registration/certification within the same household, which was hardly the case here. We, hence, used a random effects probit and truncated regression models to identify determinants of probability and intensity of investment. We also tried a modified random effects model as suggested by Mundalk (1987).The tobit model imposes a structure that is often too restrictive: exactly the same variables affecting the probability of adoption determine the level (intensity) of adoption and with the same sign (Verbeek, 2000). This is not a realistic assumption. We, thus, used the truncated regression model by taking only the positive values of levels of adoption to relax this restriction and identify the determinants of intensity of investment.

The approach we took is as follows. We established whether there was significant difference in the likelihood and level of investment (by type) using simple mean separation tests (t-test and X^2/ Z-tests). Next we explained the determinants of

probability of investment and level of investment using maximum likelihood estimation techniques.

Let the amount of conservation made on farm plot by a household i be given by:

$$y_i = x_1\beta_1 + \mu_1 \quad (1)$$

where y_i is the length of conservation structures per land area that is expected to depend on the vector x_1 regressors. y_i is non-continuous variable which is censored from below. We assumed that the level of investment made by each household on each plot is a result of rational decision. We used the physical measures of land-related investment that were made after registration. The measures include stone and soil bunds, terraces, tree planting, gully stabilization measures and water harvesting structures, among others. We regress the level of investment on set of covariates x_1 such as initial status of investment, year of registration[6], whether all plots were certified, a vector of household characteristics and resource endowments,, whether the households lost land because of past land redistribution and/or land taking, and a vector of time invariant plot characteristics such as tenure regime and observable plot characteristics such as soil type, slope, topography, soil fertility and susceptibility to erosion (using a subjective measure) and plot distance from homestead and other household characteristics such as age, sex of the household head and education of the head to obtain an estimate of the impact of an exogenous change in land rights on investment. We also controlled for household level asset holdings (land area, labor, livestock holding, and household's cash situation) and village level factors such as distance to market and agro ecology.

The participation equation, whether the household decides to invest or not, is given by:

$$y_2 = 1[x\delta_2 + v_2 > 0] \quad (2)$$

[6] Households do not get holding certificates automatically once their land is registered; there is a need to control both for registration and certification, even if they could be correlated.

where (x, y_2) are always observed whereas y_i (in eq. 1)is observed only when $y_2 = 1$. We assume that (u_1, v_2) is independent of x with mean zero implying that x is exogenous, and $v_2 \sim N(0,1)$. We used the same set of explanatory variables in equation (2) and in equation (1). Equations (1) and (2) are usually estimated using random effects probit and tobit regression models[7].

Random effects model estimators are consistent only under the assumption that the unobserved heterogeneity is uncorrelated with the observable explanatory variables. To obtain consistent estimates of the effects of registration/certification, we need to control for unobserved heterogeneity that may be correlated with observed explanatory variables. One way to do that is to exploit the panel nature of our data set (repeated cross-sectional plot observations per household). We used a modified random effects model framework proposed by Mundlak (1978), whereby we included on the right-hand side of each equation the mean values of plot varying explanatory variables. The rationale for including the mean values of plot varying explanatory variables as right hand side variables is to check if the unobserved heterogeneity that influence decisions are somewhat related to the observables (For a similar approach see Kassie *et al.*, 2008). In this case let, the model is given as:

$$y_i = x_1\beta_1 + \upsilon_h + \mu_1, \qquad (3)$$

where υ_h captures the unobserved household characteristics that affect household's decision to invest in land conservation. Assuming that the unobserved effects υ_h are linearly correlated with some of the observed explanatory variables,

$$\upsilon_h = \bar{x}\gamma + \eta_h, \eta_h \sim iid\left(0, \sigma_\eta^2\right) \qquad (4)$$

where $\bar{x}$ is the mean of plot-varying explanatory variables within each household, γ is the corresponding vector of coefficients, and η is the random error term uncorrelated with the $\bar{x}$'s. In our case, it is important to include average plot characteristics such as average soil quality, plot size, depth, slope, and the average size of initial investments,

[7]Heckman's selection model was not used because the presence of selection bias was not accepted (p-value 0.397). The results are not reported here.

which may have greater impact on adoption decisions. The vector γ will be equal to zero if the unobserved explanatory variables are uncorrelated with the random effects. For sake of comparison, we report results from the random and modified random effects models in this paper.

5. Study Site and Data Description

The study is based on a cross sectional data covering 437 randomly selected households, operating about 1695[8] plots gathered in June-Sept. 2005[9] in Tigray, northern Ethiopia. The survey covered 18 villages (tabias), four tabias strategically selected from each of the three zones (central, eastern, and southern) and 5 from the North Western and 1 from Western zones[10]. The last two tabias (1 each from Western and North Western) were purposively selected from the low land areas recently affected by the on-going human resettlement program to explore the effects of resettlement on tenure security and land investment. The selection of the 16 communities was based on stratification of differences in distance to market, agricultural potential conditions (due to variations in altitude and rainfall variability), population density and presence of irrigation projects (Hagos and Holden, 2006). The study assessed farmers' perception of land registration/certification, and its impacts, and the magnitude and quality of conservation investments made on farm through private initiative and/or public-led programs between before and after registration. The data gathered a host of household related variables as well as plot level data on the plots' biophysical features, including production and input use data, which are used for statistical analysis as reported in the subsequent sections.

6. Results and Discussion

Although land registration started in 1998, land registration and certification was still going on during the survey period (2004-2005) in some areas. This is especially the case in the lowland resettlement areas of the region. About 80 percent of the plots were registered during 1998-99. In the registration process it was found that about 96 percent

[8] There were some missing values in some observations of the data. We used only 1439 observations in the probit model.

[9] Although the data is relatively old, there is no radical land policy shift so far. The current issue is whether registration can be high cost (e.g. geo-information and cadastral survey based) instead of low cost.

[10] There have been recent changes in the boundary and number of zones in the region. The former Western zone is subdivided into North Western and Western zones.

of the plots were registered (only 4 percent indicated as not registered) and the demarcation process was also made both on paper and on the ground. In the registration process, it was found that in about 14 percent of the plots there was a change of boundary and about 8 percent of the plots were registered to somebody other than the owner. In about 13 percent of the plots there was dispute with a neighbour during the registration and demarcation of the boundaries. It was also found that about 14 percent of the plots are not certified. Title certificates were given to the household head (99.3 percent).

From the results of the survey, we found that there were households who received land through land redistribution up until 2005. The bulk of the plots (about 80 percent), however, were allotted to the current holders before 1991/92. During these redistributions about 31 percent of the households claim to have lost land while 69 percent did not. About 39 percent of the households believed that there will be future land redistribution even if land redistribution is ruled out by law (against 61 percent that did not expect land redistribution). As a consequence households expect that they will lose land due to redistribution. About 44 percent of the respondents who expect land redistribution believed that they will lose land against 56 percent who believed that they will not lose land. The major reasons for fearing future land redistributions included increasing population size, landlessness and too small land holding. Those who do not fear to lose land in a future land redistribution expect to get more land (7.2 percent), or at least would get their share (6.4 percent), or have landless member (3 percent) and they hoped will get an additional land from a redistribution. Of those who do not expect future land redistribution, only about 5.7 percent of the households indicated that there will not be further redistribution as it is prohibited by law and titles have already been issued and about 1 percent believed that resettlement is reducing pressure on further redistribution. Furthermore, 18 percent of the households also reported land takings for various reasons by the government (against 82percent who reported no land takings) and about 43 percent of those who lost land reported to have received compensation. In nutshell, non-negligible proportions of the households are apprehensive about or keen to see of future land redistributions perhaps indicating that the feeling of tenure insecurity is pervasive even after the land registration/certification although the latest law, as indicated, does not absolutely promote tenure security.

Table 1: Description and summary of important variables (n= 1695)

Variable name	Description	Mean
Latest redistribution	Proportion of land redistributed until 1991	0.79
Registration	Whether land is register or not (dummy)	0.96
Certification	Whether land is certified or not (dummy)	0.86
Change of boundary	Change of boundary during registration (dummy)	0.14
Registered to somebody	Plots were registered to somebody other than the owner (dummy)	0.08
Dispute	dispute with a neighbour during the registration (dummy)	0.13
Lost land	lost land during the latest land redistribution (dummy)	0.31
Future land redistribution	Expect future land redistribution (dummy)	0.39
Future land taking	Expect future land taking (dummy)	0.26
Will lose land	will lose land in future redistribution (dummy)	0.44
Land takings	Land takings by government after registration (dummy)	0.18
Compensation	Received compensation after land taking (dummy)	0.43
Access to formal credit market	Increased access to formal credit market because of land registration (dummy)	0.18
Access to informal credit market	Increased access to informal credit market because of land registration (dummy)	0.21
Temporary sell	Temporary transfer through sell (dummy)	0.10
Permanent sell	Permanent transfer through sell (dummy)	0.01
Tenure security	More secure because of land registration (dummy)	0.77
Tenure regime: owner operated	Proportion of owner-operated plots	0.75
Tenure regime: rented-in	Proportion of rented in plots	0.14
Tenure regime: rented-out	Proportion of rented-out plots	0.11
Conserved before	Proportion of plots conserved before registration (dummy)	0.34
Conserved after	Proportion of plots conserved after registration (dummy)	0.42
Conservation by holders before	Conservation by holders before registration (dummy)	0.52
Conservation through public programs before	Conservation through public programs before registration (dummy)	0.48
Conservation by holders after	Conservation by holders after registration (dummy)	0.66
Conservation through public programs after	Conservation through public programs after registration (dummy)	0.44

Comparison of important variables between those who invest and did not invest

Variable name	Description	Invest		Not invest	
		Mean	SD	Mean	SD
Labour endowment (adult male)	Average number of male adults	1.74	1.28	1.56	1.23
Land holding	Average parcel area	1.26	1.39	1.75	2.80
Livestock (oxen)	Average oxen holding	1.16	1.19	1.16	1.13
Credit access	Average farm loan size (in ETB)	4763.3	43107.0	3222.1	36280.6
Distance	Average distance (in min)	19.4	27.2	35.01	61.53

Source: 2004/05 survey.

When asked about the benefits of land registration, about 18 percent of the households perceived that land after certification can be used to access formal capital markets and slightly higher (21percent) to access informal credit markets. About 10 percent also believe that they can temporarily sell it against about 1 percent of the households who perceived that they can permanently sell their land, although the law stipulates differently.

Increased tenure security seems to have been also one of the most important benefits of land registration/certification. About 77 percent of the households believed that they feel more secure about their holding rights after registration. Nonetheless, a non-negligible portion of the households feel insecurity of tenure even after the land registration/certification.

Furthermore, be that as it may, whether this increased feeling of tenure security is translated into actual changes in behaviour is another main interest of this paper. The results show that about 34 percent of the plots were conserved before the registration as compared to 42 percent of the plots after the registration. Hence, there is a slight increase in the number of plots conserved after the registration. The dominant types of land investment, before registration, include establishment of stone terraces followed by soil bunds, gully control, tree planting and other conservation investments on 24, 11, 2, 2 and 5 percent of the plots respectively. Soil bunds and terraces remained dominant conservation structures established by farmers on their plots after registration both accounting for 26 and 14 percent of the plots. Gully stabilization (3 percent) and tree planting (2.4 percent) remain important as well. However, there are new introduction to land investment, most notably construction of water harvesting structures (3.3 percent) such as ponds and wells, since recently.

Before registration, about 52 percent of the investments were made by owners themselves and tenants, and 48 percent by public programs both mass mobilization and Cash/Food-For-Work programs (C/FFW). After registration, about 66 percent of the investments were made by owners themselves and tenants (i.e. who rent-in land), and 44 percent by public programs, both mass mobilization and C/FFW programs indicating an increase in private investment while public investments have also showed a decline.

In the resettlement areas, new settlers occupy about 4 percent of the plots of which nearly 80 percent are registered and certified. About 20 percent of the households expect that there will be further settlers in the future triggering fear of losing more land.

About 7 percent of the households indicated that there is land related conflict in the new resettlement areas. About 27 percent believed that those conflicts are between old and new settlers. One of the major sources of land related conflict in the resettlement areas are illegal expansion of farm holdings and unequal distribution of land. About 97 percent of the respondents from the resettlement areas, however, believed that there are institutions involved in solving land related disputes.

We explored if there is a significant difference in the proportion of plots conserved by households before and after registration. The simple mean separation result reported in Table 1 indicates that there is a significant change in conservation after registration (p-value = 0.000) Likewise, as to whether there is a significant difference in private investment before and after registration, the results indicated that there is a significant increased in private investment after registration(p-value = 0.000).

It is interesting to look at the changes in composition of investment before and after registration. From the mean separation tests, we gathered that while the proportion of stone terraces remains the same, soil bunds and other conservation measures have changed significantly (see Table 2).

We also conducted a mean separation test on the changes in levels of investment made both in terms of the level of physical measures and labour man days used for conservation. Both tests show that there are no statistically significant differences in levels of investment before and after registration, although the mean level is higher after registration. The measurement problem, as indicated earlier and the change in composition could be a reason for lack of difference in the level of investment. We can, hence, conclude that although there is significant increase in likelihood of making investment on land, the intensity remains the same. But this is unconditional mean; we did not control for the effect of other covariates.

Table 2: Mean proportion/separation tests (n= 1695)

Variables	Mean proportion		Difference	X^2/Z/t-test
	Before	After	(p-value)	(p-value)
Proportion of conserved plots	0.335(0.011)	0.415 (0.01)	-0.076 (0.016)	-4.62 (0.000)
Proportion of private investment	0.18 (0.01)	0.27 (0.011)	-0.093 (0.01)	-6.49 (0.000)
Proportion of stone terraces	0.23 (0 .010)	0.25 (0 .010)	-0.021 (0 .015)	-1.45(0.145)
Proportion of soil bunds	0.105 (0.01)	0.138 (0.01)	-0.033 (0 .011)	-2.95 (0.003)
Proportion of other conservation investments	0.046 (0.005)	0.08 (0.006)	-0.034 (0.008)	-4.14 (0.000)
Level of investment (length of conservation measures in meters)	22.9 (2.08)	25.6 (3.73)	-2.66 (3.57)	-0.7446 (0.456)
Level of investment (amount of labour man days)	18.83 (2.96)	16.59 (1.89)	2.23 (2.12)	1.0523(0.293)

Source: 2004/05 survey

The results of the regression analyses, probit and truncated regression random effect and modified random effects models, for the investments after registration while controlling for the level of initial investment, household and plot level covariates, and changes in policy (i.e. year of registration and whether all plots are certified) are reported below. The year of registration and whether plots are certified or not had no significant effect on the probability of investment indicating there is no difference between those who got their land registered and secured their certificate earlier on and those who didn't obtain certificates. This may imply that registration and certification may not have created the required security incentive for increased land investment. Year of last redistribution, which could be a good proxy for the duration of holding, is found to have a negative effect on land investment implying that those who obtained land during the recent land redistributions were less likely to invest on their land. In other words, households that kept their holdings longer were found to be likely to make investment compared to households that obtained land recently. Households that reported to have lost land during the last land redistribution were also found less likely to make investment on their land pointing to the disincentive effect of recurrent redistribution and the associated loss of holdings. Households operating rented in land were found to be less likely to invest on land indicating that they may want to maximize immediate benefits without committing more resources to long-term investments. This may point to incentive problems as renting duration is usually for one year or two but rarely longer. Plots located far away from the homestead are less likely to be conserved

mainly because the cost (e.g. transport costs) of making and maintaining those investments is very high. These results are also confirmed earlier results on investment in Ethiopia (Hagos and Holden, 2006).

Most interestingly, initial investment had a very significant effect on the likelihood of investment after registration. What this result indicates is that those who have been making investment earlier on are also making the investments after registration/certification. This may imply that household specific characteristics influence decision rather than registration. In other words, regardless of whether land registration or certification has taken place or not, there are households that are likely to make investments on their land. A host of factors related to asset holdings and access to labour and capital markets had significant effect on probability of investment. Households with more livestock, land holding and adult male labour (although only in the random effects probit and at 10 percent level of significance) were found to be more likely to make investments on land. Households whose average land holding is relatively larger were found to be more likely to make investments on land perhaps pointing to space requirement of the conservation technologies. But this result was significant in the modified random effects model. Furthermore, households with access to food-for-work markets were found to be more likely to invest. However, those who have obtained higher loan from formal credit organizations were less likely to invest perhaps indicating that those who access for more loan invest it somewhere else than in land investment.

Table 3: Survey probit regression

Dept. variable: Investment after registration (0/1)						
Variables	Random effects			Modified random effects model		
	Coef.	Std. Err.	Marginal effect	Coef.	Std. Err.	Marginal effect
Household characteristics						
Age of household head	-0.001	0.004	-0.001	-0.0004	0.005	-0.0001
Education of household head (literate)	0.026	0.049	0.008	0.044	0.052	0.013
Female-headed household (Reference male-headed)	0.234	0.162	0.075**	0.283	0.167*	0.092*
Asset holding						
Number of Male adults	0.060	0.042	0.018*	0.041	0.043	0.013
Number of female adults	-0.002	0.065	-0.001	-0.001	0.065	-0.0003
Livestock holding	0.047	0.031	0.014**	0.051	0.032	0.015**
Land holding	0.001	0.001	0.001	-0.014	0.004**	-0.003**
Access to FFW income	0.0004	0.0002**	0.0001***	0.0005	0.0002**	0.0001***
Amount of Farm loan taken	-0.0001	0.0001	-0.000	-0.0001	0.0001**	-0.00004**

Land policy related variables						
Last year of land redistribution	-0.069	0.017***	-0.021***	-0.071	0.018***	-0.22***
Year of registration	0.015	0.048	0.005	0.025	0.051	0.007
Lost land during last redistribution (yes)	-0.147	0.104	-0.045*	-0.150	0.106	-0.045*
Land taken after registration (yes)	-0.094	0.132	-0.028	-0.005	0.131	-0.001
Whether plot is registered (yes)	-0.257	0.345	-0.086	-0.034	0.339	-0.011
Whether plot is certified (yes)	0.199	0.193	0.058	0.250	0.203	0.072
Duration of land holding (since year)	0.005	0.007	0.001	-0.017	0.011	-0.005
Tenure form: rented-in (reference owner operated)	-0.302	0.141**	-0.086**	-0.235	0.146*	-0.068*
Tenure form: rented-out(reference owner operated)	-0.197	0.171	-0.057	0.218	0.210	0.071
Whether plot conserved before registration (yes)	1.092	0.111***	0.390***	0.761	0.123***	0.265**
Plot characteristics						
Plot area (tsimad)	0.028	0.018	0.008	-0.001	0.001	-0.0002
Distance (in minutes)	-0.005	0.002***	-0.001***	-0.007	0.002***	-0.002***
Soil type: Walka (reference Baekel)	-0.037	0.123	-0.011	-0.084	0.120	-0.025
Soil type: Sandy (reference Baekel)	-0.067	0.117	-0.020	-0.128	0.113	-0.038
Soil type: Red soil (reference Baekel)	0.069	0.1222	0.022	-0.085	0.129	-0.026
Soil type: Red soil: other (reference Baekel)	0.532	0.248**	0.189*	0.136	0.244	0.044
Soil depth: medium (reference shallow)	0.026	0.104	0.008	0.008	0.106	0.002
Soil depth: deep (reference shallow)	-0.006	0.128	-0.002	0.029	0.141	0.009
Soil slope: foothill (reference flat)	0.220	0.122**	0.071**	0.088	0.119	0.027
Soil slope: mid hill (reference flat)	0.358	0.130**	0.121***	0.147	0.157	0.047
Soil slope: steep hill (reference flat)	-0.041	0.279-	-0.012	-0.333	0.298	-0.090
Soil quality: medium (reference poor)	0.078	0.115	-0.024	-0.093	0.124	-0.028
Soil quality: good (reference poor)	0.011	0.147	0.003	0.085	0.180	-0.025
Susceptibility to erosion: medium (reference high)	0.250	0.159	0.081*	0.381	0.179**	0.126**
Susceptibility to erosion: low (reference high)	0.271	0.135**	0.087**	0.355	0.157**	0.0115**
Susceptibility to erosion: none (reference high)	0.216	0.135	0.068*	0.274	0.142**	0.087**
Village level characteristics						
Distance to woreda market	-0.0001	0.0005	-0.000	-0.0002	0.001	-0.0001
Distance to DA office	0.002	0.0002	0.000	0.002	0.003	0.001
Altitude: Midland (reference highland)	0.040	0.120	0.012	0.049	0.126	0.015
Altitude: lowland (reference highland)	-0.094	0.143	-0.028	-0.125	0.152	-0.037
Average time-invariant plot characteristics						
Average soil type	-	-	-	0.157	0.088*	0.048**
Average soil depth	-	-	-	0.015	0.127*	0.004
Average soil slope	-	-	-	0.239	0.129*	0.074**
Average soil quality	-	-	-	0.099	0.159	0.031
Average susceptibility to erosion	–	-	-	0.064	0.106	0.019
Average form of tenure	-	-	-	-0.373	0.159**	-0.115**
Average plot area	-			0.118	0.044**	0.036**
Average distance	-	-	-	0.002	0.001	0.001
Average duration of holding (in yrs)	-	-	-	0.031	0.015**	0.009**
Average probability of investment	-	-	-	0.891	0.243***	0.275***
Intercept	94.409	84.07	-	58.25	92.29	
	Number of obs = 1439			Number of obs = 1439		
	F(39, 354) = 6.56			F(49, 354) = 5.73		
	Prob> F = 0.0000			Prob> F = 0.0000		

Note: *, **, *** significant at 10, 5 and 1% respectively.
Source: 2004/05 survey

Some plot level characteristics were also found to be significant. Investment on land was significantly higher on plots that are moderately sloppy and moderately susceptible to erosion. This results show that households avoid making investments on highly susceptible and steep slopes perhaps the cost of investment are prohibitively high. The likelihood of investment increased with average soil type. Plots with soil type that deviate from Baekel (mixed sandy and loam soil) are likely to be conserved. The likelihood of investment decrease with average form of tenure: plots that are not owner-operated are less likely to be conserved. The likelihood of investment increase with average duration of holding strengthening duration of ownership increases the likelihood of land investment. Finally, the likelihood of investment increase with average probability of investment. The inclusion of time-invariant plot characteristics does not change much the results, although not a negligible number of the included variables themselves turned out to be significant, individually and jointly. We could conclude that the major results are quite robust.

Many of the results from the probit model were also confirmed in the truncated model random effects and modified random effects models. We also get new insights as many variables turned out significant in explaining levels of investment made by households. In this case, duration of holding significantly determines the level of investment made by households. Households that received land very recently were found to have made significantly lower investment than households that kept their holdings for a long time. Unlike in the probit models, intensity of investment seems to have significantly been influenced by the year of registration, i.e. level of investments has decreased as the year of registration was delayed. Households that reported to have lost land during the last land redistribution were found to have higher land investment. But those households whose land was taken away because of infrastructural development were found to have made lower investments strengthening the disincentive effect of land takings. Unlike the results in probit model, rented-in plots have higher investment. This implies that they are unlikely to be conserved but once they are selected for conservation they have higher intensity, although only in the random effects model. The influence of initial investment on the level of investment was also found to be significant and positive confirming that households to make higher investments on their land in the presence or absence of land registration. The results here strengthen that there are household levels characteristics that predispose households to carry on making land investments in the presence or absence of land policy changes. Consistent with the results in the probit model, households with access to food-for-work markets were found to be have made higher investment on land underscoring the significance of access to food-for-work in

relieving households' cash constraints and enhancing long-term investment (Holden et al, 2006; Bezu and Holden, 2004). Furthermore, household factors such as age of household head and education of head have a significant influence on the intensity of investment. In this case, households with relatively older heads, although not significant in the modified random effect model, invested less while households with better educated heads made higher investment on land underlying the importance of better human capital endowment for land investment.

From environmental and plot level variables, the level of investment made on land depends on altitude indicating agro-ecological variations in land degradation and the need for SWC. The level of investment is significantly higher in midland communities than high altitude. The level of investment also varies by soil and plot level characteristics. Accordingly, the level of investment varied by soil type, quality, depth and slope of the soil. Investments were found to be higher on relatively deeper soils than shallow soils; on relatively more fertile soils than poor soils pointing to the economic considerations of investment by farmers. Distance has also negative effect on the level of investment as we found in the probability of investment, although not significant in the intensity model. This could be understood in the light of the fact that making investments and undertaking proper maintenance on far away plots is costly. Farm lands located away from homesteads usually turn to common grazing lands during the dry season increasing the chance of destruction of conservation structures by livestock.

Table 4: Truncated random effects model

Dept. variable: Intensity of investment						
Variables	**Random effects**			**Modified random effects model**		
	Coef.	**Std. Err.**	**Marginal effect**	**Coef.**	**Std. Err.**	**Marginal effect**
Household characteristics						
Age of household head	-44.68	16.97***	-0.320***	-4.36	16.41	-0.033
Education of household head (literate)	968.77	221.03***	6.94***	787.43	216.15***	6.10***
Female-headed household (Reference male-headed)	191.95	573.89	1.37	862.89	584.36	6.68
Asset holding						
Number of Male adults	201.38	148.49	1.44	236.08	161.5	1.83
Number of female adults	109.06	246.05	0.78	68.35	259.4	0.529
Livestock holding	-278.78	126.38**	-1.99**	-29.42	115.85	-0.228
Land holding	87.67	72.77	0.62	78.17	0.835	0.606
Access to FFW income	3.632	0.789***	0.026***	2.518	0.762***	0.019***
Amount of Farm loan taken			-0.001	-0.093	0.278	-0.0007

Land policy related variables						
Last year of land redistribution	-239.14	112.69**	-1.71**	-191.06	114.05*	-1.481
Year of registration	-829.21	304.05***	-5.93***	-818.13	111.5***	-6.341***
Lost land during last redistribution (yes)	1648.92	466.55***	11.81***	2063.8	513.5***	15.998***
Land taken after registration (yes)	-2213.40	668.24***	-15.85***	-1704.97	652. 85***	-13.21***
Whether plot is registered (yes)	-878.50	2025.5	-6.29	-967.56	1919.06	-7.50
Whether plot is certified (yes)	1139.19	828.11	8.15	1463.27	32.75	11.34
Duration of land holding (since year)	6.476	589.17	0.046	-84.16	32.75***	-0.652***
Tenure form: rented-in (reference owner operated)	1266.03	589.17**	9.06**	349.8	600.31	2.71
Tenure form: rented-out (reference owner operated)	297.16	709.17	2.13	-625.70	832.7	-4.84
Whether plot conserved before registration (yes)	3.522	0.734***	0.025***	1614.1	490.7***	12.51***
Plot characteristics						
Plot area (tsimad)	-341.34	236.11	-2.44	-206.82	207.8	-1.60
Distance (in minutes)	-8.824	9.639	-0.06	-5.329	8.469	-0.041
Soil type: Walka (reference Baekel)	-1878.0	576.53***	-13.45***	-2572.25	634.08***	-19.94***
Soil type: Sandy (reference Baekel)	-3055.77	649.82***	-21.88***	-1950.05	617.23***	-15.12***
Soil type: Red soil (reference Baekel)	-1278.58	579.83**	-9.16**	-1458.8	654.65**	-11.31**
Soil type: other (reference Baekel)	520.8	935.39	3.73	11.43	951.94	0.088
Soil depth: medium (reference shallow)	678.16	446.82	4.85	396.83	501.29	3.076
Soil depth: deep (reference shallow)	1813.03	586.13***	12.98***	1122.0	649.03*	8.69*
Soil slope: foothill (reference flat)	977.94	542.05*	7.00*	1019.04	503.38**	7.89**
Soil slope: mid hill (reference flat)	3225.9	652.53***	23.10***	2888.9	783.1**	22.39**
Soil slope: steep hill (reference flat)	790.34	1464.01	5.66	456.22	1390.56	3.53
Soil quality: medium (reference poor)	1333.36	581.41**	9.55**	673.08	671.46	5.217
Soil quality: good (reference poor)	2650.7	768.18***	18.98***	1712.90	920.37*	13.27*
Susceptibility to erosion: medium (reference high)	979.88	911.77	7.01	-822.43	897.98	-6.37
Susceptibility to erosion: low (reference high)	1125.28	848.54	8.06	-816.42	769.71	-6.32
Susceptibility to erosion: none (reference high)	147.37	904.90	1.05	-1873.69	917.42**	-14.52**
Village level variables						
Distance to woreda market	-0.182	2.128	-0.001	1.90	2.06	0.014
Distance to DA office	27.37	10.15***	0.0196***	23.09	8.72***	0.179***
Altitude: Midland (reference highland)	3627.9	666.89***	25.98***	2216.48	557.80***	17.181***
Altitude: lowland (reference highland)	207.01	915.33	1.48	-469.64	853.03	-3.640
Average time-invariant plot characteristics						
Average soil type	-	-	-	121.49	356.65	0.941
Average soil depth	-	-	-	331.91	512.40	2.572
Average soil slope	-	-	-	-173.56	583.94	-1.345
Average soil quality	-	-	-	715.31	744.1	5.544
Average susceptibility to erosion	-	-	-	-281.78	744.07	-2.18
Average form of tenure	-	-	-	1010.76	547.34*	7.835*
Average plot area				29.93	358.52	0.232
Average distance	-	-	-	-0.117	6.243	-0.001
Average duration of holding (in yrs)	-	-	-	65.59	61.87	0.508
Average probability of investment	-	-	-	-3845.7	1182.02***	-29.81***
Intercept	2100080	648603***	15042.2***	2031827	-	-
	Number of obs = 420					
	Wald chi2(39) = 99.48					
	Prob> chi2 = 0.0000					

Note: *, **, *** significant at 10, 5 and 1% respectively.
Source: 2004/05 survey

Contrary to our expectations, we found that investments were significantly higher by households that are located far away from the Development Agent Office, which we used as a proxy for access to extension service. Whether this is capturing the effects of access to extension service or not is difficult to tell. The intensity of investment increases with average form of tenure (not owner-operated) and decrease with average probability of investment.

7. Conclusions and recommendations

The evidence that comes out of this cross sectional study is that land registration and certification has enhanced household's feeling of security but it is not a single dominant factor that affects farmers' decision on investment. Land registration/certification is, thus, a necessary policy measure to induce positive security effects on holdings with positive effect on land investments. Yet high population growth, increasing landlessness and land takings in peri-urban settings do pose serious implication on insecurity to users.

This study also indicated that there was significant increase in probability of land investment after registration although the mean level of investment statistically remained about the same. There is also a change in the composition of investments: increased investment on trees, gully stabilization and water harvesting structures than the usual soil and water conservation measures, and increase proportion of plots conserved through private investment.

Households that kept their land holdings relatively longer were found more likely to make and have made long (more) investment compared to households that obtained land recently. Likewise, households that reported to have lost land during the last land redistribution were also found to have made lower investments strengthening the disincentive effect of insecurity caused by recurrent redistribution and the associated loss of holdings. The intensity of investment are significantly influenced by the year of registration, i.e. level of investments has decreased as the year of registration was delayed indicating the security effect induced incentive on land conservation. This underscores the need for having the feeling of tenure security for increased long-term land investment. This calls for policy makers the need to minimize the potential sources of insecurity such as threats of future land redistribution and land taking without proper land compensation. The prohibition of further distribution and the proclamation 455/97on compensation (FDRE, 2005b) is in the right direction but it

requires meticulous enforcement. Households who rented in land want to maximize immediate benefits without committing more resources to long-term investments. Accordingly, they were found to be less likely to invest on land conservation. This points to incentive problems related to renting as the duration is usually for one year or two and rarely longer. Hence, there is a need to reduce the incentive problems of land rental markets perhaps by formalizing and extending the duration of land rental rights among farmers. Initial investment had a very significant effect on the likelihood and intensity of investment after registration, the results here reinforces that there are household level characteristics that predispose households to carry on making land investments in the presence or absence of land policy changes. But there is no doubt that land registration/certification strengthens those household predispositions. This calls for the expansion of land certification to other parts of Ethiopia; but the increased effect of high-cost registration including cadastral survey on security and land investments was not the focus of this study. Furthermore, households with access to food-for-work markets were found to be more likely and have made higher investment on land underscoring the significance of access to food-for-work in relieving households' cash constraints and enhancing long-term investment. Such programs not only reduce households' vulnerability to food insecurity but also generate required resources to make long-term investments. There is, hence, a need for continued support to households in the form of food-for-work.

Finally, some time invariant environmental plot level factors such as altitude, soil type, quality and depth, distance and plot area are found to have significant effect on investment. Long-term land investment, therefore, is determined by hosts of physical, socio-economic and institutional factors that need to be taken into account in planning any such event.

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