

Tenure (In)security and Agricultural Investment of Smallholder Farmers in Mozambique

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INTRODUCTION

Poor agricultural productivity and food insecurity are persistent features of many less developed countries. Governments and international development agencies have therefore rightly considered agricultural intensification as the primary means for inducing technological change in developing countries that have high population pressure and low agricultural productivity. Integral to this growing global interest in agricultural intensification is the issue of land tenure security (Holden et al. 2008). Because of the conventional view that traditional or "customary" land rights impede agricultural development (Johnson 1972; Gavian and Fafchamps 1996), many developing countries and major multilateral organizations have promoted formalization of land rights (in the form of registration and certification of land) as a top priority in their economic development agendas (Atwood 1990; IFAD 2001; Bonfiglioli 2003; Deininger 2003; Holden et al. in press).

In theory, there are three routes through which secure property rights may influence agricultural productivity. The first channel is by encouraging long term land investment and adoption of new technologies (Barrows and Roth 1990; Besley 1995; Sjaastad and Bromley 1997; Deininger and Jin 2006). According to this hypothesis, afraid of not recouping the investment made on land to which the user has access but no secure property rights, the user hesitates to spend resources on land-improving technologies (conservation, manure, fertilizer, etc.). As a result, the demand for productivity-enhancing investment declines and aggregate agricultural productivity suffers. Secondly, secure property rights also are thought to influence agricultural productivity because such rights encourage efficient resource use (factor intensity). This is so since the establishment of clear ownership of land lowers the cost and risk of transferring land, which improves factor intensity such that land will be reallocated to more efficient producers. Thirdly, it has also been claimed that secure property rights can stimulate efficient resource use as such rights should reduce land related disputes (Deininger and Castagnini 2006; Holden et al. 2008) and may contribute to better access to credit if land can be used as collateral.

Against this backdrop, land tenure reform towards individual freehold has long been seen as a prerequisite for development in sub-Saharan Africa. However, the impact of traditional land tenure systems in the region on agricultural investment and productivity continues to be the subject of intense scrutiny mainly because of the mixed nature of the effects of past land titling interventions on credit access, smallholder agriculture transformation, and overall production. Recent food security crises in Africa have revived the debate over whether current land tenure systems constrain farmer innovation and investment in agriculture. Recognizing the importance of good land governance, in 2009 the African Union (AU) heads of state agreed to a framework and guidelines for land policy initiatives in Africa which has led an increasing number of countries to implement far-reaching programs to improve land tenure security. These changes in tenure systems can potentially have major implications for agricultural transformation. Using the case of past and ongoing land tenure reforms in Mozambique, this paper aims at assessing the determinants of tenure security for households and the implications of such tenure security on their observed behavior in undertaking long-term land-related investments. An attempt is made to distinguish the source of risk of tenure insecurity as: (i) effective risk (mainly dependent on past experiences of households); and (ii) potential risk (i.e., long-term perception of tenure security). The data used in this analysis also allows us to investigate the investment effects of households' perceived tenure (in)security by disaggregating households' observed investment behavior into: (i) productivity-enhancing investments (soil and water conservation structures); and (ii) non-productivity enhancing investments (boundary demarcation).

The rest of the paper is organized as follows. A brief description of the evolution of land tenure reforms and tenure security is presented in section 2. Section 3 reviews relevant literature on the concepts of tenure security and agricultural productivity, while the relevance on how these two are linked in developing countries with particular focus on our study country, Mozambique, is presented in Section 4. The data and econometric methods applied in this study are discussed in

section 5. Section 6 is devoted to the descriptive analysis and discussion of key econometric results, while the last section (Section 7) draws policy implications and further research.

2. DISCOURSE ON LAND TENURE REFORMS AND TENURE SECURITY

Land tenure has long been a thorny issue. In the 1960s and 1970s, the main concern was equity and security as the debate mostly concerned bringing justice in land allocation in countries that emerged from colonialism. Since the collapse of the Soviet Union in the context of transitions from a socialist mode of production towards a more market oriented system, a different kind of debate has emerged about land tenure centered on efficiency issues and sustainability of resource use (Cotula et al. 2004). The purpose of this sub-section is not to look at these debates in any detail. Instead, an attempt is made to briefly summarize the theoretical issues surrounding land tenure security and the evolution of property rights. Although there is wide recognition about the desirability of tenure security for agrarian development, there is no clear and universally applicable blueprint as to the most appropriate property rights regime, as this depends on underlying socio-cultural and geographic factors.

Land tenure reform towards individual freehold system has long been seen as a prerequisite for development in sub-Saharan Africa (Feder and Noronha 1987; Migot-Adholla et al. 1994). The arguments in favor of reforming customary African land tenure systems were mainly based on the neoclassical economic theory of property rights (Demsetz 1967; Barzel 1997) that predicts greater productivity as land tenure becomes more secure and individualized.

However, empirical evidence on the effects of past land titling programs on access to credit, smallholder investment, and overall production is mixed. Studies in Kenya and Burkina Faso found no effects of land titling on access to credit (Carter et al. 1990 and Brasselle et al. 2002). Earlier cross-sectional research in Ghana, Kenya, and Rwanda on land tenure did not show increased investment in land or improved agricultural yields when comparing restrictive land laws to more flexible policy allowing land transfers (Migot-Adholla et al. 1991). A study in a rice growing area in Madagascar suggests that formal title had no effect on plot-specific investment and little impact on productivity (Jacoby and Minten, 2007). In Uganda, by contrast, the likelihood of new investment on titled land was found to be twice that of investments on merely occupied plots by owner-cum-occupants (Deininger and Ali 2008).

Debates about land reform impacts are numerous. Controversies and various empirical results partly come from the diverse definition of “land reform”, “tenure security” and “impacts”, and the complex relations linking them. The assumption that ‘land reform enhances tenure security which in turn induces impacts – such as access to credit, increase in investments, reduction of conflicts’ is quite different from the realities on the ground (Deininger and Feder, 2009).

2.1. Approaches to land tenure reform

Notably, large differences exist among past and ongoing land reform programs implemented in various countries, not only in their legal basis (institutions, rules and legal registration system created or renewed) but also in their processes of implementation (Bruce and Migot-Adholla (eds.), 1994; Lavigne-Delville (eds.), 1998; Benjaminsen and Lund (eds.), 2004; Colin et al. (eds.), 2009). Here we will briefly review the literature with emphasis on the property rights school and the evolutionary theory of land rights and on the main types of land tenure reforms that have implications for tenure security, including various land titling programs, tenancy reforms, radical land reforms, and land redistribution programs.

The Property Rights School (Alchian and Demsetz 1973; Coase 1960; Demsetz 1967; Johnson 1972; Posner 1986) emphasizes the importance of private property rights for economic development. The three main mechanisms are the investment effect, the credit access effect and the land market enhancement effect.

Property rights development are also seen as an endogenous institutional change; “Property rights develop to internalize externalities when the gains of internalization become larger than the costs of internalization” (Demsetz 1967, p. 350). This view is expressed by the **Evolutionary Theory of Land Rights** (Platteau 1996) where the logical chain reactions may be specified as follows:

Population growth and commercialization → Land scarcity → Competition for land → Land disputes → Demand for more secure land rights → Land titling and registration → Enhanced tenure security and reduced disputes → Lower transaction costs → More investment and higher land productivity → More active land markets → More efficient land use → Credit market development → More investment → Enhanced land tax revenue base, etc. (Platteau 1996).

The role of the state in this is to intervene at the appropriate time to facilitate the process.

Land titling reforms and tenure security: One of the intentions of provision of freehold tenure rights is to provide strong tenure security to land owners and thereby stimulate investment and efficiency of land use. Past failures of land titling programs to create such investment and tenure security effects may be due partly to inappropriate timing of such reforms (Bruce 1986; Roth 1993). Another explanation may be that some land titling reforms have resulted in “elite capture” and marginalization of the poor and minority groups. Inefficient and corrupt bureaucracies and high costs of conventional land titling has also caused rationing out of poor and vulnerable groups and favoured the wealthy (Barrows and Roth 1989; Roth 1993; Platteau 1996; Benjaminsen et al. 2009; Cotula et al. 2004). Other studies have revealed no significant investment or credit access effects of land titling (Migot-Adholla et al. 1994 for Kenya; Jacoby and Minten 2007 for Madagascar). Land registration and titling can create, rather than reduce, uncertainty and conflicts over land rights (Atwood 1990; Benjaminsen et al. 2009; Green 1987; Bruce 1986; Mackenzie 1993). Contradictions between customary land rights and new statutory land rights can create uncertainties and conflicts that exacerbate tenure insecurity for some groups and individuals (Mackenzie 1993)

Land-to-the-tiller policies and tenure security: Limiting ownership rights of landlords and strengthening rights of tenants, often called “land-to-the-tiller” reforms or tenancy reforms, have been important policy interventions in many Asian countries (e.g., India, Nepal) (Otsuka 2010). Landlords face the risk that the land they rent out to tenants is confiscated and ownership is transferred to the tenants. In reality, this reform has not resulted in transfer of large land areas to tenants. Rather their access may have become reduced as landlords have stopped or reduced their rental activity, only rent out to people they trust or rent out for only one season at the time to avoid legal claims by tenants. Enhanced Marshallian inefficiency may be one of the outcomes of this policy as threat of eviction cannot be used as a mechanism to enhance tenant effort and landlords may prefer to rent out to less efficient tenants or not to rent out at all (Aryal and Holden 2012).

Market-assisted land redistribution reforms and tenure security: Market-assisted land redistributions have been identified as an alternative and peaceful approach to obtain more egalitarian land distribution in some countries with highly unequal land distributions (e.g., Brazil, South Africa, Zimbabwe). Landless or land-scarce poor households that are interested in accessing land are assisted in buying land from willing sellers (large land owners) of land. Farming ability, capital constraints, market access, access to social services, restrictions in ownership, farm size, and collective management have limited the success of these programs. They have also made only a small dent in the skewed land distribution in countries where such reforms have been attempted (Simtowe et al. 2012; Wiig and Øien 2012).

Radical land redistribution reforms and tenure security: Some countries have undergone revolutionary land tenure reforms where all land was made state land, and land was to be farmed by collectives or state farms. However, the farmer collectives did not function well in most cases, so user rights to land therefore were transferred to individual households. Such distribution of weak individual rights was in many cases done according to egalitarian principles (e.g., China, Vietnam, Ethiopia, and Eritrea). In order to retain egalitarian land distribution over time, more or less frequent land redistributions were carried out within communities to provide land to new households and to adjust the land sizes to household sizes and needs. Such redistributions contributed to tenure insecurity (Deininger and Jin 2006; Holden and Yohannes 2002; Jacoby et al. 2005).

Low-cost land certification reforms and tenure security: Low-cost land certification reforms were first implemented in some of the countries that underwent radical land reforms as a response to the problems of tenure insecurity that arose due to frequent land redistributions and weak property rights which undermined incentives to invest and prevented land market development. Such reforms therefore typically have strengthened tenure security, investment, productivity and land rental market activity (Holden et al. 2009; 2011; Deininger et al. 2011; Khai et al. 2012).

Customary tenure reforms and tenure security: Various countries have attempted to strengthen and formalize customary land rights by registering customary land rights and providing customary tenure certificates to communities, clans or kinship groups (e.g., Tanzania, Malawi, and Uganda). Formal recognition of customary land rights may also serve to strengthen tenure security where such customary rights are threatened for various reasons, e.g., where certain minority groups’ rights are not recognized by more powerful groups that aim to expand their own land rights. There is, therefore, a high risk of elite capture in such customary tenure reforms.

In Ethiopia, recent studies that investigated the low-cost land certification reforms that provide perpetual user and leasing rights to farm households suggest increased economic benefits of tenure security. In a study from 2001 covering four

regions of Ethiopia, Deininger and Jin (2006) found that transfer rights to land and tenure security were associated with higher investments. In a more recent cross-sectional survey in four regions in Ethiopia, Deininger et al. (2008) found a positive association between land certification and investment whereby certified plots had 4.4 percent greater investments as compared to non-certified plots receiving investments. Using four-period panel data, another study by Deininger et al. (2011) found that the land certification program in Ethiopia has increased tenure security, land-related investment, and rental market participation and yielded benefits significantly above the cost of implementation. Utilizing data from a household-plot panel survey with baseline data collected from just before land certification and the last survey round 7 to 8 years after the land registration and certification took place, Holden, Deininger and Ghebru (2009) found similar significant positive effects of low-cost land certification on investment in trees and maintenance of soil conservation structures in the Tigray region of Ethiopia, which was the first region to implement low-cost land certification in Ethiopia. They also found that land productivity increased by about 40 percent on farm plots with land certificates as compared to plots without certificates.

Similarly, Ali et al. (2011) evaluated cross-sectional data for 3,554 households to test for increased land tenure effects in Rwanda (based on a land tenure regularization (LTR) program implemented by the government of Rwanda beginning in 2004) on a variety of outcomes. Households within the LTR program were 10 percentage points more likely to invest in or maintain soil and water conservation (SWC) structures such as bunds, terraces, and check dams. Improved land tenure security had an especially large effect on female-headed households, whereby these households had a 19 percentage point increase in the likelihood of measures to construct or maintain SWC structures compared to male headed households. These results echo findings by Place and Hazell (1993), whereby improved land tenure security in Rwanda had a positive effect on investment. Smith (2004) used cross-sectional survey data of 266 farmers from the southern provinces in Zambia to compare farm performance under statutory and customary tenure, with results that suggest land tenure is positively correlated with smallholder investments in some areas.

However, land registration and titling can create rather than reduce uncertainty and conflicts over land rights (Atwood 1990; Benjaminsen et al. 2009; Green 1987; Bruce 1986; Mackenzie 1993). Place and Hazell (1993), in their assessment of indigenous tenure systems in sub-Saharan Africa, found that lack of credit access, insufficient human capital, and labor shortages had adverse effects on investment decisions more often than tenure insecurity. Inappropriate timing of land reforms (Bruce 1986; Roth 1993), “elite capture” and marginalization of the poor and minority groups due to inefficient and corrupt bureaucracies, high costs of conventional land titling (Barrows and Roth 1989; Roth 1993; Platteau 1996; Benjaminsen et al. 2009; Cotula et al. 2004), and contradictions between customary land rights and emergent statutory land rights (Mackenzie 1993) have been identified as major causes of past failures of land titling programs to create desired investment and tenure security effects.

2.2 The new wave of land policy reforms and the ‘tenure continuum’

Recent literature on land property rights (Larson and Bromley 1990; Bromley 1991; Schlager and Ostrom 1992; de Janvry et al. 2001) acknowledges that privatization and individualization is not a priori the most efficient means of achieving tenure security. This was the basis for the revision of the 1975 World Bank land policy, which called for the introduction of private land rights in Africa, acknowledging the fact that communal tenure systems can increase tenure security and provide a basis for land transactions that are more cost-effective than freehold titles (Deininger and Binswanger, 1999). Although few African countries have gone through revolutionary land reforms or government-induced (land titling) tenure changes, there is evidence to indicate that tenure regimes are evolving towards individualized land rights in response to increased demand for secured land rights over scarce land resources (Peters, 2004; Udry, 2011).

After the land redistributive reforms dominating the land tenure debate during the last decade of the 20th century, there is now a renewed global interest in land policy and legal reforms, in part due to rapidly increasing population pressure and high food and fuel prices (IFAD 2001; Bonfiglioli 2003; Deininger 2003). Against this backdrop, there is a growing consensus that, even in rural African contexts where individual titling of land may not be desirable or feasible, simple recognition of the different breadth of rights individuals and communities have under the existing customary tenure system can yield significant benefits (Deininger et al. 2008). This can be done simply by providing poor land owners or users with options to have their rights in land documented.

With this recognition, a new and innovative approach is found in the continuum of land rights, rather than a narrow focus on individual land titling. In this approach, a range of possible forms of tenure are considered as a continuum from informal tenure systems (customary, occupancy rights) towards more formal land rights (leases or freehold rights), where each step in the process of securing the tenure can be formalized (UN-Habitat 2008). This approach has gained momentum in the last

decade due to the recognition of the aforementioned limitations of past land titling programs and the argument that, where population density is low and land is relatively abundant, the usufructuary rights given under customary tenure rights system do not impose large losses as long as markets for output, capital and insurance are poorly developed, which generally is the case in the sub-Saharan Africa context. Rather than a narrow focus on individual land titling, this approach involves a form of localized recording and documentation of rights (including secondary or derived rights to land), adapting and expanding existing tenure and land administration systems, where possible, and introducing new ones selectively (Augustinus and Deininger, 2005).

Since the turn of the new millennium, experience with implementation of the continuum of land rights approach has moved ahead in many sub-Saharan African countries, including Mozambique.¹

3. CONCEPTUAL FRAMEWORK

3.1. Tenure security: Concept and measurement issues

Before analyzing the effects of tenure (in)security (such as investment and credit impacts), the concepts of tenure (in)security and its measurement is worth exploring as its effects depend of the adopted definitions and ways of measuring tenure (in)security. Land tenure insecurity and tenure security have been defined in several ways, and in this paper, we adopt two alternative definitions, namely:

- a. Effective risk of being evicted or losing land rights
- b. Potential risk of losing land rights

In the first case, households sense of tenure (in)security may come from the perception that someone may challenge their land rights and eventually make them lose their rights to the land which can be affected by past or on-going threats either: (i) due to hazard of expropriation by the government (Jacoby et al. 2002); or (ii) encroachment or eviction by other individuals. However, a household's sense of tenure (in)security may not be strictly proportional to the number of land disputes or expropriation the household experienced in the past. The conditions that may increase their perception of risk could be global (foreign interest in land) or related to socio-economic trends of the locality (urban expansion, rural population growth, etc.). Therefore, in addition to the effective risk of losing land rights due to past and on-going land disputes or expropriation by government, the sense of tenure security of households may result from such global or local phenomenon as well, conditioned by the degree of protection the government offers against such risks.

Hence, in this paper, tenure (in-)security is defined as a perception variable where the beliefs are formed on the basis of past events – definition a) above – or expectations about the future – definition b) above – where in both cases information and knowledge about rights, legal restrictions, and various types of threats and protection opportunities really matter. These two definitions illustrate that the government may be the source of the risk or the source of protection against the risk depending on the setting or the formal land rights recognized by government that the land rights claimer has.

Land tenure (in-)security can be measured at farm plot, individual, household, group, or community levels. With conflicting claims over land, the increase in the (in-)security of one party may imply a reduction in the (in-)security of another party or parties. The strength of (in-)security can depend on traditional rights (customs, norms), modes of land acquisitions, legal protection (laws and law enforcement), duration of possession, social networks, political connections and power structure, the degree of scarcity (competition) and value of the land, and individual and group abilities.

To be able to investigate the determinants of tenure (in)security, two proxies can be used to capture the two types of sources of tenure insecurity discussed above, namely:

- a. Tenure (in)security as effective risk: We measure this source of tenure (in)security using a plot level perception of farmers' response to a question as to "whether they think their land rights might be challenged by others".
- b. Tenure (in)security as potential risk: Households' response indicating their "willingness-to-pay" for a legal document – the DUAT, or *direito de uso e aproveitamento da terra* (a certificate for the right of use and benefit of land) — to protect their interest in the land is used as a proxy variable to capture this source of tenure (in)security. For analytical purposes, it is important to distinguish the two measures of tenure (in)security.

¹ The evolution of land policy reform in Mozambique is discussed in Section 4.2 of this report.

There is no guarantee that households' willingness-to-pay for legal documents is directly correlated with the number of land disputes or expropriation they experienced in the past. To test whether or not this is the case, proper comparisons are made by comparing the correlations of the two proxy variables for tenure (in)security.²

3.2. Theoretical justification for improving property rights

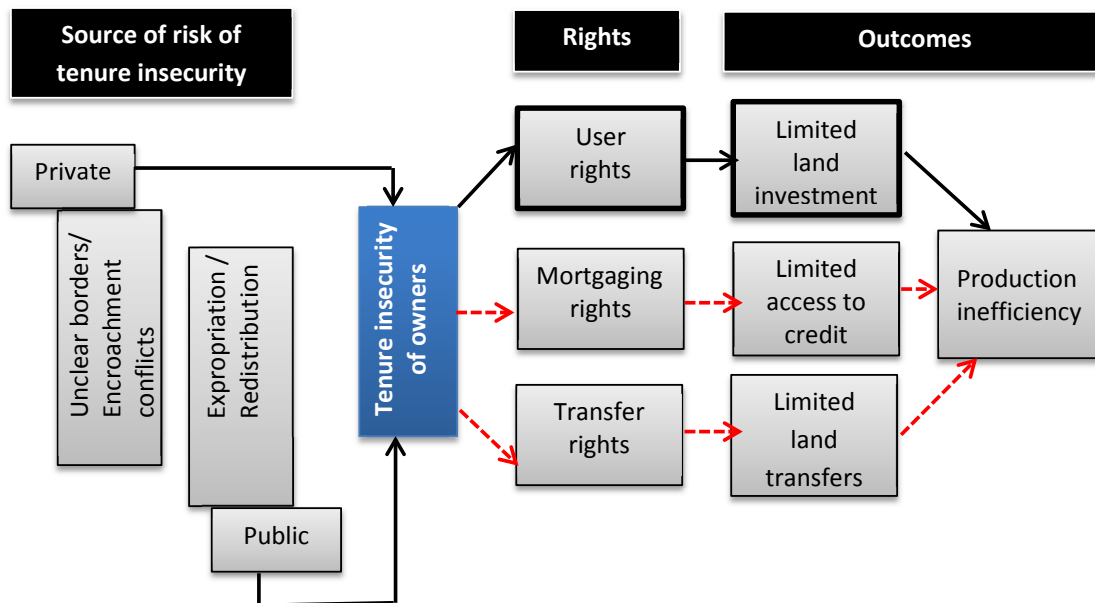
The two alternative definitions adopted in this paper do not depend on who “owns” land, but rather analyzes the formal and informal provisions that determine who has a right to enjoy *benefit streams* that emerge from the use of assets and who has no such rights (Libecap 1989; Eggertsson 1990; Bromley 1991). Regardless of the various combinations or ‘bundles’ of rights to the land (such as access, appropriation of resources and products, provision of management, exclusion of others, and alienation by selling or leasing), these rights need to be sanctioned by a collective in order to constitute effective claims.

Reflecting neoliberal thinking on private property rights and development, the existing literature identifies three channels through which land tenure security can, in principle, induce agricultural productivity, namely: (i) technological change through long-term investment in land (ii) smooth functioning of the land (rental) markets that lubricate factor-ratio adjustment, and (iii) facilitating access to (informal) credit or collateral arrangement (Besley 1995; Haavelmo 1960; Jorgenson 1967; Feder 1988). This paper focuses on analyzing the investment effects of perceived tenure (in)security.

Farm households' investment in practices that enhance the long-term viability of agricultural production hinges significantly on expectations regarding the length of time over which the investor (farmer) might enjoy the benefits, which mostly are long-term. These expectations depend on the sense of tenure (in)security (whether through ownership disputes, eviction or expropriation by the government). A landholder's sense of tenure security may, therefore, boost incentives to invest in such practices that enhance long-term sustainability of agricultural production (such as land improvements, conservation practices, and adoption of new technologies) which ultimately may increase farm productivity (Gavian and Fafchamps 1996; Hayes et al. 1997; Gebremedhin and Swinton 2003; Deininger and Jin 2006; Deininger et al. 2008; Holden et al. 2009).

Based on the theory and empirical literature discussed, a simple conceptual model for the determinants of tenure insecurity and how tenure insecurity may affect land rights and, thus, land use and production is outlined in Figure 1.

Figure 1: General model for source of tenure insecurity and their effects on land use and production



However, while it is commonly agreed that tenure security can stimulate investment, the opposite may also be true that investments are made to secure property rights (Sjaastad and Bromley 1997; Braselle et al. 2002; Place and Otsuka 2001). This means that perceived tenure insecurity of households may result in non-productivity enhancing investments (in the form of developing or maintaining boundary marks, fencing, etc.) to ascertain their claims to the land. In this study, we primarily focus on these alternative causal effects by disaggregating our outcome (investment) variable into two, namely: (i) investment in conservation structures; and (ii) investment in making and maintaining boundary marks. In our attempt to

² Correlation results show this is not the case.

analyze the productivity effects of tenure security following the framework portrayed in Figure 1, we focus our empirical analysis on showing the following linked effects a) and b) that may be seen as two sides of the same coin:

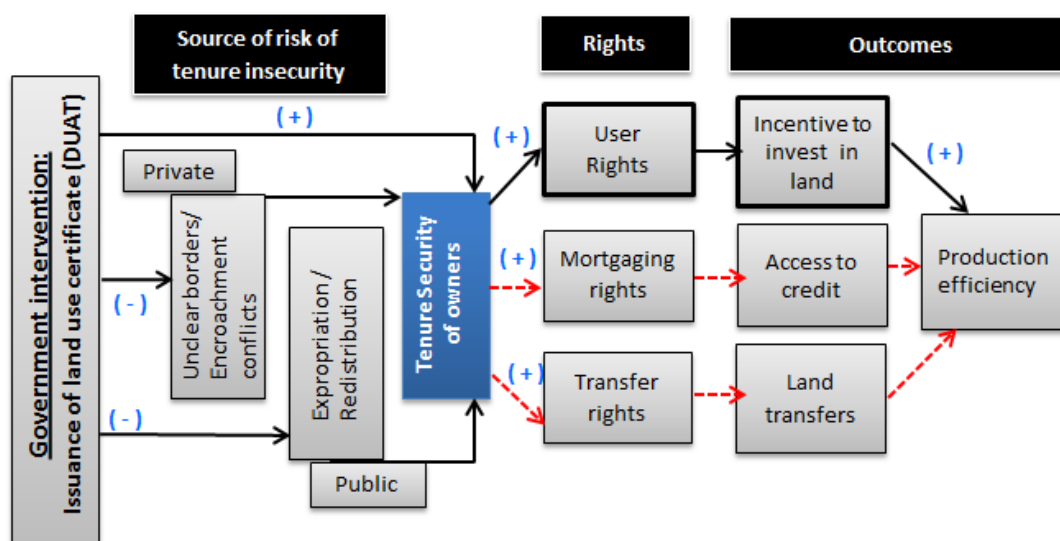
- a. Weak land rights → Tenure insecurity → Poor land management → Land degradation → Reduced land productivity → Food insecurity
- b. Land rights → Tenure security → Incentives to invest (conserve) → Reduced land degradation → Increased land productivity → Food security

Much of the tenure literature hypothesizes that tenure insecurity has a negative impact on the propensity to invest in land improvements (Hayes et al. 1997) and likewise that making land rights more secure would stimulate long-term investment on the land (Atwood 1990; Feder and Feeny 1991; Besley 1995). Several studies of investment impacts of land titling in Latin-America have demonstrated positive investment impacts (Alston et al. 1995; Deininger and Chamorro 2004; Lopes 1997) and the same is the case for some case studies in Asia (Feder 1988; Do and Iyer 2002). However, in Africa studies of land titling have not found any evidence of investment impacts (Migot-Adholla et al. 1994; Pinckney and Kimuyu 1994).

However, a recent study by Gebremedhin and Swinton (2003) found in Tigray, Ethiopia that long-term investments in stone terraces were associated with secure land tenure, while more short-term investments in soil bunds were associated with insecure tenure. In another study in the same area, Hagos and Holden (2006) find only a weak association between tenure security indicators and the probability and level of investment in stone bunds and stone terraces at farm plot level. In a study in southern Ethiopia, Holden and Yohannes (2002) found no significant effect of tenure insecurity on the probability of planting of perennials or on the probability and intensity of use of purchased farm inputs at farm plot level. On the contrary, they found that resource poverty was associated with low investment in perennials. This indicates that tenure security is insufficient to ensure investments. Other factors also matter.

We use our conceptual framework to consider on how government might act to increase the propensity for land holders to make productivity-enhancing investments. As shown in Figure 2, we assume that government intervention – for instance, the issuance of a DUAT to the land holder – enhances property rights and, thereby reduces or eliminates the risk of insecurity of tenure either by: (1) reducing or avoiding incidences of parcel border or encroachment conflicts (shown by the negative signs to imply the negative effect of the intervention on land related dispute with private entities/individuals); or (2) uncompensated confiscation or expropriation of one's property or parcel by public authorities (shown in the diagram by the negative effect of the intervention on households perceived risk of land expropriation by the government). Hence, such perpetuity in land use rights (due to significantly stronger tenure security for the household) is expected to boost incentives of owners/holders of the land to make productivity-enhancing land-related investments, such as investments in conservation structures, while it reduces unproductive investments, such as construction or maintenance of property/parcel boundary marks. (This is shown as the black and bold arrows at the top-right corner of Figure 2.) Though the productivity-enhancing effects of improved property rights could also be due to collateral-related (better access to credit) or land transferability effects, we are not able to test these hypotheses due to data limitation on credit and land transactions. To reflect this methodological constraint due to data limitation, red-broken arrows are used in Figures 1 and 2 to show the productivity effects of tenure security via the mortgage and transferability impacts.

Figure 2: Conceptual model of the relationship between low-cost land registration and certification, tenure security and food security



In a study from 2001 covering four regions of Ethiopia, Deininger and Jin (2006) found that transfer rights to land and tenure security were associated with higher investments, while Deininger et al. (2008) found a positive association between land certification and investment in a more recent cross-section survey in the same regions. Holden et al. (2009) found significant positive effects of low-cost land certification on investment in trees and maintenance of soil conservation structures in Tigray region. They also found that land productivity increased by about 40 percent on farm plots with land certificates, as compared to plots without certificates.

4. BACKGROUND: EVOLUTION OF LAND TENURE REFORM AND AGRICULTURAL PRODUCTIVITY IN MOZAMBIQUE

4.1. The broader relevance of land-related investment in Mozambique

Mozambique lies along the southeastern coast of Africa with an area of 799,380 square kilometers (km²). 68.7 percent or 49.3 million hectares of the land area is agricultural. Approximately 5.1 million hectares, which make about 10.2 percent of the agricultural area, is arable land, 44 million hectares is under permanent meadows and pastures, and 39.2 million hectares is forest area (FAOSTAT 2009).³

Currently, Mozambique's population is estimated at 24.5 million, of which 18.5 million (75.4 percent) obtain their livelihood from agriculture and 14.7 million (60 percent) reside in rural areas (FAOSTAT 2012).⁴ The country's population is growing at an annual rate of 2.3 percent. The population density is 29.7 people per square kilometer (IFAD 2010). In the last ten years, the country's population has increased by 27.5 percent, with 58.1 percent and 12.9 percent increases in the urban and rural areas, respectively. Although the proportion of the population that is agricultural has witnessed a slight decrease (by 2.7 percentage points) in the last decade, it has significantly increased in absolute terms by 3.5 million or 23.1 percent – far greater than the 1.7 million (12.9 percent) increase in the rural population (FAOSTAT 2012). This implies that in the context of Mozambique, the rural vs. urban dichotomy is not synonymous to the agricultural vs. non-agricultural dichotomy.

In 2010, Mozambique's GDP was USD 9.6 billion (in current USD) of which the contribution of agriculture was 31.9 percent, mainly from sugar, cotton, cashew nuts, timber and prawns. Since the 1992 peace settlement, there has been an increase in agricultural production and a decline in the country's dependence on food aid. However, 99 per cent of the country's food production is still generated by smallholders, most of whom continue to operate at close to subsistence level.

The basic food crops – cassava, maize, pulses, sweet potato, cashews, sorghum, and rice (paddy) – dominate overall crop production. Tobacco, sugarcane and cotton are the major commercial crops. Commercial farms are gradually gaining

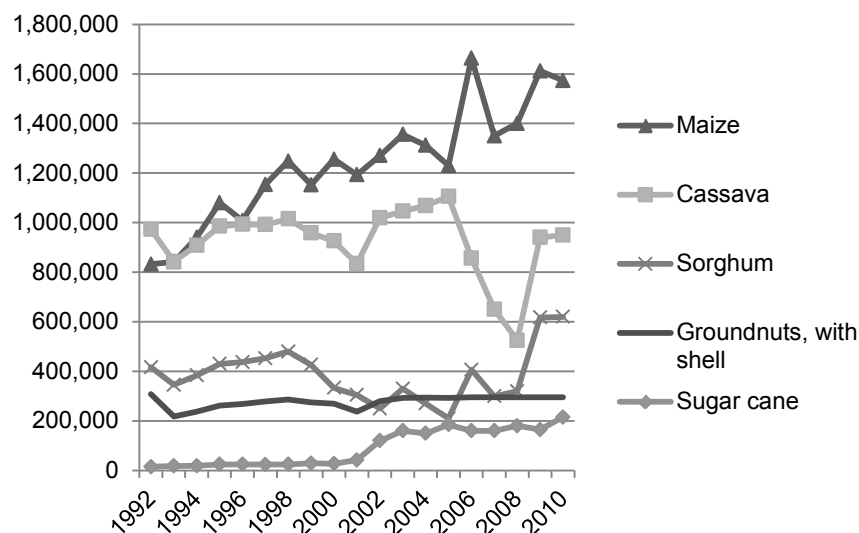
³ Some of the data are from official publications or web sites, while some others are FAO estimates.

⁴ It should be noted that the size of agricultural population is more than the size of the rural population.

importance. In the cotton and tobacco sectors, larger companies contract out production to smallholder farmers. Smaller marketing and agro-processing businesses are also developing and opening up new market opportunities for small-scale farmers in a wider range of products (IFAD 2012). As shown in Figure 3, in the last two decades the production of both food and commercial crops has increased significantly; the production of the food crops has been doubled while that of the commercial crops increased between five and ten-fold (FOSTAT 2010).

Increases in crop production are through expansion of farm land without a significant improvement in productivity (IFAD 2012). For instance, the area harvested to produce the five major agricultural crops has expanded significantly in the past two decades.

Figure 3: Trend in Expansion of Land, by Major Crops (hectares)



Source: FAOSTAT, 2012

As compared to other countries in the region, Mozambique's productivity of its major food crops is far less than that of most. For instance, Mozambique is ranked last out of ten countries in Southern and Eastern Africa, for groundnut productivity, eighth out of ten countries for its maize and sorghum productivity, and sixth and fifth out of nine countries for its productivity of cassava and sweet potatoes.

This lower level of land productivity is mainly due to the Mozambique's low level use of improved agricultural technologies (Rafael, 2009). The use of chemical fertilizers, pesticides, animal or motorized traction, and irrigation remains below regional averages. Of the total smallholders, which are almost the only sources of food production, few use modern inputs. Less than 5 percent use chemical fertilizers or pesticides. The use of improved seeds is limited (10 percent for maize, 3 percent for rice), while slightly more than 10 percent of smallholders use animal traction. This suggests that there is substantial untapped potential for increasing production and land and labor productivity (WB 2011).

In order to overcome the problem of low investment in the agriculture sector, Mozambique has done a lot in terms of improving land tenure systems. It was widely believed that the security of land tenure in Mozambique is one of the impediments to investment both for small and large farmers. Large agricultural enterprises can eventually obtain a land use title, but the process is slow. Small farmers with traditional land rights have the fear that some local authority might give the land in which they have invested to a development project, thus infringing on their traditional but undocumented land-use rights (WB 2011).

The other important feature of Mozambique's agriculture sector is the extraordinarily large amount of land that has been given to large-scale farming in the last two decades. According the 2011 report of the Oakland Institute, Mozambique granted concessions to investors for more than 2.5 million hectares (ha) of land between 2004 and the end of 2009. This is more than 3 per cent of the land area and 5 percent of the country's agricultural area. In this process, more than 1 million ha went to foreign investors. From the end of 2009 until at least mid-2011, however, there were no concessions granted of over 1,000 ha of land.⁵

⁵ Several large-scale investments were in the process of being cancelled, a step taken by the government because the investors were not carrying out the agreed upon investment plan.

To promote intensive farming that requires land-related investment in the form of conservation and agricultural intensification through modern technology adoption, new wave of land reforms has hit the country over the last two decades - mainly to strike the balance between small and large-scale, between domestic and foreign investment, and between commercial and food crops require close scrutiny of context including agroecology, population density, and some important sociopolitical conditions.

4.2. Mozambique's land policy

Following the 1992 peace accord between the ruling party, FRELIMO, and the guerrilla group, RENAMO, millions of people displaced by the civil war resumed agricultural production. In parallel to this, large amounts of land were being distributed to new and returning national and foreign companies. However, case studies revealed that land is not an abundant resource in Mozambique, free from competition or conflict. By then, the formal land-tenure and the land management systems were weak and ineffective and the land law did not reflect the economic, social, and political realities of the rural Mozambique (Myers, Eliseu, and Nhachungue 1994).

The 1979 Land Law and the 1986 Land Law Regulations allows the allocation of land concessions to the private sector and gives a right to smallholders access a small piece of land for own production purposes (De Wit 2002). Above all, the land law did not recognize customary tenure systems and therefore it denies community access rights to land that was not under cultivation. Conflicts over land were common due to the lack of compatibility between the traditional tenure system and the formal, government managed land regulation system (Tique 2001).

The situation resulted in general agreement within the government, international agencies and donor community in Mozambique that the introduction of new land was extremely important (Tanner 2001; Unruh 1997). In 1995 a new Land Policy was introduced. The new policy recognizes customary rights of access and management of land and the role of local leaders in conflict management and land allocation. In the following years through a broad based participation of all stakeholders, three key pieces of legislations were developed and approved. These are: the Land Law (Law 19/97), the Land Law Regulations (Decree 66/98), and the Technical Annex of the Land Law Regulations (2000) (De Wit 2001).

According to the new law, the State owns the land; and individuals and communities have legally recognized use rights over the land under their occupation. The law recognizes as "existing rights" the occupation of land by local communities or individuals according to customary norms and practices and occupation in good faith by individuals for a period of at least 10 years. In addition, individuals and legal entities could acquire new use rights by making formal requests to the State. The existing rights may be formalized through registration though their registration is not required by law. Registration of new rights is, however, compulsory (De Wit 2002).

The new land law also requires new land right seekers to consult the local community before procuring a land within the community's landholding; and, under normal circumstance, the community has the right to refuse the proposal (IIED 2006).

In spite of the strong legal protection they have, local communities' rights on their land remain vulnerable to increasing demand for land from investors. In connection to this, there is an argument that favors the formalization of acquired land rights though the law does not necessarily require doing so. However, formalizing acquired land rights was not an easy task; experiences show that the existing ways of formalizing land rights in the past were slow and expensive. Currently, in formalizing traditional rights on land, the widely-accepted common process is "delimitation". Delimitation is believed to be an open, flexible and participatory mechanism through which local communities define their land holdings (Norfolk and Tanner 2007).

De Wit and Norfolk (2010) summarize the community land delimitation process in six phases: i) Community sensitization; ii) Participatory community land rights diagnostics; iii) Participatory community land mappings; iv) Consensus-based community land map (Cartogram) production; v) Community land map validation by neighboring community; and vi) Issuance of community land certificate through Cadastral processing.

In the past, the community land delimitation in Mozambique was undertaken by NGOs in order to protect the local community's land from the speculators and to promote community-paced natural resources management initiatives. From the mid-2000s onwards, while still continuing to be largely donor- driven, community land delimitation started to be considered as a means of attracting investment. In line to this, in 2003, the ITC (Iniciativa Terras Comunitarias) Fund was established by group of international donors as a means of supporting the registration of local community's rights on their land with the ultimate objective of promoting local economic development opportunities through a balanced community-investor partnership. Furthermore, delimitation is also seen as means of creating local accountability for the protection of fragile environmental resources such as parks, conservation areas and community lands (De Wit and Norfolk 2010).

The delimitation process in Mozambique can be said “supply - driven” in the sense that it is mainly financed by NGOs. However, it can also be said “external demand-driven” since most of the community lands are delimited to be granted to investors (Åkesson, Calengo, and Tanner 2009; De Wit and Norfolk 2010).

With regard to the extent of the delimitation process - after ten years of community land delimitation- what is achieved is little. However, mainly due to lack of coordination between different actors – namely, the National Directorate of Lands and Forestry (DNTF), provinces and NGOs – involved in the delimitation process, it is difficult to provide accurate figures that tell the status of the process. An inventory that was made based on cadastral information revealed that, by early 2009, probably less than 10 percent of Mozambican “rural communities that equally cover less than 10 percent of the national territory were delimited. The major reasons for such low performance are, first, the process continued to be external demand-driven; secondly, the process was driven by the NGO sector and has never been government’s high priority; and, finally, the capacity of both the public and NGO sectors was weak. Although, since 2003, the ITC makes available resources for grassroots activities related to land and natural resources management, with a major focus on community land delimitation, this facility has also been slow in becoming fully operational (De Wit and Norfolk 2010).

However, in addition to lack of finance, community’s lack of legal knowledge about their land rights and the delimitation process is mentioned as a major factor behind the lack of community-driven delimitation process in Mozambique. The findings of a Randomized Control Trial study, undertaken by the International Development Law Organization (IDLO), on 58 selected communities from Mozambique, Uganda and Liberia, indicated that, on average, the performance of the communities that have received one or more types of legal support in their endeavor to complete their land documentation process is far better than the performance of those communities which have not been provided with any type of assistance. Based on this strong causal relationship and their extensive field experience, the study team concluded that providing legal education and capacity-building training concerning legal rights on land, introducing land documentation processes, educating land users on how to successfully complete the necessary land documentation process, and providing targeted legal and administration assistance to local communities would have a significant positive impact on the performance of community land documentation in the study countries (Knight et al 2012).

The introduction of the new land law of Mozambique and its partial implementation has already had some impacts, although it is not well studied and documented in a systematic manner. One of the immediate impacts of the new Land Law was the cancellation of thousands of applications in the pipeline for millions of hectares of land that were made under the old 1987 regulations. Given the fact that the old regulation did not offer sufficient safeguards for existing land users, had the applications not been canceled, it would have resulted in a considerable loss of land access for the rural poor (Norfolk, Nhantumbo, and Perira 2003).

Case studies undertaken in Nampula and Zambezia provinces indicated that local people perceive land registration as a mechanism to strengthen community land rights in relation to other communities and to private operators. The studies also showed that the reinforced security of tenure for common pool resources is fundamental for protecting the livelihoods of vulnerable groups (Chilundo et al 2005). There are also case studies that show how a delimitation exercise has strengthened local communities’ capacity to deal with outside agents. These efforts have led to the realization of useful development projects (Norfolk and Tanner 2007).

Today, the issue of land has moved higher up the political agenda of Mozambique, with the direct interventions of the President, Council of Ministers, communities, and donors in Mozambique. After it had been stopped in 2007, the community land delimitation has been resumed since 2010 with the support of the donor community (MPPB 2011).

5. DATA AND ESTIMATION STRATEGY

5.1. Data

The data used in this analysis come from the 2008 “Trabalho de Inquérito Agrícola” known as TIA-2008 survey, which was designed to be representative of rural zones at provincial and national levels. The TIA survey (collected by the Ministry of Agriculture) includes detailed field production information and rich demographic and infrastructure information for each household and community from 80 districts of the 10 provinces in Mozambique. Within each district, households were selected randomly. This yielded a sample size of 5,968 households operating 11,164 parcels. In addition to standard household characteristics, the survey contains results from various modules on land documentation, land tenure practices, perceived tenure insecurity, conflicts, investment, and land transactions for all households’ plots including information on land ownership and transfer rights, soil quality, and production at the plot level.

To explore the tenure security status of households, we used household level perception data on perceived tenure security (based on responses to whether or not they had fear of losing their land due to government expropriation) in the baseline survey in 1998. Furthermore, households' perceptions on the impacts of land certification on tenure security (i.e., households were asked if they believe that land certificates have effects on: reducing land related disputes; increasing chances of being compensated during times of possible expropriation; and enhancing women's tenure status). To assess whether there is a growing demand for more secure property rights, household responses to hypothetical questions about their willingness to pay for further government actions of improving tenure security was used.

Land-related investment: We use a dummy for whether or not households have engaged in construction of conservation structures as indicators for productivity-enhancing long-term investment. Non-productive land investment is proxied by whether or not the plot had received investments in constructing or maintaining plot borders or boundary demarcations.

5.2. Estimation methods

The available data allow us to disaggregate tenure security in to effective risk of losing land and potential risk of losing land.

TENURE (IN)SECURITY MODEL:

In addressing the major research questions, two parcel-level dichotomous dependent variables have been utilized to identify the determinants of household perceived tenure (in)security: (i) potential dispute, and (ii) willingness to pay for DUAT. As mentioned above, we model households' perceived tenure (in)security as binary choice model (with left-hand side variables equal to 1 if the household either fears losing the land or is willing-to-pay for DUAT, and 0 otherwise) treating two types of definitions of tenure (in)security, separately. With a potential major problem of non-normality of the error term concerning the standard OLS estimation of such models, we utilize the maximum likelihood binary response model – probit model (Woldridge, 2000; Gujarati, 2003; Green, 2000).

In making responses to their fear-of-losing-land or the decision regarding households' willingness-to-pay for DUAT, we assume there is unobserved factor (utility index) R_i^* that explains why farm households fear losing their land or are willing-to-pay for DUAT. We postulate this variable R_i^* (latent variable) is a function of vector of exogenous variables with the relationship specified as:

$$R_i^* = \gamma' Z_i + \varepsilon_i \quad (1)$$

where R_i^* is a latent variable (unobserved) that shows the perceived tenure (in)security; Z_i is a vector of exogenous variables (household demographic variables, asset and physical endowment variables and other village level factors such as distance to major market and population density) that influence perceived tenure security; γ' is a vector of parameters; and ε_i is independent of Z_i which represents factors unobserved by the researcher but known to the farmers (sample respondents). We further assume the random disturbance term ε_i is normally distributed with zero mean and variance equal to one ($\varepsilon_i \sim N(0,1)$).

Instead of observing the latent variable R_i^* (perceived risk of tenure insecurity), we only observe a dichotomous variable (indicator variable) R_i which follows the sign of the latent variable R_i^* . When the perceived risk is positive ($R_i^* > 0$), the farm household is observed as tenure insecure with $R_i = 1$.

Therefore, for farm household 'i', the observed binary response can be given as:

$$R_i = 1 \quad \text{if } R_i^* = \gamma' Z_i + \varepsilon_i > 0 \quad (2)$$

$$R_i = 0 \quad \text{if } R_i^* = \gamma' Z_i + \varepsilon_i \leq 0 \quad (3)$$

Thus the distribution of R_i given Z_i can be obtained as:

$$\begin{aligned}
 P(R_i = 1|Z_i) &= P(R_i^* > 0|Z_i) \\
 &= P(\gamma'Z_i + \varepsilon_i > 0|Z_i) \\
 &= P(\varepsilon_i > -\gamma'Z_i|Z_i)
 \end{aligned} \tag{4}$$

Denoting θ^6 as the standard normal cumulative distribution function (*cdf*), equation (4) yields:

$$\begin{aligned}
 P(R_i = 1|Z_i) &= 1 - \theta(-\gamma'Z_i) \\
 P(R_i = 1|Z_i) &= \theta(\gamma'Z_i)
 \end{aligned} \tag{5}$$

INVESTMENT MODELS

To be able to assess the investment effects of perceived tenure (in)security, two approaches were used to distinguish the productivity enhancing from non-productivity enhancing investment effects. Since land sales and mortgaging of land are illegal in Mozambique, we do not expect any effects along this potential line of impact chain (as shown in the conceptual framework). Lack of enough observations (with only 1.8 percent of the sampled households in 2008 participating in the land rental market) on practices of land (rental) transactions in our sample also hinders a test of the transferability effects of perceived tenure (in)security.

We use a dummy for whether or not households have engaged in construction of conservation structures as outcome variables for capturing the productivity-enhancing long-term investment while the non-productive land investment is proxied by whether or not the plot had received investments in constructing or maintaining plot borders or boundary demarcations. For an investment on parcel 'p' by household 'h', the general reduced form specification of the estimated model is as follows:

$$I_{hp} = \alpha_0 + \beta_1 Q_{hp} + \gamma_1 R_{hp} + \lambda_2 Z_h + \eta_4 V + \varepsilon_{hp} \tag{6}$$

where I denotes a dummy for whether or not investment was undertaken on parcel "p" by household "h"; Q_{hp} is a vector of plot level biophysical characteristics; R_{hp} is a dummy variable representing the two alternative tenure (in)security indicators; Z_h is a vector of household characteristics; V is village level infrastructure and land accessibility (such as market access and population density); ε_{hp} is the error component assumed to be normally distributed with zero mean and variance equal to one ($\sim N(0,1)$). As mentioned above, the two alternative specifications for the tenure (in)security variables were used to check the robustness of results.

6. RESULTS

6.1. Descriptive evidence

Summary results from Table 1 show that, on the overall, households own 2.5 parcels with an average per capita farm size of 0.66 ha. Transfer of land among relatives represents the dominant mode of land access (26.4 percent of the parcels were gift transfers from relatives while 22.7 were inherited parcels). Perhaps a direct outcome of the existing land law in Mozambique that recognized occupied parcels as legitimate acquisitions, a quarter of the parcels in the sample (25.4 percent) were acquired through occupation by farm households. On average, the level of participation in the land rental market is very low with less than one percent the parcels were transacted (either leased-in or leased-out). The low level of land transactions is also shown as less than 6 percent of land in the studied districts was acquired through purchase.

⁶ $\theta(R_i^*) = \theta(\gamma'Z_i) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma'Z_i} e^{-k^2} dk$, where k is the standard normal variable i.e., $k \sim N(0, \delta^2)$

Table 1: Descriptive summary – Parcel level

Variables	Perceived tenure insecurity (Household fear of land related dispute)						
	All		Household with no fear of loss of land		Household with fear of loss of land		significance
	mean	St. Err.	mean	St. Err.	mean	St. Err.	
Household characteristics							
Age of household head	44.443	(44.443)	44.417	(0.144)	44.806	(0.536)	
Male household head	0.789	(0.789)	0.787	(0.004)	0.812	(0.014)	
Adult equivalent family size	4.728	(4.728)	4.702	(0.026)	5.081	(0.110)	****
Head is salary employed	0.522	(0.522)	0.512	(0.008)	0.656	(0.034)	****
Head is self-employed	0.588	(0.588)	0.585	(0.007)	0.627	(0.027)	**
Number of years since plot ownership	10.402	(10.402)	10.436	(0.090)	9.912	(0.339)	*
Household is a tenant household	0.087	(0.087)	0.085	(0.003)	0.113	(0.012)	***
Household is a landlord household	0.054	(0.054)	0.052	(0.002)	0.088	(0.010)	****
Total number of plots	2.519	(2.519)	2.511	(0.013)	2.623	(0.050)	**
Farm size per consumer unit	0.66	(0.660)	0.654	(0.007)	0.748	(0.042)	****
Land rights and mode of acquisition							
Land dispute in the past	0.035	(0.035)	0.027	(0.002)	0.146	(0.013)	****
Household is willing to pay for DUAT	0.166	(0.166)	0.146	(0.003)	0.451	(0.018)	****
Household has Proof of ownership	0.012	(0.012)	0.011	(0.001)	0.027	(0.006)	****
Plot is borrowed	0.049	(0.049)	0.048	(0.002)	0.065	(0.009)	**
Plot is purchased	0.058	(0.058)	0.055	(0.002)	0.087	(0.010)	***
Plot acquired from formal authorities	0.035	(0.035)	0.034	(0.002)	0.050	(0.008)	**
Plot is acquired via inheritance	0.227	(0.227)	0.229	(0.004)	0.209	(0.015)	
Plot is acquired via individual occupation	0.254	(0.254)	0.259	(0.004)	0.186	(0.014)	****
Plot is acquired via gift from family/relatives	0.264	(0.264)	0.262	(0.004)	0.289	(0.016)	
Plot is rented	0.006	(0.006)	0.006	(0.001)	0.005	(0.003)	
Plot acquired from traditional authorities	0.100	(0.100)	0.100	(0.003)	0.100	(0.011)	
Plots with conservation investment	0.082	(0.082)	0.083	(0.003)	0.065	(0.009)	*
Plots with demarcation investment	0.040	(0.040)	0.038	(0.002)	0.075	(0.010)	****
Plot had conservation investment	0.031	(0.031)	0.092	(0.003)	0.086	(0.010)	
Plot had demarcation investment	0.092	(0.092)	0.051	(0.002)	0.100	(0.011)	****
Distance to parcel	0.054	(0.054)	20.955	(0.621)	21.949	(1.972)	
Community level characteristics							
Agricultural potential (length of growth period – LGP) – (district level)	189.8	(1.478)	189.5	(0.335)	193.3	(1.145)	***
Population density (district level)	54.7	(6.275)	52.4	(1.596)	86.0	(9.976)	****
Cultivated area per capita (district level)	1.377	(0.092)	1.411	(0.022)	0.900	(0.053)	****
Uncultivated area per capita (district level)	3.154	(0.148)	3.242	(0.048)	1.944	(0.100)	****
Number of observations	11,164		759		10,405		

Note: * significant at 10%; ** significant at 5%; *** significant at 1%; and **** significant at 0.1%

St. Err.: standard errors

Source: Author's computation from TIA 2008 survey

Only 1.2 percent of the parcels in the studied area had formal titles or any documentation as a proof of ownership while the summary results show that households' willingness-to-pay for documents of right validation remained high. Almost 17 percent of the parcels were reported as parcels where households had shown interest in their willingness-to-pay for land rights documentation. Consistent with previous studies (Rafael, 2009), farm households' decision to engage in long-term land related investment was poor. Long-term investment in the form of soil and water conservation measures was undertaken in only 3.1 percent of the plots in the studied area while investment in boundary demarcation was slightly higher (9.2 percent of the plots). The low percentage of investment in conservation structures as compared to a relatively higher percentage of investment in boundary demarcation can be an indication of a higher sense of perceived tenure insecurity in the study area.

Vindicating our choice of this variable (fear-of-loss-of-land) as a proxy for capturing tenure (in)security of households, results shows that households willingness-to-pay for documents that strengthen tenure security (willingness-to-pay for DUAT) is significantly higher on plots with self-reported risk of loss as compared to those with relatively higher degree of tenure security. Though results from the study area shows low level of willingness to pay for DUAT (only 16 percent of the

parcels were reported to be parcel that households are willing to-apply for DUAT), the proportion is significantly higher for parcels that households fear losing their rights (45 percent). On the other hand, the willingness-to-pay for acquiring a DUAT for parcels that households reported to have a relatively higher degree of tenure security is only 14.6 percent.

Table 2: Descriptive summary – Household level

Variables	Perceived tenure insecurity (Household fear of land related dispute)				
	Fear		No fear		significance
	mean	St. Err.	mean	St. Err.	
Male household head	0.788	(0.043)	0.773	(0.019)	
Age of household head	43.568	(1.783)	44.071	(0.588)	
Years of schooling for household head	2.947	(0.331)	2.643	(0.146)	**
Household head with formal employment	0.308	(0.057)	0.266	(0.020)	*
Household head with self-employment	0.414	(0.056)	0.360	(0.020)	**
Family size	5.782	(0.339)	5.382	(0.118)	**
Agricultural potential and land abundance					
Farm size per adult equivalent, ha	0.722	(0.265)	0.608	(0.028)	***
Population density	89.002	(39.992)	61.455	(7.286)	**
Cultivable area per capita, ha	2.764	(0.871)	4.809	(0.325)	****
District level length of growing period	193.3	(4.326)	188.6	(1.607)	**
Market access (walking hrs to urban center)	327.129	(21.82)	356.377	(7.313)	****
Adoption and long-term investment					
Investment in demarcation of parcels	0.066	(0.022)	0.030	(0.008)	****
Investment in conservation	0.048	(0.026)	0.048	(0.010)	
Long-term land related investment	0.149	(0.035)	0.092	(0.014)	****
Adoption of fertilizer	0.040	(0.013)	0.018	(0.006)	
Adoption of manure	0.080	(0.029)	0.047	(0.008)	
Modes of land acquisition					
Acquired land by occupying	0.162	(0.033)	0.254	(0.013)	****
Acquired land by cash purchase	0.064	(0.033)	0.033	(0.013)	***
Acquired land from inheritance	0.178	(0.047)	0.194	(0.017)	
Number of observation	377		4756		

Note: * significant at 10%; ** significant at 5%; *** significant at 1%; and **** significant at 0.1%
St. Err.: standard errors

Source: Author's computation from TIA 2008 survey

Household level results of summary statistics of key household and parcel characteristics are reported in Table 2. Results show that households with relative abundance of land have higher level of perceived tenure insecurity. The average per capita farm size of those households who reported to have fear of losing at least one of their land holdings is 0.722 hectare, while it is 0.608 hectare for those with no fear of losing their land. Perceived tenure insecurity is also higher among those households who resides in communities with densely populated and land scarce communities as well as in areas with better access to market and higher agricultural potential. Similar to the findings from the parcel level analysis, farm households' investment in making their parcel boundary marks clearer is higher for those with fear of loss of land. On the other hand, comparing households' by their status of tenure (in)security, there is no significant difference in making investments in conservation structures and adoption of fertilizer/manure.

Comparing the gender of heads of the households in Table 3, the level of knowledge of the existing land law in Mozambique is higher among male-headed households than female-headed households. Such difference is also witnessed in terms of households' willingness-to-pay for improved land rights. Results show that while 18.1 percent of the households headed by males are willing-to-apply for DUAT, only 11.5 percent of female-headed households have reported to have any interest in applying for documentations of improving land rights.

Table 3: Tenure security, disaggregated by gender of head of household

Tenure security indicators	Female		Male		signifi- cance
	mean	St. Err.	mean	St. Err.	
Knowledge of the land law	0.120	(0.009)	0.185	(0.006)	****
Land related dispute in the past	0.047	(0.006)	0.060	(0.004)	*
Fear of future loss of land	0.069	(0.007)	0.081	(0.004)	
Willingness-to-pay for DUAT	0.115	(0.009)	0.181	(0.006)	****
Has proof of ownership (DUAT)	0.010	(0.003)	0.017	(0.002)	*
Total number of plots	1.760	(0.027)	1.981	(0.016)	****
Farm size per consumer unit	0.568	(0.017)	0.613	(0.011)	**
Number of observations	1386		4582		

Note: * significant at 10%; ** significant at 5%; *** significant at 1%; and **** significant at 0.1%

St. Err.: standard errors

Source: Author's computation from TIA 2008 survey

Results from Table 4 show that the average age of heads of households who accessed land via family gift is significantly lower than those who accessed land from traditional authorities with 41.7 and 47 years old, respectively. On the other hand, results from the same table also show that the dominant mode of land access for female-headed households is inheritance while family gift is so for younger heads of households. As an evidence of potential pitfall of the traditional land tenure system in protecting land rights of vulnerable groups, such as women, almost one out of four female headed households with access to land via inheritance were female headed households while the proportion of such female headed households with having access to land via traditional authorities and individual occupation is significantly lower, 18.4 percent and 16.5 percent, respectively. The findings are similar when comparing female land ownership rights based on the various modes of land acquisitions. While 42.1 percent of parcels acquired via inheritance are owned by women, only 25.9 percent of the parcels acquired by individual occupation are under women ownership.

Table 4 also compares willingness-to-pay for DUAT of households based on the various modes of land acquisitions. As compared to parcels acquired via individual occupation, willingness-to-pay for DUAT is significantly higher on parcels accessed through inheritance. Consistent with this findings, perceived tenure insecurity (which is measured hereby reported fear of loss of land) is significantly higher on parcels acquired via inheritance as compared parcels accessed via individual occupation (which is direct reflection of the existing land law of Mozambique that gives full recognition of rights to the land acquired via individual occupation). Getting access to land from traditional authorities remained to be the most dominant mode of land acquisition in areas with high population density and communities with relative higher land abundance. Comparing land access from traditional authorities with access via individual occupation, on average, parcels acquired from traditional authorities are located in communities with a population density of 77 persons/km² while the figure is only 46.6 persons/km² for parcels acquired via individual occupation.

Table 4: Key parcel characteristics, disaggregated by major modes of land acquisitions

Variables	Modes of Parcel Acquisition			
	Traditional Authorities	Family Gift	Occupation	Inheritance
Household level characteristics				
Male household head	0.786 (0.012) *	0.779 (0.008)	0.835 (0.007) ****	0.762 (0.008)
Age of household head	47.001 (0.446) **	41.544 (0.265)	45.572 (0.271)	45.699 (0.295)
Adult equivalent family size	5.128 (0.085)	4.525 (0.044) ****	4.451 (0.047) ****	5.004 (0.064)
Landlord household	0.039 (0.006) ****	0.043 (0.004)	0.050 (0.004)	0.071 (0.005)
Tenant household	0.017 (0.004) ****	0.033 (0.003)	0.022 (0.003)	0.043 (0.004)
Years of plot ownership	11.651 (0.277) **	10.212 (0.151)	9.417 (0.128)	12.633 (0.280)
Farm size per capita, ha	0.717 (0.023) *	0.624 (0.011)	0.719 (0.014)	0.664 (0.017)
Head is salary employed	0.595 (0.028)	0.540 (0.016)	0.369 (0.013)	0.596 (0.019)
Head is self-employed	0.568 (0.022) ***	0.544 (0.013)	0.579 (0.014)	0.623 (0.016)
Total number of plots	2.213 (0.037) ****	2.499 (0.024)	2.501 (0.024)	2.717 (0.032)
Land rights and tenure security				
Plot jointly owned	0.002 (0.001)	0.002 (0.001)	0.001 (0.000)	0.002 (0.001)
Plot owned by female	0.373 (0.015) ***	0.396 (0.009) *	0.259 (0.008)	0.421 (0.010)
Plot owned by male	0.584 (0.015) ***	0.566 (0.009)	0.717 (0.008)	0.531 (0.010)
Has proof of ownership (DUAT)	0.008 (0.003)	0.006 (0.001)	0.006 (0.001)	0.006 (0.001)
Willingness to pay for DUAT	0.17 (0.011)	0.164 (0.007) **	0.137 (0.006)	0.19 (0.008)
Land dispute in past	0.031 (0.005)	0.037 (0.003)	0.030 (0.003)	0.030 (0.003)
Fear of future loss of land	0.068 (0.008)	0.074 (0.005)	0.05 (0.004)	0.063 (0.005)
Plot characteristics				
With conservation investment	0.138 (0.01) ****	0.099 (0.006) ***	0.059 (0.004)	0.062 (0.005)
With demarcation investment	0.038 (0.006)	0.033 (0.003)	0.043 (0.004)	0.044 (0.004)
Had conservation investment	0.144 (0.011) ****	0.064 (0.005)	0.109 (0.006)	0.081 (0.005)
Had demarcation investment	0.049 (0.006) ****	0.049 (0.004)	0.049 (0.004)	0.066 (0.005)
Distance to parcel	21.471 (1.744) *	21.043 (1.248)	19.17 (0.807)	17.952 (1.209)
Community level characteristics				
Length of growth period – (LGP) – (district level)	186.2 (1.2) ****	187.9 (0.596) ****	188.0 (0.698) ****	194.3 (0.582)
Population density (district)	77.812 (7.995) ***	44.311 (2.263) ***	46.635 (1.517) **	53.958 (3.47)
Cultivated area per capita (district)	1.303 (0.063)	1.554 (0.042) ***	1.45 (0.042) ****	1.238 (0.042)
Uncultivated area per capita (district)	3.897 (0.227) ****	3.093 (0.082) ****	3.651 (0.091) ****	2.59 (0.074)
Number of observations	1,112	2,947	2,834	2,538

Note: * significant at 10%; ** significant at 5%; *** significant at 1%; and **** significant at 0.1%

++ Significance test for the equality of group means was conducted using “inheritance” as a reference group.

Source: Author’s computation from TIA 2008 survey

6.2. Econometric results

Before we investigate the relationship between tenure security and long-term land related investment, we first explore what attributes contribute to a household’s perception of tenure (in)security – which is measured by household’s fear of future loss of land or, alternatively, by household’s willingness-to-pay for land certificates (DUAT). To show the robustness of results, probit and ordinary least square (OLS) results are reported in Table 5, while Table 6 shows the empirical results of the probability model of sense of tenure security after disaggregating the sample of parcels/plots by mode of acquisition. Table 7 presents results of the determinants of probability of long-term land-related investment.

On the basis of results reported in Table 5, the probability of perceived tenure insecurity is positively correlated with a parcel being owned by female members of households as compared to male owners. Similar to the findings from the descriptive summary, Table 6 shows that the probability of a household’s perceived tenure insecurity (herewith captured by fear of future loss of land) is higher on parcels acquired as a gift from relatives or family as well as via market means (purchased parcels). Perhaps showing the positive impact plot economic value plays in dictating the demand for more improved property right protection, results show that the probability of tenure insecurity is higher when the economic value of the plot is higher – i.e., when the parcel is located in urban or peri-urban areas.

Similarly, household's willingness-to-pay for the DUAT is higher when the parcel has relatively higher economic value and when the parcel is owned by households with relative land abundance (i.e., households with higher farm size per consumer unit). On the other hand, the probability of willingness-to-pay for DUAT is lower on parcels acquired via individual occupation and parcels with temporary ownership status (such as borrowed or rented land). Similar to the effect of female ownership of land on fear of loss of land, the willingness to pay for DUAT is lower if the parcel is owned by female member of the household.

Table 5: Probability models of perceived tenure security (two approaches)

Variables	Pr(fear of loss of land)		Pr(willingness-to-pay for DUAT)	
	Model 1a [†]	Model 1b ^{††}	Model 2a [†]	Model 2b ^{††}
Urban or peri-urban location	0.179*** (0.06)	0.024*** (0.01)	0.234**** (0.05)	0.055**** (0.01)
Farm size per capita	0.082* (0.04)	0.009* (0.01)	0.285**** (0.04)	0.056**** (0.01)
Farm size per capita squared	-0.006 (0.01)	-0.001 (0.00)	-0.036**** (0.01)	-0.005**** (0.00)
Total number of plots	0.012 (0.01)	0.002 (0.00)	-0.016 (0.01)	-0.003 (0.00)
Plot is purchased	0.215** (0.08)	0.030*** (0.01)	0.088 (0.07)	0.025 (0.02)
Plot is borrowed	0.175* (0.09)	0.026** (0.01)	-0.378**** (0.08)	-0.084**** (0.02)
Plot acquired from formal authorities	0.172* (0.10)	0.026* (0.01)	0.010 (0.08)	-0.000 (0.02)
Plot acquired via individual occupation	-0.021 (0.06)	0.001 (0.01)	-0.197**** (0.04)	-0.046**** (0.01)
Plot acquired via gift from family	0.130** (0.05)	0.019*** (0.01)	-0.058 (0.04)	-0.014 (0.01)
Plot is rented	-0.060 (0.26)	-0.006 (0.03)	-0.431** (0.22)	-0.094** (0.05)
Plot acquired from traditional authorities	0.068 (0.07)	0.011 (0.01)	-0.093* (0.06)	-0.022* (0.01)
Has proof of ownership	0.250* (0.14)	0.048** (0.02)	0.603**** (0.12)	0.201**** (0.03)
Owner of the plot is female	0.115** (0.05)	0.017*** (0.01)	-0.194**** (0.04)	-0.044**** (0.01)
Plot is owned jointly	1.184**** (0.28)	0.279**** (0.05)	0.469* (0.28)	0.131* (0.07)
Knowledge of the land law	0.544**** (0.04)	0.087**** (0.01)	0.600**** (0.04)	0.172**** (0.01)
Age of household	0.001 (0.00)	0.000 (0.00)	0.002** (0.00)	0.001** (0.00)
Head of the household is male	0.102* (0.06)	0.014** (0.01)	0.114** (0.05)	0.025** (0.01)
Land dispute in the past	0.923**** (0.07)	0.208**** (0.01)	0.210*** (0.07)	0.059*** (0.02)
Constant	-2.011**** (0.10)	-0.001 (0.01)	-1.308**** (0.08)	0.094**** (0.02)
R_squared	0.357	0.423	0.513	0.409
Number of observations	11,027	11,027	11,027	11,027

Note: * significant at 10%; ** significant at 5%; *** significant at 1%; and **** significant at 0.1%. Standard errors in parentheses.

†: Results from probit models; †† Results from OLS models

Source: Author's computation from TIA 2008 survey

On the other hand, Table 6 shows correlates of perceived tenure insecurity disaggregated by the various modes of land acquisition. Results show contrasting effects of key household characteristics (e.g., age of head of the household) on the perceived risk of losing land depending on the modes of land acquisition. As shown in Table 6, though older landholders feel

more insecure of the possession (use rights) of parcels acquired from formal and traditional authorities, reported risk of loss of land acquired via individual occupation is minimal the older the household head is. Consistent with the findings from Table 5, regardless of the mode of land/parcel acquisition, perceived tenure insecurity is consistently higher on parcels with past incidence of disputes/conflicts.

Table 6: Probability model of perceived tenure insecurity, disaggregated by mode of land acquisition

	Purchased	Borrowed	Formal authorities	Inheritance	Individual occupation	Family gift	Traditional authorities
Urban or peri-urban location	-0.223 (0.20)	0.362* (0.21)	-0.142 (0.28)	0.353*** (0.12)	0.232 (0.18)	0.063 (0.12)	0.460** (0.20)
Distance to parcel	0.001 (0.00)	-0.002 (0.00)	-0.001 (0.00)	-0.000 (0.00)	-0.002 (0.00)	-0.002 (0.00)	0.001 (0.00)
Farm size per capita	0.018 (0.23)	0.633* (0.33)	-0.100 (0.46)	0.177 (0.13)	0.211** (0.10)	0.121 (0.16)	-0.224 (0.17)
Farm size per capita squared	0.001 (0.05)	-0.101 (0.06)	-0.037 (0.17)	-0.035 (0.03)	-0.014 (0.01)	-0.032 (0.05)	0.056* (0.03)
Total no. of plots	-0.090 (0.06)	0.066 (0.09)	0.043 (0.08)	-0.009 (0.03)	-0.005 (0.04)	-0.007 (0.03)	0.051 (0.05)
Has proof of ownership (DUAT)	-0.035 (0.24)	1.367* (0.80)	0.437 (0.50)	-0.445 (0.61)		0.849*** (0.32)	0.539 (0.47)
Plot owned by female	0.144 (0.19)	0.027 (0.21)	-0.120 (0.24)	-0.122 (0.10)	0.030 (0.13)	0.370**** (0.09)	-0.032 (0.17)
Plot owned jointly	1.456** (0.64)	1.869*** (0.69)				2.127**** (0.57)	
Knowledge of land law	0.524**** (0.16)	0.306* (0.18)	0.946**** (0.22)	0.202** (0.09)	0.509**** (0.11)	0.808**** (0.08)	0.787**** (0.13)
Age of household head	-0.001 (0.01)	0.016** (0.01)	0.013* (0.01)	0.001 (0.00)	-0.011**** (0.00)	-0.001 (0.00)	0.014*** (0.00)
Male head of household	-0.146 (0.21)	0.875*** (0.30)	-0.335 (0.28)	0.213 (0.13)	-0.023 (0.15)	0.092 (0.10)	-0.014 (0.19)
Past experience of land dispute	0.715*** (0.24)	1.547**** (0.37)	0.903** (0.36)	1.049**** (0.17)	1.119**** (0.15)	0.769**** (0.14)	0.757*** (0.26)
Constant	-1.183*** (0.38)	-3.439**** (0.47)	-2.048**** (0.54)	-1.924**** (0.21)	-1.426**** (0.22)	-1.916**** (0.18)	-2.525**** (0.33)
R_squared	0.176	0.132	0.119	0.166	0.211	0.142	0.27
Number of Obs.	604	541	354	2,494	2,805	2,937	1,097

Note: * significant at 10%; ** significant at 5%; *** significant at 1%; and **** significant at 0.1%. Standard errors in parentheses.

Source: Author's computation from TIA 2008 survey

Table 7 presents results of probit and Ordinary Least square (OLS) regression models to investigate determinants long-term land-related investment – measured by a dummy for whether or not actions of soil conservation were undertaken (column 1a and 1b, respectively), or investment was made in constructing parcel boundary demarcations (column 2a and 2b). Results point towards a significant impact of modes of land acquisitions on investment behavior of households. While parcels that have been acquired from traditional authorities or from family as a gift are significantly more likely to have received soil conservation investments, parcels that are rented or borrowed are more likely to be without any long-term land-related investment in the form of soil conservation structures. Contrasting signs of the coefficients on the two types of proxies for tenure (in)security indicators indicate that investment in soil conservation structures is more likely in parcels where households have no fear of future loss of land and are more willing to pay for documenting their interests in the parcel (i.e., their willingness to pay for DUAT).

Comparing the effects of perceived tenure insecurity on the two types of long-term land-related investments (namely, soil conservation structure as well as investment in parcel boundary demarcation), results from Table also shows that household tenure insecurity has contrasting effects on conservation investment with potential productivity enhancing effects as compared to investments in parcel demarcations with no or little farm productivity enhancing effect. While fear of future loss of land (i.e., perceived tenure insecurity) of households increases chances of household investment on parcel boundary demarcation, its effect on productivity enhancing long-term investment (i.e., soil conservation structure) is negative. This finding is consistent with our hypothesis of the disincentive effects of tenure insecurity on long-term land-related investment.

Consistent with the findings of the investment effects of perceived tenure insecurity, higher demand for improved property rights (i.e., higher willingness-to-pay for DUAT) is associated with significantly higher probability of long-term land-related investment – both in the form of soil conservation structure as well as parcel boundary demarcations. The coefficient on household’s knowledge of the land law is significant and positive in our conservation investment model, suggesting that better knowledge of land related legal provisions increase the likelihood to make investment in conservation structures - though, this variable is not found to be statistically significant in explaining investment in parcel boundary demarcation. This would imply that, in addition to introducing low-cost and less complex land law and land administration reforms, interventions in creating public awareness of such reforms will have significant effects on household’s long-term land-related investment behavior.

Table 7: Determinants of long-term land related investment (probability of investment in soil conservation and parcel boundary marks)

Variables	Probability of soil conservation		Probability of border investment	
	Model 1a ⁺	Model 1b ⁺⁺	Model 2a ⁺	Model 2b ⁺⁺
Perceived tenure insecurity	-0.225*** (0.08)	-0.033*** (0.01)	0.266**** (0.08)	0.030**** (0.01)
Parcel is formal authorities	0.878**** (0.15)	0.188**** (0.03)	0.434** (0.19)	0.045** (0.02)
Plot is acquired from borrowed	-0.222* (0.12)	-0.024 (0.01)	-0.148 (0.14)	-0.013 (0.01)
Plot is individually occupied	-0.021 (0.05)	-0.003 (0.01)	0.012 (0.06)	-0.000 (0.01)
Plot acquired as a gift from family/relatives	0.254**** (0.05)	0.038**** (0.01)	-0.088 (0.06)	-0.008 (0.01)
Plot rented	0.480** (0.20)	0.082** (0.03)	-0.141 (0.32)	-0.012 (0.02)
Plot acquired from traditional authorities	0.430**** (0.06)	0.073**** (0.01)	-0.077 (0.08)	-0.008 (0.01)
Willingness to pay for DUAT	0.132*** (0.05)	0.022*** (0.01)	0.190**** (0.06)	0.019**** (0.01)
Plot owned by female member	-0.017 (0.05)	-0.002 (0.01)	-0.187*** (0.06)	-0.016*** (0.00)
Plot owned jointly	0.108 (0.10)	0.019 (0.02)	-0.126 (0.14)	-0.012 (0.01)
Knowledge of land law	0.142** (0.06)	0.014*** (0.01)	0.060 (0.05)	0.009 (0.01)
Age of household head	-0.007 (0.01)	-0.001 (0.00)	0.015* (0.01)	0.001 (0.00)
Male household head	0.075 (0.06)	0.010 (0.01)	0.230*** (0.08)	0.013** (0.01)
Literate household head	0.041** (0.02)	0.006** (0.00)	0.010 (0.02)	0.001 (0.00)
Farm size per capita	0.078**** (0.02)	0.015**** (0.00)	0.006 (0.03)	0.001 (0.00)
household has access to extension	0.269**** (0.06)	0.048**** (0.01)	-0.098 (0.08)	-0.008 (0.01)
Constant	-1.654**** (0.17)	0.044* (0.02)	-2.467**** (0.23)	-0.009 (0.02)
R_squared	0.361	0.237	0.346	0.127
Number of Obs.	11,004	11,028	11,004	11,028

Note: * significant at 10%; ** significant at 5%; *** significant at 1%; and **** significant at 0.1%. Standard errors in parentheses.

Source: Author’s computation from TIA 2008 survey

In line with this, literacy of the head of the household is positively associated with conservation investment while parcels owned by male-headed households are more likely to be with investment in the form of parcel boundary demarcation. More surprisingly, household farm size per consumer unit is positively associated with investment in conservation structures. While limitations in the data availability do not allow us to control for plot quality attributes (such as soil quality of parcels),

such positive effect of farm size per capita on conservation investment could be explained due to a possible positive correlation between larger farm sizes and inferiority in land quality.

7. CONCLUSION

Although issues of land rights and tenure security are high on the national policy agenda in Mozambique, comprehensive studies on how such new land reforms affect tenure security and long-term investment in land are scarce. Taking advantage of a detailed plot-specific household survey from Mozambique, this study analyzes the determinants of household perceived tenure insecurity (demand for improved property rights) and its effect on long-term land-related investment. Results show that household's perception of tenure security contributed to enhance long-term land-related investment in the form of soil conservation structure and parcel boundary demarcations.

The presence of a significant demand for certificates of land ownership (i.e., household's willingness-to-pay for DUAT), as shown from our empirical findings, implies the opportunities to strengthen the pro-poor impacts of the on-going land reform programs by establishing a system that would respond to this demand effectively. Therefore, it may not be an ill-advised direction or strategy if the government intensifies the low-cost approach to the formalization of land use rights (land certification) since such policy measure is found to improve household's perceived tenure insecurity and their engagement in long-term land related investment. However, the ongoing land tenure reform program by itself may not achieve the promised effects on agricultural development unless it is complemented by measures such as more determined efforts to disseminate new land laws.

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