Kinship, Transaction Costs and Land Rental Market Participation

By

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Abstract

Past polices with land redistribution, prohibition of land renting and later legalisation of short-term contracts only, may have prevented or undermined tenancy markets in Ethiopia. Recent policies providing more secure rights to land and allowing more long-term rental contracts may contribute to more efficient land rental markets. This paper examines the allocative efficiency of the land rental market in Northern Ethiopia and the extent to which adjustment in the tenancy market is constrained by transaction costs, using data collected about four years after land users were given land certificates. The analyses demonstrate significant transaction costs in the market through a high share of non-participants in the market and low adjustment coefficients to own land for those participating. We tested whether contracts among kin partners involve lower transaction costs possibly due to higher trust among kin. We found that access by tenants was less contrained in communities with a high share of kinship contracts out of all contracts. We did not find higher coefficients for own land in contracts among kin than among non-kin indicating that adjustment in contracts among kin is as inefficient as among non-kin. Higher probability of participation for those with previous experience in the tenancy market implies that there are nonconvex transaction costs and entry barriers causing substantial involuntary non-participation in the market for tenancies. Positive relationships between own farm size and probability of renting in land as well as area rented in by tenants, indicate that there are economies of scale in production, limiting the opportunities for landless and land-poor households of using the land rental market as a ladder to escape poverty.

Key words: Land tenancy, market participation, transaction costs, kinship contracts, selection bias.

1. Introduction

Studies of the efficiency of adjustment in the land rental market started with Bliss and Stern (1982), and were followed up by Bell and Sussangkarn (1988), Skoufias (1995), and Tikabo and Holden (2004). These studies essentially assess the efficiency of adjustment in the land rental market and whether imperfections in markets for non-land factors of production create a rationale for the land rental market, and whether transaction costs in the land rental market prevent participation and complete adjustment in this market.

Our paper adds to these papers by assessing how kinship relationship between lanlords and tenants may affect adjustment in the land rental market. Sadoulet et al. (1997) compared kinship sharecropping contracts with non-kin sharecropping contracts and found the former to be more efficient. This may imply that there is more trust among kin partners, less moral hazard problems, and therefore lower transaction costs in the rental market. On the other hand Kassie and Holden (2005) found that kinship contracts were associated with less efficient land use in a study in the Ethiopian highlands. In our study from Northern Ethiopia we therefore assess whether kinship contracts imply more efficient adjustment than in contracts among non-kin. Kassie and Holden suggested that their finding could be explained by threats of eviction being more efficient and efficiency enhancing in non-kin contracts than in contracts among kin. The threat if eviction hypothesis is only valid if there are credible threats that involve rationing in the tenancy market. We find empirical evidence of this as many "potential" tenants and tenants indicated that they would like to rent in (more) land.

Theoretical models (Bardhan 1984; Radner 1981; 1985) as well as empirical studies (Skoufias 1995; Tikabo and Holden 2004; Teklu and Lemi 2004; Kassie and Holden 2005) indicate that there may be asymmetries in the land rental market due to rationing, making it relevant to model and estimate behaviour on the two sides of the market separately. We therefore develop models for the land rental market participation of landlords and tenants separately, starting from the landlord side. Furthermore, it is possible that it is better to model land rental market participation and the degree of participation as a two-stage process rather than as a simultaneous decisions. This is also what we test for and find.

Our main hypothesis is that kin relations help to reduce transaction costs in the land rental markets. This implies that a) tenants may find it easier to rent in land from kin than non-kin landlords. It may also follow from this that b) it is more difficult for landlords to refuse to rent out land to kin than to non-kin. This leads us to the next testable hypothesis that tenants with kin tenancy contracts are able to rent in more land (adjust more efficiently) than tenants with non-kin contracts. This implies that kinship helps tenants to come closer to their desired cultivated area as they face lower fixed as well as variable transaction costs in the land rental market.

We start with a brief overview of the most relevant literature in part 2, followed by a presentation of our theoretical models of landlord and tenant land market participation (part 3). We then briefly explain the choice of econometric methods and present the data and some descriptive statistics in part 4. We present the results of the econometric analyses in part 5, followed by our conclusion.

2. Literature Review

Bliss and Stern (1982) developed a land leasing model using data from the Indian village of Palanpur. Describing 'Desired Cultivated Area (A^*)' as an area which accords with the availability of non-land factors of production (labour – $\underline{L}$ and bullocks – $\underline{O}$), the model considered leasing land in or out as an adjustment of land owned ($\underline{A}$) towards A^*, and called the difference 'Net land leased-in' (R).

Showing the possible imperfections in the land lease market, the model defined A^* and R as:

(0.1) $$A^* = f\left(\underline{L}, \underline{O}\right)$$

and

(0.2) $$R = h\left(A^* - \underline{A}\right)$$

A linear approximation by a first-order Taylor series expansion of equation (1.2) yields,

(0.3) $$R = c + \phi f_L \underline{L} + \phi f_O \underline{O} + \phi \underline{A}$$

Where c is the intercept, $\phi = \partial h / \partial A^*$ and f_L and f_O respectively are $\partial f / \partial \underline{L}$ and $\partial f / \partial \underline{O}$. Thus, the BS model was estimated using a reduced form econometric expression of equation (0.3) as

(0.4) $$R = \beta_0 + \beta_1 \underline{L} + \beta_2 \underline{O} + \beta_3 \underline{A}$$

with β_3 showing how rented in land adjusted in relation to own land. Zero transaction costs in the land tenancy market but positive transaction costs in the markets for labour and oxen, and these factors of production not being perfect substitutes, implies that $\beta_3 = -1$.

Bell and Sussangkarn (1988) developed a model that allowed for rationing or full adjustment in the land lease market. They explained the basic imperfections in the factor markets as being due to; thin sales markets for land and sales in discrete units; lumpy animals and oxen used in pairs for ploughing; children must be reared and add to the labour force discretely; the land rental market may not clear in a walrasian fashion due to sharetenancy and rationing; and transaction costs may be particularly large for landlords. The last point was because they considered the costs of search, monitoring and enforcement of rental contracts in the land rental market to possibly be higher than in the labour market, making adjustment of factor ratios through the labour market cheaper. They therefore developed a model with perfect labour market, production risk, and rationing, where the characteristics of prospective tenants influence the amount of land they are offered. Rationing may be explained by imperfect information and adverse selection. This leads to an asymmetry between the decision to rent out and to rent in. They also identified a subset of endowments that would lead to non-participation in the land rental market as transaction costs drive a wedge between costs of being a tenant vs. being a landlord. Based on this they developed a three-equation model; one for whether they are rationed or fully adjusted; one for notional demand for land; and one for rationed access. Based on their analysis of data from South India they conclude that combining the rationing in the land rental market and adjustment in other markets provide a better explanation of leasing behaviour than these taken separately. They found that a larger proportion of households were rationed than were fully adjusted. The characteristics of prospective tenants also influenced the landlords' allocation of tenancies. Ownership of draft oxen was a key to accessing the land rental market from the tenant side due to the absence of a market for draftpower services.

Skoufias (1995) used a similar approach as Bliss and Stern (1982) but tested for asymmetries across the two sides of the market using and comparing the parameters from tobit models on each side of the market. He found significant transaction costs and substantial non-participation in the tenancy market and also significant asymmetries. Participation in the market for tenancies was driven by imperfections in markets for non-land factors of production, like bullocks and labour. Land tended to be transferred from households poor in non-land resources to households that were relatively richer in non-land resources.

Tikabo and Holden (2004), analysing data from Eritrea, used a similar approach but assessed the land market participation as a two-stage decision and tested for possible selection bias based on the assumption that there may be rationing on the tenant side of the market. They found signs of entry barriers in the tenancy market on the tenant side while participants in the market appeared to adjust their intensity of leasing efficiently, pointing in direction of high fixed transaction costs but low variable transaction costs for those operating in the market. They found significant selection bias on the tenant side of the market but not on the landlord side and asymmetries across the two sides of the market.

3. Theory and Models

3.1. Land Rental Market Formation and Transaction Costs

Transaction costs in the land rental market may depend on many factors;

Trust among (potential) partners in the land rental market. Trust may depend on cultural norms (for control of moral hazard), kinship relations among partners, previous trading experience, and information available about the (potential) partner (reputation). Transaction costs are likely to be reduced as trust increases and trust may increase with knowledge and experience from earlier contracts with the partner (as long as contracts are renewed) and may be higher among kin than non-kin.

Search, screening and negotiation costs related to finding a partner (matching process). These may be seen as fixed up-front costs that may be especially hight the first time a potential landlord or tenants attempts to enter the market and find a partner. These costs are therefore not likely to be affected much by the size of the land transaction although the loss from not doing a good job first will be larger in the case when the transaction is large. The cost per unit of land will decline with the size of the land transacted.

Monitoring and enforcement costs related to following up the contract agreement may depend on the type of contract chosen, the distance between the homes of the partners and the land subject to contract, the level of trust among partners and the determinants of trust. These transaction costs may be nonconvex (the costs per unit of land tend to decrease with the size of the land transacted).

This assessment indicates that transaction costs tend to be nonconvex and this has important implications. Fafchamps (2004) has developed a general theoretical framework explaining trade patterns in typical rural economies. We will draw on this framework and derive some testable implications for the functioning of land rental markets and the pattern of participation in such markets and how it may change over time.

Land as a factor of production has certain characteristics that we also should take into account. Binswanger and Rosenzweig (1986) assessed the production relations in tropical agriculture and identified the immobility of land as one of the basic characteristics causing some transaction costs to be pervasive because other inputs and output have to be transported to and from the land. The immobility of the land and its relative robustness also made it potentially suitable as collateral, if private rights to land have been established, to pave the way for credit market development which again could stimulate investment.

Fafchamps (2004) identifies four basic assumptions for his model of trade in a rural economy; a) access to local information is good, b) self-revelation is suspect and needs to be independently verified, c) collection, verification and dissemination of information is costly, and d) there are fixed and sunk costs in information processing. This generates nonconvexities in trade.

We may assess these four assumptions for the land rental market in particular. Land rental markets when they operate largely within communities and imply that transactions are among community members that know eachother well, should imply good access to information for both parties. In a high-trust community costs related to search, screening, negotiation, monitoring and enforcement should be low. On the other hand, land fragmentation and a dispersed population and farm plots will tend to increase these costs as well as transportation costs related to land use. Poor infrastructure and a rugged topography will have a similar effect.

If one of the parties lives outside the community this will also increase her/his transaction costs. Fixed-rent contracts with up-front payment may be preferred by absent landlords to minimise the costs of monitoring and enforcement. Such contracts may be difficult to implement in communities where production is risky and potential tenants are poor and risk-averse. High trust, strong social networks with small moral hazard problems may reduce the need for independent verification of performance. Kinship networks may help to reduce the information costs.

Communities consisting of a class structure or different ethnic or kinship groups that do not communicate well or where trust is low across groups while land transactions across groups would be potentially advantageous, would face high transaction costs. Land conflicts and tenure insecurity, possibly due to policy distortions, would also lead to higher transaction costs due to low trust and higher costs of collecting information, etc. Removal of policy distortions and provision of secure property rights would contribute to a reduction of transaction costs in such communities but may be easier said than done and take a long time to implement. The transaction costs tend therefore to be high, pervasive and nonconvex in low trust communities and this would lead to a poorly functioning land rental market, characterised by substantial non-participation and rationing out of potential tenants.

Building on Fafchamps (2004) we develop a simple model for the land rental market. We start with a function of the trust that the landlord has. We assume trust between a landlord and a tenant has a basic fixed starting level $\overline{T}^{lt}$ but it accumulates over time depending on the trade history with the tenant.

$$T^{lt}(\tau) = \overline{T}^{lt} + \int_{-\Upsilon}^{0} \gamma(\tau) R^{lt}(\tau) d\tau + \sum_{\mathrm{P}} \int_{-\Gamma}^{0} \mu(\tau) \psi_{\mathrm{P}} d\tau \tag{0.5}$$

Trust is therefore increasing with the number of years (Υ) the landlord and tenant have traded, given some aggregation weights over time ($\gamma(\tau)$). Furthermore, we assume that trust can be influenced by various policy measures (ψ_{P}), some of which could reduce trust, like land-to-the-tiller programs, while others could contribute to build trust, like provision of secure rights to land. The sign of the third element in (0.5) is therefore ambiguous.

The transaction costs related to land rental consist of a fixed minimum cost (Binswanger and Rosenzweig 1986) and a part that depends on the size of the transaction and the trust between the landlord and tenant;

$$c^{lt}(\tau) = \overline{c}^{lt} + c^{lt}\left(R^{lt}(\tau), T^{lt}(\tau)\right) \quad (0.6)$$

If the landlord and tenant continue to trade over several periods the trust will increase and the transaction costs will be reduced, leading to a better functioning market. However, other potential tenants who do not participate in the market for tenancies may face an entry barrier due to low trust.

3.2. Landlord Model with Tenure Insecurity

The efficiency of the land rental market may be negatively affected if potential landlords fear losing the land if they rent it out. Policies like land-to-the-tiller programs that have been practiced in many countries may therefore have undermined the efficiency of the land rental market and therefore also the efficiency of land use. This may even explain, at least partly, the inverse farm size-land productivity relationship that has been fequently observed, e.g. in Inida and Pakistan (Otsuka, 2003; Heltberg 1999). Similarly, in Ethiopia land renting was prohibited, untill recently when short-duration renting was permitted. Land redistribution policies may also have introduced tenure insecurity and many feared to rent out the land as this could be considered a sign that they were unable to manage the land (Holden and Yohannes 2002; Tekie 1999) and was in conflict with the "land-to-the-tiller" philosophy that has dominated land policies in Ethiopia and many other countries for several decades.

We will here develop a simple household-cum-landlord model that captures a variety of issues explaining the potential inefficiency of the land rental market. For simplicity we assume that the household maximises expected income (y) from production on own land, rental income from rented out land (R) and off-farm activity. The household has a fixed endowment of land ($\underline{A}^l$) and non-land resources ($\underline{N}^l$). The non-land resources may be used in farm production or to generate off-farm income (wN^w). We also assume that land is rented out through sharecropping arrangement where the tenant gets a share (α) of the output (q). Production risk may be one of the important reasons for sharecropping but we ignore this type of risk for the moment and focus only on the risk related to tenure insecurity. Furthermore, we assume that land and non-land resources are complements in agricultural production. We use the following standard assumptions for the production functions;

$$q_A, q_R > 0, q_{AA}, q_{RR} < 0, q_{AN}, q_{RN}, q_{NA}, q_{NR} > 0$$

There is risk related to renting out land that we capture with a loss function. This is the expected future loss (λ) due to loss of the right to the rented out land. We use a single period model but include the present value of expected future loss of land due to land being rented out in this period. This is similar to including a user cost in the model.

(0.7)

$$\underset{R}{Max}\, y^l = pq\left(\underline{A}^l - R, \underline{N}^l - \underline{N}^w\right) + p(1-\alpha)q\left(R, \underline{N}^t\right) - \lambda\left(z^l, z^t, k^{lt}, r^{lt}, s^c, g, \psi\right)R + w\underline{N}^w$$

Income is maximized subject to the constraint that $R \geq 0$, implying that we should consider the corner solution related to participation or non-participation in the rental market as a landlord. It is possible that some of the variables are more important for the decision to rent out or not while other variables influence more the decision on how much to rent out.

We assume that the net present value of the expected loss is a function of the landlord's characteristics (z^l), the tenant's characteristics (z^t), the kinship relation between landlord and tenant (k^{lt}), the past duration of the contractual arrangement (r^{lt}), the social capital in the community (s^c), the land distribution (g), and the policy (ψ). More specifically, we assume that the risk of loss may be smaller if the landlord has a strong position in the community (z^l is high), then $\frac{\partial \lambda}{\partial z^l} < 0$. On the other hand, if the tenant has a strong position in the community (z^t is high), this may increase the probability of loss, $\frac{\partial \lambda}{\partial z^t}$>0. If, however, the tenant is a kin ($k^{lt} = 1,\ 0 \text{ otherwise}$), this may reduce the probability that the landlord's right to the land is threatened ($\frac{\partial \lambda}{\partial k^{lt}} < 0$). We assume that longer experience in the contractual arrangement among the landlord and the tenant increases trust in the relationship and reduces tenure insecurity ($\frac{\partial \lambda}{\partial r^{lt}} < 0$). The characteristics of the community in terms of competition for land or practices and attitudes of the local leaders may also affect the expected loss. We assume that a strong community (high social capital, s^c is high) provides its members secure rights to land and a safe livelihood, then $\frac{\partial \lambda}{\partial s^c} < 0$. An inequitable distribution of land, e.g. measured by the gini-coefficient, within the community may increase the probability of loss, implying $\frac{\partial \lambda}{\partial g} > 0$. On the other hand, a large gini-coefficient may imply that there is higher demand for land from a large number of land-poor potential tenants. This may increase the payment landlords get from their land, $\frac{\partial \alpha}{\partial g} < 0$. Policies ultimately give the basis for tenure security or insecurity but the effects may be filtered through the local leadership, cultural norms, etc. Various policies may enhance or reduce tenure security, therefore $\frac{\partial \lambda}{\partial \psi} <> 0$.

The first order condition for the simple income maximisation problem becomes

(0.8)

$$\frac{\partial y}{\partial R} = p\left(1-\alpha\left(g\right)\right)q_R(R,\underline{N}^t) - pq_A\left(\underline{A}^l - R, \underline{N}^l - \underline{N}^w\right) - \lambda\left(z^l, z^t, k^{lt}, r^{lt}, s^c, g, \psi\right) \leq 0 \perp R \geq 0$$

Based on this equation it is very easy to derive the following expected signs for the interior solution $\frac{\partial y}{\partial R} = 0$ and R>0 . The signs will also be the same for the decision to rent out land or not.

(0.9)

$\frac{\partial R}{\partial \underline{N}^l} < 0,$ less land is rented out the more non-land resources the landlord has

$\frac{\partial R}{\partial \underline{A}^l} > 0,$ more land is rented out the more land endowment the landlord has

$\frac{\partial R}{\partial \underline{N}^t} > 0,$ more land is rented out the more non-land resources the tenant has

$\frac{\partial R}{\partial \underline{N}^w} > 0,$ more land is rented out the more non-land resources are used off-farm

$\frac{\partial R}{\partial z^l} > 0,$ more land is rented out the stronger position the landlord has in the community

$\frac{\partial R}{\partial z^t} < 0,$ less land is rented out the stronger position the tenant has in the community

$\frac{\partial R}{\partial k^{lt}} > 0,$ more land is rented out to kin tenants than to non-kin tenants

$\frac{\partial R}{\partial r^{lt}} > 0,$ more land is rented out to tenants with whom landlords have contract experience

$\frac{\partial R}{\partial s^c} > 0,$ more land is rented out in communities with strong social capital (high trust communities)

$\frac{\partial R}{\partial g} <> 0,$ less land is rented out the higher the gini-coefficient for land distribution is in the community when the tenure insecurity effect dominates, and more land is rented out when the income effect dominates

$\frac{\partial R}{\partial \psi} <> 0,$ policies may reduce or enhance incentives to rent out land by landlords

These predictions may be tested econometrically;

(0.10) $$R^l = R\left(\underline{A}^l, \underline{N}^l, \underline{N}^w, \underline{N}^t, z^l, z^t, k^{lt}, r^{lt}, s^c, g, \psi\right) + u^l$$

given that data are available on the relevant variables and sufficient variation exists for the variables. It may also be relevant to test various interaction effects.

Since we in this paper put special emphasis on the role of kinship we are also interested in testing the following interaction effect;

$$\frac{\partial R}{\partial \underline{A}^{l} \partial k^{lt}} > 0, \text{ land adjustment in the rental market is smoother among kin than among non-kin partners} \tag{0.11}$$

$$\frac{\partial r^{lt}}{\partial k^{lt}} > 0, \text{ kinship contracts are of longer duration than non-kin contracts}$$

We have assumed that land renting is taking place only through sharecropping but the model could be equally valid in settings where fixed-rent contracts dominate. We have left the contract choice issue out of this model. An obvious extension of the model would be to incorporate the transaction costs in the model as we have specified. We come back to the transaction costs when we look at tenants' access to rented land later.

Another extension could be assessing how contract choice possibly could affect *R*. Policies in various countries have also favoured certain contracts, like fixed-rent over sharecropping, making contract choice and *R* interdependent. Furthermore, production risk could be included in the model, particularly if contract choice is included, as production risk may be important for contract choice (Cheung, 1969, Stiglitz 1974). We have, however, chosen not to focus on that in this study because sharecropping is the dominating contract type.

3.3. Tenant's Access to Land in the Rental Market

Based on our landlord model it is possible that potential tenants are rationed out of the land rental market. Access to the land rental market and the degree of participation may depend on a tenant's characteristics. We may assume that access to land is a function of the posession of non-land resources, social distance and reputation/farm skills, and trust as earlier introduced. The tenant may be able to use kinship relationships to increase access to rented land. Access may also be increased by good performance in previous contracts thus increasing the trust between him and the landlord and improving his reputation in the community as a good/reliable farmer.

We will base our theoretical model on the literature where contracts between landlords and tenants are seen as repeated games. Radner (1981; 1985) used infinitely repeated principal-agent games to show that cooperative solutions may be possible. He also indicated that repeated games provide the principal with the opportunity to punish the agent for inappropriate behaviour. The efficiency of such punishment will depend on the degree to which the agent discounts future utility. Bardhan (1984) developed a two-period principal-agent model to show how a threat of eviction upon unsatisfactory performance increased the incentive of the agent to work hard in the first period. He emphasized the importance of such a threat to be real and credible, meaning that eviction would make the agent worse off. This, however, requires rationing in the market such that the principal easily can replace the evicted agent with another agent while the evicted tenants should not easily find another principal. This also implies that return to the agent when he has access to rented land is above his opportunity cost.

Stiglitz and Weiss (1983) and Shapiro and Stiglitz (1984) developed similar models with rationing in credit and labour markets. They emphasized that rationing is a consequence of moral hazard (shirking). Intertemporal linkage of contracts is then a way to control or reduce the moral hazard problem. In the land rental market this implies that threat of non-renewal only is relevant when labour cannot be perfectly monitored and is not fully trusted. They also conclude that the rationing equilibrium is not Pareto-efficient as interventions may create Pareto-improvements.

Reputation effects may play an important role in these intertemporally linked markets (Hayami and Otsuka 1993, p.56-57). They may help ensure that threats are real and create lasting effects of bad behaviour as such persons may be rationed out. This may be an important way of building social capital in relatively small communities or communities with good communication links and repeated interactions.

Based on this we assume that (potential) tenants may be rationed in the land rental market. They may be fully or only partially rationed out of the market. That is; $0 \le \overline{R}^t < R^t$, where R^t is the desired (unconstrained) rented in area (Bliss and Stern 1982). We assume that the desired rented in area would maximize the expected utility of (potential) tenants. With zero transaction costs in the land rental market, constant returns to scale, and imperfections in markets for non-land factors of production, the desired area rented in would be inversely related to own land of tenants and decrease linearly with a coefficient of –1 in own land of tenants. Transaction costs would cause the coefficient to have an absolute value below 1 (Bliss and Stern 1982; Skoufias 1995). Very high transaction costs may cause potential tenants to be fully rationed out of the market for tenancies. From our landlord model we also see that a number of other variables may affect the rented out area. The tenant's access to rented-in land at time $\tau = 0$ may therefore be formulated as follows;

(0.12)

$$\overline{R}^t(\tau=0) = \sum_l \overline{R}^{lt}\left(c^{lt}(\tau=0)\right) = \sum_l \overline{R}^{lt}\left\{\overline{c}^{lt} + c^{lt}\left(\underline{N}^t, z^t, \overline{T}^{lt}\left(k^{lt}\right) + \int_{-\Upsilon}^{0}\gamma(\tau)\overline{R}^{lt}(\tau)\,d\tau + \sum_{\mathrm{P}}\int_{-\Gamma}^{0}\mu(\tau)\psi_{\mathrm{P}}\,d\tau\right)\right\}$$

Equation (0.12) says that the tenant's access to rented-in land is the sum of his access across a number of available landlords and depends on the transaction costs he faces in the land rental market at this point in time. These transaction costs depend on the non-land resource endowments of the tenant (at time $\tau = 0$), the tenant's reputation and other characteristics, e.g. social influence, and the trust that may depend on; eventual kinship relationship between the tenant and landlords; extent of earlier land rental transactions between the landlords and the tenant, and past policies. The impact of past policies may also be gradual and delayed and depend on the implementation process, local interpretation and acceptance by the community leadership. Based on this structural model we may estimate a reduced form model, suppressing the intertemporal dimension of the elements on the RHS, and using the same notation as for the landlord model.

$$\overline{R}^t(\tau=0)=\overline{R}^t\left(\underline{A}^t,\underline{N}^t,\underline{N}^{tw},z^t,k^{lt},r^{lt},s^c,g,\psi_P\right)+u^t\geq 0 \qquad (0.13)$$

Based on equation (0.12) we may draw the following hypotheses, whether (potential) tenants participate in the land rental market or not and how much land they access to;

(0.14)

$\frac{\partial\overline{R}^t}{\partial\underline{A}^t}<0;$ that is; less land is likely to be rented the more land the tenant has;

$\frac{\partial\overline{R}^t}{\partial\underline{N}^t}>0;$ that is; access is likely to increase with tenant's non-land resource endowments;

$\frac{\partial\overline{R}^t}{\partial\underline{N}^{tw}}<0;$ access is likely to decrease with the tenant's off-farm use of non-land resources;

$\frac{\partial\overline{R}^t}{\partial z^t}>0;$ access is likely to increase with the reputation or influence of the tenant in the community;

$\frac{\partial\overline{R}^t}{\partial k^{lt}}>0;$ access is likely to be better for tenants who have contracts with kin landlords;

$\frac{\partial\overline{R}^t}{\partial r^{lt}}>0;$ access is likely to be better for tenants who have had earlier contracts with the landlords;

$\frac{\partial\overline{R}^t}{\partial s^c}>0;$ access is likely to be better in high trust communities;

$\frac{\partial\overline{R}^t}{\partial g}>0;$ access is likely to increase with the gini-coefficient for land;

$\frac{\partial\overline{R}^t}{\partial\psi_P}<>0;$ policies may improve or constrain the functioning of the land rental market.

The ambiguous impact of policies is due to the diversity of policies as we already have discussed in relation to the landlord model. Land-to-the-tiller policies may have reduced the access of tenants to land in the land rental market and may also have reduced the length of rental contracts. Provision of secure tenure rights may on the other hand enhance the functioning of the land rental market and improve access. We will now turn to the estimation of the land rental market participation models.

4. Estimation and Data

4.1. Estimation Methods

Based on the theory and empirical evidence we estimate renting out and renting in decisions separately. We tested censored Tobit models against Cragg (double hurdle) models on the two sides of the market using a likelihood ratio test and found that the censored Tobit model was rejected in favour of the Cragg model on both sides of the market[1].

Using the two-stage approach we also tested for selection bias. We expected that such selection bias is more likely to be present on the tenant than the landlord side (Okbasillassie and Holden 2004; Teklu and Lemi 2004). This is what we also found. Based on this we present models for the participation decision on the two sides of the market, Truncated Tobit model for land leased out and Heckman selection model for land leased in. For the participation models we include models with village level variables as well as village fixed effects models.

Endogenous matching causes kinship contract to be endogenous in the intensity of leasing in and leasing out land models. Households may use kinship contracts to reduce risk in contracting (higher trust partners) but they may be more inclined to do so when risk is high (low trust communities). This implies that it may be difficult to separate the moral hazard and adverse selection effects in relation to endogenous matching (Ackerberg and Botticini 2002; Chiappori and Salanié 2000).

Therefore, we tried maximum likelihood switching regression models for kin vs. non-kin contracts for landlords and for tenants (Lokshin and Sajaia 2004) but these models failed to converge. As an alternative, two-step models were used. To relax the normality assumption we used a polynomial form of the predicted kinship variable instead of the inverse mills ratio, based on Deaton (1997, p. 105). This is considered an approximation to whatever the true distribution is. We used this approach for kin vs. non-kin contracts both on the landlord and the tenant side of the market.

On the tenant side of the market we found significant selection bias related to participation when we tested a maximum likelihood Heckman model. We included the predicted inverse mills ratio (*millsten*) from the maximum likelihood Heckman selection model for all tenants

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[1] Tenant side models: LR chi2(21) = 35.61, Prob > chi2 = 0.0242, and landlord side models, LR chi2(21) = 65.38, Prob > chi2 = 0.0000.

as well as the three polynomial predictors from the kinship equation to correct for selection bias related to participation and contract partner choice.

4.1. Data and Descriptive Statistics

Data were collected through a survey of 16 villages (a sample 25 farm households from each) from five administrative zones of the Tigray region of Ethiopia that covers 11 'woredas' or districts of the regionThe sampling method was administered at two levels: stratified random sampling (taking agricultural potential, population pressure, access to irrigation, and access to market into consideration) at village level and simple random sampling at household level. The survey was conducted in May-July 2003 that represents the 2002/2003 cropping season. Descriptive statistics of the village level and household level are presented in Table 1.

Table 1 gives and overview of some basic statistics for the villages included in the sample. We see that land was distributed in an equitable way as the estimated Gini-coefficients for land within each village varied from 0.12 to 0.36. The percentage of households participating in the market for tenancies varied from 16 to 84% across villages. This may indicate considerable local variation in the allocative efficiency of the tenancy market.

We present an overview of the variables we have used in the econometric analysis in Table 2. We proceed to the results and discussion in the next section.

5. Results and Discussion

We first look at the results from the participation (and access) models on each side of the market and afterwards the intensity of participation. Table 3 presents the results of the probit models for participation in the tenancy market separately on the two sides of the market, speciefied with village fixed effects or with village level variables.

5.1. The Decision to Rent Out Land

The results for the Landlord 1 and Landlord 2 models in Table 3 are consistent. Oxen per ha own land (*oxp*) were highly significant in both models. Households without or with few oxen were more likely to rent out land. Neither male nor female labour endowment had a strong significant effect on the land renting out decision. These results may indicate that there are higher transaction costs in the oxen rental market than in the land tenancy market and lower transaction costs in the labour market than in the tenancy market when it comes to entry into these markets.

Ownership of other livestock per unit of own land (*tluoxp*) was also highly significant and negative, indicating that more wealthy households were less likely to rent out their land. Households that have animals may need their land themselves to produce fodder for their animals and landlords tend to be the poorest households that lack the resources to farm their land themselves.

Previous market participation in the tenancy market was also highly significant. This is in line with our theory that transaction costs are nonconvex and lower for those who already have been operating in the market.

Old age of the head of the household increased the probability that the household rented out land. Households with off-farm income were also more likely to rent out their land. This indicates that there were imperfections in the labour market since extra off-farm income was not used to hire labour to substitute for lost household labour in farming. There are additional transaction costs related to hiring and monitoring hired labour and such costs may even be higher for households engaged in off-farm work than for other households.

Female-headed households were also significantly more likely to rent out their land than male-headed households. Traditionally females were not allowed to plough with oxen and female-headed households may therefore face more difficulties than male-headed households mobilising male labour for certain tasks. They therefore resort to renting out more land instead. Traditionally females were also not supposed to be the land managers so female household heads may face difficulties operating in the “men’s sphere”.

The farm size variable (*fs*) was included to test for economies of scale in farming, keeping in mind that the other variables were normalized to the farm size variable. We see that relatively larger farms were less likely to rent out land and this may be a sign of economies of scale.

Households in villages with more skewed land distribution (*vgini* is high) were less likely to rent out their land. Households far from the market (*mktd* is large) were less likely to rent out their land while househols in villages located far from the market (*mkt1*=1) were more likely to rent out land. This indicates that the tenancy market may work relatively efficiently in remote locations as the market is local but households far from the village center face higher transaction costs and are less likely to participate. Households living in high elevation villages (*ecol*=1) were more likely to rent out their land. Only two of the village dummy variables were significant (at 10% level only).

5.2. The Decision to Rent In vs. Access to Land

As we indicated in our theoretical model access to land may be constrained from the supply side. Nevertheless, the characteristics of tenants may be important for whether tenants succeed in participating in the market for tenancies. We therefore look at the factors that affected their participation. We see from Table 3 that oxen endowment per ha (*oxp*) also here was highly significant and positive. Oxen ownership is an important indicator of the ability to farm efficiently and therefore also very important for accessing land in the tenancy market. The male and female labour force appeared to play a less important role in relation to access to tenancies.

Previous participation in the market for tenancies had a strong positive effect on current probability of participation in the market. This is again in line with our hypothesis that transaction costs are nonconvex and non-participants may face high initial costs when attempting to enter the market.

Female-headed households were less likely to rent in land after controlling for other differences in endowments. This may be because landlords have less trust in female-headed households as land managers. Potential female-headed tenant households may therefore have been totally rationed out of the market even if they had the necessary oxen endowment for farming.

Households with large farm size (*fs*) were more likely to rent in land, again indicating economies of scale in farming. This effect was also highly significant.

Another interesting finding in Table 3 was that access by tenants to the market for tenancies was significantly higher in villages with a high share of kinship contracts. Kinhip contracts may be correlated with higher trust and lower transaction costs and entry barriers in the tenency market. This is in accordance with our theory. It also appeared that tenants faced higher access contraints in communities with more unequal land distribution (*vgini* is high). This was consistent with the finding on the landlord side of the market.

Access was more constrained in high elevation areas (*ecol*=1) and this was in contrast with the finding in the landlord model that landlords were more likely to rent out land in high elevation areas. This may be because of the higher population density in high elevation areas. The correlation coefficient between *pop1* and *ecol* was 0.58.

5.3. Intensity of Leasing Out Land

We will now look at the determinants of the intensity of participation on the landlord side of the market. We found no signs of selection bias related to participation on this side of the market. We therefore discuss the results from a truncated tobit model for for all landlords presented in Table 4. We used a village level kinship variable (*vilkin*), which was constructed as the share of all contracts in the village that were among kin partners. Furthermore, we estimated a switching regression model for kin and non-kin landlords using robust estimation and bootstrapping methods. The results from robust estimation, correcting for clustering at household level are presented in Table 4.

We see that land leased out did not adjust smoothly with the farm size of landlords as the coefficient on farm size (*lnfs*) is only 0.416 in the truncated tobit model for all landlord households. This is significantly less than 1.0 that was expected with a perfect land tenancy market with zero transaction costs and constant returns to scale. The explanation for this may be both due to transaction costs and economies of scale in farm production.

We hypothesised that trust may be higher among kin and therefore that adjustment would be smoother in kin contracts. This could imply that the land rental market functions better in villages with a high share of kinship contracts. The *vilkin* variable was insignificant, however, thus the land rental market did not function significantly better in villages with high share of kinship contracts. A large share of kinship contracts may be a sign of a low-trust community and kinship contracts may only partially be successful in reducing this problem.

More unequal land distribution (*vgini*) stimulated significantly renting out of land. This contrasts with the participation models. The probability of land being rented out was lower but those renting out land rented out more land in villages with more skewed land distribution. This may indicate that those landlords who trusted the market were willing to rent out more land where the demand was higher due to more inegalitarian distribution.

Livestock wealth other than oxen (*lntluox*) reduced renting out while oxen had no significant effect on the extent of renting out. Oxen are a lumpy resource and are necessary for ploughing and therefore for farming. Those who rented out land typically did not have oxen. If they had other livestock they needed to keep more of their land to provide fodder for their livestock.

As a further test of the impact of kinship we run a switching regression model for landlords with kin ("kin landlords") and non-kin ("non-kin landlords") contracts opening for the possibility of different logics operating in the two types of contracts. Table 4 gives the results. It indicates that land rented out adjusts more smoothly to own land of landlords for non-kin landlords than for kin landlords with a coefficient of 0.647 for non-kin landlords and 0.316 for kin landlords. This may indicate that kinship contracts may be in the form of "obligations" rather than an efficient resource adjustment process. Many landlord households are female headed. Female widow heads often live in the village of their dead husband. The relatives of their dead husband may in such cases influence their land rental decisions and may control their land. They may therefore be less free in their adjustment in the market for tenancies. They may also face higher tenure insecurity due to the male dominance in farming.

Overall we see that there are adjustment problems in the market for tenancies on the landlord side and this may be due to fixed and variable transaction costs and may be explained by low trust and tenure insecurity due to past policy distortions. This causes (potential) landlords to be hesitant to rent out land and to be careful when selecting tenants. Adjustment was not smoother for landlords with kinship contracts than for landlords with non-kin partners.

5.4. Intensity of Leasing In Land

We used a maximum likelihood Heckman (1979) selection model for the analysis of tentants' participation and degree of participation in the land rental market, and we found significant selection bias. The results of the second stage of the model are presented in Table 5. We also run a switching regression model for kin and non-kin tenants. The results of the switching regression model are also presented in Table 5.

The results show that the farm size parameters were positive in all three models, indicating that tentants rent in more land the more land they have from before. This is also in line with our finding that farm size was positively correlated with the probability of participation as tentants in the market. The explanation for this is likely to be economies of scale. To assess whether the relationship between farm size and rented in area is non-linear we introducing a squared term for farm size but the squared area variable was insignificant for kin as well as non-kin tenants and the other variables did not change significantly. This indicates that land-scarce (potential) tenants are constrained in their land access, as land-rich tenants are more able to rent in land. This may be due to the dependence on oxen for land tillage combined with a poorly functioning rental market for oxen. Kinship contracts seem not to be different from non-kin contracts in this respect. Tenants appeared to access more land in villages with more skewed land distribution.

The results may indicate that land fragmentation is excessive in Tigray from an efficiency point of view. The past policies using land as a safety net and emphasizing an egalitarian land distribution and land allocation to everybody has a reached a stage where further land fragmentation does not ensure food security because the very small farms do not produce enough for the increasing family sizes living on these small farms. The land rental market also fails to reallocate land to the land-scarce households.

6. Conclusions

We have analysed land rental market participation by landlords and tenants using data from Northern Ethiopia. We assessed whether there are transaction costs in the tenancy market or whether land allocation is efficient, and whether kinship contracts involve lower transaction costs possibly due to higher trust in kinship contracts. We found that tenants faced lower access constraints in villages with high prevalence of kinship contracts. Access to the market for tenancies was poorer in villages with high gini coefficients for land distribution but those who operated in the market for tenancies rented in or out more land in villages with high land ginis. Previous participation in the tenancy market was also very important for access, confirming our hypothesis of non-convex transaction costs and entry barriers in the tenancy market.

The parameters on the farm size variable were significantly lower than one for landlords and had even a positive sign for tenants, indicating that there are economies of scale in farming and transaction costs in the rental market. Past policies in form of land redistributions, prohibition of tenancy contracts and later limiting the length of tenancy contracts to one year may explain the low allocative efficiency of the market for tenancies. High prevalence of kinship contracts may have been a response to these policies. Recently introduced policies providing land certificates and allowing longer duration tenancy contracts may improve the functioning of the tenancy market in the future. This may lead to further specialisation and larger operational units. The land rental market may therefore have its limitations as a possible ladder out of poverty for landless and land-scarce households because of the initial capital and skill endowments that are needed to get access to and farm the land efficiently. The dominance of sharecropping contracts in the land rental market contributes to the screening and rationing mechanisms in the market.

Overall, we found large variation in the extent of participation in the land rental market across the 16 surveyed villages. Variation in local leadership may contribute to the local variation in how the market functions. More research should focus on explaining this variation and how new policies granting more secure rights and allowing more long-term leasing contracts may affect the efficiency of the land rental market and the consequent impacts on land use efficiency and management.

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Table 1. Description of Sampled 'Tabias' and Level of Land Lease Market Participation

Tabia no.	*Tabia*	*Woreda*	*Population density (Persons/km2)*	*Distance to market (in Km)*	*Mean rainfall*	*Irrigation project*	*Land distribution (Gini coeff.)*	*Tenancy market participation*
1	Hintalo	Hintalo wajirat	80.2	14	503.7	1	0.222	66%
2	Samre	Seharti samre	248.9	1.25	557.5	0	0.363	84
3	Mahbere-Genet	Enderta	441.5	8	552.1	1	0.118	60
4	Mai-Alem	Enderta	429.6	6	552.1	0	0.192	48
5	Seret	D. Tembien	707	12.5	420.4	0	0.156	56
6	Kihen	Wukro	160.6	23	420.4	0	0.169	65
7	Genfel	Wukro	166.5	4	596.8	1	0.191	67
8	Emba-Asmena	Tsaeda-emba	631.1	7	419.05	0	0.345	56
9	Hagere-selam	Gulo Mekeda	749.4	39	761.4	0	0.276	16
10	Debdebo	Ahferom	161	6	668.52	0	0.199	65
11	Mai-Keyahti	Ahferom	636.6	16	736.6	0	0.253	31
12	Adi-selam	Mreb-leke	206.8	29	579.32	0	0.160	20
13	Hadegti	Laelay Adiabo	130.8	9	832	0	0.292	40
14	Tsaeda-Ambra	Laelay Adiabo	41.8	20	596.55	0	0.252	62
15	Mai-adrasha	Tahtay Koraro	440	5.2	893.55	1	0.249	62
16	Adi-Menabir	Tahtay Koraro	236	21	783.4	0	0.281	59

Source: Hagos and Holden (2003)

Table 2. Definition and Description of Variables Used

Variable Name	Variable description	Variable type
	Household level variables	
Hhhs	Gender of the household heade (1= female, 0= male)	D
Hhha	Number of years age	C
Hhhed	(1= Household head able to read and write, 0= otherwise	D
Depratio	Dependency ratio	C
Totmal	Number of adult male	C
Totmalp	Adult males per hectare of owned land	C
Totfem	Number of adult female	C
Totfemp	Adult female per hectare of owned land	C
Kinrel	(1= transact with kin-related parteners only, 0=otherwise	D
Ox	Number of oxen	C
Oxp	Oxen per hectare of owned land	C
Tluox	Tropical livestock unit other than oxen	C
Tluoxp	Tluox per hectare of owned land	C
Fs	Owned farm size	C
Landop	Operational land holding	C
Landoc	Area under owner cultivation	C
Irrgp	Portion of irrigated land	C
Nlli	Net land leased in	C
Vinput	Value of farm inputs	C
Vasset	Value of other durable farm assets	C
Mktd	Household distance to major market (In minutes)	C
Road	Household distance to nearest road service (in minutes)	C
Ofdist	Distance to owned farm plots	C
Offarm	Lagged off-farm employment activities	D
Lrmpb	Previous participation in the land rental market; 1=yes, 0=no	D
	Village level variables	
Ecol	1=if village is located above 2000m above sea level, 0= otherwise	D
Vgini	Gini Coefficient showing land distribution within villages	C
Vilkin	Share of contracts that are among kin partners in the village	C
Irrg	Village access to irrigation projects	D
Mkt1	1= if a village is located > 10km from major market, 0=otherwise	D
Popd	Population density (1 if it is > 200 persons/km2, 0= otherwise	D

Table 3. Probit Models for Tenant and Landlord Participation in the Tenancy Market

	Tenant 1	Tenant 2	Landlord 1	Landlord 2
fs	0.608****	0.475***	-0.413**	-0.331****
	(0.16)	(0.15)	(0.16)	(0.10)
hhhs	-0.946***	-1.044****	0.509*	0.464**
	(0.31)	(0.31)	(0.29)	(0.22)
hhha	-0.012	-0.010	0.021***	0.020**
	(0.01)	(0.01)	(0.01)	(0.01)
hhhed	0.135	0.152	0.223	0.101
	(0.20)	(0.16)	(0.22)	(0.23)
totmalp	0.161*	0.127	-0.208*	-0.228
	(0.10)	(0.09)	(0.11)	(0.14)
totfemp	-0.057	-0.053	0.036	0.038
	(0.09)	(0.10)	(0.08)	(0.07)
depratio	-0.002	-0.007		0.003
	(0.05)	(0.05)		(0.04)
oxp	0.474****	0.450****	-0.650****	-0.597***
	(0.10)	(0.09)	(0.19)	(0.19)
tluoxp	0.115**	0.080*	-0.231***	-0.221***
	(0.05)	(0.04)	(0.08)	(0.07)
mktd	-0.000	-0.001	-0.003**	-0.002****
	(0.00)	(0.00)	(0.00)	(0.00)
road	0.002	0.001	0.002	0.001
	(0.00)	(0.00)	(0.00)	(0.00)
ofdist	-0.001	-0.001	0.005	0.005**
	(0.00)	(0.00)	(0.00)	(0.00)
offma	0.121	0.010	0.425*	0.376**
	(0.22)	(0.19)	(0.22)	(0.19)
lrmpb	1.770****	1.641****	1.593****	1.586****
	(0.26)	(0.27)	(0.31)	(0.42)
vd2	0.268		-0.471	
	(0.46)		(0.45)	
vd3	0.145		0.121	
	(0.43)		(0.37)	
vd4	-0.091		0.116	
	(0.49)		(0.52)	
vd5	0.821*		-0.807*	
	(0.50)		(0.41)	
vd6	-0.063		0.022	
	(0.48)		(0.38)	
vd7	0.151		-0.199	
	(0.53)		(0.49)	
vd8	0.134		-0.903*	
	(0.51)		(0.49)	
vd9	-1.293*		-0.527	
	(0.74)		(0.69)	
vd10	0.922*		-0.687	
	(0.54)		(0.50)	
vd11	0.543		-0.645	
	(0.57)		(0.53)	
vd12	0.086			
	(0.61)			
vd13	-0.177		-0.191	
	(0.49)		(0.43)	
vd14	-0.032		-0.762	
	(0.51)		(0.55)	
vd15	-0.010		-0.270	
	(0.54)		(0.53)	
vd16	0.831*		-0.821	
	(0.50)		(0.51)	
irrg		-0.187		0.107
		(0.16)		(0.18)
pop1		0.326		-0.199
		(0.22)		(0.15)
mkt1		-0.040		0.296**
		(0.21)		(0.13)
ecol		-0.563**		0.411***
		(0.26)		(0.14)
vilkin		2.353***		-0.976
		(0.81)		(0.84)
vgini		-2.115**		-1.866*
		(1.00)		(1.04)
_cons	-3.137****	-2.646***	-1.685**	-1.591*
	(0.86)	(0.96)	(0.75)	(0.83)
Number of obs.	372	372	347	372
Log pseudolikel.	-128.85659	-134.15215	-105.83585	-109.68088
Pseudo R2	0.4273	0.4038	0.4643	0.4641

Note: * significant at 10%; ** significant at 5%; *** significant at 1%, **** significant at 0.1%.

Table 4. Truncated Tobit and Switching Regression Models: Intensity of Leasing-out Land

Variables	All Landlords	Kin Landlords	Nonkin Landlords
lnfs	0.416****	0.316****	0.647****
	(0.05)	(0.08)	(0.06)
lnroad	0.015	-0.001	0.089***
	(0.01)	(0.03)	(0.03)
lndepratio	-0.028	0.031	0.013
	(0.05)	(0.07)	(0.03)
hhhs	0.164*	0.279***	0.240***
	(0.09)	(0.09)	(0.08)
lnhhha	-0.063	-0.056	-0.025
	(0.12)	(0.11)	(0.12)
hhhed	0.017	-0.064	-0.202
	(0.07)	(0.06)	(0.13)
lntotmal	0.098	0.274***	0.126
	(0.07)	(0.09)	(0.12)
lntotfem	-0.117	-0.066	0.169
	(0.11)	(0.15)	(0.14)
lnox	-0.111	-0.215	0.034
	(0.07)	(0.15)	(0.10)
lntluox	-0.169****	-0.201***	-0.566****
	(0.04)	(0.07)	(0.11)
lnofdist	-0.006	0.016	0.071*
	(0.03)	(0.03)	(0.04)
lnirrlp1	-0.022	-0.315*	0.220
	(0.21)	(0.18)	(0.19)
offma	0.049	0.025	0.051
	(0.08)	(0.07)	(0.11)
lrmpb	-0.024	0.132*	-0.299****
	(0.06)	(0.08)	(0.09)
irrg	0.152*	0.187***	0.359****
	(0.09)	(0.07)	(0.09)
mkt1	0.049	0.024	-0.209**
	(0.06)	(0.05)	(0.10)
vgini	0.978**	0.956***	0.451
	(0.50)	(0.36)	(0.56)
pop1	0.050	0.142**	-0.268****
	(0.06)	(0.07)	(0.07)
vilkin	0.207		
	(0.31)		
kinlp1		0.902	-3.401***
		(1.68)	(1.10)
kinlp2		-2.196	5.572**
		(3.12)	(2.72)
kinlp3		1.441	-3.706*
		(1.75)	(2.03)
_cons	0.373	-0.041	1.132**
	(0.49)	(0.44)	(0.52)
sigma			
_cons	0.188****	0.147****	0.127****
	(0.02)	(0.02)	(0.01)
Number of obs.	91	53	36
Log pseudolikelih.	32.153	29.74	25.09

Note: * significant at 10%; ** significant at 5%; *** significant at 1%, **** significant at 0.1%. Robust standard errors are in parentheses. These are corrected for clustering at village level. The "vilkin" variable is constructed at village level as the share of contracts within the village that are among kin partners. Truncated tobit models were used in the switching regression for the kin and non-kin landlords including a polynomial form for the predicted kinship variable (kinlp1, konlp2 and kinlp3), following Deaton 1997, p.105.

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Table 5. Heckman and Switching Regression Models: Intensity of Leasing-in Land

	All tenants	Kin tenants	Non-kin tenants
lnfs	0.247****	0.292****	0.347**
	(0.05)	0.04)	(0.16)
lnroad	-0.006	-0.010	0.131**
	(0.02)	(0.02)	(0.06)
lndepratio	-0.150**	-0.231**	0.543**
	(0.07)	(0.10)	(0.23)
hhhs	0.054	-0.056	1.325***
	(0.11)	(0.15)	(0.44)
lnhhha	-0.111	-0.146	0.867
	(0.12)	(0.16)	(0.54)
hhhed	-0.011	-0.093	0.541***
	(0.07)	(0.08)	(0.18)
lntotmal	-0.103	-0.250**	0.275
	(0.09)	(0.10)	(0.17)
lntotfem	0.044	-0.051	0.016
	(0.08)	(0.10)	(0.09)
lntluox	0.076	0.037	-0.010
	(0.05)	(0.06)	(0.07)
lnofdist	0.024	0.010	0.072**
	(0.02)	(0.02)	(0.03)
lnirrlp1	0.144	-0.519	0.983***
	(0.26)	(0.59)	(0.31)
offma	0.029	0.029	0.239
	(0.05)	(0.06)	(0.15)
irrg	0.057	0.040	0.099
	(0.07)	(0.08)	(0.10)
mkt1	-0.092*	-0.152**	0.054
	(0.05)	(0.06)	(0.09)
vgini	0.501	1.619****	1.599**
	(0.55)	(0.28)	(0.79)
pop1	0.042	0.126	0.218
	(0.09)	(0.08)	(0.14)
vilkin	0.154		
	(0.18)		
kinp1		-0.886**	-0.669***
		(0.41)	(0.25)
kinp3		0.466	1.491****
		(0.30)	(0.41)
millsten		-0.289**	-0.402****
		(0.12)	(0.10)
Constant	0.974	1.726**	-4.836*
	(0.60)	(0.70)	(2.69)
Arthro	-1.029***		
	(0.35)		
Lnsigma	-1.298****		
	(0.09)		
Rho	-0.774		
	(0.14)		
Lambda	-0.211		
	(0.05)		
Sigma-Constant		0.221****	0.148****
		(0.02)	(0.02)
Wald test (rho=0):			
Chi2(1)	8.83		
Prob>Chi2	0.003		
Number of obs.	372	79	31
Uncensored obs.	109		
Log pseudolikel.	-124.36	22.96	16.47

Note: * significant at 10%; ** significant at 5%; *** significant at 1%; **** significant at 0.1%. Standard errors adjusted for clustering at village level. Truncated tobit models are used in the switching regression for the kin and non-kin landlord models including a polynomial for the predicted kinship variable. The second order polynomial was removed due to multicollinearity.

	TTKB b/se	TTNB b/se
eq1		
lnfs	0.292****	0.347
	(0.08)	(0.47)
lnroad	-0.010	0.131
	(0.04)	(0.15)
lndepratio	-0.231	0.543
	(0.16)	(0.92)
hhhs	-0.056	1.325
	(0.21)	(1.53)
lnhhha	-0.146	0.867
	(0.19)	(1.21)
hhhed	-0.093	0.541
	(0.09)	(0.53)
lntotmal	-0.250	0.275
	(0.17)	(0.77)
lntotfem	-0.051	0.016
	(0.17)	(0.40)
lntluox	0.037	-0.010
	(0.08)	(0.16)
lnofdist	0.010	0.072
	(0.04)	(0.25)
lnirrlp1	-0.519	0.983
	(1.31)	(3.94)
offma	0.029	0.239
	(0.11)	(0.33)
irrg	0.040	0.099
	(0.23)	(0.51)
mkt1	-0.152	0.054
	(0.15)	(0.41)
vgini	1.619*	1.599
	(0.92)	(3.05)
pop1	0.126	0.218
	(0.18)	(0.40)
kinp1	-0.886	-0.669
	(1.05)	(1.04)
kinp3	0.466	1.491
	(0.65)	(1.32)
millsten	-0.289*	-0.402
	(0.15)	(0.54)
Constant	1.726	-4.836
	(1.11)	(5.28)
sigma		
Constant	0.221****	0.148****
	(0.03)	(0.04)
Prob > chi2	0.000	0.000
Numbe..	79.000	31.000

	TRLL	TRLLKin	TRLLNonkin
	b/se	b/se	b/se
eq1			
lnfs	0.416****	0.316**	0.647**
	(0.06)	(0.14)	(0.29)
lnroad	0.015	-0.001	0.089
	(0.02)	(0.06)	(0.14)
lndepratio	-0.028	0.031	0.013
	(0.05)	(0.08)	(0.27)
hhhs	0.164	0.279	0.240
	(0.11)	(0.18)	(0.46)
lnhhha	-0.063	-0.056	-0.025
	(0.13)	(0.15)	(0.55)
hhhed	0.017	-0.064	-0.202
	(0.08)	(0.18)	(0.37)
lntotmal	0.098	0.274*	0.126
	(0.10)	(0.15)	(0.31)
lntotfem	-0.117	-0.066	0.169
	(0.12)	(0.22)	(0.49)
lnox	-0.111	-0.215	0.034
	(0.08)	(0.25)	(0.31)
lntluox	-0.169***	-0.201	-0.566
	(0.06)	(0.16)	(0.52)
lnofdist	-0.006	0.016	0.071
	(0.04)	(0.07)	(0.14)
lnirrlp1	-0.022	-0.315	0.220
	(0.32)	(0.39)	(2.15)
offma	0.049	0.025	0.051
	(0.10)	(0.14)	(0.40)
lrmpb	-0.024	0.132	-0.299
	(0.09)	(0.59)	(0.57)
irrg	0.152	0.187	0.359
	(0.15)	(0.22)	(0.55)
mkt1	0.049	0.024	-0.209
	(0.12)	(0.20)	(0.88)
vgini	0.978	0.956	0.451
	(0.97)	(1.10)	(4.24)
pop1	0.050	0.142	-0.268
	(0.11)	(0.21)	(0.55)
vilkin	0.207		
	(0.67)		
kinlp1		0.902	-3.401
		(8.01)	(8.06)
kinlp2		-2.196	5.572
		(12.12)	(19.94)
kinlp3		1.441	-3.706
		(6.03)	(14.83)
_cons	0.373	-0.041	1.132
	(0.58)	(1.54)	(3.29)
sigma			
_cons	0.188****	0.147****	0.127****
	(0.03)	(0.03)	(0.03)
Prob > chi2	0.000	0.000	0.021
Numbe..	91.000	53.000	36.000

```
Truncated regression
Limit:          lower =          0                      Number of obs =     91
                upper =       +inf                      Wald chi2(19) = 147.45
Log pseudolikelihood =  32.153677                      Prob > chi2   = 0.0000


Truncated regression
Limit:          lower =          0                      Number of obs =     53
                upper =       +inf                      Wald chi2(21) = 115.24
Log pseudolikelihood =  29.738084                      Prob > chi2   = 0.0000

Truncated regression
Limit:          lower =          0                      Number of obs =     36
                upper =       +inf                      Wald chi2(21) =  36.11
Log pseudolikelihood =  25.086966                      Prob > chi2   = 0.0212
```