Land tenure security and land values in an underdeveloped land market context

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Abstract

This paper investigates the relationship between land tenure and land values. The key challenges addressed are measuring tenure security and land values in the context of underdeveloped land markets. While tenure insecurity is measured in terms of the perceived risk and actual rights, the revealed preference methodology (through self-reported hypothetical land values) is used for land values. Using cross-sectional data in urban and rural areas, the study concludes that land values are higher in land parcels acquired through formal and market-led mechanisms in rural areas, and that existing investments in land parcels have a positive effect on land values.

Key words: DUAT; property rights; Mozambique; land values; tenure security

1. Introduction

There is a perception that secure property rights lead to increased land values. This has motivated several countries to promote laws to increase tenure security. However, few studies have estimated the impact of such legislative change on land values, with the exception of Deininger and Jin (2009) in China.

The purpose of this paper is to provide empirical evidence of the effect of tenure security on land values in urban and rural areas in Northern Mozambique. This paper aims to answer two main research questions: (a) What is the effect of tenure security on land values? and (b) What is the effect of the measure of tenure insecurity on land values? These questions have important policy implications as they help to understand why landowners buy a land title (use rights), and can thus provide guidance on the creation of incentives for land market development.

2. Conceptual framework

2.1 Defining and measuring tenure security

Before developing the empirical models for this study, I want to provide the definition and measures of tenure security. Theoretically, secure and transferable land rights have long been identified as enhancing investment and productivity, as they facilitate access to credit and the relocation of production factors to maximise allocative efficiency in resource use (Deininger & Jin 2006). These relationships were formalised in three distinct channels: free from expropriation or security, collaterality, and gains from trade (Besley 1995; Deininger *et al.* 2008; Abdulai *et al.* 2011).

The security argument indicates that when people feel free from the threat of expropriation, they have an incentive to invest more in their land, therefore strengthening property rights increases the marginal value of an investment. According to Abdulai et al. (2011), secure land is expected to provide a guarantee for farmers to undertake long-term investments, since there is no fear of expropriation.

The collaterability argument asserts that, for land that is easy to collateralise, banks will charge lower interest rates on loans. As stated by Abdulai et al. (2011), secure rights mean that land is used as collateral to obtain loans for financing agricultural investments. This is valid in well-functioning credit markets under a political environment that allows free land transfers.

With the gains from trade argument, it is believed that the transferability of land lowers the cost of exchange if the land is either rented or sold. Along the same line of reasoning, Banerjee et al. (2002) observe that tenancy reform is a combination of two effects: the increased bargaining power effect and the tenure security effect. In their classification, the security effect is similar to the free from expropriation channel of Besley (1995). Abdulai et al. (2011) add that secure tenure enhances factor mobility by making farmers sell or rent their land. Another argument about the linkages between land tenure and investments is that farmers without secure rights cannot claim the returns from the investments made in or attached to land.

Unfortunately, operationalising these relationships faces several empirical challenges. The most important is stated by Arnot et al. (2011), namely that measurements and attribution are serious problems in the quantitative estimation of the effect of tenure security and investment, because tenure security is multidimensional and many dimensions are not observed directly by outsiders (Deininger & Ali 2008). On the other hand, it is now recognised that title does not necessarily provide higher tenure security, suggesting that a combination of objective and subjective measures of the threat of expropriation as a proxy for tenure security have been used, and therefore the results should be interpreted accordingly.

All these challenges make it difficult to clearly establish the content of tenure security and its effect in a systematic way. Drawing insights from Arnot et al. (2011) to capture the assurance and duration of tenure components of tenure security, tenure insecurity is defined using perception variables believed to be highly correlated with actual rights and perceived risks, and this is measured at the plot level. Tenure insecurity as the perceived risk is measured by households' responses indicating: (a) their likelihood to lose parcels due to land disputes; (b) their concerns about experiencing land conflicts in the future; and (c) their willingness to pay for a legal land-use rights document (the DUAT[1]). As actual rights, tenure insecurity is measured by: (d) the duration of possession of a parcel (10 or more years is considered good faith occupation under Mozambique's 1997 Land Law, which confers some level of security under the customary system); (e) modes of acquisition (ideally, the formal and market-led modes of acquisition would offer more tenure security than other forms of acquisition); (f) the number of perceived rights to use and transfer land should offer more security to landholders; and (g) the lack of documentation as an indication of high tenure insecurity.

To better understand how these various measures of tenure security affect investments and land values, I established bivariate relationships between the actual rights and perceived risks, as indicated in Table 1.

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[1] From the Portuguese Direito de Uso e Aproveitamento dos Terras – the right of use and benefit of land.

Table 1: Tenure security measures rights and outcomes in urban and rural areas

Objective rights	Indicators	Hypothetical land value per m²			
		Sales value (MZM)	Rental value (MZM)	Sales value (MZM)	Rental value (MZM)
		Urban		Rural	
Parcel owner for 10 or more years	No	336.41	11.20	28.91	4.16
	Yes	440.03	12.19	43.40	22.17
	Difference (Yes vs. No)	**			
Total number of full rights held over the parcel	0 (Min.)	423.18	11.53	37.00	22.31
	6 (Max.)	426.78	3.14	83.21	7.08
	Diff. (max., min.)			*	
Modes of land acquisition	1. Other modes of acquisition	337.86	9.66	32.77	9.71
	2. Ceded by formal authorities	831.39	31.68	33.12	1.68
	3. Purchased parcel	432.86	12.74	137.63	129.31
	Difference (1 vs 2)	**	**		
	Difference (1 vs 3)	**		**	**
No document	No	513.67	16.20	3.74	0.10
	Yes	326.15	8.94	45.41	20.31
	Difference (Yes vs. No)	**	**	**	
Total		400.30	11.81		39.66

* p < 0.05, ** p < 0.01, *** p < 0.001
MZM, Mozambican Meticais
Source: Author's computation from the MCA/MINAG baseline survey data, 2010 and 2012

The results highlight five key findings: First, the duration of possession of the land/parcel decreases the perceived risks of expropriation, increases the likelihood of searching for DUAT, and is associated with higher hypothetical land values. However, the longer the ownership of the parcel, the lower the probability of investing. This may suggest that the parcels are already under investment, or that they are no longer valuable to attract investment. Second, the number of perceived uses and transfers of rights is associated with lower perceived risk of expropriation and higher willingness to formalise land ownership. Surprisingly, a lower number of use and transfer rights are associated with higher rental values; this could be an indicator of inefficient land markets (speculative price).

Third, the formal and market-led modes of land acquisition seem to be associated with less perceived risk of expropriation, but are correlated with higher demand for DUAT, a higher likelihood of investments, and higher land values relative to other modes of acquisition. Fourth, the lack of documentation, chosen as a proxy for tenure insecurity, is positively associated with higher perceived risk of future land conflicts, a lower likelihood to search for DUAT, and lower investments and land values. Fifth, there are some similarities between urban and rural areas. The major differences are: duration of possession is not necessarily associated with perceived risk of expropriation. The lack of documentation in rural areas is associated with tenure insecurity and a high demand for DUAT, in contrast to the lower demand for DUAT in urban areas. Note that willingness to pay to acquire land titles is not necessarily correlated with tenure insecurity resulting from the experience of disputes or conflicts in the past (Hagos 2012), but it can be correlated with the availability of more information on land rights (awareness of the Land Law Act), access to land formalisation services, financial capacity, and community conformity or peer pressure. However, given the increased land pressure by national and foreign investors, especially in rural areas, willingness to pay (WTP) for DUAT can indicate some sort of tenure insecurity. However, our data show a weak correlation between WTP for DUAT and land disputes in the past. Thus, interpretation of the empirical results should be done with caution.

To establish the relationship between tenure security and land values, I use Figure 1 to highlight the theory of change in the form of long-term investment decisions by farm households to argue that land reform aimed at improving tenure security can lead to increased land-related investments, thus leading to high land values. However, for the stated relationships to be effective, some conditions must hold, such as the existence of legal and judicial institutions to enforce rights, the existence of functioning markets and institutions (Gavian & Fafchamps 1996; Hayes *et al*. 1997; Gebremedhin & Swinton 2003; Deininger & Jin 2006; Deininger *et al*. 2008), and a socio-economic context. Finally, the effect of tenure security and transferability on land values and productivity is expected to be high in locations with a high level of tenure security. The argument is that farmers are likely to claim the returns from the investments made or attached to their land if they have secure tenure.
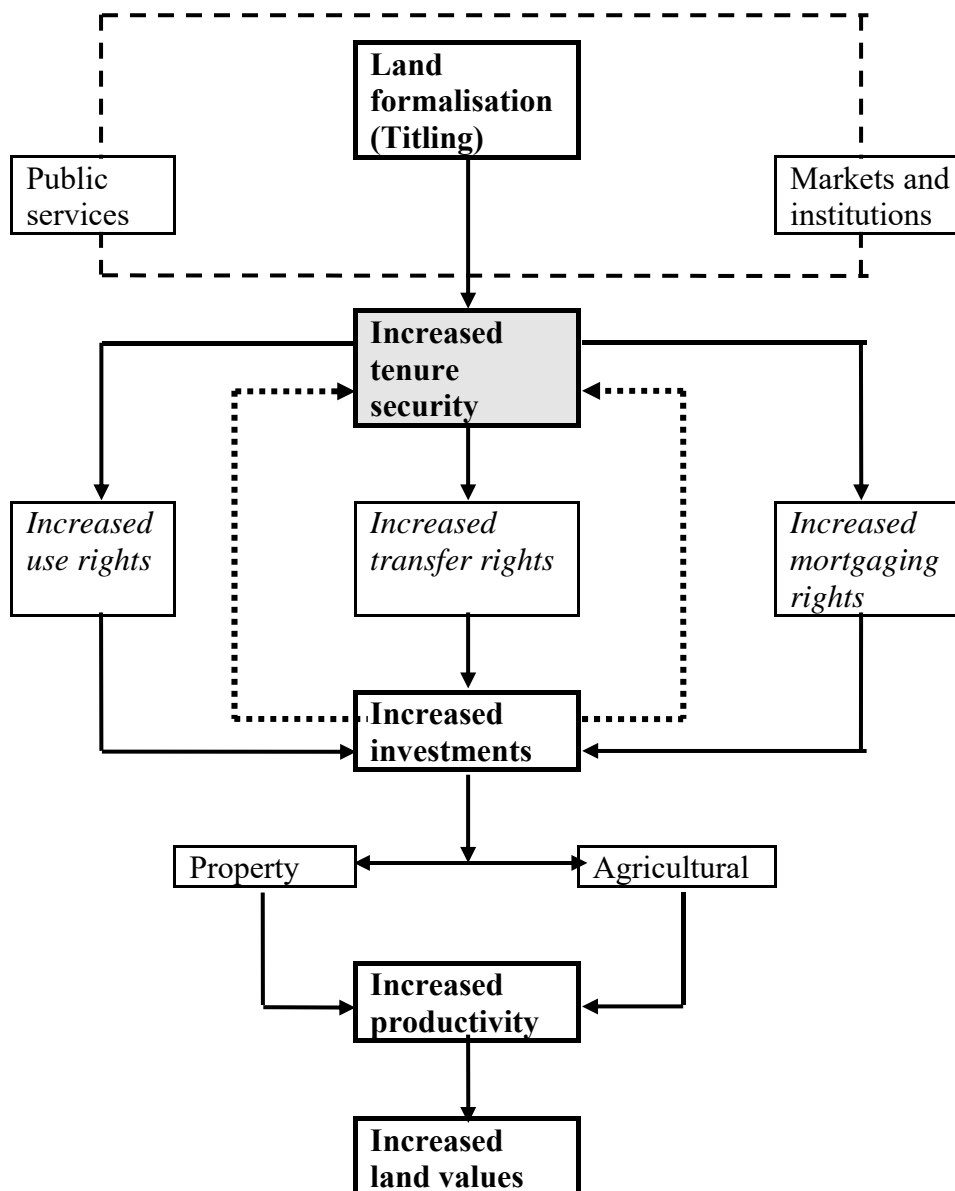

Figure 1: Conceptual framework
Source: Author's creation

3. Data and methods

3.1 Description of data

The data used for this study are drawn from two baseline surveys conducted by Michigan State University in collaboration with the Ministry of Agriculture of Mozambique to evaluate the impact of the land tenure project under the five-year compact signed between Millennium Challenge Corporation (MCC) and the Government of Mozambique.

The baseline surveys were conducted in selected urban and rural areas in Nampula and Cabo Delgado provinces (Northern Mozambique). The urban survey was conducted from October to December 2010 in the Nampula and Monapo municipalities, covering a total of 1 690 households that own a total of 3 992 parcels (3 987 with complete information). The same survey was implemented in rural areas of Malema District, where 1 417 households owning 5 216 parcels (4 422 with complete information) were surveyed in September and October 2011 and in April and May 2012 (Maredia *et al*. 2012).

The data collection team interviewed the head of the households using a structured questionnaire. In households that were male-headed with a spouse present, the spouse was the respondent for the livestock and food consumption modules. To minimise coverage error, if the head of the household was not present at the time of the first visit, enumerators tried to make an appointment to visit the household again to interview the appropriate person within the period of data collection. The questionnaire included more than 25 sections covering a variety of land- and agriculture-related topics, and questions on investment decisions.

3.2 Estimation strategy

The literature on land values tends to be categorised into two groups: (a) those that employ the net present value to measure land values, and (b) those that use the actual land prices derived from the land markets. The latter group is more recent, aiming to address some of the limitations observed in the former group of literature. As indicated by Deininger and Jin (2006), land values are best measured by the expected profit from cultivating a parcel, or simply the present value of future discounted profits from cultivating the plot. However, Goodwin *et al*. (2003) highlight that the major limitations of the present value approach arise from the fact that valuing farmland using the current value of future cash flows discounted according to the risk of these flows is based on expectations about the long-run stream of net returns to production, which is a very strong assumption and mostly unrealistic. In agricultural production settings, several uncertainties are expected (e.g. price, climate fluctuations and environmental degradation), which lead to several challenges in estimating current land values with accuracy.

Given these empirical challenges and the thin (no more than 12% in urban and rural areas were either rented in or rented out) and imperfect land market that characterises the study area, I argue that the net current value approach is expected to be very problematic as a consequence of: (a) undeveloped markets (input/output, credit, etc.), (b) the significant economic growth observed in the last decade (including land reform: land titling), which is likely to leave landowners with flexibility and security in diversifying their land uses; and (c) being cyclically hit by natural disasters, making floods and droughts less predictable and leading to large variability in farm profits. Noting from the international evidence that the hypothetical land values are much higher than the land profits, using land profits will only provide the lower bounds of land values; hence, to addresses all these challenges, this paper resorts to the non-market valuation method to elicit

the values farmers attribute to land resources. Starting from the premise that the economic value is measured by the most one is willing to forgo in terms of goods and services in exchange for other goods and services, the revealed preference method is used to evaluate the consumptive value of land through hypothetical land values as a crude approximation of land prices in a situation of lacking actual land. The empirical model to assess the effects of tenure security measures with land values is as follows:

$$L_{hi} = \lambda_0 + \lambda_1 X_{hi} + \lambda_2 T_{hi} + \lambda_3 Q_h + \alpha_4 V + \pi_{hi} \qquad (1)$$

where L_{hi} is a measure of land values (hypothetical rental and sales values per square metre); X_{hi} is a vector of interactions of household characteristics and tenure security measures; T_{hi} is a vector of tenure security measures (objective rights); Q_{hi} is a vector of pre-existing stock of investments and parcel characteristics; and π_{hi} is the error term assumed to be normally distributed. This model is estimated using ordinary least squares, with the dependent variable being the log of land values per square metre, controlling for household fixed effects and household heterogeneity.

3.3 Description of variables and their expected effects

The household characteristic variables considered in the models include household head's educational attainment (measured as the highest grade completed in years), literacy level and gender. Table 2 presents the hypothesised effects in each model.

Table 2: Expected sign of the determinants of land values

Variables	Land values per m^2
Perceived risk	
Fear of losing parcel (d)	-
Concerned about future conflict	+
Willingness to pay for DUAT	+
Actual rights	
Number of use and transfer rights	+/-
Parcels with no documentation (d)	-
Parcels owned for 10 or more years (d)	+/-
Ceded by formal authorities (d)	+
Purchased land (d)	+
Other modes of land acquisition (d)	-
Parcel characteristics	
Parcel area (m^2)	-
Number of buildings within parcels	+
Cashew trees (number)	+
Coconut trees (number)	-
Parcel used for agriculture (d)	-
Experienced land conflict (d)	+/-
Household characteristics	
Female-headed household (d)	-
Level of education of the head (years completed)	+

(+): positive effect; (-): negative effect; (+/-): undetermined effect
(d) dummy variable

I hypothesised that education and literacy were positively correlated with land values, as they allow landholders to make informed investment decisions and make rational land value assessments. A positive effect on investments is expected with number of perceived use and transfer rights, purchased land and land acquired through formal authorities; but a negative effect on investments is expected on parcels with existing investments, female-headed household land

size, lack of documentation, other modes of land acquisition than purchased, and duration of possession of parcels. Parcels that experienced past land conflicts are expected to be more land insecure, therefore discouraging investments and lowering their land values, but on the speculative market, the land values could be high give the higher insecurity.

Three additional tenure security proxies were also considered, such as documentation and property rights possessed over the parcels (parcels without documentation), and property rights parcels held over parcels (use rights without approval or unlimited user rights). I hypothesised that parcels without documentation are more tenure insecure, while those with unlimited user rights can have more investments, resulting in higher values.

The lack of documentation is expected to affect the value attached to land in both regions, although in opposite directions. The descriptive results show that, while documented parcels in the urban areas tend to be attached to higher values, this is in contrast to what is observed in rural areas. This result is puzzling in the sense that it seems to suggest that not having any documentation could raise land values, which could be seen as counterintuitive, but in the rural context it could also imply that other parcel characteristics (such as parcel amenities) are more important than a mere piece of paper signifying ownership, or that parcels with no documentation are regraded as secure and thus carry an implicit high value.

Under the customary land system in Mozambique,[2] the duration of possession of a parcel is seen as an indication of security over it, reducing the risk of expropriation. However, it creates an incentive/disincentive to demand the registration of formal property rights; therefore, we expect a negative or positive effect on investments.

Differences across plots in terms of amenities also affect the suitability of parcels for various investments. Therefore, information on parcel characteristics such as plot size, modes of land acquisition, rights over the parcels, the number of buildings, the number of trees, land uses, duration of possession of parcels (number of years) and past experience of land conflict on the parcels are included.

Regarding the perceived risks, I expected a positive effect on land values of willingness to pay for DUAT and concern about future conflicts, while a negative effect was expected on fear of losing land. Three main reasons can explain my hypothesis: (a) for any long-term investment, it is required by law that a DUAT should be obtained as a precondition for such investment; (b) concern about future conflicts can indicate land pressure and consequently high land values, especially in urban areas; and (c) when there is fear of losing land, it is perceived that the ability to secure the specific parcel is lost or is lower, leaving the landholders with perceived lower land values and discouraged to make any investment of which they cannot enjoy the benefits.

4. Results and discussion

4.1 Descriptive evidence

The summary statistics of key household characteristics are reported in Table 3. In urban areas the results show no significant statistical differences in the key household characteristics across land value distribution, except for education and fear of future conflicts, which shows that land values are positively associated with the risk of expropriation and level of education. In essence,

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[2] Under good faith occupation, a household gains rights over a parcel that it has occupied for ten or more years.

the risk of future land-related conflicts in urban areas increases with the value of the parcels, and the educated household heads tend to have significantly higher expectations of the land values of their parcels than those with lower education, suggesting that good valuation skills result from high education, or a deliberate tendency by educated heads to choose high-value land.

Table 3: Household characteristics in urban and rural areas by hypothetical land values

Household characteristics	Sales value quintiles (MZN/m²)		Monthly rental value quintiles (MZN/m²)		Significance	
	Low (1)	Top (2)	Low (3)	Top (4)	1 vs. 2	3 vs. 4
Urban						
Age of the head (years)	41.1	40.3	42.4	41.1		
Percentage of heads who are literate	78.3	79.1	72.4	82.5		
Level of education of the head (years)	6.2	6.6	5.5	6.6		**
Household size (# members)	5.3	5.6	5.9	5.9		
Fear of loss of land	4.2	3.1	4.6	3.4		
Concerns about future conflict	9.9	17.6	12.2	17.6	*	*
Number of observations	241	508	221	377		
Rural						
Age of the head (years)	46.4	44.8	45.3	42.9		**
Percentage of heads who are literate	49.0	39.8	51.5	36.4	*	**
Level of education of the head (years)	5.6	6.0	5.9	6.1		
Household size (# members)	5.2	5.8	5.3	5.2		
Fear of loss of land	1.6	4.4	1.3	2.8	**	**
Concerns about future conflict	9.3	12.4	7.6	9.0		
Number of observations	381	113	401	244		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Source: Author's calculations based on the MCA/MINAG baseline survey data, 2010 and 2012

Turning to the rural areas, there are generalised significant differences in household characteristics and land values. The results show that high-value land or higher land value expectations are associated with younger and literate or educated heads, large family size, and high risk of land loss. In general, the demographic characteristics of the households do not vary with perceived land values in the urban areas, although they do in the rural areas, and tenure insecurity increases with land values and vice versa.

Table 4 summarises the key parcel characteristics of the hypothetical land values in urban and rural areas. The summary results in Table 4 show that, overall, there are significant differences between parcels based on their hypothetical values in both regions.

The results of this study highlight the following five key points: First, the value of parcels in the urban areas does not vary with parcel size, while in the rural areas smaller parcels tend to be highly valued compared to larger parcels. Parcels used for residence tend to be highly valued in both regions.

Second, given the limited land-related investments in both rural and urban areas, the average total investment value in both regions does not vary significantly with land value. It is important to note a difference in the pattern of investments made in land in the two study areas. Our results show that, while more parcels with lower value receive investments, construction or rehabilitation in the rural areas, the opposite is observed in urban areas, leading to a significantly higher average investment value in the parcels with higher value compared to those with lower value.

Table 4: Parcel characteristics in urban and rural areas by hypothetical land values

Parcel characteristics	Sales value quintiles (MZN/m²)		Monthly rental value quintiles (MZN/m²)		Significance	
	Low (1)	Top (2)	Low (3)	Top (4)	1 vs. 2	3 vs. 4
Urban						
Average parcel size ('1 000 m²)	18.3	30.0	22.6	44.4		
Parcels used for residence (%)	49.6	63.0	45.1	62.6	**	**
Parcels used for agriculture (%)	35.4	34.0	34.5	32.6		
Parcels purchased (%)	65.6	87.3	59.2	86.6	**	**
Parcels ceded by formal authorities (%)	0.5	2.4	0.2	3.2	*	*
Average time of possession of parcels (years)	17.8	14.5	17.4	15.8	**	**
Parcel with no documentation (%)	62.4	52.4	66.4	54.6		
Parcels with primary road as the main access (%)	16.5	7.0	9.6	10.9	**	
Parcels with tap water as main water source (%)	54.1	76.6	26.4	81.0	**	**
Parcels with access to mobile network (%)	84.7	96.5	94.7	96.3	**	**
Average total investment per m² (Mt)	0.1	1.9	0.1	2.4	*	*
Parcels with investments in construction/rehabilitation (%)	8.7	12.3	5.2	12.2	*	*
Parcels with investments in facilities/services (%)	5.4	7.2	3.2	5.6		
Number of observations	376	1,493	368	1,076		
Rural						
Average parcel size ('1 000 m²)	36.0	22.5	36.1	23.1	**	**
Parcels used for residence (%)	27.9	33.6	28.3	32.9		
Parcels used for agriculture (%)	11.9	17.4	11.9	11.6		
Parcels purchased (%)	6.0	38.1	9.3	18.3	**	**
Parcels ceded by formal authorities (%)	0.3	0.3	0.3	0.7		
Average time of possession of parcels (years)	16.0	20.4	15.9	16.1		*
Parcel with no documentation (%)	50.3	99.6	51.4	100.0	**	**
Parcels with primary road as the main access (%)	4.9	7.3	5.0	12.8		**
Parcels with tap water as main water source (%)	0.7	2.1	0.8	0.8	**	
Parcels with access to mobile network (%)	14.0	50.6	17.0	27.5	**	**
Average total investment per m² (Mt)	0.0	0.1	0.0	0.1		
Parcels with investments in construction/rehabilitation (%)	5.7	4.1	5.2	5.2	**	
Parcels with investments in facilities/services (%)	0.2	0.0	0.2	0.8		
Number of observations	1,467	348	1,478	762		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Source: Author's calculations based on the MCA/MINAG baseline survey data, 2010 and 2012

Third, the modes of acquisition are also associated with the hypothesised land values. The results show that a large proportion of purchased parcels have a significantly high value in both regions, while parcels ceded by formal authorities have a significant value difference in the urban areas, but not in the rural areas.

Fourth, the time of possession of a parcel is associated with a value that the households attribute to their land. The results in Table 4 show that, while in the urban areas parcels acquired a long time ago (about 17 years) are attached to lower values, the opposite is observed in the rural areas.

Fifth, the parcels' amenities have a significant influence on land values in the study area. The results show that a large proportion of parcels with tap water as the main water source and access to the mobile network are associated with high land values in both study zones. On the other hand, a large proportion of parcels with a primary road as the main access are associated with lower land sales values in urban areas, while they are associated with higher rental values in rural areas.

4.2 Empirical results

In urban areas, the three measures of perceived risks are significant determinants of land values. According to the results in Table 5, the demand for DUATs and concerns about future land conflicts increase land values, while the fear of losing land reduces values. These results provide an assessment of the economic value of land legislation reform, as well as the potential gains from extending the coverage of land registration and full dissemination of the Land Law.

The actual rights are also good predictors of land values, as reported in Table 5. In urban areas, the perceived use and transfer rights, and duration of land possession, are negatively associated with sales and rental values respectively. The purchased parcels and those ceded by formal authorities have higher hypothetical rental values compared to those acquired through the customary system. The land values (sales) are lower in parcels with no documentation, suggesting that the formalisation of land is likely to result in high returns. The perceived use and transfer rights show an opposite effect in urban and rural areas. While land values decrease with the number of rights in urban areas, the opposite is observed in rural areas, suggesting that the land values reported in the two areas reflect two different components of land values: the transactional value in rural areas and the speculative value in urban areas.

The land values increase with pre-existing investments (buildings and coconut trees) in both rural and urban areas. However, in the rural areas, the number of cashew trees is associated with lower rental values. This can be explained by the fact that, if rented land is used for productive activities, crowded fields reduce the available space for production, thus lowering their potential values. Similarly, coconut trees increase sales values in urban areas but decrease rental values in rural areas. These results highlight the importance of the value of a pre-existing investment in determining the land value. It appears that the pre-existing investment only increases land values if it is of high value and for a definite transfer, otherwise it decreases.

Parcel characteristics such as accessibility, land size, and access to water and the mobile network were found to be determinants of land values. The results in Tables 5 and 6 show that access to tap water increases land values, and that land values decrease with land size. Contrasting results between the two regions are found with respect to accessibility. While the sales value in urban areas decreases in parcels with good accessibility, the opposite is found in rural areas. This suggests that an improvement in infrastructure is likely to have higher returns in rural than in urban areas with respect to land values. Priority therefore should be given to rural infrastructure development, given that most of the urban areas surveyed had well-established infrastructure. The second contrast between the two regions is access to the mobile network. While access to the mobile network in urban areas increases land values, it has the opposite effect in rural areas. This is surprising, given that urban areas have relatively more network coverage than rural areas.

Household heterogeneity was found with respect to land values. The results in Tables 5 and 6 show that land values are lower among female-headed households, which perceive future land conflicts in general, while they are higher for literate female-headed households in rural areas.

This suggests that education, especially for women, has the potential to contribute to land reform by allowing women to do better land valuation and bargaining.

Table 5: Determinants of land sales and rental values in urban areas (OLS)

Variables	Sales value				Rental values			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Parcel acquired in 10 or more years (1 = Yes)	-0.188 (-0.99)		-0.202 (-1.07)	-0.207 (-1.09)	-0.254** (-2.71)		-0.308** (-3.34)	-0.298** (-3.25)
Total number of rights in a parcel (Max. 6)	-0.160** (-2.87)		-0.166** (-2.90)	-0.132* (-2.07)	-0.069* (-2.51)		-0.058* (-2.06)	-0.054 (-1.78)
Ceded by formal authorities (1 = Yes)	0.699 (1.11)		0.359 (0.54)	0.339 (0.50)	0.885* (2.44)		0.748+ (1.93)	0.791* (2.00)
Purchased infrastructure/parcel (1 = Yes)	0.309 (1.39)		0.101 (0.46)	0.134 (0.57)	0.228* (2.11)		0.137 (1.29)	0.198 (1.73)
Parcel with no any documentation (1 = Yes)	-0.556* (-2.36)		-0.558* (-2.38)	-0.565* (-2.41)	-0.067 (-0.55)		0.003 (0.03)	-0.003 (-0.03)
Parcel area in m² (Log)	-0.021 (-0.41)	-0.084+ (-1.69)	-0.044 (-0.82)	-0.060 (-1.02)	-0.038 (-1.29)	-0.077** (-3.18)	-0.070** (-2.73)	-0.089** (-3.21)
Number of buildings on the parcel	0.157 (1.56)	0.195* (2.19)	0.175+ (1.92)	0.183 (1.95)	0.235** (6.05)	0.248** (6.25)	0.249** (6.01)	0.266** (6.60)
Number of cashew trees on the parcel	-0.120* (-2.23)	0.006 (0.25)	-0.012 (-0.47)	-0.012 (-0.45)	-0.049** (-4.08)	-0.004 (-0.60)	-0.018 (-1.91)	-0.018 (-1.81)
Number of coconut trees on the parcel	0.112 (1.69)	0.147* (2.17)	0.153* (2.22)	0.158* (2.30)	0.015 (0.52)	0.026 (0.84)	0.027 (0.80)	0.028 (0.84)
Tap water is the most-used water source (1 = Yes)	0.066** (5.02)	0.221** (5.95)	0.189** (5.79)	0.181** (5.80)	0.855** (8.36)	0.903** (9.24)	0.930** (9.59)	0.909** (9.48)
Parcel has access to mobile network (1 = Yes)	0.939** (6.13)	9.913** (5.37)	0.747** (4.96)	0.782** (5.04)	0.957** (7.71)	0.825** (6.18)	0.788** (6.06)	0.780** (6.00)
Parcel accessible by primary and secondary roads (1 = Yes)	-0.418 (-1.82)	-0.482* (-2.04)	-0.413+ (-1.79)	-0.390 (-1.70)	0.047 (0.43)	0.017 (0.15)	0.062 (0.56)	0.070 (0.64)
Interested in obtaining DUAT (1 = Yes)		0.167** (3.74)	0.200** (3.80)	0.210** (3.82)		0.531** (3.85)	0.567** (3.97)	0.604** (4.25)
Concerned about future conflict (1 = Yes)		0.983** (4.95)	0.900** (4.60)	0.928** (4.78)		0.734** (5.01)	0.685** (4.61)	0.917** (6.27)
Fear of losing parcel (1 = Yes)		-0.843** (-3.88)	-0.796** (-3.84)	-0.569** (-3.25)		-0.453+ (-1.65)	-0.445 (-1.63)	-0.441 (-1.60)
Female-headed * total number of rights				-0.052 (-0.44)				-0.033 (-0.47)
Female-headed * future conflict				0.166 (0.37)				-0.768** (-2.91)
Literate female-headed * future conflict				-0.927 (-1.63)				0.054 (0.21)
Constant	1.144* (2.01)	0.094 (0.17)	0.465 (0.77)	0.439 (0.72)	-1.095** (-3.90)	-1.371** (-5.33)	-1.314** (-4.86)	-1.300** (-4.81)
Observations	3,390	3,390	3,390	3,390	3,390	3,390	3,390	3,390
R-square	0.084	0.094	0.108	0.114	0.132	0.140	0.155	0.166
F-statistic	9.835	14.504	12.450	10.508	20.392	22.983	21.148	16.851

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's computations from the MCA/MINAG baseline survey data, 2010 and 2012

Table 6: Determinants of land sales and rental values in rural areas (OLS)

Variables	Sales values per m² (MZM)				Rental values per m² (MZM)			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model**
Parcel acquired in 10 or more years (1 = Yes)	-0.035 (-0.35)		-0.033 (-0.32)	-0.026 (-0.25)	0.092 (1.16)		0.088 (1.10)	0.078 (0.96)
Total number of rights in a parcel (Max. 6)	0.078** (2.97)		0.088** (3.34)	0.064* (2.16)	0.032 (1.66)		0.040* (2.02)	0.043* (2.04)
Ceded by formal authorities (1 = Yes)	-0.173 (-0.22)		0.087 (0.12)	0.119 (0.16)	0.317 (0.49)		0.453 (0.78)	0.415 (0.71)
Purchased infrastructure/ parcel (1 = Yes)	0.609** (3.58)		0.608** (3.56)	0.590** (3.44)	0.183 (1.27)		0.186 (1.28)	0.180 (1.23)
Parcel without any documentation (1 = Yes)	-0.068 (-0.08)		-0.378 (-0.37)	-0.357 (-0.35)	0.109 (0.73)		-0.094 (-0.71)	-0.097 (-0.71)
Parcel area in m² (Log)	-0.244** (-3.76)	-0.237** (-3.65)	-0.249** (-3.86)	-0.243** (-3.79)	-0.373** (-8.48)	-0.376** (-8.57)	-0.378** (-8.61)	-0.382** (-8.54)
Number of buildings on the parcel	0.119** (4.98)	0.122** (5.07)	0.117** (4.96)	0.118** (5.03)	0.070** (3.35)	0.069** (3.29)	0.067** (3.22)	0.067** (3.25)
Number of cashew trees on the parcel	-0.013** (-3.22)	-0.011** (-2.65)	-0.012** (-2.81)	-0.012** (-2.83)	-0.008** (-2.74)	-0.007* (-2.56)	-0.007* (-2.53)	-0.007* (-2.47)
Number of coconut trees on the parcel	-0.056* (-2.28)	-0.067** (-2.83)	-0.066** (-2.66)	-0.066** (-2.68)	-0.048** (-2.82)	-0.054** (-3.13)	-0.053** (-3.06)	-0.056** (-3.18)
Tap water is the most used water source (1 = Yes)	0.458 (1.04)	0.520 (1.16)	0.522 (1.12)	0.535 (1.15)	0.716** (2.89)	0.703** (2.70)	0.744** (2.90)	0.683** (2.81)
Parcel has access to mobile network (1 = Yes)	-0.206 (-1.55)	-0.140 (-1.05)	-0.247 (-1.86)	-0.245 (-1.84)	-0.120 (-1.26)	-0.125 (-1.32)	-0.154 (-1.62)	-0.164 (-1.72)
Parcel accessible by primary and secondary roads (1 = Yes)	0.558** (4.63)	0.538** (4.53)	0.548** (4.62)	0.566** (4.77)	0.444** (4.80)	0.445** (4.80)	0.436** (4.75)	0.433** (4.71)
Interested in obtaining DUAT (1 = Yes)		0.905** (5.39)	0.951** (5.82)	0.964** (5.86)		0.499** (4.55)	0.527** (4.74)	0.515** (4.59)
Concerned about future conflict (1 = Yes)		0.090 (0.53)	0.144 (0.85)	0.254 (1.33)		0.211 (1.64)	0.238+ (1.85)	0.457** (2.90)
Fear of losing parcel (1 = Yes)		-0.495+ (-1.87)	-0.554* (-2.10)	-0.634* (-2.50)		-0.378+ (-1.96)	-0.410* (-2.14)	-0.473* (-2.48)
Female-headed * total number of rights				0.072 (1.30)				-0.017 (-0.39)
Female-headed * future conflict				-0.638* (-2.22)				-0.670** (-3.61)
Literate female-headed * future conflict				0.350* (2.45)				0.114 (0.96)
Constant	3.185** (2.88)	2.400** (3.58)	2.728* (2.24)	2.590* (2.10)	2.827** (6.11)	2.651** (5.92)	2.620** (5.69)	2.671** (5.73)
Observations	3,708	3,708	3,708	3,708	3,708	3,708	3,708	3,708
R-square	0.040	0.047	0.056	0.059	0.046	0.053	0.056	0.059
F-statistic	9.599	11.754	9.795	7.667	11.647	14.425	10.731	13.901

t statistics in parentheses; $^+ p < 0.10$, $^* p < 0.05$, $^{**} p < 0.01$
Source: Author's computations from the MCA/MINAG baseline survey data, 2010 and 2012

5. Conclusions and recommendations

This study aimed to test the theory of change that states that secured tenure leads to increased land values in an environment where limited land markets prevail, using two groups of alternative measures of tenure security, and the analysis highlighted four main key findings:

First, the results corroborate the argument about the linkages between land tenure and investments, which claims that farmers without secure rights cannot claim the returns from the investments made in or attached to land. I found that the demand for land-user rights encourages

investments in rural areas but not in urban areas. This may result in differential access to land registration in the two regions, where access to these services takes place more often in the urban than in rural areas.

Second, the duration of possession and full land-use and transfer rights are associated with lower investments, suggesting that investment is not households' major objective if the majority of land is still being managed under the customary system. With a thin land market and lower land values, people accumulate land for objectives other than economic, such as prestige, pride and political power. Nevertheless, there is a significant demand for certificates of land ownership, suggesting that the government of Mozambique should intensify the formalisation of land-use rights, since such a policy intervention is likely to have a multiplicity of benefits in the long term, especially in the urban areas. As such, land-use rights and tenure security should continue to be considered a priority within the national development agenda as per the recently signed and implemented five-year compact in which the land component provided about 180 000 land titles in the four Northern provinces.

Third, the demand for the legalisation of land rights and concerns about future land conflicts increase land values, while the fear of losing land reduces the value. Given the current low level of knowledge on the Land Law, these results highlight the potential economic value of land legislation reform in relation to the resource value, which encourages the expansion of the coverage of land registration and full implementation of the Land Law and its contents.

Fourth, land characteristics and amenities determine land values and prices, as found in previous studies (Deinninger & Jin 2009). Consistent with Deininger and Jin (2006), I found that marginal land values decrease with land size and the education of the household head. Therefore, providing education, with a considerable focus on women, and increasing investment in infrastructures are key complementary investments in relation to land reform in Mozambique. In summary, the debate on the potential value of land legislation is far from its end, and this paper intends to contribute to this literature by providing additional empirical evidence from Mozambique.

As any empirical work, this study had some limitations, and these are discussed below:

This study allows methodological conclusions to be drawn by estimating the effect of tenure security on land values, but factors other than land tenure, such as access to financial markets, may be more constraining, therefore other, complementary factors for creating incentives to attract investment to land or to lower transaction costs have an effect on land values. The study could have been more informative if such information was available to control for. However, controlling for all these aspects of the empirical study is almost impossible. What appears to be evident is that the property rights are not the only determinants of land values. Having a written title registered in the cadastral offices does not necessarily ensure tenure security, nor does it necessarily lead to investments. Therefore, creating strong institutions that enforce property rights possessed under formal registration, and creating incentives for investment accompanied by complementary services and functional markets, are crucial. If the costs and insecurity are high, formal land title may not lead to increased investment.

Although it is widely accepted that tenure security has the potential to increase investment and productivity, property rights are not well developed in many developing countries. In the case of Mozambique, the willingness to pay for property rights is very high, but the access to land formalisation services is still low and the system of allocation of land-user rights (DUATs) is still

complex and lengthy. The policy implication would be to simplify and shorten the land formalisation procedures and ensure a clear sequencing between various requirements.

This study is the first of its kind and further research is recommended, especially on: First, addressing the second endogeneity problem, which is related to farmers seeking DUATs for well-located parcels, therefore diverting more investment to them. To address this concern, plot fixed effects would be useful, but their implementation would be unproductive as it would cancel the variables of interest, which are plot-level variables. Second, as noted by Jacoby *et al*. (2002), the actual plot tenure results in at least three problems: an errors-in-variable problem, leading to simultaneity bias, difficulty to interpret, and that the actual plot tenure is stochastic. To address these issues, the hazard model is recommended to give rise to a measure of tenure insecurity to use in estimating the investment models.

The limited land-related investments in Mozambique that led us to aggregate them into one or two groups could have influenced our estimations. As noted by Fenske (2011), the aggregate measures of investment have shown weak statistical effect. I have attempted to minimise the problem by using both binary and continuous variables of investments to assess not only the propensity of investment, but also its intensity. Finally, finding convincing exogenous tenure security measures or convincing instruments is crucial for a precise estimation of land tenure effects on investments.

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