Journal of African Economies Advance Access published November 13, 2014

Journal of African Economies, 2014, 1–24
doi: 10.1093/jae/eju024
Article

OXFORD

Reverse-Share-Tenancy and Agricultural Efficiency: Farm-Level Evidence from Ethiopia

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Abstract

Using a unique tenant–landlord matched dataset from the Tigray region of Ethiopia, we are able to show how the tenants' strategic response to the varying economic and tenure-security status of the landlords helps explain sharecroppers' productivity differentials. The study reveals that sharecroppers' yields are significantly lower on plots leased from landlords who are non-kin and landlords with weaker economic and tenure-security status (such as female) than on plots leased from landlords with the contrasting characteristics. While, on aggregate, the results show no significant efficiency loss on kin-operated sharecropped plots, more decomposed analyses indicate strong evidence of Marshallian inefficiency on kin-operated plots leased from landlords with weaker bargaining power and higher tenure insecurity. This study thus shows how failure to control for the heterogeneity of landowners' characteristics can explain the lack of clarity in the existing empirical literature on the extent of moral hazard problems in sharecropping contracts.

Key words: Marshallian inefficiency, kinship, matching, reverse-share-tenancy, Ethiopia

JEL classification: D1, O13, O18, Q12, Q15

1. Introduction

Claims about the potential disincentive effects and efficiency losses of sharecropping, combined with the prevalence and diffusion of the practice in much of the developing world, make share tenancy arguably one of the most controversial subjects in agricultural economics. In reviewing the large body of literature on the efficiency of sharecropping tenancy, Otsuka and Hayami (1988), Singh (1989), Hayami and Otsuka (1993) and Otsuka (2007) have claimed that the empirical evidence on Marshallian inefficiency, meaning a systematic downward bias in input intensity and productivity on sharecropped land than owned land, is far from universal.

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Only recently have case studies from Pakistan by Jacoby and Mansuri (2009); from Thailand by Sadoulet *et al*. (1994, 1997); from India by Sharma and Dreze (1996); from Ethiopia by Gavian and Ehui (1999), Pender and Fafchamps (2006) and Kassie and Holden (2007); from Ghana by Otsuka *et al*. (2003) and from Tunisia by Arcand *et al*. (2007) started to establish the particular circumstances under which share tenancy can be no less efficient than owner-operated farming or fixed-rent contracts. For instance, Otsuka (2007) suggests that land-to-the-tiller policies in several Asian countries have created tenure insecurity on the landlord side, and this may explain the Marshallian inefficiency of agricultural tenancy contracts in these countries. Notable studies by Sadoulet *et al*. (1997) and Kassie and Holden (2007, 2008) stand out for the similarities in their approach to analysing the role that indigenous institutions play in internalising the disincentive effects of share tenancy. These studies attempt to explain sharecropping efficiency differentials in terms of the role kinship ties between tenant and landlord play in mitigating the problem of moral hazard that looms over share tenancy arrangements.

While the empirical evidence obtained by Sadoulet *et al*. (1997) from the Philippines shows the positive role of kinship tenancy arrangements, the results presented by Kassie and Holden (2007, 2008) in their study of the Amhara region of Ethiopia reveal the contrary—showing that non-kin-operated farms are more productive than kin-operated farms. Furthermore, similarly, Holden and Bezabih (2008) find sharecropping inefficiency to be associated with female landlords renting out their lands to in-law tenants in the same region in Ethiopia.

We believe this discrepancy can partly be accounted for by considering farm households' motives in opting for kin-tied transactions and exchanges. Although it is a well-documented fact that households tend to operate within their own social circle mainly to address problems associated with market imperfections (moral hazard, adverse selection) and high transaction costs (Arrow, 1968; Sen, 1975; Sadoulet *et al*., 1997; Fafchamps, 2004), such arrangements may also be considered by poor households as a form of 'insurance policy' against consumption risks during times of crop failure or tenure insecurity due to land-to-the-tiller policies, as demonstrated by Aryal and Holden (2012) in Nepal. In such a case, poor landowners are more likely to be economically dependent and highly reliant on kin-based tenancy arrangements (Macours, 2004). Some claim that this economic dependence may degrade the bargaining power of landowners and undermine their ability and will to use the threat of eviction to induce greater effort or performance on the part of tenants (Holden and Bezabih, 2008). We follow up on this and aim to show how, aside from the expected higher degree of social concern between kin tenants and their landlords, the strategic response (opportunistic behaviour) of tenants to the varying economic and tenure-security status of their landlords can have an effect on the productivity of sharecropped plots.[1]

The studies by Sadoulet *et al*. (1997) and Kassie and Holden (2007, 2008) examine the demand side of the market as their efficiency analysis take account of the heterogeneity of the tenants or sharecroppers only. Failure to account for heterogeneity in the characteristics of landlord households may conceal the opportunistic behaviour of tenants. A unique tenant–landlord matched plot-level data from the Tigray region in the northern highlands of Ethiopia allow us to include the heterogeneous economic and property right conditions of landlords in

1 Holden and Bezabih (2008), in contrast, approach this from the landlord side, comparing male- and female-landlord households while taking into account tenant characteristics, including possible kinship relationships between landlords and tenants.

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our analysis, which enables us to reconcile and bridge the contrasting findings regarding sharecropping productivity differentials. We use household fixed effects to control for unobservable tenant heterogeneity, while nonparametric matching is applied to control for plot selection bias in rental and partner selection decisions. Our results confirm that, after controlling for plot selection bias, sharecroppers' yields on plots leased from landlords who are non-kin, who are female, who have lower income-generating capacity or who are perceived to be tenure insecure (pure landlords) are significantly lower than on plots leased from landlords with the opposite characteristics. The empirical evidence implies that strengthening the property rights of landholders may not only have a direct productivity-enhancing effect on owner-operated smallholder cultivation but also an indirect impact on the productivity of transacted plots.

This paper is organised as follows. Section 2 reviews the literature on the evolution of land tenure and the structure of the tenancy market in Ethiopia. The theoretical model adapted in this study, together with our testable hypotheses, is discussed in Section 3. Section 4 addresses the econometric methods applied in the analysis, while Section 5 describes the data sources and variable definition. The last two sections are devoted to discussion and a summary of the findings.

2. The land tenure system and sharecropping in Ethiopia

In examining the possible effects of the Ethiopian land tenure system on the dynamics of the tenancy market and its efficiency, three key features of the land tenure system in Ethiopia stand out: (1) tenure insecurity, (2) land fragmentation and landlessness and (3) rural factor market imperfections and the 'reverse share tenancy' scenario.

2.1 Tenure insecurity (supply-side effects)

One of the major land-related problems in Ethiopia, due primarily to frequent land distribution and redistribution in the past, has been insecurity of tenure (Alemu, 1999; Hoben, 2000). This problem highlights the need for land policies and a system of land administration that supports secure property rights, broadens access to land and supports incentives for improved land use management. It is with the desire to reap these benefits that the current Government of Ethiopia, through the Ministry of Agriculture and Rural Development (MOARD), has embarked on a land certification programme in the country (Deininger *et al.*, 2008a,b).[2] In addition to the well-documented investment effects of secured property rights (Feder *et al.*, 1988; Besley and Coast, 1995; Deininger and Feder, 1998; Li *et al.*, 1998; Holden *et al.*, 2009), there is evidence that formalisation of land rights—in the form of providing households with inheritable user certificates—lubricates the functioning of land rental markets and the factor-ratio adjustment process (Deininger *et al.*, 2011; Holden *et al.*, 2011).

A key policy concern, however, is whether land reform in the form of registration and certification has contributed to increased tenure security, especially for the poor, including women. From the supply-side perspective, for instance, without clear and definite claims to

2 The Tigray region was the first to start a land certification process in 1998–99 and used simple traditional methods in the implementation. More than 80% of the population in the region had received land certificates when the process was interrupted by the war with Eritrea (Deininger *et al.*, 2008a; Holden *et al.*, 2009).

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the land, farmers (potential landlords) can be reluctant to rent or lease out to others for fear of losing the land through future administrative redistribution (Deininger *et al.*, 2008a,b; Ghebru and Holden, 2008). In such circumstances, despite the possibility that the productivity of the land would be increased under a different operator (potential tenant) with better skill and complementary farm inputs, it is possible that the landowner may decide to operate the land himself or lease it out to a less-efficient kin tenant (Holden and Bezabih, 2008).

Furthermore, the cultural rule against women cultivating land causes single women to largely depend on sharecropping out their land to male kin. This cultural taboo causes female-headed households in Tigray often to be (kin) landlords and among the poorest of the poor (MUT, 2003; Holden *et al.*, 2011). Anecdotal evidence from Tigray (Pender *et al.*, 2003; MUT, 2003) suggests that women think differently about their land certificates than men, as their tenure rights have been less secure than those of men. This may imply that the certificates have a higher value to women than to men. Having certificates may thus help strengthen the bargaining power of female-headed (poor) households, and this may have a productivity-enhancing effect. Empirical evidence from previous studies by Holden *et al.* (2011) and Holden and Ghebru (2011) from the study area (using the same sample) shows that possession of land use certificates has increased participation in the tenancy market, especially of female-headed households, which have become more willing to rent out land.

2.2 Land fragmentation and landlessness (demand-side effects)

The post-reform halt to administrative redistributions of land, accompanied by rapid population growth in the country, has caused farm households to hugely rely on intra-household land distribution (inheritance) to accommodate descendants. This leads to a problem of dwindling farm sizes,[3] creating an increase in demand for land through the land rental market. Such direct (landlessness) and indirect (dwindling farm size) effects of population pressure, accompanied by the recent land policy reforms, make the tenancy market the main means for land-constrained farm households to access additional land and for the landless to access land.[4]

2.3 Non-land factor market imperfections and reverse share tenancy

Despite the relatively egalitarian distribution of landholdings across households in the country (Rahmato, 1984; Adal, 2002), heterogeneity in non-land resource endowment (such as labour and oxen) causes inequalities in relative factor endowments across households (Ghebru and Holden, 2008). However, due to problems of moral hazard, liquidity constraints, and the seasonality of farm production, labour and oxen rental markets do not function smoothly (Bliss and Stern, 1982; Holden *et al.*, 2001, 2008). This may cause the non-land factor markets (oxen and labour markets) to be a risky and more expensive option for farm households' factor-ratio adjustment process. Under these circumstances, despite the highly fragmented landholdings of households, there is a possibility that households may join the supply side of the tenancy market due to lack of one or more essential non-land factors of production.

Hence, the fact that non-land factor markets are imperfect, coupled with the egalitarian land distribution in the country, creates a reverse share tenancy scenario in which landlords

3 The landholding size for an average farm household in Ethiopia is only 1 ha, and the problem is even more acute in the study area, which has an average landholding size of 0.5 ha (Ghebru and Holden, 2009).

4 We were not able to analyse the severity of landlessness in the region from our sampled data, as they include only those households with access to arable land. Our matched-partner data show that 17% of tenants were landless in 2006.

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are poor in non-land resources (rather than land-rich households) while tenants can be best described as non-land-asset-rich landowners rather than landless or near-landless poor households. Empirical evidence supports the persistence of such contracts in Ethiopia (Ghebru and Holden, 2008; Holden and Bezabih, 2008; Ghebru, 2009), Eriteria (Tikabo and Holden, 2003) and Madagascar (Bellemare, 2006, 2008). Whether or not the reverse share tenancy scenario in the country has an impact on the performance (technical efficiency) of the tenancy market is an empirical issue that this study strives to address.

3. Theoretical model

Starting from the reverse share tenancy scenario and the inherent tenure insecurity in the Ethiopian tenure system, we draw on a two-period utility maximisation model developed by Kassie and Holden (2007, 2008) to show how the threat of eviction by the landlord upon unsatisfactory performance increases the performance or incentives of an agent to work hard in the first period and thereby reduces the Marshallian disincentive effects on the output of sharecropped land.

We assume that the tenant is risk averse and maximises expected utility (U) of income (Y) from farm production (Q) from Peasant Association (PA) allocated land (A^o) and leased land (A^r) with the probability (η) of carrying the rental contract through period two to produce Q^{r2}. We assume that the probability of contract renewal (η) in period two depends on the amount of output produced in period one (Q^{r1}) and on kinship relations between the landlord and the tenant, measured by (κ). In addition, we assume that the economic and tenure security of the landlord (S) is a critical factor affecting the probability of contract renewal—as it influences partner selection decisions by the landlord—especially, in rural settings like Ethiopia where smallholder farms only have restricted transfer and conditional use rights to their land.[5] Hence, the probability of contract renewal is given by

$$\eta = \eta(Q^{r1}, K, S), \quad \text{and}$$
$$\left[\frac{\partial \eta}{\partial Q^{r1}}\right] > 0, \ \left[\frac{\partial \eta}{\partial K}\right] > 0, \ \left[\frac{\partial \eta}{\partial S}\right] < 0, \ \left[\frac{\partial^2 \eta}{\partial K \partial S}\right] < 0, \ \left[\frac{\partial^2 \eta}{\partial Q^{r1} \partial S}\right] > 0 \quad (1)$$

Thus, we assume that good performance is more important to reduce the threat of eviction (probability of contract renewal) only when tenants deal with real eviction threat from the landlord—as shown by the term $[\partial \eta / \partial K] > 0$, where eviction threat is lower (contract renewal is higher) if kinship relationship exists between tenants and landlords (Kassie and Holden, 2007). However, we argue that understanding the economic and tenure-security status of the landlord (which are believed to dictate the motives behind partner selection) are equally relevant to dictate the outcomes of kinship contracts on contract renewal (and, thereby, productivity of transacted or sharecropped farms). In cases where the landlords have weaker economic and tenure-security status (lower value of S), threat of eviction from

5 Bezabih *et al.* (2012) shows that female landlords who are assumed to have a poor socioeconomic and property rights status are less likely to exercise their power of eviction due to high search costs and insecurity of land ownership. In our study, gender, the income-generating ability of the landlord, whether or not the landlord is a pure or cultivating landlord and possession of a land use certificate by the landlord household are the four key variables used as indicators to capture the economic and tenure security parameter (S).

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the landlord is minimal or tenants probability of contract renewal could be higher (as shown by $[\partial\eta/\partial S] < 0$—mainly due to high search cost and risk of land loss via confiscation. In contrast, when landlords enjoy tenure security and stronger economic conditions (better bargaining power), the threat of eviction upon unsatisfactory performance is real and high, forcing tenants to cultivate the leased land with greater care and intensity.

Especially in rural settings where tenure insecurity and reverse-share-tenancy are prevalent, we argue that motives behind partner selection decisions of landlords (largely influenced by their economic and tenure-security status) dictate outcomes of kinship ties on the probability of contract renewal (and, thereby, the effort and productivity of sharecropped plots operated). Thus, we argue that productivity on kin-tied contracts is higher the stronger the economic and tenure-security status of the landlord while Marshalian inefficiency is visible only if landlords (kin or non-kin) have weaker economic and tenure-security status (lower value of S)—as shown by the term $[\partial^2\eta/\partial K\partial S] < 0$) in Equation (1).

Following Kassie and Holden (2007), a two-period utility maximisation model for a sharecropping owner-cum-tenant is developed and given by

$$\begin{aligned}\underset{A_{it},x_{it},z_{it}}{\text{Max}}\ \text{EU}(Y) = \text{EU}_1\left\{\begin{array}{l}[p_{q1}\theta_1 Q^{o1}(A_{o1},x_{o1},z_{o1},z_{h1}) - p_{x1}x_{o1}]\\ +[p_{q1}\theta_1 Q^{r1}(A_{r1},x_{r1},z_{r1},z_{h1})\beta - p_{x1}x_{r1}]\end{array}\right\}\\ +\rho\text{EU}_2\left\{\begin{array}{l}[\eta(Q^{r1}(.),\kappa,S).p_{q2}\theta_2 Q^{r2}(A_{r2},x_{r2},z_{r2},z_{h2})\beta - p_{x2}x_{r2}]\\ +[p_{q2}\theta_2 Q^{o2}(A_{o2},x_{o2},z_{o2},z_{h2}) - p_{x2}x_{o2}]\end{array}\right\},\end{aligned} \tag{2}$$

where β is the output share going to the tenant in a pure sharecropping arrangement; the subscripts o = PA-allocated plots, r = leased plot and 1 and 2 indicate period one and two, respectively; ρ is the discount factor given by $1/(1+\delta)$, and δ is the discount rate; x is conventional inputs (fertiliser, labour, oxen and seed); z is the observed and unobserved household and plot characteristics; p_x is the price of inputs; p_q is the price of output and θ is a weather-related risk factor, which, following Stiglitz (1974), is treated as a multiplicative factor distributed with $E\theta = 1$ and positive finite variance. The first-order conditions (FOCs) for maximisation of this problem under pure sharecropping arrangement are

$$\frac{\text{EU}_y\theta_i}{\text{EU}_y}\frac{\partial Q^{oi}}{\partial x_{oi}}.p_q = p_{xi} \tag{3}$$

and

$$\beta\frac{\text{EU}_{1y}\theta_1}{\text{EU}_{1y}}\frac{\partial Q^{r1}}{\partial x_{r1}}.p_q + \rho\frac{\text{EU}_{2y}\theta_2}{\text{EU}_{1y}}\frac{\partial Q^{r1}}{\partial x_{r1}}\frac{\partial\eta}{\partial Q^{r1}}.p_q Q^{r2}\beta = p_{x1}. \tag{4}$$

The FOC in Equation (3) is with respect to input use on the tenant's own plots, while the FOC in Equation (4) is with respect to input use on sharecropped plots. Both cases (Equations (3) and (4)) satisfy the equality of expected marginal utility of farm input use to the respective input prices. The problem of the sharecropper is therefore to optimally distribute (utilise) the non-land resources between the owned plots and sharecropped plots until

$$\frac{\text{EU}_y\theta_i}{\text{EU}_y}\frac{\partial Q^{oi}}{\partial x_{oi}}.p_q = \beta\frac{\text{EU}_{1y}\theta_1}{\text{EU}_{1y}}\frac{\partial Q^{r1}}{\partial x_{r1}}.p_q + \rho\frac{\text{EU}_{2y}\theta_2}{\text{EU}_{1y}}\frac{\partial Q^{r1}}{\partial x_{r1}}\frac{\partial\eta}{\partial Q^{r1}}.p_q Q^{r2}\beta = p_{x1}, \tag{5}$$

which tells us that non-land resources are utilised by the sharecropper until the expected marginal returns from these resources are equal on the owned and sharecropped plots.

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The standard Marshallian inefficiency hypothesis prevails when the tenant does not care about his or her future utility from the sharecropped land, that is, $\rho = 0$, which is given by

$$\frac{\mathrm{EU}_y \theta_i}{\mathrm{EU}_y} \frac{\partial Q^{oi}}{\partial x_{oi}} \cdot p_q = \beta \frac{\mathrm{EU}_{1y} \theta_1}{\mathrm{EU}_{1y}} \frac{\partial Q^{r1}}{\partial x_{r1}} \cdot p_q. \tag{6}$$

However, due to the scarcity of arable land in the study area and the resultant rationing in the supply side of the market, we expect a positive discount factor ($\rho > 0$). In such a case, the second term of the right-hand side of Equation (5) shows the value of the potential loss of future utility from the sharecropped land due to eviction (contract nonrenewal). Therefore, the more the tenant is concerned about the threat of eviction or contract insecurity (the larger ρ gets), the more input and effort he or she puts into the sharecropped land so as to qualify for contract renewal, which is shown by the term $\partial\eta/\partial Q^{r1}$ (implying the decrease in the probability of eviction by increasing effort and/or yield in period one). Using the implicit function theorem on Equation (1), regardless of the kinship ties, we are able to show that a sharecropper applies less input and effort if the land is leased from a landlord with weaker economic and property rights conditions.

Building upon the theoretical model and the structure of the tenancy market in the country (see Section 2), we aim to show how the strategic response (opportunistic behaviour) of tenants to their landlords' varying economic and property rights condition can affect the tenants' performance on sharecropped plots. As a result, we expect stronger bargaining power and tenure security of landlords to increase the contract insecurity effect on sharecroppers and, thereby, induce their effort on sharecropped plots. To the best of our knowledge, this is the first study to tenant–landlord matched data that accounts for both the supply (landlord) and demand (tenant) side characteristics in analysing sharecroppers' level of effort and productivity. Earlier attempt in utilising data from both sides of the tenancy market was by Jacoby and Mansuri (2009). In their analysis of the effect of supervision on sharecroppers' productivity, they utilised data on landlord's supervision/monitoring frequency collected from share tenants in rural Pakistan.

4. Data and identification strategy

4.1 Data

The data used for analysis in this study are derived from 400 randomly selected farm households from a stratified sample of 16 *tabias* (communities) in the Tigray region of Ethiopia. These communities were stratified to represent the major variation in agro-ecological factors, market access, population density and access to irrigation. Dataset used is part of the comprehensive 5-wave household panel data (1998–99; 2000–01; 2002–03; 2005–06 and 2009–10) collected for a joint collaborative project between the Norwegian University of Life Sciences and Mekelle University in Ethiopia for impact evaluation of the land certification programme in Ethiopia. The analysis in this paper, thus, used data from 385 households (of which 103 were landlords, 105 tenants and the remaining 177 owner-operators) collected during the 2005–06 survey where complete data were successfully collected from both sides of the market (tenants and landlords). Furthermore, as the main objective of this study is to assess the productivity differentials of kin-based share tenancy, household and plot information was also collected from 128 tenant partners who leased-in plots from the 103

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landlords in our sample. This exercise enabled us to conduct our analysis from the demand side of the market.

Thus, 1,150 plots operated by 229 owner-cum-sharecroppers (i.e., 101[6] sampled and 128 partner tenants) during the 2005–06 production year were considered for analysis in this study, which uniquely utilises the supply (landlord) side information as a possible factor affecting sharecroppers' level of effort and productivity. Of the 1,150 tenant-operated parcels, 712 were owned by the tenants while the remaining 438 were sharecropped parcels. To control for plot-specific heterogeneity of parcels operated under the various arrangements and to identify plots that are comparable in their bio-physical characteristics, we applied non-parametric propensity score matching on observable plot characteristics. Consequently, only 373 leased-in plots (225 kin-sharecropped and 148 non-kin-sharecropped plots) were found to be comparable with 611 owner-operated plots.

4.2 Identification strategy

Based on the theoretical discussion in Section 3 of this paper, the reduced-form regression model for producer i on parcel p is

$$y_{ip} = \beta X_{ip} + \delta K_{ip} + \mu_i + \varepsilon_{ip}, \tag{7}$$

where y_{ip} is the yield value per hectare realised by tenant i on parcel p, X_{ip} includes observable plot characteristics and K_{ip} is a vector of dummy variables representing tenure status of the plot (i.e., whether or not the parcel is sharecropped) as well as alternative interaction variables that include kinship relationships with the landlord and proxies variables to capture tenure (in)security status of the landlord. The error component μ_i captures the unobserved tenant household characteristics such as farming ability, tenant's social connections and others that are not observable but affect input use and productivity, while ε_{ip} is a random variable that captures plot-specific unobservable that are not captured in the model, such as soil quality variations, plot susceptibility to erosion and weed infestations.

Had the tenant's effort been fully observable, where $E(\mu_i) = 0$, estimating the above regression model with ordinary least squares (OLS) would have been free of any bias and inconsistency. However, the very fact that the tenant's effort is not fully observable by the landlord, $E(\mu_i) \neq 0$, causes households to internalise such unobservable characteristics in their contract and/or partner choice decisions (self-selection of contract and/or partner types). In such a case, OLS estimates of δ are biased and inconsistent, which may lead to an overstatement of the disincentive effects of sharecropping (Jacoby and Mansuri, 2009).

Studies by Bell (1977) and Shaban (1987) have addressed the fundamental problem of unobserved productivity differential that may exist between plots under sharecropping and plots under owner operation by considering only those households that farm more than one plot—effectively, those households that are simultaneously owner-operators and sharecroppers. The use of household-specific fixed effects then allows to comparison of the productivity of the two classes of plots while at least maintaining constant the identity of the household engaging in farming these plots. We adopt this methodological approach to correct selection bias, as the majority of tenants included in the study (229 of the 233 tenants) are

6 Of the 105 tenants included in our sample, four of them were pure-sharecroppers with no land of their own to cultivate. These households, thus, were drop from the analysis.

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owner-cum-sharecropper households—sharecroppers who also cultivate at least one plot of their own.

The contextual fact that land distribution in the country (Ethiopia) is largely egalitarian, which makes household demographic features to be more binding in land rental decision, makes our Shaban-type methodological approach to be more plausible approach to control for selection bias as we expect plot-specific characteristics to have little impact in rental market decisions. Descriptive results from our study area (see Table 1) confirm this with almost 50% of landlords included in our survey leases out all their land holding (zero operational holding) while close to 70% leases out all their parcels except their homestead. These results are indicative to suggest that household characteristics (not parcel specific factors) matters most for rental decision and our household fixed effect estimation is justifiable. However, for the remaining 30% of the landlords (who leases out portions of their land holding) our household fixed effects estimator may not be robust to correlation between K_{ip} and ε_{ip} due to adverse selection in the leasing market. Under adverse selection, sharecropped land could be of lower quality than owner-cultivated land. Thus, ignoring this form of selection bias when it is present would lead us to understate the productivity of share tenancy vis-à-vis owner cultivation.

Descriptive results from the first three columns of Table 2 confirm the prevalence of difference in basic plot characteristics when the three different cultivating regimes (owner-cultivated, kin-sharecropped and non-kin-sharecropped parcels) were compared. Although none of the soil type features was found to be significant, the results from Table 2 show, soil depth and plot slope of owner-cultivated parcels were found to be significantly different from sharecropped plots (kin and/or non-kin). On average, as shown in Table 2, kin-sharecropped plots were more likely to be shallow and less flat in slope while farm size difference was statistically significant between non-kin-sharecropped plots as compared with owner-operated plots (significantly larger in cases of non-kin-sharecropped plots). To address such potential plot selection bias, we applied a nonparametric propensity score matching (PSM) method using these observable plot characteristics.

Thus, using the aforementioned list of observable plot-specific variables (such as soil type and depth, plot slope, plot size and distance of the plot to the residence of the respondent), a nearest neighbour matching method was applied to identify sharecropped and owner-operated plots that are comparable in these observable characteristics. We ensured that the common support and balancing properties were satisfied and, as a result, only 611 of the 712 owned plots were found to be comparable with 373 sharecropped plots. The assumption is that in the matched plots, the effects of exogenous physical factors on productivity are similar between sharecropped and owner-operated parcels allowing for comparative analysis. The results shown in Table 2 (that compares plot characteristics before and after the PSM matching procedure) concur with these observations as most of the differences in parcel biophysical features between matched owner-cultivated and sharecropped plots are no longer statistically significant. This type of data preprocessing reduces model dependence to a potential selection bias problem in the subsequent parametric analysis of the outcome equation (Ho *et al*., 2007).

The PSM matching exercise, however, does not account for potential selection bias due to systematic variations in unobservable plot characteristics between owner-operated and sharecropped parcels. Thus, to show the robustness of our findings and control for potential plot selection bias due to unobservable parcel characteristics, we also run household fixed effect

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Table 1: Household Level Characteristics of Landlords and Tenants

Variables	Landlord (214) [A]	Tenant (225) [B]	Mean comparison test (A versus B)	Landlord[a]		Mean comparison test (C versus D)	Tenant[b]		Mean comparison test (E versus F)
				All partners—Kin (97) [C]	All partners—non-kin (78) [D]		All partners—Kin (103) [E]	All partners—non-kin (68) [F]	
Age of household head	54.68 (16.69)	49.25 (12.84)	****	55.90 (18.31)	55.63 (15.75)		48.43 (12.62)	51.42 (13.31)	
Sex of household head	0.53 (0.50)	0.07 (0.25)	****	0.54 (0.50)	0.49 (0.50)		0.07 (0.25)	0.03 (0.17)	
Household size	4.00 (2.40)	6.34 (2.06)	****	3.49 (2.33)	4.41 (2.54)	**	6.29 (2.18)	6.35 (1.89)	
Number of oxen	0.46 (0.87)	1.71 (1.15)	****	0.40 (0.73)	0.53 (1.01)		1.51 (0.92)	1.94 (1.27)	***
Other livestock endowment	1.03 (1.97)	2.90 (2.49)	****	0.91 (1.42)	0.90 (1.34)		2.48 (1.94)	3.19 (2.36)	**
Farm size	4.06 (2.87)	3.94 (2.93)		3.35 (2.57)	4.41 (2.59)	***	3.15 (2.40)	4.29 (2.81)	***
Possess certificate	0.86 (0.35)	0.76 (0.43)	***	0.86 (0.35)	0.87 (0.34)		0.75 (0.44)	0.81 (0.40)	
Self-employment income	98.58 (486)	196.94 (927)	*	17.73 (89)	130.81 (519)	**	133.08 (728)	177.33 (628)	
Non-labour income	339.10 (834)	125.31 (581)	*	396.90 (1,062)	307.28 (664)		128.70 (773)	117.72 (336)	
No operational holding	0.46 (0.50)			0.52 (0.50)	0.40 (0.49)				
Ratio of land leased out	0.69 (0.46)			0.69 (0.46)	0.67 (0.47)				

Source: Authors' computation using data from the 2006 household survey.
Standard errors are in parentheses.
*Significant at 10%; **significant at 5%; ***significant at 1% and ****significant at 0.1%.
[a]The remaining 39 landlords have both kin and non-kin partners (tenants).
[b]The remaining 54 tenants have both kin and non-kin partners (landlords).

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Table 2: Distribution of Plot Characteristics for Parcels Operated by Owner-Cum-Sharecroppers—Before and After Propensity Score Matching

Variables	Before matching (unmatched)			After propensity score matching (PSM matched parcels)		
	Owner-operated plots (712) Mean (se)	Kin-sharecropped plots (257) Mean (se)	Non-kin-sharecropped plots (181) Mean (se)	Owner-pperated plots (611) Mean (se)	Kin-sharecropped plots (225) Mean (se)	Non-kin-sharecropped plots (148) Mean (se)
Distance to market	63.146 (2.507)	62.943 (4.445)	56.799 (4.943)	62.455 (2.614)	64.796 (4.754)	57.243 (5.278)
Crop grown: teff	0.335 (0.019)	0.386 (0.032)	0.364 (0.038)	0.339 (0.019)	0.382 (0.032)	0.372 (0.04)
Crop grown: wheat	0.183 (0.015)	0.174 (0.025)	0.109 (0.024)**	0.178 (0.016)	0.178 (0.026)	0.095 (0.024)*
Crop grown: barley	0.233 (0.017)	0.174 (0.025)*	0.17 (0.029)*	0.232 (0.017)	0.164 (0.025)*	0.176 (0.031)
Soil depth—deep	0.323 (0.018)	0.308 (0.029)	0.337 (0.036)	0.319 (0.019)	0.307 (0.031)	0.304 (0.038)
soil depth—shallow	0.277 (0.017)	0.316 (0.029)*	0.303 (0.035)	0.282 (0.018)	0.316 (0.031)	0.331 (0.039)
Slope—uphill	0.733 (0.017)	0.811 (0.025)**	0.787 (0.031)	0.74 (0.018)	0.788 (0.026)	0.791 (0.034)
Slope—foothill	0.094 (0.011)	0.083 (0.017)	0.067 (0.019)	0.097 (0.012)	0.076 (0.018)	0.074 (0.022)
Slope—flat	0.11 (0.012)	0.055 (0.014)**	0.101 (0.023)	0.106 (0.012)	0.083 (0.015)*	0.088 (0.023)
Soil type—clay	0.266 (0.017)	0.244 (0.027)	0.215 (0.031)	0.255 (0.018)	0.244 (0.029)	0.223 (0.034)
Soil type—sandy	0.271 (0.017)	0.287 (0.028)	0.249 (0.033)	0.29 (0.018)	0.293 (0.03)	0.236 (0.035)
Soil type—black	0.251 (0.016)	0.232 (0.027)	0.299 (0.035)	0.237 (0.017)	0.227 (0.028)	0.27 (0.037)
Distance to plot	32.094 (1.533)	33.502 (2.437)	33.569 (2.824)	30.635 (1.638)	33.267 (2.595)	33.27 (3.202)
Farm size (Tsimdi[a])	1.268 (0.046)	1.224 (0.063)	1.643 (0.086)***	1.289 (0.049)	1.206 (0.065)	1.326 (0.098)

Source: Authors' computation using the 2006 survey data.

Standard errors are in parentheses.

Asterisks (*) along the 'kin-sharecropped plot' and 'non-kin-sharecropped plot' columns show statistical significance of mean comparison tests conducted against owner-operated parcels where *significant at 10%; ** significant at 5%; ***significant at 1% and ****significant at 0.1%.

[a]*Tsimdi* is a local area measurement equivalent to a quarter of a hectare.

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estimations on restricted samples of 465 parcels (303 owner-operated and 162 sharecropped), where all sharecropped parcels are leased-in from absentee landlords where they only have a single tenant. Not only does this approach control for plot selection bias problems due to unobservable plot characteristics (since plot is acquired from an absentee landlord), but it also enables us to check the robustness of our findings for potential selection biases in assigning parcels to be operated by kin or non-kin tenants (as the restricted sample includes only parcels leased-in from landlords with a single tenant to deal with). Table 6 presents such results.

4.3 Descriptive statistics

To show how (kin or non-kin) sharecroppers' effort (productivity) is strategically responsive to variations in the bargaining power (economic independence) and property rights (tenure security) conditions of the landowners, we introduce four key indicator variables that we believe reasonably capture the economic and property rights status of landowners. Landlord households' economic dependence and their inability (physical or social) to cultivate their own farm may undermine their bargaining power and thereby their power to evict less performing tenants (Holden and Bezabih, 2008). For this reason, we use the gender of the household head and off-farm labour income-generating ability as alternative indicator variables to capture the economic status and bargaining power of landlords.

To capture the potential effect that the tenure security of the landholder might have on the effort of kin and/or non-kin sharecroppers, we use an indicator variable showing whether or not the sharecropped plot is included in the land use certificate of the landlord as a control variable. Earlier study by Holden *et al.* (2011) supports this argument, indicating that possession of a land use certificate boosts the perception of tenure security and landowners' confidence that they will not lose the land. However, this variable may not be effective enough to capture the tenure (in)security issues of landowners, since the majority of the rural households in the study area possess land use certificates for their plots.[7] For this reason, we construct and use an indicator variable 'pure landlords—landlord households that lease out all their parcels' as an alternative indicator to capture the tenure-security status of landlords. Due to the frequent land redistribution reforms of the past (the 1970s and 1980s), and the increasing landlessness in the country, we believe that those pure landlords belong to a risk group that feels the pressure of tenure insecurity due to fear of future confiscations.[8] The recent land proclamation in the Tigray region (TNRS, 2006), which prohibits leasing out more than 50% of a household's own holdings and makes the land subject to confiscation, vindicates our approach.

The first two columns of Table 1 report the main features distinguishing landlords from tenants. Strengthening our claim for 'reverse-share-tenancy' scenario in the region (see the discussion in Section 2), Table 1 indicates that landlords are relatively poor in non-land farm inputs and other assets. While there is no significant difference in the size of owned landholding, landlord households on average possess significantly lower amount of complementary

7 More than 80% of the rural farm households in the region and 86% of our sampled farm households possess land use certificates for their landholdings.

8 Perception data form the 2001 survey of the same households show that more than 60% of households that fear losing land indicate future land redistribution (to address landlessness) as a reason for their fear of loss.

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farm inputs such as male and female adult labour force, oxen and other draft animals as compared with tenant households. On the outset, sharecroppers in the region are wealthier landowners rather than poor landless peasants while landlords correspond to households that are predominantly female; old and households poorer in non-land resource endowments. Showing the gender-bias in agricultural production, partly due to the cultural taboo against women in cultivation activities, more than 50% of the landlord households are female-headed while only 7% of the tenant households are headed by females.

In the last two columns of Table 1, we divide landlord and tenant households into two categories based on their kinship status. The results show that landlord households with lower self-employment income (alternative income sources) are more reliant on kin-tied contract arrangements than those with better off-farm income-generating opportunity. This supports our argument that economic status (economic independence) of landowners has an effect on choice of contracts/partners. On the tenant side of the market, kin tenants are different from non-kin tenants in terms of their wealth status, oxen and other livestock ownership—the later possesses more oxen and other draft animals and also possesses more land holding. This is in line with the findings of previous studies from the study area showing the supply-constrained nature of the tenancy market in the region where access to land is highly rationed (Ghebru and Holden, 2008) and kin-based (Holden and Ghebru, 2005).

Table 3 summarises major parcel level characteristics according to kinship status of the parcel operators. According to Table 3, the value of output and labour input use is significantly higher on owner-operated parcels as compared with transacted (kin or non-kin) parcels. Similar comparisons among transacted parcels reveal that productivity and labour input use are higher on kin-operated than non-kin-operated parcels. Table 4 presents the characteristics of tenant and landlord households of transacted parcels. The paired mean comparison tests of kin and non-kin-operated parcels show a significant and systematic difference in these key landlord characteristics (the four indicator variables discussed above). A significantly

Table 3: Input–Output Distribution of Matched Parcels Operated by Owner-Cum-Sharecroppers—By Tenancy Type

Variable	Owner-operated plots (611) Mean (se)	Kin-sharecropped plots (225) Mean (se)	Non-kin-sharecropped plots (148) Mean (se)
Value of output per *Tsimdi*	622.671 (27.147)	573.323 (35.56)	334.907 (17.716)***
Value of chemical fertilizer	10.905 (1.12)	9.636 (1.064)	9.288 (1.161)
Value of seed/ha	63.36 (2.914)	62.918 (6.238)	39.906 (3.307)***
Plowing man-days	5.11 (0.554)	3.916 (0.479)	3.796 (0.729)**
Weeding man-days	13.469 (0.917)	11.117 (1.164)	7.694 (0.664)***
Harvesting man-days	6.517 (0.367)	5.704 (0.383)	4.671 (0.372)**
Threshing man-days	4.12 (0.295)	4.043 (0.345)	2.26 (0.164)***
Oxen-days	12.397 (0.997)	10.422 (0.754)	8.818 (1.504)

Source: Authors' computation using the 2006 survey data.
Standard errors are in parentheses.
Asterisks (*) along the 'kin-sharecropped plot' and 'non-kin-sharecropped plot' columns show statistical significance of mean comparison tests conducted against owner-operated parcels where *significant at 10%; **significant at 5%; ***significant at 1% and ****significant at 0.1%.

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Table 4: Characteristics of Land Rental Partners—By Tenancy Type

Variable	Owner-operated plots (611) Mean (se)	Kin-sharecropped plots (225) Mean (se)	Non-kin-sharecropped plots (148) Mean (se)
Tenant characteristics by plot category			
Female household head	0.080 (0.272)	0.112 (0.309)	0.072 (0.243)*
Age of household head	52.46 (11.83)	46.17 (12.48)	50.11 (12.99)****
Household size	6.594 (2.038)	6.172 (2.067)	6.418 (1.880)
Number of oxen	1.673 (1.176)	1.744 (1.205)	2.038 (1.442)**
Number of other livestock[a]	3.004 (2.450)	2.942 (2.512)	3.467 (3.153)**
Education of household head	0.544 (0.498)	0.596 (0.492)	0.707 (0.457)**
Number of adult Labour	1.841 (1.062)	1.676 (0.991)	1.810 (1.009)
Landlord characteristics by plot category			
Female household head	–	0.587 (0.489)	0.457 (0.501)**
Age of household head	–	54.50 (19.07)	55.75 (14.44)
Number of other livestock[a]	–	0.235 (0.426)	0.385 (0.489)**
Number of oxen	–	0.167 (0.374)	0.154 (0.363)
No operational holding	–	0.613 (0.489)	0.467 (0.521)*
Possess land certificate	–	0.852 (0.357)	0.856 (0.350)
Pure landlord	–	0.789 (0.421)	0.682 (0.465)**
Off-farm labour income opportunity	–	0.138 (0.347)	0.273 (0.448)**
Self-employment income	–	28.1 (111.6)	111.9 (442.4)**

Source: Authors' computation using data from the 2006 UMB-MU joint rural household survey.
Off-farm income sources, excluding gifts, aid, remittances and other non-labour income.
Asterisks (*) along the 'non-kin-sharecropped plot' column show the statistical significance of the mean comparison tests conducted against 'kin-sharecropped plots' where *significant at 10%; **significant at 5%; ***significant at 1% and ****significant at 0.1%.
[a]Tropical livestock unit equivalent.

larger proportion of kin-transacted plots are plots leased-out by female landowners than is the case for non-kin-transacted plots. Stated otherwise, of the total parcels leased-out to kin tenants, 57% were owned by female landlords, whereas only 47% of the parcels operated by non-kin were owned by female landlords. Supporting our earlier argument on the role of the economic independence of the landowner, off-farm income-generating opportunity is significantly lower (13%) for landowners who lease out plots to kin partners than for those who lease plots to non-kin partners (27%).

The summary result in Table 4 further indicates that pure landlords with no operational holdings (believed to be tenure-insecure landowners) are more likely lease out their plots to kin partners than to non-kin partners—that is, 60% of plots operated by kin partners were owned by pure landlords, whereas only 47% of the non-kin-operated parcels were leased out by pure landlords. Results also reveal that kin-sharecropped plots are mostly leased in by younger tenants, while the most established (more experienced) farmers gain access to land through the less likely route of non-kin contracts. This leaves younger tenants, with relatively poorer endowments of farm inputs, to rely on access through kin-tied arrangements.

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5. Results and discussion

We begin our analysis by comparing the estimates of average yield differentials between the sharecropped and owner-cultivated plots of owner-cum-sharecroppers by estimating a reduced form equation:

$$\ln(Y_{ip}) = \beta X_{ip} + \delta_1 T_{ip} + \delta_2 L_{ip} + \gamma[T_{ip}{}^{*} L_{ip}] + \mu_i + \varepsilon_{ip},$$

where Y_{ip} is yield value per hectare realised by tenant i on parcel p; X_{ip} includes plot variant observable characteristics (such as conventional input variables, plot quality variables and crops grown) and T_{ip} is indicator variable for tenure status of the plot (i.e., whether or not the parcel is sharecropped). To investigate the effects of landlord-specific features on sharecropped parcels of the tenant, alternative interaction variables [T_{ip} * L_{ip}] were used where L_{ip} includes kinship relationships with the landlord and alternative proxies to capture tenure (in)security status of the landlord (using an index of tenure insecurity[9] or the proportion of land leased out by the landlord).

A summary of the estimated results is presented in Table 5. Consistent with the Marshallian inefficiency hypothesis, we found strong evidence to suggest that productivity on sharecropped plots is lower than on sharecroppers' owner-operated plots once we control for plot quality, crop selection and unobserved household heterogeneity. Contrasting effects of kinship roles on productivity was, however, found once we controlled for variations in the characteristics of partners from the supply side of the market. Taking advantage of unique information on the kinship status and tenure security of matched landlords (complete data from both sides of the tenancy market), Models 1–4 reported in Table 5 estimate and compare how responsive sharecroppers' performance is to these variations in landowners' characteristics.

Results reported under Model 2 show the positive role kinship ties play in influencing sharecroppers' productivity. The results show that, on average, non-kin-sharecropped plots are significantly less productive than owner-cultivated crops while the productivity on kin-sharecropped plots is not statistically different (but positive) from sharecroppers' own parcels. This finding is in line with our hypothesis and supports the claim by Sadoulet *et al.* (1997) that there is a relatively higher moral hazard problem among non-kin contracts as compared with kin-tied tenancy arrangements.

In line with our hypothesis on how landlord's weaker tenure-security status can negatively affect the sharecroppers' effort and/or productivity, results under Models 3 and 4 in Table 5 further indicate that there is strong evidence of Marshallian inefficiency when tenancy arrangements are made with such landlords. While the results presented under Model 2 in Table 5 confirm that there is no significant productivity loss on plots leased in from a kin landlord, results shows that there is rather strong (statistically significant) evidence of Marshallian inefficiency even on plots leased in from kin-related when the landlords are female landowners and/or landlords with zero operational holding. This is shown by the negative and statistically significant coefficient of the interaction variable between kin-operated plots and landlord's

9 Index of tenure insecurity is generated using the summary of three proxy indicator variables, namely (i) if the landlord is female, (ii) if the landlord has no land use certificate and (iii) if the landlord is an absentee landlord with zero operational holding.

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Table 5: Linear Household Fixed Effects Estimates of Determinants of Yield Value Per hectare—For Parcels Operated By Owner-Cum-Sharecroppers (Full Regression Results Are Provided Under Supplementary Material, Appendix S1)

Explanatory variables	Model 1	Model 2[a]	Model 3[b]	Model 4[c]
Plot is sharecropped-in	−0.133** (0.06)			
Sharecropped—kin landlord		0.044 (0.07)	0.246** (0.11)	0.481** (0.23)
Sharecropped—non-kin landlord		−0.414**** (0.08)	−0.418**** (0.11)	−0.442** (0.18)
(Kin landlord)*(landlord's tenure insecurity index)[d]			−0.198** (0.11)	
(Non-kin landlord)* (landlord's tenure insecurity index)			−0.019 (0.13)	
(Kin landlord)*(proportion of land leased out)				−0.613** (0.32)
(Non-kin landlord)*(proportion of land leased out)				−0.084 (0.29)
Joint *F*-test for plot quality variables[e]	6.39****	7.11****	5.94****	7.15****
Joint *F*-test for cultivated crop-type variables[f]	8.34****	7.53****	8.33****	6.57****
Constant	7.25**** (0.159)	7.29**** (0.191)	7.26**** (0.156)	7.33**** (0.170)
R^2	0.151	0.169	0.171	0.176
Number of observations	984	984	984	820
Model test	$F(13,754) = 7.49$***	$F(14,753) = 8.71$****	$F(17,750) = 7.59$****	$F(17,586 = 7.35$****

Source: Authors' computation using data from the 2005–06 household survey.
In each alternative model specification, the counterfactual is tenants' owner-operated plots.
*Significant at 10%; **significant at 5%; ***significant at 1% and ****significant at 0.1%.
[a]Model specification created by decomposing leased-in plots based on the kinship status of the landlord.
[b]A model specification: interaction effects of tenure (in)security status of the landlord (tenure insecurity index).
[c]A model specification: interaction effects of tenure (in)security status of the landlord (captured by proportion of land leased-out by the landlord).
[d]*Tenure insecurity index* is generated using the sum of three proxy variables for tenure insecurity: (1) if the landlord is female; (2) if the landlord has a land use certificate and (3) if the landlord is an absentee landlord with zero operational holding.
[e]Plot quality variables include flat plot slope, foothill plot slope, shallow soil depth, medium soil depth, log (plot distance from residence), homestead plot, conserved plot and plot size (in *tsimdi*; *Tsimdi* is a local area measurement equivalent to a quarter of a hectare).
[f]Crop dummy variables include pulses and oilseeds plot, teff plot, barley plot and wheat plot.

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tenure insecurity index[10] under Model 3 in Table 5. Moreover, though results remain to show the prevalence of Marshallian inefficiency among non-kin-operated parcels (as shown by the negative coefficient of the variable *non-Kin landlord* in both Models 3 and 4 of Table 5), the empirical analysis also indicates that non-kin tenants are less (or none) responsive to the tenure status of their partners (landlords) as compared with kin tenants (as shown by the negative but statistically not significant coefficient of interaction *variable* (*non-kin landlord*)* (*Landlord's tenure insecurity index*)).

This is consistent with the contextual perspective and the theory discussed under Sections 2 and 3 of this paper. Given the acute land scarcity in our study area (where a household with an average size of five members owns less than a hectare of arable land), one would expect non-kin tenants to be residual options for landlords in the partner selection process—especially under circumstances where there is no systematic difference in the farming ability and resource endowment between the potential kin and non-kin tenants. Under such circumstances, the strategic response of such tenants (non-kin tenants) to the landlords' tenure status may not be as big as the response from kin tenants. This is particularly so as tenure-insecure landlords (with fear of losing their leased land) are normally expected to kin tenants (to obscure the land transaction and avoid land confiscation)—especially, if a non-kin tenant is less or equally efficient as a kin tenant. Thus, in line with threat-of-eviction hypothesis, the results show that such lack of eviction power from the landlord side (or lack of real threat of eviction to the tenant) has more downward bias on productivity of kin-operated plots than non-kin-operated plots, which is also consistent with the findings by Kassie and Holden (2007) from the Amhara region in Ethiopia. In the case of female-headed households, this result confirms the claims that weaker economic and tenure-security status of female-headed households (Holden *et al.*, 2011) undermines female landlords' ability to use the threat of eviction to induce tenant's effort and productivity (Bezabih and Holden, 2009). Results remain to be robust even after similar estimations are made using a more restricted sample of parcels leased in from landlords who have zero operational holding (as shown under Table 6).

We found similar results when the landlords' proportion of land leased-out was used as alternative proxy to capture tenure insecurity of the landlord (shown under Model 4 in Table 5). Results remain robust and the negative (statistically significant) coefficient on the interaction variable (between kinship and proportion of land leased out by the landlord) shows that yields on plots leased from kin landlord households with higher proportion of their land leased-out are significantly lower than yields on sharecroppers' owner-operated plots.

Although results, on average, show that there is no efficiency loss among kin-sharecropped plots, such negative productivity effects of the interactive term could be explained by the landlords' higher reliance on kin-based tenancy arrangements as these landlords are believed to be highly susceptible to confiscation by the government (perceived to be tenure-insecure landlords). The fact that such pure landlords (with zero or no operational holding) are more likely to be individuals that live outside the village and/or lack the technical (farming) ability, the lack (or high cost) of supervision of tenants' effort cannot be ruled out as a factor in the lower productivity of such plots. However, our results suggest that such efficiency loss is more/better explained by the strategic response of tenants to landlords' tenure insecurity (contract security of tenants) than by lack of supervision by landlords, since the productivity effects of kinship remain consistent even after similar analysis using the same covariates was

10 This result is in line with the findings of Holden and Bezabih (2008) from the Amhara region of Ethiopia.

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Table 6: Linear Household Fixed Effects Estimates of Determinants of Yield Value Per Hectare—For Parcels Operated By Owner-Cum-Sharecroppers—Restricted on Parcels Leased-in from 'Single-Tenant Absentee Landlords' (Full Regression Results Are Provided Under Supplementary Material Appendix S2)

Explanatory variables	Model 1	Model 2[a]	Model 3[b]	Model 4
Sharecropped-in	−0.236*** (0.09)			
Sharecropped—kin landlord		−0.057 (0.12)	0.418** (0.21)	–
Sharecropped—non-kin landlord		−0.608**** (0.17)	−0.697**** (0.20)	–
(Kin landlord)* (landlord's tenure insecurity index)[c]			−0.356** (0.21)	
(Non-kin landlord)* (landlord's tenure insecurity index)			−0.042 (0.23)	
(Kin landlord)* (proportion of land leased out)				–
(Non-kin landlord)*(proportion of land leased out)				–
Joint *F*-test for plot quality variables[d]	2.55**	2.46**	2.11**	–
Joint *F*-test for cultivated crop-type variables[e]	4.39***	4.95****	4.69****	–
Constant	7.52**** (0.246)	7.56**** (0.289)	7.51 **** (0.241)	–
R^2	0.129	0.165	0.185	–
Number of observations	469.000	469.000	469.000	–
Model test	$F(13,341) = 3.87$****	$F(14, 346) = 4.81$****	$F(17,337) = 4.49$****	–

Source: Authors' computation using data from the 2005–06 household survey.

Notes: In each alternative model specification, the counterfactual is tenants' owner-operated plots.

*Significant at 10%; **significant at 5%; ***significant at 1% and ****significant at 0.1%.

[a]A model specification created by decomposing leased-in plots based on the kinship status of the landlord.

[b]A model specification: interaction effects of tenure (in)security status of the landlord (tenure insecurity index).

[c]*Tenure insecurity index* is generated using the sum of three proxy variables for tenure insecurity [(1) if the landlord is female; (2) if the landlord has a land use certificate and (3) if the landlord is an absentee landlord with zero operational holding].

[d]Plot quality variables include flat plot slope, foothill plot slope, shallow soil depth, medium soil depth, log (plot distance from residence), homestead plot, conserved plot and plot size (in *tsimdi*).

[e]Crop dummy variables include pulses and oilseeds plot, teff plot, barley plot and wheat plot.

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conducted on a restricted sample (sub-sample) comparing owner-operated and sharecropped parcels leased-in from only 'single-tenant absentee landlords'. This is particularly shown by the statistically significant positive coefficients of 'kin-landlord' variables and negative coefficients of 'non-kin landlord' variables both on Model 3 of Table 5 (using unrestricted sample) as well as Model 3 in Table 6 (restricted sample only using parcels leased-in from 'single-tenant absentee landlords'). Thus, the potential efficiency loss on kin-operated farms is even more pronounced when such absentness of the landlord is coupled with tenure insecurity—as shown by the negative and statistically significant coefficients of the interaction variable '(Kin landlord)* (Landlord's tenure insecurity index)' in Table 6, respectively.

Finally, the stochastic dominance analyses presented in Figures 1–3 support the parametric findings that the yield distribution on parcels from non-kin and female landlords is not only

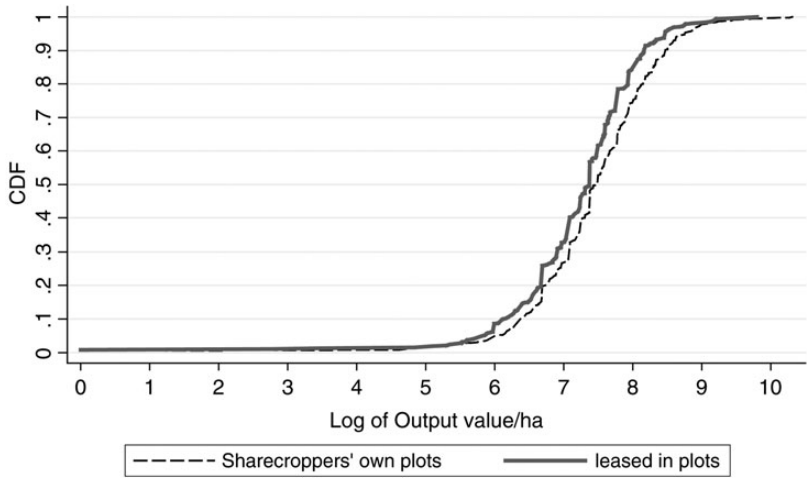

Figure 1: First-order stochastic dominance of productivity—impact of share tenancy

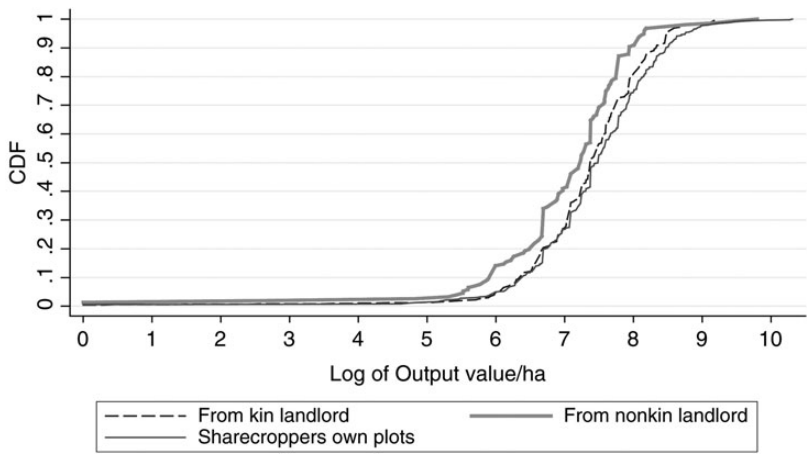

Figure 2: First-order stochastic dominance of productivity—impact of kinship with landlord

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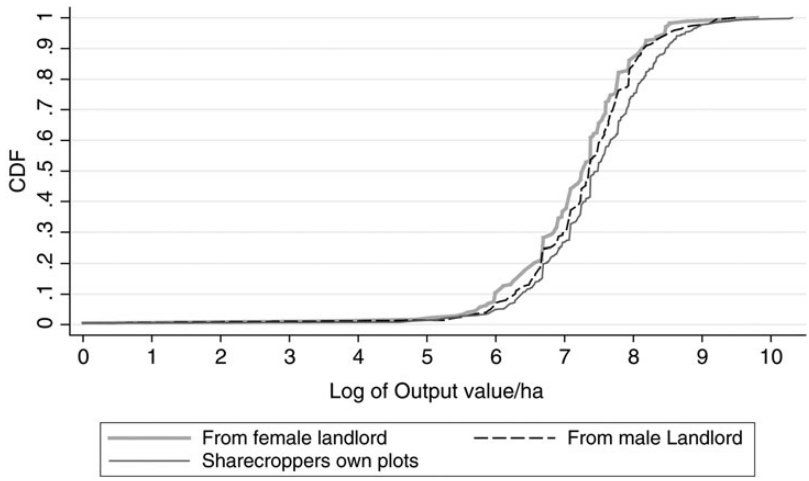

Figure 3: First-order stochastic dominance of productivity—impact of gender of the landlord

dominated by the yield distribution on tenants' owner-operated plots but also by the yield distribution on plots operated by kin tenants and on plots leased in from male landlords, respectively. Comparing the kinship and gender productivity differential, the nonparametric Kolmogorov–Smirnov significance test for differences in yield values per hectare (presented in Table 7) also shows that the yield distribution on plots leased from female landlords is unambiguously dominated not only by the yield distribution on tenants' owner-operated farms but also by the distribution of yield per hectare on plots leased from male landlords.

7. Conclusion and policy implications

Taking advantage of unique information on the kinship status, bargaining power and tenure security of landlords in matched tenant–landlord pairs, our findings show how strategic sharecroppers are in internalising these variations in their landlords' characteristics. The results show that sharecroppers' yields are significantly lower on plots leased from landlords who are non-kin, who are female, who have lower off-farm income-generating capacity and who are believed to be tenure insecure than on plots leased from landlords with the opposite characteristics.

A more in-depth analysis (after considering the interaction effects of tenants' kinship status with variables controlling for landlords' bargaining power and tenure security) also shows strong (statistically significant) evidence of Marshallian inefficiency on kin-operated plots leased from landlords who are female and from those who have no off-farm income-generating capacity. The empirical evidence implies that strengthening the property rights of landholders may not only have a direct productivity-enhancing effect on owner-operated smallholder cultivation but also an indirect impact on the productivity of transacted plots. Recent changes in the regional land proclamation (TNRS, 2006) authorise the confiscation of landholdings of households that have had their primary source of livelihood outside the village for more than 2 years. While this policy serves an equity objective, it

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Table 7: Test Results of First-Order Stochastic Dominance of Productivity (Two-Sample Kolmogorov–Smirnov Test)

Basis of category	Tenure status of plot	Log of value of output/ha			*P*-values for two-sample Kolmogorov–Smirnov test[a]		
		N[b]	Mean	(se)	Group A versus Group B	Group A versus Group C	Group B versus Group C
		(1)	(2)	(3)	(4)	(5)	(6)
Land transaction	Sharecroppers' own plot (Group A)	611	7.429	(0.04)	0.001		
	Leased-in plot (Group B)	386	7.211	(1.04)			
Kinship	Sharecroppers' own plot (Group A)	611	7.429	(0.04)	0.398	0.000	0.021
	Plot leased in from kin (Group B)	230	7.348	(0.06)			
	Plot leased in from non-kin (Group C)	156	7.010	(0.09)			
Gender	Sharecroppers' own plot (Group A)	611	7.429	(0.04)	0.078	0.002	0.049
	Plot leased in from male (Group B)	199	7.278	(0.07)			
	Plot leased in from female (Group C)	174	7.045	(0.09)			
Possession of certificate	Sharecroppers' own plot (Group A)	611	7.429	(0.04)	0.014	0.067	0.318
	Plot leased in from landlord with certificate (Group B)	173	7.175	(0.08)			
	Plot leased in from landlord without certificate (Group C)	106	7.331	(1.09)			
Pure landlord	Sharecroppers' own plot (Group A)	611	7.429	(0.04)	0.010	0.0658	0.598
	Plot leased in from pure landlord (Group B)	167	7.192	(0.07)			
	Plot leased in from cultivator landlord (Group C)	112	7.421	(0.12)			

Source: Authors' computation using data from the 2006 UMB-MU joint rural household survey.

[a]Test of H_0: distributions are equal; against H_a: distribution of the first group stochastically dominates distribution of the second group.

[b]The difference in number of observations is due to lack of complete information from the matched partners (landlords).

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may undermine the bargaining power of (potential) landlords and the efficiency of production on transacted plots.

Acknowledgement

This research is funded by the CGIAR Research Program on Policies, Institutions, and Markets, led by IFPRI and the Norwegian Agency for Development Cooperation (NORAD). We would like to thank Professor Marcel Fafchamps and two anonymous reviewers for useful comments. Valuable comments to an earlier version of this paper were also received from participants at the 28th International Conference of International Association of Agricultural Economists (IAAE), August 18–24, 2012, Iguassu, Brazil.

Supplementary data

Supplementary material available at *JAFECO* online.

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