Plot size, adjacency, and farmland rental contract Choice

by Yueming Cao, Yunli Bai, and Linxiu Zhang

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Abstract

The purpose of this paper is to assess the impact of plot size on the components of farmland rental contracts choice and evaluate its heterogeneous effects for different plot adjacency status in the context China. Based on the data from a nationally representative sample of 1215 plots from households among 5 provinces in rural China, this paper draws robust results using region fixed effect method and SUR model. The results show that the characteristics of rented-in plots measured by the size and position plots significantly affected the characteristics of farmland rental contract choice. Specially, the size of rented-in plots significantly and positively affects the likelihood of plots signing the formal contracts that are trading with non-relatives, signing the written contracts, paying rent and specifying the fixed-duration. The position of rented-in plots significantly affects the likelihood of plots trading with relatives. Besides, the large and adjacent plots are likely to be signed formal contracts. The findings imply that the local government should pay attention to the small size or non-adjacent and large size plots for the formalization of land rental contracts in order to avoid the land disputes in land rental market.

Keywords: Plot size; adjacent plot; Contract choice; Land rental market

JEL Classification: O13, Q15, Q24

1. Introduction

Land rental markets play an important role in improvement of land use efficiency and wellbeing of farmers. It enhances the efficiency of agricultural productivity and facilitates economy transformation toward productive, rapid, and sustainable growth in developing countries (Rahman, 2010). It also increases incomes and reducing poverty for land-constrained smallholder farmers by cultivating more land and generating a greater value of output (Jin and Jayne, 2011). Most of previous studies focused on the reason of renting out or renting in farmland for farmers and the effects of land rental market (Deininger and Jin, 2005; Sanzidur and Rahman, 2010; Abay etal., 2020; Kvartiuk and Petrick, 2021).

With the development of land rental market, the formalization of land rental market is gradually concerned, especially the contract choice. There are many theoretical and empirical studies on the determinants of land rental contract choices. In particular, previous theoretical studies pay high attention to alternative hypotheses about risk, risk preferences, credit constraints, moral hazard, poverty and random shocks as explanations for contract choice (Bardhan, 1989; Cheung, 1969; Stiglitz, 1974; Bezabih, 2009; Gebregziabher and Holden, 2011). Also, there is a broad empirical literature testing the alternative hypotheses. These studies found that the trust, risk and time preferences can predict preferences for contract attributes using choice experiments. (Bezabih, 2009; Fischer and Wollni, 2018), while the moral-hazard, the imperfect capital market or the proper incentives determine contract choice, but not for the risk-sharing hypothesis (Ackerberg and Botticini, 2000; Aggarwal, 2007).

However, there are some gaps to narrow in empirical studies. Most previous studies mainly focused on a certain component of contract, such as participant (relatives or non-relatives), form (oral or written), rent (free or charged), or duration (non-fixed or fixed) of contract, ignoring their relationship. Although a few studies considered the relationship among different components of farmland rental contracts (Zou and Luo, 2019), they only investigated them from household level which was not able to control the effect of plot characteristics on the contract choices. Additionally, none of these

studies have analyzed the heterogeneous effects of plot size on the land rental contract choice for different plot adjacency status, although it is the essential of scale economies by enlarging farmland size.

The overall goal of this paper is to examine the effects of plot size and adjacency on the components of farmland rental contracts choice. We have two specific objectives: assessing the impact of plot size on the components of farmland rental contracts choice and evaluating its heterogeneous effects for different plot adjacency status

The remainder of the paper are as follows. Section 2 is literature review. Section 3 introduces the methodology, including sampling and data collection, empirical model specification, and variables in this study. Section 4 shows the descriptive analyses. Section 5 presents the results of econometric model. Conclusion and implication are in Section 6.

2. Literature review

Contract choice consists of four basic components: participant, form, rent, and term. Contract participant refers to the both sides of conducting land rental contracts, especially, the relationship between contract participants gets a lot of attention. Contract form usually means the contracts are oral or written agreement. Land rental includes crop sharing and cash leases, namely, sharecropping contracts and fixed rental contracts. Contract term refers to the duration of land rental contracts, mainly including fixed-duration and non-fixed duration or short term and long term. Previous literature differentiates the land rental contracts choice between relatives and non-relatives. In developing countries, some studies from Philippines by Sadoulet et al., (1997); from America by Robison et al., (2002); from Ethiopia by Holden and Ghbru (2005); from Guatemala by Macours (2014); from China by Wang et al., (2015) suggested that trust among landlords and tenants, social capital or land tenure security play an important role in the choices of contract partners. For instance, in recent years, Cheng et al., (2019) found that land titling reform decreases the probability of households renting land out to their relatives and friends based on the official nationwide surveys. Moreover,

another significant part study concentrates on sharecropping efficiency differentials in terms of the relationship between tenant and landlord, which has offered mixed results. Some studies found that kinship sharecropping contracts are more efficient than non-kin sharecropping contracts in Philippines (Sadoulet *et al.* 1997), but some studies showed the opposite conclusions that non-relatives tenants are more productive on their sharecropped plots in Ethiopian (Kassie and Holden, 2007), which is the consistent with the study of Jin and Deininger *et al.* (2009) showing that productivity gains from renting to non-relatives almost 80% higher than from transactions involving relatives.

At the same time, a number of studies also consider that the impacts of land tenure security on the choices between written and oral contacts. For example, Both Ma et al., (2018) and Cheng et al (2019) found that insecure land tenure encourages landlords to select informal contracts, and Ma et al., (2019) further conclude that tenure security perceptions play a role in the choice between oral and written contracts. Moreover, Fukunage and Huffman (2009) also found that transaction costs and risk-sharing incentives affect the choice of contract form in America, which of the result is the same with Liu and Zhang (2013). Furthermore, informal land rental contracts are detrimental to enhance productivity and land investments (Deininger, 2003).

With regard to the contract rent, Cheung (1969) and Stiglitz (1974) were the first to pay attention to the choice between sharecropping contracts and fixed rent contracts from the perspective of alternative hypotheses about risk preferences and credit constraints. Then some studies further conducted the empirical analysis and showed that availability of credit induces households to opt for fixed-rental contract in Bangladesh (Bidisha et al., 2017; Das et al., 2019). Some studies showed that poor households are more likely to choose fixed-rent contracts when experiencing random shocks or when ex ante production risk or is low in Ethiopia (Gebregziabher and Holden, 2011). Besides, rental agreements have shifted away from crop-share towards fixed cash rent designs in American (Paulson and Schnitkey, 2013). However, in China sharecropping contracts are virtually non-existence and fixed rent contracts dominate (Ma et al., 2018).

Notably, Cheng et al., (2019) mentioned that land titling reform have no effects on the duration of the rental contract. Compared with the three other characteristic of land rental contracts, much less attention has been given to the duration of contract, which only remained at descriptive analysis.

Except for discussing the determinants of land rental contracts choice in a specific characteristic, some literatures also focused on the relationship between any two characteristics of land rental contracts. Noev (2008) found that the relationships between participants in land rental market impact the form of contracts (oral or written). This study concluded that the more formal the relationships in the rental market between households and sources of land, the more formal and traceable the contracting that appears between them. Besides, some studies paid attention to the links between land rent and participants of land rental contracts, and concluded that buyer characteristics and personal relationships affect the terms of trade in the land market (Kostov et al., 2008). Specifically, low capital social even has an impact on farmland sale prices, which are lower for friendly neighbors and relatives (Robison et al., 2002). Zou *et al.* (2016) found that households preferred to choose short duration of land rental contract when the tenants were their relatives due to high trust. We find that crop share arrangements are more likely to emerge among family relations (Bryan *et al.* 2015). However, we do not find strong evidence that family relations explain variation in the magnitude of cash rental rates.

From the perspective of households, land transfer and large-scale farming have same essence, and renting in more farmland means that farmers expand scale of farmland (Zhou, 2018). Although renting in plots generally will expand the total operational scale of farmland, it does not mean the increase of farmland area per plot, which is related to the position of rent-in plot and area of rented-in plot. For rented-in participants, renting in the area of plot is more than farmland area per plot or renting in the adjacent plot, and realizing concentrated scaled operation areas, which will alleviate the extent of land fragmentation, thereby improving agricultural production efficiency (Luo, 2017). However, renting in farmland also means households confront with more

operational risk. On the one hand, households rent in land plots from other several households who want to rent out land, and thus rented-in participants in land rental market need to take on more lease cost and contracting cost (Luo, 2017). On the other hand, in terms of scale economy, expanding the scale of farmland, generally speaking, needs to the increasing of agricultural machinery to replace labor when the scale of farmland reached to a certain amount (Hu et al, 2015). Consequently, it is necessary to pursue stable operational rights of rented-in plots for rented-in participants, and they are more eager to sign the stable land rental contracts with the increase of scale of farmland.

Although a few of studies focus on the households' choice in contract of participant, form and term, the systematic and comprehensive analysis covering the four dimensions is rare. According to previous studies, it can be seen that the studies on the relationship between scale of rent-in farmland and land rental contracts choice are scarce. To our knowledge, there are three studies which touch upon this topic in China. Luo *et al.* (2015) use the scale of rented-out farmland as control variable, conduct Logistic model and find that the probability of renting out plots to relatives is increasing with the increase of the scale of rented-out farmland, based on 203 rented-out contracts from 26 provinces in 2011. Ji *et al.* (2017) found that scale of rented-in plots improved the farmland rent by using 334 plots rented in of 8 provinces in 2013. Zou and Luo (2019) find that scale of farmland rented in have a significant impact on the contract choice based on 326 households who rented in land among 9 provinces in 2015.

In the Chinese context, existing literatures found that the significant characteristics of land rental contracts are signed informal (oral) agreement between relatives or friends (Jin and Deininger, 2009; Prosterman et al. 2009; Rozelle et al., 2010; Ye *et al.* 2010; Gao et al, 2011), and some land plots are rented out with no fixed duration or pecuniary rent (Brandt et al. 2004; Liu and Zhang, 2013; Wang et al., 2015). Jin and Deininger (2009) described some characteristics of land rental contracts, based on a representative survey of China's nine agriculturally most important provinces covering almost 8000 households, and found that during 2002-2004, for rent-in land rental

contracts, less than 10% of contracts were in writing; almost 40% of producers rent-in from a relative; about 24% of contracts were fixed term, 2% of which were length of term. In another study by Wang et al (2015) based on 1200 households from six provinces of China in 2000 and 2008, showed that 10.95% of contracts were in writing; about 46% of producers rent-in from a relative; 12.42 % of contracts were fixed term. In brief, the formalization of rental contracts remained fairly under-developed in China. Recently, "The Management Methods of Transfer of Rural Land Operational Rights" was issued by The Ministry of Agriculture in 2021, which required that signing the written contract when the duration of contract is more than one year and keeping a record to the village collectives. The aim of this announcement is safeguarding the legitimate rights of participants in land rental market and improving the formalization of rental contracts and the stability of land renal market.

3. Methodology

3.1 Sampling and data collection

The data used in this paper is from the China Rural Development Survey (CRDS) conducted by authors in 2019. CRDS involves six waves tracing investigation in 2005, 2008, 2012, 2014, 2016, and 2019. Using a multistage stratified cluster random sampling procedure, the survey selected Jiangsu, Sichuan, Shaanxi, Jilin and Hebei five provinces as the sample province in the first wave of survey in 2005. Five counties were selected in each province. Two townships were selected within each county, and two villages were selected in each county and 20 households were selected in each village. Hence, the survey covers 2020 households in 100 villages of 25 counties across five provinces (see Figure 1). For more specific sampling process, see Cao et al (2020).

The CRDS in 2019 was conducted at the plot, household and village levels. At the plot level, we collected detailed farmland rental contracts information, including the relationship between the landlords and tenants, the contract form, the annual rent per mu of farmland, the duration of contract, whether or not the rented-in plot is adjacent to the plots operated by the tenants and whether or not the subsidy of the plot belongs

to tenants. With this information, we can acquire the variables of land rental contracts, such as contract participants (relatives, non-relatives), contract form (written, oral), contract rent and contract term (fixed duration, non-fixed duration), the adjacency and ascription of subsidy of the rented-in plot. We also gathered the basic characteristics of farmland plots, including size, slope, the distance to the residence and irrigation condition.

At the household level, we collected the information on individual and household characteristics. Individuals characteristics included age and education and so on. We also documented information about the employment of each family member, including whether household members worked and whether they participated in off-farm employment. According to this information, we can construct variable of the share of off-farm laborers in the household. We also gathered the data on the number of plots contracted by the households and the value of agricultural equipment.

At the village level, we collected as many village information as possible, for instance, the distance from village to the town, the per capita of income, the total area of the irrigated land and so on.

For the purpose of this study, we limit the sample from following two aspects: First, we concentrate on the rented-in plots, because it is easier to be judged whether the households achieve the adjacent farmland or not from the perspective of tenants. In addition, we could understand behaviors of demand side to develop the land rental market. Second, the plots may be rented in from two sources: households and organizations, such as village collectives and agricultural cooperatives. There exists difference on regulations of farmland contract between households and organizations. This paper mainly analyzes the farmland contract between households. Thus, we finally keep the rented-in plots whose landlords are households. The final sample size is 1215 rented-in plots among 357 households in 5 provinces.

3.2 Variables

3.2.1 Dependent variables

We have four dependent variables to measure land rental contract choice, including contract participant, contract form, contract rent, and contract term. The first dependent variable is *contract participant* which is a dummy variable to indicate the relationship between landlords and tenants (1= the plot is rented in from relatives, 0= the plot is rented in from non-relatives). Farmland rental market is mainly divided into two types according to the contract participant in rural China: relatives market and non-relatives market (Gao and Huang, 2011).

The second dependent variable is *contract form*, which equals one if the contract form is written agreement on the plot and zero if the contract form is oral agreement. For land rental contract form, some existing literatures focus on the two types of contract form containing oral agreement and written agreement (Allen and Lueck,2002; Huffman and Just, 2004). Written agreement is used to measure the stability of contract and considered as an efficient way to secure farmland property rights (Gao and Huang, 2011; Luo *et al.* 2015).

The third dependent variable is *contract rent*, which is measured by the annual rent per mu on each plot and it indicates the value of the rented-in plot. There are generally three types of farmland rent: cash, entity and cash in grain price. We convert the latter two forms to cash in order to measure the farmland rent better.

The fourth dependent variable is *contract term* indicating the duration of land rental contract. It equals to 1 if the duration of rented-in plot is fixed and 0 otherwise.

3.2.2 Independent variables

There are two key independent variables used to measure the characteristics of rented-in plots: one of them is plot size measured by the area of rented-in plot. Considering that expanding the operating area of farmland does not mean the increase of average area of plot, we not only measure the plot size, but also consider the position of the plot rented in. Thus, the other key independent variable is the position of plot, which equals to one if the rented-in plot is adjacent to the existing plots operated by the tenants, and zero otherwise. Based on the two key independent variables, we are able

to obtain the characteristics of the rented-in plots from the perspective of both amount and space.

For trust or transactions cost, the tenants may first consider renting in plots from relatives, but due to the limited amount of farmland of relatives, and the tenants have to rent other farmland from acquaintances or strangers when the relative's farmland can't support their demand (Zuo and Luo, 2019). Therefore, it is expected that the plots have more possibility to be rented in from non-relatives with the increase of scale rented-in plots. Besides, the adjacent plots may be rented in from the relatives, since the farmland is equally allocated to households in the early contracting reform within a same village group, in which most of villagers are relatives. The probability of adjacent plots belong to their relatives or neighbors is large for tenants.

Meanwhile, tenants rent in more size of plots that means more larger sunk costs and production input of agriculture. The plots are expected to be signed in written agreement with the increasing scale of rented-in plots to secure stability of operational rights and avoid operational risk. The non-adjacent plots are more likely to be signed written contracts as the tenants may be afraid of losing rent plots owing to breaking the contract of landlords. Comparing with non-adjacent plots, the adjacent plots are more secure for tenants.

Farmland fragmentation increases the number of transactions resulting in rising of negotiation cost (Dong, 1996). Followed by Ji *et al.* (2017), large size of plots and adjacent plots can reduce the producing cost and improve production efficiency of technology (Guo et al., 2019). Besides, renting in the adjacent plots will save time for delivering fertilizer and improve operation level of agricultural mechanization (Bentley, 1987). Consequently, the large size of plots and adjacent plots are more likely to be paid for relatively higher farmland rent.

The choice of contract term is highly related with risk preference and tenancy term (Arrow, 1971). In order to avoid the risk of being recovered operating farmland at any time, the households are possible to choose the fixed term when renting in large scale

of plots. There are some evidences that operating large scale of farmland may invest in agricultural devices with a long return, which need to a long-time operational or fixed term for rented-in plots (Zou and Luo, 2019). Therefore, the rented-in plots are inclined to be signed for fixed term with the increase of size of plots.

For the control variables, the determinants of contract choice are divided into three categories. The first group is plot characteristics. This group of variables investigates the slope, distance to house and irrigation condition of the plot. The slope and irrigation condition of plot are used to measure the quality of the plot (Elad *et al.* 1994). The distance to house measures the distance from the residence of farmers to the plot, which represents the convenience of household to operate the plot. This plot characteristics may affect the valve and mobility of these plots in farmland rental market (He *et al.* 2011), and further affect the contract choice. Besides, previous studies have found that the agricultural subsidy of the plots directly affects the rent (Ji *et al.* 2017; Hendricks *et al.* 2012), and thus we also consider the ownership of subsidy on the plots.

The second group is household characteristics including age and education level of household head, employment experience of labors, number of plots, and agricultural equipment asset in the household. The number of plots contracted by household before renting in other plots is used to measure the degree of farmland fragmentation, which has been proved to affect farmland rent (Tan *et al.* 2006; Cao *et al.* 2019). Plenty of studies have shown that off-farm employment is one of the key factors affecting the development of the farmland rental market (Kung, 2002; Zhang *et al.* 2019). We use the ratio of the household's labor engaged in off-farm employment to measure this effect. Agricultural equipment asset is also included to control the capacity in operating farmland among households (Abdulai *et al.* 2011). The value of agricultural equipment is the agricultural fixed investment, which strengthen the possibility of choosing fixed or long duration of contract for tenants (Bergemann and Hege,1998). The household head plays an important role in farmland rental market and large-scale farming, which produces different decision-making on contract choice (Zhou, 2018). We use the age and years of schooling of the household head to control the impact of household head

on the contract choice.

Finally, at the village level, the distance from the village to the town is used to measure the market access. Per capita of income in the village measures the development of the village. The description and definitions of these variables are shown in Table 1.

3.2.3 Model specification

In order to estimate the extent to which characteristic of rented-in plots affected the four components of contract choice, including participants, form, rent and term, we mainly conduct two types of empirical analysis:

First, we employ logit regression with fixed effect or OLS regression with region fixed effect according to the characteristic of dependent variable in the four single equations as a benchmark to examine the basic relationship between the characteristics of rented-in plots and contract choice, since there is a strong regional characteristic in farmland rental market resulting from the fixed feature of plots (Ji et al., 2017; Guo et al., 2019), reflecting the development of agriculture and economical level in various regions. The contract choice is not only affected by the characteristics of rented-in plots but also is impacted by region characteristics. Therefore, we use the region fixed effect regression model at town level. The model specifications are as follows:

$$O_{it} = \beta_{O1} + \beta_{o2}Z_{it} + \beta_{o3}A_{it} + \sum \beta_{Okit}H_{kit} + \delta_t + \mu_{oit} \quad (1)$$

$$F_{it} = \beta_{F1} + \beta_{F2}Z_{it} + \beta_{F3}A_{it} + \sum \beta_{Fkit}H_{kit} + \delta_t + \mu_{Fit} \quad (2)$$

$$R_{it} = \beta_{R1} + \beta_{R2}Z_{it} + \beta_{R3}A_{it} + \sum \beta_{Rkit}H_{kit} + \delta_t + \mu_{Rit} \quad (3)$$

$$T_{it} = \beta_{T1} + \beta_{T2}Z_{it} + \beta_{T3}A_{it} + \sum \beta_{Tkit}H_{kit} + \delta_t + \mu_{Tit} \quad (4)$$

where t represents the town and i represents plots within the town. Where O_{it}, F_{it}, R_{it} and T_{it} represent contract participant, form, rent and term of the ith plot within the tth town, respectively. Z_{it} indicates the size of the ith rented-in plot and A_{it} indicates the adjacent status of the ith rented-in plot within the tth town. In the absence of omitted variable, β_{o2}, β_{F2}, β_{R2}, and β_{T2} would be the impact of the size of

rented-in plots on contract participant, form, rent and term, respectively. β_{o3}, β_{F3}, β_{R3}, and β_{T3} would be the impact of the adjacent status of rented-in plots on contract participant, form, rent and term, respectively.

H_{kit} represents the characteristics of plot, household and village listed in 3.2.2 Section at the tth town, respectively. β_{okit}, β_{Fkit}, β_{Rkit}, and β_{kit} are the coefficients measuring contribution of each of the variables to the land rental contract, respectively. β_{o1}, β_{F1}, β_{R1}, and β_{T1} are the constant term, respectively. δ_t represents the fixed factors impacting the land rental contract in the town level, which is used to eliminate the unobservable regional characteristics, for example productivity of plots. μ_{oit}, μ_{Fit}, μ_{Rit}, and μ_{Tit} are the error term, which account for other factors in each equation, respectively.

In the equations (1), (2) and (4), the dependent variables are binary variables, we use logit regression with fixed effect to estimate the effects of independent variables. Contract rent is a continuous variable, and OLS regression with region fixed effect is adopted in the equation (4). The contract participant, form, rent and term are excluded in the single model because of significant correlation among them (see Table A1).

Second, there are connections among four components of farmland rental contracts. However, the single equation model to estimate the choice of contract participant, form, rent and term may break the connections among them by ignoring the connections with the error terms in each equation and lead to deviation of estimation. Thus, we employ Seemingly Uncorrelated Regression (SUR) model to verify the robustness of the estimation results of the four single models, which is used to analyze multiple equations with correlated error terms. The advantage of SUR model is to get more efficient estimation than the single equations (Zellner, 1962). The specification for SUR model is:

$$\begin{cases} O_i = \beta_{O1} + \beta_{o2}Z_i + \beta_{o3}A_i + \sum \beta_{Oki}H_{ki} + \mu_{oi} \\ F_i = \beta_{F1} + \beta_{F2}Z_i + \beta_{F3}A_i + \sum \beta_{Fki}H_{ki} + \mu_{Fi} \\ R_i = \beta_{R1} + \beta_{R2}Z_i + \beta_{R3}A_i + \sum \beta_{Rki}H_{ki} + \mu_{Ri} \\ T_i = \beta_{T1} + \beta_{T2}Z_i + \beta_{T3}A_i + \sum \beta_{Tki}H_{ki} + \mu_{Ti} \end{cases} \quad (5)$$

Where O_i, F_i, R_i and T_i represent participant, form, rent and term of contract choice for the ith plot, respectively. Z_i indicates the size of the ith plot and A_i indicates the adjacent status of ith rented-in plot. In the absence of omitted variable, $\beta_{o2}, \beta_{F2}, \beta_{R2}$, and β_{T2} would be the impact of the size of rented-in plots on the contract participant, form, rent and term, respectively, and $\beta_{o3}, \beta_{F3}, \beta_{R3}$, and β_{T3} would be the impact of adjacent status of rented-in plots on the contract participant, form, rent and term, respectively. The definition of other parameters and variables are the same as those in equation (1) to (4).

4. Descriptive results

4.1 Status of farmland rental contract choice

From the perspective of some key contractual arrangements, rental transactions between non-relatives accounted for 59.1 percent of all rent-in plots, and 51.6 percent and 7.9 percent of these plots are rented in from acquaintances and strangers, respectively.

For the contract form, the oral agreement is still primary form of rental contracts, Specifically, 87.57 percent of plots rented in are signed in oral agreement, which is 6 times of that in written agreement (Table 2, row 6, columns 7 and 8). It is consistent with previous literatures (Ye et al., 2010; Qian and Hong, 2018).

For the contract rent, the average rent of rented-in plots is 189.59 yuan/mu (Table 2, row 6, column 8) and in those instances (60.74%) where rent was charged the average rent is 312.12 yuan/mu, far exceeding the land price at 221.57 yuan/mu in 2008 of Wang et al (2015), while lagging the land rent at 469.1 yuan/mu in 2014 of Guo *et al.* (2019).

With regard to the contract term, non-fixed duration contracts accounts for 83.62 percent of all contracts (Table 2, row 6, columns 10), which is similar with the previous study of Wang et al (2015), about 87.58 percent of non-fixed term in 2008. Thus, in recent years, the non-fixed term is still occupying the leading position for land transactions.

4.2 Characteristics of rented-in plot and contract choice

The size of rented-in plots is related to the contract choice. In particular, about 66 percent of the size of rented-in plots is within 3 mu (Table 2). It indicates that the size of rented-in plot is small. This is related to the situation that the size of plot contracted by households is not large owing to the principal of equally allocating farmland, which reflects the characteristic of land fragmentation in China. Similarly, existing studies find that about 45 percent of the size of rented-in plot is within 2 mu in Heilongjiang, Henan, Zhejiang, Sichuan Province (Ji *et al.* 2017).

The proportion of plots rented in from relatives has a downward trend with the increase of plot size (Table 2, rows 1 to 3, columns 4 and 5). Correspondingly, there is an upward trend in the proportion of plots rented in from non-relatives from 56.12 percent to 64.27 percent with the increase of the size of rented-in plot (Table 2, rows 1 to 3, column 5). Especially, the proportion of rental transactions between acquaintances from 1.90 percent rises to 13.02 percent according to our data. We can find that the plots with large size are more likely to be rented in from non-relatives, which is consistent with existing findings (Zou and Luo, 2019). For the contract form, the proportion of written agreement has a fluctuating growth with the size increase of the rented-in plots, from 5.32 percent to 26.86 percent (Table 2, rows 1 to 3, column 6). Most notably, the average rent per mu increases steadily from 69.13 yuan/mu to 360.04 yuan/mu with the increase of the size of the rented-in plots. With regard to the contract term. There was an increase in the percentage of fixed-duration contracts, from 5.85 percent to 32.85 percent with the increase of the size of the rented-in plots (Table 2, row 1 to 3, columns 9).

The basis relationship between the position of rented-in plot and farmland contract choice is provided in Table 3. Only 34.9 percent of rented-in plots are adjacent to the plots contracted by households (Table 3, row 1, column 2), which indicates that renting in adjacent plots is not easy to realize contiguous farmland for households. Our data shows the adjacent status of rented-in plots is highly correlated with contract choice. Specifically, if the rented-in plots are adjacent, 46.93 percent of them are rented in from

relatives, which are much higher than those non-adjacent plots (Table 3, column 3). 13.68 percent of adjacent plots are signed in written agreement, and it is more than that of non-adjacent plots (Table 3, column 5). The average rent of rented-in plots that are adjacent is 218.52 yuan/mu, which is larger than that of non-adjacent plots (Table 3, column 7). 17.45 percent of adjacent plots are specified fixed duration, which is more than those plots that are non-adjacent (Table 3, column 8).

4.3 Plot size and contract choice with different adjacent status

In the same size range of rented-in plots, the proportion of adjacent plots that are rented in from relatives is much higher than those non-adjacent plots (Table 4, row 1 to 3, columns 1 and 2). Meanwhile, the proportion difference that is rented in plots from relatives between adjacent plots and non-adjacent plots increases with the size of rented-in plots increasing (Table 4, row 1 to 3, columns (1)-(2)). For the contract form, the proportion of adjacent plots that are signed in written contracts is much more than those non-adjacent plots. With the one mu below size of plots, the proportion difference that is signed in written contracts between adjacent plots and non-adjacent plots is large, at 34.02 percent (Table 4, row 1, column (3)-(4)), nevertheless, with the one mu above size of plots, the proportion difference is small, at 3 to 5 percent. For the contract rent, the average rent of adjacent plots is much higher than those non-adjacent plots and the rent difference is growing wider with the increase of size of rented-in plots from 13.16 to 103.67 yuan/mu (Table 4, row 1 to 3, column (5)-(6)). With regard to the contract term, the proportion of adjacent plots that are specified fixed-duration is much higher than those non-adjacent plots in the same size range of rented-in plots, at 1 to 2 percent, and there is no obvious trend with the plot size increasing. At the range of one to three mu, the proportion difference that is specified fixed-duration contracts between adjacent plots and non-adjacent plots is most the lowest, at 1.24 percent (Table 4, row 2, column (7)-(8)).

In summary, with the increase of the size of rented-in plots, the characteristics of contract choice has changed with different the position of plots, which provides an intuitive interaction based on the descriptive analysis. Then, we will further verify the

effects of interactions between the size and position of rented-in plots on contract choice through empirical analysis.

5. Estimation results and discussion

The results of region fixed effect regression in the single equation and SUR model are reported in Table 5 and 6, respectively. Specifically, the model (1) (2) and (4) are the results of the aextlogit regression to estimate contract participant, form and term, respectively in Table 5. The model (3) are the results of the OLS regression used to estimate contract rent. All models are estimated at the town level to eliminate the regional endogeneity. As shown in Table 6, there is contemporaneous correlation for each equation (Pr = 0.0000). Therefore, using SUR of system estimation can improve the efficiency of estimation.

These two models perform well and there are tiny differences in significance, but the directions are mostly consistent. The effects of main variables and many control variables are also as expected. For brevity, we mainly present the results of SUR regression of key independent variables and some control variables. Notably, the "Plot subsidy" only is applied as a control variable when the dependent variable is contract rent, as the ascription of subsidy of the rented-in plot may impact the negotiated land rent.

5.1 Determinants of contract choice

According to the results of the SUR model, the large plots are more likely to be rented in from the non-relatives, signed the written agreement, paid for relatively higher rent and specified fixed-duration contracts. Specifically, if the size of rented-in plots increases 1 mu, the probability of renting in plots from non-relatives, signing written contracts, and specifying the duration increases by 0.5, 0.9, and 0.6 percent, respectively (Table 6, row 1, columns 1, 2, and 4). The rent will increase 2.48 yuan with 1 mu increase of rented-in plot size ($p<0.01$). The results are consistent with the study of Zou and Luo (2019), which found that the rented in size of farmland increase the likelihood of household trading with non-relatives, signing the written agreement and

paying more land rent and by 0.1, 0.2 and 1 percent, respectively.

This reflects the phenomenon that large-scale planting households are inclined to sign formal contracts that are written contracts, pecuniary rents and fixed-duration, and are conducted between non-relatives, because they need the formal contracts to secure the operational rights of rented-in plots. Some considerations may help explain this finding. First, in order to avoid the risk that landlords abruptly withdraw the plots, the tenants have a strong desire to make the farmland rental contract be more standardization to secure benefits of themselves, and the written agreement is conductive to secure land operational rights (Gao *et al.* 2011). Second, the tenants are more likely to pay for the high rent for the large size of plots. The large size of plots is the typical of low average costs of agricultural operation (Ji *et al.* 2017) and it can provide wide free choice in various crops for farmers (Yang and Zhong, 2010). These findings are consistent with the those based on region fixed regression model but with small magnitudes of coefficients and tiny differences of significance. This shows the limited effects of the size rented-in of plots on the characteristics of land rental contract after considering the correlation of error terms.

We also find that the position of rented-in plots increases the probability of renting from non-relatives. Specifically, the probability of renting from relatives for the adjacent plots is 17.3 percent more than that of non-adjacent plot ($p<0.05$) (Table 6, row 2, columns 1). One possible explanation is that most adjacent plots are provided by relatives, implying that trust and social capital play an important role in transaction (Brandt et al. 2002), which leads to the nonstandard of rental contract. However, the position of rented-in plots does not seem to affect contract form, rent and term at the statistically non-significant ($p>0.1$) (Table 6, row 2, column 2, 3 and 4). Some considerations may help explain this finding. First, tenants may pay more attention to the size of rented-in plots, and loose the restrictions on the position of plots. Second, there are consideration indifferences between large-scale and small-scale plating households when design the land rental contracts. Third, the rural land rental market is still in its early stages of development, not all adjacent plots could be available for

tenants, also considering the rental market rate.

The contract choice is related with plot, household, village characteristics. Specifically, households are more likely to rent in sloping plots or remote plots from relatives ($p<0.05$) (Table 6, rows 3 and 4, column 1). The results indicate that the tenants accept these poor plots from relatives in passive way since the relatives may engage in off-farm work and rent out their farmland to tenants with no pecuniary compensation. Besides, compared with the plain farmland, the sloping plots are likely to be signed written agreement ($p<0.05$) (Table 6, row 3, column 2). The distance from the rented-in plots to residence increases the likelihood of plots signing written agreement and paying higher land rent ($p<0.05$) (Table 3, row 4, columns 2 and 3). The results appear that the irrigated plot is more likely to be signed in written agreement and paid more rent ($p<0.01$) (Table 6, row 5, columns 2 and 3).

As to the household characteristics, households with more number of plots are more inclined to rent in plots from non-relatives, sign the written agreement, and pay less land rent ($p<0.1$) (Table 6, row 7, columns 1, 2 and 3). We find off-farm employment has a positive and significant impact on specifying the fixed-duration contracts ($p<0.1$) (Table 6, row 8, column 4). It indicates that households who have high share of off-farm labors prefer to specify fixed duration to secure the operational rights of land. We also find households who have more agricultural equipment assets prefer to rent in plots from non-relatives, sign written contracts and specify the fixed-duration contracts ($p<0.01$) (Table 6, row 9, columns 1 2 and 4) because this kind of household have a strong demand for renting in land and more formal land rental markets to avoid potential operation risk. With the increase of years of education of household head, household are more likely to rent in plots from relative and sign written contracts (Table 6, rows 10, columns 1 and 2). Furthermore, the household are more likely to trade with relatives, sign in oral agreement and specify the non-fixed duration with the increase of the age of household head ($p<0.01$) (Table 6, row 11, columns 1, 2 and 4).

As for the village characteristics, The distance from village to the town has a significant and positive effect on trading with relatives and signing oral contracts

($p<0.01$) (Table 6, row 12 columns 1 and 2), which means household in the village far from the town are inclined to sign the informal contracts. Besides, the per capita of income in village has a positive effect on trading with relatives ($p<0.01$) (Table 5, row 13, column 1).

5.2 Determinants of contract choice with cross item

As shown in Table 7 and 8, we add to the cross item to examine the effects of the size of rented-in plots on the contract choice with different position of plots. The results of the key independent variables and other control variables are consistent with the results in Table 5 and 6, which verifies the robustness of the estimation results.

As the moderator variable, the position difference of plots has significant impacts on the contract choice with the increasing size of rented-in plots. Specifically, the interaction between the size and position of plots significantly affects the plots signing the written contracts, paying higher land rent and specifying fixed-duration contracts ($p<0.1$) (Table 8, row 3, columns 2, 3 and 4), which indicates the tenants would like to sign the formal contracts when renting in adjacent and large size of plots. The results are consistent with the region fixed regression model. That also verifies the robustness of the estimation results. Some considerations could explain the findings. First, the adjacent and large size plots are easily given rise to land disputes due to the blurred land boundaries between land traders, so the transactions participants are more likely to sign the written contracts. Second, the adjacent and large size plots may reduce the field transportation costs and form the scale economic, thus the tenants have a preference for the adjacent and large size plots. Third, households are more likely to invest the large size and adjacent plots (Cao et al., 2020), they need to specify the duration of contracts to secure a return of investment.

6.Conclusion and implication

In this paper, we estimate the effects of plot size and adjacent status on the land rental contract choice by using region fixed effect regression and SUR model based on the data covering 1215 rented-in plots among 357 households in 5 provinces. We have

three main findings.

First, the large size of rented-in plots increases the likelihood of plots trading with non-relatives, signing the written contracts, paying higher rent and specifying the fixed-duration contracts. This result suggests that the households renting in the larger plots prefer to sign the formal contracts and the large size of plots is good for the formalization of land rental contracts, especially the contiguous farmland. Second, the adjacent plot increases the possibility of plots trading with relatives, but has no impacts on the other characteristics of land rental contacts. Therefore, comparing the adjacent status of rented-in plots, the plot size plays a larger important role in the land rental contract choice. Third, the interaction between the size and the position of rented-in plots increases the likelihood of plots signing the written contracts, paying higher rent and specifying the fixed-duration contracts. That means the households who rent in large and adjacent plots are likely to sign the formal contracts, which guarantees the benefits of contracts participants and improve the qualitative effects of land rental market.

The empirical results of this study have profound policy implications to analyze the determinants of land rental contracts. The size and position of rented-in plots are important factors for contract choice, since the plots of large size or the plots of adjacent and large size could improve the formalization of land rental contracts and the marketization of farmland rental market. Correspondingly, the small size and non-adjacent plots usually are ignored by land transaction parties in land rental market, which are traded with informal contracts, such as oral agreement, non-fixed duration contracts. Therefore, the government should pay more attention to the small size or non-adjacent and large size plots for the formalization of land rental contracts in order to avoid the land disputes in land rental market. In addition, integrating the farmland resources could increase the specification of land rental contracts.

We acknowledge the shortcoming of this study, although it is the first study to capture the heterogeneous effect of plot size on farmland rental contract choice. The mechanisms behind these effects and the relationships among farmland rental contract

components should be further explored. Owing to the data limitations in this survey, we only focus on the farmland rental market among the households in this paper, while ignoring the role of agriculture enterprise and village collectives in farmland rental market. In the future, we should also study the difference of land rental contracts among households and between households and agriculture enterprise or village collectives.

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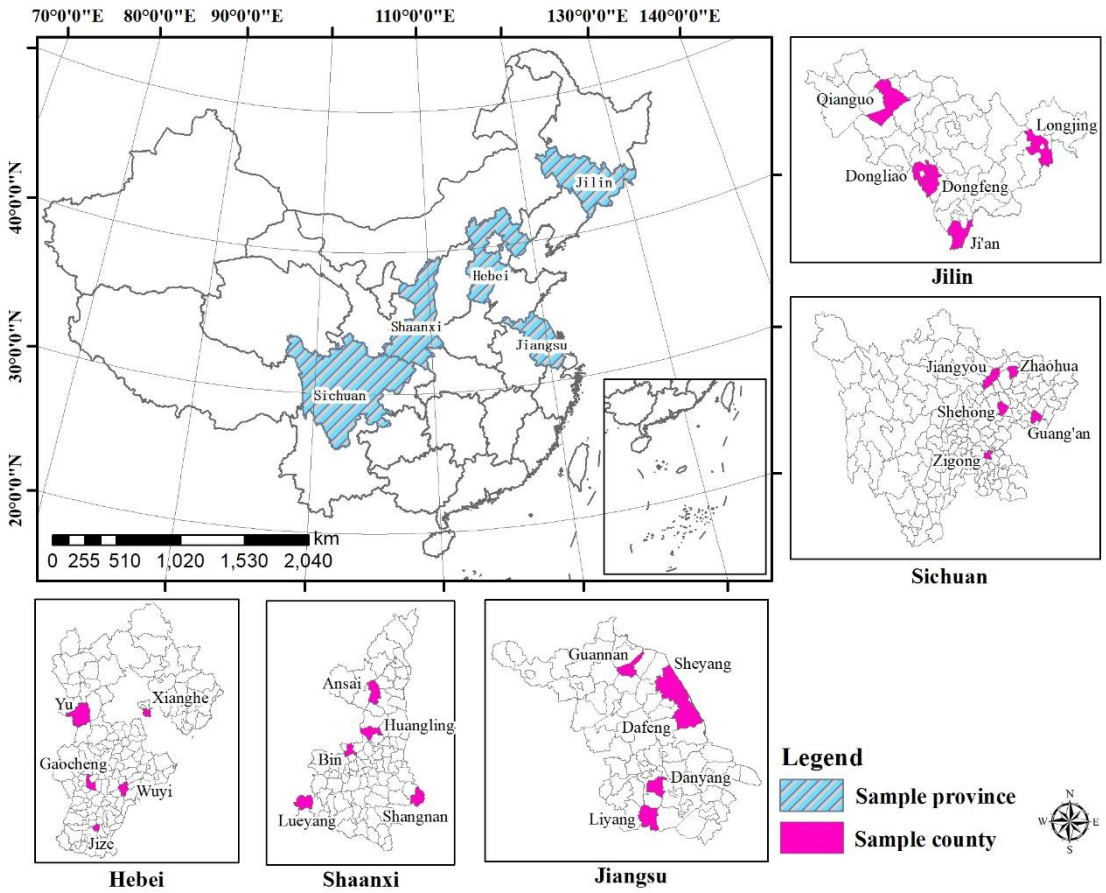

Figure. 1. Map of sample provinces and counties distribution.

Data source: China Rural Development Survey (CRDS).

Table 1 Descriptive Statistics

Variables	Definition	Mean	SD	Min	Max
Dependent variables					
Contract participants	1= the plot is rented in from relatives, 0= the plot is rented in from non-relatives	0.40	0.49	0	1
Contract form	1= written, 0 = oral	0.12	0.33	0	1
Contract rent	the rent of farmland rented in (yuan/mu*year)	189.59	237.62	0	1320
Contract term	1= fixed duration, 0= non-fixed duration	0.16	0.37	0	1
Independent variables					
Key variables					
Plot size	Area of the plot rented in (mu)	4.16	8.22	0.01	75
Adjacent plot	1 = if the plot rented in is adjacent to the plots operated by the tenants, 0 = otherwise	0.35	0.48	0	1
Plot characteristics					
Slope of plot	Respondent's subjective evaluation of plot slope (1=sloping, 0= plain)	0.24	0.43	0	1
Distance to residence	Distance from the plot to the household's residence (m)	738.59	805.64	0	10000
Irrigated plot	1 = the plot of rented in with irrigation systems, 0 = otherwise	0.62	0.49	0	1
Plot subsidy	1 = the subsidy of the plot rented belongs to transferees 0 = otherwise	0.21	0.41	0	1
Household characteristics					
No. of plots	Number of plots contracted by the households	6.54	5.25	0	42
Off-farm employment	the proportion of off-farm employment in household size (%)	32.72	25.33	0	100
Agricultural equipment assets	Value of agricultural equipment (1000 yuan)	26.4	53.39	0	370.89
Ln of agricultural equipment assets	Ln of agricultural device assets	1.23	2.9	-4.61	5.92
Education	Years of schooling of the household head (year)	7.11	2.72	0	14
Age	Age of the household head (year)	54.94	9.45	27	79
Village characteristics					
Distance to the town	Distance from village to the town (km)	6.51	4.99	0.05	24
Per of capita income	Per capital income in the village (yuan)	10781.91	6684.05	1200	35000

Table 2 The relationships between the size of plot rented in and farmland contract choice.

Plot size (mu)	Observation	Proportion	Contract participants (%)		Contract form (%)		Contract rent (yuan/mu)	Contract term (%)	
		(%)	relatives	non-relatives	written	oral		fixed	non-fixed
(0, 1]	376	30.95	43.88	56.12	5.32	94.68	69.13	5.85	94.15
[1,3)	422	34.73	42.18	57.82	4.50	95.5	128.47	9.48	90.52
3 above	417	34.32	35.73	64.27	26.86	73.14	360.04	32.85	67.15
Total	1215	100	40.49	59.51	12.43	87.57	189.59	16.38	83.62

Notes: According to the tri-quantiles of all area of the rented-in plots, the size of rented-in plots is approximately divided into three groups.

Table 3 The relationships between the position of plot rented in and farmland contract choice.

Plot position	Observation	Proportion	Contract participants (%)		Contract form (%)		Contract rent (yuan/mu)	Contract term (%)	
		(%)	relatives	non-relatives	written	oral		fixed	non-fixed
Adjacent	424	34.90	46.93	53.07	13.68	86.32	218.52	17.45	82.55
Non-adjacent	791	65.10	37.04	62.96	11.76	88.24	174.07	15.80	84.20

Table 4 The plot size with different position and contract choice.

Plot size (mu)	Participants- relatives (%)			Written form (%)			Contract rent (yuan/mu)			Fixed-term (%)		
	(1) adjacent	(2) non-adjacent	(1)-(2) diff	(3) adjacent	(4) non-adjacent	(3)-(4) diff	(5) adjacent	(6) non-adjacent	(5)-(6) diff	(7) adjacent	(8) non-adjacent	(7)-(8) diff
(0, 1]	45.6	43.03	2.57	40.0	5.98	34.02	77.92	64.76	13.16	7.2	5.18	2.02
[1,3)	50.0	37.59	12.41	6.41	3.38	3.03	139.01	122.29	16.72	10.26	9.02	1.24
3 above	44.76	31.02	13.74	30.07	25.18	4.89	428.16	324.49	103.67	34.27	32.12	2.15

Notes: According to the tri-quantiles of all area of the rented-in plots, the size of rented-in plots is approximately divided into three groups.

Table 5 The impact of the size of rented-in plot on the contract choice with town fixed effect.

Variables	Contract participants (1=relatives, 0=non-relatives)	Contract form (1=written, 0=oral)	Contract rent (yuan/mu*year)	Contract term (1=fixed,0=non-fixed)
	aextlogit	aextlogit	xtreg	aextlogit
Plot size	-0.039***	0.048***	3.601***	0.029***
	(-3.240)	(3.858)	(5.250)	(2.778)
Adjacent plot	0.578***	0.309	10.655	0.177
	(5.798)	(1.165)	(1.038)	(0.836)
Slope of plot	0.300**	0.426	-7.776	-0.154
	(2.288)	(1.145)	(-0.574)	(-0.570)
Distance to residence	0.000*	0.000**	0.019***	0.000
	(1.922)	(2.370)	(2.903)	(0.434)
Irrigated plot	0.044	0.612*	23.220*	0.206
	(0.336)	(1.729)	(1.725)	(0.727)
Plot subsidy			15.864	
			(1.158)	
No. of plots	-0.029**	0.133***	-2.932**	-0.015
	(-2.390)	(3.468)	(-2.422)	(-0.558)
Off-farm employment	0.002	0.014***	-0.247	0.009**
	(1.352)	(2.625)	(-1.259)	(2.247)
Ln of agricultural equipment assets	-0.078***	0.140**	2.140	0.147***
	(-4.067)	(2.522)	(1.070)	(4.157)
Education	0.070***	0.177***	1.234	0.033
	(3.452)	(3.077)	(0.610)	(0.758)
Age	0.038***	-0.055***	-1.001	-0.037***
	(5.844)	(-3.245)	(-1.489)	(-2.814)
Distance to the town	0.055***	-0.096**	0.253	-0.052
	(2.959)	(-2.044)	(0.141)	(-1.305)
Per capita of income	0.305**	0.383	-4.618	0.384
	(2.080)	(0.840)	(-0.321)	(1.039)
Constant			251.800*	
			(1.863)	
Observations	1,188	734	1,215	881
R-squared			0.050	
Number of town			48	
Observations	1,188	734	1,215	881

Notes: a. z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 6 The impact of the characteristics of rented-in plot on the contract choice, Seemingly Unrelated Regression Estimation

Variables	Contract participants (1= relatives, 0=non-relatives)	Contract form (0=oral, 1=written)	Contract rent (yuan/mu*year)	Contract term (1=fixed, 0=non-fixed)
Plot size	-0.005***	0.009***	3.514***	0.006***
	(-2.843)	(7.860)	(5.259)	(4.688)
Adjacent plot	0.173***	-0.001	11.068	0.012
	(6.200)	(-0.055)	(1.107)	(0.625)
Slope of plot	0.092**	0.056**	-7.360	-0.020
	(2.509)	(2.552)	(-0.557)	(-0.757)
Distance to residence	0.000**	0.000**	0.020***	0.000
	(2.300)	(2.206)	(3.052)	(0.467)
Irrigated plot	-0.007	0.072***	22.105*	0.033
	(-0.203)	(3.297)	(1.685)	(1.287)
Plot subsidy			-5.516	
			(-0.445)	
No. of plots	-0.006*	0.009***	-2.992**	0.000
	(-1.796)	(4.674)	(-2.536)	(0.102)
Off-farm employment	0.001	0.000	-0.246	0.001*
	(1.050)	(1.521)	(-1.285)	(1.824)
Ln of agricultural equipment assets	-0.025***	0.009***	2.112	0.021***
	(-4.636)	(2.803)	(1.084)	(5.472)
Education	0.020***	0.010***	1.597	0.001
	(3.636)	(2.962)	(0.811)	(0.159)
Age	0.012***	-0.006***	-0.851	-0.004***
	(6.720)	(-5.150)	(-1.300)	(-3.113)
Distance to the town	0.018***	-0.010***	0.178	-0.005
	(3.686)	(-3.619)	(0.102)	(-1.411)
Per capita of income	0.113***	0.014	-3.228	0.045
	(2.900)	(0.589)	(-0.230)	(1.622)
Town Dummy	YES	YES	YES	YES
Constant	-1.748***	0.124	135.568	0.389
	(-3.982)	(0.475)	(0.859)	(1.259)
Observations	1,215	1,215	1,215	1,215
R-squared	0.315	0.463	0.624	0.402

Table7 The impact of the size of rented-in plot on the contract choice with town fixed effect with cross term.

Variables	Contract participants (1=relatives, 0=non-relatives)	Contract form (1=written, 0=oral)	Contract rent (yuan/mu*year)	Contract term (1=fixed,0=non-fixed)
	aextlogit	aextlogit	xtreg	aextlogit
Plot size	-0.052***	0.040***	2.597***	0.023**
	(-3.055)	(3.213)	(3.667)	(2.133)
Adjacent plot	0.505***	-0.041	-16.313	-0.096
	(4.380)	(-0.130)	(-1.417)	(-0.369)
Plot size* Adjacent plot	0.027	0.058**	7.673***	0.045*
	(1.238)	(1.982)	(4.972)	(1.818)
Slope of plot	0.297**	0.354	-12.310	-0.199
	(2.261)	(0.948)	(-0.915)	(-0.733)
Distance to residence	0.000**	0.000**	0.022***	0.000
	(2.077)	(2.476)	(3.267)	(0.492)
Irrigated plot	0.033	0.579	17.455	0.178
	(0.253)	(1.622)	(1.305)	(0.621)
Plot subsidy	-	-	4.270	-
	-	-	(0.310)	-
No. of plots	-0.029**	0.134***	-2.689**	-0.014
	(-2.384)	(3.475)	(-2.242)	(-0.530)
Off-farm employment	0.002	0.014***	-0.261	0.009**
	(1.351)	(2.607)	(-1.342)	(2.224)
Ln of agricultural equipment assets	-0.079***	0.120**	1.651	0.138***
	(-4.111)	(2.156)	(0.833)	(3.874)
Education	0.070***	0.177***	1.467	0.028
	(3.470)	(3.077)	(0.732)	(0.655)
Age	0.038***	-0.056***	-0.919	-0.039***
	(5.788)	(-3.294)	(-1.380)	(-2.972)
Distance to the town	0.054***	-0.102**	0.365	-0.054
	(2.939)	(-2.139)	(0.206)	(-1.331)
Per capita of income	0.297**	0.308	-8.218	0.352
	(2.019)	(0.677)	(-0.577)	(0.955)
Constant	-	-	285.635**	-
	-	-	(2.132)	-
Observations	1,188	734	1,215	881
R-squared			0.070	
Number of town			48	

Notes: a. z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 8 The impact of the characteristics of rented-in plot on the contract choice, Seemingly Unrelated Regression Estimation with cross term.

Variables	Contract participants (1= relatives, 0=non-relatives)	Contract form (0=oral, 1=written)	Contract rent (yuan/mu*year)	Contract term (1=fixed, 0=non-fixed)
Plot size	-0.005***	0.007***	2.479***	0.005***
	(-2.684)	(6.449)	(3.596)	(3.660)
Adjacent plot	0.176***	-0.039**	-17.198	-0.021
	(5.570)	(-2.099)	(-1.533)	(-0.965)
Plot size* Adjacent plot	-0.001	0.011***	8.023***	0.009***
	(-0.199)	(4.372)	(5.347)	(3.240)
Slope of plot	0.093**	0.049**	-12.169	-0.026
	(2.517)	(2.259)	(-0.929)	(-0.986)
Distance to residence	0.000**	0.000**	0.022***	0.000
	(2.284)	(2.481)	(3.432)	(0.662)
Irrigated plot	-0.007	0.065***	16.260	0.027
	(-0.187)	(2.978)	(1.248)	(1.040)
Plot subsidy	-	-	-14.140	-
	-	-	(-1.133)	-
No. of plots	-0.006*	0.010***	-2.728**	0.001
	(-1.803)	(4.905)	(-2.335)	(0.250)
Off-farm employment	0.001	0.000	-0.261	0.001*
	(1.053)	(1.469)	(-1.375)	(1.784)
Ln of agricultural equipment assets	-0.025***	0.008***	1.606	0.020***
	(-4.621)	(2.614)	(0.832)	(5.336)
Education	0.020***	0.010***	1.781	0.001
	(3.636)	(3.001)	(0.913)	(0.171)
Age	0.012***	-0.006***	-0.789	-0.004***
	(6.721)	(-5.189)	(-1.219)	(-3.125)
Distance to the town	0.018***	-0.010***	0.307	-0.005
	(3.682)	(-3.572)	(0.178)	(-1.362)
Per capita of income	0.114***	0.008	-7.219	0.039
	(2.907)	(0.328)	(-0.520)	(1.429)
Town Dummy	YES	YES	YES	YES
Constant	-1.755***	0.220	197.949	0.474
	(-3.985)	(0.846)	(1.264)	(1.533)
Observations	1,215	1,215	1,215	1,215
R-squared	0.315	0.471	0.632	0.407

Notes: a. z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1; b. The null hypothesis that the disturbance terms for each equation are independent of each other have been rejected (Pr = 0.0000), and there is contemporaneous correlation for each equation. Therefore, using SUR of system estimation can improve the efficiency of estimation.

Table A1 The correlation analysis of characteristics of contract choice.

Variables	Contract participant	Contract form	Contract rent	Contract rent
Contract participant	1.00	-	-	-
Contract form	-0.26***	1.00	-	-
Contract rent	-0.19***	0.52***	1.00	-
Contract rent	-0.28***	0.75***	0.48***	1.00