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Fast Track Land Reform, Tenure Security, and Investments in Zimbabwe

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Abstract

Since its independence in 1980, Zimbabwe has pursued a land reform and resettlement program aimed at addressing racially skewed land distribution. The most recent phase, the Fast Track Land Reform Program, was launched in 2000 with the aim of acquiring at least five million hectares of land for redistribution. This paper investigates the impact of this program on perceptions of tenure security and investments in soil conservation. Evidence suggests that the program not only created some insecurity among its beneficiaries but also had an adverse impact on investments in soil conservation. Interestingly, households in the study that believed investing in land enhanced tenure security invested significantly more. Their perceptions of tenure security depended positively on investment levels, supporting the contention that households invest in long-term land-related investments to enhance security of tenure.

Key Words: Land reform, tenure security, investments, Zimbabwe

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Precious Zikhali*

Introduction

Since its independence in 1980, Zimbabwe has pursued a land reform and resettlement program, premised on land acquisition and redistribution with the aim of addressing racially skewed land distribution. The most recent phase, the Fast Track Land Reform Program (FTLRP), on which this analysis is based, was officially launched in July 2000. Its goal was extensive, compulsory land acquisition and redistribution, targeting at least five million hectares for resettlement (Zimbabwe 2000). While in principle, the land tenure system under the FTLRP offers each household a 99-year lease with an option to purchase the land, the reality is that the FTLRP settlers have been issued many different types of temporary licenses which the government intends to convert (in time) to permanent leases. It has been argued that this is a source of tenure insecurity among the beneficiaries of the FTLRP (Munyuki-Hungwe and Matondi 2006).

The FTLRP was accompanied by a 30-percent drop in agricultural production by 2004 (Richardson 2004). Given that agricultural production is directly influenced by the level of investments, it can be argued that the rapid decline in production is partly due to low levels of land-related investments conditioned by the reform process.[1] Moreover, a survey in 2003 concluded that about one-quarter of land in Zimbabwe was severely eroded (Richardson 2004), implying that comparatively large benefits could be derived from land-related investments. Furthermore, Zikhali (2008) found that soil conservation enhanced agricultural productivity in Zimbabwe. Thus, Zimbabwe as a case study here offers an interesting contribution to the existing

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[1] Of course there are other explanations, such as the loss of economic scale as well as replacement of experienced farmers with less experienced ones, that are more geared towards production for subsistence, among others.

literature that assesses empirically the link between tenure security and investment incentives in the context of land reforms.

Economic theory postulates three links between tenure security and agricultural investment incentives.[2] The first link is what Besley (1995) referred to as a "security argument," which captures the direct and positive link between tenure security and investment incentives. The logic is that insecure tenure leads to market imperfections and increases the risk associated with farming through threat of dispossession. The second link is referred to as "a collateral-based view," from its premise that when land tenure is secure and thus easier to collateralize, it can reduce the price of capital and subsequently increase the value of investments. The third and final link is referred to as "a gains-from-trade perspective" and is based on the fact that secure land rights increase investment incentives by lowering transaction costs if land is to be either rented out or sold, thereby expand trading opportunities and the ability to take advantage of gains from trade.

The existing literature on the empirical analysis of the link between land tenure and investment reveals mixed results.[3] Studies by Feder (1987), Besley (1995), Alemu (1999), and Holden and Yohannes (2002) underscored the significance of tenure security in promoting land-related investments. Ayalew et al. (2005) and Zerfu (2008) found that the risk of future expropriation and limited perceived transfer rights had an adverse impact on households' investments on land in Ethiopia. Other studies, however, have found little impact of property rights on land-related investments (see Migot-Adholla et al. [1994], for the Kenyan case; Roth et al. [1994], for the case of Somalia; and Gavian and Fafchamps [1996], for the case of Niger).

The main econometric challenge faced by most studies analyzing the link between tenure security and investments arises from the fact that most African countries have a causality problem where land rights may depend on past investments and vice versa (Besley 1995; Brasselle et al. 2002). Consistent with this, tree planting has been identified as a way of establishing and/or enhancing tenure security (Place and Hazell, 1993; Besley 1995; Sjaastad and Bromley 1997). Holden and Yohannes (2002) argued that tenure security is more important when one considers medium-to-long term investments. This has been the justification for most researchers' approaches to investigating the impact of tenure security on more long-term

2 See Besley (1995) for a comprehensive summary.

3 See Brasselle et al. (2002) for a survey of empirical studies of land tenure and land investment in Africa.

investments, such as tree planting and construction of soil conservation structures (see, e.g., Besley 1995; Hayes et al. 1997; Holden and Yohannes 2002).

Few studies have explored the link between tenure security and land-related investments in Zimbabwe. Moor (1996) found that perceived tenure security in the form of land titling and registration had a significant and positive effect on long-term, on-farm investments by small-scale farmers in Zimbabwe. However, the sample comprised only beneficiaries of pre-2000 land reform programs. A study by Fortmann (1998) suggested that lack of tenure security discouraged female farmers from making long-term, ecologically beneficial investments on their land. Kinsey (1999), using a 400-resettlement-area household panel study and a contrasting group of communal area households, found that earlier land reform programs increased the income of the beneficiaries (they were able to accumulate wealth in the form of cattle) and reduced their income variability. Deininger et al. (2004) found a positive, though modest, economic return (US$ 17) from land reform programs before the FTLRP. No study, as can best be determined, has conducted an empirical analysis of the impact of Zimbabwe's FTLRP on tenure security and land-related investments.

By investigating the impact of Zimbabwe's FTLRP on perceptions of tenure security and investments in soil conservation, this paper contributes to the scarce literature on the empirical analysis of the FTLRP on tenure security and land-related investments. It deals with the causality problem between land rights and investment by controlling for whether a household believes investing in land enhances tenure security. Using data from Mashonaland Central Province in Zimbabwe, the results here provide evidence that the program created some tenure insecurity among its beneficiaries and had an adverse impact on investments in soil conservation. The evidence also suggested that households in the study, which believed investing in land enhanced tenure security, were not only significantly more likely to invest but their perceptions of tenure security depended positively on their level of investment in soil conservation.

The following section gives a brief background on the FTLRP. Section 2 presents the underlying conceptual framework, while the econometric framework and estimation strategy used in the paper are discussed in section 3. Section 4 discusses the data used in the empirical estimation and section 5 has a discussion of the results. The conclusions are in section 6.

1. Fast Track Land Reform in Zimbabwe

Zimbabwe inherited a racially skewed agricultural land-ownership pattern at independence in 1980. White large-scale commercial farmers—less than 1 percent of the population—occupied 45 percent of agricultural land and 75 percent of this was in the most agriculturally productive areas (Shaw 2003).[4] Consequently, the Zimbabwean government adopted a land reform and resettlement program aimed at land acquisition and redistribution. The primary, long-standing objectives of this program have been to address the imbalances in land access while alleviating population pressure in the communal areas, extending and improving the base for productive agriculture in the smallholder farming sector, improving the living standards of the majority of the population, and bringing idle or under-utilized land into full production (Kinsey 1999).

The Fast Track Land Reform Program can be classified into two broad phases. The first phase began in 1980 with the primary objectives of addressing inequitable land ownership, insecurity of tenure, and unsustainable and sub-optimal land use (Moyo 2006). Given the government's policy of national reconciliation and reconstruction, as well as the restrictive Lancaster House Constitution,[5] the government pursued a land resettlement program based on a willing-seller/willing-buyer approach. However, in 1997 the government of Zimbabwe initiated a process of radical land reform based on extensive, compulsory land acquisition and redistribution that targeted at least 5 million hectares for resettlement (Moyo 2004). This heralded the start of the second phase of the program. The FTLRP, on which this analysis is based, was officially launched in July 2000 and is considered part of the second phase.

The main objectives of the FTLRP were to speed up identification of not less than five million hectares of land for compulsory acquisition and resettlement, to accelerate the planning and demarcation of the acquired land and place settlers, and to provide limited basic infrastructure and farmer support services (Zimbabwe 2000; Moyo 2006). The program has two models. Model A1 is intended to decongest communal areas and generally help land-constrained subsistence farmers. It is based on the existing communal-area organization, where peasants

[4] It is also worth noting that commercial farms were crucial for employment and total agricultural production, as well as export earnings. For example, in the 1990s, commercial farms accounted for 68% of gross agricultural output and 40% of export earnings (Addison and Laakson 2003).

[5] The Lancaster House Constitution obligated the government to acquire land on a willing-seller/willing-buyer basis during the first 10 years of independence.

produce mainly for subsistence with small surpluses for the market in good seasons. Model A2, on the other hand, is a commercial settlement scheme for small-, medium-, and large-scale commercial settlements. It is intended to create a cadre of black commercial farmers and is based on the concept of full-cost recovery from the beneficiary. This is, in principle, targeted at all Zimbabwean citizens who can prove they have farming experience and/or available resources (Zimbabwe 2000). The bulk of the program, however, centers on Model A1.

Although the FTLRP tenure system offers each household a 99-year lease with an option to purchase the land, the reality is that FTLRP settlers have been issued many different types of temporary licenses. Munyuki-Hungwe and Matondi (2006) claimed this was a source of tenure insecurity among beneficiaries of the FTLRP. This paper attempts to assess empirically how the FTLRP has affected perceived tenure security among farming communities, and goes a step further by analyzing how the program also affected land-related investments.

In Zimbabwean communal areas, land ownership continues to be vested in the state, with rights of usufruct allocated to an individual (usually a male) by a chief for as long as the individual may need it or cultivates it. These rights can, in principle, be passed on as an inheritance on the death of the original owner along the lines of primogeniture, but the wife of the deceased is allowed to continue to cultivate the land (Mutema 2003).

2. The Conceptual Framework

The conceptual framework models households' perceptions of tenure security and investments in soil conservation, conditioned by the FTLRP.

2.1 Fast Track Land Reform and Soil Conservation Investments

The study used the following simple model for soil conservation investments:

$$I = I(S(R), \mathbf{\Lambda}, \mathbf{P}) \ , \qquad (1)$$

where I is the level of soil conservation investments, measured as the total parcel[6] area under soil conservation structures constructed in the last five years, normalized by the total parcel size. S is an indicator of perceived tenure security. Perceived tenure security is assumed to be affected by R, a dummy indicating whether the household got the parcel via the FTLRP or

[6] A parcel is defined as a contiguous piece of land on which one or more different crops can be cultivated.

otherwise. The study maximizes on the information in hand by including dummies that capture the different modes of acquisition of the parcel (i.e., whether the parcel was bought, inherited, allocated to the household by a traditional leader, or acquired via the FTLRP). $\mathbf{\Lambda}$ is a vector of the household's socioeconomic status, which includes gender, age, education of household head, household composition, contact with agricultural extension workers, social capital indicators, and involvement in off-farm activities, for example. $\mathbf{P}$ is a vector of parcel characteristics, which include size and steepness of parcel, distance from the homestead to the parcel, and initial endowment of soil conservation structures.[7]

Consistent with theoretical postulations, the study hypothesised that

$\frac{\partial I}{\partial S} > 0$ and, assuming the FTLRP has led to tenure insecurity, $\overset{(+)}{\frac{\partial I}{\partial S}}\overset{(-)}{\frac{\partial S}{\partial R}} < 0$.

That is, levels of investments are inversely related to whether the parcel was acquired via the FTLRP or not. The model also controlled for whether the household believes investing in land enhances tenure security, to allow for the possibility that households may invest to establish and/or enhance tenure security. This is supported by the fact that about 58 percent of the households in the sample said they believed land investments reduced the probability of losing land, for example, through evictions or expropriation.

2.2 Fast Track Land Reform and Tenure Security

The study used this simple model of tenure security:

$$S = S(R, I, \mathbf{\Omega}, \mathbf{\Gamma}) \ . \qquad (2)$$

I was included to explore whether households feel more secure about parcels they have invested in. The study model also interacted I with a dummy to capture whether the household believes investing in land enhances tenure security; and to investigate whether this belief, if followed up by actual investments, affects perceived tenure security. The vector $\mathbf{\Omega}$ includes variables to

[7] Ideally the level of investment is a function of the desired stock of soil conservation structures, or rather the difference between the household's desired stock and the current stock. However, data limitations made it unworkable to model this.

capture households' socioeconomic characteristics, while $\mathbf{\Gamma}$ is a vector of parcel characteristics hypothesised to affect perceptions of tenure security.

The study hypothesized that farmers feel less secure about tenure for land they received through the FTLRP, that is, $\frac{\partial S}{\partial R} < 0$; and $\frac{\partial S}{\partial I} > 0$ for households which believe investing in land enhances tenure security.

3. The Econometric Framework and Estimation Strategy

Equations (1) and (2) imply the estimation of the reduced form equations (3) and (4) below for investment level and tenure security, respectively:

$$I = \alpha_0 + \alpha_1 R + \boldsymbol{\alpha_2}\mathbf{\Lambda} + \boldsymbol{\alpha_3}\mathbf{P} + \nu \quad (3)$$

and

$$S = \beta_0 + \beta_1 R + \beta_2 I + \boldsymbol{\beta}_3\mathbf{\Omega} + \boldsymbol{\beta_4}\mathbf{\Gamma} + \varepsilon \ , \quad (4)$$

where $\alpha_0, \alpha_1, \boldsymbol{\alpha_2}, \boldsymbol{\alpha_3}$ $\beta_0, \beta_1, \beta_2, \boldsymbol{\beta_3}$, and $\boldsymbol{\beta_4}$ are parameters or vectors of parameters to be estimated, while ε and ν are the error terms. It is assumed that the error terms are independently, identically, and normally distributed with zero means (Wooldridge 2002).

To deal with the challenge posed by the fact that beneficiaries of the FTLRP might not form a randomly selected subgroup of all farmers in the sample, the model uses the propensity score matching method to estimate the average treatment effect of the FTLRP on levels of soil conservation investments, as well as on perceptions of tenure security. It retains the observations within common support from the matching process, which is then used to estimate a Heckman selection model (to estimate equation 3) and an OLS model (to estimate equation 4). Thus, the analysis complements nonparametric methods with parametric methods, and by using observations that fall within common support from the matching process, it ensures that there is a comparable sample in estimating the parametric models. A detailed discussion of the estimation strategy follows below.

3.1 Propensity Score Matching

Here, the model uses the propensity score matching method to address the problem that beneficiaries of the FTLRP might not form a randomly selected sub-group of all farmers in the sample. Propensity score matching is a non-parametric method used to estimate the average

treatment effect of a binary treatment on a continuous scalar outcome (Rosenbaum and Rubin 1983). The main idea with this method is to estimate non-parametric regression models to construct the counterfactual under an assumption of selection on observables. This analysis takes land reform as the treatment variable, while investments in soil conservation and perceived tenure security are the outcomes. Thus, the group that benefited from the reform is the treatment group, while those in the communal areas form the control group.

The objective with this method is to estimate the average treatment effect of the FTLRP in the FTLRP sub-sample. To do this, the analysis considers the following equation:

$$ATT = E[I_1 \mid R = 1] - E[I_0 \mid R = 1] \ , \qquad (5)$$

where ATT is the average effect of the treatment on the treated parcels, $I_0 \mid R = 1$ is the level of soil conservation investments that would have been observed if the parcel had not been acquired via the FTLRP, while $I_1 \mid R = 1$ is the level of investment actually observed in the land reform sub-sample. The challenge is that one cannot observe $E[I_0 \mid R = 1]$, necessitating the creation of a counterfactual of what one observes by matching treatment and control groups. The key assumption is that conditional on X, the outcomes must be independent of the targeting dummy R, with X being the set of covariates that influence selection into the FTLRP. The model matches the treated parcels to the control units with similar values of X. Following Rosenbaum and Rubin (1983), the two groups are matched using propensity scores, which are basically the probabilities of being in the land reform group conditional on X. This gives:

$$ATT = E[I_1 \mid R = 1, p(X)] - E[I_0 \mid R = 0, p(X)] \ , \qquad (6)$$

where $p(X)$ is the propensity score. The kernel matching method, used here, matches a treated unit to all control units weighted in proportion to the closeness between the treated unit and the control unit. The analysis also estimated equation (6) for perceived tenure security instead of I, with the aim of estimating how the FTLRP has affected households' perceptions of tenure security. More details on this method can be found in Becker and Ichino (2002). The estimation here uses the psmatch2 routine in STATA.

3.2 Heckman Selection Model on Investment Levels

The fact that some farmers did not invest in soil conservation poses a sample selection problem. To circumvent this, and at the same time fully utilize the study's data on these households, a Heckman sample selection model was used to estimate equation (3). The Heckman

model removes the bias in regression weight calculation due to censorship (Wooldridge 2002). It is a two-equation model, where the regression equation is:

$$I^* = \alpha_0 + \alpha_1 R + \boldsymbol{\alpha}_2 \boldsymbol{\Lambda} + \boldsymbol{\alpha}_3 \mathbf{P} + \nu \ .$$

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

$$I = 1[\mu_0 + \mu_1 R + \boldsymbol{\mu}_2 \boldsymbol{\Lambda} + \boldsymbol{\mu}_3 \mathbf{P} + u > 0] \ , \qquad (7)$$

where I^* is observed only when $I = 1$. The analysis assumes a normal distribution of the error terms. It also uses the probability of investing in soil conservation and the total area of the parcel on which soil conservation structures were constructed in the last five years prior to the survey normalized by size of the parcel as dependent variables. The observations used fall within common support from the matching process.

3.3 OLS on Tenure Security

This analysis used OLS to estimate equation (4) and thus investigate whether the FTLRP had any impact on perceptions of tenure security, with investment levels used as an explanatory variable. I is interacted with a dummy that captures whether the household believes investing in land enhances tenure security and investigates whether believing that land investment—and actually making the investments—affects perceived tenure security. The observations used fall within common support from the matching process.

4. The Data and Survey Area

The empirical analysis is based on data from Mazowe District, one of the seven districts in Mashonaland Central Province in Zimbabwe. Mazowe District lies in Natural Regions 2 and 3 and is divided into 29 wards, 13 of which are found in Chiweshe communal areas.

The data were collected for 635 parcels of 424 randomly selected households that fell under three different chieftainships. The sample included households from both communal and resettlement areas. The beneficiaries of the FTLRP (202 households) were in the resettlement areas, while in the communal areas households got land either through inheritance, allocation by a traditional leader, buying, or renting. Around 79 percent of the FTLRP group in the sample were households which acquired land under Model A1, making the FTLRP beneficiary group fairly comparable to communal households. This kind of sample allowed exploration to see whether any behavioural differences between the two groups could be attributed to the FTLRP.

The questionnaire asked detailed questions about households' perceptions of tenure security, investments made in the last five years, and parcel and socioeconomic characteristics. The data was collected in May 2007 (seven years after the official launch of the FTLRP). It has three indicators of perceptions of tenure security at the parcel level: 1) the perceived right to bequeath the parcel, 2) the perceived ease to rent out the parcel, and 3) the perceived ease of using the parcel as collateral against a financial loan. These are all dummy variables with the value of 1 if the answer is in the affirmative, and zero otherwise. To capitalize on the information gathered, the study used a principal components analysis (PCA) to construct an overall indicator of tenure security (*tenure security)*. PCA is used here to statistically weigh the three indicators in order to calculate an aggregate index of tenure security (Jolliffe 1986). One retained component had an eigen-value higher than 1, and all three indicators had loadings or weights of more than 0.3, implying that the component used was influenced by them. *Off-farm*, s*ocial capital*, and *media* are from PCA of variables on off-farm activities, social capital indicators, and access to media (TV, radio, and newspapers), respectively.[8]

This study focuses on a specific type of soil conservation structures—contour ridges. The decision to focus on contour ridges was guided not only by availability of data but also by their popularity as soil conservation technology in the study area. As described in the *Sourcebook of Alternative Technologies for Freshwater Augmentation in Africa* (which cites Critchley et al. [1992]), "contour ridges are small earthen ridges, 15–20 cm high, with an upslope furrow to accommodate runoff from a catchment strip between the ridges." Initially, similar to the experience in Niger and Kenya (and other similar countries), the construction of contour ridges in Zimbabwe was promoted by projects and government policy. Contour ridges continue to be widely used both in commercial and communal farming areas in southern Africa as a means of controlling soil erosion (Critchley et al. 1992). Summary statistics are given in table 1 for parcel-level data and table 2 for household-level data used in the analysis. This analysis tested for the significance of the inter-group differences.

8 *Off-farm* is from a PCA of the number of household members who are small-scale artisan entrepreneurs, utilize natural resources, are formally employed, and/or engage in cross-border trade. *Social capital* is from a PCA of dummy variables indicating whether the household can easily borrow about US$ 1, borrow oxen, get assistance in the form of about 25 kgs of maize from neighbors, and/or ask for extra labor from neighbors.

Table 1 Descriptive Statistics of Parcel Level Variables

		Resettlement		Communal		Pooled	
Variable	**Description**	***Mean***	***Std. error***	***Mean***	***Std. error***	***Mean***	***Std. error***
Tenure security indicators							
Bequeath	Can easily bequeath the parcel (1=yes, 0=no)	0.520	0.501	0.794	0.405	0.707***	0.455
Rent	Can easily rent out the parcel (1=yes, 0=no)	0.193	0.396	0.261	0.440	0.239*	0.427
Collateral	Can easily use the parcel as collateral (1=yes, 0=no)	0.277	0.449	0.374	0.484	0.343**	0.475
Tenure security	Aggregate indicator of tenure security from principal components analysis	0.574	0.476	0.830	0.465	0.749***	0.484
Mode of acquisition							
FTLRP	Acquired the parcel under the FTLRP (1=yes, 0=no)					0.318	0.466
Inherited	Inherited the parcel (1=yes, 0=no). The reference mode of acquisition variable.			0.380	0.486	0.258	0.438
Allocation	Allocated the parcel by a traditional leader (1=yes, 0=no)			0.437	0.497	0.296	0.457
Bought	Bought the parcel (1=yes, 0=no)			0.094	0.292	0.0637	0.244
Rented	Renting in the parcel (1=yes, 0=no)			0.089	0.285	0.061	0.239
Soil conservation investments							
Investment decision	Decision to construct contour ridges on the parcel in the last 5 years (1=yes, 0=no)	0.347	0.034	0.282	0.022	0.302*	0.46
Investment level	Total length of contour ridges constructed in the last 5 years, in m^2 per hectare	53.217	7.319	85.842	8.423	75.463**	6.223
Endowment	Total length of contour ridges constructed more than 5 years ago, in m^2 per hectare	107.684	11.385	204.491	11.646	173.7***	8.906

Variable	Description	Resettlement		Communal		Pooled	
		Mean	***Std. error***	***Mean***	***Std. error***	***Mean***	***Std. error***
Parcel characteristics							
Parcel size	Size of the parcel, in hectares	21.833	3.561	3.552	0.173	9.368***	1.186
Distance	Distance from homestead to the parcel, in km	0.000		1.117	0.132	0.762***	0.092
Steep slope	Steep slope (1=yes, 0=no)	0.094	0.021	0.12	0.016	0.112	0.013
Moderate slope	Moderate slope (1=yes, 0=no)	0.728	0.031	0.439	0.024	0.531***	0.02
Light slope	Light slope (1=yes, 0=no). The reference slope variable.	0.178	0.027	0.441	0.024	0.357***	0.019
Deep soils	Deep soils (1=yes, 0=no)	0.257	0.031	0.268	0.021	0.265	0.018
Moderately deep soils	Moderately deep soils (1=yes, 0=no)	0.663	0.033	0.439	0.024	0.51***	0.02
Shallow soils	Shallow soils (1=yes, 0=no). The reference soil depth variable.	0.079	0.019	0.293	0.022	0.225***	0.017

Notes: *Difference significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Author's survey data, 2007.

Table 2 Descriptive Statistics of Household Level Variables

		Resettlement		Communal		Pooled	
Variable	**Description**	***Mean***	***Std. error***	***Mean***	***Std. error***	***Mean***	***Std. error***
Socioeconomic characteristics							
Male	Sex of the household head (1=male, 0=female)	0.797	0.028	0.7117	0.030	0.752**	0.020
Age	Age of the household head	46.525	0.767	52.73	1.129	49.774***	0.71
Education	Number of years of formal schooling of the household head	9.653	0.244	7.814	0.239	8.693***	0.177
Children	Number of household members younger than 15 years	2.515	0.142	2.482	0.121	2.498	0.093
Male adults	Number of male household members older than 15 years	2.114	0.104	1.829	0.163	1.964	0.099
Female adults	Number of female household members older than 15 years	2.054	0.124	2.383	0.209	2.226	0.124
Chiweshe	Chief Chiweshe (1=Chief Chiweshe)	0.495	0.035	0.14	0.023	0.309***	0.022
Negomo	Chief Negomo (1=chief Negomo)	0.406	0.035	0.568	0.033	0.491***	0.024
Makope	Chief Makope (1=chief Makope). Reference chieftainship variable.	0.099	0.021	0.293	0.031	0.194***	0.038
Livestock holdings	Livestock holdings (in TLU)	3.898	0.366	3.453	0.24	3.665	0.215
Livestock holdings2000	Livestock holdings in year 2000 (in TLU)	1.967	0.208	2.841	0.23	2.424***	0.157
Investments enhance security	Believes investing in land reduces the probability of losing land via eviction, for example (1=yes, 0=no)	0.515	0.035	0.644	0.032	0.583***	0.024
Farmer support services							
Extension	Number of household visits and community meetings called by an extension worker and attended by the household in the last season	6.53	0.489	2.518	0.26	4.429***	0.287
Farming certificates	Number of household members with a farming qualification	0.223	0.029	0.23	0.028	0.226	0.02

Variable	Description	Resettlement		Communal		Pooled	
		Mean	***Std. error***	***Mean***	***Std. error***	***Mean***	***Std. error***
Farmer support services (cont'd)							
Contours improve productivity	Believes contours improve parcel productivity (1=yes, 0=no)	0.9	0.021	0.874	0.022	0.887	0.015
Off-farm activities and social capital							
Remittances	Receipt of remittances (1=yes, 0=no)	0.243	0.03	0.41	0.033	0.33***	0.023
Off-farm	Principal components scores on involvement in off-farm activities	0.907	0.075	1.66	0.081	1.3***	0.058
Farm worker in year 2000	Household head was farm worker before FTLRP (1=yes, 0=no)	0.079	0.019	0.014	0.008	0.046***	0.01
Communal farmer in year 2000	Household head was communal farmer before FTLRP (1=yes, 0=no). The reference occupation of household head before FTLRP.	0.356	0.034	0.957	0.014	0.663***	0.023
Non-farmer in year 2000	Household head was engaged in non-farming before FTLRP (1=yes, 0=no)	0.564	0.035	0.024	0.011	0.289***	0.022
Social capital	Principal components scores of whether or not household can get assistance from neighbors	0.744	0.059	1.09	0.05	0.925***	0.04
Media	Principal components score on access television, radio, and newspapers	1.055	0.046	0.641	0.039	0.838***	0.032

Notes: TLU = tropical livestock unit. * Difference significant at 10%; ** significant at 5%; *** significant at 1%

Source: Author's own survey data, 2007.

Table 1 indicates that about 32 percent of the surveyed parcels were acquired through FTLRP; 30 percent were allocated to the household by a traditional leader; 26 percent were inherited; 6 percent were rented, and 6 percent bought. The data reveals thin land rental and sales markets. Generally, the communal group exhibits higher levels of tenure security than the group from the resettlement areas. Results also reveal that just over 30 percent of the surveyed parcels had conservation or improvement investments in the last five years. The average length of contour ridges were 75.5 square metres per hectare, and a significantly higher level of investments was made in communal areas relative to resettlement areas. These descriptive statistics are in line with the hypotheses that the FTLRP has been accompanied by tenure insecurity and a reduction in soil conservation investments. About 89 percent of the households believed contour ridges enhance land productivity.

Summary statistics on the socio-economic characteristics of the surveyed household show that around 75 percent of the households in the sample had male heads of households, and the land reform group had a significantly greater proportion of male-headed households.

5. Empirical Results and Discussion

This section presents and discusses empirical results from the econometric estimation discussed above.

5.1 Propensity Score Matching

The matching process attempts to make use of variables that capture the situation before the start of the FTLRP. This poses a challenge since there is a cross-sectional data set. Fortunately the questionnaire included questions on livestock holdings, as well as the occupation of the household head in year 2000. While one assumes some variables, such as education of household head and number of male and female adults, might not have significantly changed since the onset of the program, it is possible that other variables (such as the number of children, number of household members with a farming qualification, access to remittances and media, as well as involvement in off-farm activities) might have changed between the start of the program and the time the data was collected. To deal with this problem, two models were used in the matching process: the first one included only those variables that existed for sure at the beginning of the FTLRP, while the second model also included variables that might have changed over the years. The ensuing discussion of the results is based on the second model.

Table 3 below presents the probit results of participation or the likelihood of benefiting from the FTLRP.

Table 3 Probit Estimates for Selection into the FTLRP

	Restricted model		Full model	
Variable	***Coefficient***	***Std. error***	***Coefficient***	***Std. error***
Male	0.151	0.175	-0.179	0.212
Age in year 2000	0.080**	0.031	0.058*	0.035
Age^2 in year 2000	-.001***	0.000	-0.001**	0.000
Education	0.037	0.024	0.024	0.028
Male adults	0.049	0.036	0.170***	0.047
Female adults	-0.020	0.029	0.011	0.047
Livestock holdings in year 2000	-0.030	0.021	-0.058**	0.024
Farm worker in year 2000	1.642***	0.305	2.175***	0.408
Non-farmer in year 2000	2.453***	0.206	3.057***	0.304
Children			0.065	0.046
Farming certificates			0.161	0.201
Remittances			-.898***	0.188
Off-farm activities			-.585***	0.085
Media			0.777***	0.142
Constant	-.711***	0.701	-2.035**	0.802
Observations	617		617	
Pseudo R-squared	0.423		0.573	
Log-likelihood	-224.981		-166.692	
Chi2	330.32		446.89	

Note: * significant at 10 percent; ** significant at 5%; *** significant at 1%.

The results suggest that although the likelihood of benefiting from the land reform increases with age, the rate of this increase decreases with age. The more male adults in a household, the more likely it is to benefit from the FTLRP. Customarily in Zimbabwe, rights to land have been a preserve for men and thus the more men a household has, the greater the comparative advantage with regards to land access. This result indicates that efforts to increase women's access to land within the FTLRP may have been ineffective, in line with concerns posed by Goebel (2005). Interestingly, the more livestock a household has, the less likely it is to

benefit from the program. One possible explanation is that because the program had poverty alleviation goals and given that livestock holdings are a proxy for wealth in this study, poorer households were favored.

Contradictory to the program's goal of decongesting communal areas, results indicate that households, where the household head was either a commercial farm worker or engaged in non-farm activities prior to the commencement of the FTLRP, were more likely to have benefited from the program, as compared to households where the household head was a communal farmer. While one would expect commercial farm workers to have had an advantage in taking over commercial farms, caution is called for in interpreting this result, since the data do not reveal whether they had any land of their own prior to the reform. The significant and positive effect of a household head who engaged in non-farm activities before the program could be indicative of corrupt tendencies that could frustrate the program's decongestion goal. Again, there is need for caution because it is possible that those engaged in non-farm activities prior to the FTLRP were forced to do so because they were landless—in which case it can be argued that the FTLRP managed to redistribute land to the landless.

The negative association between participation and involvement in off-farm activities may be evidence of some screening within the FTLRP in favor of people who depend mainly on farming for a living. This is also true for the negative significant coefficient for remittances, if one views remittances as an off-farm activity (or better, the result of off-farm activity). The results might also reflect the fact that households involved in off-farm activities were less likely to apply for land under the FTLRP. The results also show that access to information or media increased the probability of being in the land reform group. This indicates that media plays a significant role in providing more information or more details about program eligibility and the application process.

The estimated propensity scores from both models in table 3 were used to generate samples of matched land reform and communal areas group using kernel matching methods. First, similar to estimating equation (3), the results were used to calculate the impact of the program on the intensity of soil conservation investments. Second, as when estimating equation (4), the results helped calculate the impact of the program on perceptions of tenure security. Propensity score results are presented in table 4. Only observations within common support are used, and the standard errors for the average treatment effect on the treated (ATT) are calculated using bootstrapping with 200 replications.

Table 4 Results from Propensity Score Matching

	Investment level		Tenure security	
	Restricted model	***Full model***	***Restricted model***	***Full model***
Resettlement	54.635	51.491	0.586	0.58
Communal	69.509	106.033	0.815	0.679
Difference, ATT	-14.874	-54.542*	-0.229**	-0.099
(std. error)	(19.697)	(30.601)	(0.117)	(0.129)
Total number of observations				
Resettlement	202	202	202	202
Communal	415	415	415	415
Number of observations within common support				
Resettlement	142	95	142	95
Communal	415	415	415	415

Note: * significant at 10%; ** significant at 5%; *** significant at 1%.

Although the effect of the program is consistently negative across both models for both outcomes (investment level and tenure security), the levels of significance differ. This underscores the need for a precise and careful data collection process that captures variable levels as they existed at the start of the program. Bear this in mind in the following discussion of the results from the full model.

The results reveal a significant and negative direct effect of the FTLRP on investment levels. After controlling for differences in observed characteristics, the average level of investments was about 51 m^2 per hectare for the land reform group, and 106 m^2 per hectare for the communal areas group. The difference in level of investment is about 55 m^2 per hectare, implying that randomly chosen farmers from the FTLRP group would invest significantly less in soil conservation than if they were in the communal areas.

However, although the ATT for the tenure security indicator is negative, results from matching using the full model do not reveal a significant direct effect of the FTLRP on perceptions of tenure security. This does not, however, lead to the conclusion that the FTLRP had no effect on perceived tenure security; it could be indicative of the need to control for factors, such as parcel characteristics, that were not controlled for in the matching process. This possibility is investigated below using parametric methods.

5.2 Fast Track Land Reform and Soil Conservation Investments

To investigate the impact of the FTLRP on soil conservation investments, a robust Heckman selection model was estimated using maximum likelihood, with the results in table 5.[9] The selection of variables used was based on the assumption that there exists a set of preferences that affect only the decision to invest, while resource constraints might be more important in determining investment levels. This set of preferences is envisaged as including household characteristics, such as gender, age and education of household head, and involvement in off-farm activities; whether the household believes soil conservation could improve productivity of land; and whether they believe investments enhance tenure security, among other factors. The study held that parcel characteristics, such as slope, are crucial in conditioning the need for soil conservation and would thus affect the decision to invest. Resources that are assumed to determine the level of investments undertaken include the number of male and female adults in the household, livestock holdings, remittances, and off-farm activities. The presence of selection bias is confirmed at the 5-percent level of significance.

Table 5 Heckman Estimation of Soil Conservation Investments

	Investment level		Decision to invest	
Variable	***Coefficient***	***Robust std. error***	***Coefficient***	***Robust std. error***
Mode of acquisition				
FTLRP	-109.628***	40.405	0.258	0.247
Allocation	64.247*	38.784	-0.195	0.16
Bought	16.959	68.309	-0.183	0.265
Rented	10.102	61.517	-0.105	0.268

[9] Although the author believes the explanatory variables used are not endogenous to investment behavior, some might argue that variables, such as households' contact with extension workers, whether the household believes contour ridges improve productivity, and whether they believe investing in land enhances tenure security (among other variables), could be endogenous to investment behavior. Accordingly a Heckman model was estimated without these variables and the results presented in appendix A1. The results are not very different from the results reported here.

Socioeconomic characteristics				
Male			0.234	0.163
Age	2.428	4.804	-0.002	0.024
Age^2	-0.018	0.04	0.000	0.000
Education	1.062	5.838	-0.012	0.024
Male adults	-16.967	12.131		
Female adults	-0.45	5.245		
Children			0.021	0.036
Livestock holdings	-5.979*	3.601	0.041**	0.016
Social capital	-20.91	18.991	0.009	0.09
Remittances	-48.732	34.818	-0.063	0.139
Off-farm activities	-2.152	11.201	0.067	0.057
Farming certificates			-0.081	0.151
Extension			-0.005	0.015
Media			-0.035	0.122
Farm worker in year 2000			0.916**	0.370
Non-farmer in year 2000			-0.701*	0.375
Contours improve productivity			-0.029	0.218
Investments enhance security	-5.646	43.47	0.673***	0.155
Chiweshe			-0.304	0.224
Negomo			-0.296*	0.159
Parcel characteristics				
Parcel size	-4.516***	1.720	0.004	0.004
$Parcel\ size^2$	0.014**	0.007		
Distance	2.703	6.292	0.01	0.023
Steep slope	46.491	55.73	0.345	0.219
Moderate slope	46.659	33.478	0.515***	0.154
Deep soils	84.887**	38.180	-0.626***	0.198
Moderately deep soils	69.237*	37.341	-0.355*	0.182
Endowment	-0.233**	0.109	-0.001***	0.000
Constant	365.136**	163.970	-0.942	0.764
Rho	-0.442** (0.1658)			
Observations	508			
Censored	361			
Log-likelihood	-1222.883			
Chi2	67.34			

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

The Heckman selection results suggest that the FTLRP had a negative and significant effect on the intensity of investments.[10] Compared to inherited parcels, parcels acquired via the FTLRP experienced significantly less investment. This adverse effect of the FTLRP on land-related investments could partly explain the decline in agricultural productivity following the launch of the program. However, the program had no significant effect on the decision to invest. Furthermore, farmers invested significantly more in parcels they got via allocation from a traditional leader, relative to those that they inherited (the reference mode of acquisition in the analysis).

In line with findings by Holden and Yohannes (2002) and Hayes et al. (1997), wealthier households (in terms of livestock holdings) were more likely to adopt soil conservation technology. Wealthier households were better able to amass resources, e.g., hiring labor to construct soil conservation structures. However, livestock holdings were found to have a negative effect on the level of investments. Having a household head who was a commercial farmer before the FTLRP began increased the likelihood of investing in soil conservation, relative to having a household head who was a communal farmer. This could indicate the possibility that commercial farm workers are more experienced and, therefore, more likely to appreciate the comparative gains of investing in soil conservation. On the contrary, in cases where the household head was engaged in non-farm activities before the start of the program, the household was less likely to have invested in soil conservation, relative to cases where the household head was farming in the communal areas before the start of the program. Similarly, this captures an understanding of the comparative gains of investing in soil conservation—an understanding that intuitively comes with farming experience. The significance of the regional dummy, Negomo, in the decision to invest, points to the importance of location-specific determinants of adoption of soil conservation technology.

Consistent with findings by Gebremedhin and Swinton (2003), investment levels decline with parcel size and this decrease increases with size—i.e., there is a convex association between parcel size and investment levels. This could be indicative of possible diminishing marginal returns to contour ridges within a given parcel. The result also suggests that households with

[10] The author also ran OLS and Tobit model on investment levels and results (not reported here). These analyses suggested that the FTLRP had a negative impact on investment levels, while a probit model on the decision to invest found no significant impact of the program on the decision to invest, consistent with Heckman results reported here. A censored least absolute deviation (CLAD) estimation was also attempted, but ran into convergence problems.

smaller parcels were more likely to practice agricultural intensification and therefore construct more contour ridges to increase agricultural productivity. Steepness of the parcel had a positive effect on the decision to construct conservation structures, with moderately steep parcels being more likely to have investments, compared to those with a light slope—consistent with Nyangena (2007) and Gebremedhin and Swinton (2003). Taking perceived soil depth as an indicator of soil quality (or abundance), parcels with deep to moderately deep soils were less likely to have conservation investments. However, the level of soil conservation was found to increase with soil depth. This is intuitive since contour ridges are earthen structures: it implies that their construction is relatively easier on deeper soils. The probability of investing, as well as investment levels, decreased with levels of initial endowments of conservation structures, reflecting possibly declining marginal returns to contour ridges.

The study found evidence that households invested on their land to establish and/or enhance their security of tenure. Specifically, households which believed investing in land reduced the probability of losing land (e.g. via evictions) were more likely to invest in soil conservation than those who did not hold this belief. This indicates that households invest in long-term land-related investments to enhance security of tenure, consistent with Place and Hazell (1993), Besley (1997), and Deininger and Jin (2006). This may result in sub-optimal or inefficient investment levels from a social perspective, as households might not focus on productivity-enhancing investments.

5.3 Fast Track Land Reform and Tenure Security

To investigate the effect of the FTLRP on tenure security, we started by estimating a model which not only controlled for variables that were used in the matching process but also controlled for parcel characteristics. In the second estimation, we explored whether investments in soil conservation had an effect on perceived tenure security, especially for households which believe investing in land strengthens tenure security. We did this by introducing soil conservation investment levels and an interaction term (*investment level, given that investments are believed to enhance security*) of a dummy that captures whether the household believed investing in land enhanced tenure security and investment levels as control variables.[11] The

[11] We did not separately include the dummy that captured whether the household believed that investing in land enhanced tenure security as we believe that it had no effect on tenure security in the absence of investment levels, which is the modifying variable in this case.

ensuing discussion on results is based on the second model which we consider to be our full model. The results are presented in table 6 below.

Table 6 OLS Estimation of Perceived Tenure Security‡

	Model 1		Model 2	
Variable	***Coefficient***	***Robust std. error***	***Coefficient***	***Robust std. error***
Mode of acquisition				
FTLRP	-0.417***	0.079	-0.391***	0.079
Allocation	-0.08*	0.048	-0.079	0.048
Bought	-0.076	0.089	-0.062	0.089
Rented	-0.787***	0.064	-0.757***	0.065
Socioeconomic characteristics				
Male	0.085*	0.047	0.084*	0.047
Age	1.197	7.527	0.415	7.396
Age^2	-0.028	0.064	-0.018	0.063
Education	4.699	6.352	4.742	6.386
Children	-27.797***	9.757	-25.72***	9.738
Male adults	-19.535**	8.524	-19.709**	8.325
Female adults	12.98*	7.859	12.4	7.818
Livestock holdings	-4.112	4.508	-3.294	4.479
Extension	-3.325	4.957	-3.133	4.892
Remittances	-0.048	0.041	-0.042	0.04
Farming certificates	130.241***	48.779	126.607***	48.503
Off-farm activities	-10.902	17.809	-6.779	17.601
Media	-31.083	40.297	-32.994	40.206
Social capital	64.441**	27.968	60.343**	27.785
Farm worker in year 2000	0.133	0.148	0.113	0.134
Non-farmer in year 2000	0.149	0.11	0.129	0.109
Chiweshe	-0.034	0.068	-0.017	0.068
Negomo	-0.031	0.05	-0.022	0.05
Parcel characteristics				
Parcel size	0.776	1.063	0.637	1.061
Distance	-1.007	6.085	-1.371	6.057

	Model 1	Model 2		Model 1
Variable	***Coefficient***	***Robust std. error***	**Variable**	***Coefficient***
Steep slope	0.114	0.072	0.118	0.072
Moderate slope	-0.01	0.047	-0.005	0.047
Deep soils	0.133**	0.062	0.13**	0.062
Moderately deep soils	0.075	0.056	0.072	0.055
Soil conservation investments				
Investment level			-0.803***	0.243
Investment level, given that investments are believed to enhance security			0.94***	0.257
Constant	0.872***	0.226	0.86***	0.225
Observations	509		509	
F-value	8.55		8.69	
R-squared	0.27		0.29	

‡ This estimate also included an OLS without possibly endogenous variables; see appendix A2.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%

The results reveal a highly significant and negative impact of the FTLRP on perceptions of tenure security, consistent with the *a priori* hypothesis. This could be due to the fact that the FTLRP was done at an accelerated pace which overrode legal procedures, thereby raising tenure insecurity among beneficiaries from the beginning. Moreover, since the introduction of the FTLRP, the government's policy and stated aims in relation to redistribution and land occupations have repeatedly changed, further fueling tenure insecurity. In addition, the use of different laws, inauguration of different administrations, and institution of different policies—creating multiple tenure systems—spawned grounds for conflict (Munyuki-Hungwe and Matondi 2006), which further contributed to tenure insecurity. In particular, the government has weakened the principle of individual or household usufruct rights (Munyuki-Hungwe and Matondi 2006). Farmers also feel insecure about parcels they rent, as compared to parcels acquired via inheritance. This reflects the uncertainty of tenure that apparently accompanies rented parcels. These results are worrisome, as tenure insecurity might have adverse implications on planning horizons and consequently agricultural productivity.

As expected in a patriarchal society, such as Zimbabwe, a male household head is associated with higher levels of tenure security. Customarily in Zimbabwe, rights to land have

been a preserve for men, which might make households feel more secure if the household head is male. This could suggest that women face discrimination regarding access to and use of land in rural Zimbabwe, which manifests itself in female-headed households having lower perceived tenure security, compared to the male-headed counterparts. However, perceived tenure security declines with the number of male adults in a household. One possible explanation for this is that, in rural areas, men are more connected to the wider events of the country and would be more informed about and more concerned with general instability in the agricultural and political arenas—which could translate into perceived tenure insecurity. Thus, although having a male household head implies increased tenure security due to the institutional discrimination in favor of men, having a lot of male adults could reduce perceived tenure security from increased awareness of the prevailing situation in Zimbabwe with regards to land.

The more children a household has, the lower is the perceived tenure security. Having many children is demanding in terms of labor hours spent taking care of them, which obviously implies less time spent working on parcels of land. Given that one of the criteria the government used in selecting people for resettlement within the FTLRP was farming experience or knowledge, we would expect households with more household members and a farming qualification to feel more secure. So, the results here are as expected. Social capital strengthens tenure security, and having more community ties assures the household of support from neighbors in case there is need to defend land rights—and thus a household with stronger ties to its neighbors would generally feel more secure.

Households perceive higher tenure security for parcels with deep soil, relative to parcels with shallow soil. Given that deep soil is one of the indicators of good parcel quality, having high quality parcels could also be confounded with other qualities that capture the unobserved relative social power of the household. Socially powerful households would get higher quality parcels and would naturally have higher perceived tenure security than other less socially-powerful households.

To investigate the overall effect of investment levels for households which believe investing in land enhances tenure security on perceived security, the study tested for the joint significance of the coefficients for the variable *investment level* and the interaction term i*nvestment level, given that investments are believed to enhance security*. The coefficients indicate that the net effect of investment levels on perceived tenure security for households which believe investing in land enhances tenure security is 0.137, which is statistically different from zero at 1-percent level of significance. Thus, there is evidence that for households which believe investing in land enhances tenure security and which actually undertake soil conservation

investments, their perceptions of tenure security depend positively on levels of investments in soil conservation.

6. Conclusions

This study contributes to the scarce literature that assesses empirically the impact of Zimbabwe's Fast Track Land Reform Program (FTLRP) on tenure security and land-related investments. Data from Mashonaland Central Province in Zimbabwe was collected to investigate the impact of FTLRP on perceptions of tenure security and investments in soil conservation. Results from the analysis provide evidence that the program created some tenure insecurity among its beneficiaries and had an adverse impact on investments in soil conservation. The analysis suggests that the program might have failed to offer security of tenure necessary for long-term planning horizons of farmers who got land under the reform program. In a way, the program has displayed the government's lack of understanding about the substance of land rights and their link to economic development. The results underscore the need for the government of Zimbabwe to restore confidence and credibility in the agricultural property rights system.

In addition, there was evidence that households, which believed investing in land enhanced tenure security, were not only significantly more likely to invest in soil conservation but their perceptions of tenure security depended on levels of investments in soil conservation. This lends support to the contention that households invest in long-term land-related investments to enhance security of tenure. The fact that we found evidence that some households might invest in soil conservation to enhance tenure security implies that measures that effectively increase land tenure security are necessary because they might allow households to focus only on productivity-enhancing investments.

The significance of the gender of the household head and, in particular, the fact that female-headed households feel less tenure secure underscore the need for the government to review the gender implications of its reform programs and reformulate policies to discourage discrimination of women in land access and use.

The credibility of this analysis could be questioned in light of the current economic crisis in Zimbabwe, especially the hyperinflationary environment, but because this analysis is based on quantities and not prices, it is cushioned from this problem. In particular, the fact that the analysis focuses on soil conservation, which is labor-intensive and has family labor as the main source, implies that liquidity or financial constraints that could be associated with the economic crisis might not be a limiting factor in soil conservation investments. Moreover, the fact that

labor is the most important input in soil conservation investment means that conservation is not very sensitive to market conditions, and this increases the chances of isolating the effect of the FTLRP on soil conservation investments. Thus, these estimates are a fairly reasonable reflection of the direction of the impact of the program on soil conservation investments and perceived tenure security.

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Appendices

Table A1 Heckman Estimation of Soil Conservation Investments without (Possibly) Endogenous Explanatory Variables

	Investment level		Decision to invest	
Variable	***Coefficient***	***Robust std. error***	***Coefficient***	***Robust std. error***
Mode of acquisition				
FTLRP	-101.117***	33.751	0.015	0.209
Allocation	92.389**	43.179	-0.249	0.152
Bought	48.324	65.185	-0.173	0.246
Rented	28.385	71.628	-0.289	0.258
Socioeconomic characteristics				
Male			0.3**	0.152
Age	-0.251	4.391	-0.005	0.022
Age^2	-0.004	0.037	0.000	0.000
Education	-0.609	6.179	-0.014	0.022
Male adults	-15.866	12.027		
Female adults	-0.397	3.629		
Children			0.024	0.033
Social capital	-13.89	20.798	0.069	0.085
Chiweshe			-0.551***	0.213
Negomo			-0.241	0.149
Parcel characteristics				
Parcel size	-5.072***	1.696	0.006*	0.004
Parcel $size^2$	0.016**	0.006		
Distance	4.357	5.333	0.003	0.022
Steep slope	40.508	51.685	0.281	0.211
Moderate slope	48.712	33.305	0.444***	0.149
Deep soils	92.85**	39.789	-0.589***	0.191
Moderately deep soils	67.739*	37.361	-0.286*	0.174
Constant	373.621**	166.673	-0.415	0.678
Rho	-0.453*** (0.115)			
Observations	509			
Censored	362			
Log-likelihood	-1250.013			
Chi2	61.31			

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

Table A2 OLS Estimation of Perceived Tenure Security without (Possibly) Endogenous Variables

	Model 3	
Variable	***Coefficient***	***Robust Std. Error***
Mode of acquisition		
FTLRP	-0.42***	0.073
Allocation	-0.082*	0.046
Bought	-0.062	0.088
Rented	-0.79***	0.065
Socioeconomic characteristics		
Male	0.103**	0.047
Age	0.764	7.322
Age^2	-0.028	0.063
Education	1.508	6.175
Children	-29.012***	9.529
Male adults	-19.785**	8.018
Female adults	13.377	8.146
Media	-37.097	37.734
Social capital	59.092**	27.71
Farm worker in year 2000	0.082	0.137
Non-farmer in year 2000	0.103	0.106
Chiweshe	-0.022	0.069
Negomo	-0.036	0.05
Parcel characteristics		
Parcel size	0.857	1.053
Distance	-2.258	6.132
Steep slope	0.103	0.072
Moderate slope	-0.021	0.047
Deep soils	0.135**	0.061
Moderately deep soils	0.074	0.055
Constant	0.899***	0.222
Observations	509	
F-value	9.08	
R-squared	0.26	

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