

# **Tenure Insecurity, Transaction Costs in the Land Lease Market, and their Implications for Gendered Productivity Differentials**

Mintewab Bezabih<sup>¥</sup>

Environmental Economics Unit

Department of Economics

Göteborg University

[Mintewab.bezabih@economics.gu.se](mailto:Mintewab.bezabih@economics.gu.se)

Stein Holden

Department of Economics and Management

Norwegian University of Life Sciences

[Stein.holden@umb.no](mailto:Stein.holden@umb.no)

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## **Abstract**

This study assesses the link between land leasing behavior and productivity differentials between male and female-headed households. A double-moral hazard model allows us to show that the landlord's tenure insecurity leads to a sub-optimal level of effort on the tenant's part, via its impact on the likelihood of contract renewal. The model also predicts that a high search cost of a landlord leads to a higher probability of contract renewal. A lower probability of contract renewal leads to lower levels of tenant's effort, and vice versa. The empirical findings support the hypotheses that female household heads have lower enforcement ability and that tenure insecurity is a significant negative determinant of productivity. However, the results show no support for a lower likelihood of contract renewal by female-headed households or for a significant impact of contract renewal on productivity.

**JEL classification:** D2, Q12, Q15, C21, C7.

**Key words:** productivity; Female-headed households; Contract renewal; Tenure insecurity; Enforcement ability

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<sup>¥</sup> Corresponding author.

## 1. Introduction

Empowering poor and vulnerable household groups in a fundamental manner, as opposed to providing them with transitory support, has been increasingly sought as a way of ensuring their effective participation in the development process (Barrett et al., 2006). Hence, the importance of identifying the underlying institutional constraints vulnerable household groups face has been receiving considerable attention. In line with this, the study focuses on female-headed households<sup>1</sup>, and the institutional and socio-cultural constraints they face in poor rural communities in Ethiopia.

A number of studies have noted a systematic downward bias in the productivity of female-owned plots (e.g. Holden et al., 2001; Tikabo, 2003). Such results persist irrespective of attempts to control for differences in labor endowment and heterogeneities in land quality. Even within the same household, empirical evidence from Burkina Faso (Udry, 1996) shows that plots controlled by women are farmed much less intensively than similar plots within the household controlled by men.

Female-headed households are characterized by lack of assets (including draught power) as well as labor shortage.<sup>2</sup> Under conditions where factor markets are working perfectly, female-headed households would be able to hire in labor and oxen or rent out land to adjust the cultivated area to other factors of production the household possesses. This would make up for the potential inefficiency in production created by labor/oxen shortage and the resulting “excess” cultivated land in proportion to the availability of labor/oxen. Equivalently, this would dissipate the productivity differentials between the less labor/oxen endowed female-headed households and the more labor/oxen endowed male-headed households. However, the markets for the complementary non-land factors (i.e. labor and oxen) are characterized by notorious imperfections and, thus, cannot play effective factor adjustment roles. The land rental market is then sought as the main mechanism by which households may adjust

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<sup>1</sup> In rural Ethiopia, female household heads comprise the poorest part of the population. Many of them are widows, separated or women who live on their own making a living out of selling liquor. They are characterized as the most resource poor, having a small amount of land, usually no pair of oxen, no full farm equipment, insufficient adult labor and little working capital.

<sup>2</sup> This is true for Ethiopia where there is a taboo against women doing certain farming operations like ploughing with oxen.

cultivated area to their access to the semi- or non-tradable factor endowments<sup>3</sup> (Deininger and Binswanger, 1982; Tikabo, 2003). Accordingly, female-headed households would rely heavily on the land lease market as a mechanism to adjust their factor endowments to cultivated area.

On the other hand, the extent to which land lease markets contribute to factor adjustment depends on the performance of the land market itself. Hence, the better the performance of the land market in terms of adjusting factor endowments to cultivated area, the higher the agricultural productivity per unit of land. The main objective of this paper is to seek explanations to productivity differentials between male and female households in terms of differences in land leasing behavior. Particularly, we plan to test the impacts of household differences in tenure insecurity, contract renewal and enforcement ability as factors explaining productivity differentials. As mentioned earlier, the existence of productivity differentials between male and female owned farms has been documented in previous studies. However, our study is the first to assess why such differences exist by linking them to the socio-cultural and institutional settings that Ethiopian peasant farmers operate under and by the subsequent differences in their land leasing behavior.

In societies where the main agricultural activities are undertaken only by men, there are tendencies to disregard the role of women as farmers (Mutimba and Bekele, 2002), which may lead to an undermining of women's positions as farmers and landowners. Historically, for instance, village-level land redistributions have been gender-uneven with women losing out disproportionately (Crummy, 2000). This might induce systematically higher tenure insecurity of female-headed households compared to male-headed ones. This might manifest in their decision to lease, since they might opt for shorter-term rental contracts. This is because female headed households would fear that tenants might establish claims towards their land if the same tenant continues to stay on the land for long. In line with this, Bellemare and Barrett (2003) argue that when choosing the terms of contract, the landlord considers the impact of his/her choice on the probability that he/she will retain future rights to the rented land. On the tenant's part, expectations of being evicted from the (rented) land may curb the incentive to exert a high level of effort.

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<sup>3</sup> By factor endowments, we are referring to land, oxen and active labor that the household has under its possession.

In addition, female landlords might not be regarded as knowledgeable farmers by tenants; thus tenants would have incentives to under-provide effort on land rented from female landlords. This is particularly true during peak labor and oxen seasons (days), when the tenant is labor constrained and meeting labor requirements of both his and the landlord's land is straining. Thus, female-headed households may need to exert extra monitoring and supervision to ensure an optimal level of tenant.

In sum, this study hypothesizes the following: heterogeneities with respect to tenure security lead to a lower likelihood of renewing contracts with the same tenant, which reduces the tenant's incentives to exert a high level of effort. This could lead to lower land productivity of female landlords. On the other hand, the inability of female headed households to enforce the terms of the contract may lead to lower tenant effort and hence lower productivity.

The paper is organized as follows: In the next section we give the theoretical background of the paper. The estimation methodology along with some considerations in the estimation procedure is provided in Section 3. Section 4 details the survey design and data employed in the empirical analysis. Section 5 presents the empirical findings and section 6 concludes the paper.

## **2. The Model**

Our main premise is that female landlords are tenure insecure and face higher costs of search screening and monitoring (higher transaction cost) in the land lease market. Higher tenure insecurity and a high level of transaction cost could make female-headed households behave differently from their male counterparts in terms of land leasing behavior. Tenure insecurity might lead to a lower likelihood of contract renewal and a higher transaction cost might be associated with inability to find a good quality/ a hard working tenant or lower contract enforcement ability. The tenant may tailor his effort in accordance with the prospect of contract renewal and the landlord's enforcement ability. The resulting difference in tenant effort could lead to a difference in productivity between rented plots of male and female headed landlord households.

Given this, the essence of the model is to assess how landlord tenure insecurity and transaction costs faced in the land lease market are linked to the tenant's optimal level of effort. As with any other contractual arrangement, land transactions could take

place for shorter or longer durations.<sup>4</sup> When search processes are costless and the landlord is fully secure about his/her land ownership, a shorter duration contract is as good as one of longer duration in terms of search cost. With positive search costs and full tenure security, however, a longer duration contract is more attractive as it reduces search costs for both parties. Thus, the landlord is then expected to renew the contract and the tenant expected to work harder not to be evicted from the land. On the other hand, if the landlord is less than fully tenure-secure, longer term contracting could induce the risk of losing land to the tenant. Thus, to the landlord, deciding on the contract renewal involves weighing the benefit of reduced search cost against the risk of losing the land to the tenant. Similarly, to the tenant, deciding on the level of effort to exert entails weighing the benefit of increased production against the chance of being evicted from the (rented) land. Accordingly, a landlord with higher tenure security will be more likely to renew the contract since the risk of losing land is going to be low. Furthermore, a tenant is likely to exert larger effort on land where contract renewal is more likely.

We consider a contract by a landlord and a tenant that stipulates output sharing conditions from rented out land. However, the tenant's effort, which is not observable to the landlord, will be one of the critical aspects of the land leasing arrangement that is not stipulated in the contract. Unobservability of tenant effort leads to moral hazard on the tenant's part since he could shirk on effort.

Another vital element in the land leasing arrangement that is not stipulated in the contract and that is also a source of moral hazard is the possibility that the landlord renews contract with the same tenant. In the Ethiopian context, contracts are typically entered for one year with a possibility of renewal. Unobservability of the likelihood of contract renewal by the landlord constitutes a source of moral hazard on the landlord's part. This situation leads to a double moral hazard problem where the landlord's decision to renew the contract is not observed by the tenant and the tenant's choice of optimal level of effort is not observed by the landlord.

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<sup>4</sup> In this context, short duration contracts refer to one-year (one production season) agreements, while longer duration contracts involve repeated and continuous renewals with the same tenant.

### **The landlord's problem:**

What we formulate in the landlord's problem is the relationship between the constraints faced by female household heads in the land lease market and their tendency to renew contracts. We argue that female landlords are tenure insecure and face higher transaction costs of search and contract enforcement in the land lease market. Because of the tenure insecurity, there is a tendency for them to renew contracts less often. On the other hand, high search cost for a tenant may increase the likelihood of renewing a contract with the same tenant.<sup>5</sup>

We consider the landlord's standard expected utility function from production profit with positive search costs that is augmented to allow for the risk of losing the land due to longer-term rentals.<sup>6</sup> The landlord's profit function is represented by the total revenue from agricultural production net the cost of searching for a tenant. The revenue is represented by the function,  $\theta f$ , where  $\theta$  is a positive random variable with an expected value of unity, intended to embody the effects of uncertainty in the agricultural production (Eswaran and Kotwal, 1985), and where  $f$  is an increasing function of effort. The cost of time and resources that the landlord incurs searching for the tenant is given by  $c^L$  and  $\alpha$  represents the share of the total output that goes to the tenant.<sup>7</sup> Since it is actual output that is observable to the landlord, we set  $Q = \theta f$ . Given this, at each period, the landlord will have the option of: 1) terminating the contract with the current tenant, incurring a search cost and obtaining a new tenant without running into the risk of losing land, or 2) renewing the contract with the same tenant and running into the risk of losing the land to the tenant. The first scenario (terminating the contract and searching for a new tenant) is represented by the following net profit function:

$$\pi_R = (1 - \alpha)Q - c^L \tag{1}$$

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<sup>5</sup> Transaction cost in the land lease market includes the cost of search, screening and monitoring and we only model the search cost aspect here while in the empirical analysis, we use the combined costs and refer to them as enforcement ability.

<sup>6</sup> We have assumed that a fixed amount of land is to be rented out and the risk of losing land is associated exclusively to contract renewals.

<sup>7</sup> Fixed rentals are very few in the data, thus we have assumed away linear contracting.

Under this scenario, the landlord gets a share of the output represented by  $(1-\alpha)Q$  and incurs a search cost,  $c^L$ . The second option (renewing the contract with the same tenant) gives the following profit equation:

$$\pi_A = (1-G)(1-\alpha)Q \quad (2)$$

Here the landlord does not incur any search cost and he/she is guaranteed to get the share of the output,  $(1-\alpha)Q$ , with probability,  $G$ , that he/she loses the rented out land. In other words, the landlord faces the risk that the tenant attempts to expropriate land and stops paying the share to the landlord. Equation (3) represents the determinants of the probability that the landlord loses the rented out land:

$$G = G(E, g, L_s, T_s, Cl, S) \quad (3)$$

$G$  is a composite variable which is a function of  $E$ , is the tenant's ability to expropriate the land;  $g$ , the gender of the household head;  $L_s$ , the landlord's socioeconomic characteristics;  $T_s$ , the tenant's socioeconomic characteristics;  $Cl$ , the duration of the contract;  $S$ , policy variables that condition the extent to which the landlord is secure about his/her tenure.  $S$  could include experience of village level redistribution, future expectations of redistribution, experience of conflict, and sense of ownership (Holden and Ghebru, 2005).

Let  $w$  be the discounted present value of expected utility for a landlord who is deciding whether to renew a contract or not to renew the contract. The utility function is given by:

$$w = \begin{cases} w_0 = EU[(1-\alpha)Q - c^L] & \text{if } h = 0 \\ w_1 = EU[(1-G)(1-\alpha)Q] & \text{if } h = 1 \end{cases} \quad (4)$$

where  $h$  is a binary variable which takes a value one if the landlord decides to renew the contract and zero if the decision is to not renew the contract. The maximization problem is a choice between two actions: renew the contract or terminate the current contract and engage in searching for a new tenant. The condition for optimization is given by the switch point, at which the landlord is indifferent between renewing and terminating the contract. In other words, the condition for optimality is given by equating the terms corresponding to  $h = 0$  and  $h = 1$  in equation (4), which is given by:

$$EU[(1-\alpha)Q - c^L] = EU[(1-G)(1-\alpha)Q] \quad (5)$$

which is equivalent to:

$$(1-\alpha)Q - c^L = (1-G)(1-\alpha)Q \quad (6)$$

Equation (6) could be solved for  $Q^*$ , the level of output that makes the landlord break the old contract and go for a new tenant.

$$Q^* = \frac{c^L}{(1-\alpha)G} \quad (7)$$

The landlord will have an expectation of the output he/she is getting, which is denoted by  $\bar{Q}$ . The decision of whether or not to renew the contract/ not is based on the levels of  $Q^*$  and  $\bar{Q}$ . If  $\bar{Q} \geq Q^*$ , then the landlord will stick with the old tenant and will not renew the contract. However, if  $\bar{Q} < Q^*$ , the landlord will be better off not renewing the contract and searching for a new tenant.

Based on (7), comparative statics give the following relationship between  $Q^*$  and the search cost,  $c^L$ , and the risk of losing land,  $G$ .

$$\frac{\partial Q^*}{\partial G} = -\frac{c^L}{G^2(1-\alpha)} < 0 \quad (8)$$

$$\frac{\partial Q^*}{\partial c^L} = \frac{1}{(1-G)(1-\alpha)} > 0 \quad (9)$$

Thus, from (8) we can see that higher  $G$  decreases,  $Q^*$ , the level of output that makes the landlord go for a new tenant. This is because when  $G$  is high, the risk of losing land is high and the amount of output the landlord requires to be compensated for the risk of losing land increases. Hence, the level of output required by the new tenant will be lower. The intuitive interpretation of (8) is that if the landlord is likely to lose the land to the tenant because of renting out, then the landlord would need higher compensation in terms of output in order to renew the contract. Equation (9) shows that a higher search cost of the tenant decreases  $Q^*$ . This is because a higher search cost increases the level of output the landlord demands from the new tenant.

*Proposition 1: Higher risk of expropriation reduces the probability of contract renewal by the landlord.*

*Proposition 2: Higher search cost by the landlord increases the probability of contract renewal by the landlord.*

The empirical implication of proposition (1) is that tenure insecurity, which increases the risk of land expropriation, decreases the likelihood of contract renewal. Similarly, higher search cost, reduces the probability of contract renewal. Thus, female-headed households, who are supposedly tenure insecure households are less likely to renew contracts with the same tenant than their male counterparts while higher search cost leads to higher probability of contract renewal.

### **The tenant's problem:**

The tenant's optimization problem considers the decision on the level of effort to put into production by taking into account the conditions of land leasing. In particular, we consider the effects of the probability of contract renewal and the tenant's search cost on the optimal level of tenant's effort.

In contracting the land, the tenant has two options: attempting to expropriate the land and not attempting to do so. The decision to go ahead with attempting to expropriate the land could lead to success or failure with some probabilities. If the attempt succeeds, the tenant would enjoy a stream of lifetime income from the land, where the yearly income is represented by  $\bar{S}$ . If the attempt fails, the tenant not only loses the prospect of renewing contract with the same landlord, but also damages his reputation and getting a good land becomes more difficult for him. We capture this damage in reputation as the inability to obtain the same quality land as before incurring the same search cost. Hence the production function of the tenant if expropriation is not successful is represented by  $f^n$ , which is lower than if the tenant did not face a damage in reputation.  $C_E$  represents the cost of expropriation. Thus, the decision to expropriate could follow the following pattern.

$$Z = \begin{cases} \sum_1^{\infty} e^{-rt} \bar{S} & \text{if expropriation is successful} \\ \sum_1^{\infty} e^{-rt} (\alpha\theta f^n(e) - c^T - C_E) & \text{if expropriation is not successful} \end{cases} \quad (10)$$

The decision to expropriate is dependent on the tenant's power to expropriate. We keep the tendency of expropriation (and its outcome) independent of effort. However, if he does not attempt to expropriate the land, he retains the prospect of the contract being renewed for him by the landlord.

In a situation where the tenant is not attempting expropriation, his optimization problem depends on the probability of contract renewal. The decision to renew the contract,  $h$ , is observed only as a probability  $P$ , to the tenant. Thus, at every period, the tenant could get a renewal with a probability  $P$  and a termination probability  $(1-P)$ . Upon termination, the tenant would have to incur a search cost  $c^T$  to find another land with the same quality, thus identical production function. The disutility to the tenant  $I$  exerting effort is given by  $k(e)$ . The likelihood of contract renewal,  $P$ , is a function of the probability that the landlord loses the rented out land to the tenant,  $G$ , and effort,  $e$  where,  $\frac{\partial P}{\partial G} < 0$ ,  $\frac{\partial P}{\partial e} > 0$  and  $\frac{\partial P}{\partial e \partial G} < 0$ . In other words, the probability of contract renewal decreases with the risk of losing land and increases with effort. In addition, the responsiveness of the likelihood of contract renewal to effort decreases with the probability that the landlord loses the rented out land to the tenant.

With this, the tenant's problem is given by:

$$v = \max_e EV \left[ P(e)(\alpha\theta f(e) - k(e)) + (1 - P(e))(\alpha\theta f(e) - k(e) - c^T) \right] \quad (11)$$

which is equivalent to:

$$v = \max_e EV \left[ (\alpha\theta f(e) - k(e) - c^T) - P(e)c^T \right] \quad (12)$$

The condition for optimality is given by:

$$\frac{\partial v}{\partial e} = (\alpha\theta f_e - k_e) + P_e c^T = 0 \quad (13)$$

The first two terms in the expression,  $\alpha\theta(f_e - k_e)$  give the standard conditions for determining the optimal level of effort under linear contracting (sharecropping). The last term,  $P_e c^T$ , gives the additional effort as a result of the probability of contract renewal

which depends on the responsiveness of the probability to effort and the search cost the tenant faces upon non renewal.

*Proposition 3: The likelihood of contract renewal has a positive impact on the tenant's effort.*

The results are in line with the model and empirical findings of Kassie and Holden (2006) in Western Gojjam, Ethiopia.

### **3. Empirical Methodology and Estimation Considerations**

The aim of this section is to set up a framework for analyzing the link between land leasing behavior and the gender gap in agricultural productivity. First, we specify the relationships between gender of the household head and land productivity to investigate the existence of significant productivity differences between farms owned by male and female household heads. To assess differentials in land leasing behavior, we define the econometric relationships between contract renewal, gender, tenure security and enforcement ability. Finally, investigate if a significant proportion of the differences are attributable to differences in the working of the land lease market by studying the relationships between productivity, contract renewal and tenure insecurity as additional determinants in the productivity regression.

#### ***3.1. The existence of gender gaps in productivity***

As per the standard productivity analysis, plot-level productivity is determined by plot characteristics and household level characteristics. In addition, because some plots are leased, lease status is included as an additional determinant of productivity. Accordingly, the econometric relationship is specified as:

$$y_{ip} = \alpha + \omega L_{cip} + \gamma g_{ip} + \mu X_{ip} + \vartheta R_{ip} + u_{ip} \quad (14)$$

where for household  $i$  and plot  $p$ ;  $y_{ip}$  is the value of output per ha;  $L_{cip}$  represents socioeconomic characteristics including gender;  $X_{ip}$  is physical farm characteristics of the plot;  $R_{ip}$  stands for the plot's lease status;  $\alpha$ ,  $\omega$ ,  $\pi$  and  $\zeta$  are the respective coefficients to be estimated; and  $u_{ip}$  is an error term.

In order to see whether differences exist between leased and non-leased plots, we estimate a Treatment Effects regression where the treatment variable is the plot's lease status.

Up to this point, we have ruled out the possibility that heterogeneities exist with respect to land leasing behavior. In other words, equation (1) implicitly assumes that the choice to lease is a decision determined by an exogenous set of factors with no bearing on productivity. However, as argued in Section 2, differences in underlying tenure insecurity and enforcement ability should lead to differences in land leasing behavior and eventually to differences in tenant effort (productivity). Sections 3.2 and 3.3 present the econometric relationships that allow for such analyses.

### 3.2. Contract Renewal

Analysis of the contract renewal decision is done using a bivariate probit model with sample selection. The estimation procedure involves two stages where in the first stage a possible sample selection is addressed by estimating a selection equation for leased out versus non-leased plots. In the second stage, a survival equation is estimated where the dependent variable is contract renewal. For the  $i^{\text{th}}$  plot, the selection equation that represents whether a plot is leased out or not is given by:

$$P_i = \begin{cases} 1 & \text{if } \beta^P S_{ip} + \gamma^P X_{ip} + u_{ip} > 0, \\ 0 & \text{otherwise} \end{cases} \quad (15)$$

where  $P_i$  is an indicator variable equal to 1 if plot is leased out,  $S_{ip}$  is a vector of socioeconomic characteristics,  $X_{ip}$  is a vector of physical farm characteristics and  $u_{ip}$  is an error term.

The survival equation is given by

$$h_{ip} = \begin{cases} 1 & \text{if } \phi + \psi L_{cip} + \pi T_{cip} + \eta g_{ip} + \mu Cl_{ip} + \gamma Cl_{ip} * g_{ip} + \lambda S_{ip} + \varepsilon E_{ip} + v_{ip} \succ 0 \\ 0 & \text{otherwise} \end{cases} \quad (16)$$

where  $L_{sip}$  represents socioeconomic characteristics;  $Cl_{ip}$  is the number of years the tenant has managed plot  $p$  of household  $i$ ;  $T_{cip}$  is a set of variables measuring the tenant characteristics;  $S_{ip}$  represents the underlying tenure security variables;  $Cl * g_{ip}$  is the interaction between gender and contract renewal;  $h_{ip}$  is a dichotomous variable indicating whether a contract will be renewed or not for the next production year.

### 3.3. Productivity analysis including land leasing behavior

Considering heterogeneous land leasing behavior implies taking contract renewal and tenure insecurity as additional determinants of productivity. Since plots that are rented out are likely to be systematically different from plots that are not rented out, the selection problem is addressed by estimating the plot lease status selection equation given in (15). The productivity equation for the non-leased plots is given by:

$$y_{ip}^N = \alpha + \varpi L_{cip}^N + \gamma g_{ip}^N + \mu X_{ip}^N + \vartheta R_{ip}^N + \delta S_{ip}^N + u_{ip}^N \quad (17)$$

The productivity equation for the leased plots is given by:

$$y_{ip}^T = \alpha + \varpi L_{cip}^T + \gamma g_{ip}^T + \mu X_{ip}^T + \vartheta R_{ip}^T + \delta S_{ip}^T + \varphi h_{ip} + \partial T_{icp} + u_{ip}^T \quad (18)$$

To estimate the selection equation along with the leased out and non-leased out plot regimes, we employ an endogenous switching regression estimation. In addition, since contract renewal is endogenous in equation (18); direct use of the variable in the regression would lead to biased and inconsistent estimates. Thus, we use an instrumental variable estimation where a predicted value of the contract renewal is used in estimating equation (16).

In order to construct the instrumental variable for contract renewal, we formed groups of households by *Kebele*. With 12 *Kebeles* in our sample, we ended up with 12 groups of households. The average contract renewal of all households within a group other than that of the household itself is calculated for each household to form the instrument for contract renewal.

## 4. The data

We gathered the data employed in the empirical analysis from households in two districts of the Amhara National Regional State, a region that encompasses part of the Northern and Central Highlands of Ethiopia. One of the Zones (Districts), East Gojjam is a fertile plateau receiving good average rainfall while the South Wollo zone is characterized by degraded hill side plots receiving lower and highly erratic rainfall.

Our sampling is based on a larger complementary a survey that involved approximately 2000 households. Among the 2000 households, information on about 230 landlord households (130 male-headed and 100 female headed) and matching

tenants are included in this study. Table 1 and Table 2 present the summary statistics and definition of the variables used in the regressions.

The survey consists of details of socioeconomic and physical farm characteristics of the landlord households. In addition, socioeconomic characteristics of tenant households are also included. The level of transaction costs faced in the land lease market and the degree of contract enforcement are represented by kinship between the tenant and the landlord, the extent to which the landlord is satisfied with the performance of the tenant and the landlord's inability to monitor the performance of the tenant. Tenure insecurity is measured in terms of past experience of changes in land holdings, expectations about changes in holdings and experience of conflict.

Table 1: Description of Variables Used in the regressions

Variables	Description
<b>Landlord socioeconomic</b>	<b>and farm Characteristics</b>
Education	Head's formal education (1=read and write; 2= read only; 3=none)
Age	Age of household head
Female	Gender of the household head
Male adult	The number of male working-age family member of the landlord per ha
Female adult	The number of female working-age family member of the landlord per ha
Livestock	The number of livestock per ha
Oxen	The number of oxen per ha
Zone	Zone the household belongs in (1=Gojjam; 0=Wello)
Flat slope plot	Flat slope of the plot (1=flat; 0=not flat)
Moderate slope plot	Medium slope of the plot (1=medium; 0=not medium)
Fertile soil	Fertile plot (1=fertile; 0=not fertile)
Medium fertile soil	Medium fertile plot (1=medium fertile; 0=not medium fertile)
Black soil	Plot with black soil color (1=black; 0=not black)
Red soil	Plot with red soil color (1=red; 0=not red)
Plot area	Total farm size (ha)
Farm area	Plot size (ha)
Plot distance	Distance of the plot from homestead (minutes)
Addis mender	Dummy for Kebele 1 (1=addismender;0=other)
Addis gudguadit	Dummy for Kebele 2(1=Gudguadit;0=other)
Ambamariam	Dummy for Kebele 3 (1=Ambamariam;0=other)
Chorisa	Dummy for Kebele 4 (1=chorisar;0=other)
Kebi	Dummy for Kebele 5 (1=kebi;0=other)
Kete	Dummy for Kebele 6 (1=kete;0=other)
Sekela debir	Dummy for Kebele 7 (1=sekeladebir;0=other)
Telima	Dummy for Kebele 8 (1=telima;0=other)
Weleke	Dummy for Kebele 9 (1=welekie;0=other)
Yamed	Dummy for Kebele 10 (1=yamed;0=other)
Amanuel	Dummy for Kebele 11 (1=amanuel;0=other)
<b>Inputs</b>	
Fertilizer	Amount of fertilizer applied (kg)

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Manure	Amount of manure applied (kg)
<b>Tenant</b>	<b>Characteristics</b>
Tenant's age	Tenant's age
Tenant's oxen	The number of oxen owned by the tenant
<b>Enforcement</b>	<b>Variables</b>
Blood relation	A dummy variable indicating whether the tenant is a blood relation or not (1=blood relation, 0=no)
Spouse relation	A dummy variable indicating whether the tenant is an in-law or not
Blood relation*female	A dummy variable indicating whether the tenant is a blood relative given that the landlord is a female
Spouse relation*female	A dummy variable indicating whether the tenant is an in-law given that the landlord is a female
Satisfaction	A dummy variable indicating whether the landlord is satisfied with the performance of the tenant (1=satisfied, 0=otherwise)
Satisfaction*female	A dummy variable indicating whether the landlord is satisfied with the performance of the tenant given that the landlord is a female
Inability to monitor	A dummy variable indicating whether the landlord is unable to monitor the activities of the tenant (1=unable to monitor, 0=otherwise)
Inability to monitor*female	A dummy variable indicating whether the landlord is unable to monitor the activities of the tenant given that the landlord is a female
Contract renewal	A dummy variable indicating whether the current tenant will get contract renewal or not in the following production year
Contract renewal*female	A dummy variable indicating whether the current tenant will get contract renewal or not in the following production year given that the landlord is a female
Predicted survival	The predicted probability that the current tenant will get contract renewal or not in the following production year
<b>Tenure security</b>	<b>Variables</b>
Security	Whether the landlord expects increase, no change or decrease in the land size in the coming five years (1=decrease 2=no change 3=increase)
Changeland	Whether the landlord has experienced change in the landownership in the last five years (1=change, 0=no change)
Conflict	Whether the landlord has experienced any conflict regarding the land
<b>Dependent</b>	<b>Variables</b>
Productivity	The value of production per ha.
Contract renewal	Whether the contract will be renewed or not in the next production year (1=renewal; 0=non-renewal)
Lease out	The lease status of the plot (1= Leased, 0=owner operated)

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Table 2: Summary statistics of variables used in the regressions

	Mean	St.Dev.	Minimum	Maximum
Education	1.581	0.871	1	3
Female	0.348	0.477	0	1
Age	55.902	18.191	13	95
Adult male	0.534	1.055	0	9
Adult female	0.414	0.900	0	9
Livestock	4.009	13.572	0	394
Oxen	1.095	1.904	0	13
Fertile plot	0.344	0.475	0	1
Medium fertile plot	0.421	0.494	0	1
Black soil	0.344	0.475	0	1
Red soil	0.520	0.500	0	1
Flat slope plot	0.633	0.482	0	1
Moderate slope plot	0.239	0.427	0	1
Plot distance plot	20.601	41.388	0	900
Plot area	0.255	0.169	0	1
Farm area	1.330	0.808	0	4
Addisgudguadit	0.093	0.290	0	1
Chorisa	0.022	0.145	0	1
Addismeder	0.040	0.196	0	1
Yamed	0.079	0.270	0	1
Ambamariam	0.078	0.269	0	1
Kete	0.092	0.289	0	1
Sekeladebir	0.093	0.290	0	1
Telima	0.087	0.282	0	1
Wolekie	0.084	0.278	0	1
Kebi	0.117	0.322	0	1
Manure	166.324	583.043	0	7600
Fertilizer	49.807	127.165	0	2381
Tenant's age	2.315	0.803	1	3
Tenant's oxen	1.977	1.074	0	8
Blood relation	0.427	0.495	0	1
Spouse relation	0.129	0.335	0	1
Spouse relation*female	0.053	0.224	0	1
Blood relation*female	0.160	0.367	0	1
Inability to monitor	0.083	0.276	0	1
Inability to monitor*female	0.033	0.179	0	1
Satisfaction	0.638	0.481	0	1
Satisfaction*female	0.239	0.426	0	1
Security	1.829	0.866	1	3
Changeland	0.132	0.339	0	1
Conflict	0.196	0.397	0	1
Contract duration	4.696	3.763	1	20
Contract duration*female	2.267	3.861	0	20
Contract choice	3.991	0.991	1	5
Predicted survival	0.925	0.161	0	1
Survival	0.806	0.396	0	1
Logvalue (yield)	6.858	1.233	0	11
Lease	0.645	0.479	0	1

Land owning farm households may or may not engage in the land lease market. Accordingly, they are categorized as ‘autarkic’, ‘landlords’ or ‘tenants’. For those who engage in the land lease market, they might do so partially or fully i.e. by renting out all/part of the plots. Table 3 presents the nature and extent of participation in the land lease market by gender category.

Table 3: Socioeconomic and endowment characteristics by household head gender

Socioeconomic characteristics							
	Age	Education	Family size	Adult family members	Oxen	Livestock (tlu)	
Female	52.71 (16.48)	1.21 (0.61)	4.05 (2.11)	2.64 (1.28)	0.34 (1.05)	1.13 (1.86)	
Male	55.67 (18.48)	1.85 (0.95)	6.00 (2.27)	3.88 (1.69)	0.80 (1.23)	2.71 (3.01)	
Tenure security indicators							
	Conflict		Certificate		Security		
Female	0.20 (0.41)		1.19 (0.57)		2.5 (0.88)		
Male	0.19 (3.97)		1.17 (0.56)		2.56 (0.94)		
Land market participation							
	Farm size	Plot size	Non leased plot	Shared in plot	Shared out plot	Rented in plot	Rented out plot
Female	1.04 (0.61)	0.25 (0.19)	0.32 (0.46)	0	0.62 (0.48)	0	0.07 (0.08)
Male	1.79 (1.03)	0.24 (0.08)	0.45 (0.49)	0.02 (0.14)	0.47 (0.49)	0.004 (0.64)	0.015 (0.12)

## 5. Results

### 5.1. The existence of gender gaps in productivity

Table 4 presents the Ordinary Least Squares and Treatment Effects estimation results for the pooled leased and non leased plots along with selection equation results for the plot’s lease status.

In the productivity equation, plots owned by female-headed households are significantly less productive. This is in line with previous studies which have shown that there is a gender gap in land productivity. This is so even after controlling for the effect of leasing out (using a dummy for leased plots), and the possibility that female and male households might not benefit equally from land leasing. Plot size is a significant negative determinant of productivity, while the impact of farm size is not significant, likely because that of plot size picks up the effect of farm size. Male adult

per unit of land is a significant positive determinant of productivity while tropical livestock units and oxen (all measured per unit of land), are insignificant. Education and age of the household head are insignificant. Zone is insignificant while many of the village variables are significant. This conforms to the expectation that agroecological and institutional (market) characteristics, which are likely to be different across villages, affect productivity in a significant manner.

The selection equation results for plot lease status indicate that female owned plots are more likely to be leased out. However, other socioeconomic characteristics like education and the number of male and female members per ha. are not significant. As would be expected, households with more oxen per ha are less likely to lease out land while the total tropical livestock units of the household per ha., which we use to proxy for wealth is not a significant determinant of the decision to rent out. Larger total land area decreases the probability of leasing out land, while a larger plot size increases the likelihood of leasing out. Plots distant to the homestead are not significantly more likely leased to be rented out. Plots with moderate slope are likely to be rented out while other plot characteristics are not significant.

Table 4: Ordinary Least Squares and Treatment effects Estimates of Pooled Plot level Productivity

Variable	OLS estimates of productivity		Treatment effects estimates of productivity		Plot rent equation	
	Coefficient	Std.dev	Coefficient	Std.dev	Coefficient	Std.dev
Zone	0.471	1.174	0.574	1.438		
Plot area	-2.594***	0.376	-2.901***	0.672	1.336***	0.458
Farm area	-0.297**	0.148	-0.129	0.225	-0.397***	0.094
Livestock	-0.001	0.009	-0.000	0.011	0.017	0.015
Oxen	0.017	0.055	0.021	0.063	-0.081**	0.038
Adult male	0.080	0.059	0.113*	0.065	-0.002	0.045
Adult female	-0.028	0.057	-0.041	0.060	-0.053	0.035
Female	-0.486**	0.189	-0.451*	0.270	1.047***	0.129
Age	0.009**	0.004	0.007	0.005	0.005	0.004
Education	0.174*	0.091	0.106	0.109	0.087	0.063
Fertile	0.082	0.247	0.132	0.266	-0.201	0.148
Medium Fertile	-0.039	0.234	-0.011	0.252	-0.157	0.139
Black	-0.649*	0.347	-0.694	0.463	0.023	0.223
Red	-0.594	0.371	-0.605	0.487	-0.176	0.208
Flat Slope	0.501	0.359	0.400	0.334	0.263	0.213
Moderate Slope	0.481	0.341	0.343	0.369	0.413*	0.221
Manure	0.000**	0.000	0.000**	0.000		
Fertilizer	0.002*	0.001	0.002*	0.001		
Lease	0.054	0.178				
Plot distance					0.004	0.003
Constant	0.269***	0.082	1.140	0.967	0.437	0.008***
Number of Observations	981					

\* significant at 10%, \*\* significant at 5%, \*\*\*significant at 1%

Note: 1. Dependent variable is the value of yield per hectare ('000).

2. Kebele Dummies are included in the productivity but not in the plot rent equations. Some are significant.

3. Standard errors are bootstrapped.

## 5.2. contract renewal

Table 5 presents the results from the survival analysis along with the selection equation representing the lease status of the plot. Female heads are not less likely to continue contracts with the same tenant than male heads. On the other hand, female-headed households that are unable to monitor are more likely to renew contracts. Among the kinship variables, male tenants are less likely to renew contracts with blood relatives, while other kinship variables are found to be insignificant for both male and female household heads. The landlord's experience of land gain or loss and expectations of future changes in the land size are significant and negative determinants of contract

renewal, among the tenure security variables. However, expectation of future land redistribution and experience of conflict are insignificant.

Older and more educated households are more likely to renew contracts. Of the tenant characteristics included, the number of oxen the tenant has is not a significant determinant of contract renewal. Older tenants are less likely to get their contracts renewed.

In addition, results from the lease status selection equation follow the same pattern as the selection equation result in Section 5.1. except that the likelihood of renting out does not significantly differ between female and male owned plots, in this case.

Table 5: Bivariate Probit Model with Selection Estimation Results for the Likelihood of Contract Renewal on Rented Plots

Variable	Contract Renewal Equation		Selection Equation	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Security	-0.041	0.091		
Changeland	-0.677**	0.268		
Conflict	-0.026	0.221		
Female	-1.509	2.377	0.142	0.118
Age	0.012**	0.005	0.012**	0.005
Education	0.229*	0.124	0.166***	0.062
Blood relation	-0.392*	0.209		
Blood relation*female	0.202	0.314		
Spouse relation	-0.181	2.358		
Spouse relation *female	-0.284	2.413		
Tenant's age	-0.321***	0.115		
Tenant's oxen	-0.006	0.089		
Inability to monitor	0.290	0.264		
Inability to monitor*female	-0.767*	0.459		
Satisfaction	0.793***	0.268		
Satisfaction*female	0.456	0.720		
Ability to find another tenant	0.013	0.181		
Ability to find another tenant*female	0.348	0.762		
Contract renewal*female	0.061	0.077		
Contract renewal	0.017	0.038		
Male adult			-0.074*	0.041
Female adult			0.002	0.033
Livestock			-0.006	0.011
Oxen			-0.081**	0.035
Farm area			-0.409***	0.085
Plot area			1.041***	0.402
Flat slope plot			0.194	0.219
Moderate slope plot			-0.001	0.261
Black soil			0.216	0.218
Red soil			0.282	0.262
Plot distance			0.004*	0.002
Fertile plot			-0.211	0.177
Moderate fertile plot			-0.115	0.146
Constant	2.925***	0.076	0.717	0.693
Number of Observations	981			

Standard errors in Parentheses : \* significant at 10%, \*\* significant at 5%, \*\*\*significant at 1%

Note: Standard errors are bootstrapped.

### 5.3. Productivity analysis including land leasing behavior

Table 6 presents the endogenous switching regression estimation for the determinants of productivity. The gender dummy variable is not significant in the leased regime. However, it is negative and significant in the non-leased regime confirming our hypothesis that female owned plots exhibit lower productivity. All the tenure security variables are also positive and significant determinants of productivity. However,

contract renewal<sup>8</sup>, the link via which land owner's tenure insecurity is linked to tenant's level of effort, is insignificant. Since tenure insecurity and contract renewal are likely to be strongly correlated, the insignificance of contract renewal might be explained by its effect being picked up by the tenure insecurity variables.

In addition, in the leased regime, plot size is a negative determinant of productivity while farm size has a weaker but significantly negative impact. The effect of previous experience of conflict and expectations of reductions in the size of holdings both have negative effects on productivity of leased plots. This indicates that tenure insecurity indeed has a negative impact on the productivity of leased plots. The number of oxen the tenant has is a negative and significant determinant of productivity. The number of oxen the tenant has is a negative and significant determinant of productivity. This is a likely result in our case where the production environment is constrained by oxen availability and the more oxen a tenant has, the more number of lease arrangements the tenant may take up.

Total livestock ownership and oxen ownership are positive and significant determinants of productivity in the non-leased regime. While the other tenure security measures are insignificant, experience of change in the size of holdings has a positive impact on the productivity of non-leased plots. However, the impacts of plot level fertility, soil type and slope are generally weak. In addition, socioeconomic characteristics like age and education of the household are insignificant.

The lease selection equation results are similar to the selection equation estimations in the previous sections. One major difference is that plot distance is a significant determinant of leasing out indicating that distant plots are more likely to be leased out.

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<sup>8</sup> Contract renewal is for the coming production year while productivity is for the current production year. It should also be noted that, since contract renewal is likely to be endogenous, we used the predicted contract renewal in the regression

Table 6: Endogenous switching regression results of the determinants of productivity

	Lease out equation		Productivity Equation: Non leased pots		Productivity Equation: Leased plots	
Plot distance	0,002**	0,001				
Plot size	-1,311***	0,307	-4,191***	1,011	-2,314***	0,582
Farm size	-0,266***	0,079	0,576*	0,340	-0,339**	0,149
Livestock	0,064	0,021	0,218**	0,083		
Male adult	0,020	0,038	-0,056	0,137		
Female adult	-0,023	0,022	0,070	0,108		
Oxen	-0,101**	0,048	0,427**	0,202		
Female	0,423	0,132	-1,386***	0,433	-0,310	0,206
Age	0,005	0,003	-0,001	0,011	0,012**	0,005
Education	0,077	0,056	-0,038	0,191	0,061	0,114
Fertility1	-0,169	0,141	0,416	0,444	0,145	0,259
Fertility2	-0,193	0,138	0,282	0,462	0,036	0,251
Black	0,234	0,171	-0,924*	0,544	-0,546*	0,329
Red	-0,038	0,152	-0,277	0,500	-0,533*	0,320
Slope1	-0,049	0,186	0,496	0,543	-0,092	0,381
Slope2	0,180	0,196	-0,177	0,598	0,200	0,398
Fertilizer			0,052	0,105	-0,048	0,061
Manure			-0,134	0,401	-0,573**	0,217
Security			0,035	0,290	-0,504***	0,167
Changeland			4,192***	0,519	0,471*	0,255
Conflict			0,340	1,731	-2,076***	0,449
Tenant's age					0,056	0,066
Tenant's oxen					-0,250**	0,108
Predicted survival					-0,434	0,299
Constant			-0,605	0,789	2,685***	0,341
Sigma(0)					-0,747***	0,235
RHO(0.u)					1,407***	0,097
Sigma(1)					0,661**	0,244
RHO(1.u)						
Number of observations	981					
Standard errors in Parentheses : * significant at 10%, ** significant at 5%, ***significant at 1%						

## 6. Conclusions

Does gender discrimination have an impact on earnings and economic performance? This question has been widely examined in labor market studies where possibilities for differential wage payment exist. This paper assesses the possibility of discrimination against women and its impact on their productivity in a poor small farm setting where women are factor owners and employers. Because the main agricultural activities are undertaken by men, there are tendencies in such settings to disregard the role of women as farmers. This might undermine their landownership and weaken their bargaining position in the land lease market. Hence, we argue that women might be more tenure

insecure and might have lower bargaining positions in the land lease market compared to their male counterparts and this would have a negative impact on tenant's effort and productivity.

In order to assess the role of women's tenure insecurity and bargaining power in maintaining the gender gap in productivity, we set up a double moral hazard model of a landlord and a tenant that allowed us to show the importance of landlord tenure (in)security in the determination of the optimal current level of tenant effort. The model also predicts that a high tenure security of a landlord leads to a higher probability of contract renewal. In turn, a lower probability of contract renewal leads to lower levels of tenant's effort, and vice versa.

The empirical analysis started out by establishing that female owned plots exhibit significantly lower productivity, which is in line with the findings by other studies. Tenure insecurity is shown to reduce the likelihood of contract renewal while contract renewal is not less likely for plots leased out by female landlords. As per the theoretical predictions, productivity is positively affected by tenure insecurity; however the impact of contract renewal is insignificant.

In sum, given the long history of women's lack of property rights over their land, an important policy progress has been made by formally entitling them to land rights. One important implication of our result is that a full stride towards empowering rural women and in land rights requires their proper recognition as farmers. This would enable them to feel more tenure secure and have better bargaining power in the land lease market and would eventually lead to closing the gender gap in productivity. At a more general level, this indicates that ensuring that informal grounds are leveled is important in order to obtain the expected results from a policy change.

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