

Research Article

Investments in farm land in Northern Ethiopia: a household-level analysis of the roles of poverty, tenure security, and conservation

Metkel Aregay Gebreeyosus^{*}, Haftu Etsay Kelebe, Teklay Negash Gebregziabher

Department of Agricultural and Resource Economics, Mekelle University, Ethiopia; P.O. Box 231

*corresponding author: zdegoseank@gmail.com

Received 6 October 2019, Accepted 20 November 2019

Abstract: There is a long-standing debate on the relationship between land-related investments and tenure security and most studies in this sense fail to reach a concrete conclusion because of their focus on one side. This paper has employed a separate analysis for short-run farm investments as represented by spending on farm inputs and long-term investments as represented by hours spent on stone bund building in an attempt to solve this problem. Two Tobit models were estimated to analyze household level determinants of land-related investment decisions by smallholder farmers in Ethiopia and its tenure security implications. The findings revealed that there is no meaningful and significant relationship between tenure security and land-related investments decisions. Poverty status, rather, was found to exert significant negative pressure on investment decisions. Productivity, livestock holding, communal conservation around plot and participation in local government activities are found to be the major determinants of land investments.

Keywords: *Ethiopia, households, land investment, tenure security, Tobit model*

To cite this article: Gebreeyosus, M.A., Kelebe, H.E. and Gebregziabher, T.N. 2020. Investments in farm land in Northern Ethiopia: a household-level analysis of the roles of poverty, tenure security, and conservation. *J. Degrade. Min. Land Manage.* 7(2): 2017-2028, DOI: 10.15243/jdmlm. 2020.072.2017.

Introduction

Land is the most important natural resource on which human kind and other species rely on since creation. Its availability has become scarce with increase in the world population. A study by Deininger et al. (2011) puts the available land estimates at a minimum of 445 million ha and a maximum of 1.7 billion ha worldwide. Population explosion and high density have changed farming practices from extensive to land saving (Boserup, 1965). The availability and costs of bringing new land into play against improvement in the productions of existing land is a debatable issue, though. Obviously, forests and grasslands can be burned; animals can be displaced and killed and the whole ecological set up might also be disturbed in addition to the huge investments (in infrastructure development, irrigation and others.) required to convert distant lands into arable ones.

The quest for land ownership has waged violence and notorious wars in every corner of the

globe throughout history. Ownership alone is, however, not enough. people strived in finding ways to improve the quality and productivity of land since the dawn of civilization. Tenure security is usually seen as the driving force for long-term investments on land (Atwood, 1990; Besley, 1995; Deininger et al., 2009; Dube and Guveya, 2013; Feder et al., 1988; Swinton and Gebremedhin, 2003; Place and Hazell, 1993; Sjaastad and Bromley, 1997; Yeboah et al., 2016) which enables farmers to reap lengthened benefits out of their efforts (Platteau, 1995; Tigistu, 2011; Twerefou et al., 2011). Investments on land are thought to have positive implications on productivity, natural and environmental resources management (Lovo, 2016; Shimelles et al., 2009) and food security (Holden and Ghebru, 2016; Shimelles et al., 2009; USAID, 2004). Farmers invest in conservation and land enhancement activities if they have some kind of assurance about their ownership of the land in concern. They are not likely to engage in land improvement activities if they are uncertain about

their tenure security (Foltz et al., 2000; Tigistu, 2011). Other studies view their findings the other way round i.e. investments on land enhances tenure security, not vice versa (for example see Akalu et al., 2016; Brassel et al., 2002; Ostuka and Place, 2001; Sjaastad and Bromley, 1997). In addition to the above contrary causations, some other studies (see for example Fenske, 2011; Holden and Yohannes, 2002; Migot-Adholla et al., 1991; Twerefou et al., 2011) have also found negligible linkages between tenure security and investment decisions by farmers. The findings on tenure

security vis-à-vis investment are mixed and inconclusive in this regard (Shädler and Gatzweiler, 2013; Trebilcock and Veel, 2008). These self-contradicting far from harmony findings are part of the motivations for this study. In assessing the determinants of land investment, one visible limitation of most of the above-mentioned studies is lack of distinction between short term and long-term land investments. A separate analysis for both types of investments is made in an attempt to fill this gap.

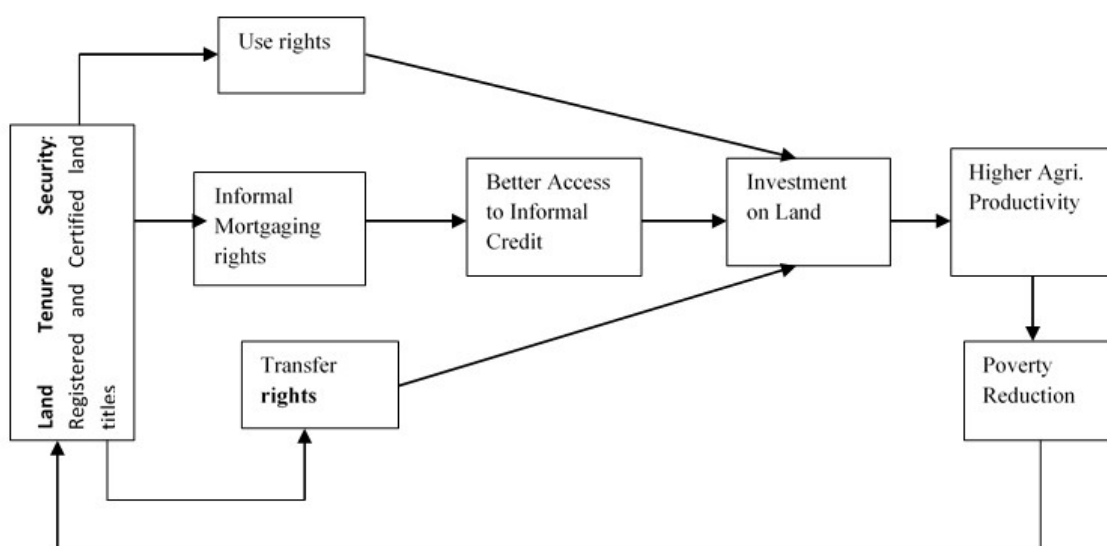


Figure 1: Conceptual framework of the study
Source: Conceptual Framework Compiled by the Authors

In addition to this, poverty status of households is included in the model as a new dimension to the existing literature. The paper is organized as follows; section two deals with the theoretical background of the study and its place in the literature. It also briefly introduces to the Ethiopian land tenure system and history. The third section is dedicated to the research methodology and the fourth section includes results and discussions. The final part is reserved for the conclusion.

Theoretical background and literature

The conceptual framework of investment and tenure security relationship emanates from the neo-classical economic theory of households where agricultural households pursue the objective of utility maximization (Ellis, 2000; Aymaga and Dzanku, 2013). Individualization of land rights enhances investment on land by improving land tenure security which in turn increases the productivity of the land in concern. The positive impacts of investment on productivity, on the other

hand, can reinforce land tenure security. This bi-directional causality makes the relationship between tenure security and investment very complex (Twerefou et al., 2011).

The paper uses the conceptual framework in figure 1. Secured land rights give farmers incentives to invest in their land which in turn increases productivity. Higher tenure security, by increasing expected investment, also motivates increased credit demand for further investment. The improved productivity also increases expected investment and further reinforce tenure security (Aymaga and Dzanku, 2013; Ghebru and Holden, 2015). This improvement in productivity can, in turn, contribute to the poverty reduction effort. The Ethiopian constitution gives farmers use rights only which make them users than owners of land. The three channels, through which secure land property rights can increase agricultural productivity that were identified by Besley (1995) come into play here: long-term investment in land,

smooth functioning of the land markets, and access to credit or collateral arrangements.

Although endowed with only use rights, Ethiopian farm households' length of using their land is not limited by law (Tigistu, 2011). Long-term investment of land comes with the expectation of long-term benefits. Tenure security/insecurity highly affects this expectation. Tenure security indicators such as ownership of officially documented land certificate and confidence against fear of land appropriation improve the landholders' sense of tenure security and thereby create motivation to invest in land. The owner of the land feels confidence that the fruits of his/her investment will not be appropriated by someone (Atwood, 1990; Besley, 1995; Deininger and Jin, 2006; Dercon et al., 2005).

Regarding the functioning of land markets and credit access, they are only informally practiced by farmers in Ethiopia. There are also informal mortgaging and leasing activities across the country. Imperfections in such activities can be worse when the formal land use arrangements are in place (Ghebru and Holden, 2015; Zemen, 2013). Land cannot formally be used as collateral for credit usage in the Ethiopian case. There is no legal instrument which encourages mortgaging of farmers land use rights.

Dercon et al. (2005) has found that secure and transferable land rights promote investment on land and efficiency of resource use with three justifications: firstly, secure rights encourage long term investments on land because farmers feel secure about their fruits; secondly, security of ownership of land enhances credit worthiness of farmers; and lastly, it allows for flexible and efficient factor mobility.

Concerning the ambiguity of tenure security vis-à-vis land investment relationship, Deininger et al. (2003) state that there must be a distinction between tenure security and transferability of land rights in modelling households' investment decisions as a two period moves. Higher tenure security will lead to higher investment on land if investment is only undertaken for the sole purpose of productivity improvement. The effect of transferability of land, to the contrary, is certain. Higher transferability of land rights results in a positive impact on farmers' investment as it allows them to capitalize on their investments even if they do not cultivate their land in the second period. Households invest in the first period and produce in the second period with the expectation of increasing wealth (Dube and Guveya, 2013).

To study the relationship between investment on land and tenure security status, it is important to identify and analyze the determinants of investment on farmland. In doing so many studies

have attempted to approximate it by various specific variables. There are studies which used construction and maintenance of soil and water conservation and plot borders (Deininger et al., 2003; Deininger et al., 2009; Dube and Guveya, 2013; Gebremedhin et al., 2003; Ghebru, 2012; Swinton and Gebremedhin, 2003). Other studies used soil conservation techniques, irrigation facilities, building wells and fences, fallowing and growing trees to represent investment on farmland (Deininger et al., 2003; Dercon et al., 2005; Dube and Guveya, 2013; Foltz et al., 2000; Gebremedhin et al., 2003; Hayes et al., 1997; Yeboah et al., 2016). Tenure security, on the other hand, was represented by land certification or titling in a handful of studies (Deininger et al., 2011; Dube and Guveya, 2013; Feder and Onchan, 1987; Hayes et al., 1997; Migot-Adolla et al., 1991; Twerfou et al., 2011).

In Ethiopia, Deininger et al. (2011) found statistically significant and economically meaningful relationship between certification and the propensity to invest in soil and water conservation measures. Yeboah et al. (2016) found an inverse relationship between farm size and tenure insecurity while they found positive correlation between tenure insecurity and the value of farmland not the size of the farm.

Using a probit model, Dube and Guveya (2013) analyzed the relationship between land-related investments, both at medium and long term, and tenure security in Zimbabwe. They found that farmers with more secure tenure system are likely to engage in plantation of fruit crops as indicators of long-term investments. Medium-term soil improvements, however, are not significantly affected by tenure security. With negligible investments on non-fixed assets, the study concluded that there is a strong relationship between farm investments and tenure security.

The main limitation of the studies that attempted to establish a meaningful casual relation between land investments and tenure security, regardless of the direction of the relationship, is they fail to distinguish between short term and long-term investments and most studies tend to focus on one side which complicates the analyses. Only very few studies have attempted to analyze the relationship between investment and tenure security by distinguishing short term and long-term investments on land (Swinton and Gebremedhin, 2003; Gebremedhin et al., 2003; Hayes et al., 1997).

Swinton and Gebremedhin (2003) on their study in Northern Ethiopia identified between short term and long-term investments and analysed their relationship with tenure security. The study represented long-run investment on land by the

construction of stone terraces and the results showed that long term investments are associated with secure land tenure, labour availability, proximity to the farmstead and learning opportunities from local food-for-work projects. On the other hand, short-term investments which were represented by soil bunds construction were strongly linked to land tenure insecurity. Another study which makes a distinction between short and long-term investments on land was undertaken by Hayes et al. in 1997 in Gambia. The study found the probability of constructing fences and wells as a representative of investment on land was motivated by the existence of strong tenure rights.

This study creates a clear distinctive analysis of short and long-term land-related investments and includes the poverty status of farm households as a decisive determinant of investment activities.

Materials and Methods

The study area

This study was undertaken in Tigray, the Northern parts of Ethiopia. Three districts (*Woredas*) namely Atsibi-wenberta, Hintalo-wajerat and Kola-tembien were randomly selected to represent three different agro-ecological zones i.e. Highland, Midland and lowland (*Dega, Woynadega and Kola* in their local terms). The selected districts represent the heterogeneity of investment behaviour of farm households in various agro ecological zones. The type of agriculture practiced in terms of the major crops grown, animals reared, and the overall agricultural land investments practices are different for the selected districts. Three representative *Tabias* (one from each district) were selected randomly for the survey.

Sampling procedure and the data

The study employed multistage area sampling technique to select 231 representative households from the three districts: out of the three districts three *tabias*¹ were selected randomly, out of the three *tabias* (one *tabia* from each district) six *kushets* were selected randomly (two *kushets* from each *Tabia*) and finally 231 households were randomly selected from the selected *kushets*. Equation 1 as suggested by Watson (2001) was employed to select the 231 representative households out of the target 965 households in the three *Tabias*. Structured questionnaire, key informant interview (KII) and field observations were used to acquire the required data. The

structured questionnaires targeted household heads of the randomly selected households. With open-ended and closed ended questions, the questionnaire was designed to gather data on demographic and socio-economic characteristics of households, biophysical features of plots, institutional factors, and access to infrastructures. Data were collected by trained and experienced enumerators on the close supervision of the researchers. Published and unpublished government reports of the study sites were the sources of the secondary data used for the study.

$$n = \frac{p(1-p)}{\frac{e^2}{Z^2} + \frac{p(1-p)}{N}} \dots\dots\dots (1)$$

where n = is the sample size; N= is the population size; Z= confidence level at 95%, Z= 1.96, P= estimated population proportion (50%), e = 0.06.

Data analysis

The econometric model

An econometric model based on Feder (1987) where farmers invest on agricultural land based on their level of tenure security was developed. Households are assumed to increase their utility in the present value of future income, characteristics of the household and asset holding of the household. Assuming the household as a utility maximizing agent, the model is set as follows:

$$Inv. = f (HH \text{ characteristics, Asset, Plot, Tenure, Location and Participation, Conservation})$$

The dependent variable is *Inv.* which is an indicator of short term and long-term investments made for land improvements by the farmers. The short-term investments are represented by the value of various farm inputs (fertilizer, improved seeds, herbicides, pesticides, and paid labour) and the long-term investments are represented by the number of hours spent on the construction of stone bunds. The explanatory variables are classified as variables that reveal household characteristics; variables related to asset holding, plot characteristics, tenure related variable, conservation related variables, and location and institutional variables. The variables related to household characteristics include marital status, age, dependency ratio, poverty status of households, and the level of education. Regarding the variables related to asset holding, livestock holding (as indicated by Tropical Livestock Units), farmland size owned by the household, value of agricultural output and off and non-farm income are included. The plot characteristics variables

¹ *Tabia* is a local administrative unit smaller than a district and *kushet* is an administrative unit smaller than *tabia*.

have to do with the soil types of the plots and the type of plots. Land tenure variables include land certification and fear of land appropriation. A number of location and institutional related variables such as access to credit services, distance to nearby market, political participation in the community, participation in trainings about soil and water conservation, access of media, and access to irrigation. The conservation related variables include communal conserved land around ones plot and involvement in community soil and water conservation. A standard Tobit model was used to estimate the investment activities of the sampled households as shown by equation 2 and 3.

$$y_i^* = x_i \beta + \varepsilon_i \dots\dots\dots (2)$$

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases} \dots\dots\dots (3)$$

where $i = 1, 2, 3, \dots, n$, n indicates the observation, y_i^* is an unobserved /latent variable, x_i is a vector of the various explanatory variables included, β is a vector of unknown parameters, and ε_i is a disturbance term which is assumed to be IID $(0, \delta^2)$ and independent of x_i . This is a censored model where observations are censored from below (Greene, 2003).

Results and Discussion

Descriptive statistics

The descriptive statistics of the variables included in the study is presented in table 1 by classifying the explanatory variables into six categories. In the first category, variables related to household characteristics such as sex, age, marital status, dependency ratio and poverty status are included. Male-headed households comprise about 78 percent of the sampled population and about 86 percent of the households are occupied by married people. 46 percent of the respondents can read and write. The mean dependency ratio per household is found at 1.06. Regarding poverty status, poorer people are expected to invest less on land. Poverty status of households was determined by taking the international absolute poverty line of USD 1.90 per adult per day adjusted to purchasing power parity. Accordingly, about 52 percent of the households are found to be poor. The average family size in the study area is about six and the average age of household heads is 45 years.

In the second category, we have explanatory variables related to households' asset holding. The average livestock holding of households as measured by TLU is four. Another variable in this category is the size of land holding by households. The average land holding per household is around

three *tsmad* which is only two third of a hectare. Another variable included in this category is productivity which is measured by dividing the total annual produce by the size of land holding. The average productivity is ETB 14,573.53 annually which is expected to affect investment positively. Total value of assets which is about ETB 67,135.5 is also expected to have positive effect on investment. Off farm income, with annual average of ETB 5560.75, and total expenditure by household are also included as an explanatory variables in this category.

Explanatory variables related to location and institutions made up the third category. Variables such as access to irrigation, credit, media, and land related trainings which are expected to affect the probability of investment on land are included in this category positively. Only 11 percent of the sampled population has access to irrigation, 48 percent has access to credit, and 33 percent has access to land related trainings. The average distance to the local administration office is 56 walking minutes where as it is 30 Walking minutes to the nearby market. The *woreda* dummy which takes the relatively less fertile *Atsbiwienberta* as a reference to the districts included in the study.

Another variables included here fall under the conservation category. Participation of the household in community soil and water conservation activities and the existence of conserved land around the households' plots which are expected to affect the investment decisions of households negatively. 86 percent of the sampled population participates in community soil and water conservation activities and 71 percent of them have communal conservation around their plots. In the tenure security variables, land certification and fear of land appropriation are included. The majority of the respondents have certified land (87%) and only 14 percent of the respondents have fear of any sort of land appropriation. Variables related to plot characteristics are included in the final group. Here, we have soil fertility variable represented by poor fertility as a reference and soil type variable represented by sandy soil as a reference. We have also removal of top soil and reduction in crop yield in addition; where 52 percent of the sampled households perceive there is reduction in crop productivity and 74 percent of perceive there is top soil removal. The study has included two dependent variables. Households annual spending on farm inputs, which amounts to ETB 1,513.2 annually, is taken as representative of short-term investments in farmland. To represent long-term investments on land, we have used households' participation in stone bund construction on their plots.

Table 1. Descriptive statistics of the study variables.

Variable Description	Mean	Standard Deviation
Household Characteristics		
Sex of the household head (dummy 1 = male, 0 = female)	0.78	0.41
Literacy (Dummy 1 = can read and write; 0, otherwise)	0.46	0.5
Family size (number)	5.67	2.02
Age of household head (Number of years)	45.08	13.17
Dependency ratio ((family members <15 and >64)/Ages 15 to 64)	1.06	0.84
Poverty status of household (dummy 1 = poor, 0 = otherwise)	0.51	0.5
Marital Status of household head (dummy 1 = ,married, 0 = otherwise)	0.86	0.35
Households' Asset Holding		
Productivity (Total produce in ETB/land holding)	14573.53	31338.84
Land holding in <i>Tsmad</i> ²	2.7	1.8
Off farm Income in ETB ³	5560.75	10121.12
Total Value of assets in ETB	67135.5	87529.27
Household livestock holding in TLU	4.09	2.7
Total expenditure in ETB	27386.52	22086.43
Location and Institutional variables		
Access to Irrigation (dummy 1 = yes, 0 = no)	0.11	0.31
Distance to local Administration (in walking minutes)	55.77	39.17
Credit Access (dummy 1 = yes, 0 = no)	0.48	0.5
Access to media (dummy 1 = yes, 0 = no)	0.67	0.47
Distance to nearby market (in walking minutes)	29.77	22.45
Local government position (dummy 1 = yes, 0 = no)	0.43	0.5
Land related training (dummy 1 = yes, 0 = no)	0.33	0.47
Woreda dummy (1 = Atsbi Wonberta, 0 = otherwise)	0.34	0.47
Conservation Related Variables		
Participation in Community SWC activities (dummy 1 = yes, 0 = no)	0.86	0.35
Community conserved land around (dummy 1 = yes, 0 = no)	0.71	0.45
Plot Characteristics		
Soil Fertility (dummy 1 = poor, 0 = otherwise)	0.29	0.45
Soil type (dummy 1 = sandy, 0 = otherwise)	0.17	0.38
Removal of top soil (dummy 1 = yes, 0 = no)	0.74	0.44
Reduction in crop yield (dummy 1 = yes, 0 = no)	0.52	0.5
Tenure Security Variables		
Certificate of ownership (dummy 1 = yes, 0 = no)	0.87	0.34
Fear of land appropriation (dummy 1 = yes, 0 = no)	0.14	0.35
Dependent Variables		
Farm Inputs (value in ETB)	1513.2	1049.9
Stone bund construction in meters	89.59	274.53

The annual stone bund construction is measured by the length of stone bunds constructed in own plot in meters. Households have built about 85.59 meters of stone bunds in a year, on average.

Econometric results short term land-related investment

The results of the Tobit regression for short term land-related investment is presented in Table 2. Among the included socio-economic and

demographic variables family size, the age variables and poverty status significantly affect the short-term investments decisions of households. Family size is significant at 10% with positive coefficient signifying that larger families tend to spend more on farm inputs than smaller families. Age and age squared are found to be significant at 10% and with the priori expected signs. Poverty status of households revealed strong negative relationship with the spending on farm inputs.

² *Tsmad* a local land measurement which is 1/4 of a hectare.

³ ETB stands for Ethiopian Birr, Ethiopian Monetary unit (1 USD = 31.3966 ETB)

The fact that the variable poverty status is significant at 1% indicates poorer households are less likely to spend more in farm inputs as compared to the non-poor ones. On the other hand,

the impact of other variables in this category such as sex of the household head, literacy, marital status, and dependency ratio are found to be insignificant.

Table 2. Tobit regression results of the short-term investment decision.

Explanatory variables	Coef.	Robust SE	t-statistics
Household Characteristics			
Sex of household head	-178.64	163.64	-1.09
Literacy	112.31	118.62	0.95
Family size	77.13	41.09	1.88*
Age of household head	37.47	22.17	1.69*
Age of household head squared	-0.37	0.21	-1.74*
Dependency ratio	17.27	54.46	0.32
Poverty status of household	-396.96	138.08	-2.87***
Marital Status	103.14	165.15	0.62
Households' Asset Holding			
Productivity	0.006	0.002	3.70***
Land holding	230.94	42.85	5.39 ***
Off farm Income	-0.0009	0.005	-0.17
Total Value of assets	0.002	0.002	1.33
Household livestock holding	82.90	30.80	2.69 ***
Total expenditure	0.0002	0.005	0.04
Location and Institutional variables			
Access to Irrigation	114.48	190.14	0.60
Distance to local Administration	-0.18	2.13	-0.08
Credit Access	29.20	110.19	0.26
Distance to market	-0.020	1.58	-0.01
Access to media	194.17	99.43	1.95*
Distance to main road	1.27	1.72	0.73
Local government position	239.44	103.41	2.32**
Woreda dummy	205.07	176.97	1.16
Conservation Related Variables			
Participation in Community SWC	-31.09	127.90	-0.24
Community conserved land around	-219.92	116.07	-1.89*
Plot Characteristics			
Soil Fertility	62.46	105.03	0.59
Soil type	-97.41	170.07	-0.57
Removal of top soil	368.01	134.26	2.74***
Reduction in crop yield	-278.43	127.26	-2.19**
Slope	-95.98	129.30	-0.74
Tenure Security Variables			
Fear of land appropriation	52.60	128.99	0.41
Certificate of ownership	64.93	170.17	0.38
Constant	-1112.97	560.83	-1.98*
Number of obs = 231			
F (31,200) = 7.58			
Prob > F = 0.0000			
Log pseudolikelihood = -1778.3151			
Pseudo R ² = 0.0526			
9 left-censored observations at FarmInput <= 0			
222 uncensored observations			

The dependent variable is the value of farm inputs in ETB
 *, **, *** indicate significance at 10%, 5% and 1% respectively.

The tenure security variables included in the model have no significant effect on the short-term investments decisions of households as represented by spending on farm inputs. Both fear of land appropriation by households and ownership of land certificates fail to exert any significant effect on the spending towards farm inputs such as fertilizer, improved seeds, herbicides, and pesticides.

Productivity, size of land holding and livestock holding were found to affect the investment decisions on farm inputs positively and significantly among the household asset holding variables. The 1% significance of the productivity variable and its positive association with farm inputs spending shown in Table 2 reveals that households spending on farm inputs increases with improvement in productivity. Households with larger farm lands are also found to spend more on farm inputs. Households' livestock holding has also strong effect on farm input spending with 1% significance. An increase in livestock holding as measured in tropical livestock unit increases the probability of short term investments on farm land as represented by farm input spending.

Almost all of the location and participation variables except for the participation in local governmental positions and access to media were found to be insignificant. With increased participation in local governmental positions comes an increase in the probability of farm input spending. Household access to media is also significant at 10% showing that households with access to media are more likely to invest in farmland than their counterparts. Having a communal conserved land near ones plots was found to affect farm input investment decisions significantly. It is with the expected sign and significant at 10%. Households with communally conservation around their plots are found to invest less on farm inputs. Among the plot characteristics variables included, removal of top soil and reduction in crop productivity were found to be significant. The strong positive significance of removal of top soil indicates households invest more on plots where the top soil is removed. The relationship between reductions of crop productivity and investment decisions fail to conform to the a priori expectation. Households seem to be less motivated to use more farm inputs on farm land where there is reduction in crop productivity.

Long term land-related investment

The tenure security variables included in the long-term investment regression were found insignificant just like the short-term analysis. The logarithmic transformation of some variables including the dependent variable was employed for

the estimation to account for outliers. Table 3 show the details. As for the socioeconomic and demographic variables included, gender of the household head and the age variables were found to be significant and with the expected signs. Males were found to engage in stone bund building than women. Age and age squared have the priori expected signs and they are significant at 5%. Although not significant, the dependency ratio variable has the expected negative sign signifying that households with larger number of dependents invest less. Among the households' asset holding variables included, productivity, total value assets, livestock holding and total expenditure were found to affect decisions regarding stone bund construction significantly. The productivity variable is significant at 1% and strongly enhances stone bund construction. The value of assets, however, was significant at 10% and reveals inverse relationship with stone bund construction. Households might be choosing to spend their earnings on other assets than on land investment here. Livestock holding affects land investment decisions strongly and positively. The total expenditure variable reveals a strong positive association with stone bund construction.

All location and participation variables included in model are found to be insignificant except for the participation in local government activities. The location specific and institutional variables seem to have a negligible effect on the decision of households to construct stone bunds. On the other hand, participation in local political activities was with the expected sign and significant at 10%. Households with local government positions are more likely to engage themselves in the construction of stone bunds on their plots. Having communal conserved land around individual plots was found to be significant at 5%. Farmers seem to have found some motivation to add private stone bunds to the already communally developed land.

Discussion

Land certification and fear of land appropriation were included as tenure in/security indicators. Land certification was expected to enhance investment on land (Feder and Onchan, 1987; Deininger et al., 2009). Fear of land appropriation by others, as an indicator of tenure insecurity, was also expected to affect investment decisions negatively. Despite these expectations, the study found no significant and meaningful relationship between tenure security variables and both short term and long term investment decisions which somehow goes in line with findings by Holden and Yohannes (2002), Fenske (2011), Migot-Adholla et al. (1991).

Table 3. Tobit regression results of the long-term investment decision.

Explanatory Variables	Coef.	Robust SE	t- statistics
Household Characteristics			
Sex of household head	1.73	0.88	1.97 **
Literacy	-0.22	0.44	-0.51
Family size	0.02	0.14	0.15
Age of household head	0.28	0.11	2.63**
Age of household head squared	-0.003	0.001	-2.81***
Dependency ratio	-0.05	0.23	-0.21
Poverty status of household	0.96	0.60	1.60
Marital Status	0.28	0.89	0.32
Households' Asset Holding			
Productivity(log)	0.46	0.16	2.78***
Land holding	0.03	0.14	0.19
Off farm Income(log)	-0.05	0.05	-1.06
Total Value of assets(log)	-0.24	0.13	-1.82*
Household livestock holding	0.20	0.09	2.23**
Total expenditure(log)	1.32	0.63	2.11 **
Location and Institutional variables			
Access to Irrigation	0.27	0.60	0.44
Distance to local Administration	-0.02	0.01	-1.73
Credit Access	-0.09	0.40	-0.23
Distance to main road	0.001	0.007	0.15
Distance to market	0.006	0.005	1.14
Access to media	-0.09	0.44	-0.20
Local government position	0.71	0.42	1.71 *
Land related training	0.01	0.41	0.03
Woreda dummy	0.22	0.53	0.42
Conservation Related Variables			
Participation in Community SWC	0.40	0.55	0.72
Community conserved land around	0.87	0.44	2.03 **
Plot Characteristics			
Soil Fertility	0.26	0.44	0.60
Soil type	-0.81	0.53	-1.53
Removal of top soil	0.07	0.44	0.16
Slope	0.003	0.46	0.01
Tenure Security Variables			
Certificate of ownership	-0.09	0.56	-0.15
Fear of land appropriation	0.01	0.53	0.02
Constant	-20.59	6.09	-3.38***
Number of obs = 231			
LR chi2(31) = 98.12			
Prob > chi2 = 0.0000			
Log likelihood = -410.5203			
Pseudo R2 = 0.1068			
81 left-censored observations at logStonbud <= 0			
150 uncensored observations			

The dependent variable is log of stone bunds constructed in meters annually, *, **, *** indicate significance at 10%, 5% and 1% respectively.

Poverty status of households was found to affect the short-term decisions to invest significantly. Poorer households were obviously found to commit fewer resources to land related investments specifically farm inputs. This result confirms Holden and Yohannes (2002) that lack of resources

lead to under investment. Productivity of households revealed strong association with both short term and long-term investment decisions. This finding is in harmony with Dube and Guveya (2013) and Aymaga and Dzanku (2013). Higher agricultural productivity strongly determined the

decision to and the magnitude of spending in farm inputs and stone bund construction. Livestock holdings of households showed strong positive effects on both short term and long term land related investments of households. This may be due to the fact that households can commit the sales of livestock for possible land investment. The findings are contrary to those of Yeboah et al. (2016) but supports Deininger et al. (2007) and Aymaga and Dzanku (2013). Another significant variable in the household asset-holding category is size of land holding. Land holding has significant effect on farm inputs spending positively. Dube and Guveya (2013) are in harmony with this result.

Another important variable that positively affected the short term and long-term investment decisions was a position in local administrative activities. This might be because farmers involved in local government activities have first-hand awareness of agricultural policies and they have the responsibility to be role models in their society when it comes to policy issues. This goes hand in hand with the findings of Goldstein and Udry (2008) that political positions and membership of social networks are strongly associated with land related investments.

The presence of conserved communal land around ones plots shows a contradictory relationship with the short term investments and long term investments. There is negative relationship between the presence of communal conservation around and farm input spending. However, it was found to be related with long-term private investments significantly and positively. The positive finding is supported by Swinton and Gebremedhin (2003) and Akalu et al. (2016). One possible explanation for this is that communal soil and water conservation around plots have proved useful and households might think it is better to enhance this trend by constructing stone bunds than spending on farm inputs.

Among the socioeconomics and demographic variables included, age and age squared affect both short term and long-term investments significantly; sex of the household head affects the long run investment significantly, while family size affects the short-term decisions. The fact that male households invest more on land is supported by Aymaga and Dzanku (2013) and Swinton and Gebremedhin (2003). Age and age squared have strong effect on both short term and long-term investments revealing positive and negative signs respectively. This finding is in support of Chirwa (2008) and Deininger et al. (2009). This indicates that the more productive young farmers with higher energy and motivation are more likely to invest in their lands than the older ones.

Conclusion

This paper attempted to explore investments in farm land in Northern Ethiopia with focus on household-level analysis on the roles of poverty, tenure security, and conservation. The main findings and their implications are as follows;

The findings fail to establish meaningful relationship between the tenure security variables and households land related investment decisions despite an attempt to test the relationship for both short term and long term analysis. Regarding household asset holding related variables, productivity, and household livestock holding exert a positive significant effect on household level investment decisions. The wealth increment from both variables can reinforce further investments on land. Poverty status of households which is included in the estimations significantly affected the decisions for short-term investments. Poorer households are willing to pay less for farm inputs. Participation in local governmental activities strongly and significantly affected both short term and long term household level land related investments. Farmers who participate in local political activities are better informed about the merits of land-related investment and agricultural policies. The presence of conserved communal land around on individual plots show inverse relationship with the short term investments decisions of households, however, is positively related to and long term investments.

Age and age squared are other demographics variables that affect investment decisions significantly; their signs indicate that young people are more likely to invest on land than their older counterparts. Another important significant variable with contrary effects on the short term and long-term investments is the existence of communally conserved land near to ones plots. In the long-term case the public investment seems to cause private land related investment in own plots.

Acknowledgements

The authors would like to thank Mekelle University for funding the study.

References

- Akalu, T., de Graaff, J. and Menale, K. 2016. Household-level determinants of soil and water conservation adoption phases: evidence from North-Western Ethiopian Highlands. *Environmental Management* 57: 620–636
- Atwood, D. 1990. Land registration in Africa: the impact on agricultural production. *World Development* 18(5): 659-71.

- Ayamga, M. and Dzanku, F. 2013. The Land Rights and Farm Investment Ghana: The Missing Link in the Operationalisation of Tenure Security, paper presented at the 4th International Conference of the African Association of Agricultural Economists, September 22-25, 2013, Hammamet, Tunisia
- Besley, T. 1995. Property rights and investment incentives: theory and evidence from Ghana. *Journal of Political Economy* 103(5): 903-937.
- Boserup, E. 1965. Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure. Aldine Publishing Co., New York
- Brasselle, A.S., Gaspard, F. and Platteau, J.P. 2002. Land tenure security and investment incentives: puzzling evidence from Burkina Faso. *Journal of Development Economics* 67: 373-418.
- Chirwa, E.W. 2008. Land Tenure, Farm Investments, and Food Production in Malawi. IPPG Discussion Paper Series Number Eighteen
- Deininger, K., Ali, D.A. and Alemu, T. 2009. Impacts of Land Certification on Tenure Security, Investment, and Land Markets Evidence from Ethiopia: Environment for Development Discussion Paper Series, EfD DP 09-11
- Deininger, K., Ali, D.A. and Alemu, T. 2011. Impacts of land certification on tenure security, investment, and land market participation: evidence from Ethiopia. *Land Economics* 87 (2): 312-334.
- Deininger, K., Ali, D.A., Holden, S. and Zevenbergen, J. 2007. Rural land certification in Ethiopia: Process, initial impact, and implications for other African countries. World Bank Policy Research Working Paper 4218
- Deininger, K. and Jin, S. 2006. Tenure security and land-related investment: evidence from Ethiopia. *European Economic Review* 50(5): 1245-1277.
- Deininger, K., Jin, S., Adenew, B., Gebreselassie, S. and Nega, B. 2003. Tenure security and land related investment: Evidence from Ethiopia. Washington DC; World Bank Policy Research, Working Paper Series 2991.
- Dercon, S., Daniel, A. and Gautam, M. 2005. Property Rights in a Very Poor Country: Tenure Insecurity and Investment in Ethiopia. GPRG-WPS-021 ESRC Global Poverty Research Group.
- Dube, L. and Guveya, E. 2013. Land tenure security and farm investments amongst small scale commercial farmers in Zimbabwe. *Journal of Sustainable Development in Africa* 15(5): 107-121.
- Ellis, F. 2000. Peasant Economics: Farm Households and Agrarian Development. 2nd edition. Cambridge University Press., Cambridge, United Kingdom.
- Feder, G. 1987. Land ownership security and farm productivity: evidence from Thailand. *Journal of Development Studies* 24: 16-30.
- Feder, G. and Onchan, T. 1987. Land ownership security and farm investment in Thailand. *American Agricultural Economics* 69(2): 311-320.
- Feder, G., Onchan, T., Chalamwong, Y. and Hongladarom, C. 1988. Land Policies and Farm Productivity in Thailand. Baltimore, Md.: Johns Hopkins University Press.
- Fenske, J. 2011. Land tenure and investment incentives: evidence from West Africa. *Journal of Development Economics* 95(2): 137-56.
- Foltz, J., Larson, B.A. and Lopez, R. 2000. Land Tenure, Investment, and Agricultural Production in Nicaragua. Development Discussion Paper No. 738, Central America Project Series, Harvard Institute for International Development, Harvard University.
- Gebremedhin, B., Pender, J. and Ehui, S. 2003. Land tenure and land management in the highlands of Ethiopia. *Ethiopian Journal of Economics* 8(2): 46-63.
- Ghebru, H. 2012. Tenure (In) Security and Agricultural Investment of Smallholder farmers in Mozambique. IFPRI working paper 5.
- Ghebru, H. and Holden, S. 2015. Technical efficiency and productivity differential effects of land right certification: a quasi-experimental evidence. *Quarterly Journal of International Agriculture* 54(1): 1-31.
- Goldstein, M. and Udry, C. 2008. The profits of power: land rights and agricultural investment in Ghana. *Journal of Political Economy* 116(6): 981-1022.
- Greene, W.H. 2003. Econometric Analysis. 5th edition, Prentice Hall, New York.
- Hayes, J., Roth, M. and Zepeda, L. 1997. Tenure security, investment and productivity in Gambian agriculture: a generalized probit analysis. *American Journal of Agricultural Economics* 79: 369-382.
- Holden, S. and Ghebru, H. 2016. Land tenure reforms, tenure security and food security in poor agrarian economies: causal linkages and research gaps. *Global Food Security* 10: 21–28.
- Holden, S. and Yohannes, H. 2002. Land redistribution, tenure insecurity, and intensity of production: a study of farm households in Southern Ethiopia. *Land Economics* 78(4): 573-590.
- Lovo, S. 2016. Tenure insecurity and investment in soil conservation. evidence from Malawi. *World Development* 78: 219–229.
- Migot-Adholla, S., Hazell, P., Blarel, B. and Place, F. 1991. Indigenous land rights systems in Sub-Saharan Africa: a constraint on productivity? *World Bank Economic Review* 5(1): 155-75.
- Otsuka, K. and Place, F. 2001. Tenure, agricultural investment, and productivity in the customary tenure sector of Malawi. *Economic Development and Cultural Change* 50: 77-99.
- Place, F. and Hazell, P. 1993. Productivity effects of indigenous land tenure systems in Sub-Saharan Africa. *American Journal of Agricultural Economics* 75(1):10-19.
- Platteau, J.P. 1995. Reforming Land Rights in Sub-Saharan Africa: Issues of Efficiency and Equity. (UNRISD Social Development News No. 13, Discussion Paper 60), Geneva.
- Schädler, M. and Gatzweiler, F.W., 2013. Institutional environments for enabling agricultural technology innovations: The role of land rights in Ethiopia, Ghana, India and Bangladesh. ZEF Working Paper Series, Working Paper 119.
- Shimelles, T., Zahidul, K.M. and Parviainen, T. 2009. Effects of land tenure and property rights on agricultural productivity in Ethiopia, Namibia and

- Bangladesh. University of Helsinki, Department of Economics and Management Discussion Papers no:33.
- Sjaastad, E. and Bromley, D.W. 1997. Indigenous land rights in Sub-Saharan Africa: appropriation, security and investment demand. *World Development* 25 (4): 549-562.
- Swinton, M. and Gebremedhin, B. 2003. Investment in soil conservation in Northern Ethiopia: the role of land tenure security and public programs. *Agricultural Economics* 29: 69-84.
- Tigistu, G. 2011. Experience and Future Direction in Ethiopian Rural Land Administration. Paper Presented at the Annual World Bank Conference on Land and Poverty, Washington DC.
- Trebilcock, M. and Veel, P.E. 2008. Property rights and development: the contingent case for formalization. *University of Pennsylvania Journal of International Law* 30(2): 397-478.
- Twerefou, D.K., Osei-Assibey, E. and Agyire-Tettey, F. 2011. Land tenure security, investments and the environment in Ghana. *Journal of Development and Agricultural Economics* 3(6): 261-273.
- USAID. 2004. Ethiopia Land Policy and Administration Assessment Final Report with Appendices. May 2004
- Watson, J. 2001. How to determine a sample size: University Park. PA: Penn State Cooperative Extension.
- Yeboah, R., Ayamga, M. and Ayambila, S. 2016. An analysis of household farm investment decisions under varying land tenure arrangements in Ghana. *Journal of Agriculture and Rural Development in the Tropics and Subtropics* 117(1): 21-34.
- Zemen, H. 2013. Towards Improved Transactions of Land Use Rights in Ethiopia. Annual World Bank Conference on Land and Poverty 2013.