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Determinants of land rental markets: Theory and econometric evidence from rural Rwanda

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Land market developments and household access to land through land rental markets are important, especially at the stage where land reform is taking place in Rwanda. Determinants of land rental markets in rural Rwanda, assessed according to household and land market characteristics as well as transaction costs constraints, were studied based on a survey of 251 household farms from the Southern Province during 2006 to 2007. Around 22% of the households surveyed did not participate in the rental markets, while 43% rented in land and 35% rented out land. Results from a Tobit regression analysis indicated that, households often combine buying and renting of land to adjust their land holding to the optimal farm size. Land rental markets reallocate land between households with different management abilities and allow a consolidation of land use, as land ownership in Rwanda is very fragmented. Land specific issues such as transaction costs, rural credit and labor constraints impeding access of households to land were evident in the data. Policies should be implemented to improve the functioning of other rural markets, in order to allow the rental markets to contribute to further efficiency improvements and poverty reduction in rural areas.

Key words: Land market, management ability, transaction cost, efficiency, productivity.

INTRODUCTION

Rwanda, with a surface area of 26,338 km^2, is one of Africa's smallest countries, but exhibits one of the highest population densities of all African countries (about 300 inhabitants per km^2) based on a World Bank (2002) report. In Rwanda, as in many other countries, the major resource is land. As the population density figures indicate, the amount of land per household is extremely small and as the rural population grows, not only does the farm size decline, but also parcels are increasingly fragmented into small plots, scattered over a wide area (Bizimana et al., 2004). Customary laws governing access to, utilization of and transfer of land in Rwanda are diverse (Place et al., 1994). Under the customary system, land markets were operating fairly well but they were de *jure* illegal (André and Platteau, 1998). According to the 1976 decree 09/76, all land in Rwanda belongs to the state, apart from those parcels registered following cadastral surveys, and all Rwandans retain only usufructuary rights to it (RISD, 1999). This decree prohibits any Rwandan from buying or selling customary rights to land without the authorization of the Ministry of Land. However, in practice Rwandans regularly buy and sell these rights without authorization. Takeuchi and Marara (2000) contend that, co-existence of this written (or "modern") law with the customary laws has resulted in rights to land being so ambiguous that investment tends to be hindered.

This study uses an econometric model to test which characteristics are important determinants of household participation in the rental market, using data from 251 households in the Southern Province. Determinants studied include those related to household characteristics, land endowment, and transaction costs on land rental activities. Farms studied are privately owned and the size of farm included the initial land endowment and the amount of additional land purchased by the household.

MATERIALS AND METHODS

Data were collected through a survey of 26 cells[1] (a sample of 10 household heads from each) from three administrative districts - representing the former provinces of Gikongoro, Gitarama, and Butare- of the Southern province. The sampling method was administered at three levels: 1) stratified random sampling at district

[1] The Rwandan local administration comprises four levels: Province – District – Sector - Cell. The Southern province is one of Rwanda's five provinces.

level (with respect to zonal location and livelihoods variation), 2) random sampling method at sector level (two sectors were picked from each district), and 3) purposive and simple random sampling methods at household level. This allowed representation of households renting in land, households renting out land, and households not participating in the rental market.

The survey was conducted from October 2006 to March 2007, using a standardized questionnaire that consisted of both pre-coded and open-ended questions. Questions were designed to be answered by household heads who typically manage farm operations in Rwanda. In addition to the survey of households, some questions were posed to agricultural officials in order to obtain data at regional and national levels.

Empirical model

Censored Tobit regressions were used to analyze the determinants of land rental markets. Based on the theory and empirical evidence, renting in and renting out decisions were estimated separately. The empirical model includes two models: one model uses the amount of land rented in as dependent variable, the other model uses the amount of land rented out as dependent variable. The amount of land rented includes both land rented under formal and informal contracts. The explanatory variables included in the analysis are based upon the literature on land rental market. These variables are further explained into different groups, namely household characteristics, land endowment, and transaction costs.

Household characteristics

Household level variables include human capital endowment (measured by age and education of the household head), the family size, income remitted by wage earners, and a dummy variable representing a proxy for credit availability in the area (CRD) (one if household head had used credit for agricultural production, zero otherwise). Age (AGE) and the education level (EDU) of the household head are expected to affect the marginal productivity of the land, and hence rental activities; although the impact may be non-linear (Vranken and Swinnen, 2006). Age may have a negative impact on renting in (and a positive impact on renting out) as younger household heads are expected to be entrepreneurial and innovative because of their long-term planning horizons and lower risk aversion (Adesina et al., 2000). Age may, however, mean that a farmer has accumulated enough information through longer experience and experimentation (Hassan, 1998), which would lead to higher marginal productivity and hence, influence the decision to rent in land. For these reasons, the squared term of the age variable was considered to test for non-linear effects.

Education (EDU), which is measured as school standard passed, is expected to have a positive impact on renting in, because it increases the management capacity of the household. However, beyond a certain education level, household heads may get access to better off-farm opportunities, and hence reduce their labor allocation to farming and shift to off-farm employment. Different off-farm employment opportunities could arise because (a) of an improvement in off-farm income or (b) an improvement in the farmer training or education which enables him to obtain a job outside of agriculture. If it is due to (a) then it needs to be hypothesized that labor is not perfectly mobile otherwise the difference in off-farm income will disappear in different areas. Off-farm job opportunities in the study appear largely a function of education of the head of the household (Pearson Correlation = 0.46)[2]. This implies that improving education will improve labor mobility from agriculture. The squared terms of the education variable was thus considered to test for non-linear effects.

The family size (FSZ) representing the number of dependents in each household could also have both a positive and a negative effect on the household's decision to rent land upto a certain critical point (Thompson, 1996) that is a certain number of dependents, households will have an incentive to farm in order to meet family subsistence needs. Thereafter, the likelihood of renting is expected to diminish as time needed for child-care increases and competes with farming for labor. Likewise, investments in farming have to compete with increasing expenditure on education. For these reasons, the squared term of the family size variable was considered to test for non-linear effects. Income remitted by wage earners (REM) is an important source of liquidity (Thompson, 1996) and could be used to finance land rental. Due to the nature of the remittance data, two variables were estimated that is, monthly income remitted and a squared term. Given the nature of transaction costs, the amount of land rented in/out is not likely to increase linearly with increasing remittance income. The rate of increase is expected to fall.

Consequently, a positive relationship is anticipated between REM and renting in (and a negative relationship with renting out), but a negative relationship is expected between the squared term and renting in (and a positive relationship with renting out). Vranken and Swinnen (2006) argue that, credit constraints will reduce the demand for land by the household but will also make it more likely that additional land will be rented instead of bought by the household. The main advantage of renting land -compared to buying land- is that, it requires less liquidity or access to credit. With credit market imperfections, this is a very important consideration in the household's choice.

Land endowment

Land market characteristics of farms studied were measured by the amount of land owned by the household (LDO) and the household's subjective ranking of the quality of each plot (QLT) (one for highest quality). The LDO variable is expected to be positively related with the amount of land rented in, and negatively with the amount of land rented out. To prevent potential endogeneity problems with the LDO variable, there was a separation of this variable into the household's initial land endowment (land received through inheritance or State allocation) (LDE) and land purchased by the household (LDB), since some sampled households had purchased additional land.

One model with LDO was estimated and another with LDE and LDB to separate the initial endowment and land purchase effects. The marginal productivity of the land is affected by land quality. Thus, households working on better quality land are expected to rent in more land and rent out less. The QLT variable may also reflect differences in the average price of a plot of land or variables affecting demand for land, including competition for land in the study area.

Transaction costs

Transaction costs in the land lease market include the cost of search, screening and monitoring (Bezabih and Holden, 2009) referred to as enforcement ability. Araujo et al. (2007) view transaction costs as the sum of costs which result from the contractual relationship in the land market, and that can prevent the acquisition of property rights. In this article, transaction costs are a function of tenure security that again depends on trust, costs of obtaining information about alternatives, and of negotiating, policing and enforcing contracts, following Williamson (1979).

In economics, trust can be viewed as an expectation, and it pertains to circumstances in which agents take risky actions in

[2]Correlation is significant at the 1% level of probability

Table 1. Description of the regression variables.

Variable	Code	Description
Independent variable		
Age	AGE	Age of the household head (years)
Education	EDU	Formal education of the household head (years)
Family size	FSZ	Number of dependents in each household
Income remitted	REM	Monthly wage remittances plus welfare payments (Rwf)
Use of credit	CRD	Dummy variable representing a proxy for credit availability in the area (one if household head had used credit for agricultural production, zero otherwise)
Land owned	LDO	Amount of land owned by the household (hectares)
Initial land endowment	LDE	Land received through inheritance or state allocation (hectares)
Land bought	LDB	Amount of additional land purchased by the household (hectares)
Land quality	QLT	Average land quality at district level
Tenure certainty	TNR	Dichotomous (1,0) one if household head feels assured of his long-term tenure, zero otherwise
Enforcement ability	ENF	The assessment of the ability to command the necessary level of effort between households participating in the rental market
Cooperative	COP	Dichotomous (1,0) one if household head is a member of a cooperative farm, zero otherwise
Dependent variable		
Rent	RENT IN	Amount of land rented in (hectares)
	RENT OUT	Amount of land rented out (hectares)

environments characterized by uncertainty or informational incompleteness (James, 2002).

There are several reasons that can explain why a household may opt for acquiring more land for farming. One of them includes uncertainty regarding property rights (Deininger and Feder, 2002). Tenure (TNR) in this article was captured as the future use certainty (a dummy variable equal one if household head is confident of his long-term tenure). This appears to vary somewhat between households despite the fact that, none of the sampled farmers in the study area possessed a legal title for any parcel. Other transaction costs variables include enforcement ability (ENF) -an assessment of the ability to command the necessary level of effort between households participating in the rental market, and cooperative membership (a dummy variable equal one if household head is a member of a cooperative farm) (COP).

Spagnolo (1999) shows that, workers have an incentive to cooperate in both the social and production interactions if they trust each other, that is, if the probability agents assign to the event that, the other worker cooperates is large enough. All this suggests that households face different transaction costs in accessing land, depending whether or not households belong to a farming cooperative. They may also reduce transaction costs in accessing other inputs and sales markets for household farms, or create spill-overs in terms of better management, information, or technology, and therefore enhance the profitability of land use on the household farm (Vranken and Swinnen, 2006). All these variables are therefore expected to have a positive impact on renting in and renting out of land. Both empirical models can be summarized as follows:

$$y_i = \alpha_0 + x_i \beta + z_i \gamma + r_i \delta + \varepsilon_i$$

where:

y_i represents the dependent variable; x_i, z_i, and r_i are vectors of variables measuring respectively, household characteristics, land market characteristics, and transaction cost effects; β, γ, δ are vectors of parameters related to the household characteristics, the land market characteristics, and transaction cost variables, respectively; ε_i refers to the error term.

Table 1 lists the regression variables specified in both empirical models together with their description.

RESULTS

Statistics reflecting household characteristics were computed to provide base information about the households sampled. Table 2 shows important differences between households which rent in land and those who rent out land or do not participate in the rental market. From a total of 251 households sampled, 108 (43%) rent in land, 88 (35.1%) rent out land, and 55 (21.9%) do not participate in the rental market. Land is rented out to other households and the average amount of land rented in is 0.21 ha, and that of land rented out is 0.18 ha.

On the average, household heads renting in land appear to be younger and slightly less educated compared to household heads renting out land, despite having a similar number of dependents. More households in the first group own and operate much less land; however, this demonstrates that the proportion of land rented falls with increase in size of farm operated. The heads of households renting in land receive important off-farm income, felt assured of their long-term tenure sources of lending rather than formal sources. Table 3 shows descriptive statistics and pair-wise correlation between the

Table 2. Characteristics of rural Rwandan households by rental activities.

Characteristic	Households that rent			All
	In	Not	Out	
Number of observations	108	55	88	251
Share of total sample (%)	43.0	21.9	35.1	100
Age of household head (years)	42.4	42.7	45.1	43.4
Education of household head (years)	5.2	5.1	5.4	5.3
Number of dependents in each household	3.2	3.3	3.4	3.3
Income remitted (Rwf/Month)	3786[1]	0	619[2]	1846
Own land area (hectares)	0.42	0.34	0.96[1]	0.59
Operated land area (hectares)	0.63[2]	0.32	0.78[1]	0.61
Household membership of cooperatives (% yes)	36.1	32.7	33.0	34.3
Use of credit (% yes)	15.7	9.1	6.8	11.2
Tenure certainty (% yes)	60.2	60.0	51.1	57.0
Possession of title deed for land (% yes)	0.0	0.0	0.0	0.0

Source: Own computations based on survey. Test for equal means between household renting in land and not participating in rental market, and between households renting out land and not participating in the land market. Rwf denotes Rwandan Franc (During data collection period, 1US Dollar = 548.8 Rwf). [1] and [2] denote significance at the 1 and 5% levels of probability, respectively.

Table 3. Means, standard deviations and correlations.

		Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10
1	AGE	43.43	11.709	1.000									
2	EDU	5.27	3.564	-0.264[1]	1.000								
3	FSZ	3.27	1.923	0.056	0.241[1]	1.000							
4	REM	1846.02	5293.476	-0.182[1]	0.130[2]	0.038	1.000						
5	LDO	0.59	0.752	0.133[2]	0.108	0.187[1]	0.055	1.000					
6	TNR	0.57	0.496	-0.038	0.028	0.078	0.112	0.193[1]	1.000				
7	ENF	0.10	0.305	-0.134[2]	0.276[1]	0.197[1]	0.386[1]	0.168[1]	0.084	1.000			
8	COP	0.34	0.476	-0.037	0.134[2]	0.163[1]	0.101	0.096	0.204[1]	0.195[1]	1.000		
9	QLT	1.88	0.715	0.255[1]	-0.165[1]	0.009	-0.194[1]	0.247[1]	-0.107	-0.110	-0.013	1.000	
10	CRD	0.11	0.315	-0.200[1]	0.204[1]	0.312[1]	0.160[2]	0.172[1]	0.155[2]	0.502[1]	0.197[1]	-0.191[1]	1.000

[1] and [2] denote significance at the 1 and 5% levels of probability, respectively.

correlations between the variables for 251despite the fact that, none of the sample households in the study area possessed a legal title for any parcel, and have access more to credit. The lack of credit use might be explained by the absence of formal credit institutions within the study area. A question was asked to assess whether sample households would consider borrowing capital to expand their farming activities if formal credit institutions were available. Almost all household heads knew about borrowing and would consider this option. However, their preferred sources of credit differed considerably and favoured informal households. Collinearity problems were not expected as the majority of correlation coefficients are below 0.5 (Gujarati, 1995). The highest correlation is between ENF and CRD (0.502). Most other correlations are below 0.25. To examine if the standard errors of the coefficients estimates could be inflated by multicollinearity, we also computed Variance Inflation Factor (VIF). VIFs for independent variables were found to be below 2.52 with a mean of 1.58 and hence quite satisfactory.

The results of the Tobit estimations are presented in Table 4 for renting in and renting out. Both “rent-in” and “rent-out” estimations used the whole sample with zero or positive values for the amount of land rented in and land rented out, respectively. A positive sign for the coefficient implies that, the corresponding variable has a positive effect on the probability that a household will rent in or rent out land and a negative sign implies the contrary.

The results with the total amount of land owned (LDO) as independent variable are first presented (Models I.1 and II.1 for renting in and out, respectively), then the results when the amount of land owned is divided between its initial land endowment (LDE) and land bought by the household (LDB) (Models I.2 and II.2). The model likelihood

Table 4. Tobit models for land renting in Southern Rwanda, 2007.

Explanatory variable	Rent in		Rent out	
	I. 1 Tobit	I. 2 Tobit	II. 1 Tobit	II. 2 Tobit
AGE	-0.47	-0.33	0.30	0.11
SAGE	0.004	0.003	-0.002	-0.001
EDU	-0.09	-0.15	0.08	0.25
SEDU	0.03	0.03	-0.03	-0.05*
FSZ	0.86	0.58	-1.78*	-1.11
SFSZ	-0.15	-0.12	0.23**	0.14
REM	0.56E-03**	0.63E-03**	-0.22E-03	-0.47E-03
SREM	-0.60E-08	-1.16E-08	3.88E-08	5.41E-08
CRD	3.76*	3.26	-5.45**	-4.44**
LDO	5.06**		-11.96***	
SLDO	-1.02*		2.64***	
LDE		2.75		-4.18**
SLDE		-0.72		1.41**
LDB		75.16***		-60.03***
SLDB		-70.75***		54.95***
QLT	6.75***	4.88***	-6.44***	-3.99***
TNR	0.53	0.89	2.37**	2.88**
ENF	2.31	3.04	5.71**	4.06**
COP	0.34	0.59	0.77	1.34
Intercept	7.19	6.52	16.25**	15.54**
No. of observations		251		
	Rent in		Rent out	
Standard error of estimate	6.56	5.69	6.16	5.04
Log-likelihood	-427.27	-400.91	-342.51	-314.77
Chi2	119.31	172.02	161.76	217.24
Prob > chi2	0.0000	0.0000	0.0000	0.0000
McFadden pseudo-R2	0.12	0.18	0.19	0.26

***, ** and * Significance at 1, 5 and 10% levels, respectively. Source: Own calculations based on survey.

likelihood ratio (LR) chi-square (which is analogous to the F statistic in multiple regression) is highly significant in all models ($p<0.01$) implying that, they have significantly higher log likelihood and fit the data better than intercept only model. Table 4 summarizes the results of the land rental market models. The results from the Censored Tobit regression analysis are consistent with the hypothesized relationships. Renting in and renting out of land is determined by other factors than human capital, as there is no effect of either age or education on renting in and renting out of land.

The effect of age and education is less certain. The age of a farm household captures three elements 1) ability to farm, 2) managerial experience and 3) degree of risk-tolerance- all of which tend to change with age. Their effects on land rent decisions are mixed. A young farmer is more willing to trade on the land rental market. But his propensity to trade may diminish in later years, as he gains farm experience and skill. The effect of education is also ambiguous. As a farm household acquires more education that enhances its ability to obtain, process and utilize new information, it may choose to rent out less of its land and work on its farm efficiently. But the propensity to rent out may increase, as the opportunity cost of farming increases, especially in areas where farmers have off-farm employment opportunities. The effect of education can be positive on the decision to rent out land in such an environment. A conclusion consistent with the findings of Asfaw and Admassie (1996). The number of dependent in each household has an important impact on renting out of land. The impact is mostly non-linear, with significant coefficient estimate for the square term of the variable. Households with more dependents have a higher probability of renting out less of their land. Similarly, remitted income has also a non-linear impact but on renting in of land, that is households with higher remittances

have higher probability of renting in land.

According to the results, the land endowment of the household has a strong impact on land renting. T-values and beta-coefficients (standardized coefficients), indicating the relative importance or impact of each variable in the model, suggest important relationships between landownership and renting. Land endowment variables have a non-linear impact on land renting, with significant estimates coefficients for most of the squared terms of the variables. All these relationships are consistent with *a priori* expectations and agree with findings of previous research (Swinnen, 2001). Households who own more land are more likely to rent in land, *ceteris paribus*. More interesting, the land purchased by a household has a strong positive impact on renting in land, while the estimations indicate that, renting in of land is not correlated with the amount of land initially owned by the household. This is in line with *a priori* expectations that liquidity constrains are affecting the decision to rent in land. Vranken and Swinnen (2006) reported a similar result that, while household may prefer buying land for property right security reasons, faced with important liquidity and credit constrains; they opt for renting of additional land. Vranken and Swinnen (2006) further argue that, more land bought in the previous periods is likely to both tighten the credit constraints in the current period because of the investments in the land purchase, and to reduce the marginal benefits of security, which falls with more land purchased already. The average land quality at the district level has a strong positive effect on household decision to rent out or rent in land. This implies that, land renting is significantly higher in regions where the land quality is also higher.

As regards transaction cost variables, results indicate that there is no effect on renting in of land of either tenure certainty or enforcement ability. However, renting out of land is positively affected by tenure certainty and enforcement ability. Generally, the degree of insecurity a potential landlord has towards his/her land could affect the renting out of land behavior in two ways. First, the potential landlord would decide on whether or not to lease out a plot considering the possibility of losing the plot to the tenant (landlord's tenure insecurity) and the transaction cost (of both search and supervision). The results agree with *a priori* expectations that, transaction costs are likely to be reduced as tenure security and enforcement ability increase. This indicates that, even when property rights remain informal, active land rental markets can exist. This finding confirms observations in Mexico where communities with high endowments in social capital are observed to sustain active land markets without formal titling (de Janvry and Sadoulet, 2001).

The results also indicate that, members of cooperatives do not get benefits in the form of reduced transactions costs or lower constraints to induce them to rent more land. This suggests that trust among potential partners in the land rental market may depend on other factors such as cultural norms (for control of moral hazard), kinship relations among partners, previous trading experience, and information available about the potential partner reputation.

CONCLUSIONS AND POLICY IMPLICATIONS

The research has studied determinants of household participation in the rental market in Southern Rwanda. Determinants studied include those related to household characteristics, land endowment, and transaction costs on land rental activities. Results indicate important relationships between households' land endowment, land quality, credit constraints, and transaction costs in the land market and land rental activities of rural households. Following the developed model and theoretical hypotheses, it is concluded that, imperfections in other markets may have significant effects on rural rental markets. As per the theoretical predictions, land rental markets can positively influence households with higher management abilities to access more land.

However, the impact of age and education on renting of land is shown to be weak. Since income remitted by wage earners is a significant determinant of off-farm employment, the indirect effect of age and education on renting of land is maintained, nevertheless. As such, land rental markets play an important role by reallocating land between households with different management abilities. The need for extending land by households is done by a combination of buying and renting land. But with important liquidity and credit constraints, renting of additional land becomes an imperative option to enlarge the farm size; despite the fact that buying land may provide a number of advantages over renting of land. There is also an important effect of the initial land endowment on renting out of land, suggesting that households rent out in situations where their initial land endowment is large compared to their optimal farm size. This indicates that, land rental markets allow more land use efficiency by reallocating land to more proficient households, and enabling them to access relatively larger land holdings. Taking into account the present dispersed distribution of land in Rwanda, rental markets can play an important role in increasing efficient land allocation through consolidation of land use. This is in line with the recent Rwandan land policy to reallocate relatively larger holdings to households with relatively better farm management capacities, in order to reduce the present land fragmentation.

Another important conclusion of this article is that, the efficiency of the land market can be constrained by uneven enforcement of land rights and exchange. The findings show that, households who are certain of their long-term tenure are willing to engage in land rental, even if none of the sampled farmers in the study area possessed a legal title for any parcel. In addition, households do not profit from being members of farm cooperatives –

assumed to be an incentive of trust among potential partners in the land rental market- to reduce transactions costs or lower constraints to induce them to rent more land. Rural development implications of these findings are crucial in a sense that land rental markets play an important role in promoting beneficial equity and efficiency effects for household farms, in contributing to reduce farm fragmentation through consolidation of land use reallocation of land to more proficient household farms, despite existing imperfections. Policies in Rwanda should seek to address specific land issues such as rural credit and labor markets constraints, and transaction costs impeding access of households to land, in order to allow the land rental markets to stimulate agricultural production, which is important for poverty reduction in rural areas.

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